

A rinse and repeat?

Dutch sea level rise historicised



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AR2A011

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Content	01
1 Introduction	02
1.1 History of water	02
1.2 Current situation	02
1.3 Arising questions	03
2 Methodology	04
2.1 Literature research	04
2.2 Timeline	04
3 The history of Dutch sea level rise	05
3.1 Scientific discovery	06
3.2 Public knowledge	10
3.3 Political action	12
3.4 Historicised timeline	14
4 Conclusion	15
4.1 Repeating mistakes	15
4.2 A future outlook	15
5 Bibliography	16

1 Introduction

The sea and the Netherlands have forever been both friend and foe, the sea being both a source of prosperity and an existential threat. Dutch history is marked by a continuous effort to control and contain water through technical innovation and infrastructural projects. Yet, as currently the sea rises steadily due to climate change, a new kind of threat emerges, one which tests not only the strength of our dykes but the responsiveness of our institutions, policies, and public awareness.

1.1 A history of water

Historically, the Netherlands' greatest threat came from storm surges and river floodings. These events heralded monumental engineering works such as the Zuiderzee works and the Delta works following the disastrous 1953 '*Watersnoodramp*' (Ministerie van Infrastructuur en Waterstaat, 2024). These projects, however, were not in reaction to global phenomena but to local and regional flood risks. The difference in managing immediate threats and responding to long-term global processes such as sea level rises, is fundamental to understanding the evolution of Dutch sea level rise policy, research and public awareness. Yet the Netherlands has always enjoyed a head start in water management. Take for example one of the first systems used to standardise water management in the world, which is the Normaal Amsterdams Peil (NAP), established in the 19th century. This sea level reference point provided the Netherlands a consistent framework in the efforts to control the water and keep the country afloat. Reinforcing the Dutch idea that the water was a controllable variable, something which could be dealt with locally. The reality however is that Dutch water management must now operate at a larger scale, with nearly 60% of the country prone to flooding (Low Probabilities - Large Consequences, n.d.) any response requires full (inter)national coordination.

1.2 Current situation

In recent years, sea-level rise has shifted from a distant scientific projection to an increasingly urgent societal and political issue. Sea-level rise has thus become an increasingly prominent theme within Dutch water management discussions. Institutions such as Rijkswaterstaat now incorporate sea-level scenarios into infrastructural planning, and initiatives like the Delta Programme signal growing institutional awareness. However, concrete large-scale measures directly addressing rising sea levels remain limited. The challenge is no longer just water management, but adapting existing systems to a slower, less visible, yet inevitable threat.

Yet despite growing technical awareness, large-scale interventions remain mostly conceptual. Current measures largely extend existing infrastructure rather than rethink it and still exist for the most part in numerous reports and studies. The challenge is as much political and societal as it is scientific. Sea-level rise unfolds over decades, and as such, competes with more immediate issues in the political and public discourse. This tension complicates the translation of long-term projections into immediate action.

1.3 Arising questions

The research brought to light in this thesis delves into the evolving understanding of sea-level rise in the Netherlands, therefore the thesis poses the research question:

“When did the Netherlands become aware of the threat that sea-level rise poses?”

This topic will be discussed by way of three sub-questions

1. ***“When did the Dutch scientific community first discover the rising sea-level?”***
2. ***“When did the general public become aware of the threat that sea-level rise poses?”***
3. ***“When did sea-level rise become a prevalent issue in Dutch coastal protection policy?”***

This thesis will first delve in to the emergence of sea level rise as a prevalent issue. By discussing sub questions one and two, looking at the flow of information from the scientific community to the public and in turn to government in the form of policy and advisory reports. Through this a historicised timeline will be constructed of when major events and turning points took place and how these influenced one another.

2 Methodology

The research into the subject is done through the use of literature research. With this a broader historicised picture will be painted, starting at the first measurements done of sea levels within the Netherlands and continuing on until the policy discussions of the 21st century.

This is brought together in a complete timeline of the relevant events, highlighting how these events relate to each other in time and which events preceded each other. Forming a complete picture of the subject

2.1 Literature research

The main method of research through which this thesis was created is literature research, the committed research was done with the help of different databases. As a main search engine Google scholar was utilised, this was done with some of the following search engine prompts: 'Dutch sea level rise' 'Zeespiegelstijging' 'Johan van Veen' 'Jakob Bennema' etc. and different combination of these terms. Furthermore, different governmental databases were used to gain topic specific information, documents from both the KNMI (Royal Netherlands Meteorological Institute), the Deltaprogramma, CLO (Environmental Data Compendium) and from the ministry of Infrastructure and Water Management. The combination of these databases yielded a host of advisory reports and research papers, out of this list of papers the most relevant and thereby important were selected for further research. These documents include the first Dutch report on sea level rise throughout the century, published in 1954, an overview of sea level rise by the CLO from 1890 to 2018 published in 2020, the 'Kennisprogramma Zeespiegelstijging' which focuses on mapping potential scenarios. Besides these governmental entities research was done using the Dutch newspaper database Delpher. This database includes a majority of the published (Dutch) newspapers starting from the 17th century, this database was fundamental to the start of the research, with 20th century newspapers discussing sea level rise.

2.2 Timeline

With all the information gathered throughout the literary research these specific insights which were garnered are put into a complete timeline with all relevant events. The historization of these events puts them in a new context thus relating the seemingly individual occurrences to one another in order to find any relationship between the events.

3 The history of Dutch sea level rise

The Dutch story of sea level rise is one quite dissimilar to many other countries, as described before, with the Netherlands having a historically existential relationship to water and with the sea. For the Dutch it is not merely a matter of interest but an essential part of continued existence, with the majority of the economic centre being positioned below sea level (Low Probabilities - Large Consequences, n.d.). Therefore, Dutch society as a whole has integrated water management into policy since the foundation of the country in the medieval age, so called 'water boards' were created before a central government came into power. These 'water boards' which since 1255 regulate water management and dictate policy throughout the country up to the current day (Waterschap, 2019).

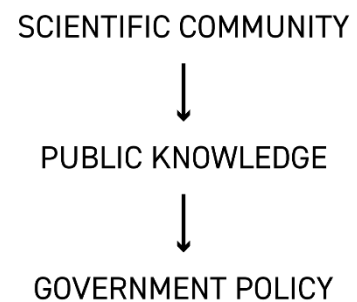


Figure 1 – Hypothesis, order of events

During these long years of fighting against the water countless different crisis arose and ebbed away, however now a major crisis looms, a rising water level threatens the very existence of the country. Thus, the aforementioned question is: “When did the Netherlands become aware of the threat that sea-level rise poses?” For this a hypothesis is stated, drawing a parallel to the earlier Delta Works, which were focused on protecting against storm surges. During that timeline the information regarding necessary improvements was first brought to attention by the scientific community, specifically the prominent engineer Johan van Veen (Veltman et al., 2023). This was followed with a slow gaining of public knowledge on the danger of storm surges, with the major event being the flood of 1953. The flood of 1953 is engraved in the collective memory of the Netherlands as a major turning point, after which the public became acutely aware of just what kind of danger storm surges posed to the Netherlands. During the flood 1836 people lost their lives and approximately 4 300 buildings were destroyed, causing massive physical and monetary damage (Min. IenW, 2024). This disastrous event gave way to broad public support for government policy in order to protect the country against similar events. The government almost immediately granted van Veen his wishes, starting the broad construction of the earlier planned Delta works.

Regarding this chain of events, it is hypothesised that the situation regarding the discovery of sea level rise follows the same manner of progression. Moving from the discovery by the scientific community to broader public knowledge, which in turn leads to a base of support for governmental policy (See figure 1 above).

3.1 Scientific discovery

For this research emphasis has been put on the Dutch scientific community, however it is of course neigh impossible to view the sea level rise on the Dutch coast in isolation. With this taken into consideration the Dutch scientific discovery of sea level rise follows an array of markers signalling a shift in sea levels.

The Dutch coastal sea level fluctuations have been consistently monitored with multiple measurement stations starting from the 1890s. In a scientific report published in 2019 the measurements taken between 1890 and 2017 are considered and explained, a thought is also given to the early taken measurements. Informal measuring is alleged to have already been taking place during the 1700s in Amsterdam, however no recorded data has survived until the current day. These measurements were mainly carried out in order to be able to properly protect land below sea level, however not yet with scientific goals in mind.

The first true recorded measurements can be traced back to 1862 when the first main measuring station which is still active today went into operation in Vlissingen. However this data is found to be unreliable, with specific data being available starting in the year 1890 according to Baart et al (2019). This data is taken from six appointed 'main stations', these are Delfzijl, West-Terschelling, Harlingen, Den Helder, IJmuiden, Hoek van Holland and Vlissingen, all of these aforementioned stations have been active from before 1890 until the current day. In figure 4 one can see the operational history of all measuring stations in the Netherlands. (Baart et al., 2019)



Figure 2 – Measuring station at Hoek van Holland (Redactie Waterforum, 2018)

While these measurements have been consistent from the 1890s it took even longer for the first scientists to start noticing an upwards trend in the collected data. Internationally the first to theorise a rising of sea levels is the Finnish oceanographer Professor Rolf Witting (1879-1944). Who in 1933 at an international convention on geodesy in Lisbon advocated for the creation of an international committee for the monitoring of sea levels, by stating:

“For the study of the tides and the tidal currents, of other movements of the sea surface and of currents of different origin, continual observations of sea level are the sole or a most valuable basis.” (Rossiter, 1962)

This committee was in turn formed with the British Joseph Proudman as secretary, the organisation, now known as the Permanent Service for Mean Sea Level (PMSL), gathered monthly and yearly data from as many sea level measuring stations globally as was feasible during this time (Rossiter, 1962).

Meanwhile in the Netherlands one of the very first to start discussing sea level rise was chief engineer Johan van Veen. While Van Veen did mention theories regarding sea level rise, he never published specific scientific research supporting this hypothesis. So while being an early proponent of warnings against sea-level rise, he prioritised the more pressing threat of his time, storm surges in his actual research and personal campaigning.

In 1954 the Dutch researcher Jakob Bennema Published a PhD dissertation titled: *“Bodem- en zeespiegelbewegingen in het Nederlandse kustgebied”* (Soil and Sea level movements in the Dutch coastal areas) at the “Landbouwhogeschool Wageningen” (Agricultural College Wageningen). The paper delves into a variety of subjects, however, most prominently discusses soil movements and sea level changes, going back to the post-glacial age 8.000 years prior. The paper proceeds to discuss the hypothesised sea level changes throughout these periods up until the so defined ‘post roman time’ until the time the paper was published (1954). Bennema describes these time periods as functioning in ‘shocks’ with stretches of rising sea levels and following this, counteracting periods of sea level decrease (Bennema, 1954). However as Bennema notes these shocks when plotted out against time form a consistent rise in sea levels, starting in the aforementioned post-glacial period. The paper concludes that there is a clear upwards trend in sea level measurements as seen in figure 3, further along in the paper Bennema states that based on more recent measurement one can extrapolate that sea levels are entering an upwards accelerating trend.

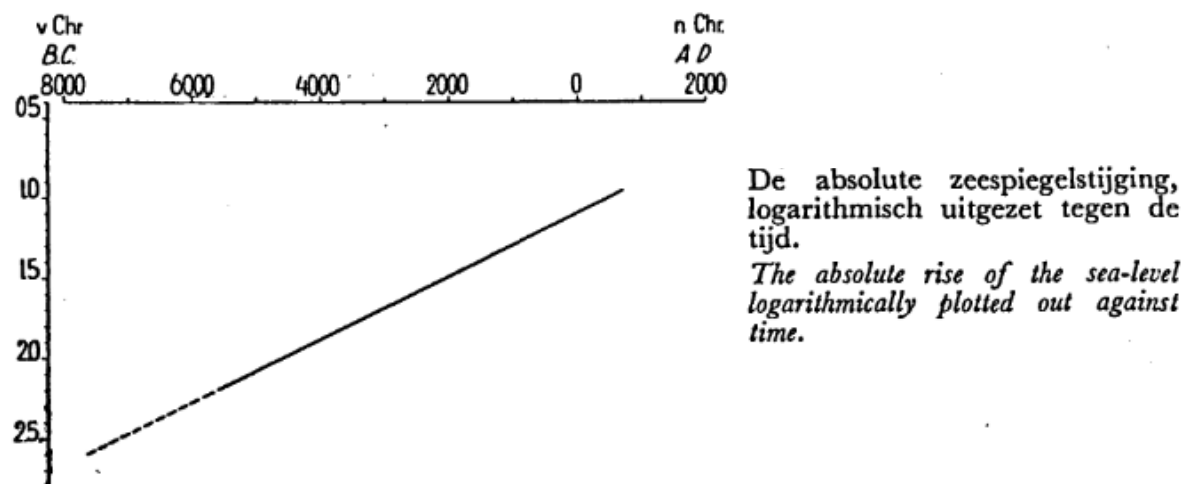


Figure 3 – Rise in sea levels in metres plotted against time in years (Bennema, 1954)



Figure 4 – Historical operations of measuring stations in the Netherlands (Baart et al., 2019)

Answering this first sub-question leads to another, as during our current day sea level rise has become almost synonymous with climate change. Yet this has not always been the case, therefore an important question arises: “When did the scientific community discover that one of the leading factors for sea level rise is rapidly accelerating climate change”. Whilst the scientific community already was aware of the rising of sea levels quite early, this was not found to have a direct cause yet.

Starting in the late 19th century and early 20th century a first hypothesis was made on climate change, with at first the Swedish scientist Svante Arrhenius (1896) theorising that increased carbon dioxide in the atmosphere could lead to a warming of the planet. Further building on this John Tyndall and Guy Callendar (1938) expanded on the research and gave concrete evidence linking human activities to the aforementioned warming of the planet (Jackson, 2019). However, during this time these developments were not yet linked to concrete evidence of sea level rises, even though researchers were aware of both phenomena.

Only starting in the 1960s did a link slowly start to appear between the observed sea level rises and the warming of the planet. This was due to the use of satellite imagery, which was for the first time capable of advanced measurements of glaciers and ice sheets on a global scale. This led to researchers keeping watch on developments regarding melting ice sheets and glaciers, these results were brought to a conclusion when the Intergovernmental Panel on Climate Change (IPCC), which was formed in 1988, presented strong evidence in 1990 that human caused climate change is driving sea level rise through thermal expansion and ice melt (Houghton, 1990). Therein the specific year when this link was made is 1990.

3.2 Public knowledge

The Dutch awareness around the threat of the sea goes in waves, before the aforementioned disastrous flood of 1953 public knowledge around storm surges had become rarer. Due to this low public awareness and the underestimation of this threat casualties were high, maintenance of dykes and storm barriers was neglected in the years preceding it. This neglect was made possible by public apathy towards the threat, as the experts such as J. van Veen already signalled looming disaster before it struck, however without prior public support and thereby knowledge these crucial measures could not be enacted (Veltman et al., 2023). Therefore, the following sub question is posed:

“When does the general public become aware of the threat that sea-level rise poses?”

To elevate a subject such as sea level rise within public discourse a link must be made between the general public and the scientific discovery, discussed in 3.1. This link can be formed in a variety of ways, by word of mouth, government memos, student initiatives, however, during the time period following the scientific discoveries regarding sea level rise the main medium used to form this link were newspaper articles. To this end, the very first Dutch newspaper making mention of sea level rise was published in 1954, around the same time Jakob Bennema published the first Dutch scientific evidence showing a rise in sea levels. In this article titled ‘*NEDERLANDSE DIJKEN ZIJN METERS GEZAKT*’ (*Dutch dykes have sunken metres*) published in the Dutch communist paper ‘*De Waarheid*’ J. van Veen is to quote:

“...in hoeverre er sprake is van daling van de bodem in ons land, is het de mening van dr ir J. van Veen, dat een zeespiegelstijging van 47 cm per eeuw door historisch onderzoek geconstateerd zou kunnen worden.” (De Waarheid, 1954).

(...to what extent there is subsidence of the soil in our country, it is the opinion of Dr. Ir. J. van Veen that a sea level rise of 47 cm per century could be established by historical research.)

NEDERLANDSE DIJKEN ZIJN METERS GEZAKT

Deskundigen spreken over bodemdaling in Nederland

UTRECHT, 6 Maart. — Betreffende de vraag, **in hoeverre er sprake is van daling van de bodem in ons land, is het de mening van dr ir J. van Veen, dat een zeespiegelstijging van 47 cm per eeuw door historisch onderzoek geconstateerd zou kunnen worden.**

In dit verband, aldus dr ir Van Veen, die deel uitmaakt van de Deltacommissie, welke de sluiting van onze zeegaten onder ogen ziet, moet men ook rekening houden met een daling of zakking van de dijken.

**Verrassende Vietnamese
aanval**

Vast staat evenwel, dat de dijken vroeger veel hoger zijn geweest. Dr ir Van Veen wijst er in dit verband op, dat de dijk van Vlaardingen naar Hoek van Holland meters lager is geworden. Hetgeen te begrijpen is, want een dijk is onderhevig aan slijting, erosie, inklinking en ook door het gebruik als weg.

Deze belangrijke mening van een deskundige van het waterwezen als dr. ir. J. van Veen werd gisteren uitgesproken op een bijeenkomst van verscheidene geleerden, die hun meningen uitwisselden over de onbetwistbare daling van onze bodem.

Over de vraag in hoeverre de zeespiegel nog zal rijzen en ook of onze bodem nog meer zal dalen, bestaan nog zeer veel onzekerheden. Dat bleek tij-

dens de uitwisseling van gedachten daarover tussen de Nederlandse geleerden.

Zo meende prof. dr. ir. F. A. Vening Meinesz, dat de grootste daling van de bodem bereikt zal zijn plus minus in het jaar 6000. Nederland zou thans 97 M. gedaald zijn. Het maximum zal 100½ m. bedragen, zodat wij nog 3½ meter te verwachten hebben.

Over het algemeen was men het eens, dat er ontegenzeggelijk een verschil in zakking bestaat tussen Noord- en Zuid-Nederland.

Met de mening van dr. ir. Van Veen voor ogen blijkt echter duidelijk, dat de reeds meerdere malen signaleerde meningen over de zwakke toestand van onze dijken bevestigd worden.

**Geruchtmakend proces in
Zoon van mini
hij dood van V**

Figure 5 – News article in the Dutch communist paper (*De Waarheid*, 1954)

While not referencing directly to a specific research case it is clear van Veen realised the potential danger in a rising sea level to the Netherlands based on historical data, he seems to have had access to. The year following this very first mention, a second article was published in the 'Gazet van Limburg', titled: 'HET RAADSEL OPGELOST?' (*The mystery solved?*). This article discusses the findings of the research done by Jakob Bennema, while mainly putting focus on the sinking Dutch ground, it does thoroughly make mention of rising sea levels. In the section of the article discussing rising sea levels, with the subtitle '*Hoeveel centimeters in een eeuw?*' (*How many centimetres in a century?*), it is described that J. Bennema in his report already mentions a quickening sea level rise (see figure 6) based on historical data. The article is to quote:

"We do not envy our ancestors that happiness, but it is very harsh that we, innocent descendants, must pay so dearly for it."

With the direct language used it is clear that a stance is taken where action is encouraged, the author seems to understand that possible sea level rise has major implications for the Netherlands. The author notes that in the time of our ancestors, in this case 1500-1850, they seemingly enjoyed a time free of worry, with an average sea level rise of 4-10 centimetres per century. Whilst in the time of the author in the 20th century this was already starting to exceed 35 centimetres. Interestingly the author notes that Bennema realises a sudden shift is causing this accelerating sea level rise, however difficult to note is that climate change is not yet mentioned as a possible cause. Relating to the discussion in 3.1, climate change only started to be considered as a possible cause after the time of the author.

We zouden ons dus thans in een tijd van **versnelde zeespiegelrijzing** bevinden. We mogen de lezer de belangwekkende sprong niet onthouden, die nodig is geweest om over de moeilijkheden heen te komen.

De schrijver speurt n.l. bij de zee 'n uiterst regelmatig terugkeren van hoog en laag. Zo'n gezamenlijke periode van up en down beslaat dan 525 jaar. Van 1500 tot 1850 heeft Nederland van een onbezorgde tijd genoten. „In deze drie en een halve eeuw is dus de gemiddelde stijging van 4-10 c.m. per eeuw, dat wil zeggen 14-35 c.m. niet gerealiseerd.” (blz. 77). Inderdaad 3,5 x 4 is 14 en 3,5 x 10 is 35.

We benijden onze voorouders dat geluk niet, maar het is wel erg hard, dat wij, onschuldige nakomelingen, daar zo diep voor moeten boeten. Niet alleen dat de stijging van 4-10 c.m. per eeuw weer is begonnen, maar ook die van 14-35 c.m. moet na dat lange tijdperk van stilstand worden ingehaald. Dat is nu iets, dat er meer wraakzuchtig dan logisch uitziet. De gedachtensprong van het niet-realiseren van de gemiddelde stijging naar het volgende is wel bijzonder groot en grillig: „Dit betekent dat na 1850, toen de versnelde zeespiegelstijging begon deze 14-35 c.m. als extra-stijging zal optreden” (blz. 77).

Figure 6 – News article in the 'Gazet van Limburg' discussing sea level rise (Gazet van Limburg, 1955)

While it is near impossible to pinpoint an exact date the Dutch general public became aware of the threat posed by sea level rise, as awareness does not arise in a singular moment. It can be assumed that this awareness started building after the first articles making a link to recent scientific discoveries in 1954 (De Waarheid) & 1955 (De Gazet). Furthermore, the awareness was exacerbated by increasing attention for climate change related topics starting around this age, with an increasing public interest each following year.

3.3 Political action

Following both the scientific discovery and the public knowledge of sea level rise, the hypothesised follow up is political action driven by discourse. Through this the following question is posed:

“When was the first political action taken regarding sea level rise?”

For this question two parts are considered, first, when is the earliest political mention of sea level rise, and following this, when is budget allocated to sea level rise. The very earliest political mention of sea level rise was done in the Dutch house of representatives (*Tweede Kamer der Staten Generaal*). During this time the serving Minister of Infrastructure and Water Management was politician Drs. J.A. Bakker from the now disbanded ARP (Anti-Revolutionary Party). Bakker was serving under the cabinet of De Jong from the KVP (Catholic Peoples Party), from 1967 to 1971. During a sitting of the house of representatives discussing the water management in the Netherlands among other topics, J.A. Bakker addresses a question regarding the safety of the Netherlands to different threats of the sea. He responds by naming sea level rise as a cause of rising temperature (See chapter 3.1) as a major threat, and is to quote:

“Zouden de verwachte gevolgen inderdaad optreden, dan dienen niet alleen in Nederland, maar over de gehele wereld maatregelen te worden getroffen.” (Bakker, 1970)

(Should the expected consequences indeed occur, measures should be taken not only in the Netherlands, but around the world)

Here J.A. Bakker recognises sea level rise as a critical threat, for not just the Netherlands but even worldwide. To close this part of the sitting he puts the cabinet at ease, noting that the mean sea level is currently being recorded.

Minister Bakker: Ik begrijp nu, dat het de heer Oele is geweest, die met deze problematiek naar voren is gekomen. Uitvoering van de genoemde plannen en de stijgende temperatuur door het grotere koolzuurgehalte zouden n.l. resulteren in **zeespiegelstijging**. Zouden de verwachte gevolgen inderdaad optreden, dan dienen niet alleen in Nederland, maar over de gehele wereld maatregelen te worden getroffen. Een groot deel van de wereldbevolking woont namelijk in de laag gelegen deltagebieden. De gevolgen van **zeespiegelrijzing** voor ons land kunnen zeer belangrijk zijn. Dit is echter in eerste instantie meer een waterkerings- dan een waterhuishoudings-kwestie. De gemiddelde **zeespiegelstand** wordt uiteraard wel in het oog gehouden.

Figure 7 – Excerpt from a meeting in the Dutch house of representatives (Bakker, 1970)

07.03 Onderzoek en ontwikkeling

a. het te voeren beleid en de grondslag van het artikel

De hoofdlijnen van het KNMI-beleid zijn mede gericht op de verbetering van het klimaatonderzoek met ontwikkeling van modellen, transportprocessen in atmosfeer en oceaan (milieu) en trends en effecten (zeespiegelrijzing).

Het onderzoek richt zich enerzijds op modelontwikkeling ten behoeve van meteorologische dienstverlening en anderzijds op wetenschappelijk onderzoek op het gebied van klimaat en milieu.

Ontwikkeling richt zich met name op de verbetering van de productieprocessen terzake van meteorologische dienstverlening. Hiertoe wordt gebruik gemaakt van technologische ontwikkelingen op het gebied van communicatie, automatische verwerking en presentatie.

Figure 8 – Excerpt from policy written to the Dutch house of representatives (Jorritsma-Lebbink, 1996)

After this sitting of J.A. Bakker, government records show sparse discussions regarding sea level rise, only twenty-six years later a relevant budgetary record appears. This note written to the house of representatives by the then Minister for Infrastructure and Water management Jorritsma-Lebbink of the VVD (People's Party for Freedom and Democracy) describes how the allocated budget for the KNMI (Royal Dutch Meteorological Institute) shall be spent. Importantly it states that the main policy will be research into climate processes both in the atmosphere and oceans, specifying that this will be focused on sea level rise. Thereby looking at the trends and possible effects a sea level rise will incur. While the government records seem to show this as the first piece of actionable government policy, it remains questionable that within twenty-six years following J.A. Bakker's statement to the house of representatives no budgetary moves were made to study possible consequences sea level rise could bring to the Netherlands. While budget was still allocated to measuring the current and future sea level rise, the step to prevention was yet to be made. For an example of direct sea level rise intervention policy, one can look to Rijkswaterstaat, which is tasked with the construction and maintenance of sea defences. In a recent document it is shown that Rijkswaterstaat already accounts for sea level rise, as seen below.

“Een stijging van de zeespiegel heeft per definitie consequenties voor de manier waarop wij Nederland beschermen tegen het water. Daarom houdt Rijkswaterstaat bij het ontwerp van waterstaatkundige werken voor het midden van de 21 e eeuw nu al rekening met een toekomstige zeespiegelstijging van een halve meter.” (Baart et al, 2019)

(A rise in sea level by definition has consequences for how we protect the Netherlands from water. This is why Rijkswaterstaat is already taking a future sea level rise of half a metre into account when designing hydraulic works for the middle of the 21st century.)

With all this considered, the exact years for political action can be pointed out as 1970 and 1996 respectively, where in 1970 the first political mention is made and following this in 1996 the first budgetary allocation appears in government records.

3.4 Historicised Timeline

Collecting all the different historical events discussed in chapters 3.1, 3.2 and 3.3 provides a complete historicised picture of relevant occurrences to the Dutch sea level rise. The timeline begins with the institutionalisation of sea level measuring in the later 19th century, when recordings started at Hoek van Holland and Vlissingen. This recorded data then provided the base for the scientific discoveries in the following years, with emphasis on Jakob Bennema’s dissertation in 1954, publishing his findings on sea level rise in Dutch coastal areas. Here Bennema identified a long-term rising trend in mean sea levels and speculated an acceleration in sea levels in the following centuries. In parallel, public discourse around the topic can be first seen in newspaper articles from 1954 and 1955, on statements made by van Veen and the research done by Bennema. While small in scale these publications show sea level rise did not stay a mere scientific concern but already moved into the public domain. However political action took a slower pace with the first explicit mention occurring in 1970, with Minister Bakker reporting to the house of representatives concerning water management, even further along the first budget allocation can be noted, in 1996 by Jorritsma-Lebbink.

This timeline highlights a pattern: scientific knowledge precedes public awareness, which in turn lays the groundwork for political action. Understanding this progression offers insights not only into how the Netherlands adapted its flood risk strategy, but also how scientific findings slowly integrate into society and governmental policy.

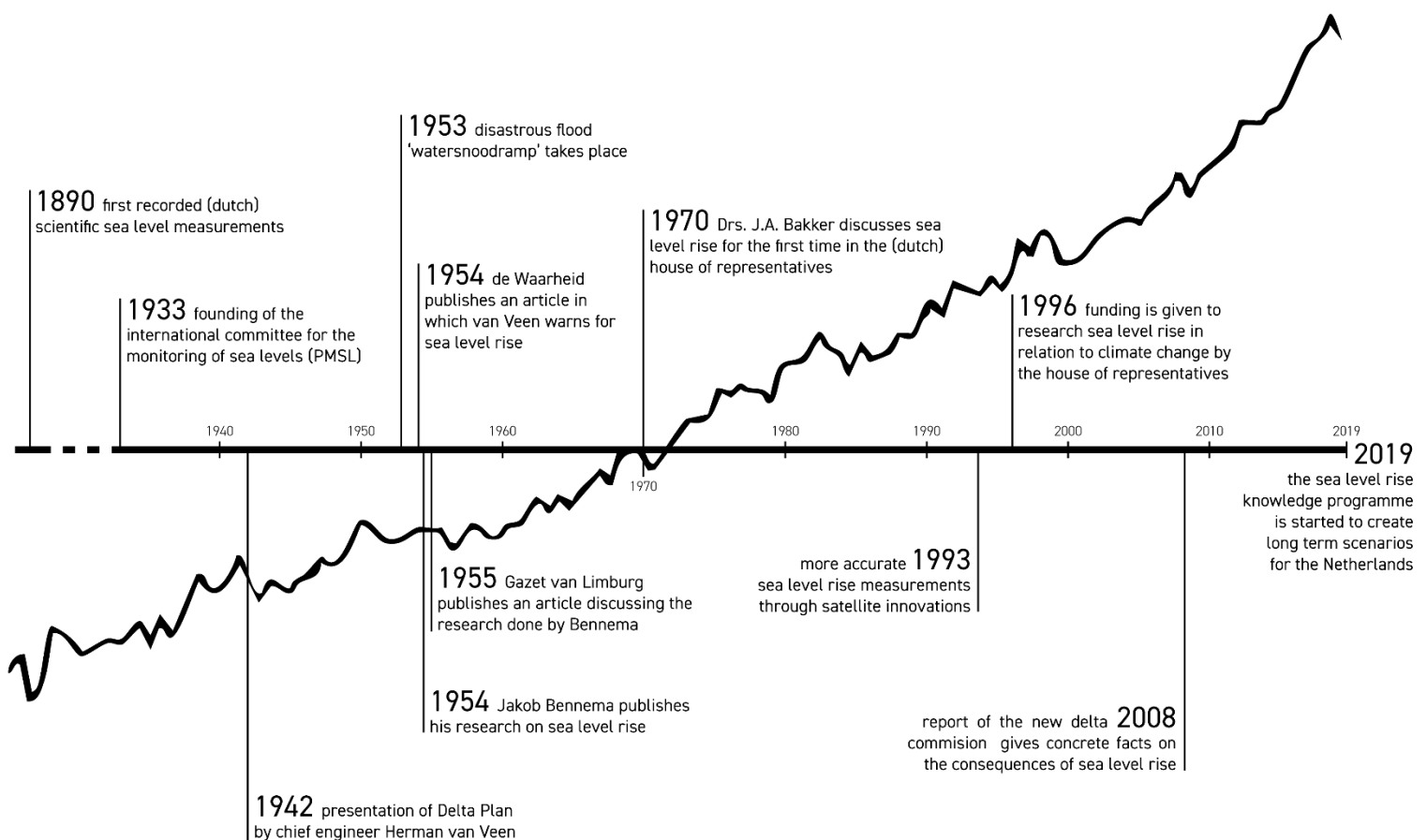


Figure 9 – Assembled timeline, with global mean sea level rise overlaid, interpreted from CSIRO, 2020

4 Conclusion

The following chapter will draw a conclusion based on the information gathered in the literature research. These conclusions drawn from insights garnered through the historicised timeline and the afore done literary research are described.

4.1 Repeating mistakes?

The timeline presented in chapter 3.4 presents a pattern in the Dutch reaction to sea level rise, early interest, early warnings and late action. From the first recorded sea level measurements in the late 19th century to the dissertation from Bennema in 1954, the threat of rising sea levels has long been known, scientifically and publicly. However, tangible political action has consistently lagged behind. These events while seemingly different become eerily similar when historicised. The hypothesis proposed at the start of the research, that the Netherlands exhibits a pattern of delayed political response despite early public and scientific awareness. The progression thus moves from Bennema (1954) to the newspaper articles (1954 & 1955) to the first political mention of sea level rise (1970).

This development in many ways echoes the same frustrations felt by Van Veen before the enacting of the Deltaplan, as Van Veen, then a leading voice within Rijkswaterstaat, had been warning of weak dykes well before the disastrous '*Watersnoodramp*' of 1953. The comparison to the present day is striking. As early as 1970, sea level rise entered political discourse, albeit slowly and sporadically. Since that point, scientific understanding has been furthered, and public awareness has grown. Reports have been written, advisory committees formed, and strategies outlined. Yet, as in Van Veen's time, these warnings are often met with bureaucratic passivity, fragmented discourse, or are absorbed into broader climate policy discussions. While Rijkswaterstaat now factors sea level rise into future design standards, a decisive and coordinated national policy shift is still elusive.

4.2 Future outlook

What policies will be necessary to support continued existence within the Netherlands in the face of sea level rise? Conceptual plans to mitigate sea level rise have already been proposed by various individuals and organisations ranging from continent wide initiatives such as the North Sea Dam, which proposes connecting the England to France and Scotland to Norway in order to protect the European coast, to the damming of the Wadden Sea (Henley & Evans, 2021). A measure reserved for when other options have been exhausted, both echo the same sentiment surrounding the Afsluitdijk, currently however these plans are single initiatives without broader governmental support or long-term political will. While a trend of increasingly right-wing politics in the last years have focused on putting any climate change related policy through the shredder, the increasing danger will force the hand the Dutch cabinet at one point or another (AO Klimaat, n.d.). As with Van Veen before 1953, today Dutch researchers, engineers, and climate activists continue to raise the topic. Yet a fundamental question stays: will proactive planning be enough, or will the Netherlands once again passively wait for a moment of disaster to force a perspective shift? The warning signs are present. The scientific groundwork is laid. Whether it will translate into action remains to be seen.

5 Bibliography

Cover image:

The Netherlands compared to sealevel. (2024, September 8). Wikimedia Commons. Retrieved April 16, 2025 from https://commons.wikimedia.org/w/index.php?title=File:The_Netherlands_compared_to_sealevel.png&oldid=920930615.

Sources:

AO Klimaat: “Klimaatbeleid zonder basis.” (n.d.). <https://www.pvv.nl/nieuws/machiel-de-graaf/7139-ao-klimaat-klimaatbeleid-zonder-basis.html>

Baart, F., Rongen, G., Hijma, M., Kooi, H., De Winter, R., & Nicolai, R. (2019). *Zeespiegelmonitor 2018: De stand van zaken rond de zeespiegelstijging langs de Nederlandse kust*. In *Rijkswaterstaat Publicatie Platform (No. 11202193-000-ZKS-0004)*. Rijkswaterstaat. <https://open.rijkswaterstaat.nl/open-overheid/onderzoeksrapporten/@135962/zeespiegelmonitor-2018-stand-zaken-rond/>

Bakker, J. A. (1970, April 15). *53ste vergadering*. Tweede Kamer Der Staten Generaal, The Hague, Netherlands. <https://zoek.officielebekendmakingen.nl/0000228059>

Bennema, J. (1954). *Bodem- en zeespiegelbewegingen in het Nederlandse kustgebied [PhD dissertation, Landbouwhogeschool Wageningen]*. <https://library.wur.nl/WebQuery/titel/104590>

CSIRO. (2020). *Sea level: Understanding the past – Improving projections for the future*. <https://research.csiro.au/slrwavescoast/sea-level/>

De waarheid. NEDERLANDSE DIJKEN ZIJN METERS GEZAKT. (1954, March 6). Amsterdam, p. 3. Consulted on Delpher on 12-03-2025, <https://resolver.kb.nl/resolve?urn=ddd:010369213:mpeg21:p003>

Gazet van Limburg. Hoeveel centimeters in een eeuw? (1955, April 15), Maastricht, p. 5. Consulted on Delpher on 02-03-2025, <https://resolver.kb.nl/resolve?urn=MMCC01:047994012:mpeg21:a00060>

Henley, J., & Evans, A. (2021, August 25). Giant dams enclosing North Sea could protect millions from rising waters. *The Guardian*. <https://www.theguardian.com/environment/2020/feb/12/giant-dams-could-protect-millions-from-rising-north-sea>

Houghton, J. T., Intergovernmental Panel on Climate Change Working Group 1., & World Meteorological Organization. (1990). *IPCC first assessment report*. WMO. archive.ipcc.ch/ipccreports/far/wg_1/ipcc_far_wg_1_full_report.pdf

Jackson, R. (2019, May). *Who discovered the greenhouse effect?* | *Royal Institution*. Royal Institution. <https://www.rigb.org/explore-science/explore/blog/who-discovered-greenhouse-effect>

Jorritsma-Lebbink, A. (1996). Vaststelling van de begroting van de uitgaven en de ontvangsten van het Ministerie van Verkeer en Waterstaat (XII) voor het jaar 1996. In *Tweede Kamer Der Staten-Generaal*. <https://zoek.officielebekendmakingen.nl/kst-24400-XII-41.html>

KNMI - Watersnoodramp 1953: de dag ervoor. (n.d.-b). <https://www.knmi.nl/kennis-en-datacentrum/uitleg/watersnoodramp-1953-de-dag-ervoor>

Low probabilities - large consequences. (n.d.). Low Probabilities - Large Consequences. <https://themasites.pbl.nl/o/flood-risks/>

Ministerie van Infrastructuur en Waterstaat. (2024, October 14). *Watersnoodramp 1953*. <https://www.rijkswaterstaat.nl/water/waterbeheer/bescherming-tegen-het-water/watersnoodramp-1953>

Redactie Waterforum. (2018, 15 januari). *Zeespiegel langs Nederlandse kust na tien jaar op nieuw record - Waterforum*. Waterforum. <https://www.waterforum.net/geringer-aantal-stormvloeden-zorgden-afgelopen-tien-jaar-minder-zeespiegelstijging/>

Rossiter, J. R. (1962, May). The work of the permanent service for mean sea level. VIIIth International Hydrographic Conference. https://psmsl.org/about_us/other_reports/rossiter_iho_1964.pdf

Veltman, F., Brugsma, C., Van De Kamp, I., De Graaf, B., Van Lier, M., & Bus, S. (2023, January 13). *Waarschuwing in de wind (season 23, episode 2)*. In *Andere Tijden*. NTR. <https://anderetijden.nl/programma/1/Andere-Tijden/aflevering/913/Waarschuwing-in-de-wind>

Waterschap. (2019). Parlement.com. <https://www.parlement.com/id/vi6qcgqh9ov6/waterschap>