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

Projections of Future Climate Change

4) River Runoff and the Baltic Sea

River Runoff Projections

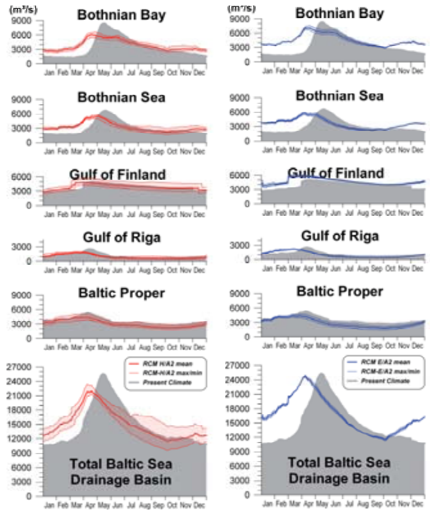

Fig. 1: Mean river discharge from HBV-Baltic for RCM-A2 scenarios, driven by HadAM3H (left; 10 RCMs) and ECHAM4/OPYC3 (right; 2 RCMs). The scenarios represent future climate for the period 2071-2100 compared to the control period 1961-1990. (Adapted from Graham et al., 2006b.)

Sea Surface Temperature Projections

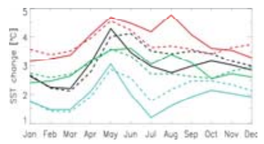

Fig.2: Mean monthly sea surface temperature change: RCAO-H/B2 (blue solid line), RCAO-H/A2 (black solid line), RCAO-E/B2 (green solid line), and RCAO-E/A2 (red solid line). Dashed lines denote the corresponding RCO scenarios. (From Meier, 2006.)

Sea Level Rise and Surge Projections

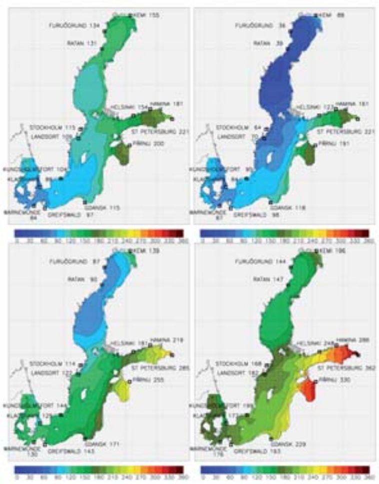

Fig. 3: 100-year surge (in cm) of the hindcast experiment using RCO (upper left panel) relative to the mean sea level 1903-1998 and 3 selected regional scenarios of the 100-year surge: "lower case" scenario (RCO-H/B2) with a global average sea level rise of 9 cm (upper right panel), "ensemble average" scenario with a global average sea level rise of 48 cm (lower left panel), and "higher case" scenario (RCO-E/A2) with a global average sea level rise of 88 cm (lower right panel). (From Meier, 2006.)

Assessing both future hydrological and oceanographic changes due to climate change requires additional model studies that expand upon results from both global (GCM) and regional (RCM) projections. The results shown here are results from simulations using hydrological and oceanographic models that were coupled to RCM simulations of anthropogenic climate change.

River runoff is projected to increase in the north and decrease in the south with distinct changes in seasonal variation

Shown here are selected results using a large scale hydrological model, HBV-Baltic, that was driven by some 20 simulations using 10 different RCMs. Comparing scenario simulations of 2071-2100 to control simulations representing 1961-1990, some conclusions from these hydrological studies follow:

- Annual river runoff would increase in the northernmost catchments of the Baltic Sea basin and decrease in the southernmost catchments.
- Projected summer river runoff shows a decrease of as much as 20%, while winter runoff shows an increase of up to 50%, on average for the total basin.
- The projected occurrence of medium to high river runoff events shows a higher frequency.
- The projected magnitude of high runoff events shows no pronounced increase on the large scale.

The Baltic Sea is projected to become warmer and have less ice cover

Detailed studies are shown using four projections from a regional coupled atmosphere-ocean model, RCAO, based on two GCM simulations and two SRES scenarios. Additional projections were performed using an ocean only model, RCO. Comparing projections of 2071-2100 to control simulations representing 1961-1990, some conclusions from these oceanographic studies follow:

- Mean annual sea surface temperatures are projected to increase by some 2 to 4ºC.
- Ice extent in the sea would then decrease by some 50 to 80%.
- Average salinity of the Baltic Sea is projected to decrease between 8 and 50%, but uncertainty for this is large.
- Risk for coastal inundation would increase most along the eastern and southern shores of the Baltic Sea.

Salinity Projections

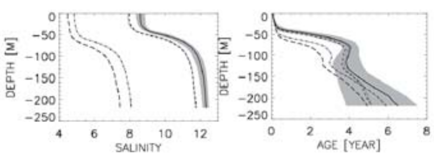

Fig. 6: Median profiles of salinity and age at Gotland Deep: RCO hindcast simulation for 1961-1990 (black solid line, shaded areas indicate the range between the first and third quartiles) and four scenario simulations for 2071-2100 (dotted line: RCO-H/B2, dashed line: RCO-H/A2, dash-dotted line: RCO-E/B2, long-dashed line: RCO-E/A2). (Adapted from Meier, 2006.)

River Runoff Projections

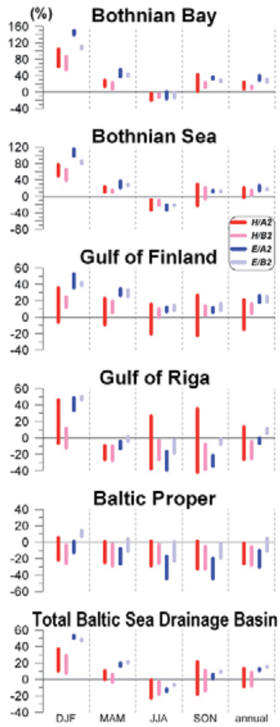

Fig.4: Percent volume change in river discharge from HBV-Baltic simulations using RCM scenarios for 2071-2100 compared to1961-1990. This is summarised by season, winter (DJF), spring (MAM), summer (JJA), and autumn (SON). Each bar represents the range of results between the simulations driven by HadAM3H (H/A2, 10 simulations; H/B2, 4 simulations), and by ECHAM4/OPYC3 (E/A2, 2 simulations; E/B2, 2 simulations). (Created with results from Graham, 2004 and Graham et al. 2006b.)

Sea Ice Extent Projections

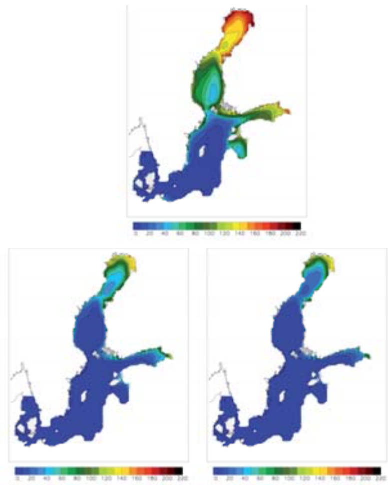

Fig. 5: Mean number of ice days averaged for regional downscaling simulations of HadAM3H and ECHAM4/OPYC3: control (top), B2 scenario (bottom left), and A2 scenario (bottom right). (Adapted from Meier et al., 2004a.)

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