



Assessment of Climate Change for the Baltic Sea Basin - The BACC Project - 22-23 May 2006, Göteborg, Sweden



Detection of Past and Current Climate Change 4) The Baltic Sea

Climate shift at the end of the 19th century

- Time-series extending back to 1800 or earlier indicate a climatic shift at the end of the 19th century.

No significant state changes in the 20th century

- The sensitivity to large-scale atmospheric circulation, e.g. the North Atlantic Oscillation (NAO), makes the decadal variability large in most variables, and shorter climatic trends difficult to attribute to certain causes.

No significant change in heat content

- There are indications that the integrated heat content has not increased in response to increased air temperature during the past three decades. This may be explained by changes in the heat exchange caused by simultaneous changes in cloudiness and wind speeds.
- The heat content of the Baltic Sea varies significantly on decadal time scales, but no significant trends have been found for the period from 1958 until now.

No trend in salinity

- Changes in the salinity of the Baltic Sea are essentially determined by variations in freshwater supply, which is primarily river runoff, and variations in wind speeds altering the exchange with the Ocean.
- The response is quite slow since the time scale of salinity changes set by the residence time is about 33 yrs.
- Observations show that the spatially averaged salinity has varied with about ± 0.5 during the 20th Century, but there is no trend in the data.

The eustatic sea level is rising

- The observed trend in the Baltic is due to the composite of isostatic change due to postglacial rebound, and eustatic change due to global, or at least North Atlantic, sea level change. This results in rising sea levels in the southern Baltic and sinking in the north.
- Sea level records show in general that the sea level rise has accelerated, that is the eustatic sea level rise was higher in the 20th century compared to the 19th century.
- Observations from Stockholm indicate that the change in eustatic sea level rise was from 0 mm yr^{-1} to 1 mm yr^{-1} .
- Annual to decadal variations in sea levels are to a large extent due to variations in atmospheric circulation.

Less sea ice in the 20th century

- No clear trend in Maximum Ice Extent (MIB) during the 20th century, but the entire time series indicates less ice during the 20th compared to the 19th century.
- The change seems to have occurred as a rather sudden shift towards less ice in the late 1800s, in conjunction with the ending of the Little Ice Age.
- The data quality of older parts of the time series is not readily assessed since the background analysis was not published.

Aggravated coastal erosion during recent decades

- Coastal damages result from a combination of an increased number of strong storms, accelerated sea level rise, and a decreasing trend of the presence of ice cover in winter, when the most intensive storms occur.
- Currently, most of these factors in the Baltic region are strengthened and act simultaneously and jointly towards an aggravated erosion in the area during the last decades of the 20th century.
- Analysis of wave height variations shows an increase in severe wave events during 1958 – 2002.
- Storm variations of the past decades seem to be within natural variability and not due to climate change.

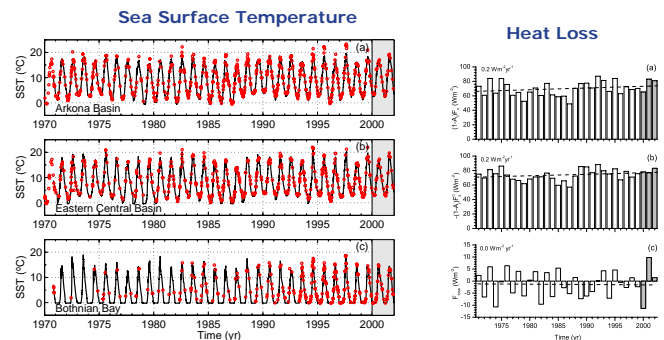


Fig. 1: Time series of sea surface temperature (SST) in 3 different Baltic Sea basins and annual mean Baltic Sea heat loss. From Omstedt and Nohr (2004).

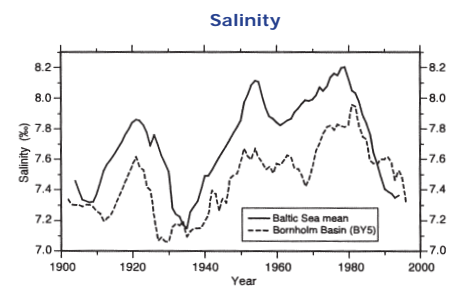


Fig. 2: Five-years running mean of spatially averaged salinity of the Baltic Sea and the surface salinity in the Bornholm Basin. From Winsor et al. (2001).

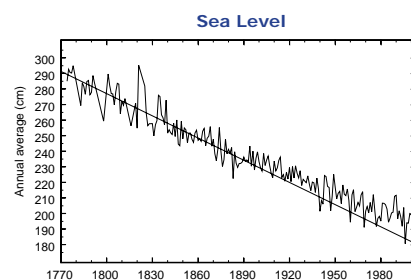


Fig. 3: The sea level in Stockholm 1774 - 2002. The linear trend is computed for 1774-1884 and extrapolated to 2002. Reproduced from Ekman (1999), recomputed and extended.

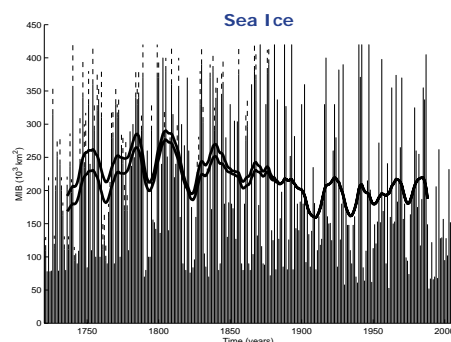


Fig. 4: The maximum extent of ice cover from 1720 to 2005 in the Baltic Sea and its classification according to Seinä and Palosuo (1996).