Geophysical Research Abstracts
Vol. 16, EGU2014-12186, 2014
EGU General Assembly 2014

Modelling the variations and extremes of the sea level on the Finnish coast in the Baltic Sea

Matti Kämäräinen, Kimmo K. Kahma, Olli Jokinen, Milla M. Johansson, and Jani Särkkä
Finnish Meteorolgical Institute, Helsinki, Finland (matti.kamarainen@fmi.fi)

A computationally highly effective model was developed to study the variations and extremes of the sea level in the Baltic Sea. The sea level model consists of two main components: 1) The spatial variability as well as the predominantly short-term variability was modelled by a simple barotropic dynamic model (Hansen), which was implemented by modelling the Baltic Sea as an enclosed basin. 2) The spatially uniform, predominantly long-term variability, was modelled by a water balance model of the Baltic Sea, which is based on the regression coefficients of the cross correlation function of the sea level and the zonal wind near the Danish Straits. Both sea level model components are forced by the air pressure gradient -based geostrophic wind, and component 1) in addition directly by the sea level air pressure distribution. For geostrophic wind calculations the 2-meter temperature field is used in addition, and for the transformation to the surface winds a location-based downscaling is applied. Atmospheric reanalysis ERA-40 (1961-2000) and the sea level observations from the Finnish tide gauge network were used to optimize the model system, both the atmospheric and the sea components. The model performance was then evaluated using independet ERA-Interim data from the years 1979–2013. The best correlation and RMS performance, measured between model results and observed sea levels, were 0.93 and 10 cm respectively. The optimised model setup was then used to study the performance of high resolution regional climate models from the ENSEMBLES project above the open Baltic Sea where almost no meteorological observations exist. The hindcast climate model runs forced by ERA-40 were used to evaluate the ability of the climate models to recreate the past low pressure situations in 1961-2000, and the A1B scenario forced runs were used for climate change studies in 1951-2100. Hindcast results with different climate models varied in the range 0.84–0.89 (correlation) and 13–17 cm (RMS).