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Propagation of freshwater fronts in the Rhine ROFI

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Prior studies have shown that freshwater fronts in the Rhine ROFI have a significant role of the cross-shore currents. Here we present results from the STRAINS project in which a major field campaign was carried out along the Dutch coast near the Sand Engine in 2014. Here we investigate the propagation and strength of freshwater fronts in the mid-field river plume by using field-data, radar images and numerical modelling. We used a unique dataset collected 10 km north of the river mouth at 2 and 6 km offshore. The dataset contains salinity, temperature and velocity data. In addition, high frequency velocity data just above the bed (0.25, 0.5 and 0.75 m) is available at the station 2km offshore, which has been used to calculate near bed Reynolds stresses.

The data and radar images show the onshore propagation of freshwater fronts after high tide. The data shows that during spring tide with moderate downwelling winds (here SW) the fronts are thicker and propagate faster than during neap tides. The spring tide fronts coincide with a high cross-shore Reynolds stress near the seabed just after frontal arrival corresponding to high near bed velocities.

A 3D hydrostatic numerical model is used to investigate the spatial structure of the plume. First results show the existence of multiple freshwater lenses within the entire plume, formed each tidal cycle. The data, radar images and numerical model results provide a detailed picture of plume and frontal dynamics within a shallow river plume area.