

BACC: BALTEX Assessment of Climate Change for the Baltic Sea Basin – Summary and Outlook

Hans von Storch

Chair of BACC@BALTEX

Institute for Coastal Research, GKSS Research Center, and

KlimaCampus, University of Hamburg, Germany

The BACC assessment of past, ongoing and future climate change in the Baltic Sea basin offers a review of published knowledge in four chapters, two dealing with the geophysical (atmosphere, ocean, sea ice) side and two with the ecological (terrestrial and marine) dimension.

In the past century there has been a marked increase of **temperature** of more than 0.7 °C in the region, which is larger than the global mean temperature increase of 0.5 °C. Consistent with this increase in mean and extreme temperatures, other variables show changes, such as increase of winter runoff, shorter ice seasons and reduced ice thickness on rivers and lakes in many areas. These trends are statistically significant but they have not been shown to be larger than what may be expected from natural variability. In addition, no robust link to anthropogenic warming, which on the hemispheric scale has been causally related to increased levels of greenhouse gases in the atmosphere in “detection and attribution” studies, has been established. However, the identified trends in temperature and related variables are consistent with regional climate change scenarios prepared with climate models. Therefore, it is plausible that at least part of the recent warming in the Baltic Sea basin is related to the steadily increasing atmospheric concentrations of greenhouse gases. Efforts are needed which systematically examine the inconsistency of recent trends with natural variability, circulation changes as well as the consistency with elevated greenhouse gas concentrations as a potential cause.

The situation is much less clear regarding **precipitation**: in the past, a spatially non-uniform pattern of upward and downward trend has been observed, which can hardly be related to anthropogenic climate change. For the future, intensified winter precipitation may emerge later in this century over the entire area, while summers may become drier in the southern part – but this expectation is uncertain for the time being. For the water body of the Baltic Sea, a

tendency towards lower **salinity** is expected. Similarly, no clear signals, whether for the past or for the scenarios, are available with regard to **wind** conditions.

In view of the large uncertainty in our knowledge about the changing climatic conditions, it is not surprising that knowledge about ecological implications of ongoing and future climate change is far from complete and also very uncertain. The observed changes in temperature in the past have been associated with consistent changes in **terrestrial ecosystems**, such as earlier spring phenological phases, northward species shifts and increased growth and vigour of vegetation. In lakes, higher summer algal biomasses have been found. These trends are expected to continue into the future; induced species shifts may be slower than the warming which causes it. In the **marine ecosystem** of the Baltic Sea the assessment is particularly difficult because of the presence of strong non-climatic stressors (eutrophication, fishing, release of pollutants) related to human activities. Changing temperatures have been related to various effects, in particular to the composition of species. A lowering of salinity is thought to have a major influence on the distribution, growth and reproduction of the Baltic Sea fauna. Freshwater species are expected to enlarge their significance, and invaders from warmer seas (such as the zebra mussel *Dreissena polymorpha* or the North American jelly comb *Mnemiopsis leidyi*) are expected to enlarge their distribution area. The expected changes in precipitation (and thus river runoff) may have additional detrimental effects on the problem of eutrophication.