A Data-Fusion Technique for Forecasting of Absolute Sea Levels in the Baltic Sea

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Accurate sea level determination is a key component in many disciplines and especially in operational forecasting systems. As a result geoid-referred sea level or dynamic topography (DT) is a more realistic property to be used. Previously quantification of DT has been limited due to access to high-resolution geoid models. This however has changed for a collaboration of the Baltic sea countries (e.g. extensive field campaigns and computing expertise) has resulted in development of a high-resolution geoid (NKG 015). Thus, accurate quantification of DT combined with the current advances in artificial intelligence (AI) especially recently developed deep learning models (e.g. Convolutional Neural Network/ Long short-term memory (CNN-LSTM)) can be successfully utilized to spatio-temporally forecast DT. As a result, this study employs a multi-source data-fusion strategy to generate a new sea level product that uses as input sources wind speed, sea level pressure, and sea surface temperature, sea surface salinity, and sea surface height. A multistep framework based on a multivariate CNN-LSTM model will be used to forecast the sea level of future days for various temporal scales (3d, 5d, 7d ahead). These results are then validated using along track satellite altimetry data. Preliminary results of spatial accuracy for most of the Baltic Sea point show RMSE distributed within ± 4 cm. The external validation with along-track satellite altimetry data demonstrate differences between forecasted and SA being within 5 cm. The forecasted model shows promising results and can be used for other sea areas.

Keywords: Absolute Sea Level; Dynamic Topography; Geoid; Satellite Altimetry; Deep Learning; Hydrogeodesy, Data Fusion.

Session: Learning from Observations-Merge different datasets, data fusion, and multivariate analysis