



Rapid decline in tidal amplitude along the Dutch coast

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As the astronomical forces that drive tides are constant, tides are generally considered to be stationary. However, they can be altered due to various reasons ranging from global change in sea level and ocean stratification to local changes in bathymetry, and river discharge.

In this presentation, we will present an analysis of tidal records along the North Sea coasts of The Netherlands. The data are analyzed with a mixed statistical-deterministic modeling approach using a high-resolution hydrodynamic model to remove natural tidal variability, including the nodal cycle, from the observed time series. This offers a methodological advantage compared to a statistical removal of the nodal cycle from observations and also allows for numerical experiments to explore potential causes of the changes.

Analysis of M2 amplitude shows considerable inter-annual variability, but virtually no trend prior to 2006-2007 at the Dutch coastal stations. However, from 2007 onwards we observe a relatively strong decline in M2 amplitude at many of the stations. In some stations, we observe a cumulative decline over 2007-2017 of up to 5%. The strongest relative decline occurred at station Petten located at the Holland coast, with a decrease of 0.46 % per year (i.e. 3.2 mm/year). The decline shows a strong spatial coherence, with a gradually decreasing rates of change to the north and south of this station.

Finally, we use model experiments and literature to evaluate the various physical mechanisms for their ability to cause the observed changes.