Oral Presentation

Variations of regional sea level and coastal tides: observations and model results

Hartmut Hein [1] · Bernhard Mayer [2] · Stephan Mai [1] · Ulrich Barjenbruch [1]

[1] Federal Institute of Hydrology, Koblenz, Germany · [2] Institute of Oceanography, Hamburg

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Sea level rise is known as one mayor impact of climate change. However, sea level is not really level, its changes differ in meso-scale spatial domains. In a wide range of publications coastal impact of climate change is attempt to be described by the means of the mean sea level – a commonly accepted first order solution to estimate vulnerability of coastal regions and to estimate coastal measures. However, the use of a mean (or "still") water level assumes that the mean is changing with time, but that the variance or higher order statistical moments should be actually stationary. The assumption imply changelessness of the tides itself. In our studies we use both, newly digitized tide gauge data sets, as well as modeling studies to estimate historic variations of tides in the southern German Bight. Both data sets have a temporal resolution of 10 minutes, which allows the detailed image of the tides.

Our study starts with the report of the difficulties connected with the digitalization of tide gauge data in paper form. The crucial challenge is situated in the quality control of the data. Stochastic methods – by the means of fuzzy logic – can be used to close gabs in the datasets. For the modeling part of the study a continuous 50 year-long hindcast simulation of the North Sea implemented by the well known numerical model HAMSOM (e.g. Pohlmann, 2006) is used. The applicability of the model is shown by validation against the digitized datasets. Despite the limitations of computer power, long-term runs allows only relatively coarse topographic representations, the long term changes of tides can be described. Stochastic analyzes details the differences between the hindcast data and the digitized data.

In order to account for inter-annual multi-decadal fluctuations (Hein et al. 2011) the variations of the tides is discussed. Our findings support former studies (Woodworth, 2010; Müller et al., 2011) which address changes of the tidal main components. Changes in sea level modify the ocean's response to the tidal forcing (Müller et al., 2011). We conclude, that the stationary assumptions behind the engineering usage of mean sea level does not hold generally. One answer could be the use of process based models, which allow also views inside the future variations of the tides. However, also all methods uncertainty analysis must be seen as best practice.

References

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