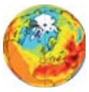
Assessment of Climate Change for the Baltic Sea Basin - The BACC Project - 22-23 May 2006, Göteborg, Sweden

Projections of Future Climate Change



2) Projections from Global Climate Models (GCM)

Present Day Climate in GCMs

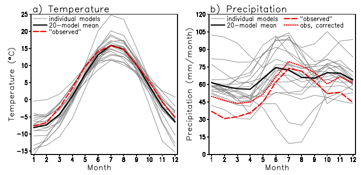


Fig.1: Average seasonal cycles of (a) temperature and (b) precipitation over the total land area of the Baltic Sea basin. The thin solid lines represent the control run climates of the 20 individual CMIP2 models and the thick solid line the 20-model mean. The dashed lines give observational estimates (CRU climatology, New et al. 1999). For precipitation, a corrected observational estimate is also given (dotted line).

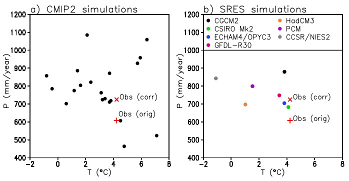


Fig. 2: Annual area means of temperature and precipitation over the Baltic Sea basin land area for control simulations from (a) CMIP2 and (b) SRES. The plus sign (+) represents the observational estimate from climatology (as in Figure 3.3.2) and the cross (×) estimate includes precipitation correction.

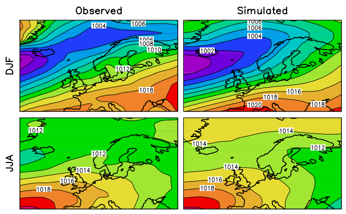


Fig. 3: Distribution of time mean sea level pressure in winter (top) and summer (bottom) as observed in 1961-1990 (Kistler et al. 2001) and as averaged over the 20 CMIP2 simulations. Contours are drawn at every 2 hPa.

CMIP2 Scenario Projections (around mid 21st century)

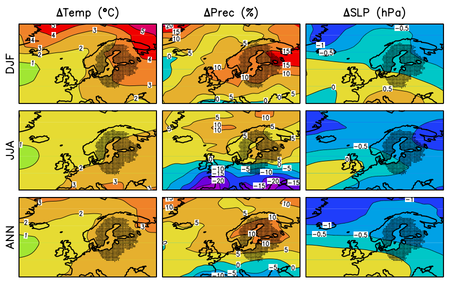


Fig. 4: Changes in temperature (left), precipitation (middle) and sea level pressure (right) around the time of the doubling of CO_2 as averaged over the 20 CMIP2 models. Results are shown for winter (DJF), summer (JJA) and the annual mean (ANN). The contour interval is 1°C for changes in temperature, 5% for changes in precipitation and 0.5 hPa for changes in sea level pressure. Shading shows the Baltic Sea basin land area.

Global climate models (GCMs) are used for numerical simulations of global climate. They aim to represent all relevant physical processes of the atmosphere, land surface and oceans important for determining the evolution of climate on time scales of decades and centuries. Due to computational demands, the horizontal resolution of GCMs tends to be some 300 km in the atmosphere and some 150 km in the oceans. This is sufficient to reproduce the major atmospheric and oceanic circulation patterns and trends for climatological variables over continental scales. Shown are results from GCM simulations based on both CMIP2 and SRES greenhouse gas projections (see below). Summary conclusions for the mid to late 21st century follow.

Temperature is projected to increase at rates exceeding the global mean

- Projected regional warming over the Baltic Sea basin is about 50% larger than the global mean warming.
- In northern areas of the basin, the largest warming is generally projected for winter; further south the seasonal cycle of warming is less pronounced.
- Relative uncertainty for warming in the Baltic Sea basin is larger than that for global mean warming.

Precipitation is projected to increase

- A general increase in precipitation is projected for the Baltic Sea basin, except for southernmost areas in summer.
- Uncertainty for precipitation change is, however, larger than that for temperature change.
- The coarse resolution of GCMs does not resolve small-scale variations of precipitation change that are induced by regional topography and land cover.

Wind speed projections are not robust

- Projections indicate that an increase in windiness for the Baltic Sea basin would be somewhat more likely than a decrease.
- The magnitude of such a change is highly uncertain and it may take a long time for indications of GHG-induced changes in windiness to emerge from natural variability.

CMIP2: Coupled Model Intercomparison Project, Phase 2 (idealized experiments with CO_2 gradually increasing at 1% per year; results from 20 GCMs shown here)

SRES: Special Report on Emission Scenarios (IPCC; Nakićenović et al. 2000; see related poster; results from 6 GCMs shown here)

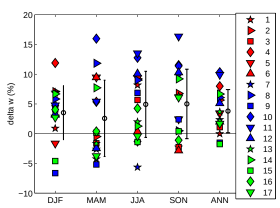


Fig.5: Differences in percent between control and scenario for seasonal means of large scale wind speed from 17 CMIP2 GCM simulations. The mean and the error bar (±one standard deviation) of the changes in the 17 GCMs are also plotted. (From Chen et al., 2006).

CMIP2 Temperature Projections (around mid 21st century)

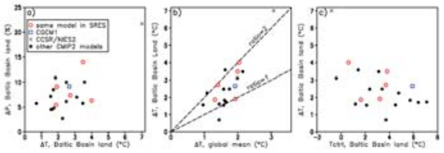


Fig. 6: CMIP2 simulation results for, (a) Changes in annual area mean temperature (x-axis) and precipitation (y-axis) in the Baltic Sea basin land area, (b) changes in global mean temperature (x-axis) and Baltic Sea basin land area mean temperature (y-axis), and (c) control run mean temperature (x-axis) and temperature change in the Baltic Sea basin land area (y-axis). Models for which SRES simulations are also available are identified.

SRES Scenario Projections (around late 21st century)

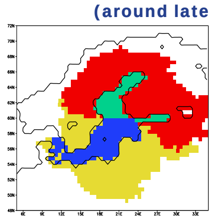


Fig. 7: Four subregions used for Fig. 8 and 9.

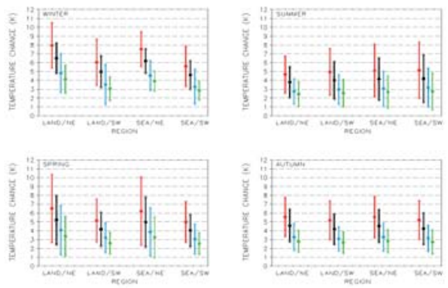


Fig. 8: 95% probability intervals of GCM-derived seasonal temperature change in 2070–2099 compared to 1961–1990 for four subregions (defined in Fig. 7). The intervals (vertical bars) are based on SRES simulations from six GCMs and are given separately for A1FI (red), A2 (black), B2 (blue) and B1 (green) scenarios. The central dot on each bar denotes the median of the interval.

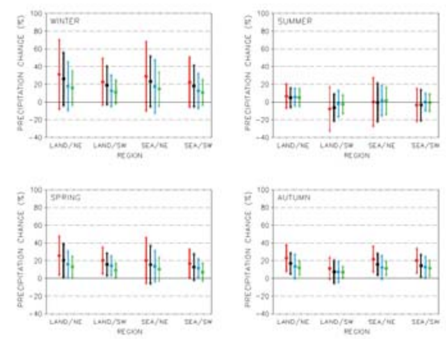


Fig. 9: 95% probability intervals of GCM-derived seasonal precipitation change in percent for four subregions. Details as in Figure 8.

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