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Verification of numerical wave propagation models with laboratory measurements

HISWA verification in the directional wave basin

delft hydraulics

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CONTENTS

APPENDIX H. Wave heights resulting from the computations.

In this appendix the computed results for the wave heights for both the HISWA and the CREDIZ computations are given for the 26 sites. The wave heights given are the averaged values over the middle nine points of the averaging blocks; the averaging blocks have in most instances sides of 0.25 m. This wave height is indicated as <H> in the Tables. The standard deviation obtained over the nine points has also been given and is indicated by s(H). Both <H> and s(H) are given in cm.

As the value in the midpoint of the averaging block differs hardly from the averaged value <H>, it has not been given. As also the averaging has been carried out over the 25 points of the whole averaging block, an example has been given on page 237. Because it appeared necessary in the CREDIZ computations to consider a larger averaging block (with sides of 3 m instead of 0.5 m), one HISWA computation has been performed also with the same large averaging block, computation ve35aa, which is otherwise the same as ve35b. Full results of both computations have been added (pages 236 and 237) so as to make it possible for the reader to ascertain the difference in choice of averaging block size. Also the full results for the wave height from the CREDIZ computations ce32a and ce32b have been added (pages 238 and 239).

In order to have information on the depths of the sites and the effect of averaging over the blocks, the first Tables concern the depth-values of the sites, one for the fully cylindrical bar geometry and two for the semi-cylindrical bar geometry (one with block size 0.5 m and one with size of 3 m).

The Tables are given in the following sequence :

- the depth values for the geometries;
- the wave heights for computations ve2x;
- the wave heights for computations ve3x;
- the wave heights for computations ce3x;
- the full results of ve35aa and ve35b;
- the full results of ce32a and ce32b.

ve21a

depth

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		30.00	30.00	30.00	30.00
10.00	10.00	10.00		10.00	10.00
		20.00		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

<depth>

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		30.00	30.00	30.00	30.00
10.00	10.00	10.00		10.00	10.00
		20.00		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

s(depth)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		1.08	1.08	1.08	1.08
0.00	0.00	0.00		0.00	0.00
		0.54		0.54	0.54
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve21a

<depth>25

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		30.00	30.00	30.00	30.00
10.00	10.00	10.00		10.00	10.00
		20.00		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

s(depth)25

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		1.80	1.80	1.80	1.80
0.00	0.00	0.00		0.00	0.00
		0.90		0.90	0.90
0.00		0.00		0.00	0.00
0.00				0.00	0.00

Depth values in cm of the 26 sites for fully cylindrical bar.
Averaging block for 9 points .25 m and for 25 points .5 m.

ve31

depth

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		33.58	30.94	30.00	30.00
40.00	32.50	17.50		10.00	10.00
		24.50		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

<depth>

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		33.60	30.97	30.00	30.00
40.00	32.54	17.57		10.00	10.00
		24.52		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

s(depth)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.96	1.03	1.08	1.08
0.00	0.54	0.54		0.01	0.00
		0.55		0.54	0.54
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve31

<depth>25

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		33.63	31.00	30.01	30.00
40.00	32.57	17.63		9.99	10.00
		24.53		20.01	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

s(depth)25

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		1.60	1.72	1.80	1.80
0.00	0.90	0.90		0.02	0.00
		0.91		0.90	0.90
0.00		0.00		0.00	0.00
0.00				0.00	0.00

Depth values in cm of the 26 sites for semi-cylindrical bar.
Averaging block for 9 points .25 m and for 25 points .5 m.

ve35aa

depth

40.00		40.00		40.00	40.00
		40.00		40.00	40.00
		33.58	30.94	30.00	30.00
40.00	32.50	17.50		10.00	10.00
		24.50		20.00	20.00
40.00		40.00		40.00	40.00
40.00				40.00	40.00

<depth>

40.00		40.00		40.00	40.00
		39.66		39.18	39.17
		33.45	31.16	30.12	30.00
40.00	32.88	18.19		10.17	10.00
		24.76		20.17	20.00
40.00		39.91		39.60	39.58
40.00				40.00	40.00

s(depth)

0.00		0.00		0.00	0.00
		0.63		1.23	1.25
		5.13	6.00	6.43	6.50
0.00	3.23	3.21		0.49	0.00
		3.25		3.22	3.25
0.00		0.22		0.61	0.62
0.00				0.00	0.00

ve35aa

<depth>25

40.00		40.00		40.00	40.00
		38.57		37.60	37.50
		32.67	30.57	29.40	29.00
40.00	33.36	19.44		12.30	11.50
		25.24		20.50	20.00
40.00		39.45		38.82	38.75
40.00				40.00	40.00

s(depth)25

0.00		0.00		0.00	0.00
		2.72		3.83	3.95
		7.28	8.49	9.18	9.49
0.00	5.09	5.22		2.52	2.04
		5.39		5.30	5.41
0.00		1.23		1.90	1.98
0.00				0.00	0.00

Depth values in cm of the 26 sites for semi-cylindrical bar.
Averaging block for 9 points 1.5 m and for 25 points 3.0 m.

ve21a

<H>

4.19		4.20		4.20	4.20
		4.20		4.20	4.20
		4.10	4.10	4.10	4.10
4.74	4.74	4.74		4.74	4.74
		5.27		5.27	5.27
5.13		5.13		5.13	5.13
5.14				5.14	5.14

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.01	0.01	0.01	0.01
0.05	0.05	0.05		0.05	0.05
		0.01		0.01	0.01
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22

<H>

4.87		4.87		4.87	4.87
		4.87		4.87	4.87
		4.74	4.74	4.74	4.74
5.39	5.39	5.39		5.39	5.39
		9.50		9.50	9.50
9.58		9.58		9.58	9.58
9.59				9.59	9.59

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.11	0.11	0.11		0.11	0.11
		0.03		0.03	0.03
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22a

<H>

4.85		4.85		4.85	4.85
		4.85		4.85	4.85
		4.72	4.72	4.72	4.72
5.35	5.35	5.35		5.35	5.35
		9.74		9.74	9.74
9.92		9.92		9.92	9.92
9.95				9.95	9.95

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.11	0.11	0.11		0.11	0.11
		0.04		0.04	0.04
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve23

⟨H⟩					
4.87		4.92		4.92	4.91
		4.94		4.94	4.93
		4.80	4.81	4.81	4.80
5.40	5.40	5.40		5.40	5.40
		9.80		9.80	9.80
10.23		10.24		10.24	10.24
10.29				10.29	10.29
s(H)					
0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.11	0.11	0.11		0.11	0.11
		0.05		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve24

⟨H⟩					
4.81		4.86		4.86	4.85
		4.87		4.88	4.87
		4.75	4.75	4.75	4.75
5.28	5.28	5.28		5.28	5.28
		9.48		9.49	9.48
10.04		10.05		10.05	10.05
10.10				10.10	10.10
s(H)					
0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.10	0.10	0.10		0.10	0.10
		0.05		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve25

⟨H⟩					
4.81		4.85		4.85	4.84
		4.87		4.87	4.86
		4.74	4.74	4.74	4.74
5.30	5.30	5.29		5.29	5.29
		9.65		9.66	9.65
10.16		10.17		10.17	10.17
10.21				10.21	10.21
s(H)					
0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.11	0.11	0.11		0.11	0.11
		0.05		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve26

<H>

4.93		4.92		4.91	4.88
		4.93		4.92	4.91
		4.79	4.79	4.79	4.78
5.31	5.31	5.31		5.31	5.32
		9.67		9.67	9.65
10.24		10.24		10.24	10.24
10.28				10.28	10.28

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.11	0.11	0.11		0.10	0.10
		0.05		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve27

<H>

4.88		4.87		4.85	4.81
		4.89		4.88	4.87
		4.76	4.76	4.76	4.76
5.29	5.29	5.29		5.29	5.31
		9.64		9.63	9.57
10.43		10.43		10.43	10.43
10.50				10.50	10.50

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.10	0.10	0.10		0.10	0.10
		0.06		0.06	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve28

<H>

4.71		4.71		4.71	4.71
		4.71		4.71	4.71
		4.57	4.57	4.57	4.57
5.38	5.38	5.38		5.38	5.38
		10.06		10.06	10.06
9.79		9.79		9.79	9.79
9.82				9.82	9.82

s(H)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.02	0.02	0.02	0.02
0.12	0.12	0.12		0.12	0.12
		0.03		0.03	0.03
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve31

⟨H⟩

4.83		3.66		4.61	4.89
		4.02		5.00	4.44
		4.40	4.50	5.05	4.14
5.04	4.71	5.33		5.07	4.71
		5.15		5.31	5.21
5.06		5.06		5.06	5.06
5.07				5.07	5.07

s(H)

0.01		0.01		0.06	0.02
		0.02		0.06	0.03
		0.03	0.03	0.03	0.02
0.00	0.01	0.05		0.05	0.05
		0.02		0.02	0.01
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve32

⟨H⟩

9.52		6.72		6.86	6.20
		7.43		7.04	5.26
		7.91	7.04	6.54	4.80
9.95	9.27	8.78		5.65	5.35
		9.99		9.94	9.78
10.02		10.02		10.02	10.02
10.05				10.05	10.05

s(H)

0.02		0.02		0.03	0.04
		0.05		0.01	0.05
		0.07	0.08	0.07	0.03
0.00	0.03	0.12		0.11	0.11
		0.01		0.04	0.04
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve33

⟨H⟩

8.79		6.90		6.55	5.96
		7.30		6.52	5.25
		7.63	6.64	6.01	4.86
9.91	9.36	8.72		5.67	5.31
		10.12		9.99	9.80
10.32		10.33		10.33	10.33
10.38				10.38	10.38

s(H)

0.02		0.03		0.00	0.02
		0.05		0.03	0.03
		0.08	0.09	0.06	0.03
0.01	0.03	0.13		0.10	0.11
		0.01		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve34

<H>

8.53		6.78		6.46	5.91
		7.16		6.45	5.24
		7.45	6.53	5.97	4.86
9.59	9.05	8.45		5.61	5.28
		9.72		9.60	9.43
9.98		9.99		9.99	9.99
10.04				10.04	10.04

s(H)

0.02		0.03		0.00	0.02
		0.05		0.03	0.03
		0.07	0.08	0.06	0.03
0.01	0.03	0.11		0.10	0.10
		0.01		0.04	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35

<H>

8.77		6.84		6.42	5.78
		7.21		6.37	5.07
		7.49	6.48	5.84	4.70
9.88	9.31	8.43		5.41	5.07
		9.98		9.77	9.60
10.31		10.32		10.32	10.32
10.39				10.39	10.39

s(H)

0.02		0.03		0.01	0.02
		0.05		0.03	0.03
		0.08	0.09	0.06	0.03
0.01	0.03	0.13		0.10	0.10
		0.02		0.06	0.07
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

<H>

8.80		6.94		6.56	5.95
		7.30		6.49	5.28
		7.58	6.70	6.03	4.88
9.90	9.36	8.56		5.95	5.47
		10.02		9.81	9.63
10.33		10.34		10.33	10.33
10.40				10.40	10.40

s(H)

0.12		0.18		0.03	0.14
		0.29		0.18	0.21
		0.44	0.49	0.35	0.19
0.09	0.17	0.71		0.70	0.70
		0.13		0.34	0.37
0.01		0.01		0.02	0.02
0.01				0.01	0.01

ve35b

<H>

8.80		6.93		6.56	5.97
		7.31		6.53	5.26
		7.62	6.64	6.02	4.88
9.91	9.35	8.65		5.66	5.31
		10.06		9.91	9.73
10.33		10.34		10.34	10.34
10.40				10.40	10.40

s(H)

0.02		0.03		0.00	0.02
		0.05		0.03	0.03
		0.08	0.09	0.06	0.03
0.01	0.03	0.12		0.10	0.10
		0.02		0.05	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35bs

<H>

9.43		8.16		6.43	6.90
		8.98		6.35	6.86
		8.91	7.47	6.42	6.40
10.62	10.36	8.62		5.76	5.76
		10.35		9.40	8.99
10.67		10.49		10.29	10.10
10.41				10.40	10.39

s(H)

0.01		0.10		0.03	0.00
		0.14		0.06	0.00
		0.12	0.14	0.07	0.05
0.01	0.03	0.15		0.08	0.07
		0.04		0.07	0.05
0.01		0.01		0.01	0.01
0.00				0.00	0.00

ve35s1

<H>

9.89		7.75		6.62	6.28
		8.03		7.44	6.28
		7.72	7.09	6.82	5.89
11.31	10.39	8.29		6.13	6.06
		9.84		9.25	8.72
10.67		10.85		10.51	9.72
10.20				10.41	10.19

s(H)

0.07		0.05		0.05	0.01
		0.05		0.04	0.02
		0.07	0.07	0.07	0.03
0.02	0.10	0.10		0.08	0.08
		0.06		0.07	0.07
0.04		0.05		0.03	0.02
0.01				0.02	0.01

ve35s2

<H>

9.43		7.34		6.44	6.28
		7.82		7.35	6.28
		7.56	7.01	6.78	5.89
10.80	10.21	8.23		6.12	6.06
		9.81		9.24	8.73
10.58		10.85		10.51	9.72
10.21				10.41	10.19

s(H)

0.05		0.05		0.05	0.01
		0.04		0.03	0.02
		0.06	0.06	0.07	0.03
0.03	0.09	0.09		0.08	0.08
		0.06		0.07	0.07
0.03		0.05		0.03	0.02
0.01				0.02	0.01

ve35c

<H>

8.84		7.08		6.81	6.31
		7.48		6.84	5.62
		7.83	6.91	6.36	5.22
9.95	9.40	9.02		6.14	5.76
		10.17		10.12	9.93
10.35		10.36		10.36	10.36
10.40				10.40	10.40

s(H)

0.02		0.03		0.01	0.02
		0.05		0.02	0.03
		0.07	0.08	0.06	0.03
0.01	0.03	0.11		0.11	0.11
		0.01		0.03	0.04
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve36

<H>

7.64		7.11		6.87	5.33
		7.36		6.72	5.00
		7.48	6.75	6.12	4.78
9.95	8.90	8.37		5.47	5.33
		10.05		9.93	9.88
10.43		10.43		10.43	10.43
10.48				10.48	10.48

s(H)

0.06		0.01		0.03	0.02
		0.03		0.05	0.01
		0.07	0.07	0.09	0.02
0.04	0.04	0.14		0.11	0.11
		0.02		0.06	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve37

<H>					
8.14		6.74		6.47	5.59
		7.12		6.49	5.12
		7.35	6.54	6.04	4.81
9.78	8.96	8.31		5.54	5.31
		9.93		9.80	9.67
10.47		10.47		10.47	10.46
10.53				10.53	10.53
s(H)					
0.03		0.02		0.01	0.02
		0.04		0.03	0.02
		0.07	0.07	0.06	0.03
0.03	0.03	0.12		0.10	0.10
		0.02		0.06	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve38

<H>					
9.66		6.40		6.98	6.46
		7.40		7.47	5.23
		8.09	7.40	7.05	4.71
9.86	9.18	8.99		5.70	5.40
		10.09		10.13	9.97
9.90		9.90		9.90	9.90
9.92				9.92	9.92
s(H)					
0.02		0.03		0.06	0.05
		0.05		0.02	0.06
		0.06	0.06	0.07	0.03
0.00	0.03	0.12		0.12	0.12
		0.02		0.03	0.03
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31

⟨H⟩

4.95		3.99		2.38	4.88
		5.15		7.16	3.87
		5.81	5.68	7.26	3.93
5.00	4.76	5.80		5.15	4.73
		5.18		5.29	5.19
5.08		5.08		5.08	5.08
5.08				5.08	5.08

s(H)

0.02		0.37		0.15	0.12
		0.13		0.28	0.01
		0.33	0.61	0.33	0.01
0.01	0.02	0.19		0.03	0.04
		0.02		0.02	0.01
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31a

⟨H⟩

5.16		3.56		2.20	4.62
		4.20		5.12	3.70
		4.56	4.30	6.41	3.88
5.00	4.63	5.28		5.02	4.64
		5.15		5.29	5.19
5.08		5.08		5.08	5.08
5.08				5.08	5.08

s(H)

0.01		0.09		0.18	0.20
		0.06		0.40	0.07
		0.04	0.07	0.23	0.00
0.00	0.01	0.05		0.07	0.03
		0.02		0.02	0.01
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31b

⟨H⟩

5.16		3.58		2.29	4.73
		4.18		5.20	3.66
		4.53	4.30	6.41	3.89
5.02	4.63	5.26		5.07	4.69
		5.15		5.28	5.19
5.08		5.08		5.08	5.08
5.08				5.08	5.08

s(H)

0.02		0.09		0.20	0.20
		0.06		0.39	0.09
		0.04	0.07	0.22	0.01
0.00	0.02	0.05		0.06	0.04
		0.02		0.02	0.01
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31c

<H>

5.13		3.57		3.32	3.90
		4.12		5.25	3.94
		4.47	4.68	5.66	3.92
5.06	4.65	5.24		5.17	4.73
		5.16		5.29	5.21
5.07		5.07		5.07	5.07
5.08				5.08	5.08

s(H)

0.11		0.35		1.20	1.19
		0.22		1.63	0.33
		0.19	0.51	1.06	0.11
0.03	0.10	0.24		0.39	0.25
		0.11		0.13	0.06
0.01		0.01		0.01	0.01
0.00				0.00	0.00

ce32

<H>

9.76		7.78		5.09	6.09
		9.14		9.84	4.78
		9.52	7.92	9.11	4.85
9.86	9.39	9.35		6.45	6.04
		10.00		9.85	9.73
10.02		10.02		10.02	10.02
10.07				10.07	10.07

s(H)

0.06		0.39		0.16	0.13
		0.16		0.33	0.02
		0.24	0.69	0.41	0.01
0.01	0.03	0.04		0.07	0.09
		0.01		0.04	0.04
0.00		0.00		0.00	0.00
0.01				0.01	0.01

ce32a

<H>

10.03		7.29		4.56	6.04
		8.12		7.43	4.58
		8.37	6.86	8.48	4.75
9.87	9.18	8.97		6.17	5.81
		9.93		9.78	9.65
10.02		10.02		10.02	10.02
10.07				10.07	10.07

s(H)

0.03		0.07		0.13	0.18
		0.03		0.42	0.10
		0.06	0.16	0.19	0.01
0.01	0.03	0.09		0.10	0.08
		0.01		0.05	0.04
0.00		0.00		0.00	0.00
0.01				0.01	0.01

ce32b

⟨H⟩

9.99		7.20		5.74	4.83
		7.93		7.52	4.78
		8.21	7.34	7.50	4.76
9.96	9.20	8.86		6.44	5.92
		9.88		9.67	9.55
10.02		10.02		10.01	10.01
10.07				10.07	10.07

s(H)

0.18		0.30		1.14	1.49
		0.28		1.56	0.35
		0.41	0.57	1.17	0.08
0.06	0.17	0.55		0.64	0.51
		0.09		0.32	0.35
0.00		0.00		0.01	0.01
0.01				0.01	0.01

ce35

⟨H⟩

10.46		8.00		5.96	5.84
		9.44		9.84	4.89
		9.55	7.67	8.92	4.92
10.27	9.69	9.28		6.39	6.00
		10.16		9.92	9.81
10.38		10.38		10.38	10.38
10.46				10.46	10.46

s(H)

0.05		0.12		0.21	0.09
		0.06		0.38	0.01
		0.29	0.76	0.43	0.00
0.01	0.03	0.05		0.07	0.09
		0.01		0.05	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35a

⟨H⟩

10.09		7.96		5.21	6.14
		9.32		9.94	4.81
		9.67	8.00	9.19	4.89
10.18	9.70	9.49		6.50	6.09
		10.29		10.09	9.98
10.38		10.38		10.38	10.38
10.42				10.42	10.42

s(H)

0.06		0.38		0.15	0.14
		0.16		0.34	0.02
		0.22	0.69	0.42	0.01
0.01	0.03	0.05		0.07	0.10
		0.01		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35b

⟨H⟩

10.41		7.50		4.66	6.08
		8.30		7.52	4.62
		8.55	6.96	8.55	4.78
10.24	9.48	9.10		6.22	5.85
		10.22		10.00	9.88
10.38		10.38		10.38	10.38
10.42				10.42	10.42

s(H)

0.04		0.07		0.13	0.18
		0.03		0.42	0.10
		0.07	0.16	0.19	0.01
0.00	0.03	0.10		0.10	0.08
		0.02		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35b1

⟨H⟩

10.41		7.51		4.76	6.26
		8.29		7.62	4.61
		8.50	6.96	8.54	4.82
10.24	9.48	9.14		6.37	6.01
		10.23		10.07	9.95
10.38		10.38		10.38	10.38
10.42				10.42	10.42

s(H)

0.04		0.07		0.15	0.20
		0.02		0.42	0.14
		0.07	0.15	0.18	0.02
0.01	0.03	0.10		0.10	0.09
		0.01		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35ba

⟨H⟩

10.16		6.34		8.73	5.11
		6.89		8.44	5.65
		7.56	7.80	6.95	5.47
9.08	11.71	8.54		6.42	6.02
		9.13		9.48	7.81
9.86		10.32		10.50	9.11
10.26				10.42	10.20

s(H)

0.04		0.23		0.31	0.06
		0.12		0.38	0.06
		0.13	0.16	0.35	0.05
0.02	0.14	0.12		0.08	0.05
		0.06		0.06	0.10
0.08		0.04		0.03	0.09
0.02				0.02	0.02

ce35bb

<H>

9.90		6.30		8.66	5.10
		6.81		8.37	5.61
		7.47	7.74	6.92	5.43
8.73	11.48	8.39		6.40	5.95
		8.82		9.23	7.54
9.51		9.96		10.13	8.78
9.88				10.04	9.83

s(H)

0.04		0.24		0.31	0.07
		0.12		0.38	0.06
		0.13	0.16	0.34	0.05
0.03	0.13	0.11		0.08	0.04
		0.05		0.05	0.10
0.08		0.04		0.03	0.09
0.02				0.02	0.02

ce35bc

<H>

9.94		6.98		8.13	5.28
		7.37		7.68	5.48
		7.64	7.63	6.77	5.45
9.07	11.26	8.32		6.62	6.03
		9.10		9.23	7.63
9.56		9.87		10.08	8.84
9.89				10.03	9.82

s(H)

0.23		1.13		1.80	0.40
		0.56		1.87	0.42
		0.55	0.61	1.40	0.23
0.28	0.58	0.72		0.50	0.28
		0.39		0.35	0.55
0.47		0.22		0.10	0.47
0.11				0.06	0.12

ce35s1

<H>

14.45		6.24		8.93	5.11
		6.74		8.91	5.63
		7.57	8.35	6.86	5.48
9.84	11.90	8.60		6.59	6.04
		9.00		9.54	7.88
9.59		10.38		10.51	9.19
10.28				10.44	10.25

s(H)

0.08		0.26		0.28	0.08
		0.08		0.37	0.06
		0.12	0.25	0.31	0.04
0.20	0.26	0.15		0.09	0.05
		0.03		0.06	0.10
0.08		0.05		0.03	0.08
0.02				0.02	0.02

ce35sa

⟨H⟩

14.33		6.30		8.70	5.03
		6.82		8.45	5.61
		7.52	7.86	6.95	5.45
10.13	11.73	8.52		6.32	5.95
		9.08		9.42	7.78
9.65		10.34		10.52	9.11
10.26				10.42	10.20

s(H)

0.07		0.24		0.31	0.06
		0.11		0.39	0.06
		0.13	0.17	0.35	0.04
0.26	0.16	0.13		0.08	0.05
		0.06		0.06	0.11
0.08		0.04		0.03	0.09
0.02				0.02	0.02

ce35sb

⟨H⟩

10.39		6.36		8.68	5.11
		6.88		8.43	5.62
		7.54	7.84	6.96	5.47
9.34	11.69	8.50		6.32	5.96
		9.08		9.42	7.76
9.85		10.34		10.52	9.13
10.26				10.42	10.20

s(H)

0.04		0.23		0.32	0.07
		0.11		0.39	0.06
		0.13	0.17	0.35	0.04
0.04	0.14	0.13		0.08	0.05
		0.05		0.06	0.10
0.09		0.04		0.03	0.09
0.02				0.02	0.02

ce35c

⟨H⟩

10.35		7.49		4.67	6.08
		8.31		7.52	4.62
		8.55	6.96	8.56	4.78
10.20	9.49	9.10		6.22	5.85
		10.22		10.00	9.88
10.38		10.38		10.38	10.38
10.42				10.42	10.42

s(H)

0.03		0.07		0.13	0.18
		0.03		0.42	0.10
		0.07	0.16	0.19	0.01
0.00	0.03	0.10		0.10	0.08
		0.02		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

H

8.80		6.93		6.56	5.97
		7.31		6.54	5.26
		7.62	6.63	6.02	4.88
9.91	9.35	8.65		5.65	5.31
		10.06		9.91	9.73
10.33		10.34		10.34	10.34
10.40				10.40	10.40

<H>

8.80		6.94		6.56	5.95
		7.30		6.49	5.28
		7.58	6.70	6.03	4.88
9.90	9.36	8.56		5.95	5.47
		10.02		9.81	9.63
10.33		10.34		10.33	10.33
10.40				10.40	10.40

s(H)

0.12		0.18		0.03	0.14
		0.29		0.18	0.21
		0.44	0.49	0.35	0.19
0.09	0.17	0.71		0.70	0.70
		0.13		0.34	0.37
0.01		0.01		0.02	0.02
0.01				0.01	0.01

ve35aa

<H>25

8.78		6.96		6.57	5.92
		7.27		6.45	5.30
		7.50	6.75	6.08	4.91
9.87	9.37	8.42		6.50	5.80
		9.91		9.61	9.41
10.33		10.33		10.32	10.32
10.40				10.40	10.40

s(H)25

0.21		0.29		0.08	0.24
		0.48		0.35	0.34
		0.74	0.78	0.61	0.30
0.16	0.30	1.13		1.29	1.31
		0.35		0.69	0.78
0.02		0.03		0.04	0.04
0.01				0.01	0.01

Averaging blocks : 1.5 m for 9 points and 3 m for 25 points.

ve35b

H

8.80		6.93		6.56	5.97
		7.31		6.54	5.26
		7.62	6.63	6.02	4.88
9.91	9.35	8.65		5.65	5.31
		10.06		9.91	9.73
10.33		10.34		10.34	10.34
10.40				10.40	10.40

<H>

8.80		6.93		6.56	5.97
		7.31		6.53	5.26
		7.62	6.64	6.02	4.88
9.91	9.35	8.65		5.66	5.31
		10.06		9.91	9.73
10.33		10.34		10.34	10.34
10.40				10.40	10.40

s(H)

0.02		0.03		0.00	0.02
		0.05		0.03	0.03
		0.08	0.09	0.06	0.03
0.01	0.03	0.12		0.10	0.10
		0.02		0.05	0.06
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35b

<H>25

8.80		6.93		6.56	5.97
		7.31		6.53	5.26
		7.62	6.64	6.02	4.88
9.91	9.35	8.64		5.67	5.32
		10.06		9.91	9.72
10.33		10.34		10.34	10.34
10.40				10.40	10.40

s(H)25

0.03		0.05		0.01	0.04
		0.08		0.05	0.06
		0.13	0.14	0.10	0.05
0.02	0.05	0.20		0.17	0.18
		0.03		0.08	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

Averaging blocks : .25 m for 9 points and .5 m for 25 points.

ce32a

H

10.04		7.30		4.52	6.08
		8.12		7.42	4.58
		8.38	6.84	8.52	4.74
9.86	9.18	8.98		6.16	5.80
		9.92		9.78	9.66
10.02		10.02		10.02	10.02
10.06				10.06	10.06

<H>

10.03		7.29		4.56	6.04
		8.12		7.43	4.58
		8.37	6.86	8.48	4.75
9.87	9.18	8.97		6.17	5.81
		9.93		9.78	9.65
10.02		10.02		10.02	10.02
10.07				10.07	10.07

s(H)

0.03		0.07		0.13	0.18
		0.03		0.42	0.10
		0.06	0.16	0.19	0.01
0.01	0.03	0.09		0.10	0.08
		0.01		0.05	0.04
0.00		0.00		0.00	0.00
0.01				0.01	0.01

ce32a

<H>25

10.03		7.29		4.66	5.95
		8.12		7.43	4.59
		8.37	6.89	8.41	4.75
9.88	9.18	8.96		6.18	5.81
		9.92		9.77	9.65
10.02		10.02		10.02	10.02
10.07				10.07	10.07

s(H)25

0.04		0.12		0.24	0.32
		0.05		0.68	0.14
		0.10	0.25	0.32	0.01
0.01	0.04	0.15		0.16	0.13
		0.02		0.08	0.08
0.00		0.00		0.00	0.00
0.01				0.01	0.01

Averaging blocks : .25 m for 9 points and .5 m for 25 points.

ce32b

H

10.04		7.30		4.52	6.08
		8.12		7.42	4.58
		8.38	6.84	8.52	4.74
9.86	9.18	8.98		6.16	5.80
		9.92		9.78	9.66
10.02		10.02		10.02	10.02
10.06				10.06	10.06

<H>

9.99		7.20		5.74	4.83
		7.93		7.52	4.78
		8.21	7.34	7.50	4.76
9.96	9.20	8.86		6.44	5.92
		9.88		9.67	9.55
10.02		10.02		10.01	10.01
10.07				10.07	10.07

s(H)

0.18		0.30		1.14	1.49
		0.28		1.56	0.35
		0.41	0.57	1.17	0.08
0.06	0.17	0.55		0.64	0.51
		0.09		0.32	0.35
0.00		0.00		0.01	0.01
0.01				0.01	0.01

ce32b

<H>25

9.87		6.95		6.79	4.68
		7.57		7.38	4.77
		7.94	7.66	6.94	4.85
10.01	9.24	8.73		6.91	6.16
		9.79		9.49	9.32
10.02		10.02		10.01	10.01
10.07				10.07	10.07

s(H)25

0.38		0.48		1.75	1.41
		0.77		1.52	0.52
		0.80	0.86	1.42	0.19
0.07	0.29	0.82		1.16	1.08
		0.27		0.65	0.74
0.01		0.01		0.02	0.02
0.01				0.01	0.01

Averaging blocks : 1.5 m for 9 points and 3 m for 25 points.

APPENDIX J. Wave periods resulting from the computations.

In this appendix the computed wave periods for the HISWA computations are given for the 26 sites. The wave periods, denoted as <T>, are the averaged values over the middle nine points of the averaging blocks. These blocks have sides of 0.5 m for all computations, except for the case ve35aa, where the sides have a length of 3 m. The standard deviation obtained over the nine points is denoted by s(T).

As in appendix H, full results are given also for the cases ve35aa and ve35b so as to be able to ascertain the effect of the block size on the averaging.

As CREDIZ has a fixed wave period, no results for CREDIZ have been given.

Thew depth-values at the sites have been given in appendix H (pages 219 and 220).

The Tables are given in the following sequence :

- the wave periods for computations ve2x;
- the wave periods for computations ve3x;
- the full results for ve35aa;
- the full results for ve35b.

ve21a

<T>

0.973		0.973		0.973	0.973
		0.973		0.973	0.973
		0.973	0.973	0.973	0.973
1.040	1.040	1.040		1.040	1.040
		1.206		1.206	1.206
1.209		1.209		1.209	1.209
1.211				1.211	1.211

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.008	0.008	0.008		0.008	0.008
		0.000		0.000	0.000
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve22

<T>

0.787		0.787		0.787	0.787
		0.787		0.787	0.787
		0.787	0.787	0.787	0.787
0.848	0.847	0.847		0.847	0.847
		1.192		1.192	1.192
1.217		1.217		1.217	1.217
1.220				1.220	1.220

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.008	0.008	0.008		0.008	0.008
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve22a

<T>

0.777		0.777		0.777	0.777
		0.777		0.777	0.777
		0.777	0.777	0.777	0.777
0.836	0.836	0.836		0.836	0.836
		1.186		1.186	1.186
1.217		1.217		1.217	1.217
1.220				1.220	1.220

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.008	0.008	0.008		0.008	0.008
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve23

<T>

0.785		0.782		0.782	0.782
		0.781		0.781	0.782
		0.781	0.781	0.781	0.782
0.840	0.838	0.838		0.838	0.838
		1.168		1.168	1.169
1.200		1.200		1.200	1.200
1.204				1.204	1.204

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.008	0.008	0.008		0.008	0.008
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve24

<T>

0.770		0.767		0.767	0.767
		0.766		0.766	0.767
		0.766	0.766	0.766	0.767
0.821	0.819	0.818		0.818	0.819
		1.116		1.116	1.116
1.144		1.144		1.144	1.144
1.147				1.147	1.147

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.007	0.007	0.007		0.007	0.007
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve25

<T>

0.774		0.771		0.771	0.772
		0.771		0.771	0.771
		0.770	0.770	0.770	0.771
0.828	0.826	0.825		0.825	0.826
		1.147		1.147	1.147
1.179		1.179		1.179	1.179
1.182				1.182	1.182

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.007	0.007	0.007		0.007	0.007
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve26

<T>

0.779		0.780		0.781	0.786
		0.780		0.780	0.783
		0.779	0.780	0.780	0.782
0.836	0.836	0.836		0.836	0.838
		1.168		1.168	1.168
1.201		1.201		1.201	1.201
1.205				1.205	1.205

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.008	0.008	0.008		0.008	0.008
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve27

<T>

0.773		0.775		0.777	0.783
		0.774		0.775	0.780
		0.773	0.774	0.774	0.779
0.826	0.826	0.826		0.827	0.831
		1.135		1.136	1.137
1.169		1.169		1.169	1.169
1.173				1.173	1.173

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.007	0.007	0.007		0.007	0.007
		0.004		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve28

<T>

0.822		0.822		0.822	0.822
		0.822		0.822	0.822
		0.822	0.822	0.822	0.822
0.902	0.902	0.902		0.902	0.902
		1.412		1.412	1.412
1.460		1.460		1.460	1.460
1.464				1.464	1.464

s(T)

0.000		0.000		0.000	0.000
		0.000		0.000	0.000
		0.000	0.000	0.000	0.000
0.011	0.011	0.011		0.011	0.011
		0.007		0.007	0.007
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve31

<T>

1.212		1.182		1.069	1.018
		1.200		1.057	0.988
		1.206	1.155	1.030	0.982
1.214	1.214	1.210		1.014	1.049
		1.214		1.213	1.213
1.216		1.216		1.216	1.216
1.218				1.218	1.218

s(T)

0.000		0.002		0.004	0.001
		0.001		0.006	0.001
		0.000	0.008	0.007	0.000
0.000	0.000	0.001		0.011	0.008
		0.000		0.000	0.000
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve32

<T>

1.201		1.161		1.032	0.883
		1.158		0.992	0.799
		1.143	1.064	0.927	0.776
1.205	1.203	1.102		0.816	0.832
		1.197		1.175	1.177
1.209		1.209		1.209	1.209
1.212				1.212	1.212

s(T)

0.000		0.003		0.007	0.003
		0.004		0.009	0.004
		0.006	0.010	0.012	0.001
0.000	0.000	0.013		0.009	0.008
		0.002		0.005	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve33

<T>

1.185		1.117		1.019	0.888
		1.122		0.985	0.800
		1.117	1.042	0.928	0.774
1.189	1.186	1.086		0.816	0.826
		1.178		1.156	1.158
1.193		1.193		1.193	1.193
1.197				1.197	1.197

s(T)

0.000		0.003		0.004	0.003
		0.004		0.007	0.004
		0.006	0.009	0.011	0.001
0.000	0.000	0.012		0.008	0.008
		0.002		0.005	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve34

⟨T⟩

1.131		1.070		0.981	0.866
		1.076		0.951	0.791
		1.073	1.004	0.901	0.768
1.135	1.132	1.050		0.807	0.817
		1.127		1.109	1.111
1.138		1.138		1.138	1.138
1.141				1.141	1.141

s(T)

0.000		0.003		0.004	0.002
		0.004		0.007	0.003
		0.005	0.008	0.009	0.001
0.000	0.000	0.010		0.008	0.007
		0.001		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35

⟨T⟩

1.156		1.089		0.995	0.865
		1.092		0.960	0.777
		1.086	1.012	0.903	0.750
1.160	1.156	1.051		0.791	0.799
		1.147		1.122	1.125
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.000		0.003		0.004	0.003
		0.004		0.007	0.004
		0.005	0.008	0.010	0.001
0.000	0.000	0.011		0.008	0.007
		0.002		0.005	0.005
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35aa

⟨T⟩

1.157		1.092		1.002	0.875
		1.095		0.967	0.797
		1.089	1.013	0.916	0.772
1.161	1.157	1.063		0.836	0.830
		1.148		1.123	1.125
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.001		0.019		0.026	0.017
		0.024		0.043	0.020
		0.031	0.052	0.058	0.007
0.000	0.003	0.054		0.049	0.048
		0.013		0.029	0.028
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35b

<T>

1.157		1.093		1.000	0.877
		1.098		0.967	0.794
		1.094	1.021	0.914	0.769
1.161	1.158	1.065		0.810	0.820
		1.151		1.130	1.132
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.000		0.003		0.004	0.003
		0.004		0.007	0.003
		0.005	0.008	0.010	0.001
0.000	0.000	0.011		0.008	0.007
		0.002		0.005	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35bs

<T>

1.146		1.059		0.959	0.878
		1.033		0.921	0.868
		1.015	0.933	0.889	0.866
1.162	1.156	1.035		0.894	0.925
		1.145		1.140	1.147
1.164		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.001		0.002		0.006	0.001
		0.006		0.004	0.000
		0.008	0.007	0.004	0.000
0.000	0.001	0.009		0.007	0.007
		0.002		0.003	0.002
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35s1

<T>

1.165		1.039		0.945	0.856
		1.059		0.903	0.834
		1.077	0.970	0.872	0.827
1.170	1.155	1.084		0.868	0.911
		1.149		1.140	1.149
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.001		0.005		0.003	0.001
		0.007		0.004	0.001
		0.007	0.011	0.006	0.000
0.000	0.001	0.008		0.010	0.010
		0.001		0.003	0.002
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35s2

⟨T⟩

1.170		1.022		0.931	0.849
		1.053		0.896	0.831
		1.074	0.966	0.869	0.826
1.170	1.154	1.085		0.869	0.910
		1.149		1.140	1.149
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.001		0.005		0.003	0.001
		0.007		0.004	0.001
		0.007	0.011	0.006	0.000
0.000	0.001	0.008		0.010	0.010
		0.001		0.003	0.002
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35c

⟨T⟩

1.158		1.099		1.009	0.899
		1.107		0.981	0.827
		1.106	1.037	0.934	0.806
1.162	1.160	1.087		0.847	0.858
		1.156		1.141	1.143
1.166		1.166		1.166	1.166
1.169				1.169	1.169

s(T)

0.000		0.003		0.004	0.002
		0.004		0.006	0.003
		0.005	0.008	0.009	0.001
0.000	0.000	0.009		0.008	0.007
		0.001		0.003	0.003
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve36

⟨T⟩

1.202		1.035		0.902	0.817
		1.065		0.873	0.784
		1.075	0.937	0.836	0.777
1.208	1.203	1.085		0.824	0.833
		1.196		1.175	1.176
1.213		1.213		1.213	1.213
1.217				1.217	1.217

s(T)

0.000		0.008		0.003	0.002
		0.010		0.005	0.001
		0.011	0.013	0.007	0.000
0.000	0.001	0.013		0.008	0.008
		0.002		0.005	0.005
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve37

<T>

1.160		1.034		0.931	0.846
		1.055		0.907	0.792
		1.064	0.964	0.867	0.777
1.168	1.162	1.064		0.817	0.828
		1.157		1.137	1.140
1.173		1.173		1.173	1.173
1.177				1.177	1.177

s(T)

0.000		0.005		0.003	0.002
		0.007		0.005	0.002
		0.008	0.010	0.007	0.001
0.000	0.001	0.011		0.008	0.007
		0.002		0.004	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve38

<T>

1.318		1.297		1.139	0.939
		1.283		1.078	0.828
		1.257	1.166	0.987	0.799
1.322	1.321	1.197		0.843	0.865
		1.313		1.286	1.289
1.327		1.327		1.327	1.327
1.331				1.331	1.331

s(T)

0.000		0.002		0.011	0.004
		0.003		0.013	0.005
		0.007	0.013	0.016	0.001
0.000	0.000	0.016		0.011	0.009
		0.002		0.006	0.005
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35aa

T

1.157		1.093		1.000	0.877
		1.098		0.967	0.794
		1.094	1.022	0.914	0.769
1.161	1.158	1.065		0.810	0.820
		1.151		1.130	1.133
1.165		1.165		1.165	1.165
1.169				1.169	1.169

<T>

1.157		1.092		1.002	0.875
		1.095		0.967	0.797
		1.089	1.013	0.916	0.772
1.161	1.157	1.063		0.836	0.830
		1.148		1.123	1.125
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.001		0.019		0.026	0.017
		0.024		0.043	0.020
		0.031	0.052	0.058	0.007
0.000	0.003	0.054		0.049	0.048
		0.013		0.029	0.028
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35aa

<T>25

1.157		1.089		1.003	0.873
		1.089		0.965	0.803
		1.078	1.002	0.918	0.777
1.161	1.155	1.059		0.889	0.853
		1.141		1.111	1.108
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)25

0.001		0.032		0.041	0.028
		0.041		0.068	0.032
		0.057	0.087	0.089	0.015
0.001	0.007	0.085		0.094	0.090
		0.032		0.055	0.057
0.001		0.001		0.001	0.001
0.001				0.001	0.001

Averaging blocks : 1.5 m for 9 points and 3.0 m for 25 points.

ve35b

T

1.157		1.093		1.000	0.877
		1.098		0.967	0.794
		1.094	1.022	0.914	0.769
1.161	1.158	1.065		0.810	0.820
		1.151		1.130	1.133
1.165		1.165		1.165	1.165
1.169				1.169	1.169

<T>

1.157		1.093		1.000	0.877
		1.098		0.967	0.794
		1.094	1.021	0.914	0.769
1.161	1.158	1.065		0.810	0.820
		1.151		1.130	1.132
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)

0.000		0.003		0.004	0.003
		0.004		0.007	0.003
		0.005	0.008	0.010	0.001
0.000	0.000	0.011		0.008	0.007
		0.002		0.005	0.004
0.000		0.000		0.000	0.000
0.000				0.000	0.000

ve35b

<T>25

1.157		1.093		1.000	0.876
		1.097		0.967	0.794
		1.093	1.021	0.914	0.770
1.161	1.158	1.065		0.811	0.820
		1.151		1.130	1.132
1.165		1.165		1.165	1.165
1.169				1.169	1.169

s(T)25

0.000		0.005		0.007	0.005
		0.007		0.012	0.006
		0.009	0.014	0.017	0.002
0.000	0.001	0.018		0.013	0.012
		0.003		0.008	0.007
0.000		0.000		0.000	0.000
0.000				0.000	0.000

Averaging blocks : 0.25 m for 9 points and 0.50 m for 25 points.

APPENDIX J. Wave directions resulting from the computations.

In this appendix the computed values for the principal wave directions are given for the 26 sites for both the HISWA and CREDIZ computations. The wave directions, denoted as <teta>, are the averaged values over the middle nine points of the averaging blocks. These blocks have sides of 0.5 m for most of the computations, but for ve35aa, and ce31c, ce32b and ce35bc the block size is 3 m. The standard deviation obtained over the nine points is indicated by s(teta). The depth-values at the sites have been given in appendix H.

In order to ascertain the effect of size the averaging blocks, full results are given for the HISWA computations ve35aa and ve35b and for the CREDIZ computations ce32a and ce32b (pages 266-269).

The Tables are given in the following sequence :

- the wave directions for computations ve2x;
- the wave directions for computations ve3x;
- the wave directions for computations ce3x;
- the full results for ve35aa;
- the full results for ve35b.

ve21a

<teta>

0.68		0.53		0.52	0.49
		0.52		0.52	0.51
		0.46	0.46	0.46	0.46
0.16	0.16	0.16		0.16	0.16
		0.05		0.05	0.05
0.00		0.00		0.00	-0.00
0.00				0.00	0.00

s(teta)

0.01		0.00		0.00	0.00
		0.00		0.00	0.00
		0.01	0.01	0.01	0.01
0.00	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22

<teta>

0.47		0.38		0.38	0.36
		0.38		0.38	0.38
		0.36	0.36	0.36	0.36
0.15	0.15	0.15		0.15	0.15
		0.05		0.05	0.05
0.00		-0.00		-0.00	-0.00
-0.00				-0.00	-0.00

s(teta)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.00	0.00	0.00	0.00
0.00	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22a

<teta>

0.46		0.37		0.37	0.36
		0.37		0.37	0.37
		0.35	0.35	0.35	0.35
0.15	0.14	0.14		0.14	0.14
		0.05		0.05	0.05
0.00		-0.00		-0.00	-0.00
-0.00				-0.00	-0.00

s(teta)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.00	0.00	0.00	0.00
0.00	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve23

<teta>

1.45		0.22		-0.02	-0.56
		0.09		-0.02	-0.29
		0.05	0.01	-0.03	-0.21
0.33	0.08	0.01		-0.02	-0.11
		0.02		-0.02	-0.13
0.12		0.00		0.00	-0.01
-0.00				-0.00	-0.00

s(teta)

0.04		0.01		0.01	0.02
		0.01		0.00	0.01
		0.00	0.00	0.00	0.01
0.01	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve24

<teta>

1.53		0.28		0.02	-0.53
		0.14		0.02	-0.26
		0.10	0.06	0.02	-0.17
0.36	0.10	0.03		-0.00	-0.10
		0.04		-0.00	-0.12
0.12		0.00		-0.00	-0.01
-0.00				-0.00	-0.00

s(teta)

0.04		0.01		0.01	0.02
		0.01		0.00	0.01
		0.00	0.00	0.00	0.01
0.01	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve25

<teta>

1.44		0.22		-0.02	-0.56
		0.09		-0.02	-0.29
		0.05	0.01	-0.03	-0.21
0.33	0.08	0.01		-0.02	-0.11
		0.02		-0.02	-0.14
0.12		0.00		-0.00	-0.01
-0.00				-0.00	-0.00

s(teta)

0.04		0.01		0.01	0.02
		0.01		0.00	0.01
		0.00	0.00	0.00	0.01
0.01	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve26

<teta>

22.50		22.40		22.30	21.88
		22.48		22.44	22.21
		21.94	21.93	21.91	21.74
15.77	15.77	15.77		15.76	15.67
		21.52		21.51	21.43
28.57		28.57		28.57	28.57
28.59				28.59	28.59

s(teta)

0.00		0.01		0.01	0.02
		0.00		0.00	0.01
		0.10	0.10	0.10	0.10
0.02	0.02	0.02		0.02	0.02
		0.26		0.26	0.26
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve27

<teta>

16.50		16.02		15.74	14.75
		16.26		16.11	15.47
		16.06	16.01	15.95	15.42
11.84	11.82	11.79		11.73	11.38
		17.57		17.50	16.99
24.71		24.71		24.70	24.67
24.77				24.77	24.77

s(teta)

0.01		0.02		0.02	0.04
		0.01		0.01	0.03
		0.05	0.05	0.05	0.05
0.04	0.04	0.04		0.04	0.04
		0.25		0.25	0.25
0.00		0.00		0.00	0.01
0.00				0.00	0.00

ve28

<teta>

0.19		0.19		0.19	0.19
		0.19		0.19	0.19
		0.18	0.18	0.18	0.18
0.07	0.07	0.07		0.07	0.07
		0.02		0.02	0.02
-0.00		-0.00		-0.00	-0.00
-0.00				-0.00	-0.00

s(teta)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.00	0.00	0.00	0.00
0.00	0.00	0.00		0.00	0.00
		0.00		0.00	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve31

<teta>

-1.48		-16.31		-14.85	-13.22
		-25.07		-22.47	-5.77
		-29.06	-32.16	-24.85	-1.02
-0.09	-9.50	-18.59		-7.29	0.15
		-4.99		-1.11	0.05
0.00		0.00		0.00	-0.00
-0.00				-0.00	-0.00

s(teta)

0.09		0.29		0.28	0.12
		0.61		0.53	0.59
		0.53	0.19	0.75	0.27
0.02	0.45	0.79		0.90	0.00
		0.28		0.17	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve32

<teta>

-1.48		-19.48		-23.43	-21.21
		-26.33		-30.37	-8.55
		-29.45	-34.22	-30.48	-1.34
-0.09	-9.44	-18.11		-7.62	0.13
		-4.96		-1.09	0.04
0.00		-0.00		-0.00	-0.00
-0.00				-0.00	-0.00

s(teta)

0.09		0.40		0.22	0.20
		0.67		0.33	0.89
		0.58	0.20	0.65	0.35
0.02	0.46	0.72		1.05	0.00
		0.28		0.17	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve33

<teta>

-2.70		-19.41		-23.08	-21.35
		-25.86		-29.46	-9.24
		-29.46	-33.53	-29.43	-2.98
0.30	-11.03	-20.80		-11.52	-0.22
		-5.84		-1.90	-0.18
0.12		0.00		0.00	-0.01
0.00				0.00	0.00

s(teta)

0.18		0.32		0.21	0.18
		0.63		0.27	0.77
		0.54	0.18	0.64	0.35
0.11	0.44	0.79		1.26	0.01
		0.32		0.20	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve34

<teta>

-2.52		-18.61		-21.99	-20.24
		-24.84		-28.24	-8.99
		-28.41	-32.42	-28.30	-2.89
0.36	-10.43	-20.10		-11.06	-0.22
		-5.55		-1.82	-0.17
0.12		0.00		-0.00	-0.01
-0.00				-0.00	-0.00

s(teta)

0.18		0.31		0.20	0.17
		0.61		0.27	0.73
		0.54	0.18	0.63	0.35
0.11	0.43	0.78		1.20	0.01
		0.31		0.19	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35

<teta>

-2.65		-19.62		-23.49	-21.82
		-25.86		-29.80	-9.59
		-29.35	-33.50	-29.60	-3.04
0.32	-10.81	-20.68		-11.48	-0.21
		-5.74		-1.86	-0.17
0.12		0.00		-0.00	-0.01
-0.00				-0.00	-0.00

s(teta)

0.18		0.32		0.21	0.18
		0.63		0.25	0.79
		0.54	0.18	0.63	0.37
0.11	0.44	0.79		1.26	0.01
		0.32		0.20	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

<teta>

-2.64		-19.17		-22.76	-20.62
		-25.39		-28.35	-9.56
		-28.50	-31.89	-28.30	-3.44
0.27	-10.63	-20.19		-12.60	-0.25
		-5.74		-2.14	-0.18
0.13		-0.01		-0.00	-0.01
0.00				-0.00	-0.00

s(teta)

1.10		1.84		1.20	1.25
		3.37		2.05	4.15
		3.05	1.09	4.29	2.19
0.68	2.72	4.54		7.63	0.07
		1.85		1.35	0.03
0.08		0.01		0.01	0.01
0.00				0.00	0.00

ve35b

⟨teta⟩

-2.62		-19.16		-22.74	-21.00
		-25.49		-29.05	-9.20
		-29.06	-33.10	-29.01	-2.97
0.33	-10.76	-20.52		-11.33	-0.22
		-5.71		-1.86	-0.18
0.12		0.00		-0.00	-0.01
0.00				0.00	0.00

s(teta)

0.18		0.31		0.20	0.18
		0.62		0.26	0.76
		0.54	0.18	0.63	0.35
0.11	0.44	0.78		1.24	0.01
		0.31		0.20	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35bs

⟨teta⟩

-0.07		-4.73		0.01	-0.19
		1.19		5.11	1.01
		-1.66	4.98	7.71	2.12
0.03	-6.32	-3.07		7.96	2.05
		3.10		6.09	2.02
0.11		3.12		3.22	1.40
-0.11				-0.16	-0.16

s(teta)

0.13		0.17		0.29	0.03
		0.62		0.30	0.10
		0.84	0.48	0.18	0.08
0.08	0.31	0.63		0.20	0.08
		0.22		0.05	0.07
0.04		0.11		0.11	0.05
0.00				0.03	0.02

ve35s1

⟨teta⟩

-6.22		-1.50		-2.86	-7.54
		-6.43		-3.53	-2.74
		-12.25	-13.18	-5.63	0.30
-0.54	-0.29	-7.67		1.16	1.75
		0.88		3.31	2.26
0.54		3.23		3.38	1.70
0.69				-0.06	0.15

s(teta)

0.16		0.07		0.15	0.05
		0.50		0.30	0.27
		0.45	0.50	0.67	0.17
0.11	0.20	0.58		0.70	0.05
		0.14		0.08	0.05
0.06		0.05		0.09	0.08
0.07				0.04	0.04

ve35s2

<teta>

-0.37		2.88		-0.23	-6.07
		-4.07		-1.76	-2.18
		-10.30	-11.62	-4.48	0.61
4.00	1.62	-6.68		1.60	1.88
		1.17		3.41	2.37
1.35		3.22		3.36	1.69
0.59				-0.06	0.15

s(teta)

0.11		0.11		0.16	0.03
		0.53		0.30	0.24
		0.51	0.52	0.64	0.16
0.01	0.15	0.57		0.67	0.04
		0.12		0.08	0.05
0.03		0.05		0.09	0.08
0.06				0.04	0.04

ve35c

<teta>

-2.57		-18.26		-21.29	-19.50
		-24.78		-27.60	-8.55
		-28.51	-32.32	-27.87	-2.86
0.33	-10.69	-20.25		-11.06	-0.25
		-5.67		-1.86	-0.18
0.12		0.00		-0.00	-0.01
0.00				0.00	0.00

s(teta)

0.18		0.30		0.20	0.17
		0.61		0.29	0.70
		0.53	0.18	0.64	0.33
0.11	0.43	0.78		1.19	0.01
		0.31		0.19	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve36

<teta>

16.42		-3.43		-3.90	6.78
		-9.29		-6.43	16.29
		-12.14	-13.17	-4.55	18.62
23.07	9.26	-1.04		9.79	13.64
		15.40		18.01	18.57
24.64		24.64		24.64	24.64
24.66				24.66	24.66

s(teta)

0.18		0.22		0.12	0.36
		0.42		0.42	0.43
		0.46	0.35	0.97	0.05
0.12	0.57	0.79		0.81	0.01
		0.40		0.28	0.22
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve37

<teta>

7.95		-7.87		-10.43	-6.45
		-14.15		-15.52	5.36
		-17.89	-21.02	-15.22	10.89
16.44	3.85	-7.54		2.00	9.22
		10.58		13.26	13.92
20.36		20.36		20.36	20.33
20.42				20.42	20.42

s(teta)

0.19		0.28		0.16	0.25
		0.56		0.29	0.71
		0.55	0.20	0.73	0.25
0.20	0.53	0.92		1.06	0.03
		0.43		0.31	0.21
0.00		0.00		0.00	0.01
0.00				0.00	0.00

ve38

<teta>

-0.44		-22.16		-26.51	-24.12
		-29.20		-33.64	-9.18
		-31.78	-36.89	-33.04	-0.90
-0.01	-9.98	-18.26		-6.46	0.07
		-5.18		-0.99	0.02
0.00		-0.00		-0.00	-0.00
0.00				0.00	0.00

s(teta)

0.04		0.45		0.25	0.21
		0.69		0.39	1.10
		0.60	0.27	0.73	0.31
0.00	0.50	0.68		1.01	0.00
		0.29		0.17	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31

<teta>

1.48		-25.85		-39.94	-4.38
		-16.36		-22.85	0.03
		-21.23	-33.52	-15.97	0.05
-0.07	-8.48	-18.09		-4.39	0.00
		-4.78		-0.61	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.24		3.52		4.83	0.66
		0.85		1.71	0.12
		2.00	9.50	3.00	0.04
0.13	0.39	1.45		1.26	0.00
		0.29		0.17	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31a

<teta>

1.17		-18.26		-47.30	-11.33
		-24.62		-31.16	2.31
		-25.61	-36.32	-26.94	0.10
-0.16	-8.52	-15.98		-3.11	0.01
		-4.57		-0.52	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.13		0.39		3.26	0.78
		0.47		2.15	1.47
		0.60	1.66	1.63	0.04
0.05	0.42	0.57		0.76	0.00
		0.26		0.15	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31b

<teta>

1.16		-18.15		-45.87	-11.50
		-24.43		-30.36	3.33
		-25.52	-35.91	-26.15	0.52
-0.33	-8.50	-15.86		-3.23	0.01
		-4.54		-0.54	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.08		0.35		3.53	0.68
		0.27		1.94	1.69
		0.38	1.39	1.37	0.19
0.04	0.43	0.55		0.76	0.00
		0.26		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce31c

<teta>

0.87		-18.11		-33.04	-0.57
		-24.33		-31.56	-0.39
		-25.93	-32.06	-25.95	0.19
-0.06	-8.32	-15.71		-5.24	0.00
		-4.48		-0.84	0.00
0.00		-0.01		-0.00	0.00
0.00				0.00	0.00

s(teta)

0.41		1.22		11.08	15.33
		2.34		8.79	4.39
		2.62	4.27	10.70	1.73
0.27	2.60	3.56		6.15	0.01
		1.49		1.02	0.00
0.00		0.01		0.01	0.00
0.00				0.00	0.00

ce32

<teta>

1.33		-21.80		-32.82	-4.66
		-19.01		-22.72	0.16
		-24.21	-34.93	-16.27	0.06
-0.09	-7.67	-17.20		-3.95	0.00
		-4.23		-0.54	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.14		1.75		2.93	0.97
		0.57		1.78	0.08
		1.25	9.04	3.48	0.04
0.09	0.36	0.90		1.14	0.00
		0.26		0.15	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce32a

<teta>

1.23		-16.42		-40.86	-13.21
		-22.36		-32.83	1.40
		-23.57	-35.38	-28.00	0.11
-0.13	-7.67	-14.75		-2.44	0.00
		-4.06		-0.43	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.11		0.23		0.77	0.61
		0.50		1.95	1.63
		0.69	1.73	1.77	0.05
0.04	0.37	0.60		0.72	0.00
		0.23		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce32b

<teta>

0.88		-16.44		-31.46	-1.27
		-22.00		-31.29	-0.23
		-23.49	-31.01	-25.61	0.12
-0.01	-7.46	-14.53		-4.83	-0.00
		-4.01		-0.75	0.00
0.00		-0.01		-0.00	0.00
0.00				0.00	0.00

s(teta)

0.60		1.34		6.78	15.88
		2.74		6.98	3.51
		3.27	4.62	11.23	0.78
0.27	2.27	3.61		6.15	0.00
		1.33		0.94	0.00
0.01		0.02		0.01	0.00
0.00				0.00	0.00

ce35

<teta>

0.76		-24.30		-29.47	-3.64
		-17.13		-19.70	0.17
		-24.22	-33.76	-14.56	0.04
-0.12	-6.87	-16.54		-3.77	0.00
		-3.93		-0.48	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.25		0.88		3.54	1.25
		0.39		1.85	0.06
		1.52	9.86	3.36	0.03
0.07	0.31	0.89		1.13	0.00
		0.24		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35a

<teta>

1.29		-21.70		-32.67	-4.68
		-19.25		-22.74	0.16
		-24.35	-34.97	-16.28	0.06
-0.08	-7.63	-17.18		-3.93	0.00
		-4.21		-0.53	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.15		1.71		2.85	0.97
		0.57		1.79	0.08
		1.21	9.02	3.49	0.04
0.08	0.36	0.89		1.14	0.00
		0.25		0.15	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35b

<teta>

1.07		-16.54		-40.74	-13.18
		-22.36		-32.90	1.41
		-23.64	-35.41	-27.99	0.10
-0.30	-7.59	-14.76		-2.43	0.00
		-4.04		-0.43	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.07		0.23		0.72	0.53
		0.50		1.95	1.61
		0.69	1.71	1.77	0.05
0.03	0.37	0.60		0.73	0.00
		0.23		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35b1

<teta>

1.06		-16.41		-40.05	-13.41
		-22.21		-32.11	2.21
		-23.49	-34.96	-27.23	0.50
-0.31	-7.59	-14.66		-2.60	0.00
		-4.01		-0.46	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.07		0.17		0.91	0.21
		0.37		1.76	2.05
		0.54	1.48	1.52	0.24
0.03	0.37	0.57		0.74	0.00
		0.23		0.13	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce35ba

<teta>

1.84		-0.77		9.26	2.03
		-10.74		3.18	-2.85
		-12.78	-13.43	1.85	-2.56
0.14	-2.15	-7.45		-1.28	-3.55
		0.13		-0.61	-2.37
-0.20		-1.57		-2.69	-1.96
-1.91				-3.75	-2.47

s(teta)

0.50		1.48		0.22	0.16
		1.17		1.20	0.10
		1.08	1.13	1.95	0.11
0.10	0.05	0.35		0.16	0.05
		0.16		0.15	0.18
0.25		0.13		0.09	0.22
0.13				0.02	0.01

ce35bb

<teta>

1.77		-0.69		9.41	1.95
		-10.82		3.33	-2.89
		-12.79	-13.27	1.97	-2.65
0.11	-2.25	-7.44		-1.32	-3.64
		0.16		-0.62	-2.35
-0.19		-1.57		-2.69	-1.95
-1.91				-3.75	-2.47

s(teta)

0.53		1.50		0.22	0.15
		1.15		1.20	0.10
		1.07	1.13	1.92	0.10
0.09	0.05	0.35		0.17	0.05
		0.16		0.16	0.18
0.25		0.13		0.09	0.22
0.13				0.02	0.01

ce35bc

<teta>

2.00		1.98		10.12	0.63
		-8.40		5.63	-1.75
		-11.82	-11.47	2.37	-2.31
0.64	-2.56	-7.53		-2.37	-3.19
		-0.81		-0.76	-2.31
-0.54		-1.40		-2.61	-2.24
-2.02				-3.81	-2.66

s(teta)

3.17		4.89		1.77	1.35
		4.72		8.53	1.26
		4.55	5.22	9.26	0.35
0.99	0.49	2.51		2.38	0.44
		1.10		0.93	0.96
1.52		0.94		0.61	1.32
0.81				0.11	0.21

ce35s1

<teta>

-7.15		-1.43		9.20	0.88
		-12.66		2.20	-2.12
		-13.46	-13.91	0.66	-2.52
-1.63	-0.56	-8.16		-2.25	-3.46
		2.00		-0.87	-2.22
2.27		-1.60		-2.62	-1.81
-1.93				-3.78	-2.39

s(teta)

0.78		1.41		0.38	0.55
		0.81		1.58	0.10
		0.78	2.59	2.26	0.09
1.06	0.14	0.48		0.26	0.09
		0.17		0.19	0.25
4.45		0.18		0.10	0.26
0.09				0.03	0.06

ce35sa

<teta>

-8.92		-0.20		9.24	1.44
		-10.72		3.21	-2.72
		-12.79	-13.38	2.01	-2.60
-1.82	-2.20	-7.46		-1.23	-3.67
		0.23		-0.61	-2.22
0.80		-1.57		-2.68	-1.93
-1.94				-3.76	-2.45

s(teta)

0.63		1.51		0.22	0.24
		1.20		1.21	0.11
		1.14	1.16	1.96	0.06
0.66	0.08	0.36		0.17	0.06
		0.16		0.12	0.20
0.31		0.13		0.09	0.23
0.12				0.02	0.01

ce35sb

<teta>

0.93		-0.46		9.26	1.90
		-10.85		3.33	-2.68
		-12.83	-13.32	2.03	-2.56
-0.63	-2.16	-7.40		-1.23	-3.62
		0.22		-0.60	-2.37
0.03		-1.57		-2.67	-1.88
-1.91				-3.76	-2.45

s(teta)

0.27		1.54		0.22	0.17
		1.19		1.20	0.10
		1.12	1.15	1.94	0.05
0.10	0.05	0.36		0.17	0.05
		0.16		0.12	0.20
0.24		0.14		0.09	0.22
0.14				0.02	0.01

ce35c

<teta>

1.23		-16.45		-40.78	-13.25
		-22.40		-32.88	1.38
		-23.62	-35.41	-28.00	0.11
-0.13	-7.62	-14.76		-2.42	0.00
		-4.04		-0.43	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.11		0.23		0.73	0.62
		0.51		1.95	1.62
		0.69	1.72	1.77	0.05
0.04	0.37	0.60		0.72	0.00
		0.23		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

teta

-2.62		-19.16		-22.74	-21.01
		-25.49		-29.07	-9.20
		-29.07	-33.14	-29.03	-2.95
0.33	-10.76	-20.50		-11.30	-0.22
		-5.71		-1.86	-0.18
0.12		0.00		-0.00	-0.01
0.00				0.00	0.00

<teta>

-2.64		-19.17		-22.76	-20.62
		-25.39		-28.35	-9.56
		-28.50	-31.89	-28.30	-3.44
0.27	-10.63	-20.19		-12.60	-0.25
		-5.74		-2.14	-0.18
0.13		-0.01		-0.00	-0.01
0.00				-0.00	-0.00

s(teta)

1.10		1.84		1.20	1.25
		3.37		2.05	4.15
		3.05	1.09	4.29	2.19
0.68	2.72	4.54		7.63	0.07
		1.85		1.35	0.03
0.08		0.01		0.01	0.01
0.00				0.00	0.00

ve35aa

<teta>25

-2.67		-19.16		-22.66	-19.88
		-24.90		-27.07	-10.05
		-27.24	-29.43	-26.53	-4.39
0.16	-10.38	-19.24		-13.21	-0.38
		-5.75		-2.60	-0.19
0.16		-0.08		-0.05	-0.02
0.00				-0.00	-0.00

s(teta)25

1.83		3.04		1.95	2.50
		4.90		3.51	6.09
		4.77	2.83	6.52	4.08
1.17	4.60	7.06		10.14	0.35
		3.09		2.55	0.05
0.14		0.17		0.12	0.02
0.00				0.00	0.00

Averaging blocks : 1.5 m for 9 points and 3 m for 25 points.

ve35b

teta

-2.62		-19.16		-22.74	-21.01
		-25.49		-29.07	-9.20
		-29.07	-33.14	-29.03	-2.95
0.33	-10.76	-20.50		-11.30	-0.22
		-5.71		-1.86	-0.18
0.12		0.00		-0.00	-0.01
0.00				0.00	0.00

<teta>

-2.62		-19.16		-22.74	-21.00
		-25.49		-29.05	-9.20
		-29.06	-33.10	-29.01	-2.97
0.33	-10.76	-20.52		-11.33	-0.22
		-5.71		-1.86	-0.18
0.12		0.00		-0.00	-0.01
0.00				0.00	0.00

s(teta)

0.18		0.31		0.20	0.18
		0.62		0.26	0.76
		0.54	0.18	0.63	0.35
0.11	0.44	0.78		1.24	0.01
		0.31		0.20	0.00
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35b

<teta>25

-2.62		-19.16		-22.75	-20.98
		-25.49		-29.00	-9.22
		-29.04	-33.04	-28.97	-3.00
0.32	-10.76	-20.51		-11.41	-0.23
		-5.71		-1.88	-0.18
0.12		0.00		-0.00	-0.01
-0.00				-0.00	-0.00

s(teta)25

0.30		0.52		0.34	0.30
		1.03		0.46	1.25
		0.89	0.30	1.09	0.59
0.19	0.73	1.30		2.09	0.01
		0.52		0.33	0.01
0.02		0.00		0.00	0.00
0.00				0.00	0.00

Averaging blocks : 0.25 m for 9 points and 0.50 m for 25 points.

ce32a

teta

1.22		-16.24		-40.61	-12.46
		-21.93		-31.86	1.45
		-23.03	-34.31	-26.64	0.10
-0.13	-7.66	-14.52		-2.55	0.00
		-4.04		-0.45	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

<teta>

1.23		-16.42		-40.86	-13.21
		-22.36		-32.83	1.40
		-23.57	-35.38	-28.00	0.11
-0.13	-7.67	-14.75		-2.44	0.00
		-4.06		-0.43	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)

0.11		0.23		0.77	0.61
		0.50		1.95	1.63
		0.69	1.73	1.77	0.05
0.04	0.37	0.60		0.72	0.00
		0.23		0.14	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ce32a

<teta>25

1.20		-16.36		-39.66	-12.46
		-22.17		-32.55	1.40
		-23.41	-34.84	-27.64	0.07
-0.12	-7.66	-14.65		-2.61	0.00
		-4.05		-0.46	0.00
-0.00		0.00		0.00	0.00
0.00				0.00	0.00

s(teta)25

0.19		0.33		1.85	1.08
		0.69		3.01	2.07
		0.93	2.52	2.67	0.10
0.06	0.62	0.95		1.30	0.00
		0.39		0.22	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

Averaging blocks : 0.25 m for 9 points and 0.50 m for 25 points.

ce32b

teta

1.22		-16.24		-40.61	-12.46
		-21.93		-31.86	1.45
		-23.03	-34.31	-26.64	0.10
-0.13	-7.66	-14.52		-2.55	0.00
		-4.04		-0.45	0.00
0.00		0.00		0.00	0.00
0.00				0.00	0.00

<teta>

0.88		-16.44		-31.46	-1.27
		-22.00		-31.29	-0.23
		-23.49	-31.01	-25.61	0.12
-0.01	-7.46	-14.53		-4.83	-0.00
		-4.01		-0.75	0.00
0.00		-0.01		-0.00	0.00
0.00				0.00	0.00

s(teta)

0.60		1.34		6.78	15.88
		2.74		6.98	3.51
		3.27	4.62	11.23	0.78
0.27	2.27	3.61		6.15	0.00
		1.33		0.94	0.00
0.01		0.02		0.01	0.00
0.00				0.00	0.00

ce32b

<teta>25

0.32		-17.22		-26.63	0.25
		-23.11		-25.90	-0.63
		-23.93	-26.32	-20.86	-0.33
0.09	-7.10	-14.20		-6.86	0.00
		-3.94		-1.22	-0.00
0.00		-0.05		-0.02	0.00
0.00				0.00	0.00

s(teta)25

0.94		4.30		7.83	13.37
		6.94		11.05	5.11
		6.75	7.26	14.30	2.07
0.39	3.89	6.07		9.21	0.01
		2.23		1.83	0.01
0.01		0.11		0.07	0.00
0.00				0.00	0.00

Averaging blocks : 1.5 m for 9 point and 3 m for 25 points.

APPENDIX L. Directional spread resulting from the computations.

In this appendix the values of the directional spread as resulting from the HISWA computations are given for the 26 sites. The directional spread values, denoted as <sigma> in this appendix, are the averaged values over the middle nine points of the averaging blocks. These blocks have sides of 0.50 m for all computations, except case ve35aa, where the sides have a length of 3 m. The standard deviation as obtained over the nine points is denoted as s(sigma). The values of the depths at the sites are given in the Table in the beginning of appemdix H.

In order to ascertain the effect of the size of the averaging blocks, full results are given for cases ve35aa and ve35b at the end of the appendix.

The Tables are given in the following sequence :

- the directional spread of computations ve2x,
- the directional spread of computations ve3x,
- the full results for ve35aa,
- the full results for ve35b.

ve21a

<sigma>					
13.92		14.14		14.15	14.11
		14.16		14.16	14.15
		13.12	13.12	13.12	13.12
7.95	7.95	7.95		7.95	7.95
		10.11		10.11	10.11
12.50		12.50		12.50	12.50
12.50				12.50	12.50
s(sigma)					
0.01		0.00		0.00	0.00
		0.00		0.00	0.00
		0.15	0.15	0.15	0.15
0.00	0.00	0.00		0.00	0.00
		0.09		0.09	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22

<sigma>					
12.05		12.17		12.18	12.16
		12.18		12.18	12.18
		11.78	11.78	11.78	11.77
8.06	8.07	8.07		8.07	8.07
		10.11		10.11	10.11
12.50		12.50		12.50	12.50
12.50				12.50	12.50
s(sigma)					
0.01		0.00		0.00	0.00
		0.00		0.00	0.00
		0.07	0.07	0.07	0.07
0.00	0.00	0.00		0.00	0.00
		0.09		0.09	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve22a

<sigma>					
11.95		12.07		12.07	12.05
		12.07		12.07	12.07
		11.70	11.70	11.70	11.70
8.07	8.08	8.08		8.08	8.08
		10.11		10.11	10.11
12.49		12.49		12.49	12.49
12.50				12.50	12.50
s(sigma)					
0.01		0.00		0.00	0.00
		0.00		0.00	0.00
		0.07	0.07	0.07	0.07
0.00	0.00	0.00		0.00	0.00
		0.09		0.09	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve23

<sigma>

19.61		20.53		20.58	20.35
		20.84		20.87	20.73
		20.42	20.44	20.44	20.34
13.88	14.12	14.18		14.19	14.13
		19.05		19.07	18.99
24.84		24.95		24.95	24.94
24.97				24.97	24.97

s(sigma)

0.03		0.02		0.01	0.02
		0.01		0.01	0.01
		0.09	0.09	0.09	0.09
0.03	0.02	0.02		0.02	0.02
		0.21		0.21	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve24

<sigma>

19.58		20.51		20.57	20.34
		20.83		20.87	20.72
		20.47	20.49	20.50	20.39
14.10	14.34	14.40		14.42	14.35
		19.28		19.30	19.22
24.83		24.94		24.94	24.94
24.97				24.97	24.97

s(sigma)

0.03		0.02		0.02	0.02
		0.01		0.01	0.01
		0.08	0.08	0.08	0.08
0.03	0.02	0.02		0.02	0.02
		0.21		0.21	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve25

<sigma>

19.52		20.43		20.48	20.26
		20.74		20.77	20.63
		20.36	20.38	20.38	20.28
13.96	14.20	14.26		14.27	14.21
		19.13		19.15	19.07
24.83		24.94		24.94	24.94
24.97				24.97	24.97

s(sigma)

0.03		0.02		0.01	0.02
		0.01		0.01	0.01
		0.08	0.08	0.08	0.08
0.03	0.02	0.02		0.02	0.02
		0.21		0.21	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve26

<sigma>

13.42		13.33		13.25	12.93
		13.40		13.37	13.21
		13.07	13.06	13.05	12.92
8.47	8.47	8.47		8.46	8.38
		10.25		10.24	10.16
12.35		12.35		12.35	12.35
12.36				12.36	12.36

s(sigma)

0.00		0.01		0.01	0.02
		0.00		0.00	0.01
		0.07	0.07	0.07	0.06
0.01	0.01	0.01		0.01	0.01
		0.08		0.08	0.08
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve27

<sigma>

18.95		18.89		18.72	18.06
		19.11		19.01	18.62
		18.80	18.77	18.72	18.40
13.28	13.29	13.26		13.21	12.93
		17.23		17.19	16.88
21.87		21.87		21.87	21.85
21.89				21.89	21.89

s(sigma)

0.01		0.01		0.02	0.03
		0.01		0.01	0.02
		0.07	0.07	0.07	0.06
0.02	0.02	0.02		0.02	0.02
		0.17		0.18	0.18
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve28

<sigma>

6.83		6.83		6.83	6.83
		6.83		6.83	6.83
		6.56	6.56	6.56	6.56
4.51	4.51	4.51		4.51	4.51
		5.61		5.61	5.61
7.11		7.11		7.11	7.11
7.11				7.11	7.11

s(sigma)

0.00		0.00		0.00	0.00
		0.00		0.00	0.00
		0.04	0.04	0.04	0.04
0.00	0.00	0.00		0.00	0.00
		0.05		0.05	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve31

<sigma>

11.16		15.73		20.82	24.65
		15.30		23.36	21.52
		15.13	17.75	22.80	15.51
12.37	11.97	12.69		11.67	7.96
		11.61		10.44	10.10
12.50		12.50		12.50	12.50
12.50				12.50	12.50

s(sigma)

0.04		0.29		0.12	0.08
		0.28		0.21	0.47
		0.12	0.44	0.30	0.50
0.01	0.03	0.12		0.39	0.00
		0.04		0.08	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve32

<sigma>

11.12		11.52		17.38	25.72
		13.46		20.38	22.54
		14.40	15.69	21.21	14.69
12.36	11.96	12.39		12.09	8.11
		11.60		10.46	10.12
12.49		12.49		12.49	12.49
12.50				12.50	12.50

s(sigma)

0.04		0.16		0.29	0.14
		0.18		0.42	0.61
		0.05	0.27	0.49	0.59
0.01	0.03	0.09		0.42	0.00
		0.04		0.08	0.09
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve33

<sigma>

17.01		17.38		22.28	29.17
		18.83		25.50	27.42
		19.28	20.97	26.28	22.95
22.11	20.53	19.58		19.88	14.29
		21.46		19.98	19.06
24.83		24.94		24.94	24.94
24.97				24.97	24.97

s(sigma)

0.06		0.15		0.25	0.13
		0.18		0.36	0.38
		0.04	0.34	0.44	0.37
0.08	0.07	0.07		0.37	0.02
		0.12		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve34

<sigma>

17.13		17.75		22.57	29.09
		19.10		25.78	27.40
		19.55	21.41	26.54	23.07
22.16	20.66	19.74		19.87	14.52
		21.62		20.17	19.29
24.83		24.94		24.94	24.94
24.97				24.97	24.97

s(sigma)

0.06		0.15		0.24	0.12
		0.19		0.34	0.36
		0.05	0.35	0.41	0.36
0.08	0.07	0.07		0.36	0.02
		0.11		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35

<sigma>

17.03		17.05		21.87	29.02
		18.62		25.13	27.39
		19.22	20.83	26.08	22.79
22.12	20.55	19.59		19.95	14.38
		21.51		20.05	19.14
24.82		24.93		24.93	24.92
24.97				24.97	24.97

s(sigma)

0.06		0.14		0.25	0.13
		0.18		0.36	0.38
		0.03	0.33	0.44	0.38
0.08	0.07	0.07		0.37	0.02
		0.12		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

<sigma>

17.06		17.60		22.30	28.98
		19.02		25.31	27.20
		19.46	21.54	25.80	23.04
22.09	20.62	19.69		19.54	14.44
		21.54		20.09	19.11
24.81		24.92		24.85	24.84
24.97				24.97	24.97

s(sigma)

0.38		0.89		1.48	0.70
		1.00		2.09	1.96
		0.44	1.99	2.45	2.16
0.49	0.43	0.39		1.87	0.14
		0.69		1.01	1.25
0.07		0.05		0.13	0.14
0.00				0.00	0.00

ve35b

<sigma>

17.06		17.47		22.34	29.13
		18.90		25.57	27.42
		19.37	21.13	26.37	22.99
22.13	20.58	19.64		19.89	14.39
		21.53		20.06	19.16
24.83		24.94		24.94	24.93
24.97				24.97	24.97

s(sigma)

0.06		0.15		0.24	0.12
		0.19		0.35	0.37
		0.04	0.34	0.42	0.37
0.08	0.07	0.07		0.36	0.02
		0.12		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35bs

<sigma>

20.37		26.24		24.31	21.55
		27.75		29.79	22.65
		27.85	31.28	30.67	22.03
19.71	19.04	19.73		20.83	18.45
		20.76		21.39	21.35
23.01		24.43		25.37	26.31
24.35				25.03	25.40

s(sigma)

0.16		0.13		0.22	0.09
		0.22		0.37	0.09
		0.44	0.25	0.27	0.10
0.08	0.04	0.17		0.17	0.01
		0.12		0.12	0.17
0.03		0.04		0.04	0.01
0.03				0.01	0.03

ve35s1

<sigma>

25.37		24.57		25.83	22.89
		22.94		30.24	24.13
		21.94	26.32	31.24	23.14
23.25	21.25	19.89		19.84	17.26
		22.06		21.89	21.20
23.11		25.04		25.01	26.14
24.33				25.11	25.60

s(sigma)

0.07		0.08		0.16	0.13
		0.32		0.27	0.15
		0.26	0.55	0.21	0.15
0.05	0.04	0.03		0.20	0.07
		0.11		0.12	0.11
0.02		0.02		0.02	0.03
0.05				0.04	0.02

ve35s2

<sigma>

21.95		22.50		24.89	22.82
		21.80		29.44	24.12
		20.88	25.72	30.71	23.19
20.48	19.73	19.11		19.41	17.34
		21.81		21.81	21.29
22.51		25.04		25.01	26.15
24.40				25.11	25.60

s(sigma)

0.11		0.15		0.18	0.12
		0.36		0.28	0.13
		0.30	0.57	0.21	0.14
0.04	0.05	0.03		0.17	0.07
		0.12		0.12	0.11
0.03		0.02		0.02	0.03
0.05				0.04	0.02

ve35c

<sigma>

17.11		18.29		23.17	29.29
		19.44		26.34	27.50
		19.67	21.69	26.87	23.35
22.14	20.62	19.73		19.78	14.41
		21.56		20.08	19.18
24.84		24.95		24.95	24.94
24.97				24.97	24.97

s(sigma)

0.06		0.16		0.23	0.11
		0.20		0.33	0.35
		0.07	0.37	0.40	0.35
0.08	0.07	0.07		0.36	0.02
		0.11		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve36

<sigma>

9.27		17.51		23.46	27.53
		17.51		26.99	19.09
		16.64	22.10	27.05	13.44
11.52	11.47	12.55		10.96	8.32
		11.68		10.53	10.20
12.44		12.44		12.44	12.43
12.44				12.44	12.44

s(sigma)

0.03		0.31		0.26	0.13
		0.44		0.33	0.66
		0.39	0.62	0.27	0.27
0.05	0.07	0.10		0.47	0.01
		0.02		0.08	0.08
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve37

<sigma>

16.50		20.28		25.76	31.64
		21.45		29.79	27.23
		21.41	25.66	30.57	21.25
20.68	19.14	19.13		18.23	13.35
		19.94		18.37	17.56
22.87		22.87		22.87	22.86
22.90				22.90	22.90

s(sigma)

0.04		0.26		0.23	0.07
		0.36		0.30	0.56
		0.27	0.53	0.30	0.43
0.09	0.05	0.05		0.47	0.02
		0.09		0.16	0.19
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve38

<sigma>

6.79		8.34		14.52	24.22
		10.14		17.13	20.79
		10.70	11.45	17.94	9.71
7.09	7.33	7.68		7.99	4.59
		6.83		5.95	5.69
7.11		7.11		7.11	7.11
7.11				7.11	7.11

s(sigma)

0.02		0.11		0.39	0.18
		0.15		0.53	0.82
		0.08	0.22	0.61	0.78
0.00	0.05	0.07		0.46	0.00
		0.03		0.06	0.05
0.00		0.00		0.00	0.00
0.00				0.00	0.00

ve35aa

sigma

17.06		17.47		22.34	29.13
		18.89		25.57	27.43
		19.36	21.12	26.38	22.99
22.13	20.57	19.62		19.90	14.39
		21.53		20.06	19.16
24.83		24.94		24.94	24.93
24.97				24.97	24.97

<sigma>

17.06		17.60		22.30	28.98
		19.02		25.31	27.20
		19.46	21.54	25.80	23.04
22.09	20.62	19.69		19.54	14.44
		21.54		20.09	19.11
24.81		24.92		24.85	24.84
24.97				24.97	24.97

s(sigma)

0.38		0.89		1.48	0.70
		1.00		2.09	1.96
		0.44	1.99	2.45	2.16
0.49	0.43	0.39		1.87	0.14
		0.69		1.01	1.25
0.07		0.05		0.13	0.14
0.00				0.00	0.00

ve35aa

<sigma>25

17.06		17.86		22.27	28.66
		19.26		24.88	26.81
		19.70	21.99	24.88	22.93
22.02	20.66	19.83		19.63	15.43
		21.54		20.12	19.00
24.79		24.81		24.69	24.65
24.97				24.97	24.97

s(sigma)25

0.63		1.53		2.39	1.08
		1.71		3.12	2.76
		1.22	2.97	3.26	3.71
0.82	0.76	0.63		2.69	1.37
		1.16		1.67	2.10
0.13		0.26		0.40	0.45
0.01				0.01	0.01

Averaging blocks : 1.5 m for 9 points and 3.0 m for 25 points.

ve35b

sigma

17.06		17.47		22.34	29.13
		18.89		25.57	27.43
		19.36	21.12	26.38	22.99
22.13	20.57	19.62		19.90	14.39
		21.53		20.06	19.16
24.83		24.94		24.94	24.93
24.97				24.97	24.97

<sigma>

17.06		17.47		22.34	29.13
		18.90		25.57	27.42
		19.37	21.13	26.37	22.99
22.13	20.58	19.64		19.89	14.39
		21.53		20.06	19.16
24.83		24.94		24.94	24.93
24.97				24.97	24.97

s(sigma)

0.06		0.15		0.24	0.12
		0.19		0.35	0.37
		0.04	0.34	0.42	0.37
0.08	0.07	0.07		0.36	0.02
		0.12		0.17	0.21
0.01		0.00		0.00	0.00
0.00				0.00	0.00

ve35b

<sigma>25

17.06		17.48		22.34	29.12
		18.90		25.55	27.41
		19.38	21.14	26.34	23.00
22.13	20.58	19.65		19.87	14.39
		21.53		20.07	19.16
24.82		24.94		24.94	24.93
24.97				24.97	24.97

s(sigma)25

0.11		0.25		0.41	0.21
		0.31		0.59	0.61
		0.08	0.57	0.71	0.61
0.14	0.12	0.11		0.61	0.04
		0.19		0.29	0.35
0.02		0.00		0.00	0.00
0.00				0.00	0.00

Averaging blocks : 0.25 m for 9 points and 0.50 m for 25 points.

APPENDIX M. Relative differences of wave height.

In this appendixare given the relative errors δ (denoted also as del) between the computed and measured wave heights. These errors are given for each measuring position separately, for each of the HISWA and CREDIZ computations. At first the computations on the fully cylindrical bar are given (ve2x) and subsequently the ones for the semi-cylindrical bar are given (ve3x). The relative errors for the performed CRTEDIZ computations are given subsequently (ce3x).

The values are given as a percentage. At the end, a Table with the bias, the mean of the absolute relative differences, $<|\delta|>$ and its standard deviation, $s(|\delta|)$, together with the root mean square error, rmse are added for all computations. Here the mean is taken over all 26 measuring sites. Subsequently, tables with 22, 20, 17, 16, 10, 9 and 7 measuring sites are given with the same parameters, as is done in appendix E for the statistical parameters; there is referred to appendix E for the location of the positions taken into account.

The parameters are defined as follows.

$$\delta = \frac{H_{comp} - H_{meas}}{H_{meas}} \cdot 100\ \%$$

$$<|\delta|> = n^{-1}\sum_{i=1}^{n} |\delta_i|$$

$$s(|\delta|) = \left[(n-1)^{-1}\sum_{i=1}^{n}\{|\delta_i| - <|\delta|>\}^2\right]^{1/2}$$

$$bias = \frac{<H_{comp}> - <H_{meas}>}{<H_{meas}>} \cdot 100\ \%$$

ve21a

relative error del

-11.97		-5.19		3.70	0.00
		-6.67		6.33	1.94
		-9.69	-2.84	0.49	-0.49
0.21	1.07	-1.04		2.82	-1.04
		-0.94		-1.50	-0.94
-2.47		-0.39		1.38	3.85
-6.72				0.00	-1.34

ve22

relative error del

-2.79		7.74		2.53	4.73
		7.51		1.67	7.27
		0.00	-1.46	-3.27	0.85
-2.36	-1.82	-2.36		1.89	-1.10
		-5.38		-3.26	-3.26
-3.23		-2.84		-2.34	0.63
-6.53				-3.71	-3.91

ve22a

relative error del

-3.19		7.30		2.11	4.30
		7.06		1.25	6.83
		-0.42	-1.87	-3.67	0.43
-3.08	-2.55	-3.08		1.13	-1.83
		-2.99		-0.81	-0.81
0.20		0.61		1.12	4.20
-3.02				-0.10	-0.30

ve23

relative error del

0.21		3.80		4.68	1.03
		5.33		7.39	2.92
		-1.44	0.42	-2.24	-2.64
-6.57	-5.10	-7.22		-3.74	-2.53
		-4.67		-3.73	2.08
0.49		1.09		1.29	2.20
-6.54				-0.48	2.90

ve24

relative error del

-0.21		2.75		6.81	0.21
		3.40		8.20	1.67
		-2.46	-0.84	0.42	-2.46
-6.71	-8.01	-8.17		-4.86	-4.52
		-2.17		-1.15	4.29
2.14		2.45		2.66	2.97
-4.81				-0.20	1.92

ve25

relative error del

1.48		2.54		4.53	0.41
		1.04		8.46	0.62
		-4.44	-1.25	0.21	-3.07
-6.69	-7.02	-7.19		-5.37	-5.03
		-4.17		-3.01	4.32
-0.20		1.90		1.19	3.14
-6.59				-0.20	1.79

ve26

relative error del

-5.56		-6.29		-2.77	10.41
		-5.92		2.29	18.60
		-9.62	-7.53	1.27	17.73
-12.66	-10.30	-8.29		-3.10	2.70
		1.47		-1.33	8.92
-12.48		1.49		5.46	6.22
-6.46				-0.19	0.69

ve27

relative error del

-6.87		-3.56		-3.77	5.71
		-6.86		-0.81	5.64
		-12.01	-6.85	-8.99	4.85
-15.90	-14.95	-13.84		-10.94	-2.21
		-5.02		-0.93	6.57
-17.61		4.30		5.04	14.49
-5.15				-0.28	-3.05

ve28

relative error del

1.07		-6.18		6.80	-12.94
		0.21		2.61	-8.54
		-0.87	-6.73	-2.77	-6.16
2.87	-2.00	1.13		5.28	5.70
		3.50		5.89	7.36
-3.83		1.14		0.72	2.73
-3.73				-0.10	8.87

ve31

relative error del

-6.58		-16.06		-15.41	14.25
		-7.80		-15.68	0.45
		-4.56	-13.96	-17.08	-7.38
3.49	-7.65	1.33		5.19	3.06
		-1.90		-0.75	2.96
-3.44		-5.77		-3.80	0.40
-4.34				0.00	-0.20

ve32

relative error del

-20.47		-22.49		0.00	11.11
		-10.05		-5.38	-7.88
		-6.50	-13.94	-6.17	-18.09
-6.40	-6.93	-1.90		-6.30	-9.93
		1.83		2.47	7.83
-0.89		-4.11		-2.15	4.05
-6.25				-0.10	2.03

ve33

relative error del

-25.32		-15.13		-4.66	-3.72
		-12.05		-14.66	-13.93
		-9.38	-18.63	-17.90	-22.98
-14.57	-6.40	-2.02		-7.95	-14.77
		1.71		0.60	8.77
1.98		-4.35		-1.90	-1.71
-7.82				-0.57	3.28

ve34

relative error del

-19.38		-11.37		-8.76	-5.59
		-9.02		-12.72	-17.22
		-4.97	-16.17	-17.66	-22.61
-10.29	-4.74	0.60		-8.03	-16.32
		1.36		1.69	9.91
-0.10		-3.57		-2.92	-0.50
-6.26				-0.20	1.62

ve35

relative error del

-22.73		-14.07		-8.02	-7.67
		-12.29		-16.18	-17.96
		-9.87	-19.70	-20.87	-25.28
-12.41	-6.24	-3.55		-11.89	-18.88
		1.53		-0.10	8.23
1.98		-4.00		-1.43	-0.39
-6.23				-0.29	3.49

ve35aa

relative error del

-22.47		-12.81		-6.02	-4.95
		-11.19		-14.61	-14.56
		-8.78	-16.98	-18.29	-22.42
-12.23	-5.74	-2.06		-3.09	-12.48
		1.93		0.31	8.57
2.18		-3.81		-1.34	-0.29
-6.14				-0.19	3.59

ve35b

relative error del

-22.47		-12.94		-6.02	-4.63
		-11.07		-14.08	-14.89
		-8.30	-17.72	-18.43	-22.42
-12.15	-5.84	-1.03		-7.82	-15.04
		2.34		1.33	9.70
2.18		-3.81		-1.24	-0.19
-6.14				-0.19	3.59

ve35bs

relative error del

-16.92		2.51		-7.88	10.22
		9.25		-16.45	11.00
		7.22	-7.43	-13.01	1.75
-5.85	4.33	-1.37		-6.19	-7.84
		5.29		-3.89	1.35
5.54		-2.42		-1.72	-2.51
-6.05				-0.19	3.49

ve35s1

relative error del

-12.86		-2.64		-5.16	0.32
		-2.31		-2.11	1.62
		-7.10	-12.14	-7.59	-6.36
0.27	4.63	-5.15		-0.16	-3.04
		0.10		-5.42	-1.69
5.54		0.93		0.38	-6.18
-7.94				-0.10	1.49

ve35s2

relative error del

-16.92		-7.79		-7.74	0.32
		-4.87		-3.29	1.62
		-9.03	-13.14	-8.13	-6.36
-4.26	2.82	-5.84		-0.33	-3.04
		-0.20		-5.52	-1.58
4.65		0.93		0.38	-6.18
-7.85				-0.10	1.49

ve35c

relative error del

-22.11		-11.06		-2.44	0.80
		-9.00		-10.00	-9.06
		-5.78	-14.37	-13.82	-17.01
-11.79	-5.34	3.20		0.00	-7.84
		3.46		3.48	11.95
2.37		-3.63		-1.05	0.00
-6.14				-0.19	3.59

ve36

relative error del

-42.77		-12.76		25.36	-5.16
		-19.12		6.33	-17.36
		-15.19	-17.88	-6.28	-21.25
-26.78	-15.88	-9.71		-8.53	-11.31
		-6.16		2.80	14.09
-10.40		-2.98		0.38	1.16
-7.42				-0.19	4.28

ve37

relative error del

-27.52		-21.45		-4.43	-6.37
		-21.67		-15.16	-15.65
		-20.97	-22.14	-19.47	-27.67
-24.71	-17.72	-7.15		-12.89	-15.04
		-7.54		1.87	19.98
-15.97		-9.82		-2.88	9.41
-4.96				-0.28	-1.31

ve38

relative error del

-24.06		-18.88		11.68	21.66
		-1.73		-1.06	-7.10
		2.80	-4.64	-0.28	-17.37
-8.11	-2.34	6.26		-2.90	-8.63
		6.43		7.88	12.53
-7.04		-0.80		-1.98	2.17
-6.15				-0.10	1.74

ce31

relative error del

-4.26		-8.49		-56.33	14.02
		18.12		20.74	-12.44
		26.03	8.60	19.21	-12.08
2.67	-6.67	10.27		6.85	3.50
		-1.33		-1.12	2.57
-3.05		-5.40		-3.42	0.79
-4.15				0.20	0.00

ce31a

relative error del

-0.19		-18.35		-59.63	7.94
		-3.67		-13.66	-16.29
		-1.08	-17.78	5.25	-13.20
2.67	-9.22	0.38		4.15	1.53
		-1.90		-1.12	2.57
-3.05		-5.40		-3.42	0.79
-4.15				0.20	0.00

ce31b

relative error del

-0.19		-17.89		-57.98	10.51
		-4.13		-12.31	-17.19
		-1.74	-17.78	5.25	-12.98
3.08	-9.22	0.00		5.19	2.63
		-1.90		-1.31	2.57
-3.05		-5.40		-3.42	0.79
-4.15				0.20	0.00

ce31c

relative error del

-0.77		-18.12		-39.08	-8.88
		-5.50		-11.47	-10.86
		-3.04	-10.52	-7.06	-12.30
3.90	-8.82	-0.38		7.26	3.50
		-1.71		-1.12	2.96
-3.24		-5.59		-3.61	0.60
-4.15				0.20	0.00

ce32

relative error del

-18.46		-10.27		-25.80	9.14
		10.65		32.26	-16.29
		12.53	-3.18	30.70	-17.24
-7.24	-5.72	4.47		6.97	1.68
		1.94		1.55	7.28
-0.89		-4.11		-2.15	4.05
-6.06				0.10	2.23

ce32a

relative error del

-16.21		-15.92		-33.53	8.24
		-1.69		-0.13	-19.79
		-1.06	-16.14	21.66	-18.94
-7.15	-7.83	0.22		2.32	-2.19
		1.22		0.82	6.39
-0.89		-4.11		-2.15	4.05
-6.06				0.10	2.23

ce32b

relative error del

-16.54		-16.96		-16.33	-13.44
		-4.00		1.08	-16.29
		-2.96	-10.27	7.60	-18.77
-6.30	-7.63	-1.01		6.80	-0.34
		0.71		-0.31	5.29
-0.89		-4.11		-2.25	3.95
-6.06				0.10	2.23

ce35

relative error del

-7.84		0.50		-14.61	-6.71
		14.84		29.47	-20.87
		14.92	-4.96	20.87	-21.78
-8.95	-2.42	6.18		4.07	-4.00
		3.36		1.43	10.60
2.67		-3.44		-0.86	0.19
-5.60				0.38	4.18

ce35a

relative error del

-11.10		0.00		-25.36	-1.92
		13.38		30.79	-22.17
		16.37	-0.87	24.53	-22.26
-9.75	-2.32	8.58		5.86	-2.56
		4.68		3.17	12.51
2.67		-3.44		-0.86	0.19
-5.96				0.00	3.78

ce35b

relative error del

-8.28		-5.78		-33.24	-2.88
		0.97		-1.05	-25.24
		2.89	-13.75	15.85	-24.01
-9.22	-4.53	4.12		1.30	-6.40
		3.97		2.25	11.39
2.67		-3.44		-0.86	0.19
-5.96				0.00	3.78

ce35b1

relative error del

-8.28		-5.65		-31.81	0.00
		0.85		0.26	-25.40
		2.29	-13.75	15.72	-23.37
-9.22	-4.53	4.58		3.75	-3.84
		4.07		2.97	12.18
2.67		-3.44		-0.86	0.19
-5.96				0.00	3.78

ce35ba

relative error del

-10.48		-20.35		25.07	-18.37
		-16.18		11.05	-8.58
		-9.03	-3.35	-5.83	-13.04
-19.50	17.93	-2.29		4.56	-3.68
		-7.12		-3.07	-11.95
-2.47		-4.00		0.29	-12.07
-7.40				0.00	1.59

ce35bb

relative error del

-12.78		-20.85		24.07	-18.53
		-17.15		10.13	-9.22
		-10.11	-4.09	-6.23	-13.67
-22.61	15.61	-4.00		4.23	-4.80
		-10.27		-5.62	-14.99
-5.93		-7.35		-3.25	-15.25
-10.83				-3.65	-2.09

ce35bc

relative error del

-12.42		-12.31		16.48	-15.65
		-10.34		1.05	-11.33
		-8.06	-5.45	-8.27	-13.35
-19.59	13.39	-4.81		7.82	-3.52
		-7.43		-5.62	-13.98
-5.44		-8.19		-3.72	-14.67
-10.74				-3.74	-2.19

ce35s1

relative error del

27.31		-21.61		27.94	-18.37
		-18.00		17.24	-8.90
		-8.90	3.47	-7.05	-12.88
-12.77	19.84	-1.60		7.33	-3.36
		-8.44		-2.45	-11.16
-5.14		-3.44		0.38	-11.29
-7.22				0.19	2.09

ce35sa

relative error del

26.26		-20.85		24.64	-19.65
		-17.03		11.18	-9.22
		-9.51	-2.60	-5.83	-13.35
-10.20	18.13	-2.52		2.93	-4.80
		-7.63		-3.68	-12.29
-4.55		-3.81		0.48	-12.07
-7.40				0.00	1.59

ce35sb

relative error del

-8.46		-20.10		24.36	-18.37
		-16.30		10.92	-9.06
		-9.27	-2.85	-5.69	-13.04
-17.20	17.72	-2.75		2.93	-4.64
		-7.63		-3.68	-12.51
-2.57		-3.81		0.48	-11.87
-7.40				0.00	1.59

ce35c

relative error del

-8.81		-5.90		-33.09	-2.88
		1.09		-1.05	-25.24
		2.89	-13.75	15.99	-24.01
-9.57	-4.43	4.12		1.30	-6.40
		3.97		2.25	11.39
2.67		-3.44		-0.86	0.19
-5.96				0.00	3.78

case	n	bias	rmse	<|del|>	s(|del|)
ve21a	26	-1.30	4.16	2.89	3.12
ve22	26	-1.45	4.04	3.25	2.13
ve22a	26	0.08	2.71	2.47	2.12
ve23	26	-0.64	3.82	3.18	2.20
ve24	26	-0.17	3.81	3.33	2.52
ve25	26	-0.88	4.03	3.30	2.50
ve26	26	-0.97	7.53	6.53	5.04
ve27	26	-3.37	9.59	7.16	4.94
ve28	26	0.53	5.20	4.22	3.18
ve31	26	-4.19	8.66	6.29	5.60
ve32	26	-4.82	9.36	7.13	6.02
ve33	26	-7.35	11.39	9.11	7.23
ve34	26	-6.35	9.63	8.21	6.73
ve35	26	-7.78	11.39	9.82	7.68
ve35aa	26	-6.52	10.29	8.35	6.85
ve35b	26	-6.56	10.45	8.67	6.88
ve35bs	26	-1.63	7.46	6.22	4.49
ve35s1	26	-2.76	5.66	3.97	3.59
ve35s2	26	-3.85	6.74	4.78	4.18
ve35c	26	-4.47	9.15	6.90	5.79
ve36	26	-8.98	18.02	11.98	9.75
ve37	26	-11.19	16.31	13.62	8.43
ve38	26	-2.05	10.21	7.17	6.77
ce31	26	0.54	15.80	9.70	11.81
ce31a	26	-5.76	14.74	7.60	12.05
ce31b	26	-5.52	14.46	7.73	11.71
ce31c	26	-5.36	10.65	6.72	8.02
ce32	26	-0.12	11.52	9.34	9.05
ce32a	26	-3.98	10.17	7.73	8.68
ce32b	26	-4.25	8.30	6.62	6.09
ce35	26	0.55	9.83	8.30	7.91
ce35a	26	0.73	11.08	9.04	9.17
ce35b	26	-3.04	9.33	7.46	8.52
ce35b1	26	-2.67	9.20	7.29	8.40
ce35ba	26	-4.68	11.16	9.20	6.96
ce35bb	26	-6.85	12.46	10.67	6.42
ce35bc	26	-6.54	10.65	9.21	4.88
ce35s1	26	-1.90	12.98	10.32	8.04
ce35sa	26	-2.71	12.20	9.70	7.52
ce35sb	26	-4.63	10.79	9.05	6.75
ce35c	26	-3.07	9.38	7.50	8.52

case	n	bias	rmse	<|del|>	s(|del|)
ve21a	22	-0.53	3.31	2.44	2.53
ve22	22	-0.90	3.78	3.16	2.20
ve22a	22	0.52	2.74	2.49	2.24
ve23	22	-0.09	3.42	3.13	1.98
ve24	22	0.26	3.67	3.30	2.53
ve25	22	-0.36	3.69	3.22	2.40
ve26	22	0.98	6.27	6.03	5.14
ve27	22	-1.42	7.57	6.39	4.40
ve28	22	1.04	5.48	4.47	3.38
ve31	22	-4.45	9.23	6.62	6.02
ve32	22	-3.83	8.23	6.87	5.72
ve33	22	-6.24	9.43	8.50	6.74
ve34	22	-5.71	8.92	8.07	6.67
ve35	22	-7.21	10.45	9.63	7.64
ve35b	22	-5.75	9.18	8.30	6.65
ve35bs	22	-0.56	6.38	5.79	4.28
ve35s1	22	-2.46	4.56	3.48	3.13
ve35s2	22	-3.25	5.23	4.12	3.59
ve35c	22	-3.22	7.29	6.23	5.13
ve36	22	-5.20	11.40	10.19	7.29
ve37	22	-9.36	14.33	12.77	8.06
ve38	22	0.46	7.71	6.41	6.34
ce31	22	1.07	17.17	10.83	12.54
ce31a	22	-6.59	16.03	8.53	12.91
ce31b	22	-6.33	15.72	8.65	12.53
ce31c	22	-6.14	11.54	7.39	8.55
ce32	22	1.90	11.54	9.56	9.45
ce32a	22	-3.03	10.13	7.76	9.16
ce32b	22	-3.40	7.59	6.47	6.16
ce35	22	1.90	10.51	8.67	8.51
ce35a	22	2.39	11.74	9.35	9.87
ce35b	22	-2.48	9.84	7.63	9.22
ce35b1	22	-2.02	9.68	7.42	9.09
ce35ba	22	-3.37	10.79	9.06	7.09
ce35bb	22	-5.34	11.57	10.24	6.39
ce35bc	22	-5.19	9.57	8.70	4.65
ce35s1	22	-2.54	11.70	9.82	7.81
ce35sa	22	-3.65	11.02	9.26	7.24
ce35sb	22	-3.57	10.76	9.07	6.99
ce35c	22	-2.46	9.83	7.64	9.21

case	n	bias	rmse	<¦del¦>	s(¦del¦)
ve21a	20	-0.51	3.50	2.62	2.58
ve22	20	-0.45	3.71	3.09	2.30
ve22a	20	0.64	3.02	2.72	2.22
ve23	20	-0.28	3.64	3.28	1.98
ve24	20	0.16	3.99	3.52	2.53
ve25	20	-0.54	4.02	3.45	2.39
ve26	20	1.09	6.93	6.59	5.06
ve27	20	-1.38	8.32	6.87	4.32
ve28	20	0.57	5.30	4.46	3.25
ve31	20	-4.89	9.69	7.27	5.92
ve32	20	-4.42	8.80	7.46	5.67
ve33	20	-7.18	10.07	9.16	6.71
ve34	20	-6.50	9.55	8.79	6.57
ve35	20	-8.30	11.16	10.41	7.57
ve35aa	20	-6.61	9.51	8.51	6.59
ve35b	20	-6.67	9.79	8.94	6.62
ve35bs	20	-0.83	6.77	6.18	4.27
ve35s1	20	-2.85	4.87	3.75	3.16
ve35s2	20	-3.74	5.59	4.45	3.59
ve35c	20	-3.83	7.76	6.66	5.16
ve36	20	-6.11	12.19	10.98	7.14
ve37	20	-10.43	15.38	13.96	7.43
ve38	20	0.42	8.26	6.96	6.40
ce31	20	1.17	18.03	11.90	12.67
ce31a	20	-7.27	16.84	9.37	13.26
ce31b	20	-6.98	16.51	9.51	12.85
ce31c	20	-6.77	12.11	8.12	8.64
ce32	20	1.99	12.34	10.40	9.51
ce32a	20	-3.55	10.83	8.42	9.36
ce32b	20	-3.96	8.10	7.00	6.21
ce35	20	1.86	11.21	9.30	8.66
ce35a	20	2.46	12.54	10.09	10.04
ce35b	20	-3.02	10.49	8.21	9.48
ce35b1	20	-2.50	10.33	7.98	9.35
ce35ba	20	-3.89	11.56	9.89	6.90
ce35bb	20	-5.65	12.35	10.97	6.22
ce35bc	20	-5.46	10.19	9.27	4.48
ce35s1	20	-2.99	12.54	10.68	7.65
ce35sa	20	-4.20	11.80	10.11	7.05
ce35sb	20	-4.11	11.53	9.90	6.78
ce35c	20	-3.00	10.49	8.21	9.46

case	n	bias	rmse	<|del|>	s(|del|)
ve21a	17	-0.92	3.70	2.75	2.72
ve22	17	-0.12	4.16	3.30	2.41
ve22a	17	0.24	3.16	2.85	2.30
ve23	17	-0.82	4.21	3.59	1.99
ve24	17	-0.59	4.38	3.67	2.73
ve25	17	-1.33	4.54	3.69	2.50
ve26	17	0.12	7.57	6.97	5.34
ve27	17	-3.97	7.85	6.68	4.22
ve28	17	0.29	6.21	4.98	3.24
ve31	17	-5.21	10.44	7.97	6.11
ve32	17	-5.24	9.79	8.16	5.87
ve33	17	-8.25	11.37	10.31	6.62
ve34	17	-7.49	10.79	9.93	6.46
ve35	17	-9.80	12.66	11.90	7.19
ve35aa	17	-7.74	10.77	9.69	6.42
ve35b	17	-7.83	11.09	10.21	6.34
ve35bs	17	-0.50	7.62	6.88	4.26
ve35s1	17	-3.16	5.18	3.97	3.19
ve35s2	17	-4.25	6.05	4.80	3.63
ve35c	17	-4.36	8.76	7.56	5.04
ve36	17	-7.45	13.88	12.66	6.37
ve37	17	-12.47	16.91	15.13	7.36
ve38	17	0.57	9.37	7.89	6.50
ce31	17	1.89	19.63	13.43	13.16
ce31a	17	-8.11	18.32	10.46	14.14
ce31b	17	-7.77	17.96	10.62	13.66
ce31c	17	-7.48	13.12	8.98	9.09
ce32	17	2.65	13.87	11.63	9.83
ce32a	17	-4.17	12.14	9.30	9.92
ce32b	17	-4.66	8.99	7.63	6.54
ce35	17	2.63	12.73	10.68	8.67
ce35a	17	3.37	14.27	11.61	10.15
ce35b	17	-3.40	11.92	9.39	9.82
ce35b1	17	-2.76	11.72	9.12	9.71
ce35ba	17	-3.57	12.54	10.67	6.90
ce35bb	17	-4.95	12.94	11.39	6.33
ce35bc	17	-4.66	10.19	9.34	4.47
ce35s1	17	-2.58	13.79	11.68	7.65
ce35sa	17	-3.99	12.83	10.93	7.05
ce35sb	17	-3.89	12.52	10.70	6.77
ce35c	17	-3.38	11.91	9.40	9.80

case	n	bias	rmse	<|del|>	s(|del|)
ve21a	16	-1.18	3.70	2.69	2.80
ve22	16	-0.26	4.21	3.35	2.48
ve22a	16	0.15	3.19	2.90	2.36
ve23	16	-1.09	4.18	3.52	2.03
ve24	16	-0.95	4.25	3.47	2.69
ve25	16	-1.61	4.54	3.63	2.57
ve26	16	0.28	7.72	7.24	5.40
ve27	16	-3.98	7.97	6.86	4.29
ve28	16	-0.02	6.18	4.87	3.32
ve31	16	-4.51	9.96	7.50	5.99
ve32	16	-5.53	10.02	8.68	5.65
ve33	16	-8.45	11.59	10.66	6.67
ve34	16	-7.42	10.88	10.00	6.67
ve35	16	-9.90	12.84	12.14	7.36
ve35aa	16	-7.84	10.95	9.92	6.56
ve35b	16	-7.93	11.28	10.47	6.46
ve35bs	16	-0.10	7.60	6.82	4.39
ve35s1	16	-3.04	5.18	3.90	3.28
ve35s2	16	-4.05	5.96	4.62	3.67
ve35c	16	-4.47	8.95	7.89	5.02
ve36	16	-8.88	13.34	11.86	5.64
ve37	16	-12.88	17.23	15.80	7.04
ve38	16	-0.01	9.25	7.66	6.64
ce31	16	5.90	13.18	10.75	7.38
ce31a	16	-4.56	9.55	7.38	6.47
ce31b	16	-4.31	9.58	7.66	6.33
ce31c	16	-5.31	8.32	7.09	4.89
ce32	16	4.21	13.00	10.74	9.43
ce32a	16	-2.55	9.99	7.79	7.96
ce32b	16	-4.01	8.47	7.09	6.35
ce35	16	3.58	12.63	10.44	8.89
ce35a	16	4.97	13.48	10.75	9.83
ce35b	16	-1.75	9.72	7.90	7.91
ce35b1	16	-1.15	9.71	7.70	8.00
ce35ba	16	-5.16	11.57	9.77	6.01
ce35bb	16	-6.56	12.13	10.60	5.60
ce35bc	16	-5.83	9.78	8.90	4.21
ce35s1	16	-4.27	12.68	10.66	6.61
ce35sa	16	-5.58	11.95	10.08	6.30
ce35sb	16	-5.46	11.63	9.84	5.97
ce35c	16	-1.73	9.73	7.92	7.91

case	n	bias	rmse	<|del|>	s(|del|)
ve21a	10	-1.45	4.99	3.73	3.20
ve22	10	2.66	4.51	3.70	2.93
ve22a	10	2.24	4.27	3.52	2.74
ve23	10	1.86	3.71	3.19	2.15
ve24	10	1.69	3.73	2.92	2.65
ve25	10	0.82	3.52	2.66	2.59
ve26	10	0.91	9.22	8.24	6.03
ve27	10	-3.02	6.82	5.91	3.09
ve28	10	-3.76	6.86	5.38	3.86
ve31	10	-9.13	13.35	11.26	5.76
ve32	10	-8.60	12.54	10.16	6.59
ve33	10	-13.37	14.54	13.30	6.08
ve34	10	-12.45	13.39	12.61	5.74
ve35	10	-15.09	15.96	15.19	5.86
ve35aa	10	-13.02	13.94	13.06	5.50
ve35b	10	-13.01	13.99	13.05	5.67
ve35bs	10	-0.51	9.66	8.67	4.44
ve35s1	10	-4.55	6.15	4.73	3.62
ve35s2	10	-6.14	7.62	6.23	3.81
ve35c	10	-9.27	10.58	9.33	5.18
ve36	10	-9.72	16.31	14.67	6.91
ve37	10	-18.04	19.75	17.50	7.28
ve38	10	-2.00	10.74	8.72	8.08
ce31	10	1.85	25.44	19.61	14.05
ce31a	10	-13.52	23.91	15.69	16.60
ce31b	10	-13.07	23.40	15.78	15.93
ce31c	10	-12.95	16.84	12.68	10.15
ce32	10	2.96	18.83	16.81	9.76
ce32a	10	-7.65	16.42	13.71	10.80
ce32b	10	-8.58	11.80	10.77	6.51
ce35	10	2.43	16.91	14.95	8.85
ce35a	10	2.57	18.72	15.76	11.28
ce35b	10	-7.82	15.57	12.57	11.70
ce35b1	10	-7.34	15.19	11.91	11.83
ce35ba	10	-5.88	14.48	13.08	6.85
ce35bb	10	-6.61	14.70	13.41	6.56
ce35bc	10	-6.61	10.73	10.23	4.71
ce35s1	10	-4.68	16.06	14.44	7.52
ce35sa	10	-6.23	14.83	13.39	7.04
ce35sb	10	-5.95	14.36	13.00	6.74
ce35c	10	-7.80	15.57	12.59	11.65

case	n	bias	rmse	<¦del¦>	s(¦del¦)
ve21a	9	-1.99	5.10	3.74	3.39
ve22	9	2.68	4.68	3.83	3.07
ve22a	9	2.25	4.45	3.68	2.86
ve23	9	1.55	3.59	3.02	2.21
ve24	9	1.14	3.26	2.49	2.41
ve25	9	0.42	3.39	2.45	2.66
ve26	9	1.34	9.73	8.85	6.07
ve27	9	-2.93	7.09	6.14	3.18
ve28	9	-4.82	6.87	5.22	4.06
ve31	9	-8.34	13.03	10.80	5.91
ve32	9	-9.50	13.15	11.29	5.87
ve33	9	-14.27	15.15	14.26	5.58
ve34	9	-12.85	13.80	13.04	5.91
ve35	9	-15.83	16.54	15.99	5.61
ve35aa	9	-13.76	14.49	13.84	5.21
ve35b	9	-13.75	14.54	13.83	5.42
ve35bs	9	0.27	9.82	8.76	4.70
ve35s1	9	-4.48	6.24	4.69	3.83
ve35s2	9	-5.98	7.61	6.06	4.00
ve35c	9	-9.99	11.07	10.10	4.85
ve36	9	-12.68	15.51	13.48	6.15
ve37	9	-19.38	20.53	18.95	6.00
ve38	9	-3.37	10.64	8.39	8.50
ce31	9	9.10	17.13	15.53	5.91
ce31a	9	-7.77	12.41	10.80	6.46
ce31b	9	-7.47	12.39	11.09	6.16
ce31c	9	-9.69	10.46	9.75	4.36
ce32	9	5.99	17.98	15.81	9.79
ce32a	9	-4.93	13.57	11.51	8.76
ce32b	9	-7.77	11.25	10.15	6.59
ce35	9	4.23	17.12	14.99	9.38
ce35a	9	5.51	17.92	14.70	11.42
ce35b	9	-5.15	12.50	10.27	9.73
ce35b1	9	-4.77	12.35	9.70	10.12
ce35ba	9	-9.14	12.96	11.75	5.73
ce35bb	9	-9.84	13.41	12.22	5.71
ce35bc	9	-9.04	9.98	9.54	4.42
ce35s1	9	-8.12	14.35	12.94	6.18
ce35sa	9	-9.48	13.46	12.14	6.17
ce35sb	9	-9.14	12.94	11.73	5.77
ce35c	9	-5.13	12.53	10.31	9.72

case	n	bias	rmse	<¦del¦>	s(¦del¦)
ve21a	7	-1.95	3.89	2.83	2.57
ve22	7	-1.66	5.21	4.37	2.19
ve22a	7	0.39	2.78	2.71	2.50
ve23	7	-0.02	4.35	2.84	2.33
ve24	7	0.14	3.42	2.50	2.51
ve25	7	-0.54	4.13	2.47	2.33
ve26	7	-2.06	5.15	4.90	3.79
ve27	7	-2.66	4.22	4.05	2.13
ve28	7	-1.29	6.79	6.48	4.00
ve31	7	-5.46	11.17	9.17	7.34
ve32	7	-4.92	10.79	7.99	8.37
ve33	7	-6.40	9.55	7.69	6.71
ve34	7	-6.11	8.12	7.14	5.54
ve35	7	-6.78	9.66	8.50	6.52
ve35aa	7	-5.69	8.46	7.24	5.73
ve35b	7	-5.77	8.66	7.32	5.98
ve35bs	7	-1.07	5.65	5.40	3.49
ve35s1	7	-3.73	6.05	4.26	4.47
ve35s2	7	-4.82	6.99	5.49	4.94
ve35c	7	-4.11	7.21	5.51	5.38
ve36	7	-3.10	11.06	10.44	8.79
ve37	7	-8.22	11.60	8.71	9.19
ve38	7	-0.80	9.94	9.26	8.40
ce31	7	-7.48	24.27	13.11	19.70
ce31a	7	-13.95	26.61	15.44	20.90
ce31b	7	-13.32	26.04	15.50	20.18
ce31c	7	-11.68	18.10	11.56	13.70
ce32	7	-4.72	9.60	8.11	8.62
ce32a	7	-8.28	13.69	11.75	11.41
ce32b	7	-7.68	10.02	9.34	6.72
ce35	7	-3.22	6.06	5.28	4.78
ce35a	7	-3.68	8.41	5.41	9.06
ce35b	7	-7.15	11.87	9.34	11.36
ce35b1	7	-6.68	11.46	8.71	11.19
ce35ba	7	-3.21	12.14	10.88	10.17
ce35bb	7	-5.36	12.80	12.02	9.12
ce35bc	7	-5.02	9.78	9.51	5.76
ce35s1	7	-1.99	12.94	11.56	10.94
ce35sa	7	-3.35	12.28	10.96	10.42
ce35sb	7	-3.19	11.93	10.67	10.03
ce35c	7	-7.15	11.84	9.34	11.31

APPENDIX N. Measured and computed wave periods.

In this appendix the values of the wave period T as computed by HISWA at the seven sites, are directly compared with the corresponding values Tm-10 as resulting from the measurements. The value of T used here is the value as is denoted by ⟨T⟩ in appendix J. The relative error between T and Tm-10 is also given and is denoted as del. The results for all verification computations with HISWA are given.

The relative error del is defined as del = [(T - Tm-10)/Tm-10]*100 %.

site ve21a	T	Tm-10	del %
19	1.211	1.200	0.96
10	1.211	1.211	0.04
18	1.211	1.210	0.12
38	0.973	1.191	-18.31
39	0.973	1.104	-11.87
29	0.973	1.125	-13.54
28	0.973	1.109	-12.30

site ve22	T	Tm-10	del %
19	1.220	1.222	-0.20
10	1.220	1.221	-0.10
18	1.220	1.211	0.78
38	0.787	1.234	-36.23
39	0.787	1.153	-31.72
29	0.787	1.143	-31.14
28	0.787	1.184	-33.53

site ve22a	T	Tm-10	del %
19	1.220	1.222	-0.20
10	1.220	1.221	-0.10
18	1.220	1.211	0.78
38	0.777	1.234	-37.04
39	0.777	1.153	-32.58
29	0.777	1.143	-32.01
28	0.777	1.184	-34.37

site ve23	T	Tm-10	del %
19	1.204	1.204	-0.02
10	1.204	1.205	-0.06
18	1.204	1.187	1.42
38	0.781	1.169	-33.17
39	0.782	1.088	-28.11
29	0.782	1.073	-27.10
28	0.782	1.072	-27.04

site ve24	T	Tm-10	del %
19	1.147	1.126	1.88
10	1.147	1.148	-0.08
18	1.147	1.112	3.11
38	0.766	1.172	-34.67
39	0.767	1.076	-28.74
29	0.767	1.075	-28.67
28	0.767	1.086	-29.38

site ve25	T	Tm-10	del %
19	1.182	1.164	1.55
10	1.182	1.183	-0.05
18	1.182	1.160	1.94
38	0.770	1.162	-33.74
39	0.771	1.075	-28.30
29	0.771	1.054	-26.87
28	0.772	1.061	-27.24

site	T	Tm-10	del %
ve26			
19	1.205	1.219	-1.15
10	1.205	1.206	-0.11
18	1.205	1.188	1.43
38	0.780	1.167	-33.14
39	0.780	1.056	-26.11
29	0.781	1.081	-27.74
28	0.786	1.200	-34.50

site	T	Tm-10	del %
ve27			
19	1.173	1.191	-1.50
10	1.173	1.179	-0.49
18	1.173	1.174	-0.11
38	0.774	1.143	-32.29
39	0.775	1.045	-25.83
29	0.777	1.059	-26.63
28	0.783	1.091	-28.26

site	T	Tm-10	del %
ve28			
19	1.464	1.371	6.76
10	1.464	1.466	-0.12
18	1.464	1.384	5.79
38	0.822	1.918	-57.14
39	0.822	1.915	-57.07
29	0.822	2.277	-63.91
28	0.822	1.833	-55.16

site	T	Tm-10	del %
ve31			
19	1.218	1.218	-0.03
10	1.218	1.218	0.02
18	1.218	1.210	0.68
38	1.155	1.213	-4.75
39	1.182	1.116	5.91
29	1.069	1.098	-2.63
28	1.018	1.071	-4.96

site	T	Tm-10	del %
ve32			
19	1.212	1.205	0.55
10	1.212	1.213	-0.04
18	1.212	1.205	0.59
38	1.064	1.204	-11.61
39	1.161	1.126	3.14
29	1.032	1.129	-8.60
28	0.883	1.004	-12.02

site	T	Tm-10	del %
ve33			
19	1.197	1.185	1.05
10	1.197	1.198	-0.12
18	1.197	1.198	-0.04
38	1.042	1.167	-10.68
39	1.117	1.110	0.65
29	1.019	1.093	-6.74
28	0.888	0.962	-7.69

site	T	Tm-10	del %
ve34			
19	1.141	1.107	3.07
10	1.141	1.142	-0.08
18	1.141	1.122	1.69
38	1.004	1.176	-14.61
39	1.070	1.078	-0.79
29	0.981	1.054	-6.91
28	0.866	0.980	-11.61

site	T	Tm-10	del %
ve35			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	1.012	1.168	-13.32
39	1.089	1.092	-0.24
29	0.995	1.069	-6.94
28	0.865	0.966	-10.42

site	T	Tm-10	del %
ve35aa			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	1.013	1.168	-13.24
39	1.092	1.092	0.03
29	1.002	1.069	-6.28
28	0.875	0.966	-9.39

site	T	Tm-10	del %
ve35b			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	1.021	1.168	-12.55
39	1.093	1.092	0.12
29	1.000	1.069	-6.47
28	0.877	0.966	-9.18

site	T	Tm-10	del %
ve35bs			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	0.933	1.168	-20.09
39	1.059	1.092	-2.99
29	0.959	1.069	-10.30
28	0.878	0.966	-9.07

site	T	Tm-10	del %
ve35s1			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	0.970	1.168	-16.92
39	1.039	1.092	-4.82
29	0.945	1.069	-11.61
28	0.856	0.966	-11.35

site	T	Tm-10	del %
ve35s2			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	0.966	1.168	-17.26
39	1.022	1.092	-6.38
29	0.931	1.069	-12.92
28	0.849	0.966	-12.08

site	T	Tm-10	del %
ve35c			
19	1.169	1.148	1.82
10	1.169	1.170	-0.10
18	1.169	1.164	0.42
38	1.037	1.168	-11.18
39	1.099	1.092	0.67
29	1.009	1.069	-5.63
28	0.899	0.966	-6.90

site	T	Tm-10	del %
ve36			
19	1.217	1.216	0.11
10	1.217	1.218	-0.11
18	1.217	1.212	0.42
38	0.937	1.151	-18.61
39	1.035	1.171	-11.64
29	0.902	1.095	-17.60
28	0.817	1.027	-20.41

site	T	Tm-10	del %
ve37			
19	1.177	1.172	0.40
10	1.177	1.178	-0.06
18	1.177	1.177	0.01
38	0.964	1.183	-18.51
39	1.034	1.139	-9.25
29	0.931	1.125	-17.28
28	0.846	0.987	-14.33

site	T	Tm-10	del %
ve38			
19	1.331	1.282	3.84
10	1.331	1.332	-0.05
18	1.331	1.394	-4.50
38	1.166	1.364	-14.50
39	1.297	1.230	5.45
29	1.139	1.510	-24.56
28	0.939	1.568	-40.12

APPENDIX P. Measured and computed principal wave directions.

In this appendix the values of the principal wave directions, tetac, as computed by HISWA at the seven sites, are directly compared with the corresponding values, tetam, as resulting from the measurements. The difference between tetac and tetam is also given (in degrees); there is deltet = tetac - tetam. The results for all verification computations with HISWA are given. The results for the wave directions of the CREDIZ computations have been added also.

site ve21a	tetac	tetam	deltet
19	0.00	-3.42	3.42
10	0.00	4.32	-4.32
18	0.00	-2.28	2.28
38	0.46	1.71	-1.25
39	0.53	-3.22	3.75
29	0.52	-3.00	3.52
28	0.49	-5.32	5.81

site ve22	tetac	tetam	deltet
19	0.00	-2.76	2.76
10	0.00	3.96	-3.96
18	0.00	-1.51	1.51
38	0.36	-8.77	9.13
39	0.38	-4.43	4.81
29	0.38	-4.34	4.72
28	0.36	-5.11	5.47

site ve22a	tetac	tetam	deltet
19	0.00	-2.76	2.76
10	0.00	3.96	-3.96
18	0.00	-1.51	1.51
38	0.35	-8.77	9.12
39	0.37	-4.43	4.80
29	0.37	-4.34	4.71
28	0.36	-5.11	5.47

site ve23	tetac	tetam	deltet
19	0.00	-4.58	4.58
10	0.00	2.48	-2.48
18	0.00	-0.06	0.06
38	0.01	-3.83	3.84
39	0.22	-10.50	10.72
29	-0.02	-5.01	4.99
28	-0.56	2.24	-2.80

site ve24	tetac	tetam	deltet
19	0.00	-3.16	3.16
10	0.00	3.05	-3.05
18	0.00	0.84	-0.84
38	0.06	-5.76	5.82
39	0.28	-4.96	5.24
29	0.02	-4.72	4.74
28	-0.53	-3.39	2.86

site ve25	tetac	tetam	deltet
19	0.00	-4.14	4.14
10	0.00	2.47	-2.47
18	0.00	0.29	-0.29
38	0.01	-4.38	4.39
39	0.22	-7.54	7.76
29	-0.02	-6.35	6.33
28	-0.56	1.06	-1.62

site	tetac	tetam	deltet
ve26			
19	28.59	19.13	9.46
10	28.59	28.68	-0.09
18	28.59	20.94	7.65
38	21.93	-6.84	28.77
39	22.40	-21.14	43.54
29	22.30	-19.50	41.80
28	21.88	-16.70	38.58

site	tetac	tetam	deltet
ve27			
19	24.77	18.87	5.90
10	24.77	29.44	-4.67
18	24.77	23.37	1.40
38	16.01	-16.85	32.86
39	16.02	-18.53	34.55
29	15.74	-21.22	36.96
28	14.75	-15.32	30.07

site	tetac	tetam	deltet
ve28			
19	0.00	-1.26	1.26
10	0.00	3.18	-3.18
18	0.00	-0.98	0.98
38	0.18	-0.60	0.78
39	0.19	-2.83	3.02
29	0.19	-4.64	4.83
28	0.19	-2.89	3.08

site	tetac	tetam	deltet
ve31			
19	0.00	-5.91	5.91
10	0.00	0.74	-0.74
18	0.00	-3.95	3.95
38	-32.16	-28.63	-3.53
39	-16.31	-8.70	-7.61
29	-14.85	-6.02	-8.83
28	-13.22	-8.54	-4.68

site	tetac	tetam	deltet
ve32			
19	0.00	-5.57	5.57
10	0.00	1.72	-1.72
18	0.00	-5.28	5.28
38	-34.22	-14.11	-20.11
39	-19.48	1.71	-21.19
29	-23.43	-4.04	-19.39
28	-21.21	-1.45	-19.76

site	tetac	tetam	deltet
ve33			
19	0.00	-5.42	5.42
10	0.00	1.60	-1.60
18	0.00	-3.61	3.61
38	-33.53	-14.16	-19.37
39	-19.41	-1.18	-18.23
29	-23.08	-11.95	-11.13
28	-21.35	2.81	-24.16

site	tetac	tetam	deltet
ve34			
19	0.00	-6.82	6.82
10	0.00	1.85	-1.85
18	0.00	-5.35	5.35
38	-32.42	-16.19	-16.23
39	-18.61	-2.74	-15.87
29	-21.99	-7.84	-14.15
28	-20.24	-0.71	-19.53

site	tetac	tetam	deltet
ve35			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-33.50	-13.88	-19.62
39	-19.62	-3.37	-16.25
29	-23.49	-9.64	-13.85
28	-21.82	2.32	-24.14

site	tetac	tetam	deltet
ve35aa			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-31.89	-13.88	-18.01
39	-19.17	-3.37	-15.80
29	-22.76	-9.64	-13.12
28	-20.62	2.32	-22.94

site	tetac	tetam	deltet
ve35b			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-33.10	-13.88	-19.22
39	-19.16	-3.37	-15.79
29	-22.74	-9.64	-13.10
28	-21.00	2.32	-23.32

site	tetac	tetam	deltet
ve35bs			
19	-0.11	-5.56	5.45
10	-0.16	1.34	-1.50
18	-0.16	-3.63	3.47
38	4.98	-13.88	18.86
39	-4.73	-3.37	-1.36
29	0.01	-9.64	9.65
28	-0.19	2.32	-2.51

site	tetac	tetam	deltet
ve35s1			
19	0.69	-5.56	6.25
10	-0.06	1.34	-1.40
18	0.15	-3.63	3.78
38	-13.18	-13.88	0.70
39	-1.50	-3.37	1.87
29	-2.86	-9.64	6.78
28	-7.54	2.32	-9.86

site	tetac	tetam	deltet
ve35s2			
19	0.59	-5.56	6.15
10	-0.06	1.34	-1.40
18	0.15	-3.63	3.78
38	-11.62	-13.88	2.26
39	2.88	-3.37	6.25
29	-0.23	-9.64	9.41
28	-6.07	2.32	-8.39

site	tetac	tetam	deltet
ve35c			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-32.32	-13.88	-18.44
39	-18.26	-3.37	-14.89
29	-21.29	-9.64	-11.65
28	-19.50	2.32	-21.82

site	tetac	tetam	deltet
ve36			
19	24.66	15.53	9.13
10	24.66	24.67	-0.01
18	24.66	16.22	8.44
38	-13.17	-7.10	-6.07
39	-3.43	0.91	-4.34
29	-3.90	-10.13	6.23
28	6.78	-9.71	16.49

site	tetac	tetam	deltet
ve37			
19	20.42	11.15	9.27
10	20.42	22.91	-2.49
18	20.42	21.19	-0.77
38	-21.02	-25.96	4.94
39	-7.87	-7.11	-0.76
29	-10.43	-21.43	11.00
28	-6.45	-16.39	9.94

site	tetac	tetam	deltet
ve38			
19	0.00	-3.04	3.04
10	0.00	0.48	-0.48
18	0.00	-5.43	5.43
38	-36.89	-15.75	-21.14
39	-22.16	-2.95	-19.21
29	-26.51	1.96	-28.47
28	-24.12	2.77	-26.89

site	tetac	tetam	deltet
ce31			
19	0.00	-5.91	5.91
10	0.00	0.74	-0.74
18	0.00	-3.95	3.95
38	-33.52	-28.63	-4.89
39	-25.85	-8.70	-17.15
29	-39.94	-6.02	-33.92
28	-4.38	-8.54	4.16

site	tetac	tetam	deltet
ce31a			
19	0.00	-5.91	5.91
10	0.00	0.74	-0.74
18	0.00	-3.95	3.95
38	-36.32	-28.63	-7.69
39	-18.26	-8.70	-9.56
29	-47.30	-6.02	-41.28
28	-11.33	-8.54	-2.79

site	tetac	tetam	deltet
ce31b			
19	0.00	-5.91	5.91
10	0.00	0.74	-0.74
18	0.00	-3.95	3.95
38	-35.91	-28.63	-7.28
39	-18.15	-8.70	-9.45
29	-45.87	-6.02	-39.85
28	-11.50	-8.54	-2.96

site	tetac	tetam	deltet
ce31c			
19	0.00	-5.91	5.91
10	0.00	0.74	-0.74
18	0.00	-3.95	3.95
38	-32.06	-28.63	-3.43
39	-18.11	-8.70	-9.41
29	-33.04	-6.02	-27.02
28	-0.57	-8.54	7.97

site	tetac	tetam	deltet
ce32			
19	0.00	-5.57	5.57
10	0.00	1.72	-1.72
18	0.00	-5.28	5.28
38	-34.93	-14.11	-20.82
39	-21.80	1.71	-23.51
29	-32.82	-4.04	-28.78
28	-4.66	-1.45	-3.21

site	tetac	tetam	deltet
ce32a			
19	0.00	-5.57	5.57
10	0.00	1.72	-1.72
18	0.00	-5.28	5.28
38	-35.38	-14.11	-21.27
39	-16.42	1.71	-18.13
29	-40.86	-4.04	-36.82
28	-13.21	-1.45	-11.76

site	tetac	tetam	deltet
ce32b			
19	0.00	-5.57	5.57
10	0.00	1.72	-1.72
18	0.00	-5.28	5.28
38	-31.01	-14.11	-16.90
39	-16.44	1.71	-18.15
29	-31.46	-4.04	-27.42
28	-1.27	-1.45	0.18

site	tetac	tetam	deltet
ce35			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-33.76	-13.88	-19.88
39	-24.30	-3.37	-20.93
29	-29.47	-9.64	-19.83
28	-3.64	2.32	-5.96

site	tetac	tetam	deltet
ce35a			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-34.97	-13.88	-21.09
39	-21.70	-3.37	-18.33
29	-32.67	-9.64	-23.03
28	-4.68	2.32	-7.00

site	tetac	tetam	deltet
ce35b			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-35.41	-13.88	-21.53
39	-16.54	-3.37	-13.17
29	-40.74	-9.64	-31.10
28	-13.18	2.32	-15.50

site	tetac	tetam	deltet
ce35b1			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-34.96	-13.88	-21.08
39	-16.41	-3.37	-13.04
29	-40.05	-9.64	-30.41
28	-13.41	2.32	-15.73

site	tetac	tetam	deltet
ce35ba			
19	-1.91	-5.56	3.65
10	-3.75	1.34	-5.09
18	-2.47	-3.63	1.16
38	-13.43	-13.88	0.45
39	-0.77	-3.37	2.60
29	9.26	-9.64	18.90
28	2.03	2.32	-0.29

site	tetac	tetam	deltet
ce35bb			
19	-1.91	-5.56	3.65
10	-3.75	1.34	-5.09
18	-2.47	-3.63	1.16
38	-13.27	-13.88	0.61
39	-0.69	-3.37	2.68
29	9.41	-9.64	19.05
28	1.95	2.32	-0.37

site	tetac	tetam	deltet
ce35bc			
19	-2.02	-5.56	3.54
10	-3.81	1.34	-5.15
18	-2.66	-3.63	0.97
38	-11.47	-13.88	2.41
39	1.98	-3.37	5.35
29	10.12	-9.64	19.76
28	0.63	2.32	-1.69

site	tetac	tetam	deltet
ce35s1			
19	-1.93	-5.56	3.63
10	-3.78	1.34	-5.12
18	-2.39	-3.63	1.24
38	-13.91	-13.88	-0.03
39	-1.43	-3.37	1.94
29	9.20	-9.64	18.84
28	0.88	2.32	-1.44

site	tetac	tetam	deltet
ce35sa			
19	-1.94	-5.56	3.62
10	-3.76	1.34	-5.10
18	-2.45	-3.63	1.18
38	-13.38	-13.88	0.50
39	-0.20	-3.37	3.17
29	9.24	-9.64	18.88
28	1.44	2.32	-0.88

ce35sb			
19	-1.91	-5.56	3.65
10	-3.76	1.34	-5.10
18	-2.45	-3.63	1.18
38	-13.32	-13.88	0.56
39	-0.46	-3.37	2.91
29	9.26	-9.64	18.90
28	1.90	2.32	-0.42

ce35c			
19	0.00	-5.56	5.56
10	0.00	1.34	-1.34
18	0.00	-3.63	3.63
38	-35.41	-13.88	-21.53
39	-16.45	-3.37	-13.08
29	-40.78	-9.64	-31.14
28	-13.25	2.32	-15.57

APPENDIX Q. Measured and computed directional spread.

In this appendix the values of the directional spread, sigmac, as computed by HISWA at the seven sites, are directly compared with the corresponding values sigmam as resulting from the measurements. The difference between sigmac and sigmam is also given (in degrees); there is delsig = sigmac - sigmam. The results for all verification computations with HISWA are given.

site	sigmac	sigmam	delsig
ve21a			
19	12.50	18.59	-6.09
10	12.50	19.68	-7.18
18	12.50	16.89	-4.39
38	13.12	26.34	-13.22
39	14.14	23.88	-9.74
29	14.15	27.64	-13.49
28	14.11	24.12	-10.01

site	sigmac	sigmam	delsig
ve22			
19	12.50	16.46	-3.96
10	12.50	18.89	-6.39
18	12.50	16.78	-4.28
38	11.78	34.78	-23.00
39	12.17	32.33	-20.16
29	12.18	31.82	-19.64
28	12.16	29.07	-16.91

site	sigmac	sigmam	delsig
ve22a			
19	12.50	16.46	-3.96
10	12.50	18.89	-6.39
18	12.50	16.78	-4.28
38	11.70	34.78	-23.08
39	12.07	32.33	-20.26
29	12.07	31.82	-19.75
28	12.05	29.07	-17.02

site	sigmac	sigmam	delsig
ve23			
19	24.97	26.34	-1.37
10	24.97	27.65	-2.68
18	24.97	25.73	-0.76
38	20.44	45.21	-24.77
39	20.53	37.46	-16.93
29	20.58	38.30	-17.72
28	20.35	38.69	-18.34

site	sigmac	sigmam	delsig
ve24			
19	24.97	27.20	-2.23
10	24.97	27.99	-3.02
18	24.97	25.74	-0.77
38	20.49	41.12	-20.63
39	20.51	35.60	-15.09
29	20.57	37.50	-16.93
28	20.34	38.93	-18.59

site	sigmac	sigmam	delsig
ve25			
19	24.97	26.46	-1.49
10	24.97	27.33	-2.36
18	24.97	25.33	-0.36
38	20.38	42.48	-22.10
39	20.43	35.95	-15.52
29	20.48	37.79	-17.31
28	20.26	36.87	-16.61

site	sigmac	sigmam	delsig
ve26			
19	12.36	17.16	-4.80
10	12.36	19.47	-7.11
18	12.36	18.68	-6.32
38	13.06	39.71	-26.65
39	13.33	35.70	-22.37
29	13.25	37.82	-24.57
28	12.93	39.04	-26.11

site	sigmac	sigmam	delsig
ve27			
19	21.89	30.29	-8.40
10	21.89	30.45	-8.56
18	21.89	26.54	-4.65
38	18.77	46.21	-27.44
39	18.89	38.74	-19.85
29	18.72	39.82	-21.10
28	18.06	46.83	-28.77

site	sigmac	sigmam	delsig
ve28			
19	7.11	9.40	-2.29
10	7.11	13.17	-6.06
18	7.11	9.83	-2.72
38	6.56	20.67	-14.11
39	6.83	16.66	-9.83
29	6.83	21.43	-14.60
28	6.83	15.79	-8.96

site	sigmac	sigmam	delsig
ve31			
19	12.50	18.15	-5.65
10	12.50	21.07	-8.57
18	12.50	15.64	-3.14
38	17.75	22.84	-5.09
39	15.73	25.58	-9.85
29	20.82	25.30	-4.48
28	24.65	27.16	-2.51

site	sigmac	sigmam	delsig
ve32			
19	12.50	16.24	-3.74
10	12.50	19.07	-6.57
18	12.50	14.01	-1.51
38	15.69	21.44	-5.75
39	11.52	23.37	-11.85
29	17.38	26.23	-8.85
28	25.72	26.59	-0.87

site	sigmac	sigmam	delsig
ve33			
19	24.97	25.32	-0.35
10	24.97	27.09	-2.12
18	24.97	25.36	-0.39
38	20.97	30.53	-9.56
39	17.38	29.51	-12.13
29	22.28	30.72	-8.44
28	29.17	36.62	-7.45

site	sigmac	sigmam	delsig
ve34			
19	24.97	26.75	-1.78
10	24.97	26.80	-1.83
18	24.97	25.46	-0.49
38	21.41	29.07	-7.66
39	17.75	29.48	-11.73
29	22.57	28.64	-6.07
28	29.09	33.52	-4.43

site	sigmac	sigmam	delsig
ve35			
19	24.97	26.65	-1.68
10	24.97	27.08	-2.11
18	24.97	25.40	-0.43
38	20.83	28.48	-7.65
39	17.05	28.07	-11.02
29	21.87	29.80	-7.93
28	29.02	34.50	-5.48

site	sigmac	sigmam	delsig
ve35aa			
19	24.97	26.65	-1.68
10	24.97	27.08	-2.11
18	24.97	25.40	-0.43
38	21.54	28.48	-6.94
39	17.60	28.07	-10.47
29	22.30	29.80	-7.50
28	28.98	34.50	-5.52

site	sigmac	sigmam	delsig
ve35b			
19	24.97	26.65	-1.68
10	24.97	27.08	-2.11
18	24.97	25.40	-0.43
38	21.13	28.48	-7.35
39	17.47	28.07	-10.60
29	22.34	29.80	-7.46
28	29.13	34.50	-5.37

site	sigmac	sigmam	delsig
ve35bs			
19	24.35	26.65	-2.30
10	25.03	27.08	-2.05
18	25.40	25.40	0.00
38	31.28	28.48	2.80
39	26.24	28.07	-1.83
29	24.31	29.80	-5.49
28	21.55	34.50	-12.95

site	sigmac	sigmam	delsig
ve35s1			
19	24.33	26.65	-2.32
10	25.11	27.08	-1.97
18	25.60	25.40	0.20
38	26.32	28.48	-2.16
39	24.57	28.07	-3.50
29	25.83	29.80	-3.97
28	22.89	34.50	-11.61

site	sigmac	sigmam	delsig
ve35s2			
19	24.40	26.65	-2.25
10	25.11	27.08	-1.97
18	25.60	25.40	0.20
38	25.72	28.48	-2.76
39	22.50	28.07	-5.57
29	24.89	29.80	-4.91
28	22.82	34.50	-11.68

site	sigmac	sigmam	delsig
ve35c			
19	24.97	26.65	-1.68
10	24.97	27.08	-2.11
18	24.97	25.40	-0.43
38	21.69	28.48	-6.79
39	18.29	28.07	-9.78
29	23.17	29.80	-6.63
28	29.29	34.50	-5.21

site	sigmac	sigmam	delsig
ve36			
19	12.44	18.97	-6.53
10	12.44	20.87	-8.43
18	12.44	18.82	-6.38
38	22.10	31.01	-8.91
39	17.51	26.80	-9.29
29	23.46	37.79	-14.33
28	27.53	40.47	-12.94

site	sigmac	sigmam	delsig
ve37			
19	22.90	30.40	-7.50
10	22.90	29.65	-6.75
18	22.90	27.57	-4.67
38	25.66	34.88	-9.22
39	20.28	28.46	-8.18
29	25.76	31.42	-5.66
28	31.64	38.91	-7.27

site	sigmac	sigmam	delsig
ve38			
19	7.11	12.22	-5.11
10	7.11	15.33	-8.22
18	7.11	8.99	-1.88
38	11.45	13.85	-2.40
39	8.34	17.27	-8.93
29	14.52	24.06	-9.54
28	24.22	16.26	7.96

APPENDIX R. Measured and computed current fields.

In this appendix the results of the current computations are given, using the driving forces as resulting from HISWA computations ve35a and ve35s2. The current computation which used the driving forces from HISWA computation ve35s1 is not considered here because the computational results are not any more available. As the purpose of this appendix is to compare the computed current fields with the measured one (me35) on 81 locations in a grid of 3 by 3 m (see appendix D), at these measuring points the computed current fields given by the x- and y-components ux and uy have been interpolated from the fields given in curvilinear coordinates.

The ODYSSEE computations are denoted with ve35a and ve35s2, according to the HISWA computations from which the driving forces are obtained. Because it is difficult to decide whether the current field in an ODYSSEE computation has become fully developed, and for ve35a a number of 30 time steps with 10 s steps seemed to suffice, another 30 timesteps have been performed; the resulting computation has been denoted ve35az. Because it can be shown that in breaking waves also a mass flux correction should be applied in the continuity equation (see chapter 5), also a current computation with mass flux correction, ve35am, has been performed; here was started with the current field as resulting from ve35a and 30 more timesteps of 10 s each were computed. The effect of mass flux correction can then bee seen upon comparing the current fields from ve35am and ve35az. (Notice that the codes ve35az and ve35am have been chosen such that it is clear that the driving forces from HISWA computation ve35a have been used and the addition of "z" and "m" have been chosen according to the Dutch words "zonder" (English : without) and "met" (English : with).)

Using the interpolation method as described in chapter 5, with a search radius of 1.7 m, the values of the two horizontal velocity components, ux and uy, have been obtained in six significant digits. From these values the absolute value of the current velocity, u, and its direction have been determined. These resulting velocities have been given furberon in cm/s with one digit behind the decimal point (thus in three significant digits at most) and the wave directions, θ , (from u-direction) have been given in degrees accurate. The coordinate frame as used here is the same as the one used in appendix D. For intercomparison purposes the velocity variables u, ux and uy as resulting from the computations are in cm/s with two decimals; for the directions θ also two decimals are used.

The results of the current computations ve35a, ve35az, ve35am and ve35s2 have been given below in Tables R.1-R.4, R.5-R.8, R.9-R.12 and R.13-R.16 respectively. Here u, θ, ux and uy have been given. Vector plots for the currents at the measuring positions have been given in Figures 79-82. The currents and the stream function plots as determined at the computational mesh have been given in Figures 67-76 (also for ve35s1) and the computational mesh is given in Figure 66.

In order to facilitate a direct comparison with the measured currents for the measuring condition me35 as given in Tables D.3-D.6, the deviation between the computation and the measurement has been given for each point. For u the deviation is thus defined as [u(computed) - u(measured)]. The deviations for the cases ve35a, ve35az, ve35am and ve35s2 have been given in Tables R.17-R.20, R.21-R.24, R.25-R.28 and R.29-R.32 respectively. Notice that for the deviations in directions figures larger than 180° occur; here the complement of 360° should have been taken in order to have a clear notion on the difference in direction; this has not been carried out for simplicity and to preserve the sign of the deviation.

To obtain some overall measure for the observed deviations of the computed current fields, we calculated the mean and the standard deviation of the abolute values of u, ux and uy at the 81 measuring positions. Also the mean and standard deviation of the absolute values of the deviations have been computed. The results have been given in Table R.33.

Based on the figures of Table R.33, the conclusion is that the current field ve35a comes closest to the measured current field, me35. That ve35az performs less well than ve35a poses a problem insofar that a current computation proceeding over 10 minutes physical time gives somewhat less result than a computation over 5 minutes. It may be well true that the computation of ve35az did not yet reach its ultimate steady state condition.
Furthermore, no sensitivity due to the chosen time step has been determined. In a sense these current computations are to be considered as only a first try to predict the current field in a realistic situation. As the plotted current fields show, the general appearance is rather good for ve35a, ve35az and ve35am. Only the current computation ve35s2 gives unreal-

istic results; this has still to be analyzed further.

Concerning the performance of the computed current fields ve35a and ve35a2, we notice that case ve35a performs best. This was not to be expected. The driving forces from the HISWA computation in which current refraction on basis of the measured current distribution has been taken into account were expected to yield better results, also in view with the much better wave height prediction as was obtained for that case. We remark that in HISWA the driving forces are calculated by numerical differentiation of the radiation stresses; because the mesh in y-direction is rather large (1 m), certainly when compared to the mesh-size in x-direction (0.1 m), numerical errors may be obtained. One feature of the driving forces as resulting from HISWA computations ve35a and ve35a2, which could be responsible for the less performance of ODYSSEE computation ve35a2 is that for ve35a2 the driving force directions near the side walls are not parallel to those walls, as is the case for ve35a. This may be well due to an error in the introduced measured velocity field as is discussed in appendix D; however, we expect that the problem of extending the velocity field to the whole of the computational domain of HISWA is of more importance here. Also the impossibility to use refelecting boundaries in HISWA may be important here; this is especially true when (small) errors in the directions of the measured velocity are present. Notice in this connection that the measured velocity field as obtained on the parallel lines closest to the sidewalls of the basin have been used to extend the velocity field outside the physical basin; at the sidewalls the velocity field is by necessity parallel to the wall, but this needs not to be true with such an extension method. It is now our idea that current refraction due to such inaccuracies in the introduced current field are responsible for the occurency of extra circulation cells in the current computation, see Figures 46 and 47 for ve35a2 and ve35a1.

To obtain more information on the difference between the velocity fields, a statistical evaluation of the performance of the current computations has to be carried out. Because the direction of the current vectors is now of importance, a procedure as proposed by Willmott et al. (1985) should be followed. Notice that Willmott's procedure as used so far is based on scalar quantities; the corresponding procedure for vector quantities has not yet been worked out by us. In order to obtain nonetheless some idea of the performance of the current computations, we used the scalar procedure for the quantities u, ux and uy separately; it has to be stressed that the results for u are of more use than those of the components ux and uy; however, for perfect agreement all three should be correct. We give results for u, ux and uy in Table R.34, but more value should be attached to those of u than to those of ux and uy. The latter ones are in fact given to make this clear. It has to be stressed that the relative measures for ux and uy are nearly senseless because the means of ux and uy are very small, but to make this clear the results of the secondary parameters have been given in Table R.35.

In order to show the difference between the current computations ve35a, ve35az and ve35am more clearly, an intercomparison of these cases is given by calculating the difference between these cases. The differences between ve35az and ve35a are defined, for u, as u(ve35az) - u(ve35a); for the differences between ve35am and ve35a a similar procedure has been followed. The differences between ve35az and ve35a have been given in Tables R.36 to R.39 and the differences between ve35am and ve35a have been given in Tables R.40-R.43. The differences between ve35az and ve35am have been given in Tables R.44-R.47 in order to show the effect of the mass flux correction term in the continuity equation; here the difference for u is defined as u(ve35az) - u(ve35am).

The interpolation method used is one suited for interpolating from a random grid to a rectangular grid. A search radius has to be chosen and the points of the random grid lying within the circle around the desired position with this radius are used; see chapter 5 for a description of the procedure. The result of the interpolation depends on the search radius. This dependence has been investigated for current computation ve35a by choosing different search radii. The search radii 1.15, 1.45 and 2.30 m have been chosen to compare with the radius 1.70 m used in the situations before. The velocity fields at the measuring positions as resulting with these search radii have been denoted by ve35-115, ve35-145 and ve35-230 and these cases have been compared with ve35a, in which case the search radius of 1.70 m has been used. The differences between ve35-115 and ve35a have been given in Tables R.48-R.51; here again the difference in u is defined as [u(ve35-115 - u(ve35a)]. The differences as obtained for ve35-145 and ve35-230 have been given in Tables R.52-R.55 and R.56-R.59 respectively. In order to show the differences clearly all differences of 0.00 for the velocities and 0.0 for the directions have been given as 0 in these Tables.

To show the difference in performance of these velocity fields compared with the measurements me35, the mean and standard deviation of the absolute values of the measurements, the computed values and the deviations between them on the 81 measuring points have been given in Table R.60. The statistical parameters have been given in Tables R.61 and R.62. In terms of the parameters as given in Tables R.60-R.62 the differences in velocities due to different search radii in the interpolation procedure are very slight. A thorough check on the interpolation method is possible in the present case by applying the same method to the coordinates as they are given for the curvilinear grid together with the velocity components ux and uy.

Using the search radius of 1.70 m the x- and y-values after interpolation appear as they are given in Tables R.63 and R.64. For the depth values the values as given in Table R.65 are obtained. Applying the interpolation procedure also with search radiae of 1.15, 1.45 and 2.30 m, the differences with the exact positions as given in Table D.1 and D.2 are given for the x-coordinates in Tables R.66-R.69 and for the y-coordinates in Tables R.70 - R.73. These differences give some idea of the errors in the velocity field which are due to the interpolation procedure alone. It would be advisable to devise an interpolation procedure which makes good use of the regularities which are present in the curvilinear coordinate system instead of regarding all values as lying on a purely random grid. It should be remarked that the errors due to the interpolation method are not so serious that the given velocity fields are much in error sothat the velocity fields as obtained from interpolation do not reflect the properties of the computation; the point is that it could be done in a better, more precise way.

2.3	4.9	8.3	11.1	11.4	9.3	6.4	3.2	1.5
6.2	7.6	10.3	12.0	11.5	9.4	7.1	5.4	3.1
9.2	10.3	11.6	9.9	10.4	8.4	7.4	7.6	4.5
10.9	11.6	11.8	3.7	16.9	15.0	13.9	15.2	12.8
10.5	11.2	12.0	7.1	23.2	26.2	24.7	21.1	25.3
8.8	9.4	10.1	9.7	10.1	10.6	10.1	9.3	9.1
6.1	6.8	7.7	8.3	8.2	7.1	5.9	4.9	4.6
3.6	4.3	5.6	6.6	6.6	5.8	4.5	3.2	2.6
1.2	2.6	4.4	5.6	5.8	5.0	3.6	1.9	1.0

Table R.1 Case ve35a, current velocities u, in cm/s.

-70.	-30.	-15.	-5.	3.	10.	17.	36.	73.
-83.	-58.	-38.	-15.	12.	32.	45.	69.	86.
-86.	-74.	-59.	-33.	35.	65.	71.	78.	86.
-89.	-87.	-85.	-127.	124.	98.	94.	89.	89.
-93.	-96.	-106.	-149.	104.	98.	95.	93.	90.
-93.	-107.	-124.	-159.	143.	118.	108.	99.	92.
-95.	-116.	-138.	-164.	168.	146.	129.	111.	94.
-98.	-128.	-152.	-170.	174.	160.	146.	125.	98.
-112.	-156.	-169.	-176.	178.	173.	167.	154.	110.

Table R.2 Case ve35a, current directions θ, in degrees.

-2.2	-2.4	-2.1	-1.0	0.6	1.6	1.9	1.9	1.5
-6.1	-6.5	-6.3	-3.0	2.4	5.0	5.1	5.1	3.1
-9.2	-9.9	-10.0	-5.3	6.0	7.6	7.0	7.4	4.5
-10.9	-11.6	-11.7	-2.9	14.0	14.9	13.9	15.2	12.8
-10.5	-11.1	-11.5	-3.6	22.5	25.9	24.6	21.0	25.3
-8.8	-9.0	-8.3	-3.4	6.1	9.3	9.6	9.2	9.1
-6.1	-6.1	-5.1	-2.3	1.7	3.9	4.5	4.6	4.6
-3.6	-3.4	-2.7	-1.2	0.7	2.0	2.5	2.6	2.6
-1.1	-1.1	-0.8	-0.3	0.2	0.6	0.8	0.8	1.0

Table R.3 Case ve35a, current velocity components ux, in cm/s.

0.8	4.3	8.0	11.0	11.4	9.2	6.1	2.6	0.5
0.7	4.0	8.1	11.6	11.3	8.0	5.0	1.9	0.2
0.6	2.9	5.9	8.3	8.5	3.6	2.4	1.5	0.4
0.2	0.6	1.0	-2.2	-9.5	-2.2	-0.9	0.2	0.2
-0.5	-1.2	-3.3	-6.1	-5.6	-3.8	-2.3	-1.1	0.1
-0.5	-2.7	-5.7	-9.1	-8.0	-5.0	-3.2	-1.5	-0.3
-0.5	-3.0	-5.7	-8.0	-8.0	-5.9	-3.7	-1.7	-0.3
-0.5	-2.7	-4.9	-6.5	-6.6	-5.4	-3.7	-1.8	-0.4
-0.5	-2.4	-4.3	-5.6	-5.8	-5.0	-3.5	-1.7	-0.3

Table R.4 Case ve35a, current velocity components uy, in cm/s.

0.8	4.1	8.2	10.5	10.7	8.7	5.5	2.2	0.3
3.2	7.2	10.2	12.0	11.4	9.4	7.3	5.2	0.4
4.5	9.7	11.5	10.2	10.5	8.5	7.8	9.0	0.4
5.6	11.0	11.7	3.9	16.3	14.9	13.9	15.8	5.9
7.3	10.7	12.1	7.6	22.6	25.9	24.2	20.1	14.1
3.9	9.2	10.4	10.2	10.0	10.4	9.8	8.9	5.1
2.5	6.7	8.0	8.7	8.3	7.0	5.7	4.7	2.9
1.2	3.6	5.2	6.3	6.4	5.6	4.4	2.9	1.6
0.2	1.5	3.2	4.6	5.0	4.5	3.1	1.5	0.6

Table R.5 Case ve35az, current velocities u, in cm/s.

-34.	-23.	-17.	-8.	2.	11.	22.	48.	61.
-76.	-54.	-37.	-16.	11.	33.	48.	77.	101.
-82.	-72.	-58.	-33.	32.	64.	68.	79.	60.
-89.	-87.	-84.	-121.	125.	98.	92.	80.	76.
-95.	-98.	-107.	-146.	104.	98.	95.	92.	89.
-99.	-110.	-125.	-157.	145.	119.	109.	99.	93.
-104.	-118.	-138.	-162.	170.	148.	131.	112.	97.
-108.	-123.	-147.	-166.	177.	162.	148.	129.	103.
-146.	-146.	-165.	-174.	178.	172.	166.	158.	123.

Table R.6 Case ve35az, current directions θ, in degrees.

-0.4	-1.6	-2.5	-1.4	0.4	1.6	2.0	1.6	0.3
-3.1	-5.8	-6.2	-3.3	2.2	5.1	5.5	5.1	0.4
-4.4	-9.2	-9.7	-5.5	5.6	7.6	7.2	8.9	0.4
-5.6	-11.0	-11.6	-3.4	13.4	14.8	13.9	15.6	5.7
-7.2	-10.6	-11.6	-4.2	21.9	25.6	24.1	20.1	14.1
-3.8	-8.7	-8.5	-3.9	5.7	9.1	9.3	8.8	5.1
-2.5	-5.9	-5.4	-2.7	1.4	3.7	4.3	4.4	2.9
-1.1	-3.0	-2.8	-1.5	0.3	1.8	2.4	2.3	1.6
-0.1	-0.8	-0.8	-0.5	0.1	0.6	0.7	0.5	0.5

Table R.7 Case ve35az, current velocity components ux, in cm/s.

0.6	3.8	7.8	10.4	10.7	8.5	5.1	1.5	0.2
0.8	4.3	8.1	11.5	11.2	7.9	4.9	1.2	-0.1
0.6	3.0	6.0	8.6	8.8	3.8	2.9	1.7	0.2
0.1	0.6	1.1	-2.0	-9.3	-2.1	-0.5	2.7	1.4
-0.6	-1.6	-3.5	-6.3	-5.5	-3.7	-2.0	-0.6	0.2
-0.6	-3.1	-6.0	-9.4	-8.2	-5.1	-3.2	-1.4	-0.3
-0.6	-3.1	-5.9	-8.2	-8.2	-5.9	-3.7	-1.8	-0.3
-0.4	-2.0	-4.4	-6.1	-6.4	-5.4	-3.8	-1.8	-0.4
-0.2	-1.3	-3.0	-4.5	-5.0	-4.4	-3.0	-1.4	-0.3

Table R.8 Case ve35az, current velocity components uy, in cm/s.

0.7	3.6	7.2	9.6	10.0	8.0	5.1	2.0	0.5
2.7	6.2	9.0	11.1	11.6	9.0	6.2	4.5	1.1
3.7	8.0	10.2	8.4	5.8	10.5	7.0	7.4	1.3
4.4	8.0	10.3	4.9	12.6	15.5	13.2	14.4	5.3
5.4	8.0	10.6	7.1	27.3	29.7	26.1	26.9	17.8
2.8	6.8	8.4	9.1	8.9	9.3	8.8	8.1	4.7
1.8	4.9	6.0	6.9	6.7	5.8	4.7	3.9	2.4
1.0	2.7	3.9	4.8	5.0	4.5	3.6	2.4	1.3
0.2	1.3	2.5	3.6	4.1	3.6	2.6	1.3	0.5

Table R.9 Case ve35am, current velocities u, in cm/s.

-40.	-25.	-18.	-8.	3.	12.	23.	38.	62.
-76.	-55.	-40.	-19.	11.	37.	53.	71.	82.
-83.	-74.	-63.	-43.	25.	70.	75.	82.	92.
-90.	-89.	-88.	-126.	142.	105.	89.	87.	79.
-96.	-101.	-110.	-155.	109.	99.	95.	92.	90.
-100.	-111.	-126.	-157.	148.	121.	110.	99.	93.
-103.	-117.	-137.	-161.	173.	149.	132.	113.	97.
-105.	-122.	-146.	-164.	178.	163.	149.	129.	103.
-142.	-147.	-164.	-173.	179.	174.	168.	159.	122.

Table R.10 Case ve35am, current directions θ, in degrees.

-0.5	-1.5	-2.2	-1.3	0.5	1.7	2.0	1.3	0.4
-2.6	-5.1	-5.8	-3.6	2.3	5.4	5.0	4.3	1.1
-3.7	-7.7	-9.1	-5.8	2.4	9.9	6.7	7.3	1.3
-4.4	-8.0	-10.3	-4.0	7.7	15.0	13.2	14.3	5.2
-5.4	-7.9	-9.9	-3.0	25.9	29.3	26.0	26.9	17.8
-2.7	-6.4	-6.8	-3.6	4.7	7.9	8.3	7.9	4.7
-1.8	-4.3	-4.1	-2.3	0.9	2.9	3.5	3.6	2.4
-0.9	-2.3	-2.2	-1.3	0.2	1.3	1.8	1.9	1.3
-0.1	-0.7	-0.7	-0.4	0.0	0.4	0.5	0.5	0.4

Table R.11 Case ve35am, current velocity components ux, in cm/s.

0.6	3.3	6.9	9.5	10.0	7.8	4.7	1.6	0.2
0.6	3.5	6.9	10.5	11.4	7.2	3.8	1.5	0.2
0.4	2.2	4.6	6.1	5.3	3.6	1.8	1.0	-0.0
0.0	0.1	0.3	-2.9	-10.0	-4.0	0.2	0.7	1.0
-0.6	-1.6	-3.6	-6.4	-8.7	-4.5	-2.2	-0.8	0.1
-0.5	-2.5	-5.0	-8.4	-7.6	-4.8	-3.0	-1.3	-0.3
-0.4	-2.2	-4.5	-6.5	-6.7	-5.0	-3.2	-1.5	-0.3
-0.3	-1.4	-3.2	-4.6	-5.0	-4.3	-3.1	-1.5	-0.3
-0.1	-1.1	-2.4	-3.6	-4.1	-3.6	-2.5	-1.2	-0.3

Table R.12 Case ve35am, current velocity components uy, in cm/s.

2.1	3.8	5.8	8.0	7.8	4.8	2.4	2.5	1.6
6.8	6.8	8.5	9.2	10.1	10.8	7.7	3.3	5.2
10.0	7.9	6.2	5.5	6.5	18.9	10.3	2.5	7.6
7.7	8.5	5.9	5.5	14.8	25.2	21.1	13.4	4.7
4.8	8.6	7.4	5.3	18.3	17.1	16.0	15.8	3.7
1.0	6.6	9.4	8.3	4.3	5.8	5.7	7.9	8.2
0.9	3.1	4.9	7.4	5.7	3.3	3.3	5.1	5.2
0.8	3.7	0.9	3.4	5.4	5.1	4.0	3.7	2.7
0.6	1.2	1.9	2.2	3.0	3.8	3.7	2.2	1.0

Table R.13 Case ve35s2, current velocities u, in cm/s.

-70.	-25.	-12.	-6.	9.	34.	113.	-163.	-113.
-82.	-43.	-23.	-14.	14.	59.	109.	-144.	-96.
-91.	-88.	-70.	-43.	20.	62.	76.	-72.	-90.
-93.	-100.	-102.	-148.	161.	135.	49.	15.	-59.
-103.	-112.	-117.	-136.	85.	81.	74.	68.	72.
-143.	-127.	-132.	-146.	140.	81.	58.	53.	79.
92.	-84.	-119.	-148.	-169.	154.	127.	113.	97.
93.	-103.	164.	-145.	-158.	-180.	154.	119.	97.
68.	-105.	-162.	179.	-174.	-175.	174.	153.	112.

Table R.14 Case ve35s2, current directions θ, in degrees.

-1.9	-1.6	-1.2	-0.8	1.2	2.7	2.2	-0.7	-1.5
-6.7	-4.6	-3.3	-2.2	2.5	9.3	7.3	-2.0	-5.2
-10.0	-7.9	-5.8	-3.8	2.2	16.7	9.9	-2.4	-7.6
-7.7	-8.4	-5.8	-2.9	4.8	17.9	15.9	3.4	-4.1
-4.7	-8.0	-6.6	-3.7	18.2	16.8	15.4	14.6	3.5
-0.6	-5.3	-6.9	-4.7	2.8	5.7	4.8	6.4	8.0
0.9	-3.1	-4.3	-4.0	-1.1	1.4	2.6	4.6	5.2
0.8	-3.6	0.3	-1.9	-2.0	-0.0	1.7	3.2	2.7
0.5	-1.2	-0.6	0.1	-0.3	-0.3	0.4	1.0	1.0

Table R.15 Case ve35s2, current velocity components ux, in cm/s.

0.7	3.5	5.7	7.9	7.8	4.0	-0.9	-2.4	-0.6
0.9	4.9	7.8	8.9	9.8	5.5	-2.6	-2.7	-0.6
-0.1	0.3	2.1	4.0	6.1	8.9	2.5	0.8	0.0
-0.3	-1.5	-1.2	-4.6	-14.0	-17.8	13.9	12.9	2.4
-1.0	-3.1	-3.4	-3.9	1.7	2.8	4.4	6.0	1.1
-0.8	-4.0	-6.3	-6.9	-3.3	0.9	3.0	4.7	1.6
-0.0	0.3	-2.4	-6.3	-5.6	-3.0	-2.0	-2.0	-0.6
-0.0	-0.8	-0.9	-2.7	-5.0	-5.1	-3.6	-1.8	-0.3
0.2	-0.3	-1.9	-2.2	-3.0	-3.8	-3.6	-2.0	-0.4

Table R.16 Case ve35s2, current velocity components uy, in cm/s.

1.7	-0.7	-5.3	-2.8	-2.1	-1.5	-1.5	-2.3	-1.6
5.2	-2.8	-3.9	-3.7	-5.9	-2.2	-0.2	-1.5	-3.0
-1.2	-6.5	-3.7	4.8	7.3	-3.5	0.5	1.7	-0.2
-2.8	-0.6	1.3	-2.8	-0.4	-2.8	0.1	3.7	2.5
-4.2	-3.0	1.9	-1.5	-1.1	-3.0	-4.4	-8.7	-3.1
-3.0	-1.9	-2.0	3.3	3.8	3.1	2.5	2.4	3.3
-3.5	-2.3	-6.5	-1.9	0.7	-0.5	-5.5	1.7	1.0
-1.8	-3.1	-3.5	-4.5	-4.4	-2.8	-5.8	-0.4	1.2
-2.1	-4.5	-2.7	-2.3	-1.9	-1.8	-3.0	-1.7	-1.3

Table R.17 Case ve35a, deviations for u in cm/s.

15.	-165.	-129.	-110.	-81.	-68.	-50.	-19.	50.
-216.	-194.	-156.	-111.	-54.	-9.	17.	54.	90.
92.	-233.	-212.	-187.	16.	53.	63.	68.	-89.
86.	-267.	-262.	-58.	176.	118.	100.	91.	90.
78.	65.	50.	-88.	137.	114.	107.	100.	97.
73.	44.	25.	-48.	206.	157.	135.	112.	96.
67.	21.	-41.	-41.	271.	203.	173.	171.	111.
62.	-30.	-14.	-89.	243.	227.	199.	215.	120.
30.	-80.	-38.	-80.	269.	258.	226.	297.	147.

Table R.18 Case ve35a, deviations for θ, in degrees.

-2.2	1.5	3.4	2.5	-0.8	-0.6	-1.2	-1.3	-1.5
-5.5	1.0	0.3	-1.4	-4.7	-3.8	-1.4	-1.6	-3.0
1.2	5.8	3.6	-0.7	3.0	-4.1	0.1	1.6	9.3
2.7	0.6	-1.2	-5.3	3.4	-1.9	0.2	3.7	2.4
4.0	2.3	-2.3	-7.8	2.2	-2.1	-3.9	-8.6	-2.9
2.6	0.9	2.0	-1.1	3.2	3.5	2.8	2.5	3.3
3.1	0.5	-3.4	3.3	3.4	-0.2	-3.6	3.0	1.2
1.5	-2.3	4.1	-2.9	-3.3	-1.4	-3.7	2.6	1.3
1.5	-2.8	3.8	0.5	0.3	0.0	-2.6	3.7	-0.9

Table R.19 Case ve35a, deviations for ux, in cm/s.

1.4	0.3	-4.4	-2.4	-2.0	-1.4	-1.2	-1.9	-0.8
0.0	-3.2	-4.4	-4.0	-4.6	0.3	1.6	0.1	0.7
0.9	-3.1	-1.0	6.1	7.5	1.1	1.5	0.5	-0.1
1.4	0.6	0.5	3.9	4.1	3.9	0.6	0.6	0.4
1.8	3.4	0.8	1.5	7.6	4.3	3.8	2.5	3.6
2.4	2.8	0.5	-3.1	-2.5	-0.3	0.3	-0.1	0.1
2.5	3.2	8.3	0.6	-0.7	0.5	4.1	1.1	0.7
1.3	4.6	1.2	4.4	3.7	2.5	4.5	1.7	0.2
1.6	4.5	1.0	2.3	1.9	1.8	2.1	0.4	1.0

Table R.20 Case ve35a, deviations for uy, in cm/s.

0.2	-1.5	-5.4	-3.3	-2.7	-2.2	-2.4	-3.3	-2.8
2.3	-3.1	-3.9	-3.7	-6.0	-2.3	0.0	-1.7	-5.7
-6.0	-7.2	-3.8	5.1	7.3	-3.4	0.8	3.2	-4.3
-8.1	-1.2	1.2	-2.6	-0.9	-2.9	0.1	4.3	-4.4
-7.4	-3.4	2.0	-1.0	-1.6	-3.3	-4.9	-9.7	-14.3
-7.9	-2.1	-1.7	3.8	3.7	2.9	2.2	2.0	-0.7
-7.1	-2.4	-6.2	-1.6	0.8	-0.6	-5.6	1.5	-0.7
-4.3	-3.8	-3.9	-4.8	-4.7	-2.9	-5.9	-0.6	0.2
-3.2	-5.6	-3.9	-3.4	-2.7	-2.3	-3.5	-2.1	-1.7

Table R.21 Case ve35az, deviations for u, in cm/s.

51.	-158.	-131.	-113.	-82.	-67.	-45.	-7.	38.
-209.	-190.	-155.	-112.	-55.	-8.	20.	62.	105.
96.	-231.	-211.	-187.	13.	52.	60.	69.	-115.
86.	-267.	-261.	-52.	177.	118.	98.	82.	77.
76.	63.	49.	-85.	137.	114.	107.	99.	96.
67.	41.	24.	-46.	208.	158.	136.	112.	97.
58.	19.	-41.	-39.	273.	205.	175.	172.	114.
52.	-25.	-9.	-85.	246.	229.	201.	219.	125.
-4.	-70.	-34.	-78.	269.	257.	225.	301.	160.

Table R.22 Case ve35az, deviations for θ, in degrees.

-0.5	2.3	3.1	2.1	-1.0	-0.6	-1.1	-1.5	-2.6
-2.5	1.6	0.5	-1.6	-4.9	-3.7	-1.0	-1.6	-5.7
6.0	6.5	3.9	-1.0	2.6	-4.0	0.3	3.1	5.1
8.0	1.2	-1.2	-5.7	2.8	-2.0	0.2	4.0	-4.6
7.3	2.7	-2.4	-8.4	1.6	-2.5	-4.4	-9.5	-14.1
7.5	1.2	1.8	-1.6	2.8	3.3	2.5	2.1	-0.7
6.7	0.7	-3.6	2.8	3.1	-0.4	-3.8	2.7	-0.6
4.0	-2.0	4.0	-3.3	-3.7	-1.6	-3.8	2.3	0.2
2.5	-2.6	3.8	0.4	0.3	0.1	-2.7	3.4	-1.3

Table R.23 Case ve35az, deviations for ux, in cm/s.

1.2	-0.2	-4.6	-3.0	-2.7	-2.1	-2.2	-3.0	-1.1
0.1	-2.9	-4.4	-4.1	-4.7	0.2	1.4	-0.6	0.4
1.0	-3.0	-0.9	6.4	7.8	1.3	1.9	0.6	-0.2
1.3	0.6	0.6	4.0	4.3	4.0	1.0	3.1	1.6
1.7	3.0	0.5	1.2	7.7	4.4	4.0	3.1	3.7
2.2	2.3	0.2	-3.4	-2.7	-0.3	0.3	0.1	0.1
2.4	3.1	8.2	0.4	-0.9	0.4	4.1	1.0	0.7
1.5	5.3	1.7	4.9	4.0	2.5	4.5	1.7	0.2
1.9	5.6	2.3	3.3	2.7	2.3	2.7	0.8	1.1

Table R.24 Case ve35az, deviations for uy, in cm/s.

0.2	-2.0	-6.4	-4.3	-3.4	-2.8	-2.8	-3.4	-2.7
1.8	-4.2	-5.1	-4.6	-5.8	-2.6	-1.1	-2.4	-5.0
-6.8	-8.8	-5.1	3.3	2.7	-1.4	0.0	1.5	-3.4
-9.3	-4.2	-0.2	-1.6	-4.7	-2.4	-0.5	2.8	-5.0
-9.3	-6.1	0.5	-1.5	3.1	0.5	-3.0	-2.9	-10.6
-9.0	-4.5	-3.7	2.7	2.7	1.7	1.2	1.2	-1.1
-7.8	-4.2	-8.1	-3.3	-0.8	-1.8	-6.6	0.7	-1.2
-4.5	-4.6	-5.3	-6.3	-6.0	-4.1	-6.8	-1.1	-0.1
-3.2	-5.8	-4.5	-4.3	-3.6	-3.1	-4.0	-2.2	-1.8

Table R.25 Case ve35am, deviations for u, in cm/s.

45.	-160.	-132.	-113.	-81.	-66.	-44.	-17.	39.
-209.	-191.	-158.	-115.	-55.	-4.	25.	56.	86.
95.	-233.	-216.	-197.	6.	58.	67.	72.	-83.
85.	-269.	-265.	-57.	194.	125.	95.	89.	80.
75.	60.	46.	-94.	142.	115.	107.	99.	97.
66.	40.	23.	-46.	211.	160.	137.	112.	97.
59.	20.	-40.	-38.	276.	206.	176.	173.	114.
55.	-24.	-8.	-83.	247.	230.	202.	219.	125.
-0.	-71.	-33.	-77.	270.	259.	227.	302.	159.

Table R.26 Case ve35am, deviations for θ, in degrees.

-0.5	2.4	3.3	2.3	-0.9	-0.6	-1.1	-1.9	-2.5
-2.0	2.4	0.8	-2.0	-4.8	-3.4	-1.5	-2.4	-5.0
6.8	8.0	4.5	-1.2	-0.6	-1.8	-0.2	1.5	6.1
9.2	4.2	0.1	-6.3	-2.9	-1.8	-0.5	2.8	-5.1
9.1	5.5	-0.7	-7.2	5.5	1.2	-2.4	-2.7	-10.4
8.7	3.5	3.6	-1.3	1.8	2.1	1.5	1.2	-1.1
7.4	2.3	-2.4	3.3	2.5	-1.2	-4.7	2.0	-1.0
4.2	-1.3	4.6	-3.0	-3.8	-2.0	-4.4	1.9	-0.0
2.5	-2.4	3.9	0.4	0.2	-0.2	-2.9	3.3	-1.4

Table R.27 Case ve35am, deviations for ux, in cm/s.

1.2	-0.7	-5.6	-3.9	-3.4	-2.7	-2.6	-2.9	-1.0
-0.0	-3.7	-5.6	-5.1	-4.5	-0.4	0.3	-0.3	0.6
0.8	-3.8	-2.4	3.9	4.3	1.1	0.9	0.0	-0.5
1.2	0.1	-0.2	3.2	3.6	2.1	1.6	1.1	1.2
1.7	3.0	0.5	1.1	4.4	3.6	3.8	2.8	3.5
2.4	3.0	1.2	-2.4	-2.0	-0.1	0.5	0.2	0.2
2.6	4.0	9.6	2.0	0.6	1.4	4.7	1.3	0.8
1.6	5.9	2.9	6.4	5.3	3.6	5.2	2.0	0.2
1.9	5.8	2.9	4.3	3.6	3.1	3.1	0.9	1.1

Table R.28 Case ve35am, deviations for uy, in cm/s.

1.5	-1.8	-7.8	-5.9	-5.6	-6.0	-5.5	-3.0	-1.6
5.9	-3.6	-5.7	-6.5	-7.3	-0.9	0.4	-3.6	-0.9
-0.4	-8.9	-9.1	0.4	3.3	7.0	3.3	-3.3	2.8
-6.0	-3.6	-4.6	-1.0	-2.5	7.4	7.3	1.8	-5.6
-9.9	-5.6	-2.6	-3.3	-6.0	-12.1	-13.1	-14.0	-24.7
-10.8	-4.7	-2.7	1.9	-1.9	-1.7	-1.9	1.0	2.3
-8.8	-6.0	-9.3	-2.8	-1.8	-4.3	-8.1	1.8	1.6
-4.6	-3.6	-8.2	-7.8	-5.7	-3.5	-6.3	0.1	1.3
-2.8	-5.9	-5.1	-5.7	-4.6	-2.9	-2.9	-1.3	-1.3

Table R.29 Case ve35s2, deviations for u, in cm/s.

15.	-160.	-126.	-111.	-75.	-44.	46.	-218.	-136.
-215.	-179.	-141.	-110.	-52.	18.	81.	-159.	-92.
87.	-247.	-223.	-197.	1.	50.	68.	-82.	-265.
82.	-280.	-279.	-79.	213.	155.	55.	17.	-58.
68.	49.	39.	-75.	118.	97.	86.	75.	79.
23.	24.	17.	-35.	203.	120.	85.	66.	83.
254.	53.	-22.	-25.	-66.	211.	171.	173.	114.
253.	-5.	302.	-64.	-89.	-113.	207.	209.	119.
210.	-29.	-31.	275.	-83.	-90.	233.	296.	149.

Table R.30 Case ve35s2, deviations for θ, in degrees.

-2.0	2.3	4.3	2.8	-0.2	0.4	-0.9	-3.9	-4.4
-6.1	2.8	3.4	-0.6	-4.6	0.5	0.8	-8.7	-11.3
0.4	7.8	7.8	0.8	-0.8	5.0	3.0	-8.2	-2.8
6.0	3.8	4.7	-5.2	-5.8	1.1	2.2	-8.1	-14.4
9.8	5.4	2.6	-7.8	-2.1	-11.2	-13.1	-15.0	-24.7
10.8	4.6	3.4	-2.3	-0.0	-0.1	-2.0	-0.3	2.2
10.1	3.6	-2.6	1.6	0.6	-2.7	-5.6	3.0	1.7
5.9	-2.6	7.1	-3.7	-6.0	-3.4	-4.4	3.2	1.3
3.2	-2.9	4.0	0.9	-0.2	-0.9	-3.0	3.9	-0.9

Table R.31 Case ve35s2, deviations for ux, in cm/s.

1.3	-0.5	-6.8	-5.5	-5.6	-6.6	-8.2	-6.8	-1.8
0.2	-2.3	-4.7	-6.7	-6.2	-2.2	-6.0	-4.5	-0.2
0.3	-5.8	-4.9	1.7	5.1	6.5	1.5	-0.3	-0.4
0.9	-1.5	-1.7	1.4	-0.4	-11.7	15.4	13.3	2.6
1.2	1.4	0.7	3.6	14.9	10.9	10.5	9.7	4.6
2.1	1.5	-0.1	-0.9	2.2	5.6	6.5	6.3	2.0
3.0	6.5	11.7	2.3	1.7	3.4	5.9	0.8	0.4
1.8	6.5	5.2	8.3	5.3	2.9	4.6	1.8	0.2
2.3	6.6	3.5	5.7	4.7	2.9	2.0	0.1	1.0

Table R.32 Case ve35s2, deviations for uy, in cm/s.

case	vel.	meas.		comp.		deviation	
		$\langle \vert . \vert \rangle$	$s(\vert . \vert)$	$\langle \vert . \vert \rangle$	$s(\vert . \vert)$	$\langle \vert . \vert \rangle$	$s(\vert . \vert)$
ve35a	u	10.12	6.18	8.69	5.27	2.75	1.73
ve35az	u	10.12	6.18	7.74	5.28	3.46	2.42
ve35am	u	10.12	6.18	7.13	5.96	3.64	2.43
ve35s2	u	10.12	6.18	6.56	4.87	4.82	3.81
ve35a	ux	7.20	6.59	6.52	5.97	2.56	1.78
ve35az	ux	7.20	6.59	5.67	5.60	3.00	2.42
ve35am	ux	7.20	6.59	5.32	6.20	2.99	2.35
ve35s2	ux	7.20	6.59	4.69	4.46	4.37	4.12
ve35a	uy	5.34	4.13	3.88	3.22	2.18	1.86
ve35az	uy	5.34	4.13	3.79	3.18	2.39	1.90
ve35am	uy	5.34	4.13	3.32	2.94	2.47	1.88
ve35s2	uy	5.34	4.13	3.57	3.50	4.16	3.57

Table R.33 Mean and standard deviations of absolute values.

case	vel.	meas.		comp.		deviation	
		$\langle \lvert . \rvert \rangle$	$s(\lvert . \rvert)$	$\langle \lvert . \rvert \rangle$	$s(\lvert . \rvert)$	$\langle \lvert . \rvert \rangle$	$s(\lvert . \rvert)$
ve35a	u	10.12	6.18	8.69	5.27	2.75	1.73
ve35az	u	10.12	6.18	7.74	5.28	3.46	2.42
ve35am	u	10.12	6.18	7.13	5.96	3.64	2.43
ve35s2	u	10.12	6.18	6.56	4.87	4.82	3.81
ve35a	ux	7.20	6.59	6.52	5.97	2.56	1.78
ve35az	ux	7.20	6.59	5.67	5.60	3.00	2.42
ve35am	ux	7.20	6.59	5.32	6.20	2.99	2.35
ve35s2	ux	7.20	6.59	4.69	4.46	4.37	4.12
ve35a	uy	5.34	4.13	3.88	3.22	2.18	1.86
ve35az	uy	5.34	4.13	3.79	3.18	2.39	1.90
ve35am	uy	5.34	4.13	3.32	2.94	2.47	1.88
ve35s2	uy	5.34	4.13	3.57	3.50	4.16	3.57

Table R.33 Mean and standard deviations of absolute values.

case		n	(Um)	(Uc)	s(Um)	s(Uc)	a	b	mae	rmse	rmses	rmseu	d	d1
			cm/s	cm/s	cm/s	cm/s	cm/s		cm/s	cm/s	cm/s	cm/s		
ve35a	u	81	10.12	8.69	6.18	5.27	1.08	0.75	2.75	3.24	2.09	2.48	0.92	0.68
ve35az	u	81	10.12	7.74	6.18	5.28	0.60	0.71	3.46	4.21	2.99	2.97	0.86	0.62
ve35am	u	81	10.12	7.13	6.18	5.96	-1.27	0.83	3.64	4.37	3.17	3.01	0.87	0.63
ve35s2	u	81	10.12	6.56	6.18	4.87	1.70	0.48	4.82	6.12	-4.77	3.83	0.70	0.51
ve35a	ux	81	1.41	1.55	9.69	8.73	0.35	0.85	2.56	3.11	1.41	2.77	0.97	0.81
ve35az	ux	81	1.41	1.46	9.69	7.86	0.40	0.75	3.00	3.84	2.41	2.99	0.95	0.77
ve35am	ux	81	1.41	1.80	9.69	7.99	0.72	0.76	2.99	3.79	2.32	3.00	0.95	0.76
ve35s2	ux	81	1.41	0.71	9.69	6.45	-0.04	0.53	4.37	5.99	4.57	3.87	0.85	0.64
ve35a	uy	81	-1.56	-0.39	6.59	5.05	0.72	0.71	2.18	2.86	2.21	1.81	0.94	0.75
ve35az	uy	81	-1.56	-0.32	6.59	4.95	0.75	0.69	2.39	3.04	2.36	1.92	0.93	0.73
ve35am	uy	81	-1.56	-0.42	6.59	4.43	0.56	0.63	2.47	3.10	2.68	1.55	0.92	0.71
ve35s2	uy	81	-1.56	0.08	6.59	5.02	0.82	0.47	4.16	5.46	3.82	3.91	0.75	0.52

Table R.34 Primary statistical parameters for the current.

case		n	bias	mae	rmse	rmses	rmseu	pes	peu	sd	r2
			%	%	%	%	%	%	%	%	
ve35a	u	81	-14.10	27.18	32.03	20.61	24.52	41.39	58.61	28.94	0.78
ve35az	u	81	-23.52	34.17	41.65	29.54	29.35	50.33	49.67	34.58	0.68
ve35am	u	81	-29.56	36.02	43.19	31.31	29.76	52.53	47.47	31.69	0.74
ve35s2	u	81	-35.12	47.60	60.52	47.18	37.90	60.78	39.22	49.60	0.37
ve35a	ux	81	10.24	181.81	220.90	100.42	196.75	20.66	79.34	222.03	0.90
ve35az	ux	81	3.39	212.93	272.78	171.41	212.19	39.49	60.51	274.46	0.85
ve35am	ux	81	27.70	212.30	269.15	164.37	213.13	37.30	62.70	269.39	0.86
ve35s2	ux	81	-49.53	310.47	425.43	324.74	274.84	58.27	41.73	425.17	0.64
ve35a	uy	81	74.71	139.85	183.42	141.64	116.53	59.64	40.36	168.56	0.87
ve35az	uy	81	79.20	153.60	195.50	151.88	123.10	60.35	39.65	179.85	0.85
ve35am	uy	81	27.70	212.30	269.15	164.37	213.13	37.30	62.70	269.39	0.86
ve35s2	uy	81	105.35	267.03	350.87	245.17	251.00	48.82	51.18	336.77	0.39

Table R.35 Secondary statistical parameters for the current.

-1.56	-0.75	-0.12	-0.55	-0.67	-0.69	-0.91	-0.97	-1.21
-2.96	-0.38	-0.04	-0.06	-0.15	-0.04	0.21	-0.19	-2.70
-4.73	-0.64	-0.16	0.37	0.07	0.14	0.35	1.48	-4.11
-5.30	-0.61	-0.06	0.25	-0.59	-0.07	-0.01	0.56	-6.88
-3.23	-0.43	0.14	0.51	-0.57	-0.35	-0.48	-0.98	-11.15
-4.87	-0.17	0.36	0.47	-0.08	-0.16	-0.27	-0.43	-4.03
-3.62	-0.12	0.27	0.32	0.11	-0.08	-0.14	-0.24	-1.73
-2.43	-0.71	-0.40	-0.33	-0.27	-0.14	-0.05	-0.21	-1.00
-1.04	-1.10	-1.21	-1.02	-0.75	-0.54	-0.54	-0.42	-0.42

Table R.36 Difference between ve35az and ve35a, u, in cm/s.

35.8	6.5	-2.5	-2.5	-0.9	0.8	4.1	12.3	-11.9
7.7	4.6	1.0	-1.2	-1.3	0.7	2.9	7.8	15.5
4.2	1.8	1.2	-0.1	-2.6	-1.3	-2.6	1.2	-25.6
0.4	-0.3	0.5	5.5	0.7	-0.1	-1.6	-9.0	-12.5
-2.0	-2.0	-0.8	3.0	0.1	-0.1	-0.5	-1.4	-0.7
-6.0	-3.4	-0.8	2.2	2.4	0.8	0.3	0.1	1.3
-9.1	-1.8	0.7	2.5	2.4	1.6	1.3	1.3	2.6
-10.2	5.0	4.4	3.9	2.8	1.4	1.8	4.1	5.4
-34.5	9.6	4.5	2.3	0.4	-1.3	-0.6	4.1	12.8

Table R.37 Difference between ve35az and ve35a, θ, in degrees.

1.76	0.79	-0.32	-0.40	-0.20	-0.01	0.10	-0.22	-1.17
3.02	0.65	0.16	-0.23	-0.28	0.08	0.40	0.03	-2.70
4.75	0.71	0.25	-0.22	-0.34	0.05	0.21	1.47	-4.15
5.30	0.61	0.08	-0.41	-0.60	-0.07	0.01	0.33	-7.04
3.25	0.48	-0.08	-0.60	-0.57	-0.34	-0.45	-0.96	-11.15
4.91	0.34	-0.21	-0.52	-0.38	-0.22	-0.27	-0.43	-4.02
3.66	0.21	-0.26	-0.45	-0.33	-0.22	-0.20	-0.26	-1.74
2.46	0.36	-0.15	-0.37	-0.33	-0.18	-0.14	-0.30	-1.02
1.03	0.23	-0.02	-0.12	-0.06	0.04	-0.10	-0.27	-0.46

Table R.38 Difference between ve35az and ve35a, ux, in cm/s.

-0.16	-0.44	-0.21	-0.60	-0.67	-0.70	-1.00	-1.11	-0.30
0.08	0.28	0.08	-0.12	-0.09	-0.10	-0.12	-0.76	-0.32
0.03	0.11	0.12	0.30	0.32	0.23	0.44	0.11	-0.13
-0.03	-0.09	0.09	0.17	0.16	0.04	0.38	2.48	1.14
-0.09	-0.32	-0.20	-0.22	0.08	0.09	0.25	0.54	0.12
-0.14	-0.47	-0.32	-0.30	-0.18	-0.05	0.03	0.06	0.01
-0.08	-0.13	-0.14	-0.20	-0.17	-0.04	0.00	-0.02	-0.00
0.15	0.69	0.56	0.42	0.24	0.08	-0.03	-0.04	-0.01
0.29	1.14	1.24	1.03	0.74	0.55	0.53	0.33	0.03

Table R.39 Difference between ve35az and ve35a, uy, in cm/s.

-1.58	-1.25	-1.11	-1.48	-1.37	-1.34	-1.26	-1.16	-1.06
-3.43	-1.47	-1.22	-0.90	0.05	-0.42	-0.87	-0.90	-1.99
-5.51	-2.28	-1.42	-1.48	-4.58	2.15	-0.44	-0.17	-3.21
-6.50	-3.62	-1.44	1.25	-4.32	0.47	-0.69	-0.88	-7.43
-5.07	-3.12	-1.40	0.00	4.14	3.45	1.45	5.86	-7.49
-6.02	-2.55	-1.65	-0.61	-1.16	-1.31	-1.25	-1.26	-4.42
-4.32	-1.93	-1.64	-1.43	-1.47	-1.32	-1.18	-1.02	-2.19
-2.62	-1.58	-1.73	-1.84	-1.61	-1.26	-0.93	-0.74	-1.26
-1.05	-1.35	-1.85	-1.95	-1.72	-1.36	-1.02	-0.59	-0.50

Table R.40 Difference between ve35am and ve35a, u, in cm/s.

29.7	4.8	-3.1	-2.5	0.1	2.0	5.7	2.5	-10.6
7.1	3.0	-2.0	-4.3	-0.9	4.6	7.3	1.8	-3.5
3.4	-0.3	-4.1	-10.8	-10.5	5.1	4.0	3.7	6.6
-0.8	-2.4	-3.2	0.8	18.3	6.7	-4.3	-2.2	-9.6
-3.7	-4.8	-3.8	-5.8	4.8	0.5	-0.4	-1.2	0.1
-6.9	-4.5	-1.9	2.6	5.5	3.1	1.1	0.2	1.3
-8.4	-0.9	0.9	3.3	4.5	3.3	3.0	2.0	2.9
-6.8	6.3	5.8	5.5	3.8	2.5	3.4	4.1	5.2
-30.4	9.1	5.4	3.2	1.4	0.6	1.4	4.6	11.9

Table R.41 Difference between ve35am and ve35a, θ, in degrees.

1.71	0.90	-0.09	-0.28	-0.05	0.03	0.10	-0.61	-1.04
3.47	1.42	0.51	-0.57	-0.17	0.37	-0.10	-0.79	-1.99
5.52	2.18	0.87	-0.46	-3.55	2.31	-0.28	-0.09	-3.19
6.50	3.61	1.40	-1.04	-6.31	0.09	-0.66	-0.90	-7.51
5.09	3.21	1.56	0.64	3.37	3.38	1.46	5.87	-7.49
6.05	2.62	1.53	-0.17	-1.40	-1.41	-1.23	-1.24	-4.42
4.34	1.78	1.02	0.01	-0.84	-1.02	-1.07	-1.00	-2.20
2.62	1.06	0.49	-0.14	-0.49	-0.61	-0.70	-0.71	-1.27
1.03	0.37	0.11	-0.07	-0.15	-0.20	-0.30	-0.35	-0.51

Table R.42 Difference between ve35am and ve35a, ux, in cm/s.

-0.22	-0.94	-1.18	-1.52	-1.37	-1.38	-1.37	-0.99	-0.24
-0.06	-0.51	-1.15	-1.11	0.08	-0.76	-1.21	-0.45	-0.09
-0.12	-0.68	-1.37	-2.22	-3.22	0.05	-0.62	-0.50	-0.40
-0.15	-0.54	-0.69	-0.69	-0.49	-1.82	1.03	0.54	0.75
-0.11	-0.32	-0.27	-0.33	-3.20	-0.74	0.04	0.27	-0.06
-0.01	0.22	0.70	0.72	0.44	0.19	0.24	0.17	0.03
0.12	0.78	1.28	1.49	1.35	0.92	0.57	0.23	0.04
0.27	1.22	1.72	1.92	1.58	1.11	0.66	0.29	0.05
0.31	1.34	1.87	1.96	1.71	1.35	0.97	0.49	0.08

Table R.43 Difference between ve35am and ve35a, uy, in cm/s.

0.02	0.50	0.99	0.93	0.70	0.65	0.35	0.19	-0.15
0.47	1.09	1.18	0.84	-0.20	0.38	1.08	0.71	-0.71
0.78	1.64	1.26	1.85	4.65	-2.01	0.79	1.65	-0.90
1.20	3.01	1.38	-1.00	3.73	-0.54	0.68	1.44	0.55
1.84	2.69	1.54	0.51	-4.71	-3.80	-1.93	-6.84	-3.66
1.15	2.38	2.01	1.08	1.08	1.15	0.98	0.83	0.39
0.70	1.81	1.91	1.75	1.58	1.24	1.04	0.78	0.46
0.19	0.87	1.33	1.51	1.34	1.12	0.88	0.53	0.26
0.01	0.25	0.64	0.93	0.97	0.82	0.48	0.17	0.08

Table R.44 Difference between ve35az and ve35am, u, in cm/s.

6.1	1.6	0.6	0.0	-1.0	-1.2	-1.5	9.8	-1.3
0.6	1.6	3.0	3.1	-0.4	-3.9	-4.4	6.0	19.0
0.8	2.1	5.3	10.7	7.9	-6.4	-6.6	-2.4	-32.2
1.1	2.2	3.6	4.8	-17.6	-6.8	2.7	-6.8	-2.8
1.7	2.8	3.0	8.9	-4.7	-0.6	-0.1	-0.2	-0.8
0.9	1.1	1.1	-0.4	-3.1	-2.3	-0.8	-0.1	-0.1
-0.8	-0.9	-0.2	-0.7	-2.1	-1.6	-1.7	-0.7	-0.3
-3.4	-1.4	-1.4	-1.6	-1.1	-1.1	-1.6	0.0	0.2
-4.1	0.4	-0.8	-0.8	-1.0	-1.9	-2.0	-0.5	0.9

Table R.45 Difference between ve35az and ve35am, θ, in degrees.

0.05	-0.11	-0.23	-0.12	-0.15	-0.04	0.00	0.39	-0.13
-0.45	-0.77	-0.35	0.34	-0.11	-0.29	0.50	0.82	-0.71
-0.77	-1.47	-0.62	0.24	3.21	-2.26	0.49	1.56	-0.96
-1.20	-3.00	-1.32	0.63	5.71	-0.16	0.67	1.23	0.47
-1.84	-2.73	-1.64	-1.24	-3.94	-3.72	-1.91	-6.83	-3.66
-1.14	-2.28	-1.74	-0.35	1.02	1.19	0.96	0.81	0.40
-0.68	-1.57	-1.28	-0.46	0.51	0.80	0.87	0.74	0.46
-0.16	-0.70	-0.64	-0.23	0.16	0.43	0.56	0.41	0.25
0.00	-0.14	-0.13	-0.05	0.09	0.24	0.20	0.08	0.05

Table R.46 Difference between ve35az and ve35am, ux, in cm/s.

0.06	0.50	0.97	0.92	0.70	0.68	0.37	-0.12	-0.06
0.14	0.79	1.23	0.99	-0.17	0.66	1.09	-0.31	-0.23
0.15	0.79	1.49	2.52	3.54	0.18	1.06	0.61	0.27
0.12	0.45	0.78	0.86	0.65	1.86	-0.65	1.94	0.39
0.02	0.00	0.07	0.11	3.28	0.83	0.21	0.27	0.18
-0.13	-0.69	-1.02	-1.02	-0.62	-0.24	-0.21	-0.11	-0.02
-0.20	-0.91	-1.42	-1.69	-1.52	-0.96	-0.57	-0.25	-0.04
-0.12	-0.53	-1.16	-1.50	-1.34	-1.03	-0.69	-0.33	-0.06
-0.02	-0.20	-0.63	-0.93	-0.97	-0.80	-0.44	-0.16	-0.05

Table R.47 Difference between ve35az and ve35am, uy, in cm/s.

0.27	0	0	0	0	0	0	0	0.11
-0.14	0	0	0	0	0	0	0.01	-0.10
0.23	0.03	0	0	0	0	0	-0.05	0.20
0	0.12	0	0	0	0	0	0	0.10
0.02	0	0	0	0	0	0	0	-1.72
0.03	0	0	0	0	0	0	0.01	0.02
0.10	-0.05	0.02	0.05	0.04	0	-0.04	-0.15	-0.20
0.07	0	0.02	0.03	-0.02	-0.01	-0.01	0	0.05
0.17	0	0.03	0.01	-0.01	-0.02	-0.02	0	-0.02

Table R.48 Difference between ve35-115 and ve35a, u, in cm/s.

12.7	0	0	0	0	0	0	0	-10.0
6.1	0.1	0	0	0	0	0	-0.2	-3.2
1.8	-0.3	0	0	0	0	0	0.3	-2.9
0.6	0.2	0	0	0	0	0	0	-0.6
-0.7	0	0	0	0	0	0	0	0
-2.4	0	0	0	0	0	0	0	1.2
-3.8	-0.2	-0.3	-1.0	-0.3	0.1	0	0.8	3.4
-6.0	0	-0.2	-0.7	-0.4	0	-0.2	0	5.1
-14.0	0	0.1	0.1	0.1	0.1	0	0	14.3

Table R.49 Difference between ve35-115 and ve35a, θ, in degrees.

0	0	0	0	0	0	0	0	0
0.25	0	0	0	0	0	0	0	-0.12
-0.21	-0.04	0	0	0	0	0	-0.05	0.18
0.01	-0.11	0	0	0	0	0	0	0.11
-0.01	0	0	0	0	0	0	0	-1.72
0	0	0	0	0	0	0	0.01	0.02
-0.05	0.06	0.01	0.13	0.05	-0.01	-0.03	-0.16	-0.23
0.02	0	0.01	0.07	0.05	0	0	0	0
0	0	-0.01	-0.01	-0.01	-0.01	-0.01	0	-0.13

Table R.50 Difference between ve35-115 and ve35a, ux, in cm/s.

0.60	0	0	0	0	0	0	0	0.30
0.61	0.01	0	0	0	0	0	0.02	0.15
0.31	-0.05	0	0	0	0	0	-0.05	0.26
0.12	0.04	0	0	0	0	0	0	0.14
-0.13	0	0	0	0	0	0	0	0
-0.36	0	0	0	0	0	0	0	-0.19
-0.42	0	-0.05	-0.09	-0.03	-0.01	0.03	-0.01	-0.25
-0.38	0	-0.03	-0.05	0.02	0.01	0.02	0	-0.24
-0.37	0	-0.03	-0.01	0.01	0.01	0.02	0	-0.21

Table R.51 Difference between ve35-115 and ve35a, uy, in cm/s.

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.01	0
0	0.03	0	0	0	0	0	-0.05	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.01	0
0.04	-0.05	0	0	0	0	0	-0.15	-0.09
0.02	0	0	0	0	0	0	0	0.02
0.07	0	0	0	0	0	0	0	-0.08

Table R.52 Difference between ve35-145 and ve35a, u, in cm/s.

0	0	0	0	0	0	0	0	0
0	0.1	0	0	0	0	0	-0.2	0
0	-0.3	0	0	0	0	0	0.3	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
-1.7	-0.2	0	0	0	0	0	0.8	1.5
-2.5	0	0	0	0	0	0	0	2.2
-6.7	0	0	0	0	0	0	0	7.7

Table R.53 Difference between ve35-145 and ve35a, θ, in degrees.

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	-0.04	0	0	0	0	0	-0.05	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.01	0
-0.03	0.06	0	0	0	0	0	-0.16	-0.11
0.01	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	-0.12

Table R.54 Difference between ve35-145 and ve35a, ux, in cm/s.

0	0	0	0	0	0	0	0	0
0	0.01	0	0	0	0	0	0.02	0
0	-0.05	0	0	0	0	0	-0.05	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
-0.18	0	0	0	0	0	0	-0.01	-0.11
-0.16	0	0	0	0	0	0	0	-0.10
-0.17	0	0	0	0	0	0	0	-0.08

Table R.55 Difference between ve35-145 and ve35a, uy, in cm/s.

0	-0.11	0	0	0	0	0	0.10	0
0	0.04	0	0	0	0	0	0.24	0
0	-0.05	0	0	0	0	0	-0.10	0
0	0	0	0	0	0	0	-1.67	0
0	0	0	0	0	0	0	0	0
0	-0.03	0	0	0	0	0	0.09	0
0	-0.07	0	0	0	0	0	-0.18	0
0	-0.04	0	0	0	0	0	0.06	0
0	-0.04	0	0	0	0	0	0.09	0

Table R.56 Difference between ve35-230 and ve35a, u, in cm/s.

0	0.2	0	0	0	0	0	-3.3	0
0	-0.9	0	0	0	0	0	-1.1	0
0	-0.2	0	0	0	0	0	-0.7	0
0	0	0	0	0	0	0	0.1	0
0	0	0	0	0	0	0	0	0
0	0.4	0	0	0	0	0	0.4	0
0	0.3	0	0	0	0	0	2.4	0
0	0.6	0	0	0	0	0	1.6	0
0	0.5	0	0	0	0	0	1.4	0

Table R.57 Difference between ve35-230 and ve35a, θ, in degrees.

0	0.07	0	0	0	0	0	-0.10	0
0	-0.10	0	0	0	0	0	0.19	0
0	0.04	0	0	0	0	0	-0.13	0
0	0	0	0	0	0	0	-1.67	0
0	0	0	0	0	0	0	0	0
0	0.01	0	0	0	0	0	0.08	0
0	0.05	0	0	0	0	0	-0.24	0
0	-0.01	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Table R.58 Difference between ve35-230 and ve35a, ux, in cm/s.

0	-0.09	0	0	0	0	0	0.19	0
0	-0.09	0	0	0	0	0	0.18	0
0	-0.06	0	0	0	0	0	0.07	0
0	0	0	0	0	0	0	-0.05	0
0	0	0	0	0	0	0	0	0
0	0.06	0	0	0	0	0	-0.08	0
0	0.06	0	0	0	0	0	-0.12	0
0	0.05	0	0	0	0	0	-0.10	0
0	0.06	0	0	0	0	0	-0.10	0

Table R.59 Difference between ve35-230 and ve35a, uy, in cm/s.

<table>
<tr><th></th><th></th><th>meas.</th><th></th><th>comp.</th><th></th><th>deviation</th><th></th></tr>
<tr><th>case</th><th>vel.</th><th><|.|></th><th>s(|.|)</th><th><|.|></th><th>s(|.|)</th><th><|.|></th><th>s(|.|)</th></tr>
<tr><td>ve35-115</td><td>u</td><td>10.12</td><td>6.18</td><td>8.68</td><td>5.21</td><td>2.76</td><td>1.75</td></tr>
<tr><td>ve35-145</td><td>u</td><td>10.12</td><td>6.18</td><td>8.69</td><td>5.28</td><td>2.75</td><td>1.73</td></tr>
<tr><td>ve35a</td><td>u</td><td>10.12</td><td>6.18</td><td>8.69</td><td>5.27</td><td>2.75</td><td>1.73</td></tr>
<tr><td>ve35-230</td><td>u</td><td>10.12</td><td>6.18</td><td>8.67</td><td>5.25</td><td>2.72</td><td>1.73</td></tr>
<tr><td>ve35-115</td><td>ux</td><td>7.20</td><td>6.59</td><td>6.50</td><td>5.91</td><td>2.58</td><td>1.80</td></tr>
<tr><td>ve35-145</td><td>ux</td><td>7.20</td><td>6.59</td><td>6.52</td><td>5.97</td><td>2.56</td><td>1.78</td></tr>
<tr><td>ve35a</td><td>ux</td><td>7.20</td><td>6.59</td><td>6.52</td><td>5.97</td><td>2.56</td><td>1.78</td></tr>
<tr><td>ve35-230</td><td>ux</td><td>7.20</td><td>6.59</td><td>6.50</td><td>5.94</td><td>2.54</td><td>1.78</td></tr>
<tr><td>ve35-115</td><td>uy</td><td>5.34</td><td>4.13</td><td>3.94</td><td>3.16</td><td>2.17</td><td>1.86</td></tr>
<tr><td>ve35-145</td><td>uy</td><td>5.34</td><td>4.13</td><td>3.89</td><td>3.21</td><td>2.17</td><td>1.86</td></tr>
<tr><td>ve35a</td><td>uy</td><td>5.34</td><td>4.13</td><td>3.88</td><td>3.22</td><td>2.18</td><td>1.86</td></tr>
<tr><td>ve35-230</td><td>uy</td><td>5.34</td><td>4.13</td><td>3.88</td><td>3.22</td><td>2.18</td><td>1.87</td></tr>
</table>

Table R.60 Mean and standard deviations of absolute values.

case		n	(Um)	(Uc)	s(Um)	s(Uc)	a	b	mae	rmse	rmses	rmseu	d	d1
			cm/s	cm/s	cm/s	cm/s	cm/s		cm/s	cm/s	cm/s	cm/s		
ve35-115	u	81	10.12	8.68	6.18	5.21	1.18	0.74	2.76	3.26	2.14	2.46	0.91	0.68
ve35-145	u	81	10.12	8.69	6.18	5.28	1.07	0.75	2.75	3.24	2.08	2.48	0.92	0.68
ve35a	u	81	10.12	8.69	6.18	5.27	1.08	0.75	2.75	3.24	2.09	2.48	0.92	0.68
ve35-230	u	81	10.12	8.67	6.18	5.25	1.07	0.75	2.72	3.22	2.10	2.44	0.92	0.68
ve35-115	ux	81	1.41	1.53	9.69	8.68	0.33	0.85	2.58	3.14	1.47	2.77	0.97	0.81
ve35-145	ux	81	1.41	1.55	9.69	8.73	0.34	0.85	2.56	3.11	1.41	2.77	0.97	0.81
ve35a	ux	81	1.41	1.55	9.69	8.73	0.35	0.85	2.56	3.11	1.41	2.77	0.97	0.81
ve35-230	ux	81	1.41	1.53	9.69	8.70	0.33	0.85	2.54	3.09	1.43	2.74	0.97	0.81
ve35-115	uy	81	-1.56	-0.40	6.59	5.06	0.72	0.72	2.17	2.85	2.19	1.82	0.94	0.76
ve35-145	uy	81	-1.56	-0.40	6.59	5.05	0.71	0.71	2.17	2.85	2.20	1.81	0.94	0.76
ve35a	uy	81	-1.56	-0.39	6.59	5.05	0.72	0.71	2.18	2.86	2.21	1.81	0.94	0.75
ve35-230	uy	81	-1.56	-0.39	6.59	5.05	0.72	0.71	2.18	2.86	2.21	1.82	0.94	0.76

Table R.61 Primary statistical parameters for the current.

case		n	bias	mae	rmse	rmses	rmseu	pes	peu	sd	r2
			%	%	%	%	%	%	%	%	
ve35-115	u	81	-14.20	27.27	32.23	21.16	24.32	43.09	56.91	23.12	0.77
ve35-145	u	81	-14.12	27.14	32.01	20.60	24.50	41.42	58.58	28.90	0.78
ve35a	u	81	-14.10	27.18	32.03	20.61	24.52	41.39	58.61	28.94	0.78
ve35-230	u	81	-14.30	26.93	31.85	20.79	24.13	42.61	57.39	28.63	0.78

Table R.62 Secondary statistical parameters for the current.

26.00	26.00	26.00	26.00	26.00	26.00	26.00	25.90	26.00
23.00	23.00	23.00	23.14	23.12	23.14	23.15	23.10	23.00
20.00	19.95	20.00	20.00	20.00	20.00	20.00	20.00	20.00
17.00	17.00	17.00	17.00	17.00	17.00	17.00	16.90	17.00
14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	13.98
11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.90	11.00
8.00	8.06	8.00	8.00	8.00	8.00	8.00	8.13	8.00
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Table R.63 Interpolated x-values for the 81 points; x in m.

12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.00	-12.00
12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.00	-12.00
12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.00	-12.00
12.00	9.00	6.00	3.00	0.00	-3.00	-6.00	-9.00	-12.00
11.55	9.00	6.00	2.93	0.00	-3.00	-6.00	-9.00	-12.00
12.00	8.93	6.00	3.00	-0.01	-3.00	-6.00	-9.00	-12.00
12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.00	-12.00
12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.05	-12.00
12.00	8.93	6.00	3.00	0.00	-3.00	-6.00	-9.05	-12.00

Table R.64 Interpolated y-values for the 81 points; y in m.

40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
40.00	40.00	39.40	27.60	20.00	20.00	20.00	19.10	20.00
40.00	40.00	35.50	20.80	10.50	10.60	11.00	11.70	10.90
40.00	40.00	39.80	30.10	25.00	25.00	25.00	25.50	25.00
40.00	40.00	40.00	39.80	39.10	39.00	38.80	38.40	37.90
40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00

Table R.65 Interpolated depth-values for the 81 points, in cm.

0	0	0	0	0	0	0	0.01	0
0.23	0.05	0	0.14	0.12	0.14	0.15	0.11	0.23
-0.23	-0.05	0	0	0	0	0	-0.11	-0.23
0	0	0	0	0	0	0	0.01	0
0.01	0	0	0	0	0	0	0	-0.02
0	0	0	0	0	0	0	0.01	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Table R.66 Difference between interpolated and exact positions, in m; x-coordinates; search radius 1.15 m.

0	0	0	0	0	0	0	0.01	0
0	0.05	0	0.14	0.12	0.14	0.15	0.11	0
0	-0.05	0	0	0	0	0	-0.11	0
0	0	0	0	0	0	0	0.01	0
0	0	0	0	0	0	0	0	-0.02
0	0	0	0	0	0	0	0.01	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Table R.67 Difference between interpolated and exact positions, in m; x-coordinates; search radius 1.45 m.

0	0	0	0	0	0	0	0.01	0
0	0	0	0.14	0.12	0.14	0.15	0.01	0
0	-0.05	0	0	0	0	0	-0.11	0
0	0	0	0	0	0	0	0.01	0
0	0	0	0	0	0	0	0	-0.02
0	0	0	0	0	0	0	0.01	0
0	0.06	0	0	0	0	0	0.13	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Table R.68 Difference between interpolated and exact positions, in m; x-coordinates; search radius 1.70 m.

0	-0.05	0	0	0	0	0	-0.10	0
0	0.05	0	0.14	0.12	0.14	0.15	0.11	0
0	-0.05	0	0	0	0	0	0	0
0	0	0	0	0	0	0	-0.10	0
0	0	0	0	0	0	0	0	-0.02
0	-0.05	0	0	0	0	0	-0.10	0
0	0.06	0	0	0	0	0	0.13	0
0	-0.06	0	0	0	0	0	0	0
0	-0.06	0	0	0	0	0	0	0

Table R.69 Difference between interpolated and exact positions, in m; x-coordinates; search radius 2.30 m.

-0.93	-0.07	0	0	0	0	0	-0.20	0.80
-0.93	-0.07	0	0	0	0	0	-0.20	0.80
-0.93	-0.07	0	0	0	0	0	-0.20	0.80
-0.93	-0.07	0	0	0	0	0	-0.20	0.80
-0.89	0	0	-0.07	0	0	0	0	0.83
-0.93	-0.07	0	0	-0.01	0	0	-0.20	0.80
-0.93	-0.07	-0.04	-0.03	-0.07	-0.03	-0.04	-0.20	0.80
-0.93	-0.07	-0.04	-0.03	-0.02	-0.03	-0.04	-0.20	0.80
-0.93	-0.07	-0.05	-0.04	-0.04	-0.04	-0.05	-0.20	0.80

Table R.70 Difference between interpolated and exact positions, in m; y-coordinates; search radius 1.15 m.

0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	0	0	0	0	0	0	-0.20	0
-0.45	0	0	-0.07	0	0	0	0	0
0	-0.07	0	0	-0.01	0	0	-0.20	0
-0.41	-0.07	0	0	0	0	0	-0.20	0.34
-0.41	-0.07	0	0	0	0	0	-0.20	0.34
-0.41	-0.07	0	0	0	0	0	-0.20	0.34

Table R.71 Difference between interpolated and exact positions, in m; y-coordinates; search radius 1.45 m.

0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	0	0	0	0	0	0	-0.20	0
-0.45	0	0	-0.07	0	0	0	0	0
0	-0.07	0	0	-0.01	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0
0	-0.07	0	0	0	0	0	-0.20	0

Table R.72 Difference between interpolated and exact positions, in m; y-coordinates; search radius 1.70 m.

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
-0.45	0	0	-0.07	0	0	0	0	0
0	0	0	0	-0.01	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Table R.73 Difference between interpolated and exact positions, in m; y-coordinates; search radius 2.30 m.

APPENDIX S. Spectral moments and spectral mean frequency measures from the measurements.

In this appendix the variance density spectra E(f) and frequency measures at the seven sites are analyzed. In first instance spectral moments are calculated from E(f). There are calculated the moments m_{-1} (denoted as m-1), m0, m1, m2, m3 and m4. The variance densities E(f) have been given in 129 point (128 intervals), with $0 \le f \le 3.125$ Hz, where the Nyquist frequency fNy = 3.125 Hz. From the spectral moments other spectral measures may be derived and therefore the moments have been given in five significant digits. The variance density spectrum has been given in values with dimension cm^2/Hz, sothat the dimensions of the calculated moments are based on the length scale of cm. Moreover, the files from which the spectra were taken, had the spectra in four significant digits (E-format).

Furthermore, a Table has been added with values of m0, m0d1, m0d2 and m0d2/m0; m0d1 and m0d2 are as defined in section 2.7 : m0d1 is the variance of E(f) from f = 0 to f = 1.1 Hz and m0d2 is the variance from 1.1 to, 3.125 Hz. (In fact, m0d1 is the integral over the spectral values fom 0Δf to 45Δf and thus from f = 0 to f = 1.0986 Hz.) The rate m0d2/m0, which has been given as a percentage, gives an indication for the appearance of a secondary peak in the spectrum; from the results for theoretical JONSWAP-type spectra in appendix G it is seen that the variance above the frequency f=1.36fm is about 15 % of the total variance. (Ofcourse, the value of m0d2/m0, with the separation frequency over the peak frequency a fixed value, depends on the peak-enhancement factor.)

Lastly, several wave period measures have been given. We gave Tp (=1/fm) and the mean zero wave crossing period, <Tz>. From the spectral moments the usual mean wave periods Tm01 and Tm02 have been calculated. From the given results it is seen that Tm02 is not a good measure for <Tz>; mostly there is obtained Tm02 < <Tz> < Tm01.

Because in HISWA the wave period measure Tm-10 is used (Tm-10 = m-1/m0), this value has also been given in order to facilitate the comparison with the other wave period measures.

As the peak frequency fm differs for two sites easily by one interval Δf, another, more stable, frequency measure has been introduced in 1975 at

Delft Hydraulics, the socalled "dominant frequency", fd. This frequency fd is defined as the frequency of the centre of gravity of that part of the variance density E(f) for which E(f) > 0.8.Em, where Em = E(fm). As fd is computed in the standard wave processing procedure, we took these frequency values and gave the wave period measure Td = 1/fd also. The values for fd have only been taken for measurement conditions me2x and me3x, not for the empty basin measurements.

Some variability in Tp can be noted. Because Δf = 3.125/128 = 0.0244 Hz, a difference of one interval Δf in the value of fm means that the following differences in Tp are obtained. In most cases we obtain fm = 33Δf. For fm = 34Δf we obtain Tp = 1.205 and for fm = 32Δf we have Tp = 1.280 s. So, the variations in fm, as occurring in the results of for example me23, are in fact due to differences of only one interval Δf in the value of fm.

Because at site 10 the measurements are repeated twice (at the repetitions the site is denoted by site 20 and site 30 respectively), the spectral moments have been given for all measurements separately. The wave period measures are obtained for site 10 in the following way. At first the frequency measures f are calculated for each site 10, 20 or 30 separately; then the mean of these three values is taken. In fact, the same procedure has been followed for the values Hm0 at those places where measurements have been repeated. The wave period measures have been calculated using the mean frequencies; so is at the location of site 10 Tp = 1/<fm> and Tm01 = 1/<fm01>.

For later use we have also given the measurement test numbers from which the results have been obtained. For me11 three measurements have been performed so as to cover all 26 sites; these test results have been filed under number P111, P121 and P131; writing the test number as Pxzy, where x = 1, 2 or 3 denotes the empty basin, the fully cylindrical bar geometry and the semi-cylindrical bar geometry respectively, as before. The value of y denotes again the measurement condition (y=1 to 8) and z is the code for the repetition of the measurements, with other placing of the measuring instruments.

A few measurements have been repeated because due to errors, the results were lost. The measurements P114, P115, P116 and P117 are replaced by P144, P145, P146 and P147 respectively. After analyzing the measurements of me18, the results have been lost so that we could not any more calculate the spectral parameters.

It has to be noted that the given values for the spectral moments m3 and m4 are not used in the present study, but they have been given for possible future use.

For possible future use, the organisation of the measurement files Pxzy is given below. Nine channel numbers of 8 to 16 are used for the two velocity and the one water elevation signals of each wave direction meter (GRSM).

The corresponding channel numbers and measuring positions (sites) are given in next Table for the GRSM's for the three measurements.

	Px1y		Px2y		Px3y	
signal	channel	site	channel	site	channel	site
ζ	10	10	10	20	10	30
Ux	8	10	8	20	8	30
Uy	9	10	9	20	9	30
ζ	13	18	13	28	13	38
Ux	11	18	11	28	11	38
Uy	12	18	12	28	12	38
ζ	16	19	16	29	16	39
Ux	14	19	14	29	14	39
Uy	15	19	15	29	15	39

For the seven wave gauges the corresponding channel numbers and measuring positions are given in next Table.

	Px1y		Px2y		Px3y	
signal	channel	site	channel	site	channel	site
ζ	1	11	1	21	1	31
ζ	2	12	2	22	2	23
ζ	3	13	3	23	3	33
ζ	4	14	4	24	4	34
ζ	5	15	5	25	5	35
ζ	6	16	6	26	6	36
ζ	7	17	7	27	7	37

me11, measurements P111, P121, P131.

site	m-1	m0	m1	m2	m3	m4
me11						
19	0.20962E+01	0.17812E+01	0.16346E+01	0.16547E+01	0.19332E+01	0.27174E+01
10	0.19451E+01	0.16347E+01	0.14845E+01	0.14756E+01	0.16736E+01	0.22578E+01
20	0.18534E+01	0.15677E+01	0.14321E+01	0.14364E+01	0.16507E+01	0.22644E+01
30	0.18179E+01	0.15390E+01	0.14057E+01	0.14120E+01	0.16297E+01	0.22533E+01
18	0.20392E+01	0.17320E+01	0.15831E+01	0.15910E+01	0.18384E+01	0.25466E+01
38	0.20230E+01	0.17272E+01	0.15848E+01	0.15966E+01	0.18442E+01	0.25471E+01
39	0.21412E+01	0.18294E+01	0.16755E+01	0.16780E+01	0.19135E+01	0.25887E+01
29	0.22544E+01	0.19141E+01	0.17470E+01	0.17455E+01	0.19922E+01	0.27150E+01
28	0.19864E+01	0.16654E+01	0.15120E+01	0.14986E+01	0.16830E+01	0.22283E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me11				
19	0.17812E+01	0.15151E+01	0.26605E+00	14.94
10	0.16347E+01	0.14073E+01	0.22736E+00	13.91
20	0.15677E+01	0.13376E+01	0.23014E+00	14.68
30	0.15390E+01	0.13188E+01	0.22017E+00	14.31
18	0.17320E+01	0.14794E+01	0.25267E+00	14.59
38	0.17272E+01	0.14668E+01	0.26044E+00	15.08
39	0.18294E+01	0.15565E+01	0.27292E+00	14.92
29	0.19141E+01	0.16347E+01	0.27943E+00	14.60
28	0.16654E+01	0.14199E+01	0.24547E+00	14.74

site	Tp	Tm-10	Tm01	Tm02	<Tz>
me11					
19	1.280	1.177	1.090	1.038	1.07
10	1.254	1.184	1.097	1.047	1.11
18	1.241	1.177	1.094	1.043	1.05
38	1.241	1.171	1.090	1.040	1.09
39	1.241	1.170	1.092	1.044	1.09
29	1.241	1.178	1.096	1.047	1.09
28	1.280	1.193	1.101	1.054	1.11

me12, measurements P112, P122, P132.

site	m-1	m0	m1	m2	m3	m4
me12						
19	0.78663E+01	0.64748E+01	0.59539E+01	0.61313E+01	0.74294E+01	0.11016E+02
10	0.76924E+01	0.63035E+01	0.57145E+01	0.57288E+01	0.66596E+01	0.94048E+01
20	0.73813E+01	0.61297E+01	0.55918E+01	0.56396E+01	0.65853E+01	0.93009E+01
30	0.74290E+01	0.60927E+01	0.55374E+01	0.55603E+01	0.64546E+01	0.90582E+01
18	0.76498E+01	0.63486E+01	0.58547E+01	0.60259E+01	0.72708E+01	0.10726E+02
38	0.79759E+01	0.65899E+01	0.59688E+01	0.59570E+01	0.68527E+01	0.95181E+01
39	0.85541E+01	0.70359E+01	0.63060E+01	0.62030E+01	0.70074E+01	0.95451E+01
29	0.88216E+01	0.72094E+01	0.64733E+01	0.63962E+01	0.72721E+01	0.99769E+01
28	0.74391E+01	0.61303E+01	0.55227E+01	0.54685E+01	0.62221E+01	0.85290E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me12				
19	0.64748E+01	0.54986E+01	0.97626E+00	15.08
10	0.63035E+01	0.54305E+01	0.87297E+00	13.85
20	0.61297E+01	0.52322E+01	0.89750E+00	14.64
30	0.60927E+01	0.52321E+01	0.86059E+00	14.12
18	0.63486E+01	0.53735E+01	0.97509E+00	15.36
38	0.65899E+01	0.56774E+01	0.91249E+00	13.85
39	0.70359E+01	0.61176E+01	0.91831E+00	13.05
29	0.72094E+01	0.62343E+01	0.97502E+00	13.52
28	0.61303E+01	0.53215E+01	0.80884E+00	13.19

site	Tp	Tm-10	Tm01	Tm02	<Tz>
me12					
19	1.241	1.215	1.088	1.028	1.09
10	1.241	1.215	1.100	1.046	1.10
18	1.241	1.205	1.084	1.026	1.06
38	1.241	1.210	1.104	1.052	1.12
39	1.280	1.216	1.116	1.065	1.12
29	1.241	1.224	1.114	1.062	1.13
28	1.280	1.213	1.110	1.059	1.12

me13, measurements P113, P123, P133.

site	m-1	m0	m1	m2	m3	m4
me13						
19	0.86847E+01	0.72241E+01	0.66266E+01	0.67358E+01	0.79506E+01	0.11384E+02
10	0.76433E+01	0.63179E+01	0.57077E+01	0.56894E+01	0.65623E+01	0.91952E+01
20	0.77995E+01	0.63991E+01	0.57555E+01	0.56918E+01	0.64904E+01	0.89826E+01
30	0.76751E+01	0.63457E+01	0.57368E+01	0.57093E+01	0.65632E+01	0.91638E+01
18	0.73475E+01	0.61655E+01	0.56725E+01	0.58106E+01	0.69706E+01	0.10228E+02
38	0.76857E+01	0.63411E+01	0.57873E+01	0.58654E+01	0.69131E+01	0.98938E+01
39	0.85512E+01	0.71281E+01	0.64950E+01	0.65625E+01	0.77146E+01	0.11020E+02
29	0.81850E+01	0.68264E+01	0.62469E+01	0.63546E+01	0.75363E+01	0.10862E+02
28	0.75878E+01	0.63399E+01	0.58417E+01	0.60122E+01	0.72498E+01	0.10651E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me13				
19	0.72241E+01	0.61579E+01	0.10662E+01	14.76
10	0.63179E+01	0.54479E+01	0.86998E+00	13.77
20	0.63991E+01	0.55540E+01	0.84514E+00	13.21
30	0.63457E+01	0.55018E+01	0.84390E+00	13.30
18	0.61655E+01	0.52275E+01	0.93802E+00	15.21
38	0.63411E+01	0.54053E+01	0.93587E+00	14.76
39	0.71281E+01	0.61076E+01	0.10205E+01	14.32
29	0.68264E+01	0.58367E+01	0.98978E+00	14.50
28	0.63399E+01	0.53633E+01	0.97664E+00	15.40

site	Tp	Tm-10	Tm01	Tm02	⟨Tz⟩
me13					
19	1.241	1.202	1.090	1.036	1.08
10	1.241	1.213	1.108	1.056	1.10
18	1.205	1.192	1.087	1.030	1.07
38	1.280	1.212	1.096	1.040	1.08
39	1.241	1.200	1.097	1.042	1.09
29	1.241	1.199	1.093	1.036	1.07
28	1.170	1.197	1.085	1.027	1.08

me14, measurements P144, P134; measurements second series are lost.

site	m-1	m0	m1	m2	m3	m4
me14						
19	0.87779E+01	0.78546E+01	0.79117E+01	0.90586E+01	0.12146E+02	0.19401E+02
10	0.68856E+01	0.60062E+01	0.59037E+01	0.65443E+01	0.84043E+01	0.12776E+02
30	0.68833E+01	0.60402E+01	0.59483E+01	0.66270E+01	0.85987E+01	0.13276E+02
18	0.70845E+01	0.63877E+01	0.64838E+01	0.74526E+01	0.99810E+01	0.15865E+02
38	0.69391E+01	0.60100E+01	0.58532E+01	0.64463E+01	0.82747E+01	0.12658E+02
39	0.73507E+01	0.64445E+01	0.62660E+01	0.68833E+01	0.88428E+01	0.13610E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me14				
19	0.78546E+01	0.57003E+01	0.21543E+01	27.43
10	0.60062E+01	0.44470E+01	0.15591E+01	25.96
30	0.60402E+01	0.44846E+01	0.15555E+01	25.75
18	0.63877E+01	0.45236E+01	0.18641E+01	29.18
38	0.60100E+01	0.46091E+01	0.14008E+01	23.31
39	0.64445E+01	0.49370E+01	0.15075E+01	23.39

site	Tp	Tm-10	Tm01	Tm02	⟨Tz⟩
me14					
19	1.241	1.118	0.993	0.931	0.97
10	1.223	1.143	1.016	0.956	1.01
30	1.107	1.109	0.985	0.926	0.98
38	1.280	1.155	1.027	0.966	1.01
39	1.241	1.141	1.028	0.968	1.00

me15, measurements P145, P125, P135.

site	m-1	m0	m1	m2	m3	m4
me15						
19	0.98100E+01	0.83499E+01	0.78908E+01	0.83666E+01	0.10387E+02	0.15590E+02
10	0.74480E+01	0.62878E+01	0.58672E+01	0.60975E+01	0.73528E+01	0.10677E+02
20	0.74315E+01	0.62552E+01	0.58226E+01	0.60353E+01	0.72546E+01	0.10499E+02
30	0.72406E+01	0.61332E+01	0.57240E+01	0.59449E+01	0.71563E+01	0.10362E+02
18	0.76443E+01	0.65709E+01	0.62751E+01	0.67268E+01	0.84321E+01	0.12757E+02
38	0.73154E+01	0.61814E+01	0.58169E+01	0.61527E+01	0.76224E+01	0.11423E+02
39	0.80491E+01	0.68447E+01	0.64012E+01	0.67083E+01	0.82336E+01	0.12251E+02
29	0.75493E+01	0.64306E+01	0.60421E+01	0.63868E+01	0.79242E+01	0.11900E+02
28	0.74523E+01	0.63020E+01	0.59155E+01	0.62412E+01	0.77200E+01	0.11564E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me15				
19	0.83499E+01	0.68071E+01	0.15427E+01	18.48
10	0.62878E+01	0.51668E+01	0.11210E+01	17.83
20	0.62552E+01	0.51493E+01	0.11059E+01	17.68
30	0.61332E+01	0.50493E+01	0.10839E+01	17.67
18	0.65709E+01	0.52267E+01	0.13442E+01	20.46
38	0.61814E+01	0.50233E+01	0.11581E+01	18.74
39	0.68447E+01	0.56398E+01	0.12049E+01	17.60
29	0.64306E+01	0.52557E+01	0.11749E+01	18.27
28	0.63020E+01	0.51819E+01	0.11201E+01	17.77

site	Tp	Tm-10	Tm01	Tm02	<Tz>
me15					
19	1.241	1.175	1.058	0.999	1.02
10	1.267	1.184	1.072	1.016	1.05
18	1.205	1.163	1.047	0.988	1.03
38	1.280	1.183	1.063	1.002	1.05
39	1.241	1.176	1.069	1.010	1.06
29	1.241	1.174	1.064	1.003	1.05
28	1.170	1.183	1.065	1.005	1.04

me16, measurements P146, P126, P136.

site	m-1	m0	m1	m2	m3	m4
me16						
19	0.10494E+02	0.86556E+01	0.79055E+01	0.80011E+01	0.94295E+01	0.13551E+02
10	0.78823E+01	0.64544E+01	0.58645E+01	0.58922E+01	0.68407E+01	0.95773E+01
20	0.77568E+01	0.64425E+01	0.58964E+01	0.59943E+01	0.70880E+01	0.10162E+02
30	0.77809E+01	0.64176E+01	0.58291E+01	0.58563E+01	0.68126E+01	0.95909E+01
18	0.83730E+01	0.70043E+01	0.64979E+01	0.67613E+01	0.82871E+01	0.12405E+02
38	0.87343E+01	0.72798E+01	0.66125E+01	0.66265E+01	0.76689E+01	0.10711E+02
39	0.10479E+02	0.86764E+01	0.78027E+01	0.77430E+01	0.89185E+01	0.12519E+02
29	0.85857E+01	0.71205E+01	0.64827E+01	0.65765E+01	0.77918E+01	0.11212E+02
28	0.51835E+01	0.43751E+01	0.41494E+01	0.44532E+01	0.56474E+01	0.86977E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me16				
19	0.86556E+01	0.74477E+01	0.12079E+01	13.96
10	0.64544E+01	0.55297E+01	0.92476E+00	14.33
20	0.64425E+01	0.54655E+01	0.97700E+00	15.16
30	0.64176E+01	0.54998E+01	0.91783E+00	14.30
18	0.70043E+01	0.59146E+01	0.10897E+01	15.56
38	0.72798E+01	0.62383E+01	0.10415E+01	14.31
39	0.86764E+01	0.75566E+01	0.11198E+01	12.91
29	0.71205E+01	0.60575E+01	0.10630E+01	14.93
28	0.43751E+01	0.35295E+01	0.84560E+00	19.33

site	Tp	Tm-10	Tm01	Tm02	<Tz>
me16					
19	1.241	1.212	1.095	1.040	1.09
10	1.241	1.213	1.098	1.043	1.11
18	1.280	1.195	1.078	1.018	1.07
38	1.241	1.200	1.101	1.048	1.10
39	1.241	1.208	1.112	1.059	1.11
29	1.321	1.206	1.098	1.041	1.08
28	1.205	1.185	1.054	0.991	1.03

me17, measurements P147, P127, P137.

site	m-1	m0	m1	m2	m3	m4
me17						
19	0.97883E+01	0.84018E+01	0.80778E+01	0.88227E+01	0.11411E+02	0.17923E+02
10	0.74003E+01	0.63557E+01	0.60533E+01	0.64615E+01	0.80265E+01	0.11944E+02
20	0.74494E+01	0.63757E+01	0.60626E+01	0.64603E+01	0.80102E+01	0.11902E+02
30	0.73872E+01	0.63768E+01	0.60988E+01	0.65445E+01	0.81868E+01	0.12296E+02
18	0.88423E+01	0.75725E+01	0.71550E+01	0.76014E+01	0.94787E+01	0.14305E+02
38	0.83250E+01	0.70508E+01	0.66351E+01	0.70252E+01	0.87045E+01	0.12981E+02
39	0.91962E+01	0.77536E+01	0.72230E+01	0.75784E+01	0.93351E+01	0.13902E+02
29	0.88094E+01	0.75168E+01	0.70727E+01	0.74746E+01	0.92536E+01	0.13841E+02
28	0.77027E+01	0.66756E+01	0.63440E+01	0.67535E+01	0.84032E+01	0.12611E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me17				
19	0.84018E+01	0.67123E+01	0.16896E+01	20.11
10	0.63557E+01	0.50614E+01	0.12943E+01	20.36
20	0.63757E+01	0.50890E+01	0.12867E+01	20.18
30	0.63768E+01	0.50678E+01	0.13090E+01	20.53
18	0.75725E+01	0.61652E+01	0.14073E+01	18.58
38	0.70508E+01	0.56930E+01	0.13578E+01	19.26
39	0.77536E+01	0.63582E+01	0.13953E+01	18.00
29	0.75168E+01	0.61130E+01	0.14039E+01	18.68
28	0.66756E+01	0.54021E+01	0.12735E+01	19.08

site	Tp	Tm-10	Tm01	Tm02	<Tz>
me17					
19	1.205	1.165	1.040	0.976	1.01
10	1.241	1.164	1.049	0.991	1.05
18	1.241	1.168	1.058	0.998	1.04
38	1.321	1.181	1.063	1.002	1.05
39	1.280	1.186	1.073	1.011	1.05
29	1.241	1.172	1.063	1.003	1.05
28	1.241	1.154	1.052	0.994	1.04

me21, measurements P211, P221, P231.

site me21	m-1	m0	m1	m2	m3	m4
19	0.22745E+01	0.18961E+01	0.17341E+01	0.17558E+01	0.20587E+01	0.29116E+01
10	0.19883E+01	0.16419E+01	0.15009E+01	0.15174E+01	0.17668E+01	0.24610E+01
20	0.20268E+01	0.16695E+01	0.15254E+01	0.15459E+01	0.18135E+01	0.25591E+01
30	0.19821E+01	0.16426E+01	0.15006E+01	0.15178E+01	0.17725E+01	0.24830E+01
18	0.20543E+01	0.16984E+01	0.15521E+01	0.15788E+01	0.18714E+01	0.26924E+01
38	0.13247E+01	0.11122E+01	0.12078E+01	0.15660E+01	0.23743E+01	0.41177E+01
39	0.13489E+01	0.12217E+01	0.13444E+01	0.17301E+01	0.25826E+01	0.44050E+01
29	0.11498E+01	0.10217E+01	0.11263E+01	0.14596E+01	0.21994E+01	0.37870E+01
28	0.12160E+01	0.10961E+01	0.11959E+01	0.15269E+01	0.22653E+01	0.38458E+01

site me21	m0	m0d1	m0d2	m0d2/m0 %
19	0.18961E+01	0.16072E+01	0.28895E+00	15.24
10	0.16419E+01	0.13949E+01	0.24700E+00	15.04
20	0.16695E+01	0.14211E+01	0.24843E+00	14.88
30	0.16426E+01	0.13959E+01	0.24668E+00	15.02
18	0.16984E+01	0.14440E+01	0.25440E+00	14.98
38	0.11122E+01	0.68468E+00	0.42750E+00	38.44
39	0.12217E+01	0.73980E+00	0.48190E+00	39.45
29	0.10217E+01	0.62441E+00	0.39731E+00	38.89
28	0.10961E+01	0.67945E+00	0.41663E+00	38.01

site me21	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
19	1.280	1.249	1.200	1.093	1.039	1.08
10	1.241	1.250	1.211	1.094	1.040	1.10
18	1.280	1.255	1.210	1.094	1.037	1.07
38	1.205	1.201	1.191	0.921	0.843	0.94
39	1.280	1.279	1.104	0.909	0.840	0.90
29	1.170	1.257	1.125	0.907	0.837	0.90
28	1.205	1.235	1.109	0.917	0.847	0.90

me22, measurements P212, P222, P232.

site me22	m-1	m0	m1	m2	m3	m4
19	0.79811E+01	0.65285E+01	0.59992E+01	0.61800E+01	0.74914E+01	0.11124E+02
10	0.74725E+01	0.61269E+01	0.55945E+01	0.56787E+01	0.67054E+01	0.96125E+01
20	0.75448E+01	0.61477E+01	0.55854E+01	0.56314E+01	0.66006E+01	0.94113E+01
30	0.75381E+01	0.61948E+01	0.56476E+01	0.57095E+01	0.66973E+01	0.95219E+01
18	0.74786E+01	0.61779E+01	0.56829E+01	0.58317E+01	0.69999E+01	0.10246E+02
38	0.16518E+01	0.13385E+01	0.15872E+01	0.22901E+01	0.38077E+01	0.70757E+01
39	0.13379E+01	0.11608E+01	0.13790E+01	0.19613E+01	0.32167E+01	0.59305E+01
29	0.14661E+01	0.12829E+01	0.15285E+01	0.21650E+01	0.35173E+01	0.64117E+01
28	0.14495E+01	0.12243E+01	0.14176E+01	0.19616E+01	0.31409E+01	0.56938E+01

site me22	m0	m0d1	m0d2	m0d2/m0 %
19	0.65285E+01	0.55373E+01	0.99121E+00	15.18
10	0.61269E+01	0.52264E+01	0.90049E+00	14.70
20	0.61477E+01	0.52674E+01	0.88029E+00	14.32
30	0.61948E+01	0.52961E+01	0.89868E+00	14.51
18	0.61779E+01	0.52387E+01	0.93917E+00	15.20
38	0.13385E+01	0.65482E+00	0.68371E+00	51.08
39	0.11608E+01	0.58152E+00	0.57928E+00	49.90
29	0.12829E+01	0.62266E+00	0.66021E+00	51.46
28	0.12243E+01	0.63582E+00	0.58851E+00	48.07

site me22	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
19	1.241	1.238	1.222	1.088	1.028	1.09
10	1.241	1.246	1.221	1.098	1.042	1.09
18	1.280	1.245	1.211	1.087	1.029	1.06
38	1.280	1.217	1.234	0.843	0.765	0.90
39	1.280	1.277	1.153	0.842	0.769	0.93
29	1.205	1.282	1.143	0.839	0.770	0.91
28	1.280	1.258	1.184	0.864	0.790	0.94

me23, measurements P213, P223, P233.

site me23	m-1	m0	m1	m2	m3	m4
19	0.90656E+01	0.75279E+01	0.68970E+01	0.70078E+01	0.82941E+01	0.11957E+02
10	0.78753E+01	0.65435E+01	0.59385E+01	0.59350E+01	0.68311E+01	0.94841E+01
20	0.81076E+01	0.67341E+01	0.60969E+01	0.60686E+01	0.69489E+01	0.96014E+01
30	0.80272E+01	0.66522E+01	0.60225E+01	0.59911E+01	0.68478E+01	0.94343E+01
18	0.73584E+01	0.61986E+01	0.57186E+01	0.58602E+01	0.70029E+01	0.10188E+02
38	0.15599E+01	0.13349E+01	0.15758E+01	0.22361E+01	0.36735E+01	0.68054E+01
39	0.14117E+01	0.12977E+01	0.15374E+01	0.21542E+01	0.34856E+01	0.63726E+01
29	0.13440E+01	0.12529E+01	0.15061E+01	0.21343E+01	0.34771E+01	0.63749E+01
28	0.14441E+01	0.13473E+01	0.15950E+01	0.22231E+01	0.35694E+01	0.64703E+01

site me23	m0	m0d1	m0d2	m0d2/m0 %
19	0.75279E+01	0.64767E+01	0.10513E+01	13.96
10	0.65435E+01	0.56211E+01	0.92248E+00	14.10
20	0.67341E+01	0.57993E+01	0.93483E+00	13.88
30	0.66522E+01	0.57476E+01	0.90455E+00	13.60
18	0.61986E+01	0.52555E+01	0.94312E+00	15.21
38	0.13349E+01	0.68764E+00	0.64725E+00	48.49
39	0.12977E+01	0.67584E+00	0.62190E+00	47.92
29	0.12529E+01	0.63087E+00	0.62204E+00	49.65
28	0.13473E+01	0.67978E+00	0.66750E+00	49.54

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me23						
19	1.241	1.246	1.204	1.091	1.036	1.07
10	1.241	1.244	1.205	1.104	1.052	1.09
18	1.241	1.244	1.187	1.084	1.028	1.07
38	1.205	1.248	1.169	0.847	0.773	0.89
39	1.241	1.252	1.088	0.844	0.776	0.89
29	1.241	1.231	1.073	0.832	0.766	0.90
28	1.280	1.280	1.072	0.845	0.778	0.90

me24, measurements P214, P224, P234.

site	m-1	m0	m1	m2	m3	m4
me24						
19	0.78580E+01	0.69794E+01	0.70469E+01	0.81294E+01	0.11015E+02	0.17769E+02
10	0.72266E+01	0.63239E+01	0.62297E+01	0.69194E+01	0.88968E+01	0.13527E+02
20	0.73972E+01	0.64313E+01	0.63118E+01	0.69836E+01	0.89364E+01	0.13510E+02
30	0.73009E+01	0.63437E+01	0.62232E+01	0.68843E+01	0.88089E+01	0.13312E+02
18	0.67681E+01	0.60843E+01	0.61757E+01	0.71281E+01	0.96186E+01	0.15427E+02
38	0.15918E+01	0.13576E+01	0.15990E+01	0.22738E+01	0.37313E+01	0.68803E+01
39	0.14119E+01	0.13116E+01	0.15692E+01	0.22183E+01	0.35994E+01	0.65699E+01
29	0.12925E+01	0.12019E+01	0.14577E+01	0.20893E+01	0.34247E+01	0.62845E+01
28	0.14910E+01	0.13728E+01	0.16184E+01	0.22535E+01	0.36073E+01	0.65202E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me24				
19	0.69794E+01	0.50343E+01	0.19451E+01	27.87
10	0.63239E+01	0.46620E+01	0.16620E+01	26.28
20	0.64313E+01	0.47397E+01	0.16916E+01	26.30
30	0.63437E+01	0.47377E+01	0.16060E+01	25.32
18	0.60843E+01	0.43435E+01	0.17408E+01	28.61
38	0.13576E+01	0.65643E+00	0.70119E+00	51.65
39	0.13116E+01	0.61188E+00	0.69976E+00	53.35
29	0.12019E+01	0.54950E+00	0.65245E+00	54.28
28	0.13728E+01	0.64064E+00	0.73220E+00	53.33

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me24						
19	1.241	1.177	1.126	0.990	0.927	0.98
10	1.170	1.197	1.148	1.018	0.959	1.01
18	1.205	1.215	1.112	0.985	0.924	0.96
38	1.280	1.237	1.172	0.849	0.773	0.87
39	1.412	1.352	1.076	0.836	0.769	0.87
29	1.365	1.335	1.075	0.825	0.758	0.87
28	1.365	1.367	1.086	0.848	0.781	0.86

me25, measurement P215, P225, P235.

site	m-1	m0	m1	m2	m3	m4
me25						
19	0.86278E+01	0.74127E+01	0.70863E+01	0.76371E+01	0.96722E+01	0.14812E+02
10	0.78102E+01	0.66023E+01	0.62017E+01	0.65009E+01	0.78998E+01	0.11511E+02
20	0.76552E+01	0.64434E+01	0.59950E+01	0.62044E+01	0.74290E+01	0.10674E+02
30	0.76258E+01	0.64810E+01	0.60877E+01	0.63803E+01	0.77589E+01	0.11333E+02
18	0.72283E+01	0.62336E+01	0.59871E+01	0.64715E+01	0.81941E+01	0.12520E+02
38	0.15623E+01	0.13443E+01	0.15964E+01	0.22807E+01	0.37542E+01	0.69302E+01
39	0.13983E+01	0.13003E+01	0.15605E+01	0.22096E+01	0.35987E+01	0.66077E+01
29	0.13076E+01	0.12403E+01	0.15057E+01	0.21475E+01	0.35017E+01	0.63977E+01
28	0.14176E+01	0.13361E+01	0.15853E+01	0.22088E+01	0.35319E+01	0.63651E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me25				
19	0.74127E+01	0.59380E+01	0.14748E+01	19.89
10	0.66023E+01	0.53494E+01	0.12529E+01	18.98
20	0.64434E+01	0.52974E+01	0.11460E+01	17.79
30	0.64810E+01	0.52721E+01	0.12089E+01	18.65
18	0.62336E+01	0.49388E+01	0.12949E+01	20.77
38	0.13443E+01	0.66873E+00	0.67561E+00	50.26
39	0.13003E+01	0.63029E+00	0.67002E+00	51.53
29	0.12403E+01	0.59387E+00	0.64642E+00	52.12
28	0.13361E+01	0.65445E+00	0.68161E+00	51.02

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me25						
19	1.241	1.234	1.164	1.046	0.985	1.02
10	1.241	1.230	1.183	1.068	1.012	1.05
18	1.205	1.256	1.160	1.041	0.981	1.03
38	1.321	1.243	1.162	0.842	0.768	0.88
39	1.241	1.240	1.075	0.833	0.767	0.88
29	1.241	1.305	1.054	0.824	0.760	0.86
28	1.280	1.257	1.061	0.843	0.778	0.89

me26, measurements P216, P226, P236.

site	m-1	m0	m1	m2	m3	m4
me26						
19	0.91555E+01	0.75106E+01	0.68972E+01	0.70708E+01	0.85062E+01	0.12543E+02
10	0.79253E+01	0.65530E+01	0.61134E+01	0.64153E+01	0.78957E+01	0.11748E+02
20	0.80094E+01	0.66606E+01	0.61935E+01	0.64649E+01	0.79064E+01	0.11682E+02
30	0.79546E+01	0.65901E+01	0.61435E+01	0.64462E+01	0.79585E+01	0.11932E+02
18	0.76816E+01	0.64662E+01	0.61172E+01	0.65360E+01	0.82229E+01	0.12513E+02
38	0.18880E+01	0.16183E+01	0.19552E+01	0.28326E+01	0.47051E+01	0.87236E+01
39	0.17508E+01	0.16587E+01	0.20711E+01	0.30373E+01	0.50564E+01	0.93598E+01
29	0.16503E+01	0.15269E+01	0.18560E+01	0.26510E+01	0.43145E+01	0.78427E+01
28	0.13650E+01	0.11375E+01	0.12973E+01	0.17499E+01	0.27148E+01	0.47593E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me26				
19	0.75106E+01	0.64073E+01	0.11033E+01	14.69
10	0.65530E+01	0.54398E+01	0.11132E+01	16.99
20	0.66606E+01	0.55890E+01	0.10717E+01	16.09
30	0.65901E+01	0.54976E+01	0.10924E+01	16.58
18	0.64662E+01	0.52664E+01	0.11997E+01	18.55
38	0.16183E+01	0.78358E+00	0.83475E+00	51.58
39	0.16587E+01	0.72459E+00	0.93407E+00	56.31
29	0.15269E+01	0.69778E+00	0.82914E+00	54.30
28	0.11375E+01	0.60130E+00	0.53622E+00	47.14

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me26						
19	1.241	1.248	1.219	1.089	1.031	1.09
10	1.254	1.257	1.206	1.073	1.012	1.05
18	1.280	1.242	1.188	1.057	0.995	1.04
38	1.205	1.244	1.167	0.828	0.756	0.83
39	1.205	1.229	1.056	0.801	0.739	0.80
29	1.241	1.227	1.081	0.823	0.759	0.84
28	1.280	1.272	1.200	0.877	0.806	0.91

me27, measurements P217, P227, P237.

site	m-1	m0	m1	m2	m3	m4
me27						
19	0.90522E+01	0.76013E+01	0.73332E+01	0.81163E+01	0.10736E+02	0.17345E+02
10	0.83438E+01	0.70551E+01	0.68704E+01	0.76941E+01	0.10319E+02	0.16908E+02
20	0.79226E+01	0.67645E+01	0.64388E+01	0.68752E+01	0.85243E+01	0.12602E+02
30	0.80569E+01	0.68128E+01	0.64931E+01	0.69688E+01	0.87208E+01	0.13066E+02
18	0.85428E+01	0.72750E+01	0.70698E+01	0.78504E+01	0.10361E+02	0.16606E+02
38	0.17907E+01	0.15665E+01	0.18856E+01	0.27299E+01	0.45551E+01	0.85185E+01
39	0.15861E+01	0.15180E+01	0.18772E+01	0.27306E+01	0.45361E+01	0.84250E+01
29	0.15875E+01	0.14990E+01	0.18253E+01	0.26145E+01	0.42821E+01	0.78512E+01
28	0.13034E+01	0.11942E+01	0.14251E+01	0.19922E+01	0.31734E+01	0.56635E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me27				
19	0.76013E+01	0.60376E+01	0.15637E+01	20.57
10	0.70551E+01	0.54758E+01	0.15794E+01	22.39
20	0.67645E+01	0.53821E+01	0.13825E+01	20.44
30	0.68128E+01	0.54048E+01	0.14080E+01	20.67
18	0.72750E+01	0.56849E+01	0.15901E+01	21.86
38	0.15665E+01	0.76715E+00	0.79933E+00	51.03
39	0.15180E+01	0.69031E+00	0.82771E+00	54.53
29	0.14990E+01	0.70867E+00	0.79032E+00	52.72
28	0.11942E+01	0.56932E+00	0.62484E+00	52.32

site me27	Tp	Td	Tm-10	Tm01	Tm02	$\langle T_z \rangle$
19	1.280	1.265	1.191	1.037	0.968	1.01
10	1.280	1.244	1.179	1.042	0.979	1.04
18	1.241	1.266	1.174	1.029	0.963	1.00
38	1.205	1.220	1.143	0.831	0.758	0.83
39	1.321	1.269	1.045	0.809	0.746	0.83
29	1.170	1.239	1.059	0.821	0.757	0.85
28	1.138	1.198	1.091	0.838	0.774	0.88

me28, measurements P218, P228, P238.

site me28	m-1	m0	m1	m2	m3	m4
19	0.80672E+01	0.58827E+01	0.56068E+01	0.60934E+01	0.77756E+01	0.11945E+02
10	0.84811E+01	0.59791E+01	0.55116E+01	0.57414E+01	0.69796E+01	0.10252E+02
20	0.91582E+01	0.60192E+01	0.55062E+01	0.56867E+01	0.68180E+01	0.98382E+01
30	0.87365E+01	0.59805E+01	0.55045E+01	0.57211E+01	0.69117E+01	0.10048E+02
18	0.81906E+01	0.59186E+01	0.56053E+01	0.60689E+01	0.77594E+01	0.12025E+02
38	0.26502E+01	0.13817E+01	0.15110E+01	0.20882E+01	0.33465E+01	0.60307E+01
39	0.27713E+01	0.14475E+01	0.15722E+01	0.21229E+01	0.33010E+01	0.57613E+01
29	0.25290E+01	0.11105E+01	0.12099E+01	0.16749E+01	0.26730E+01	0.47824E+01
28	0.31766E+01	0.17328E+01	0.18963E+01	0.25166E+01	0.38057E+01	0.64504E+01

site me28	m0	m0d1	m0d2	m0d2/m0 %
19	0.58827E+01	0.46221E+01	0.12606E+01	21.43
10	0.59791E+01	0.49305E+01	0.10486E+01	17.54
20	0.60192E+01	0.49824E+01	0.10367E+01	17.22
30	0.59805E+01	0.49241E+01	0.10564E+01	17.66
18	0.59186E+01	0.47510E+01	0.11676E+01	19.73
38	0.13817E+01	0.73247E+00	0.64927E+00	46.99
39	0.14475E+01	0.77604E+00	0.67148E+00	46.39
29	0.11105E+01	0.56997E+00	0.54048E+00	48.67
28	0.17328E+01	0.87827E+00	0.85457E+00	49.32

site me28	Tp	Td	Tm-10	Tm01	Tm02	$\langle T_z \rangle$
19	1.241	1.262	1.371	1.049	0.983	1.03
10	1.254	1.234	1.466	1.088	1.024	1.06
18	1.241	1.253	1.384	1.056	0.988	1.01
38	1.463	1.005	1.918	0.914	0.813	0.95
39	1.463	1.338	1.915	0.921	0.826	0.97
29	0.788	1.460	2.277	0.918	0.814	0.97
28	0.836	0.943	1.833	0.914	0.830	0.95

me31, measurements P311, P321, P331.

site	m-1	m0	m1	m2	m3	m4
me31						
19	0.21335E+01	0.17512E+01	0.15813E+01	0.15713E+01	0.17859E+01	0.24188E+01
10	0.19587E+01	0.16096E+01	0.14507E+01	0.14311E+01	0.16008E+01	0.21115E+01
20	0.19492E+01	0.15974E+01	0.14380E+01	0.14213E+01	0.16023E+01	0.21474E+01
30	0.19578E+01	0.16100E+01	0.14560E+01	0.14500E+01	0.16526E+01	0.22450E+01
18	0.19437E+01	0.16067E+01	0.14570E+01	0.14549E+01	0.16681E+01	0.22928E+01
38	0.20734E+01	0.17098E+01	0.16158E+01	0.17398E+01	0.22022E+01	0.33365E+01
39	0.13259E+01	0.11880E+01	0.12370E+01	0.14876E+01	0.21022E+01	0.34863E+01
29	0.20380E+01	0.18563E+01	0.19721E+01	0.24446E+01	0.35625E+01	0.60303E+01
28	0.12289E+01	0.11473E+01	0.13103E+01	0.17786E+01	0.28316E+01	0.51576E+01

site	m0	m0d1	m0d2	m0d2/m0 %
me31				
19	0.17512E+01	0.14954E+01	0.25587E+00	14.61
10	0.16096E+01	0.13868E+01	0.22280E+00	13.84
20	0.15974E+01	0.13715E+01	0.22593E+00	14.14
30	0.16100E+01	0.13771E+01	0.23293E+00	14.47
18	0.16067E+01	0.13716E+01	0.23511E+00	14.63
38	0.17098E+01	0.13769E+01	0.33287E+00	19.47
39	0.11880E+01	0.83335E+00	0.35470E+00	29.86
29	0.18563E+01	0.12558E+01	0.60047E+00	32.35
28	0.11473E+01	0.67902E+00	0.46828E+00	40.82

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me31						
19	1.205	1.235	1.218	1.107	1.056	1.08
10	1.254	1.239	1.218	1.109	1.058	1.11
18	1.241	1.240	1.210	1.103	1.051	1.06
38	1.241	1.255	1.213	1.058	0.991	1.03
39	1.205	1.214	1.116	0.960	0.894	0.94
29	1.280	1.249	1.098	0.941	0.871	0.91
28	1.280	1.261	1.071	0.876	0.803	0.84

me32, measurements P312, P322, P332.

site	m-1	m0	m1	m2	m3	m4
me32						
19	0.86505E+01	0.71769E+01	0.66124E+01	0.67847E+01	0.81126E+01	0.11770E+02
10	0.76589E+01	0.63269E+01	0.57845E+01	0.58591E+01	0.68653E+01	0.96901E+01
20	0.75998E+01	0.62745E+01	0.57536E+01	0.58502E+01	0.68787E+01	0.97246E+01
30	0.77143E+01	0.63451E+01	0.58107E+01	0.59065E+01	0.69586E+01	0.98925E+01
18	0.73138E+01	0.60698E+01	0.56280E+01	0.58671E+01	0.72073E+01	0.10799E+02
38	0.49293E+01	0.40948E+01	0.41521E+01	0.49828E+01	0.71278E+01	0.12004E+02
39	0.52213E+01	0.46384E+01	0.49402E+01	0.61785E+01	0.91047E+01	0.15593E+02
29	0.32781E+01	0.29033E+01	0.31884E+01	0.41917E+01	0.65536E+01	0.11901E+02
28	0.19560E+01	0.19489E+01	0.25721E+01	0.40182E+01	0.71593E+01	0.14155E+02

site me32	m0	m0d1	m0d2	m0d2/m0 %
19	0.71769E+01	0.60559E+01	0.11211E+01	15.62
10	0.63269E+01	0.53637E+01	0.96324E+00	15.22
20	0.62745E+01	0.52770E+01	0.99748E+00	15.90
30	0.63451E+01	0.53679E+01	0.97722E+00	15.40
18	0.60698E+01	0.51026E+01	0.96727E+00	15.94
38	0.40948E+01	0.29307E+01	0.11641E+01	28.43
39	0.46384E+01	0.30732E+01	0.15651E+01	33.74
29	0.29033E+01	0.18220E+01	0.10813E+01	37.24
28	0.19489E+01	0.80789E+00	0.11410E+01	58.55

site me32	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
19	1.205	1.250	1.205	1.085	1.028	1.08
10	1.241	1.240	1.213	1.092	1.037	1.09
18	1.241	1.241	1.205	1.079	1.017	1.05
38	1.280	1.268	1.204	0.986	0.907	0.97
39	1.241	1.257	1.126	0.939	0.866	0.90
29	1.280	1.271	1.129	0.911	0.832	0.85
28	1.205	1.209	1.004	0.758	0.696	0.71

me33, measurements P313, P323, P333.

site me33	m-1	m0	m1	m2	m3	m4
19	0.93945E+01	0.79305E+01	0.73983E+01	0.77174E+01	0.94271E+01	0.13988E+02
10	0.81065E+01	0.67747E+01	0.62219E+01	0.63385E+01	0.74900E+01	0.10683E+02
20	0.81998E+01	0.68151E+01	0.62444E+01	0.63375E+01	0.74403E+01	0.10519E+02
30	0.81762E+01	0.68383E+01	0.62683E+01	0.63555E+01	0.74514E+01	0.10531E+02
18	0.75554E+01	0.63093E+01	0.58415E+01	0.60530E+01	0.73783E+01	0.11014E+02
38	0.47752E+01	0.40933E+01	0.42313E+01	0.51620E+01	0.74913E+01	0.12765E+02
39	0.45331E+01	0.40846E+01	0.43663E+01	0.54615E+01	0.80525E+01	0.13839E+02
29	0.31920E+01	0.29213E+01	0.32509E+01	0.43070E+01	0.67579E+01	0.12274E+02
28	0.23067E+01	0.23978E+01	0.31552E+01	0.48358E+01	0.83775E+01	0.16044E+02

site me33	m0	m0d1	m0d2	m0d2/m0 %
19	0.79305E+01	0.66385E+01	0.12921E+01	16.29
10	0.67747E+01	0.57480E+01	0.10267E+01	15.16
20	0.68151E+01	0.57855E+01	0.10296E+01	15.11
30	0.68383E+01	0.58283E+01	0.10100E+01	14.77
18	0.63093E+01	0.53077E+01	0.10016E+01	15.87
38	0.40933E+01	0.28632E+01	0.12300E+01	30.05
39	0.40846E+01	0.26908E+01	0.13938E+01	34.12
29	0.29213E+01	0.18063E+01	0.11151E+01	38.17
28	0.23978E+01	0.96360E+00	0.14342E+01	59.81

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me33						
19	1.241	1.244	1.185	1.072	1.014	1.06
10	1.241	1.239	1.198	1.090	1.036	1.08
18	1.241	1.240	1.198	1.080	1.021	1.05
38	1.241	1.263	1.167	0.967	0.890	0.92
39	1.241	1.244	1.110	0.935	0.865	0.88
29	1.280	1.244	1.093	0.899	0.824	0.84
28	1.170	1.173	0.962	0.760	0.704	0.71

me34, measurements P314, P324, P334.

site	m-1	m0	m1	m2	m3	m4
me34						
19	0.79352E+01	0.71678E+01	0.73285E+01	0.85322E+01	0.11586E+02	0.18574E+02
10	0.72469E+01	0.63483E+01	0.62894E+01	0.70503E+01	0.91882E+01	0.14204E+02
20	0.71912E+01	0.62927E+01	0.62198E+01	0.69505E+01	0.90174E+01	0.13858E+02
30	0.72254E+01	0.63311E+01	0.62637E+01	0.70181E+01	0.91533E+01	0.14162E+02
18	0.68474E+01	0.61026E+01	0.62424E+01	0.73299E+01	0.10128E+02	0.16638E+02
38	0.43886E+01	0.37326E+01	0.38560E+01	0.47236E+01	0.68566E+01	0.11630E+02
39	0.39020E+01	0.36180E+01	0.40416E+01	0.52986E+01	0.81136E+01	0.14313E+02
29	0.32647E+01	0.30979E+01	0.36186E+01	0.50117E+01	0.80770E+01	0.14795E+02
28	0.23999E+01	0.24496E+01	0.31957E+01	0.49128E+01	0.85738E+01	0.16552E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me34				
19	0.71678E+01	0.51060E+01	0.20617E+01	28.76
10	0.63483E+01	0.47285E+01	0.16198E+01	25.52
20	0.62927E+01	0.46546E+01	0.16381E+01	26.03
30	0.63311E+01	0.47022E+01	0.16289E+01	25.73
18	0.61026E+01	0.42891E+01	0.18134E+01	29.72
38	0.37326E+01	0.25017E+01	0.12309E+01	32.98
39	0.36180E+01	0.20759E+01	0.15422E+01	42.62
29	0.30979E+01	0.16561E+01	0.14418E+01	46.54
28	0.24496E+01	0.96859E+00	0.14810E+01	60.46

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me34						
19	1.241	1.193	1.107	0.978	0.917	0.95
10	1.159	1.214	1.142	1.011	0.950	1.01
18	1.170	1.116	1.122	0.978	0.912	0.95
38	1.412	1.291	1.176	0.968	0.889	0.91
39	1.280	1.291	1.078	0.895	0.826	0.84
29	1.321	1.347	1.054	0.856	0.786	0.80
28	1.170	1.116	0.980	0.767	0.706	0.71

me35, measurements P315, P325, P335.

site me35	m-1	m0	m1	m2	m3	m4
19	0.88019E+01	0.76668E+01	0.74156E+01	0.80859E+01	0.10336E+02	0.15896E+02
10	0.78256E+01	0.67003E+01	0.64011E+01	0.68650E+01	0.85619E+01	0.12754E+02
20	0.80075E+01	0.68255E+01	0.64766E+01	0.68797E+01	0.84714E+01	0.12434E+02
30	0.79860E+01	0.68289E+01	0.64923E+01	0.69230E+01	0.85883E+01	0.12744E+02
18	0.73321E+01	0.62984E+01	0.60699E+01	0.66419E+01	0.85989E+01	0.13506E+02
38	0.46689E+01	0.39989E+01	0.41246E+01	0.50267E+01	0.72900E+01	0.12424E+02
39	0.42682E+01	0.39098E+01	0.42648E+01	0.54672E+01	0.82454E+01	0.14415E+02
29	0.32208E+01	0.30125E+01	0.34741E+01	0.47717E+01	0.76980E+01	0.14234E+02
28	0.23657E+01	0.24499E+01	0.32512E+01	0.50501E+01	0.88671E+01	0.17175E+02

site me35	m0	m0d1	m0d2	m0d2/m0 %
19	0.76668E+01	0.60695E+01	0.15973E+01	20.83
10	0.67003E+01	0.53258E+01	0.13744E+01	20.51
20	0.68255E+01	0.54836E+01	0.13419E+01	19.66
30	0.68289E+01	0.54701E+01	0.13589E+01	19.90
18	0.62984E+01	0.49624E+01	0.13360E+01	21.21
38	0.39989E+01	0.27910E+01	0.12079E+01	30.21
39	0.39098E+01	0.24580E+01	0.14517E+01	37.13
29	0.30125E+01	0.17143E+01	0.12982E+01	43.09
28	0.24499E+01	0.95687E+00	0.14931E+01	60.94

site me35	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
19	1.241	1.233	1.148	1.034	0.974	1.02
10	1.241	1.244	1.170	1.051	0.992	1.04
18	1.241	1.231	1.164	1.038	0.974	1.01
38	1.205	1.263	1.168	0.970	0.892	0.74
39	1.241	1.246	1.092	0.917	0.846	0.74
29	1.280	1.219	1.069	0.867	0.795	0.81
28	1.170	1.168	0.966	0.754	0.697	0.71

me36, measurements P316, P326, P336.

site me36	m-1	m0	m1	m2	m3	m4
19	0.97350E+01	0.80077E+01	0.72859E+01	0.73524E+01	0.86537E+01	0.12457E+02
10	0.81064E+01	0.66540E+01	0.60635E+01	0.61082E+01	0.71115E+01	0.99991E+01
20	0.84325E+01	0.69140E+01	0.63110E+01	0.63864E+01	0.74945E+01	0.10660E+02
30	0.86230E+01	0.70848E+01	0.64429E+01	0.64692E+01	0.75009E+01	0.10516E+02
18	0.76421E+01	0.63059E+01	0.59226E+01	0.62794E+01	0.78652E+01	0.12013E+02
38	0.48341E+01	0.41987E+01	0.45554E+01	0.59520E+01	0.92696E+01	0.16743E+02
39	0.48410E+01	0.41327E+01	0.42321E+01	0.51273E+01	0.74610E+01	0.12888E+02
29	0.20488E+01	0.18716E+01	0.22288E+01	0.31872E+01	0.53318E+01	0.10153E+02
28	0.20273E+01	0.19748E+01	0.25392E+01	0.37818E+01	0.63441E+01	0.11774E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me36				
19	0.80077E+01	0.69087E+01	0.10990E+01	13.72
10	0.66540E+01	0.56918E+01	0.96221E+00	14.46
20	0.69140E+01	0.58908E+01	0.10231E+01	14.80
30	0.70848E+01	0.60877E+01	0.99717E+00	14.07
18	0.63059E+01	0.51910E+01	0.11148E+01	17.68
38	0.41987E+01	0.26970E+01	0.15017E+01	35.77
39	0.41327E+01	0.29639E+01	0.11688E+01	28.28
29	0.18716E+01	0.97642E+00	0.89519E+00	47.83
28	0.19748E+01	0.79176E+00	0.11831E+01	59.91

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me36						
19	1.241	1.245	1.216	1.099	1.044	1.09
10	1.241	1.253	1.218	1.098	1.044	1.10
18	1.280	1.251	1.212	1.065	1.002	1.04
38	1.280	1.291	1.151	0.922	0.840	0.87
39	1.241	1.243	1.171	0.977	0.898	0.95
29	1.280	1.280	1.095	0.840	0.766	0.78
28	1.321	1.280	1.027	0.778	0.723	0.74

me37, measurements P317, P327, P337.

site	m-1	m0	m1	m2	m3	m4
me37						
19	0.89988E+01	0.76762E+01	0.73048E+01	0.78462E+01	0.99098E+01	0.15161E+02
10	0.81620E+01	0.68985E+01	0.65159E+01	0.69048E+01	0.85334E+01	0.12692E+02
20	0.81556E+01	0.69421E+01	0.65559E+01	0.69492E+01	0.86188E+01	0.12925E+02
30	0.82995E+01	0.70619E+01	0.66852E+01	0.71073E+01	0.88366E+01	0.13262E+02
18	0.83811E+01	0.71216E+01	0.68235E+01	0.74884E+01	0.97966E+01	0.15550E+02
38	0.51662E+01	0.43674E+01	0.44714E+01	0.54330E+01	0.78829E+01	0.13464E+02
39	0.52010E+01	0.45645E+01	0.47049E+01	0.56814E+01	0.81521E+01	0.13781E+02
29	0.32068E+01	0.28494E+01	0.30598E+01	0.39219E+01	0.60086E+01	0.10778E+02
28	0.21969E+01	0.22249E+01	0.28418E+01	0.42412E+01	0.71871E+01	0.13536E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me37				
19	0.76762E+01	0.61891E+01	0.14871E+01	19.37
10	0.68985E+01	0.55987E+01	0.12999E+01	18.84
20	0.69421E+01	0.56575E+01	0.12846E+01	18.50
30	0.70619E+01	0.57411E+01	0.13208E+01	18.70
18	0.71216E+01	0.56461E+01	0.14756E+01	20.72
38	0.43674E+01	0.30781E+01	0.12893E+01	29.52
39	0.45645E+01	0.32174E+01	0.13471E+01	29.51
29	0.28494E+01	0.18997E+01	0.94970E+00	33.33
28	0.22249E+01	0.93159E+00	0.12933E+01	58.13

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me37						
19	1.241	1.277	1.172	1.051	0.989	1.02
10	1.280	1.256	1.178	1.058	0.999	1.07
18	1.241	1.275	1.177	1.044	0.975	1.03
38	1.241	1.276	1.183	0.977	0.897	0.92
39	1.241	1.255	1.139	0.970	0.896	0.92
29	1.280	1.251	1.125	0.931	0.852	0.87
28	1.321	1.247	0.987	0.783	0.724	0.75

me38, measurements P318, P328, P338.

site	m-1	m0	m1	m2	m3	m4
me38						
19	0.89424E+01	0.69768E+01	0.65858E+01	0.70176E+01	0.87415E+01	0.13124E+02
10	0.83143E+01	0.61389E+01	0.56697E+01	0.58684E+01	0.70387E+01	0.10141E+02
20	0.81521E+01	0.61370E+01	0.56742E+01	0.58663E+01	0.70113E+01	0.10033E+02
30	0.81597E+01	0.62141E+01	0.57830E+01	0.60273E+01	0.72799E+01	0.10553E+02
18	0.82742E+01	0.59369E+01	0.55834E+01	0.59757E+01	0.75105E+01	0.11402E+02
38	0.49998E+01	0.36661E+01	0.37683E+01	0.46391E+01	0.67277E+01	0.11323E+02
39	0.46994E+01	0.38206E+01	0.41556E+01	0.53481E+01	0.80446E+01	0.13934E+02
29	0.36079E+01	0.23897E+01	0.24896E+01	0.33187E+01	0.54200E+01	0.10315E+02
28	0.29597E+01	0.18874E+01	0.23895E+01	0.37290E+01	0.66980E+01	0.13399E+02

site	m0	m0d1	m0d2	m0d2/m0 %
me38				
19	0.69768E+01	0.55930E+01	0.13838E+01	19.83
10	0.61389E+01	0.50452E+01	0.10937E+01	17.82
20	0.61370E+01	0.50549E+01	0.10821E+01	17.63
30	0.62141E+01	0.50668E+01	0.11473E+01	18.46
18	0.59369E+01	0.47586E+01	0.11783E+01	19.85
38	0.36661E+01	0.24148E+01	0.12513E+01	34.13
39	0.38206E+01	0.23455E+01	0.14751E+01	38.61
29	0.23897E+01	0.15661E+01	0.82361E+00	34.47
28	0.18874E+01	0.76218E+00	0.11253E+01	59.62

site	Tp	Td	Tm-10	Tm01	Tm02	<Tz>
me38						
19	1.280	1.258	1.282	1.059	0.997	1.06
10	1.280	1.258	1.332	1.080	1.020	1.07
18	1.280	1.243	1.394	1.063	0.997	1.05
38	1.280	1.419	1.364	0.973	0.889	0.95
39	1.241	1.258	1.230	0.919	0.845	0.87
29	1.463	1.291	1.510	0.960	0.849	0.90
28	0.853	1.215	1.568	0.790	0.711	0.75

Appendix T: The averaging in HISWA

In this appendix the averaging over frequency in HISWA is discussed and the effect of evaluating velocities such as the group velocity c_g at the mean frequency instead of taking the average of the velocity over frequency is investigated.

A quantity $X(\omega,\theta)$ is averaged as follows:

$$(T.1)\quad \langle X \rangle = \frac{1}{A_o(\theta)} \int_o^\infty A(\omega,\theta)\, X(\omega,\theta)\, d\omega ,$$

where

$$(T.2)\quad A_o(\omega) = \int_o^\infty A(\omega,\theta)\, d\omega$$

is the mean wave action. The mean wave frequency ω_o is then defined by

$$(T.3)\quad \omega_o(\theta) = \frac{1}{A_o(\theta)} \int_o^\infty \omega A(\omega,\theta)\, d\omega .$$

In this appendix we do not consider ambient current fields and therefore, in the linear approximation (as is consistent with the linear wave propagation part of HISWA), we have

$$(T.4)\quad A = \frac{E}{\omega}$$

where E is the energy density.

In the balance equation the following terms appear:

$$(T.5)\quad c_g = \frac{\partial\omega}{\partial k} \quad \text{and} \quad \vec{c}_\theta = -\frac{1}{k}\frac{\partial\omega}{\partial h}\nabla h .$$

Because the balance equation is averaged over frequency in the method of Eq. (T.1), also such averaging of c_g and $\vec{c}_\theta$ is necessary. However, in HISWA these terms are simply evaluated at the mean frequency ω_o:

(T.6) $c_{g_o} = \frac{\partial \omega_o}{\partial k_o}$, $\vec{c}_{\theta_o} = -\frac{1}{k_o} \frac{\partial \omega_o}{\partial h} \nabla h$,

where ω_o and k_o are related through the dispersion relationship

(T.7) $\omega_o^2 = g k_o \tanh k_o h$.

The purpose of the present appendix is to investigate the error which is made when the averages

$$\text{(T.8)} \quad \begin{cases} \langle \frac{\partial \omega}{\partial k} \rangle = \frac{1}{A_o} \int_o^\infty A(\omega,\theta) \frac{\partial \omega}{\partial k} d\omega \\ \\ \langle \frac{1}{k} \frac{\partial \omega}{\partial h} \rangle = \frac{1}{A_o} \int_o^\infty A(\omega,\theta) \frac{1}{k} \frac{\partial \omega}{\partial h} d\omega \end{cases}$$

are replaced by the evaluation of $\partial\omega/\partial k$ and $k^{-1} \partial\omega/\partial h$ at the mean frequency ω_o for various spectral forms of JONSWAP-type.

With $\omega^2 = gk \tanh kh$ we have

$$\text{(T.9)} \quad \begin{cases} c_g = \frac{\partial \omega}{\partial k} = \frac{g}{2\omega} [\tanh kh + kh\,(1 - \tanh^2 kh)] \\ \\ \frac{h}{k} \frac{\partial \omega}{\partial h} = \frac{g}{2\omega} kh.(1 - \tanh^2 kh) \end{cases}$$

The dimensionless functions (F(kh) and G(kh) are introduced by

$$\text{(T.10)} \quad \begin{cases} F(kh) = \tanh kh + G(kh) \\ \\ G(kh) = kh(1 - \tanh^2 kh) \end{cases} ,$$

sothat

(T.11) $\frac{\partial \omega}{\partial k} = \frac{g}{2\omega} F(kh), \quad \frac{h}{k}\frac{\partial \omega}{\partial h} = \frac{g}{2\omega} G(kh)$

Subsequently we do not consider the θ-depence because that is not necessary for the present purpose. We have

(T.12) $A(\omega) = \frac{E(\omega)}{\omega}$ and $2\pi E(\omega) = E(f)$,

where f in Hz and ω in rad/s. For the variance density E(f) we take spectra of the JONSWAP-type. As in appendix G we write

(T.13) $E(f) = a_o S(\nu)$,

where $S(\nu)$ is the dimensionless spectrum and ν the dimensionless frequency, $\nu = f/f_m$, see Eq. (G.2).

Except the action-averages we also want to consider the method of energy-averages; this means that we average except with A also with ωA. The averages with $\omega^2 A$ are also considered.

For a weighted average $\langle\phi\rangle$ of $\phi(x)$ we have

(T.14) $\langle\phi\rangle = \int_o^\infty p(x)\phi(x)dx$,

where $\int_o^\infty p(x)dx = 1$ for the weight function $p(x)$. In the present situation we consider

(T.15) $p_j(\omega) = \frac{\omega^j A(\omega)}{\int_o^\infty \omega^j A(\omega)d\omega}$, j = 0, 1, 2

The relation with probability densities is obvious and the functions $p_j(\omega)$ can be considered as the probability densities for the j-th moment (in term of wave action). We have

$$\int_o^\infty \omega^j A(\omega)dw = \int_o^\infty \omega^{j-1}E(\omega)d\omega = \frac{1}{2\pi}\int_o^\infty \omega^{j-1}E(f)\,d\omega =$$

$$= (2\pi)^{j-1} \int_0^\infty f^{j-1} E(f)\, df =$$

$$= (2\pi)^{j-1} f_m^j\, a_o \int_0^\infty \nu^{j-1} S(\nu) d\nu =$$

$$= (2\pi)^{j-1} f_m^j\, a_o \cdot M_{j-1} ,$$

where the non-dimensional moments M_{j-1} have been calculated in appendix G for several JONSWAP-type spectra (as function of the peak enhancement factor γ_o).

For $\int_0^\infty p_j(\omega) \frac{\partial\omega}{\partial k} d\omega = \langle\partial\omega/\partial k\rangle_j$ and for $\langle\frac{h}{k}\frac{\partial\omega}{\partial h}\rangle_j$

is then obtained by substitution:

(T.16)
$$\left\{ \begin{aligned} \langle\frac{\partial\omega}{\partial k}\rangle_j &= \frac{gM_{j-1}^{-1}}{4\pi f_m} \int_0^\infty \nu^{j-2} S(\nu) F(kh) d\nu \\ \langle\frac{h}{k}\frac{\partial\omega}{\partial h}\rangle_j &= \frac{gM_{j-1}^{-1}}{4\pi f_m} \int_0^\infty \nu^{j-2} S(\nu) G(kh) d\nu \end{aligned} \right.$$

For the mean frequencies $\langle\omega\rangle_j$ is obtained

(T.17) $$\frac{\langle\omega\rangle_j}{2\pi f_m} = \frac{M_j}{M_{j-1}}$$

The mean quantities (T.16) are now compared with the quantities evaluated at the mean frequencies:

(T.18)
$$\left\{ \begin{aligned} &\frac{\partial}{\partial k_j} \langle\omega\rangle_j \quad \text{and} \quad \frac{h}{k_j}\frac{\partial}{\partial h} \langle\omega\rangle_j \quad , \\ &\text{where } [\langle\omega\rangle_j]^2 = gk_j \tanh k_j h. \end{aligned} \right.$$

For this comparison we took as example the case of a peak frequency f_m of the variance densities E(f) the case of f_m= 0.125 Hz and took a range of depths h so as to have the range of shallow to deep water. Notice that with T = 8 s one has the deep water wave length L_o = 100 m. As examples are taken h = 5, h = 20 and h = 50.

In deep water, kh>>1, one has $\omega^2 = gk$ and $\partial\omega/\partial k = g/2\omega$). The mean group velocity, $\langle\partial\omega/\partial k\rangle_j$ can then be integrated analytically as

$$(T.19)\quad \langle\frac{\partial\omega}{\partial k}\rangle_j = \frac{g}{4\pi f_m} \cdot \frac{M_{j-2}}{M_{j-1}} \ .$$

Furthermore, we have $\langle\frac{h}{k}\frac{\partial\omega}{\partial h}\rangle_j = 0$ in deep water. In deep water the group velocity evaluated at the mean frequency $\langle\omega\rangle_j$ becomes upon using (T.17):

$$(T.20)\quad \frac{\partial}{\partial k}\langle\omega\rangle_j = \frac{g}{4\pi f_m} \cdot \frac{M_{j-1}}{M_j} \ .$$

For γ_o = 1 and 3.3 we have M_{-2} = 0.158530 and M_{-2} = 0.262109 respectively; the moments M_j for j = -1, 0, 1 and 2 have been given in Table G.2. We then have that the difference between expressions (T.19) and (T.20) is given by the difference between M_{j-2}/M_{j-1} and M_{j-1}/M_j. For γ_o the relative deviation between (T.20) and (T.19) is, for j = 0 which represents the HISWA averaging, -7.3% and for γ = 3.3 the relative deviation is -5.1%.

For shallow water, kh<<1, one obtains from (T.9) $c_g = \sqrt{gh}$ and $\frac{h}{k}\frac{\partial\omega}{\partial h} = \frac{1}{2}\sqrt{gh}$ and therefore it follows immediately from the definition that

$$(T.21)\quad \left\{ \begin{array}{ll} \langle\frac{\partial\omega}{\partial k}\rangle_j = \frac{\partial}{\partial k_j}\langle\omega\rangle_j & , kh \to 0 \\ \langle\frac{h}{k}\frac{\partial\omega}{\partial h}\rangle_j = \frac{h}{k_j}\frac{\partial}{\partial h}\langle\omega\rangle_j & , kh \to 0 \end{array} \right.$$

In very shallow water the deviation between the mean quantities and the quantities evaluated at the mean frequency goes to zero as kh → 0.

In Tables T.1 - T.3 the two group velocities are compared for averaging according to the wave action (j=0), the wave energy (j=1) and the quantity

$\omega^2 A$ (j=2); this is carried out for f_m = 0.125 Hz for the depths h = 10, h = 20 and h = 50 m. In Tables T.4-T.6 the quantities $(h/k)\partial\omega/\partial h$ are given for the same parameters. The dimensionless JONSWAP spectra have been evaluated from ν_b = 0.5 to ν_e = 6 with a step size $\Delta\nu$ = 0.01 (see appendix G).

In these Tables the following notation has been adopted. The columns marked int-0, int-1 and int-2 give the mean quantities for j = 0, 1 and 2 respectively (int from "integration"). The columns marked with <.>-0, <.>-1 and <.>-2 are the quantities evaluated at the respective mean frequencies.

Concentrating on the averaging according to the wave action (j=0), we see that the differences in the group velocities are largest for the widest spectra (γ_o= 1, the Pierson-Moskowitz spectrum) as was to be expected. For the group velocity we get for γ_o = 1 the relative deviations: -1.6% (h = 10 m), -8.5% (h = 20 m) and -10.0% (h = 50 m). For c_θ the deviations are larger; the corresponding values give the relative deviations -6.0% (h = 10), -34.2% (h = 20) and -31.4% (h = 50 m).

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.64993E+01	0.63946E+01	0.60681E+01	0.58089E+01	0.54952E+01	0.49345E+01
2.0	0.66393E+01	0.65595E+01	0.62735E+01	0.60644E+01	0.57530E+01	0.52610E+01
3.0	0.67206E+01	0.66550E+01	0.63989E+01	0.62212E+01	0.59214E+01	0.54818E+01
3.3	0.67392E+01	0.66769E+01	0.64282E+01	0.62580E+01	0.59621E+01	0.55359E+01
4.0	0.67759E+01	0.67198E+01	0.64867E+01	0.63313E+01	0.60449E+01	0.56468E+01
5.0	0.68166E+01	0.67674E+01	0.65529E+01	0.64143E+01	0.61410E+01	0.57766E+01
6.0	0.68482E+01	0.68043E+01	0.66050E+01	0.64797E+01	0.62188E+01	0.58824E+01
7.0	0.68736E+01	0.68338E+01	0.66474E+01	0.65328E+01	0.62834E+01	0.59708E+01
8.0	0.68945E+01	0.68582E+01	0.66828E+01	0.65771E+01	0.63382E+01	0.60459E+01
9.0	0.69121E+01	0.68786E+01	0.67128E+01	0.66146E+01	0.63854E+01	0.61108E+01
10.0	0.69272E+01	0.68961E+01	0.67387E+01	0.66469E+01	0.64265E+01	0.61675E+01

Table T.1 d(omega)/dk, h = 10, fm = 0.125

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.66306E+01	0.60686E+01	0.60748E+01	0.52657E+01	0.54026E+01	0.43501E+01
2.0	0.67887E+01	0.63251E+01	0.63171E+01	0.55955E+01	0.57036E+01	0.46570E+01
3.0	0.68803E+01	0.64798E+01	0.64651E+01	0.58135E+01	0.59007E+01	0.48870E+01
3.3	0.69012E+01	0.65158E+01	0.64997E+01	0.58663E+01	0.59484E+01	0.49464E+01
4.0	0.69425E+01	0.65873E+01	0.65688E+01	0.59738E+01	0.60454E+01	0.50720E+01
5.0	0.69882E+01	0.66676E+01	0.66470E+01	0.60985E+01	0.61581E+01	0.52262E+01
6.0	0.70237E+01	0.67306E+01	0.67087E+01	0.61992E+01	0.62494E+01	0.53574E+01
7.0	0.70522E+01	0.67816E+01	0.67589E+01	0.62826E+01	0.63253E+01	0.54710E+01
8.0	0.70757E+01	0.68238E+01	0.68007E+01	0.63532E+01	0.63897E+01	0.55706E+01
9.0	0.70954E+01	0.68596E+01	0.68363E+01	0.64138E+01	0.64452E+01	0.56588E+01
10.0	0.71123E+01	0.68903E+01	0.68669E+01	0.64665E+01	0.64937E+01	0.57375E+01

Table T.2 d(omega)/dk, h = 20, fm = 0.125

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.59734E+01	0.53736E+01	0.55000E+01	0.48467E+01	0.49378E+01	0.42066E+01
2.0	0.60576E+01	0.55464E+01	0.56613E+01	0.50628E+01	0.51555E+01	0.44320E+01
3.0	0.61054E+01	0.56532E+01	0.57590E+01	0.52053E+01	0.52974E+01	0.45926E+01
3.3	0.61162E+01	0.56784E+01	0.57818E+01	0.52399E+01	0.53317E+01	0.46332E+01
4.0	0.61374E+01	0.57289E+01	0.58272E+01	0.53107E+01	0.54013E+01	0.47180E+01
5.0	0.61607E+01	0.57864E+01	0.58785E+01	0.53935E+01	0.54822E+01	0.48206E+01
6.0	0.61786E+01	0.58320E+01	0.59187E+01	0.54610E+01	0.55476E+01	0.49071E+01
7.0	0.61929E+01	0.58693E+01	0.59514E+01	0.55175E+01	0.56018E+01	0.49815E+01
8.0	0.62046E+01	0.59005E+01	0.59786E+01	0.55656E+01	0.56479E+01	0.50466E+01
9.0	0.62144E+01	0.59271E+01	0.60017E+01	0.56073E+01	0.56875E+01	0.51041E+01
10.0	0.62228E+01	0.59501E+01	0.60216E+01	0.56439E+01	0.57220E+01	0.51556E+01

Table T.3 d(omega)/dk, h = 50, fm = 0.125

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.22852E+01	0.21486E+01	0.20005E+01	0.17172E+01	0.16499E+01	0.11090E+01
2.0	0.23799E+01	0.22728E+01	0.21377E+01	0.19034E+01	0.18165E+01	0.13300E+01
3.0	0.24349E+01	0.23452E+01	0.22214E+01	0.20192E+01	0.19254E+01	0.14838E+01
3.3	0.24475E+01	0.23618E+01	0.22410E+01	0.20466E+01	0.19517E+01	0.15220E+01
4.0	0.24723E+01	0.23945E+01	0.22802E+01	0.21013E+01	0.20053E+01	0.16007E+01
5.0	0.24999E+01	0.24308E+01	0.23244E+01	0.21634E+01	0.20676E+01	0.16939E+01
6.0	0.25213E+01	0.24590E+01	0.23593E+01	0.22125E+01	0.21180E+01	0.17704E+01
7.0	0.25385E+01	0.24816E+01	0.23877E+01	0.22526E+01	0.21599E+01	0.18348E+01
8.0	0.25526E+01	0.25003E+01	0.24114E+01	0.22861E+01	0.21954E+01	0.18898E+01
9.0	0.25646E+01	0.25159E+01	0.24315E+01	0.23145E+01	0.22260E+01	0.19376E+01
10.0	0.25748E+01	0.25294E+01	0.24488E+01	0.23390E+01	0.22528E+01	0.19795E+01

Table T.4 (h/k)*d(omega)/dh, h = 10, fm = 0.125

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.15097E+01	0.99359E+00	0.12253E+01	0.55180E+00	0.92460E+00	0.17496E+00
2.0	0.15796E+01	0.11491E+01	0.13381E+01	0.72375E+00	0.10613E+01	0.28126E+00
3.0	0.16200E+01	0.12456E+01	0.14070E+01	0.84505E+00	0.11510E+01	0.37520E+00
3.3	0.16292E+01	0.12683E+01	0.14232E+01	0.87526E+00	0.11728E+01	0.40121E+00
4.0	0.16473E+01	0.13137E+01	0.14554E+01	0.93762E+00	0.12170E+01	0.45838E+00
5.0	0.16674E+01	0.13652E+01	0.14919E+01	0.10114E+01	0.12685E+01	0.53224E+00
6.0	0.16829E+01	0.14059E+01	0.15207E+01	0.10721E+01	0.13103E+01	0.59811E+00
7.0	0.16954E+01	0.14390E+01	0.15441E+01	0.11230E+01	0.13450E+01	0.65713E+00
8.0	0.17056E+01	0.14666E+01	0.15636E+01	0.11665E+01	0.13745E+01	0.71029E+00
9.0	0.17143E+01	0.14900E+01	0.15802E+01	0.12042E+01	0.14000E+01	0.75841E+00
10.0	0.17216E+01	0.15102E+01	0.15946E+01	0.12372E+01	0.14222E+01	0.80217E+00

Table T.5 (h/k)*d(omega)/dh, h = 20, fm = 0.125

gamma0	int-0	<.>-0	int-1	<.>-1	int-2	<.>-2
1.0	0.25913E+00	0.17779E-01	0.18456E+00	0.29274E-02	0.12073E+00	0.11120E-03
2.0	0.23847E+00	0.28362E-01	0.17923E+00	0.66207E-02	0.12542E+00	0.41562E-03
3.0	0.22571E+00	0.36897E-01	0.17544E+00	0.10682E-01	0.12816E+00	0.94872E-03
3.3	0.22271E+00	0.39155E-01	0.17450E+00	0.11923E-01	0.12878E+00	0.11487E-02
4.0	0.21671E+00	0.43970E-01	0.17256E+00	0.14798E-01	0.13002E+00	0.16923E-02
5.0	0.20990E+00	0.49946E-01	0.17026E+00	0.18815E-01	0.13138E+00	0.26275E-02
6.0	0.20451E+00	0.55072E-01	0.16837E+00	0.22670E-01	0.13244E+00	0.37206E-02
7.0	0.20011E+00	0.59532E-01	0.16678E+00	0.26326E-01	0.13328E+00	0.49348E-02
8.0	0.19643E+00	0.63443E-01	0.16542E+00	0.29781E-01	0.13396E+00	0.62529E-02
9.0	0.19329E+00	0.66911E-01	0.16423E+00	0.33032E-01	0.13453E+00	0.76468E-02
10.0	0.19057E+00	0.70016E-01	0.16318E+00	0.36087E-01	0.13502E+00	0.90893E-02

Table T.6 (h/k)*d(omega)/dh, h = 50, fm = 0.125

Appendix U. Consideration of the wave-breaking formulation in HISWA.

U.1 Introduction.

In the present appendix we consider the wave-reaking formulation in a one-dimensional setting; that is, we do not consider the way in which the directionality of the wave field is accounted for in the wave breaking formulation. Here we are especially concerned with the effect of the wave dissipation formulation, while using the wave period T_{m-10} instead of the peak period T_p as is used in the one-dimensional model ENDEC which is described in Battjes and Stive (1985).

U.2 Statement of the problem.

As remarked earlier, the setting of the wave breaking parameter γ is of the utmost importance in order to obtain a reliable wave height prediction. We applied the optimal setting for γ as given by Battjes and Stive (1985), which was obtained from investigation of a large number of prototype situations and laboratory measurements, while using T_p as the wave period in the computations. In HISWA a wave period which is about 10 % lower than T_p is used (see the formulation in appendix A) and we investigate the effect of using a from T_p-different wave period on the prediction of wave heights, while using the one-dimensional energy balance equation :

$$\frac{d}{dx}\left[c_g E\right] + D_b = 0 .$$

The dissipation function D_b is given as

$$D_b = \frac{1}{4}\alpha \rho g \; f \; Q_b H_m^2 ,$$

with the maximum allowable wave height H_m given by an adapted Miche criterion as

$$H_m = \frac{\gamma_s}{k} \tanh \left[\frac{\gamma}{\gamma_s} kh\right] .$$

The steepness parameter γ_s has always been taken as $\gamma_s = 0.88$ in ENDEC and also in all computations reported in the present study. The computational parameter Q_b, which represents a measure for the fraction of breaking waves (see also the remarks in chapter 5) is determined by iteration of

$$Q_b = \exp[-(1-Q_b)/b^2] \quad , \quad b = H_{rms}/H_m \; .$$

The optimal setting for γ has been related to the deep-water wave steepness as :

$$\text{(U.1)} \quad \gamma_{opt} = 0.5 + 0.4\tanh[\,33H_{rmsO}/L_O] \; ,$$

where H_{rmsO} is the root mean square wave height in deep water, evaluated by applying linear shoaling and L_O is the deep-water wave length; notice that this relation has been obtained by applying the peak period T_p.

We now address the question which wave breaking parameter to use in HISWA, applying a constant, non-changing, wave frequency which is different from f_m; denote this frequency by f_h and the corresponding wave period by T_h.

In applying the HISWA-model for practical situations, we look for the characteristic shape of the spectra, e.g. of JONSWAP-type and then take for f_h/f_m the ratio ν_{-10} as given in Table G.3; introduce now for simplicity of writing the notation $(1+\mu) = \nu_{-10}$ sothat we have

$$\text{(U.2)} \quad f_h = (1+\mu)f_m \; , \quad 0 < \mu < 1.$$

Consider now the energy-balance equation. We distinguish the cases for $f=f_m$ and $f=f_h$ by tildes on all quantities which depend on f_h. We thus have to compare the prediction of the wave energies E and $\tilde{E}$ with the two equations

$$\frac{d}{dx}(c_g E) + D_b = 0 \quad \text{for } f = f_m$$

and

$$\frac{d}{dx}(\tilde{c}_g \tilde{E}) + \tilde{D}_b = 0 \quad \text{for } f = f_h \; .$$

We consider of course the situation that both computations proceed along the same depth-path and that the wave heights at the start point (offshore) is the same; at x=0 we thus have $\tilde{E} = E$. For the purpose of the discussion we consider a very simple discretization and evaluate the dissipation function at the old level :

$$(c_g E)_{n+1} - (c_g E)_n + (D_b)_n = 0 .$$

For the two cases we then have as prediction of wave energy at the new level

$$E_{n+1} = \left[\frac{c_{g_n}}{c_{g_{n+1}}} E_n - \frac{D_{b_n}}{c_{g_{n+1}}}\right] \Delta x , \quad \tilde{E}_{n+1} = \left[\frac{\tilde{c}_{g_n}}{\tilde{c}_{g_{n+1}}} \tilde{E}_n - \frac{\tilde{D}_{b_n}}{\tilde{c}_{g_{n+1}}}\right] \Delta x$$

Suppose that E_n and $\tilde{E}_n$ are equal. For small step-sizes Δx (and thus also small changes in depth from level n to level n+1) the ratios of the group velocities are almost unity. In order that the predicted wave energies at level n+1 are equal it is therefore necessary that the ratio D_b/c_g is the same for the two frequencies f_m amd f_h.

The invariance of D_b/c_g for the two wave-frequency measures $f=f_m$ and $f=f_h$ has to be accomplished by a suitable choice of the parameter γ and possibly also γ_s. We concentrate at first on intermediate to shallow-water depth and keep the steepness parameter γ_s fixed. The expression for the dissipation function is given by

$$D_b = \frac{1}{4}\alpha \rho g f Q_b H_m^2 ,$$

which is not very suitable to see the differences due to different frequencies, in the first place because of Q_b, which depends critically on H_m, which in turn depends on the frequency. An approximate expression for Q_b, due to Stive, has been given in Dingemans (1983, p.183) and is

$$Q_b = 2.4(H_{rms}/H_m)^7 ,$$

sothat the corresponding approximation to D_b can be written as

(U.3) $$D_b = 0.6\ \alpha \rho g\ f\ H_{rms}^7/H_m^5 .$$

For a prediction of the wave energy to give the same results for the frequencies f_m and f_h, D_b/c_g has to be invariant. This now amounts to the invariance of the quantity, F, given as

$$F = \frac{f}{c_g} H_m^{-5} , \qquad \text{(U.4)}$$

the other parameters being the same.

U.3 Small parameter expansions.

In the present section the setting of the wave-breaking parameters in HISWA is related to that of the case of the situations where the peak frequency is used. This is accomplished by expressing the HISWA quantities in terms of the other ones by expanding the parameters into terms of the usual ones.

U.3.1 Relations between frequencies and wave numbers.

With different frequencies, also the wave numbers are different. The amount of difference between the wave numbers is set by the frequency differences and the relation between the two is now first investigated. Hereby the new (HISWA) frequency and wave number are expressed in terms of the old ones.

Notice that c_g and H_m are given by

$$c_g = \frac{g}{2\omega} [\tanh kh + kh(1 - \tanh^2 kh)] , \quad \omega = 2\pi f$$

$$H_m = \frac{\gamma_s}{k} \tanh \left[\frac{\gamma}{\gamma_s} kh\right] . \qquad \text{(U.5)}$$

Using the dispersion relation

$$\omega^2 = gk \tanh kh \qquad \text{(U.6)}$$

and denoting the quantities dependent on ω_h by a tilde, we obtain with

$$\omega_h = \tilde{\omega} = (1+\mu)\omega , \qquad k_h = \tilde{k} = (1+\delta)k \qquad \text{(U.7)}$$

and the expansion

$$\tanh[(1+\delta)kh] = \tanh kh + \delta kh(1-\tanh^2 kh) - \tfrac{1}{2}(\delta kh)^2 \tanh kh\,(1-\tanh^2 kh) + O(\delta^3)$$

the following relation between μ and δ :

(U.8) $$kh[\frac{1}{\sigma} - \sigma - \frac{1}{2}kh(1-\sigma^2)]\,\delta^2 + [1 + kh(\frac{1}{\sigma} - \sigma)]\,\delta - \mu(\mu+2) + O(\delta^3) = 0\ ,$$

where the abbrevation $\sigma = \tanh(kh)$ has been used.

Given μ, the value for δ is the positive root of this equation and follows easily as a function of kh. Consider the limiting values for shallow- and deep-water. For shallow water, kh << 1 and $\sigma \cong kh$. Then is obtained upon neglection of $(kh)^2$ terms :

$$\delta^2 + 2\delta - \mu(\mu+2) \cong 0, \quad \text{or} \quad (\delta+1)^2 \cong (\mu+1)^2 \quad \text{and thus,} \quad \delta \cong \mu.$$

For deep water, kh >> 1, one has $\tanh(kh) \cong 1$ and there is obtained with $\sigma=1$

$$\delta = \mu(2+\mu), \quad \text{or} \quad (1+\delta) = (1+\mu)^2 \quad \text{and thus,} \quad \delta \cong 2\mu\ .$$

It is noted that these limiting values for δ in terms of μ also follow directly from the deep-water dispersion relation $\omega^2 = gk$ and the shallow water dispersion relation $\omega^2 = ghk^2$.

U.3.2 The maximum wave height.

Expressing $\tilde{H}_m$ in terms of H_m yields, with

(U.9)
$$\tilde{\gamma} = (1+\nu)\gamma \quad \text{and}$$
$$(1+p) = (1+\delta)(1+\nu),$$

(U.10)
$$\tilde{H}_m = \frac{1}{1+\delta} H_m + \frac{p}{1+\delta}\gamma h\left[1 - \tanh^2 \frac{\gamma}{\gamma_s} kh\right] + O(p^2)$$
$$\tilde{H}_m = \frac{1}{1+\delta}(H_m + \Delta H_m)\ .$$

The group velocity $\tilde{c}_g$ is expressed in terms of c_g in the following way

$$\text{(U.11)} \quad \begin{aligned} \tilde{c}_g &= \frac{1}{1+\mu}\left[c_g + \frac{g}{2\omega}\, 2\delta kh(1-\tanh^2 kh)\{1 + kh \tanh kh\}\right] . \\ \tilde{c}_g &= \frac{1}{1+\mu}\left[c_g + \Delta c_g\right] \end{aligned}$$

Substitution into $\tilde{F}$ then yields

$$\tilde{F} = (1+\mu)^2(1+\delta)^5\, f\, \frac{(H_m + \Delta H_m)^{-5}}{c_g + \Delta c_g} = (1+\mu)^2(1+\delta)^5 \frac{\left[1 + \frac{\Delta H_m}{H_m}\right]^{-5}}{1 + \frac{\Delta c_g}{c_g}} F .$$

For invariance of F it is thus necessary that the following condition is fulfilled :

$$\text{(U.12)} \quad (1+\mu)^2(1+\delta)^5 \left[1 + \frac{\Delta H_m}{H_m}\right]^{-5} = 1 + \frac{\Delta c_g}{c_g} ,$$

or,

$$\text{(U.13)} \quad \frac{\Delta H_m}{H_m} = (1+\mu)^{0.4}(1+\delta)\left[1 + \frac{\Delta c_g}{c_g}\right]^{-0.2} .$$

Expressions for $\Delta H_m/H_m$ and $\Delta c_g/c_g$ follow from (U.10) and (U.11) as

$$\text{(U.14)} \quad \begin{aligned} \frac{\Delta H_m}{H_m} &= p\, \frac{\gamma}{\gamma_s} kh \frac{\left[1-\tanh^2 \frac{\gamma}{\gamma_s} kh\right]}{\tanh \frac{\gamma}{\gamma_s} kh} + O(p^2) \\ \frac{\Delta c_g}{c_g} &= \frac{2\delta kh(1-\tanh^2 kh)[\,1 + kh.\tanh kh]}{\tanh kh + kh(1-\tanh^2 kh)} \end{aligned}$$

A difficulty with condition (U.12) is that it is still a function of kh, see above expressions for ΔH_m and Δc_g. Substituting the expressions for $\Delta H_m/H_m$ and $\Delta c_g/c_g$, a condition for p is obtained in terms of μ and σ. A numerical evaluation for some values kh with fixed values for μ, γ and γ_s

(0.13, 0.80 and 0.88) yields for the increase in γ, given by ν ($\tilde{\gamma}=(1+\nu)\gamma$) :

kh	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
ν	.025	.027	.030	.034	.040	.048	.058	.072	.090	.112
δ	.130	.132	.134	.137	.141	.146	.152	.158	.165	.172
$\Delta c_g/c_g$	.131	.135	.142	.150	.160	.171	.183	.195	.206	.215

Table U.1 ν, δ and $\Delta c_g/c_g$ as function of kh; μ=0.13, γ=0.88, $\tilde{\gamma}$=0.88 .

Consider now limiting values. In deep water one has $\sigma \cong 1$ and the expressions for $\Delta c_g/c_g$ and $\Delta H_m/H_m$ reduce to zero, sothat the condition that F is invariant would become $(1+\mu)^2(1+\delta)^5 = 1$, kh >> 1 .
This condition cannot be fulfilled because, in deep water, the relation between μ and δ is $(1+\delta) = (1+\mu)^2$. However, because the limiting wave height in deep water is given by its steepness, equivalent wave breaking cannot be achieved without accounting for the steepness of the waves, governed by the parameter γ_s, which has been held constant up till now.
Introducing again a small parameter, ε, by

(U.15) $\tilde{\gamma}_s = (1+\varepsilon)\gamma_s$,

and noting that for deep water one then has

$$\tilde{H}_m = \frac{\tilde{\gamma}_s}{\tilde{k}} = \frac{1+\varepsilon}{1+\delta} H_m = \frac{1+\varepsilon}{1+\delta}\frac{\gamma_s}{k} ,$$

the following condition for invariance of F is obtained, which condition can be used to choose the appropriate wave steepness for wave breaking in deep water :

$$(1+\mu)^2(1+\delta)^5(1+\varepsilon)^{-5} = 1 ,$$

and thus,

$$1+\varepsilon = (1+\mu)^{12/5} \quad \text{for kh >> 1} .$$

Taking as example $1+\mu$ = 1.13, there is obtained $1+\varepsilon$ = 1.34 and $\tilde{\gamma}_s = 1.34\cdot\gamma_s$ = 1.18 for the usual choice γ_s = 0.88 .

For shallow water, kh << 1, one obtains

$$\frac{\Delta c_g}{c_g} = \delta \,, \qquad \frac{\Delta H_m}{H_m} = p$$

and the condition that F is invariant becomes

$$1+p = (1+\mu)^{1.2} \quad \text{for } kh \ll 1,$$

which yields the new choice of the wave breaking parameter $\tilde{\gamma}$ in shallow water (see also relations (U.9)). Using the shallow-water relation $(1+\delta) = (1+\mu)$, there is obtained for ν :

$$1+\nu = (1+\mu)^{0.2} \quad \text{for } kh \ll 1.$$

With $1+\mu = 1.13$ there is obtained $1+\nu = 1.025$ and thus $\tilde{\gamma}$ is 2.5 % higher than γ.

It has been seen above that it is necessary in deep water to change the value of the steepness parameter γ_s so as to make it possible to obtain invariance of F when the computation proceeds with $\tilde{\omega}$ instead of with ω. As the values for γ and γ_s are both fixed in the whole of the computational domain, a higher value of γ_s has also consequences for the wave breaking in intermediate water depths; only in shallow water the influence of the wave steepness disappears. Because condition (U.13) has been derived under the condition that $\gamma_s = \tilde{\gamma}_s$, it is necessary to redo the previous analysis to account for differences in allowed wave steepness.

The maximum wave height $\tilde{H}_m$ is written now as

$$\text{(U.16)} \qquad \tilde{H}_m = \frac{1+\varepsilon}{1+\delta} \frac{\gamma_s}{k} \tanh[\,(1+r)\,\frac{\gamma}{\gamma_s}\,kh] \,,$$

with the small parameter r given by

$$\text{(U.17)} \qquad 1+r = \frac{1+\nu}{1+\varepsilon}\,(1+\delta) \,.$$

An expansion of $\tilde{H}_m$ up to O(r) yields :

(U.18) $$\tilde{H}_m = \frac{1+\varepsilon}{1+\delta} H_m + (1+\nu)\gamma h\left[1 - \tanh^2 \frac{\gamma}{\gamma_s}kh\right] + O(r^2) ,$$

which can also be written as

$$\tilde{H}_m = \frac{1+\varepsilon}{1+\delta} H_m \left[1 + \frac{\Delta H_m}{H_m} \right] ,$$

(U.19)

$$\frac{\Delta H_m}{H_m} = r \frac{\gamma}{\gamma_s}kh \frac{1 - \tanh^2 \frac{\gamma}{\gamma_s}kh}{\tanh \frac{\gamma}{\gamma_s}kh}$$

For deep water the previous result is recovered because, for $\frac{\gamma}{\gamma_s}kh \to \infty$, one has $\Delta H_m/H_m \to 0$. In the shallow water limit, $kh \to 0$, one has $\Delta H_m/H_m \to r$, and thus, $\tilde{H}_m \to (1+\nu)H_m = \tilde{\gamma}h$.

The condition for equivalent wave breaking effect can be obtained by substituting expression (U.14b) for $\Delta c_g/c_g$ and expression (U.19b) for $\Delta H_m/H_m$ in condition (U.12). It is to be noted that, with μ given, this is one relation for two unknowns, ν and ε. Furthermore a possible solution depends still on the local value of kh. Introcucing the quantities G_1 and G_2, which are functions of kh (and of γ and γ_s) by :

(U.20a) $$G_1 = \frac{\gamma}{\gamma_s}kh \frac{1 - \tanh^2 \frac{\gamma}{\gamma_s}kh}{\tanh \frac{\gamma}{\gamma_s}kh}$$

and

(U.20b) $$G_2 = 2kh \frac{(1-\tanh^2 kh)[1 + kh.\tanh kh]}{\tanh kh + kh(1-\tanh^2 kh)} ,$$

the relation for invariance of F can be reworked into

(U.21) $$(1+\nu)G_1 = \left[\frac{(1+\mu)^2}{1+\delta G_2} \right]^{1/5} - \frac{1+\varepsilon}{1+\delta} (1-G_1) .$$

In order to get some idea of the parameters involved, a numerical evaluation of expression (U.21) is given below, for kh-values ranging from $\pi/20$ to $\pi/2$, while for γ, γ_s are taken the standard values 0.80 and 0.88. This has been carried out for two values of μ, viz., μ = 0.13 and μ = 0.107, according to the cases of JONSWAP-type spectra with peak-enhancement factors of 2 and 3.3 respectively (see Table G.3). As either ν or ε can be calculated, one of the two is chosen beforehand. The range of the steepness variation is from ε = 0 to ε = 0.35, giving a range of steepness parameters $\tilde{\gamma}_s$ between 0.88 and 1.19. The corresponding values for ν are calculated and presented in the Tables below as 100ν.

ε \ kh	.157	.314	.471	.628	.785	.942	1.099	1.256	1.413	1.570
.000	2.61	3.03	3.80	5.06	6.98	9.82	13.91	19.68	27.65	38.49
.050	2.55	2.78	3.25	4.05	5.36	7.40	10.47	14.95	21.31	30.13
.100	2.49	2.54	2.69	3.04	3.74	4.98	7.03	10.23	14.97	21.77
.150	2.43	2.30	2.13	2.03	2.11	2.56	3.59	5.50	8.64	13.40
.200	2.37	2.05	1.58	1.02	.49	.13	.15	.78	2.30	5.04
.250	2.31	1.81	1.02	.01	-1.14	-2.29	-3.29	-3.95	-4.04	-3.32
.300	2.24	1.57	.47	-1.00	-2.76	-4.71	-6.73	-8.68	-10.38	-11.68
.350	2.18	1.32	-.09	-2.01	-4.38	-7.14	-10.17	-13.40	-16.72	-20.04

Table U.2 Values 100ν for μ = 0.13, γ = 0.80 and γ_s = 0.88

ε \ kh	.157	.314	.471	.628	.785	.942	1.099	1.256	1.413	1.570
.000	2.16	2.52	3.17	4.23	5.85	8.24	11.69	16.56	23.29	32.45
.050	2.10	2.27	2.60	3.19	4.18	5.75	8.15	11.69	16.75	23.81
.100	2.04	2.02	2.03	2.16	2.52	3.27	4.61	6.82	10.21	15.16
.150	1.98	1.77	1.47	1.13	.85	.78	1.07	1.95	3.67	6.52
.200	1.92	1.52	.90	.09	-.81	-1.71	-2.46	-2.92	-2.88	-2.12
.250	1.86	1.27	.33	-.94	-2.47	-4.19	-6.00	-7.79	-9.42	-10.77
.300	1.80	1.03	-.24	-1.98	-4.14	-6.68	-9.54	-12.65	-15.96	-19.41
.350	1.73	.78	-.81	-3.01	-5.80	-9.17	-13.08	-17.52	-22.50	-28.05

Table U.3 Values 100ν for μ = 0.107, γ = 0.80 and γ_s = 0.88

It is to be noted that the whole exercise has been carried out to get any idea how to choose the wave breaking parameters $\tilde{\gamma}$ and $\tilde{\gamma}_s$ when the wave computation is carried out with another frequency than the peak frequency of the spectrum. For the latter one the choice of the parameter γ has been tuned to a large number of measurements, carrying out all computations with a fixed steepness parameter, γ_s = 0.88. Furthermore, it is to be noted that the analysis is carried out for a fixed frequency $\tilde{\omega}$, whereas HISWA computations are often carried out with variable frequency, where the variation is determined by the wave dissipation.

Relation (U.21) gives only an indication of the choice of parameters, in the first place because the expansions are carried out to first-order and also because of the approximate formulation for Q_b, giving the approximate expression for the wave dissipation, Eq. (U.3). Expression (U.21) should therefore only be considered to give an indication of the interdependence of the parameters.

The result of (U.21), as e.g., expressed in Tables U.2 and U.3, is that for one combination of $\tilde{\gamma}$ and $\tilde{\gamma}_s$ the prediction of the wave energy in the whole of the computational region using the frequency ω cannot be the same as obtained with a combination γ, γ_s for the peak frequency ω. One has to concentrate on the kh values where the wave field is of importance to the application involved. In that respect expression (U.21) may be helpful.

In order to facilitate the evaluation of (U.21) for other choices of parameters, the values for G_1 and G_2 are given below for some kh-values; notice that for G_1 the choice γ=0.80 and γ_s=0.88 has been made. Notice furthermore that G_1 decreases monotoneously from 1 for kh=0 to zero for kh $\rightarrow \infty$. For G_2 a maximum value near kh=1 is obtained. see Table U.4. Values for δ as function of kh are given for several values of μ in Table U.5. Notice that the μ-values chosen correspond with JONSWAP-type spectra with peak-enhancement factors of 1, 2, 3.3, 5 and 7, see Table G.3 on page 208.

kh	.157	.314	.471	.628	.785	.942	1.099	1.256	1.413	1.570
G_1	.987	.948	.887	.812	.727	.639	.552	.470	.396	.330
G_2	1.016	1.060	1.120	1.812	1.229	1.252	1.243	1.203	1.134	1.044

Table U.4 Values G_1 and G_2 as function of kh; for G_1 : γ=0.80, γ_s=0.88 .

μ \ kh	.157	.314	.471	.628	.785	.942	1.099	1.256	1.413	1.570
.167	.168	.173	.180	.190	.202	.216	.232	.248	.264	.279
.130	.131	.135	.140	.148	.157	.168	.179	.191	.203	.215
.107	.108	.111	.115	.121	.129	.138	.147	.157	.166	.175
.088	.089	.091	.095	.100	.106	.113	.120	.128	.136	.143
.074	.074	.076	.079	.084	.089	.094	.101	.107	.113	.119

Table U.5 Values δ .

There are two possible courses open to choose a combination $(\tilde{\gamma}, \tilde{\gamma}_s)$, when μ and values for γ and γ_s are known. One consists of determining ε (and thus $\tilde{\gamma}_s$) from deep-water wave-breaking considerations; then ε might follow from the relation $1+\varepsilon = (1+\mu)^{12/5}$ given earlier and from (U.21) the appropriate value for ν (and thus $\tilde{\gamma}$) can be obtained sothat in the region of interest (for specific kh-values) the quantity F is aproximately invariant. A second approach which is possible, is to choose $\tilde{\gamma}$ first and then to use (U.21) to decide upon the appropriate value of ε. As the wave breaking parameter γ is related to the deep-water wave steepness, a similar approach might be used for $\tilde{\gamma}$; this is considered further in next section.

U.4 The choice of the optimal wave breaking parameter.

The wave breaking parameter γ is determined according to the deep-water wave steepness H_{rmso}/L_o, which is determined by applying linear shoaling using T_p and the wave height H_{rms} at the start position. This start position has been chosen such that is is outside the wave-breaking zone. When using T_h instead of T_p to determine the deep-water steepness, a different steepness results for the same wave height at the start position.

There is

$$c_{gO} H^2_{rmsO} = c_g H^2_{rms} , \quad \tilde{c}_{gO} \tilde{H}^2_{rmsO} = \tilde{c}_g \tilde{H}^2_{rms} ,$$

with

$$\tilde{c}_g = \frac{1}{1+\mu}(c_g + \Delta c_g) , \quad \tilde{c}_{gO} = \frac{1+\mu}{1+\delta} c_{gO} .$$

Because $\tilde{L}_o = (1+\mu)^{-2}L_o$, we obtain for $\tilde{s}_o \equiv 33\,\tilde{H}_{rmso}/\tilde{L}_o$ the expression

$$\tilde{s}_o = s_o(1+\mu)^2\left(1+\frac{\Delta c_g}{c_g}\right)^{0.5} \equiv (1+q)s_o \,. \tag{U.22}$$

From (U.20b) and (U.14b) it is noted that there can be written

$$1+q = (1+\mu)^2(1+\delta G_2)^{0.5} \,. \tag{U.23}$$

Applying the formula for the optimal setting of the wave-breaking parameter for $\tilde{\gamma}$, Eq. (U.1), we obtain upon expanding the resulting expression for small q,

$$\tilde{\gamma} = \gamma + 0.4\, qs_o(1-\tanh^2 s_o) + O(q^2) \,. \tag{U.24}$$

For a specific value γ the corresponding deep-water steepness parameter s_o follows from (U.1) as

$$s_o = \operatorname{arctanh}\left(\frac{\gamma - 0.5}{0.4}\right) \,. \tag{U.25}$$

For an evaluation of $\tilde{\gamma}$, given γ, the start position of the computation is still required in order to obtain kh (q depends through δG_2 on kh). The start position should be in relatively deep water, sothat not much dissipation due to wave breaking and bottom dissipation has appeared from truly deep water to the start position. Therefore a few examples are worked out for kh above 0.8 (notice that kh is determined by ω, not $\tilde{\omega}$). Notice that it follows from Eq. (U.1) and also from (U.25) that the range of values for γ is restricted between 0.5 and 0.9. The dependence of q on kh is very slight because both δ and G_2 do not vary much with kh (see Tables U.4 and U.5) and, moreover, the dependence is in the form of $(1+\delta G_2)^{1/2}$, see Eq. (U.23). The largest difference is four units in the third decimal in the range kh = 0.80 to kh = 1.70 (obtained for μ = .167). The values $\tilde{\gamma}$, as resulting from Eq. (U.24), are given as function of γ for kh=0.8 in Table U.6. The corresponding values 100ν are given in Table U.7.

γ / μ	.66	.68	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88
.167	.734	.761	.786	.810	.833	.853	.872	.889	.903	.913	.918	.917
.130	.716	.741	.765	.788	.810	.831	.950	.867	.883	.895	.904	.908
.107	.706	.729	.753	.775	.797	.817	.837	.854	.871	.885	.896	.903
.088	.697	.720	.743	.765	.786	.806...	.826	.844	.861	.876	.889	.898
.074	.691	.713	.735	.757	.778	.798	.818	.837	.854	.870	.884	.895

Table U.5 Values $\tilde{\gamma}$, kh = 0.80.

γ / μ	.66	.68	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88
.167	11.3	11.9	12.3	12.5	12.5	12.3	11.8	11.1	10.1	8.7	6.8	4.2
.130	8.5	9.0	9.3	9.5	9.5	9.3	9.0	8.4	7.6	6.6	5.2	3.2
.107	6.9	7.3	7.5	7.7	7.7	7.5	7.3	6.8	6.2	5.3	4.2	2.6
.088	5.6	5.9	6.1	6.2	6.2	6.1	5.9	5.5	5.0	4.3	3.4	2.1
.074	4.6	4.9	5.1	5.2	5.2	5.1	4.9	4.6	4.1	3.6	2.8	1.7

Table U.6 Values 100ν, kh = 0.80.

It should be remembered that the value for $\tilde{\gamma}$ as predicted by (U.24) is only approximate, due to the approximations involved in the derivation of the relation, especially in (U.22). Consider therefore two examples: at a start depth of 25.8 m, the incoming wave field is given by T_p = 14 and 11 s, with Hs = 8 m and 6 m respectively. Take μ = 0.13 sothat the wave periods T_{m-10} become 12.39 and 9.73 s. Applying relation (U.1) for all cases, we obtain $(\gamma, \tilde{\gamma})$ = (.727, .774) and (.768, .811) for the peak periods 14 and 11 s respectively. According to linear shoaling an exact evaluation of the quantities s_o and $\tilde{s}_o$ yields $(s_o, \tilde{s}_o)$ = (.643, .840) and (.810, 1.036). Evaluating q from U.23) for the start position (kh = .7987 and 1.0812 respectively) one obtains from (U.24) the estimates $\tilde{\gamma}$ = .796 and .841. The relation (U.24) thus yields too high estimates, .02 and .03 for the present cases. These estimates give 100ν = 9.5 and 9.5 instead of 6.5 and 5.6. This furnishes a reason for the high values ν in Table U.6, whereas in Table U.3 lower values for the same kh-values are obtained.

The conclusion to be drawn from this comparison is that the expansion

(U.22) is clearly not sufficient, which is to be expected because the parameter q is not really very small, but has values up to 0.5; in the above comparison, q was around 0.4. So, for the expansion as given in this section to be of any use, it has to be carried out to higher order in q, at least up to the second-order. Instead of (U.24), there is simply obtained up to $O(q^2)$:

$$\text{(U.26)} \qquad \tilde{\gamma} = \gamma + 0.4\, qs_o(1-\tanh^2 s_o)[1 - \tfrac{1}{2} qs_o \tanh s_o] + O(q^3) .$$

A check on the previous two examples gives, with s_o = 0.643 and 0.810, the values $\tilde{\gamma}$ = 0.757 and 0.828, which is clearly an insufficient improvement of the previously obtained estimates. That this improvement is insufficient can also be seen directly from the factor $[1 - 0.5qs_o \tanh s_o]$ in Eq. (U.26); with s_o about 0.7 and kh between 0.8 and 1, there is obtained q about 0.4 and the factor obtains a value around 0.9 (in the previous two examples : 0.93 and 0.89), whereas the increase in γ is about 0.03.

The conclusion is thus that neither (U.24) nor (U.26) are fruitful expansions. A better approach is to use formulation (U.1) directly with the mean wave period T_{m-10} to obtain $\tilde{\gamma}$, and thus also ν. Notice that this approach is quite feasable for project work in which specific cases are to be considered. Using the so obtained value for ν, the steepness parameter may be adapted by using formula (U.21) of which a numerical evaluation for specific choices of μ and γ is given in Tables U.2 and U.3.

The validity of using the setting (U.1) applied for the wave period T_{m-10} to get an estimate for $\tilde{\gamma}$ is investigated now. Taking the pevious example of T_p = 14 s, H_s = 6 m at a start depth of 25.8 m, resulting in γ = 0.7267, we found that ν would be 0.0656 for μ = 0.13, resulting in $\tilde{\gamma}$ = 0.7744. The difference between γ and $\tilde{\gamma}$ is rather large. Calculating the change in the steepness parameter, ε, for ν = 0.0656 results in negative values for ε for kh-values between 0.5 and 0.4 (notice that in this kh-range most wave breaking takes place and that the corresponding depths are between 12 and 7 m). As positive ε-values are physically more sound, we calculated for the present example the ε-values for a few lower values of ν, see Table U.7 below. For the present example the case of ν = 0.02 and ε = 0.17 seems a reasonable compromise. This would result into the setting $\tilde{\gamma}$ = 0.74 and $\tilde{\gamma}_s$ =

1.03. In order to show the result of choosing an ε-value first and calculating the with (U.21) corresponding value for ν, the results of some variation in ε are given in Table U.8 below.

ν \ kh	1.0000	.9000	.8000	.7000	.6000	.5000	.4000	.2000
.0000	.2059	.2109	.2224	.2439	.2823	.3516	.4850	1.6317
.0200	.1609	.1542	.1494	.1472	.1489	.1574	.1791	.3936
.0250	.1497	.1401	.1312	.1230	.1156	.1089	.1026	.0841
.0300	.1384	.1259	.1129	.0988	.0823	.0604	.0261	-.2254
.0400	.1159	.0976	.0764	.0504	.0156	-.0367	-.1269	-.8445
.0500	.0934	.0692	.0400	.0021	-.0511	-.1338	-.2799	-1.4635
.0656	.0583	.0250	-.0170	-.0734	-.1552	-.2852	-.5186	-2.4292

Table U.7 Values ε from (U.21) as function of kh;
γ = 0.7267, γ_s = 0.88, μ = 0.13.

ε \ kh	1.0000	.9000	.8000	.7000	.6000	.5000	.4000	.2000
.00	.0915	.0744	.0610	.0504	.0423	.0362	.0317	.0264
.05	.0693	.0568	.0472	.0401	.0348	.0311	.0284	.0256
.10	.0471	.0391	.0335	.0298	.0273	.0259	.0252	.0247
.15	.0249	.0215	.0198	.0194	.0198	.0208	.0219	.0239
.17	.0160	.0144	.0144	.0153	.0168	.0187	.0206	.0236
.20	.0026	.0038	.0061	.0091	.0123	.0156	.0186	.0231
.25	-.0196	-.0138	-.0076	-.0013	.0048	.0105	.0154	.0223
.30	-.0418	-.0314	-.0213	-.0116	-.0027	.0053	.0121	.0215
.35	-.0640	-.0491	-.0350	-.0219	-.0101	.0002	.0088	.0207

Table U.8 Values ν from (U.21) as function of kh;
γ = 0.7267, γ_s = 0.88, μ = 0.13.

U.5 Conclusion.

In the present appendix some excercises have been carried out in order to get some insight in the problem of choosing wave breaking parameters when the wave propagation computation is carried out using another wave period measure than the peak period. It has been shown that the parameter setting can not be carried out in a unique way, given experience and validation of parameter setting in the case of the wave propagation with T_p. One has to focus to a specific region in space, within the computational region, where the quality of the wave height prediction is especially important.

It is stressed that the methods given in this appendix do not give an answer which can be used in practical cases with great confidence. Moreover, the problem of a wave frequency which changes due to wave dissipation is not considered at all. What is needed in fact is a new consideration of the wave data sets to obtain a new curve of optimal wave breaking parameter values, as was described in Battjes and Stive (1985) for the case of T_p. Because of more parameters involved in HISWA, it is not certain beforehand whether such an excercise leads to useful results.

It is certain that the problem of the choice of parameter setting in HISWA needs more attention than is given in the present report. This appendix has been included primarily to notice the problem, to give some indication of possible courses which might be useful (or not) to solve the problem, and to give some help in choosing the parameters in the mean time, until the question becomes settled.

APPENDIX V. Comparison of measured and with WAQUA computed current fields.

In this appendix the current computations with the model WAQUA are reported. As in appendix R, driving forces of the same HISWA computation ve35aa have been used. There are performed two sets of computations, one with a fine grid (these computations are denoted by ve35whx) and one with a coarse grid (denoted by ve35wkx). Variations in time-step and in aplying mass-flux corection terms have been applied. The differences between the various computations have been given in Table V.0 below. In all cases the computation time was 20 minutes physical time.

computation	grid	Δt	mass-flux correction
ve35wh1	76×67	3.0 s	-
ve35wh2	76×67	1.5 s	-
ve35wh3	76×67	3.0 s	+
ve35wh4	76×67	1.5 s	+
ve35wk1	26×23	6.0 s	-
ve35wk2	26×23	3.0 s	-
ve35wk3	26×23	6.0 s	+
ve35wk4	26×23	3.0 s	+

Table V.0 Overview of the WAQUA computations

The computed velocity fields have been analyzed in the same way as was done in appendix R for the ODYSSEE current fields. As these computations were carried out as part of another project, a more extensive analysis will appear elsewhere.

To ease the visualization, the current fields after 15 minutes of computational time have been given in Figures 83 to 90; the current vectors on the computational grid are shown. Because in WAQUA the free surface elevation is computed together with the velocities (whereas in ODYSSEE a rigid-lid approximation is used), graphs of the time histories of the water level and the current velocity for a selected grid point are given in Figs. 91 to 98. These Figures show that the computations go to their equilibium value.

It follows from Table V.65 that the computations give less variation in absolute current values than the measurements (see the standard deviations). the currents computed on the large grid are more uniform ("smeared out") than those computed on the small grid, which is as expected. The mass-flux correction gives a more uniform current field than when it is not applied. Also the deviations with the measured current field are slightly larger in the computations with mass-flux correction than in the ones without that correction. The current fields computed with WAQUA are not significantly better than those computed with ODYSSEE (see appendix R).

6.5	8.6	11.0	15.7	14.2	10.9	6.9	5.3	3.4
11.1	12.2	13.7	11.8	11.6	16.3	8.5	7.0	6.2
11.9	13.6	10.1	2.3	3.4	14.6	7.4	7.8	6.3
12.9	14.1	10.6	8.4	16.4	20.0	15.8	15.9	14.6
10.0	11.2	10.4	8.4	17.8	25.6	24.6	27.3	24.3
7.8	9.5	10.4	10.3	9.3	10.7	10.4	10.8	10.1
4.9	6.1	6.9	8.0	6.6	6.8	5.5	5.3	4.6
4.1	4.1	5.4	7.5	7.0	6.5	4.8	4.0	3.7
2.4	3.1	4.1	5.9	5.8	6.0	4.3	3.3	1.8

Table V.1 Case ve35vh1, current velocities u, in cm/s.

-76.	-41.	-24.	-7.	12.	22.	32.	48.	75.
-83.	-65.	-46.	-18.	19.	50.	58.	66.	81.
-88.	-83.	-79.	-76.	105.	91.	80.	87.	91.
-91.	-98.	-112.	178.	144.	114.	100.	93.	91.
-96.	-110.	-123.	-167.	122.	105.	98.	94.	91.
-99.	-116.	-130.	-159.	151.	123.	111.	102.	93.
-97.	-119.	-137.	-158.	171.	147.	130.	114.	96.
-97.	-129.	-151.	-165.	179.	160.	145.	126.	100.
-113.	-163.	-171.	-174.	-179.	174.	166.	155.	118.

Table V.2 Case ve35vh1, current directions θ, in degrees.

-6.3	-5.7	-4.5	-2.0	3.0	4.1	3.7	3.9	3.3
-11.1	-11.1	-9.9	-3.6	3.8	12.5	7.2	6.4	6.1
-11.9	-13.5	-9.9	-2.3	3.3	14.6	7.3	7.7	6.3
-12.9	-14.0	-9.8	0.3	9.5	18.3	15.6	15.9	14.6
-9.9	-10.5	-8.7	-1.9	15.1	24.8	24.3	27.2	24.3
-7.7	-8.6	-7.9	-3.7	4.5	9.0	9.7	10.6	10.1
-4.9	-5.3	-4.7	-3.0	1.0	3.8	4.2	4.8	4.6
-4.0	-3.1	-2.6	-2.0	0.1	2.2	2.8	3.3	3.6
-2.2	-0.9	-0.6	-0.7	-0.1	0.7	1.0	1.4	1.6

Table V.3 Case ve35vh1, current velocities ux, in cm/s.

1.6	6.4	10.0	15.6	13.9	10.1	5.8	3.5	0.9
1.3	5.2	9.5	11.2	11.0	10.4	4.5	2.9	1.0
0.3	1.6	2.0	0.6	-0.8	-0.4	1.3	0.5	-0.2
-0.2	-2.0	-3.9	-8.4	-13.3	-8.2	-2.7	-0.9	-0.2
-1.1	-3.8	-5.8	-8.2	-9.4	-6.5	-3.2	-1.8	-0.5
-1.2	-4.1	-6.8	-9.6	-8.1	-5.8	-3.7	-2.2	-0.5
-0.6	-2.9	-5.0	-7.4	-6.5	-5.7	-3.6	-2.2	-0.5
-0.5	-2.6	-4.7	-7.2	-7.0	-6.1	-4.0	-2.4	-0.6
-0.9	-3.0	-4.1	-5.9	-5.8	-5.9	-4.1	-3.0	-0.8

Table V.4 Case ve35vh1, current velocities uy, in cm/s.

5.7	8.2	10.5	14.7	13.2	11.7	7.5	5.6	3.6
9.8	12.2	14.8	12.4	11.2	15.9	9.3	7.5	6.1
10.9	13.0	11.1	3.2	3.7	12.8	8.6	7.7	6.5
12.4	13.0	11.4	8.7	15.9	20.7	16.1	16.0	14.6
9.7	10.3	10.7	8.9	17.5	25.3	24.3	27.1	24.2
8.4	8.5	9.5	10.9	10.2	10.6	10.1	10.6	10.0
5.8	5.8	5.8	7.6	6.6	6.6	5.2	5.0	4.7
4.7	4.3	5.1	6.4	6.3	6.0	4.5	3.7	3.9
2.6	3.3	4.2	5.6	5.3	5.4	4.0	3.2	2.0

Table V.5 Case ve35vh2, current velocities u, in cm/s.

-76.	-45.	-25.	-9.	8.	22.	34.	48.	75.
-83.	-65.	-47.	-20.	17.	48.	61.	70.	84.
-87.	-82.	-80.	-87.	112.	95.	89.	87.	89.
-91.	-98.	-111.	180.	146.	119.	101.	94.	91.
-94.	-108.	-123.	-166.	126.	107.	99.	94.	91.
-96.	-114.	-132.	-161.	156.	129.	113.	102.	93.
-95.	-120.	-142.	-163.	174.	152.	133.	114.	95.
-99.	-136.	-156.	-169.	178.	164.	149.	127.	99.
-115.	-165.	-173.	-177.	180.	175.	170.	157.	119.

Table V.6 Case ve35vh2, current directions θ, in degrees.

-5.55	-5.74	-4.50	-2.35	1.76	4.42	4.14	4.17	3.45
-9.71	-11.05	-10.85	-4.31	3.33	11.73	8.11	7.07	6.11
-10.88	-12.92	-10.93	-3.15	3.43	12.72	8.59	7.71	6.49
-12.44	-12.92	-10.58	0.02	8.85	17.99	15.79	15.91	14.58
-9.71	-9.83	-9.02	-2.14	14.21	24.17	23.98	26.99	24.19
-8.37	-7.82	-7.07	-3.61	4.13	8.25	9.25	10.35	10.03
-5.74	-5.04	-3.54	-2.24	0.73	3.06	3.81	4.58	4.72
-4.65	-2.95	-2.06	-1.26	0.26	1.64	2.31	2.94	3.81
-2.36	-0.89	-0.52	-0.32	0.04	0.43	0.71	1.25	1.72

Table V.7 Case ve35vh2, current velocities ux, in cm/s.

1.4	5.8	9.5	14.5	13.1	10.8	6.2	3.8	0.9
1.1	5.2	10.0	11.6	10.7	10.7	4.6	2.5	0.7
0.5	1.7	1.9	0.1	-1.4	-1.2	0.2	0.4	0.2
-0.2	-1.7	-4.2	-8.7	-13.2	-10.2	-3.2	-1.2	-0.2
-0.7	-3.2	-5.8	-8.7	-10.3	-7.5	-3.7	2.0	-0.5
-0.9	-3.4	-6.3	-10.3	-9.3	-6.7	-4.0	-2.2	-0.5
-0.5	-2.9	-4.6	-7.2	-6.6	-5.8	-3.6	-2.1	-0.5
-0.8	-3.1	-4.7	-6.3	-6.3	-5.8	-3.9	-2.3	-0.6
-1.1	-3.2	-4.2	-5.6	-5.3	-5.4	-3.9	-3.0	-0.9

Table V.8 Case ve35vh2, current velocities uy, in cm/s.

4.9	8.2	10.3	14.2	11.9	10.7	7.5	5.8	3.5
9.9	12.6	15.1	15.5	15.4	14.0	8.8	7.6	6.3
12.0	14.1	11.3	3.8	3.2	13.7	8.4	8.5	6.2
14.2	14.7	11.0	7.5	14.1	19.7	16.6	16.3	14.9
11.9	11.5	10.5	10.1	14.8	23.9	23.4	26.1	23.7
10.6	10.1	9.8	12.1	11.4	11.7	11.3	12.1	10.7
6.4	7.1	7.0	8.8	7.5	6.8	5.8	6.0	4.9
4.2	4.9	5.3	6.7	6.7	6.5	5.1	4.1	3.0
1.6	3.1	3.9	5.0	5.1	5.7	4.1	2.8	1.1

Table V.9 Case we35vh3, current velocities u, in cm/s.

-77.	-41.	-22.	-6.	5.	16.	29.	43.	72.
-83.	-60.	-41.	-16.	15.	38.	52.	68.	85.
-87.	-79.	-72.	-66.	89.	83.	82.	89.	82.
-90.	-93.	-109.	-170.	145.	117.	100.	93.	91.
-92.	-103.	-125.	-157.	128.	107.	98.	94.	92.
-95.	-114.	-137.	-163.	158.	127.	110.	101.	91.
-97.	-125.	-147.	-162.	178.	154.	130.	114.	100.
-99.	-131.	-153.	-162.	-169.	174.	153.	134.	105.
-112.	-149.	-164.	-169.	-170.	-178.	173.	162.	125.

Table V.10 Case we35vh3, current directions θ, in degrees.

-4.8	-5.4	-3.8	-1.6	1.0	2.9	3.6	3.9	3.3
-9.9	-10.9	-9.9	-4.2	4.1	8.7	6.9	7.0	6.2
-12.0	-13.8	-10.7	-3.5	3.2	13.6	8.4	8.5	6.2
-14.2	-14.7	-10.4	-1.4	8.0	17.5	16.3	16.3	14.9
-11.9	-11.2	-8.6	-3.9	11.6	22.9	23.1	26.1	23.7
-10.6	-9.2	-6.6	-3.5	4.2	9.4	10.6	11.9	10.7
-6.4	-5.8	-3.8	-2.7	0.3	3.0	4.5	5.5	4.9
-4.1	-3.7	-2.4	-2.1	-1.3	0.7	2.3	2.9	2.9
-1.5	-1.6	-1.1	-0.9	-0.9	-0.2	0.5	0.8	0.9

Table V.11 Case we35vh3, current velocities ux, in cm/s.

1.1	6.1	9.5	14.2	11.9	10.3	6.6	4.3	1.1
1.2	6.2	11.4	14.9	14.8	11.0	5.4	2.8	0.6
0.6	2.8	3.5	1.6	0.1	1.7	1.1	0.2	0.8
-0.1	-0.8	-3.5	-7.4	-11.5	-9.0	-2.8	-0.9	-0.3
-0.4	-2.6	-6.0	-9.3	-9.1	-6.9	-3.4	-1.8	-0.7
-0.9	-4.2	-7.2	-11.6	-10.6	-7.1	-3.9	-2.2	-0.2
-0.8	-4.0	-5.9	-8.4	-7.5	-6.1	-3.7	-2.4	-0.8
-0.7	-3.2	-4.7	-6.4	-6.6	-6.4	-4.6	-2.8	-0.8
-0.6	-2.7	-3.7	-4.9	-5.1	-5.7	-4.1	-2.7	-0.6

Table V.12 Case we35vh3, current velocities uy, in cm/s.

5.2	7.9	10.0	13.8	12.7	11.8	7.7	5.7	3.4
9.5	11.4	14.0	15.7	14.1	15.0	9.4	7.6	6.0
10.7	13.1	12.6	4.3	2.6	12.6	8.8	7.9	6.4
12.5	14.1	12.4	7.0	14.1	20.8	16.6	16.4	14.8
10.2	11.6	11.3	10.3	15.3	24.2	23.1	25.7	23.4
9.4	9.9	9.5	12.1	11.8	12.0	11.0	11.7	10.5
6.3	7.0	6.4	7.5	7.0	6.8	5.6	5.7	4.7
4.4	5.2	5.6	6.6	6.3	6.1	4.7	3.8	2.9
1.8	3.5	4.4	5.8	5.3	5.5	3.8	2.7	1.1

Table V.13 Case ve35vh4, current velocities u, in cm/s.

-78.	-44.	-25.	-10.	5.	19.	30.	44.	73.
-85.	-64.	-46.	-21.	12.	41.	55.	67.	83.
-88.	-80.	-73.	-68.	89.	88.	85.	85.	89.
-90.	-92.	-104.	-166.	146.	120.	101.	94.	91.
-92.	-102.	-122.	-156.	130.	109.	100.	95.	92.
-94.	-110.	-133.	-163.	157.	129.	113.	102.	91.
-96.	-118.	-140.	-163.	172.	152.	132.	115.	100.
-99.	-127.	-149.	-166.	-178.	170.	155.	135.	104.
-112.	-148.	-163.	-171.	-176.	180.	174.	164.	124.

Table V.14 Case ve35vh4, current directions θ, in degrees.

-5.0	-5.5	-4.2	-2.4	1.1	3.8	3.8	4.0	3.3
-9.4	-10.3	-10.0	-5.6	2.9	9.8	7.7	7.1	6.0
-10.7	-12.8	-12.1	-4.0	2.6	12.6	8.7	7.9	6.4
-12.5	-14.1	-12.1	-1.7	7.8	18.0	16.3	16.4	14.8
-10.2	-11.3	-9.6	-4.2	11.8	22.9	22.8	25.7	23.3
-9.4	-9.3	-7.0	-3.5	4.6	9.3	10.1	11.5	10.5
-6.2	-6.2	-4.1	-2.2	1.0	3.2	4.1	5.2	4.7
-4.3	-4.2	-2.9	-1.6	-0.2	1.1	2.0	2.7	2.8
-1.6	-1.9	-1.3	-0.9	-0.4	0.0	0.4	0.8	0.9

Table V.15 Case ve35vh4, current velocities ux, in cm/s.

1.0	5.7	9.0	13.6	12.6	11.2	6.7	4.1	1.0
0.9	5.0	9.8	14.6	13.8	11.3	5.4	3.0	0.7
0.4	2.4	3.7	1.6	0.0	0.5	0.8	0.7	0.2
-0.1	-0.6	-3.0	-6.8	-11.8	-10.4	-3.2	-1.2	-0.3
-0.4	-2.4	-5.9	-9.4	-9.8	-7.9	-4.0	-2.1	-0.8
-0.6	-3.3	-6.5	-11.6	-10.8	-7.6	-4.3	-2.4	-0.2
-0.6	-3.2	-4.9	-7.2	-6.9	-6.0	-3.8	-2.4	-0.8
-0.7	-3.1	-4.8	-6.4	-6.3	-6.0	-4.3	-2.7	-0.7
-0.7	-2.9	-4.2	-5.7	-5.3	-5.5	-3.8	-2.6	-0.6

Table V.16 Case ve35vh4, current velocities uy, in cm/s.

2.6	6.1	8.7	11.0	12.7	9.5	7.0	4.8	2.6
6.6	10.0	12.0	13.6	14.1	11.2	8.1	6.4	5.0
6.7	12.3	11.0	6.5	4.7	9.9	7.6	7.0	5.8
9.9	13.5	10.9	6.6	14.7	18.6	16.8	16.8	15.2
7.0	11.5	9.4	6.5	14.4	19.3	20.0	21.8	19.3
5.9	9.6	8.6	7.8	9.2	9.6	9.5	10.2	8.7
5.7	7.5	7.3	7.8	8.6	7.2	6.2	5.6	4.8
2.6	4.7	4.9	5.4	6.1	4.9	4.1	3.4	2.6
1.5	3.3	4.8	5.5	5.8	4.8	3.9	2.7	1.4

Table V.17 Case ve35vk1, current velocities u, in cm/s.

-77.	-39.	-19.	-8.	3.	14.	21.	32.	60.
-85.	-65.	-42.	-21.	12.	39.	48.	61.	79.
-88.	-80.	-72.	-63.	72.	81.	80.	82.	87.
-90.	-91.	-99.	-146.	135.	110.	98.	93.	91.
-92.	-100.	-114.	-147.	121.	105.	100.	95.	92.
-93.	-106.	-125.	-153.	146.	122.	112.	103.	95.
-95.	-113.	-139.	-162.	168.	148.	134.	117.	100.
-98.	-124.	-152.	-172.	173.	162.	151.	133.	107.
-107.	-148.	-167.	-177.	176.	172.	167.	156.	127.

Table V.18 Case ve35vk1, current directions θ, in dgrees.

-2.5	-3.8	-2.8	-1.6	0.7	2.3	2.5	2.5	2.3
-6.6	-9.0	-8.0	-4.9	2.9	7.0	6.0	5.6	4.9
-6.7	-12.1	-10.5	-5.8	4.5	9.8	7.5	7.0	5.8
-9.9	-13.5	-10.7	-3.7	10.4	17.5	16.6	16.8	15.2
-7.0	-11.3	-8.6	-3.5	12.4	18.7	19.8	21.7	19.3
-5.8	-9.3	-7.0	-3.6	5.1	8.2	8.8	9.9	8.7
-5.7	-6.9	-4.8	-2.4	1.8	3.8	4.4	5.0	4.7
-2.6	-3.9	-2.3	-0.8	0.8	1.5	2.0	2.5	2.4
-1.4	-1.7	-1.0	-0.3	0.4	0.6	0.8	1.1	1.1

Table V.19 Case ve35vk1, current velocities ux, in cm/s.

0.6	4.7	8.3	10.9	12.6	9.2	6.6	4.1	1.3
0.6	4.3	8.9	12.6	13.8	8.7	5.4	3.1	0.9
0.3	2.2	3.5	3.0	1.5	1.6	1.4	0.9	0.3
0.1	-0.2	-1.7	-5.5	-10.4	-6.3	-2.4	-0.9	-0.2
-0.2	-1.9	-3.7	-5.4	-7.4	-5.1	-3.4	-2.0	-0.6
-0.3	-2.6	-5.0	-6.9	-7.6	-5.1	-3.6	-2.3	-0.7
-0.5	-2.9	-5.4	-7.5	-8.4	-6.1	-4.3	-2.6	-0.8
-0.4	-2.6	-4.3	-5.4	-6.1	-4.6	-3.6	-2.3	-0.7
-0.4	-2.8	-4.7	-5.5	-5.8	-4.7	-3.8	-2.5	-0.8

Table V.20 Case ve35vk1, current velocities uy, in cm/s.

2.8	6.2	8.9	11.1	12.6	9.2	6.8	4.7	2.6
7.2	10.2	12.5	13.7	14.2	11.0	7.9	6.2	4.9
7.3	12.9	11.6	5.7	5.3	10.1	7.4	6.9	5.8
10.4	14.4	11.3	6.0	15.4	18.5	16.7	16.8	15.3
7.2	12.1	9.9	6.4	15.2	19.6	20.2	22.0	19.6
6.1	10.0	9.0	7.8	9.2	9.5	9.5	10.3	9.0
5.9	7.7	7.6	8.0	8.3	7.0	6.1	5.8	5.1
2.7	4.8	5.1	5.7	6.3	5.1	4.3	3.7	2.8
1.5	3.3	4.9	5.8	6.4	5.3	4.3	3.0	1.5

Table V.21 Case ve35vk2, current velocities u, in cm/s.

-77.	-38.	-18.	-8.	4.	14.	21.	31.	62.
-85.	-64.	-41.	-19.	14.	39.	47.	60.	79.
-88.	-79.	-69.	-52.	67.	79.	78.	81.	87.
-90.	-91.	-100.	-158.	131.	107.	97.	92.	91.
-92.	-100.	-116.	-157.	119.	104.	99.	95.	91.
-93.	-106.	-126.	-155.	145.	120.	111.	101.	94.
-95.	-113.	-139.	-162.	168.	146.	132.	115.	99.
-97.	-124.	-151.	-168.	175.	161.	150.	131.	107.
-108.	-148.	-167.	-175.	178.	172.	167.	155.	127.

Table V.22 Case ve35vk2, current directions θ, in degrees.

-2.8	-3.8	-2.8	-1.5	1.0	2.3	2.4	2.4	2.3
-7.2	-9.2	-8.2	-4.4	3.4	6.9	5.8	5.4	4.8
-7.3	-12.6	-10.9	-4.5	4.9	9.9	7.2	6.8	5.8
-10.4	-14.4	-11.2	-2.3	11.7	17.7	16.6	16.8	15.3
-7.2	-11.9	-8.9	-2.6	13.3	19.0	19.9	21.9	19.5
-6.1	-9.6	-7.2	-3.3	5.3	8.3	8.9	10.1	9.0
-5.9	-7.1	-5.0	-2.5	1.7	4.0	4.5	5.2	5.0
-2.7	-4.0	-2.5	-1.1	0.6	1.7	2.2	2.8	2.6
-1.5	-1.8	-1.1	-0.5	0.2	0.7	1.0	1.2	1.2

Table V.23 Case ve35vk2, current velocities ux, in cm/s.

0.6	4.9	8.5	11.0	12.5	8.9	6.4	4.0	1.2
0.6	4.5	9.5	13.0	13.8	8.6	5.4	3.1	1.0
0.3	2.4	4.1	3.5	2.1	1.9	1.6	1.1	0.4
0.0	-0.3	-1.9	-5.6	-10.1	-5.5	-2.0	-0.7	-0.1
-0.2	-2.1	-4.3	-5.9	-7.4	-4.8	-3.0	-1.7	-0.5
-0.3	-2.8	-5.3	-7.1	-7.5	-4.8	-3.4	-2.0	-0.6
-0.5	-3.1	-5.7	-7.6	-8.1	-5.8	-4.1	-2.4	-0.8
-0.4	-2.7	-4.4	-5.5	-6.3	-4.8	-3.7	-2.4	-0.8
-0.5	-2.8	-4.8	-5.8	-6.4	-5.2	-4.2	-2.7	-0.9

Table V.24 Case ve35vk2, current velocities uy, in cm/s.

5.9	7.6	9.8	11.5	12.3	8.8	6.7	5.0	3.3
9.9	11.7	13.0	12.7	13.0	11.0	8.1	6.6	5.5
11.0	13.3	9.6	3.0	5.9	10.0	7.9	7.1	5.9
13.0	13.7	9.0	5.9	15.7	18.8	16.7	16.6	15.1
11.1	11.1	8.4	6.1	15.3	19.0	19.1	21.0	19.2
9.9	9.2	7.7	7.7	9.6	9.2	8.7	9.7	9.0
9.1	7.6	6.5	7.0	7.9	6.6	5.8	6.0	5.5
6.3	5.3	5.0	5.3	5.6	4.4	3.8	3.8	3.4
4.4	6.3	7.5	8.0	8.0	6.5	5.4	3.9	2.2

Table V.25 Case ve35vk3, current velocities u, in cm/s.

-76.	-39.	-20.	-7.	8.	22.	31.	44.	71.
-83.	-61.	-39.	-15.	22.	47.	56.	68.	82.
-87.	-78.	-72.	-63.	88.	85.	84.	86.	88.
-90.	-93.	-109.	-173.	128.	108.	98.	93.	91.
-92.	-103.	-126.	-166.	118.	105.	99.	95.	91.
-94.	-108.	-136.	-167.	144.	121.	110.	98.	92.
-95.	-115.	-144.	-172.	158.	140.	125.	108.	96.
-98.	-129.	-157.	-175.	170.	162.	150.	127.	104.
-119.	-163.	-174.	180.	175.	172.	167.	155.	125.

Table V.26 Case ve35vk3, current directions θ, in degrees.

-5.7	-4.8	-3.4	-1.4	1.7	3.4	3.4	3.5	3.1
-9.8	-10.2	-8.2	-3.3	4.8	8.0	6.7	6.1	5.4
-11.0	-13.0	-9.2	-2.6	5.9	9.9	7.8	7.1	5.9
-13.0	-13.7	-8.5	-0.7	12.4	17.8	16.5	16.6	15.1
-11.1	-10.8	-6.8	-1.4	13.5	18.3	18.8	21.0	19.2
-9.9	-8.8	-5.4	-1.7	5.7	7.8	8.1	9.6	9.0
-9.1	-6.9	-3.8	-0.9	3.0	4.2	4.8	5.7	5.5
-6.3	-4.2	-2.0	-0.4	0.9	1.3	1.9	3.0	3.3
-3.8	-1.9	-0.7	0.0	0.7	0.9	1.2	1.7	1.8

Table V.27 Case ve35vk3, current velocities ux, in cm/s.

1.4	5.9	9.2	11.4	12.2	8.1	5.7	3.5	1.1
1.2	5.7	10.0	12.3	12.1	7.5	4.6	2.4	0.7
0.6	2.8	2.9	1.3	0.2	0.8	0.8	0.5	0.2
0.0	-0.6	-3.0	-5.9	-9.7	-5.8	-2.2	-0.8	-0.2
-0.4	-2.5	-5.0	-5.9	-7.2	-5.0	-3.1	-1.7	-0.5
-0.6	-2.9	-5.5	-7.5	-7.7	-4.8	-3.0	-1.4	-0.3
-0.8	-3.2	-5.3	-6.9	-7.3	-5.0	-3.4	-1.9	-0.5
-0.9	-3.3	-4.6	-5.2	-5.5	-4.2	-3.3	-2.3	-0.8
-2.1	-6.0	-7.5	-8.0	-8.0	-6.4	-5.3	-3.5	-1.3

Table V.28 Case ve35vk3, current velocities uy, in cm/s.

6.0	7.6	9.6	11.3	12.1	8.6	6.4	4.8	3.2
10.1	11.5	13.0	12.6	13.3	11.0	7.8	6.4	5.4
11.3	13.4	9.9	3.2	6.0	10.4	7.5	7.0	6.0
13.3	14.4	9.1	5.2	16.4	18.6	16.6	16.8	15.5
11.2	12.0	8.8	6.1	16.1	19.3	19.4	21.4	20.0
9.9	9.8	8.4	8.0	9.7	9.2	8.8	9.9	9.7
9.1	7.8	7.2	7.5	8.0	6.7	5.8	5.9	6.4
6.1	5.4	5.3	5.7	6.0	4.7	3.8	3.8	4.2
4.2	6.0	7.3	7.9	8.3	6.9	5.9	4.6	2.9

Table V.29 Case ve35vk4, current velocities u, in cm/s.

-76.	-39.	-20.	-6.	10.	22.	30.	44.	71.
-83.	-60.	-39.	-14.	22.	47.	55.	66.	81.
-87.	-77.	-68.	-44.	80.	83.	80.	83.	88.
-90.	-92.	-106.	179.	125.	105.	96.	92.	91.
-92.	-103.	-126.	-175.	116.	104.	98.	93.	91.
-94.	-109.	-137.	-170.	142.	119.	109.	95.	90.
-95.	-116.	-145.	-171.	159.	139.	125.	106.	94.
-99.	-131.	-156.	-171.	174.	163.	154.	128.	102.
-118.	-163.	-174.	-178.	177.	173.	170.	159.	125.

Table V.30 Case ve35vk4, current directions θ, in degrees.

-5.8	-4.8	-3.3	-1.2	2.0	3.2	3.2	3.3	3.0
-10.0	-10.0	-8.1	-3.0	5.0	8.0	6.4	5.9	5.3
-11.3	-13.1	-9.2	-2.2	5.9	10.3	7.4	6.9	6.0
-13.3	-14.4	-8.8	0.1	13.5	18.0	16.6	16.8	15.5
-11.2	-11.7	-7.1	-0.5	14.5	18.7	19.2	21.4	20.0
-9.9	-9.3	-5.8	-1.4	6.0	8.0	8.3	9.8	9.7
-9.1	-7.0	-4.2	-1.2	2.8	4.4	4.7	5.7	6.4
-6.1	-4.1	-2.2	-0.8	0.6	1.4	1.7	3.0	4.1
-3.7	-1.8	-0.8	-0.2	0.4	0.8	1.0	1.7	2.4

Table V.31 Case ve35vk4, current velocities ux, in cm/s.

1.5	5.9	9.1	11.3	11.9	7.9	5.5	3.4	1.1
1.2	5.8	10.2	12.2	12.4	7.5	4.5	2.6	0.8
0.6	3.0	3.7	2.3	1.1	1.2	1.3	0.8	0.2
-0.1	-0.4	-2.4	-5.2	-9.3	-4.7	-1.7	-0.7	-0.2
-0.5	-2.7	-5.2	-6.1	-7.0	-4.6	-2.7	-1.3	-0.3
-0.6	-3.2	-6.2	-7.9	-7.6	-4.5	-2.8	-0.9	-0.1
-0.9	-3.5	-5.9	-7.5	-7.5	-5.0	-3.3	-1.6	-0.4
-0.9	-3.5	-4.9	-5.6	-6.0	-4.5	-3.4	-2.3	-0.8
-2.0	-5.8	-7.3	-7.9	-8.2	-6.8	-5.8	-4.3	-1.6

Table V.32 Case ve35vk4, current velocities uy, in cm/s.

5.9	3.0	-2.7	1.8	0.8	0.1	-1.0	-0.2	0.3
10.2	1.9	-0.5	-3.9	-5.8	4.7	1.2	0.1	0.0
1.4	-3.3	-5.2	-2.8	0.2	2.7	0.5	1.9	1.5
-0.8	2.0	0.1	1.9	-0.9	2.2	2.1	4.4	4.3
-4.7	-2.9	0.4	-0.2	-6.4	-3.6	-4.6	-2.5	-4.1
-3.9	-1.8	-1.6	3.9	3.0	3.2	2.8	3.9	4.2
-4.8	-3.0	-7.3	-2.2	-0.9	-0.8	-5.8	2.1	1.0
-1.4	-3.3	-3.8	-3.7	-4.1	-2.1	-5.5	0.5	2.3
-1.0	-4.0	-2.9	-2.0	-1.9	-0.8	-2.3	-0.2	-0.5

Table V.33 Case ve35vhl, deviations for u, in cm/s.

9.	-176.	-138.	-112.	-72.	-56.	-35.	-7.	52.
-216.	-201.	-164.	-114.	-47.	9.	30.	51.	85.
90.	-242.	-232.	-230.	86.	79.	72.	77.	-84.
84.	-278.	-289.	247.	196.	134.	106.	95.	92.
75.	51.	33.	-106.	155.	121.	110.	101.	98.
67.	35.	19.	-48.	214.	162.	138.	115.	97.
65.	18.	-40.	-35.	274.	203.	174.	174.	113.
63.	-31.	-13.	-84.	248.	227.	198.	216.	122.
29.	-87.	-40.	-78.	-88.	259.	225.	298.	155.

Table V.34 Case ve35vhl, deviations for θ, in degrees.

-6.4	-1.7	1.1	1.6	1.6	1.8	0.6	0.8	0.4
-10.4	-3.6	-3.2	-1.9	-3.3	3.7	0.8	-0.3	-0.0
-1.5	2.2	3.7	2.3	0.3	2.9	0.4	2.0	11.0
0.7	-1.8	0.6	-2.1	-1.1	1.5	1.9	4.4	4.3
4.6	2.8	0.5	-6.1	-5.2	-3.3	-4.1	-2.4	-3.9
3.7	1.3	2.4	-1.4	1.7	3.1	2.9	3.9	4.2
4.3	1.3	-3.0	2.5	2.7	-0.4	-3.9	3.2	1.2
1.1	-2.1	4.2	-3.7	-3.8	-1.1	-3.4	3.3	2.3
0.4	-2.6	4.0	0.2	0.0	0.1	-2.4	4.3	-0.3

Table V.35 Case ve35vhl, deviations for ux, in cm/s.

2.2	2.5	-2.4	2.2	0.5	-0.5	-1.4	-1.0	-0.3
0.6	-2.0	-3.1	-4.4	-4.9	2.8	1.1	1.1	1.4
0.7	-4.4	-4.9	-1.7	-1.9	-2.8	0.3	-0.5	-0.6
1.0	-2.0	-4.5	-2.3	0.3	-2.1	-1.2	-0.5	-0.0
1.2	0.8	-1.7	-0.7	3.8	1.6	2.8	1.9	3.0
1.7	1.3	-0.6	-3.6	-2.5	-1.1	-0.2	-0.6	-0.1
2.4	3.3	9.0	1.2	0.8	0.7	4.3	0.6	0.5
1.4	4.7	1.4	3.8	3.3	1.8	4.3	1.2	-0.1
1.1	3.9	1.2	2.0	1.9	0.8	1.5	-0.9	0.5

Table V.36 Case ve35vhl, deviations for uy, in cm/s.

5.1	2.5	-3.1	0.8	-0.2	0.9	-0.4	0.1	0.4
8.9	1.8	0.6	-3.3	-6.2	4.3	2.0	0.6	0.0
0.4	-3.8	-4.2	-1.9	0.6	0.9	1.6	1.8	1.7
-1.3	0.9	0.9	2.2	-1.4	2.8	2.3	4.4	4.3
-5.0	-3.8	0.6	0.3	-6.7	-3.9	-4.9	-2.8	-4.2
-3.3	-2.8	-2.6	4.5	4.0	3.1	2.5	3.7	4.2
-3.9	-3.3	-8.4	-2.6	-0.9	-1.0	-6.1	1.8	1.1
-0.7	-3.1	-4.1	-4.7	-4.8	-2.6	-5.8	0.2	2.4
-0.8	-3.7	-2.8	-2.3	-2.4	-1.4	-2.6	-0.3	-0.3

Table V.37 Case ve35vh2, deviations for u, in cm/s.

9.	-180.	-139.	-114.	-76.	-56.	-33.	-7.	52.
-216.	-201.	-165.	-116.	-49.	7.	33.	55.	88.
91.	-241.	-233.	-241.	93.	83.	81.	77.	-86.
84.	-278.	-288.	249.	198.	139.	107.	96.	92.
77.	53.	33.	-105.	159.	123.	111.	101.	98.
70.	37.	17.	-50.	219.	168.	140.	115.	97.
67.	17.	-45.	-40.	277.	209.	177.	174.	112.
61.	-38.	-18.	-88.	247.	231.	202.	217.	121.
27.	-89.	-42.	-81.	271.	260.	229.	300.	156.

Table V.38 Case ve35vh2, deviations for θ, in degrees.

-5.6	-1.8	1.1	1.2	0.4	2.2	1.1	1.0	0.5
-9.1	-3.6	-4.2	-2.7	-3.8	2.9	1.7	0.4	0.0
-0.4	2.8	2.7	1.4	0.5	1.1	1.7	1.9	11.2
1.2	-0.8	-0.1	-2.3	-1.8	1.2	2.1	4.4	4.3
4.8	3.5	0.2	-6.3	-6.1	-3.9	-4.5	-2.6	-4.0
3.0	2.1	3.3	-1.3	1.3	2.4	2.5	3.6	4.2
3.4	1.6	-1.8	3.3	2.4	-1.1	-4.4	3.0	1.3
0.4	-1.9	4.7	-3.0	-3.7	-1.7	-3.9	2.9	2.5
0.3	-2.6	4.1	0.5	0.2	-0.2	-2.7	4.1	-0.1

Table V.39 Case ve35vh2, deviations for ux, in cm/s.

1.9	1.8	-3.0	1.1	-0.3	0.2	-1.0	-0.7	-0.3
0.5	-2.0	-2.5	-4.0	-5.2	3.1	1.1	0.7	1.1
0.9	-4.3	-5.0	-2.1	-2.4	-3.6	-0.8	-0.6	-0.2
1.0	-1.7	-4.7	-2.6	0.4	-4.1	-1.7	-0.8	-0.1
1.6	1.4	-1.7	-1.1	2.9	0.5	2.3	1.7	3.0
1.9	2.1	-0.1	-4.3	-3.8	-2.0	-0.5	-0.7	-0.1
2.5	3.3	9.5	1.3	0.7	0.6	4.3	0.7	0.6
1.1	4.2	1.5	4.7	4.1	2.1	4.3	1.3	-0.1
1.0	3.7	1.1	2.2	2.4	1.4	1.7	-0.8	0.4

Table V.40 Case ve35vh2, deviations for uy, in cm/s.

4.3	2.6	-3.4	0.4	-1.5	-0.1	-0.4	0.3	0.3
9.0	2.2	1.0	-0.2	-2.1	2.3	1.5	0.6	0.2
1.6	-2.8	-4.0	-1.3	0.1	1.8	1.5	2.6	1.4
0.5	2.6	0.6	1.0	-3.2	1.8	2.8	4.8	4.6
-2.8	-2.6	0.4	1.5	-9.4	-5.3	-5.7	-3.7	-4.7
-1.2	-1.2	-2.3	5.7	5.2	4.2	3.7	5.2	4.9
-3.2	-2.0	-7.2	-1.4	0.0	-0.8	-5.5	2.7	1.3
-1.3	-2.5	-3.9	-4.4	-4.4	-2.1	-5.2	0.5	1.6
-1.7	-4.0	-3.2	-2.9	-2.6	-1.1	-2.5	-0.8	-1.2

Table V.41 Case ve35vh3, deviations for u, in cm/s.

8.	-176.	-136.	-111.	-79.	-62.	-38.	-12.	49.
-216.	-196.	-159.	-112.	-51.	-3.	24.	53.	89.
91.	-238.	-225.	-220.	70.	71.	74.	79.	-93.
85.	-273.	-286.	-101.	197.	137.	106.	95.	92.
79.	58.	31.	-96.	161.	123.	110.	101.	99.
71.	37.	12.	-52.	221.	166.	137.	114.	95.
65.	12.	-50.	-39.	281.	211.	174.	174.	117.
61.	-33.	-15.	-81.	-100.	241.	206.	224.	127.
30.	-73.	-33.	-73.	-79.	-93.	232.	305.	162.

Table V.42 Case ve35vh3, deviations for θ, in degrees.

-4.8	-1.4	1.7	2.0	-0.4	0.6	0.5	0.8	0.4
-9.3	-3.5	-3.3	-2.5	-3.0	-0.1	0.5	0.3	0.1
-1.6	1.9	2.9	1.1	0.3	2.0	1.5	2.7	10.9
-0.5	-2.5	0.0	-3.7	-2.6	0.7	2.6	4.8	4.6
2.7	2.1	0.6	-8.1	-8.7	-5.2	-5.4	-3.5	-4.5
0.8	0.7	3.7	-1.2	1.4	3.5	3.8	5.2	4.9
2.8	0.8	-2.1	2.9	2.0	-1.2	-3.7	3.8	1.4
1.0	-2.6	4.4	-3.8	-5.3	-2.7	-3.9	2.9	1.6
1.2	-3.3	3.6	-0.1	-0.7	-0.8	-2.9	3.7	-1.0

Table V.43 Case ve35vh3, deviations for ux, in cm/s.

1.7	2.2	-2.9	0.8	-1.5	-0.3	-0.7	-0.2	-0.2
0.5	-1.0	-1.1	-0.7	-1.1	3.3	2.0	1.0	1.0
0.9	-3.3	-3.5	-0.7	-0.9	-0.7	0.1	-0.8	0.4
1.1	-0.8	-4.1	-1.3	2.1	-2.9	-1.4	-0.5	-0.1
1.9	2.0	-1.9	-1.7	4.1	1.1	2.6	1.8	2.7
1.9	1.3	-1.0	-5.7	-5.1	-2.3	-0.5	-0.7	0.3
2.2	2.2	8.2	0.2	-0.2	0.3	4.2	0.4	0.2
1.2	4.1	1.4	4.6	3.8	1.5	3.7	0.7	-0.3
1.5	4.2	1.6	2.9	2.6	1.0	1.5	-0.5	0.8

Table V.44 Case ve35vh3, deviations for uy, in cm/s.

4.6	2.3	-3.7	-0.1	-0.7	1.0	-0.2	0.2	0.3
8.6	1.0	-0.1	-0.0	-3.3	3.3	2.1	0.7	-0.1
0.3	-3.8	-2.6	-0.8	-0.5	0.7	1.8	2.0	1.6
-1.2	1.9	2.0	0.5	-3.1	3.0	2.8	4.9	4.5
-4.4	-2.6	1.2	1.7	-8.9	-5.0	-6.0	-4.1	-5.1
-2.4	-1.4	-2.5	5.7	5.5	4.5	3.4	4.9	4.6
-3.4	-2.0	-7.8	-2.7	-0.5	-0.8	-5.8	2.5	1.1
-1.1	-2.1	-3.5	-4.6	-4.8	-2.5	-5.6	0.3	1.5
-1.6	-3.6	-2.6	-2.1	-2.4	-1.3	-2.7	-0.9	-1.2

Table V.45 Case ve35vh4, deviations for u, in cm/s.

7.	-179.	-139.	-115.	-79.	-59.	-37.	-11.	50.
-218.	-200.	-164.	-117.	-54.	-0.	27.	52.	87.
90.	-239.	-226.	-222.	70.	76.	77.	75.	-86.
85.	-272.	-281.	-97.	198.	140.	107.	96.	92.
79.	59.	34.	-95.	163.	125.	112.	102.	99.
72.	41.	16.	-52.	220.	168.	140.	115.	95.
66.	19.	-43.	-40.	275.	209.	176.	175.	117.
61.	-29.	-11.	-85.	-109.	237.	208.	225.	126.
30.	-72.	-32.	-75.	-85.	265.	233.	307.	161.

Table V.46 Case ve35vh4, deviations for θ, in degrees.

-5.1	-1.5	1.3	1.1	-0.3	1.5	0.7	0.8	0.4
-8.8	-2.8	-3.4	-4.0	-4.2	1.0	1.2	0.4	-0.1
-0.3	2.9	1.5	0.6	-0.4	0.9	1.8	2.1	11.2
1.2	-1.9	-1.6	-4.0	-2.8	1.2	2.6	4.9	4.5
4.3	2.0	-0.4	-8.3	-8.5	-5.1	-5.7	-3.9	-4.9
2.0	0.6	3.4	-1.2	1.8	3.5	3.4	4.8	4.6
3.0	0.4	-2.4	3.3	2.7	-0.9	-4.0	3.6	1.2
0.8	-3.2	3.9	-3.4	-4.2	-2.3	-4.2	2.7	1.5
1.0	-3.6	3.3	-0.0	-0.2	-0.5	-3.0	3.6	-0.9

Table V.47 Case ve35vh4, deviations for ux, in cm/s.

1.6	1.7	-3.4	0.2	-0.7	0.6	-0.6	-0.4	-0.2
0.2	-2.2	-2.7	-1.0	-2.1	3.7	1.9	1.2	1.1
0.8	-3.7	-3.2	-0.6	-1.0	-2.0	-0.2	-0.3	-0.3
1.1	-0.6	-3.6	-0.7	1.8	-4.3	-1.7	-0.8	-0.1
1.9	2.2	-1.8	-1.9	3.4	0.2	2.0	1.6	2.7
2.2	2.1	-0.3	-5.6	-5.3	-2.9	-0.9	-0.8	0.2
2.4	2.9	9.2	1.4	0.4	0.4	4.1	0.4	0.2
1.2	4.2	1.3	4.6	4.1	1.9	4.0	0.8	-0.2
1.4	3.9	1.1	2.2	2.4	1.3	1.8	-0.4	0.8

Table V.48 Case ve35vh4, deviations for uy, in cm/s.

2.0	0.5	-4.9	-2.8	-0.8	-1.3	-0.8	-0.6	-0.5
5.7	-0.4	-2.2	-2.1	-3.3	-0.5	0.8	-0.6	-1.1
-3.7	-4.6	-4.2	1.4	1.6	-2.0	0.6	1.2	1.0
-3.9	1.3	0.4	0.1	-2.5	0.8	3.0	5.3	4.8
-7.7	-2.7	-0.7	-2.1	-9.8	-9.9	-9.1	-8.0	-9.1
-5.9	-1.7	-3.5	1.4	2.9	2.1	1.9	3.3	2.9
-4.0	-1.6	-6.9	-2.4	1.1	-0.4	-5.1	2.4	1.2
-2.8	-2.6	-4.2	-5.7	-4.9	-3.7	-6.2	-0.1	1.1
-1.9	-3.8	-2.2	-2.4	-1.9	-2.0	-2.7	-0.8	-0.9

Table V.49 Case ve35vkl, deviations for u, in cm/s.

8.	-174.	-133.	-113.	-81.	-64.	-46.	-23.	37.
-218.	-201.	-160.	-117.	-54.	-2.	20.	46.	83.
90.	-239.	-225.	-217.	53.	69.	72.	72.	-88.
85.	-271.	-276.	-77.	187.	130.	104.	95.	92.
79.	61.	42.	-86.	154.	121.	112.	102.	99.
73.	45.	24.	-42.	209.	161.	140.	116.	99.
67.	24.	-42.	-39.	271.	205.	178.	177.	117.
62.	-26.	-14.	-91.	242.	229.	204.	223.	129.
35.	-72.	-36.	-81.	267.	257.	226.	299.	164.

Table V.50 Case ve35vkl, deviations for θ, in degrees.

-2.6	0.1	2.7	2.0	-0.7	0.0	-0.6	-0.6	-0.6
-6.0	-1.6	-1.4	-3.3	-4.2	-1.8	-0.4	-1.1	-1.2
3.7	3.6	3.1	-1.2	1.5	-1.8	0.6	1.2	10.6
3.8	-1.3	-0.3	-6.0	-0.2	0.7	2.9	5.3	4.8
7.5	2.1	0.6	-7.7	-7.9	-9.4	-8.7	-7.9	-8.9
5.5	0.6	3.3	-1.3	2.2	2.3	2.0	3.2	2.9
3.5	-0.3	-3.1	3.2	3.4	-0.3	-3.7	3.3	1.3
2.5	-2.9	4.5	-2.5	-3.2	-1.9	-4.2	2.5	1.1
1.2	-3.5	3.6	0.5	0.5	0.1	-2.5	4.0	-0.7

Table V.51 Case ve35vkl, deviations for ux, in cm/s.

1.2	0.7	-4.2	-2.5	-0.7	-1.4	-0.7	-0.4	0.1
-0.1	-2.9	-3.6	-3.0	-2.1	1.1	2.0	1.3	1.4
0.6	-3.8	-3.4	0.7	0.5	-0.8	0.4	-0.1	-0.1
1.2	-0.2	-2.3	0.6	3.2	-0.2	-1.0	-0.5	-0.1
2.1	2.7	0.3	2.1	5.8	2.9	2.7	1.6	2.8
2.5	2.9	1.2	-0.9	-2.1	-0.3	-0.2	-0.7	-0.3
2.5	3.3	8.6	1.1	-1.1	0.3	3.5	0.3	0.2
1.5	4.7	1.8	5.6	4.3	3.3	4.7	1.2	-0.2
1.6	4.1	0.6	2.3	1.9	2.0	1.9	-0.3	0.5

Table V.52 Case ve35vkl, deviations for uy, in cm/s.

2.2	0.6	-4.7	-2.8	-0.9	-1.6	-1.1	-0.8	-0.6
6.3	-0.1	-1.6	-2.0	-3.2	-0.6	0.6	-0.7	-1.2
-3.2	-4.0	-3.7	0.6	2.2	-1.8	0.4	1.1	1.0
-3.3	2.2	0.9	-0.5	-1.8	0.7	2.9	5.3	5.0
-7.5	-2.0	-0.2	-2.2	-9.0	-9.6	-9.0	-7.8	-8.9
-5.7	-1.4	-3.1	1.4	2.9	2.0	1.9	3.4	3.2
-3.7	-1.3	-6.6	-2.2	0.8	-0.6	-5.2	2.5	1.5
-2.7	-2.6	-4.1	-5.5	-4.8	-3.5	-6.0	0.2	1.3
-1.8	-3.8	-2.1	-2.1	-1.3	-1.5	-2.3	-0.6	-0.7

Table V.53 Case ve35vk2, deviations for u, in cm/s.

8.	-173.	-132.	-113.	-80.	-64.	-46.	-24.	39.
-218.	-200.	-159.	-115.	-52.	-2.	19.	46.	83.
90.	-238.	-222.	-206.	48.	67.	70.	71.	-88.
85.	-271.	-277.	-89.	183.	127.	103.	94.	92.
79.	61.	40.	-96.	152.	120.	111.	102.	98.
73.	45.	23.	-44.	208.	159.	138.	114.	98.
67.	24.	-42.	-39.	271.	203.	176.	175.	116.
63.	-26.	-13.	-87.	244.	228.	203.	221.	129.
34.	-72.	-36.	-79.	269.	257.	226.	298.	164.

Table V.54 Case ve35vk2, deviations for θ, in degrees.

-2.8	0.1	2.7	2.1	-0.4	0.0	-0.7	-0.7	-0.7
-6.5	-1.7	-1.5	-2.8	-3.7	-1.9	-0.6	-1.3	-1.2
3.2	3.1	2.8	0.1	1.9	-1.7	0.3	1.0	10.6
3.3	-2.2	-0.7	-4.6	1.1	0.9	2.9	5.3	5.0
7.3	1.5	0.3	-6.7	-7.0	-9.1	-8.5	-7.7	-8.7
5.3	0.3	3.1	-1.0	2.5	2.4	2.1	3.4	3.1
3.3	-0.4	-3.3	3.1	3.4	-0.2	-3.6	3.6	1.5
2.4	-2.9	4.3	-2.9	-3.4	-1.7	-4.0	2.8	1.3
1.2	-3.5	3.5	0.3	0.4	0.2	-2.4	4.1	-0.6

Table V.55 Case ve35vk2, deviations for ux, in cm/s.

1.2	0.9	-4.0	-2.4	-0.8	-1.6	-0.9	-0.5	-0.0
-0.0	-2.7	-3.0	-2.6	-2.1	1.0	1.9	1.3	1.4
0.6	-3.6	-2.8	1.2	1.1	-0.6	0.6	0.1	-0.1
1.2	-0.3	-2.5	0.5	3.5	0.7	-0.5	-0.3	0.0
2.1	2.5	-0.3	1.6	5.8	3.2	3.0	1.9	3.0
2.5	2.7	0.9	-1.1	-1.9	-0.0	0.1	-0.5	-0.2
2.5	3.1	8.4	1.0	-0.8	0.6	3.7	-0.4	0.3
1.5	4.6	1.7	5.5	4.0	3.1	4.5	1.1	-0.3
1.6	4.0	0.5	2.1	1.3	1.5	1.4	-0.6	0.4

Table V.56 Case ve35vk2, deviations for uy, in cm/s.

5.3	2.0	-3.8	-2.3	-1.1	-2.0	-1.2	-0.5	0.1
8.9	1.3	-1.2	-2.9	-4.4	-0.6	0.8	-0.3	-0.7
0.6	-3.5	-5.6	-2.1	2.8	-1.9	0.9	1.3	1.1
-0.7	1.5	-1.4	-0.6	-1.6	0.9	2.9	5.0	4.8
-3.6	-3.0	-1.6	-2.5	-8.9	-10.2	-10.1	-8.8	-9.2
-1.8	-2.1	-4.4	1.2	3.4	1.7	1.1	2.8	3.2
-0.5	-1.5	-7.7	-3.3	0.4	-1.0	-5.5	2.7	1.9
0.9	-2.0	-4.1	-5.9	-5.5	-4.2	-6.5	0.2	2.0
1.0	-0.8	0.5	0.1	0.3	-0.3	-1.1	0.4	-0.1

Table V.57 Case ve35vk3, deviations for u, in cm/s.

9.	-174.	-134.	-112.	-76.	-56.	-36.	-11.	48.
-216.	-197.	-157.	-111.	-44.	6.	28.	53.	86.
91.	-237.	-225.	-217.	69.	73.	76.	76.	-87.
85.	-273.	-286.	-104.	180.	128.	104.	95.	92.
79.	58.	30.	-105.	151.	121.	111.	102.	98.
72.	43.	13.	-56.	207.	160.	137.	111.	96.
67.	22.	-47.	-49.	261.	197.	169.	168.	113.
62.	-31.	-19.	-94.	239.	229.	203.	217.	126.
23.	-87.	-43.	276.	266.	257.	226.	298.	162.

Table V.58 Case ve35vk3, deviations for θ, in degrees.

-5.8	-0.9	2.2	2.1	0.3	1.1	0.4	0.3	0.2
-9.2	-2.7	-1.6	-1.7	-2.3	-0.8	0.2	-0.6	-0.7
-0.6	2.7	4.4	1.9	2.9	-1.7	0.9	1.3	10.6
0.7	-1.5	1.9	-3.0	1.7	1.1	2.8	5.0	4.7
3.4	2.5	2.4	-5.6	-6.8	-9.7	-9.7	-8.6	-9.0
1.5	1.1	5.0	0.6	2.9	2.0	1.3	2.9	3.2
0.1	-0.2	-2.1	4.7	4.7	0.1	-3.4	4.0	2.1
-1.2	-3.1	4.8	-2.2	-3.0	-2.0	-4.3	3.0	2.0
-1.2	-3.6	3.9	0.8	0.9	0.3	-2.2	4.5	-0.1

Table V.59 Case ve35vk3, deviations for ux, in cm/s.

2.0	1.9	-3.2	-1.9	-1.2	-2.4	-1.6	-0.9	-0.2
0.5	-1.5	-2.5	-3.3	-3.8	-0.1	1.1	0.7	1.2
0.9	-3.3	-4.0	-0.9	-0.8	-1.7	-0.2	-0.5	-0.2
1.2	-0.6	-3.5	0.2	3.9	0.3	-0.7	-0.4	-0.1
1.9	2.1	-0.8	1.6	6.0	3.1	3.0	2.0	3.0
2.2	2.6	0.7	-1.5	-2.2	-0.1	0.4	0.1	0.1
2.2	3.0	8.8	1.7	-0.0	1.3	4.5	0.9	0.5
1.0	4.0	1.5	5.8	4.8	3.7	5.0	1.3	-0.3
-0.0	0.8	-2.2	-0.1	-0.3	0.3	0.3	-1.4	0.1

Table V.60 Case ve35vk3, deviations for uy, in cm/s.

5.4	2.0	-4.0	-2.6	-1.4	-2.3	-1.5	-0.7	0.0
9.2	1.1	-1.2	-3.1	-4.1	-0.7	0.5	-0.5	-0.7
0.9	-3.4	-5.4	-1.9	2.9	-1.5	0.5	1.1	1.3
-0.4	2.2	-1.3	-1.2	-0.8	0.7	2.9	5.3	5.2
-3.5	-2.1	-1.3	-2.5	-8.1	-9.9	-9.7	-8.4	-8.4
-1.8	-1.5	-3.6	1.6	3.5	1.7	1.1	3.0	3.8
-0.5	-1.3	-7.0	-2.7	0.5	-0.9	-5.6	2.7	2.8
0.7	-2.0	-3.8	-5.5	-5.0	-3.9	-6.5	0.3	2.8
0.9	-1.1	0.3	-0.0	0.6	0.1	-0.7	1.0	0.6

Table V.61 Case ve35vk4, deviations for u, in cm/s.

9.	-174.	-134.	-111.	-75.	-56.	-37.	-11.	48.
-216.	-196.	-157.	-110.	-44.	6.	27.	51.	85.
91.	-236.	-221.	-198.	61.	71.	72.	73.	-87.
85.	-272.	-283.	248.	177.	125.	102.	94.	92.
79.	58.	30.	-114.	149.	120.	110.	100.	98.
72.	42.	12.	-59.	205.	158.	136.	108.	94.
67.	21.	-48.	-48.	262.	196.	169.	166.	111.
61.	-33.	-18.	-90.	243.	230.	207.	218.	124.
24.	-87.	-43.	-82.	268.	258.	229.	302.	162.

Table V.62 Case ve35vk4, deviations for θ, in degrees.

-5.9	-0.8	2.3	2.4	0.6	1.0	0.1	0.2	0.1
-9.4	-2.5	-1.4	-1.4	-2.1	-0.8	-0.1	-0.8	-0.8
-0.9	2.6	4.4	2.4	3.0	-1.3	0.5	1.1	10.8
0.4	-2.2	1.7	-2.3	2.9	1.2	2.9	5.3	5.2
3.3	1.7	2.1	-4.7	-5.8	-9.4	-9.3	-8.2	-8.2
1.5	0.6	4.6	0.9	3.2	2.2	1.5	3.1	3.9
0.1	-0.3	-2.4	4.4	4.5	0.3	-3.4	4.1	2.9
-1.0	-3.0	4.6	-2.6	-3.4	-2.0	-4.5	3.0	2.8
-1.1	-3.5	3.9	0.6	0.6	0.3	-2.4	4.5	0.5

Table V.63 Case ve35vk4, deviations for ux, in cm/s.

2.1	1.9	-3.4	-2.1	-1.5	-2.6	-1.7	-1.1	-0.2
0.5	-1.4	-2.4	-3.4	-3.6	-0.2	1.1	0.8	1.2
1.0	-3.0	-3.2	0.0	0.0	-1.2	0.3	-0.2	-0.2
1.1	-0.4	-3.0	0.8	4.3	1.4	-0.2	-0.3	-0.0
1.8	1.9	-1.1	1.4	6.2	3.5	3.4	2.4	3.2
2.2	2.3	0.1	-1.9	-2.1	0.2	0.7	0.6	0.3
2.1	2.7	8.2	1.1	-0.2	1.3	4.6	1.2	0.7
0.9	3.8	1.2	5.4	4.3	3.5	4.8	1.2	-0.3
0.1	1.1	-1.9	-0.0	-0.6	-0.1	-0.1	-2.1	-0.3

Table V.64 Case ve35vk4, deviations for uy, in cm/s.

case	vel.	meas. <|.|>	meas. s(|.|)	comp. <|.|>	comp. s(|.|)	deviation <|.|>	deviation s(|.|)
ve35vh1	u	10.12	6.18	9.56	5.45	2.59	1.94
ve35vh2	u	10.12	6.18	9.46	5.37	2.66	1.92
ve35vh3	u	10.12	6.18	9.72	5.28	2.60	1.99
ve35vh4	u	10.12	6.18	9.61	5.26	2.66	2.00
ve35vk1	u	10.12	6.18	8.49	4.57	2.88	2.37
ve35vk2	u	10.12	6.18	8.66	4.62	2.77	2.30
ve35vk3	u	10.12	6.18	8.99	4.25	2.70	2.54
ve35vk4	u	10.12	6.18	9.17	4.31	2.65	2.44
ve35vh1	ux	7.20	6.59	7.21	6.05	2.56	1.98
ve35vh2	ux	7.20	6.59	7.05	5.97	2.55	1.95
ve35vh3	ux	7.20	6.59	7.14	5.92	2.64	2.13
ve35vh4	ux	7.20	6.59	7.13	5.80	2.69	2.13
ve35vk1	ux	7.20	6.59	6.36	5.14	2.86	2.42
ve35vk2	ux	7.20	6.59	6.48	5.26	2.80	2.31
ve35vk3	ux	7.20	6.59	6.75	5.15	2.78	2.45
ve35vk4	ux	7.20	6.59	6.86	5.33	2.77	2.39
ve35vh1	uy	5.34	4.13	4.41	3.65	1.90	1.54
ve35vh2	uy	5.34	4.13	4.44	3.70	1.99	1.63
ve35vh3	uy	5.34	4.13	4.64	3.87	1.76	1.50
ve35vh4	uy	5.34	4.13	4.55	3.86	1.85	1.59
ve35vk1	uy	5.34	4.13	3.98	3.24	1.81	1.61
ve35vk2	uy	5.34	4.13	4.04	3.24	1.76	1.56
ve35vk3	uy	5.34	4.13	4.09	3.22	1.76	1.65
ve35vk4	uy	5.34	4.13	4.13	3.21	1.74	1.60

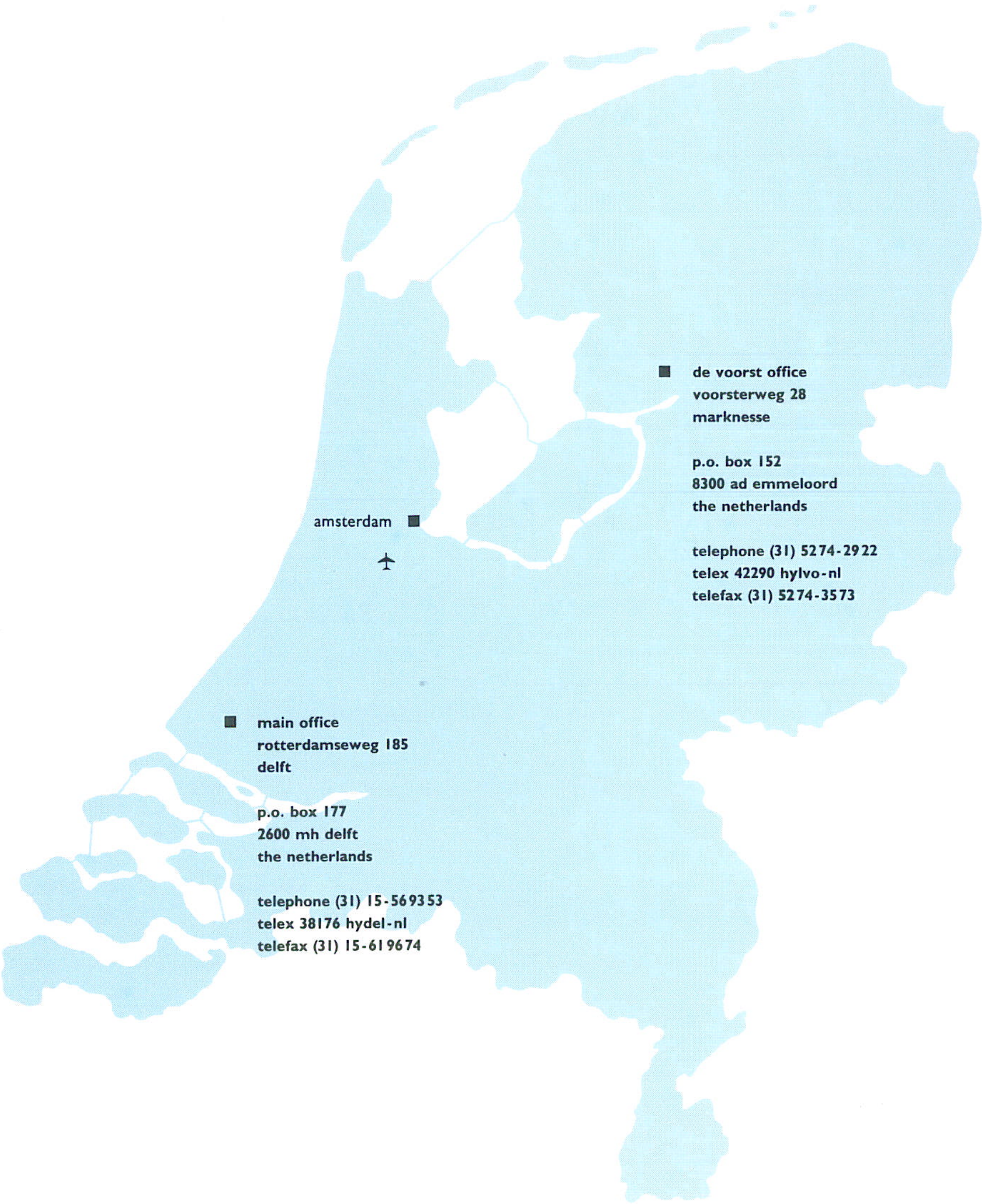
Table V.65 Mean and standard deviations of absolute values.

case		n	(Um) [cm]	(Uc) [cm]	s(Um) [cm]	s(Uc) [cm]	a [cm]	b	mae [cm]	rmse [cm]	rmses [cm]	rmseu [cm]	d	d1
ve35wh1	u	81	10.12	9.56	6.18	5.45	1.92	0.76	2.59	3.23	1.60	2.80	0.92	0.70
ve35wh2	u	81	10.12	9.46	6.18	5.37	1.96	0.74	2.66	3.28	1.72	2.79	0.91	0.69
ve35wh3	u	81	10.12	9.72	6.18	5.28	2.37	0.73	2.60	3.27	1.73	2.77	0.91	0.70
ve35wh4	u	81	10.12	9.61	6.18	5.26	2.33	0.72	2.66	3.32	1.80	2.80	0.91	0.69
ve35wk1	u	81	10.12	8.49	6.18	4.57	2.16	0.63	2.88	3.72	2.81	2.43	0.88	0.66
ve35wk2	u	81	10.12	8.66	6.18	4.62	2.22	0.64	2.77	3.59	2.67	2.40	0.88	0.67
ve35wk3	u	81	10.12	8.99	6.18	4.25	3.21	0.57	2.70	3.70	2.86	2.35	0.87	0.67
ve35wk4	u	81	10.12	9.17	6.18	4.31	3.26	0.58	2.65	3.59	2.73	2.34	0.87	0.67
ve35wh1	ux	81	1.41	1.74	9.69	9.28	0.46	0.90	2.56	3.23	0.99	3.08	0.97	0.82
ve35wh2	ux	81	1.41	1.69	9.69	9.11	0.44	0.89	2.55	3.21	1.12	3.00	0.97	0.82
ve35wh3	ux	81	1.41	1.34	9.69	9.21	0.09	0.89	2.64	3.39	1.06	3.22	0.97	0.82
ve35wh4	ux	81	1.41	1.32	9.69	9.13	0.08	0.88	2.69	3.42	1.15	3.22	0.97	0.81
ve35wk1	ux	81	1.41	1.37	9.69	8.09	0.28	0.77	2.86	3.74	2.18	3.03	0.95	0.79
ve35wk2	ux	81	1.41	1.40	9.69	8.25	0.29	0.79	2.80	3.62	2.00	3.02	0.96	0.79
ve35wk3	ux	81	1.41	1.45	9.69	8.40	0.32	0.80	2.78	3.70	1.91	3.17	0.96	0.80
ve35wk4	ux	81	1.41	1.52	9.69	8.58	0.36	0.82	2.77	3.65	1.73	3.21	0.96	0.80
ve35wh1	uy	81	-1.56	-1.18	6.59	5.63	0.06	0.80	1.90	2.44	1.38	2.01	0.96	0.79
ve35wh2	uy	81	-1.56	-1.27	6.59	5.65	-0.04	0.79	1.99	2.57	1.39	2.16	0.95	0.78
ve35wh3	uy	81	-1.56	-1.04	6.59	5.97	0.28	0.85	1.76	2.31	1.10	2.03	0.96	0.81
ve35wh4	uy	81	-1.56	-1.11	6.59	5.89	0.19	0.83	1.85	2.43	1.18	2.12	0.96	0.80
ve35wk1	uy	81	-1.56	-0.74	6.59	5.10	0.41	0.74	1.81	2.42	1.89	1.50	0.96	0.80
ve35wk2	uy	81	-1.56	-0.72	6.59	5.15	0.45	0.75	1.76	2.34	1.84	1.45	0.96	0.80
ve35wk3	uy	81	-1.56	-0.99	6.59	5.13	0.16	0.74	1.76	2.41	1.80	1.60	0.96	0.80
ve35wk4	uy	81	-1.56	-0.95	6.59	5.16	0.21	0.75	1.74	2.35	1.77	1.56	0.96	0.81

Table V.66 Primary statistical parameters for the current.

case		n	bias %	mae %	rmse %	rmses %	rmseu %	pes %	peu %	sd %	r2
ve35wh1	u	81	-5.49	25.57	31.88	15.82	27.68	24.61	75.39	31.60	0.73
ve35wh2	u	81	-6.46	26.31	32.38	16.97	27.57	27.48	72.52	31.92	0.73
ve35wh3	u	81	-3.96	25.73	32.30	17.07	27.43	27.92	72.08	32.26	0.72
ve35wh4	u	81	-5.05	26.31	32.86	17.79	27.63	29.30	70.70	32.67	0.71
ve35wk1	u	81	-16.06	28.46	36.76	27.82	24.02	57.28	42.72	33.27	0.71
ve35wk2	u	81	-14.44	27.38	35.47	26.35	23.73	55.22	44.78	32.59	0.73
ve35wk3	u	81	-11.12	26.72	36.58	28.27	23.21	59.73	40.27	35.07	0.69
ve35wk4	u	81	-9.40	26.24	35.51	26.95	23.12	57.59	42.41	34.45	0.70
ve35wh1	ux	81	23.31	181.84	229.51	70.19	218.51	9.35	90.65	229.74	0.89
ve35wh2	ux	81	19.99	181.01	227.56	79.66	213.16	12.25	87.75	228.09	0.89
ve35wh3	ux	81	-4.70	187.54	240.47	75.14	228.42	9.76	90.24	241.92	0.88
ve35wh4	ux	81	-6.20	190.68	242.88	81.74	228.72	11.33	88.67	244.32	0.87
ve35wk1	ux	81	-2.94	203.24	265.33	154.89	215.43	34.08	65.92	266.96	0.86
ve35wk2	ux	81	-0.42	198.44	257.01	142.08	214.16	30.56	69.44	258.61	0.86
ve35wk3	ux	81	3.08	197.55	262.69	135.64	224.96	26.66	73.34	264.31	0.86
ve35wk4	ux	81	7.62	196.52	258.78	122.72	227.83	22.49	77.51	260.27	0.86
ve35wh1	uy	81	24.29	121.92	156.67	88.82	129.06	32.14	67.86	155.74	0.87
ve35wh2	uy	81	18.47	127.65	164.75	89.30	138.45	29.38	70.62	164.73	0.85
ve35wh3	uy	81	32.94	112.78	148.14	70.46	130.31	22.62	77.38	145.33	0.88
ve35wh4	uy	81	28.80	118.64	156.13	75.98	136.40	23.68	76.32	154.41	0.87
ve35wk1	uy	81	52.59	116.35	155.14	121.67	96.25	61.51	38.49	146.86	0.91
ve35wk2	uy	81	54.07	113.07	150.45	118.37	92.87	61.90	38.10	141.28	0.92
ve35wk3	uy	81	36.33	113.23	154.83	115.79	102.78	55.93	44.07	151.44	0.90
ve35wk4	uy	81	38.94	111.77	151.19	113.41	99.98	56.27	43.73		

Table V.67 Secondary statistical parameters for the current.



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