Geophysical Research Abstracts
Vol. 17, EGU2015-5940, 2015
EGU General Assembly 2015

Two centuries of mean Baltic Sea level variability - an overview

Birgit Hünicke (1), Eduardo Zorita (1), Kristine S. Madsen (2), and Milla Johannson (3)

(1) Institute of Coastal Research, Helmholtz-Zentrum Geesthacht, Germany , (2) Danish Meteorological Institute, Centre of Ocean and Ice, Copenhagen, Denmark, (3) Finnish Meteorological Institute, Marine Research, Helsinki, Finland

The understanding of the processes which drive future climatic trends of sea-level on global to regional scales presumes the understanding of long-term variability in the observational period. This requires an accurate assessment of past and recent global and regional sea-level changes.
Here, we review the observed changes (1800-2000) in mean sea-level variability in the Baltic region and the main (climate) drivers for these changes. We introduce the datasets available for studying sea-level and review the major published findings which can be derived from them.
The Baltic is one of the most investigated sea-level sites in the world. It has a remarkable number of long and high quality densely spaced, tide gauge records with many stations in continuous operation since the late 19th century and some of the oldest sea-level records reporting since 200 years. More than 45 stations with at least 60 years of data have continued until recent times.
Mean Baltic Sea level changes are dominated by crustal deformations due to the glacio-isostatic land movement effect. The basin-wide pattern of relative sea-level trends shows a clear north-south gradient with a negative rate of -8.2 mm/yr in the Gulf of Bothnia. Thus, RSL is falling in the northern Baltic (where the continental crust is uplifting at roughly 10 mm/yr) and rising in parts of the Southern Baltic.
Baltic Sea level changes are affected by a sum of processes. These include thermo and halosteric effects, changes in wind, surface air-pressure and ocean currents, increasing freshwater input and gravitational effects.
The decadal sea-level variability around the quasi-linear long-term trend is strongly influenced by westerly winds, closely related to the dominant large-scale sea-level pressure (SLP) pattern of the North Atlantic (NAO). The correlation between sea-level and SLP is highest in winter, but shows significant temporal and spatial heterogeneity with low values in southern Baltic parts. The decadal influence of other atmospheric forcing factors is found to vary geographically.
The annual cycle in Baltic sea-level displays, in general, higher values during winter and lower values during spring with an increase in the amplitude (winter-spring sea-level trend) 1800-2000. The magnitude of these increasing trends is found to be basin-wide uniform (except for the Skagerrak area). The precise mechanisms responsible for this have not been completely ascertained, but are very likely not exclusively of regional to local origin (e.g. due to wind-driven changes).
Baltic absolute sea-level estimated from recent combined analysis of geodetic information (measurements and models) and tide gauge observations, show positive trends in the range of 1.3 to 1.8 mm/yr, depending on the spatial and temporal coverage of the considered datasets (1800-2000). These values lie within the range of recent estimates of global trends. Recent changes in linear (30yr) gliding trends of Baltic tide-gauge records (1800-2000) show generally increasing trends, but similar or even slightly higher than recent 30-year rates were observed around 1900 and 1950. All sites show a slight acceleration of the sea-level rate, but the large decadal variability around these positive trends hampers to establish its local statistical significance.