SALTWATER FLUSHING FROM BATHYMETRIC HOLLOWS IN A SEMI CLOSED ESTUARY

A STUDY BASED ON DATA FROM THE HARINGVLIET

With controlled saltwater intrusion at the Haringvliet estuary, a vertical density stratification can establish and locally persist over time. The research objective is to study the flow dynamics through which salt water accumulated in bathymetric hollows is flushed out. This is approached by analyzing velocity and turbulence characteristics from the data collected in two bathymetric hollows as illustrated in Figure 1.

At location 1, the accumulated salinity reaches around 5 PSU. Two events where the density stratification interface is lowered are triggered by towards the sea directed overflowing currents of varying magnitudes that do not need to be amongst the largest peaks observed during winter. The constant directionality of the velocity appears more important and interfacial turbulence is only observed when the orientation is sustained beyond the time of a single tidal ebb, suggesting that first direct shear entrainment needs to settle the stratification. Indeed, as the interface establishes, instabilities induce turbulent mixing that allows shear from the overflowing water to continue to transport salt water away. A third event instead occurs while the water column remains affected by the tidal cycle. On this occasion, the only aspect that appears to set the flushing and non flushing times apart is the observed below interface dynamics. Indeed the systematic cycle of below interface flow orientations that is paired with the tidal one is disequilibrated during the flushing period.

Of the three times that salt water accumulates in the second hollow only once the interface is sufficiently raised to observe an accumulated salinity peak of 1 PSU. It is found that the shear exerted by the overflowing current tilts the horizontal interface indicated by the velocity profiles. In the absence of a detected peak in velocity variations in the density transition region, it is expected that direct shear entrainment occurs that transports along salt water from the inclined interface. Thereby the accumulated salinity appears low enough to not enable that the entrainment of the upper layer of the unsettled stratification establishes an interface that would require turbulent mixing to be lowered further. The observed behavior is also expected to link to how the hollow is more like a channel with direct shear just moving the salt water along in the downstream direction where its exit is to some extent slightly restrained by the upward slopping bed out of the hollow.

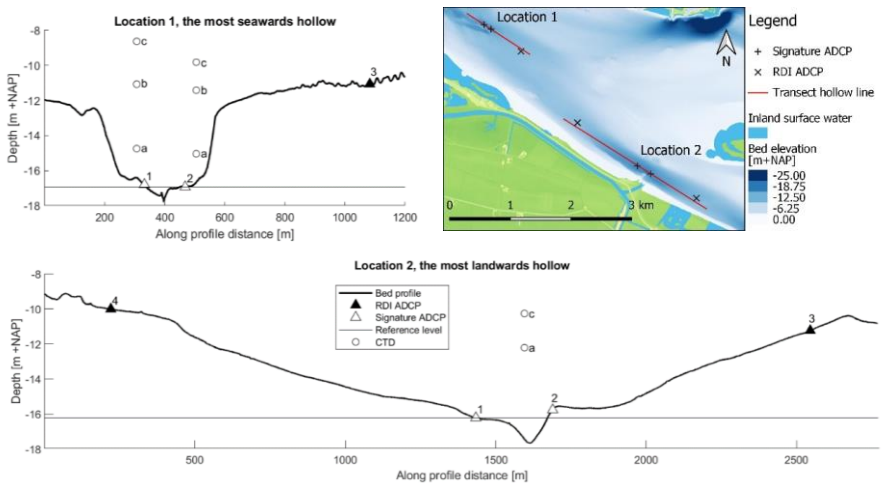

Figure 1: Position of the Acoustic Current Doppler Profilers and Conductivity Temperature Depth sensors shown on the along channel transects of the two bathymetric hollows studied in the Haringvliet estuary.

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