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

2) Atmosphere: Clouds, Radiation and Wind

Cloudiness and solar radiation show remarkable inter-annual and inter-decadal variability

- During the latter half of the 20th century, a decrease in cloudiness and an increase in sunshine duration was observed in the south (Poland), while opposite trends revealed in the north (Estonia). In the 1990s, these trends turned their sign.
- At Tartu-Tõravere, Estonia, annual totals of global radiation show a decreasing tendency from the 1950s up to the beginning of the 1990s when a reversal from decrease to increase occurred. Direct radiation shows a similar behavior. There has been a decrease in diffuse radiation during the last 15 years or so. At Tartu, a decrease of reflected radiation is related to a decrease of snow cover.
- Long-term observations in Estonia show that an improvement in air quality (i.e. a decrease in the aerosol emissions to the atmosphere) reversed a decreasing trend in atmospheric transparency and direct radiation during the 1990s. Presently, the atmospheric transparency is at the same level as in the 1930s.
- There are few data describing variability and trends in cloud cover and solar radiation. There are problems with reliable visual cloud cover observations and instrumental records of global radiation, and other components of radiation budget are sparse. Notable exceptions are the widely studied records from Tartu, Estonia.

No long-term trends in storminess

- Centennial time series from southern Scandinavia uncover that there are no long-term trend in storminess indices. There is nonetheless a consistent picture across most data sources of an intensification of the wind climate during the 1980s–mid 1990s.
- In the Baltic region, different data sources give slightly different results with respect to trends and variations in the extreme wind climate, especially concerning small-scale extreme winds.
- There are indications for an increasing impact from extreme wind events. But this increasing impact results from a complex interaction between climate and development trends that increase the exposure to damage and/or the vulnerability of nature and society.
- As direct wind measurements are usually not reliable for studying long-term changes in strong winds, different storminess indices, based on e.g. air pressure records, have been developed.

Solar Radiation

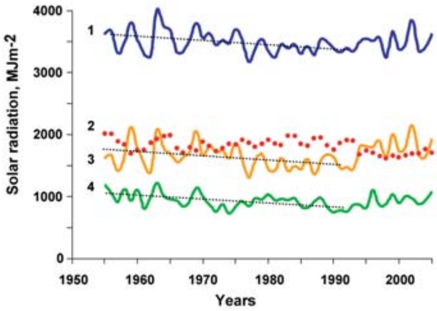

Fig. 1: Annual totals of global (1, blue), diffuse (2, red), direct (3, orange) and reflected (4, green) radiation at Tartu-Tõravere, Estonia in 1955-2005, MJm^{-2}.

Atmospheric Transparency

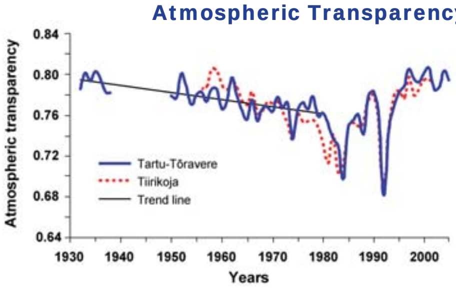

Fig. 2: Annual mean atmospheric transparency at Tartu-Tõravere (blue, 1932-1938, 1950-2005) and at Tiirikoja (red, 1956-2001) in Estonia.

Storminess

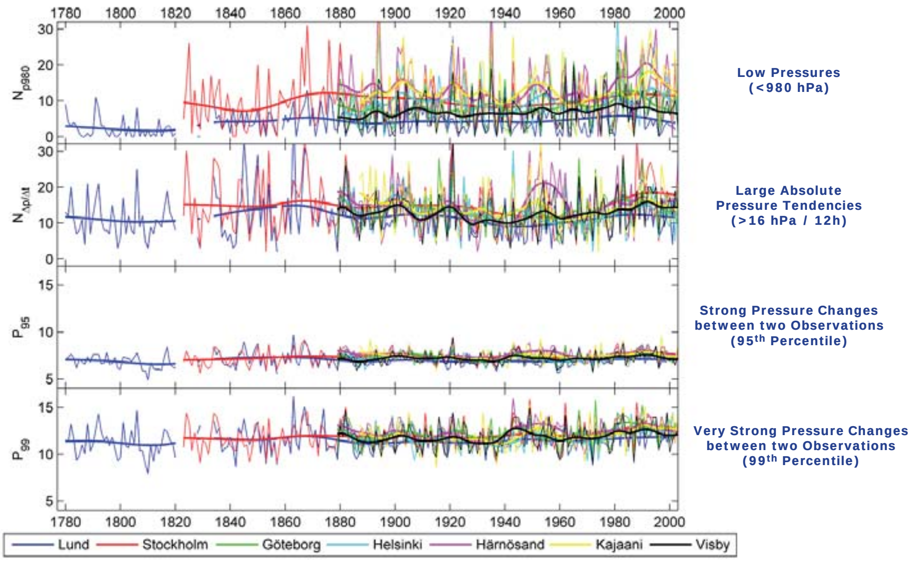

Fig. 3: Four different annual storminess indices derived from station pressure records in the Baltic region. From top to bottom: N_{p980} – number of low pressure observations below 980 hPa, $N_{\Delta p/\Delta t}$ – number of events when the absolute pressure tendency exceeds 16 hPa/12h, P_{95} and P_{99} – the 95 and 99 percentiles of pressure differences (hPa) between two observations. The three observation hours (morning, midday and evening) vary over the period, in modern times it is typically 05-06, 11-12 and 17–19 UTC (cf. Bärring and von Storch, 2004; and Schmith et al., 1997). The thin lines show annual variations and the smooth thick curves highlight variability on timescales longer than 10 years.

Organised by: Göteborg University, GKSS

Support by: SMHI, Kungl. Vetenskapsakademien, IOW, FIMR