

Estimation of the influence of regional climate on the recent past and future sea-level changes in the Baltic Sea with statistical methods and simulations of climate models

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Long-term variations of mean sea-level in the Baltic Sea have been probably caused in the past by different sources, mainly geological (glacio-hydro-isostatic effect) and climatological. The dominant long-term trend in sea-level observations from most locations in the Baltic is caused by the combination of isostatic change due to postglacial rebound and eustatic change due to global or at least North Atlantic sea level change. However, the contribution of regional processes is not well quantified.

This talk provides an insight into ongoing work about the estimation of the influence of regional climate forcing on past and future sea-level changes in the Baltic Sea by using statistical methods and global climate models. The analysis of the statistical relationships between sea level and climatic data-sets in the observational record and the analysis of global climate simulations should yield a clearer picture of the contributions of regional climatic forcings to sea-level variations at time scales of several centuries. This is essential to understand the future sea-level changes under global climate change.

As one strategy the application of statistical regression models is used, whereby the considered predictors are restricted to those for which long term observations or reconstructions are available and which are potentially well simulated by coarse resolution models. In practise, these are sea-level pressure (an indicator of geostrophic wind), precipitation and temperature. Furthermore, this analysis helps to explain other observed trends, such as the increasing amplitude of the annual cycle of Baltic sea-level in the 20th century.

Once these statistical models have been validated and physically interpreted, the past sea-level variations related to climatic variations can be reconstructed by feeding these models with large-scale climate changes simulated by a climate model. Although global climate models cannot realistically represent the Baltic Sea due to the coarse spatial resolution, the output of the statistical model when driven by simulated fields of SLP, precipitation and temperature provides an estimation of the consequences of past climate variations for Baltic Sea level.

Climate simulations of the past few millennia may provide useful information of the amplitude of climate variations at centennial timescales and help to put the recent 20th century global warming into the perspective of natural climate variations. Several simulations covering all or parts of the past millennium have been conducted with the global climate model ECHO-G driven by estimations of past external forcing. Here, some main results of simulated climate in the Baltic Sea area will be presented.

References

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