

## MARISPLAN WP1

# Probabilistic Climate Projections of Physical Properties of the Baltic Sea

Byoung Woon An, Jari Haapala, Katriina Juva and Iina Ronkainen  
Finnish Meteorological Institute, Marine Research Unit

## Why

Traditionally, projections of the changes in the Baltic Sea are quantified by a change of mean conditions for a specific model and emission scenario applied. In order to capture uncertainties due to imperfect physical models and natural variability of climate, we are constructing probabilistic estimates of future marine conditions based on ensemble simulations.

Specific objectives of the WP1 are :

- to examine decade scale variability and extremes of the ice conditions, hydrography and water level in the future
- to estimate changes in a local scale
- to produce scenarios for marine spatial planning database

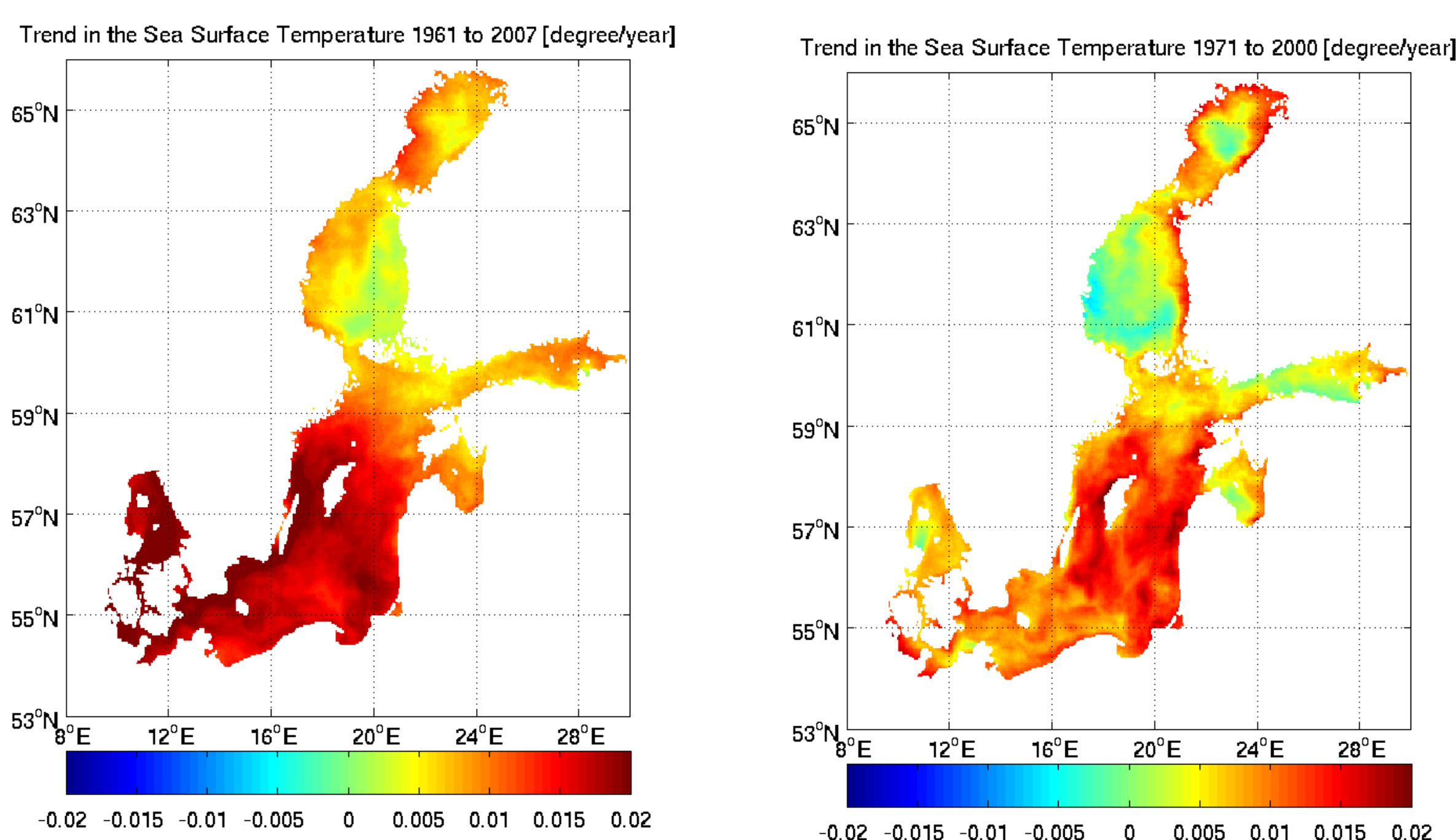


Fig. 1. Simulated trends of sea surface temperature, A) period 1961 - 2007, B) period 1971 - 2000

## How?

1) Utilize an advanced Baltic Sea model (BaltiX) for numerical investigations

- NEMO/LIM3 based ice-ocean circulation model
- Horizontal resolution 2 nautical miles, 56 vertical layers, the North Sea and tides included
- multicategory sea-ice model
- Hindcast simulations period : 1961-1997
- Climate simulations periods : 1950 - 2100

2) Analyze Rossby Center/SMHI climate simulations

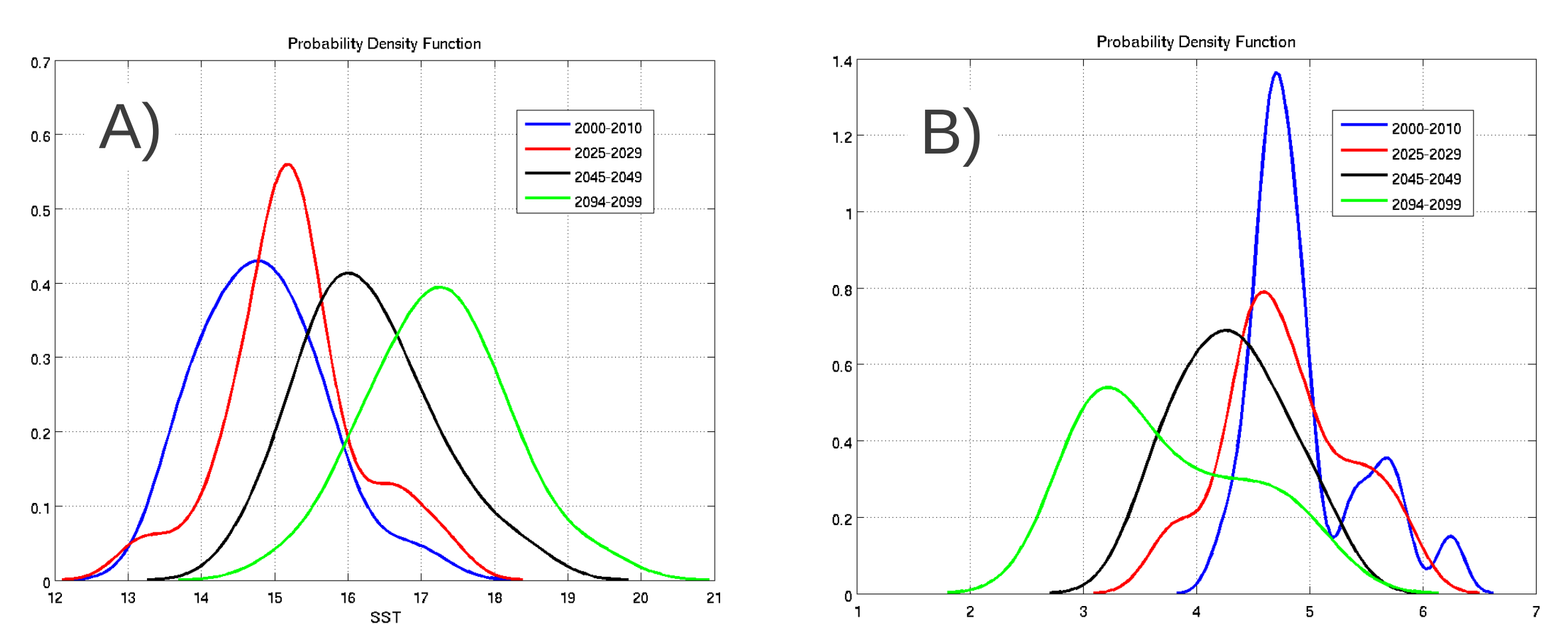


Fig. 2. Modelled summer period (JJA) sea surface temperature (A) and salinity (B) distributions in the Gulf of Finland for a periods 2000-2010, 2025-2029, 2045-2049 and 2094 - 2099. Analysis is based on the four ensembles four ensembles (ECHAM5-r1-A1B, ECHAM5-r3-A1B, ECHAM5-r1-A2, HadCM3-A1B).

## Main results this far

1. New circulation model, BaltiX, has been applied for the climate simulations. Model simulates inter-annual variability of hydrography, currents and ice conditions realistically. Detailed validation of the model is an ongoing activity.

2. Modelled trends of SST manifest large regional differences. Locally, negative trends in 20-30 year time scales are found regardless of a positive trend in a Baltic Sea scale. Regional differences are expected due to changes in circulation and upwelling/downwelling intensity.

3. Statistical analysis of existing Baltic Sea projections have been conducted. For the SST, largest changes are found in the Bay of Bothnia both in summer and winter period.

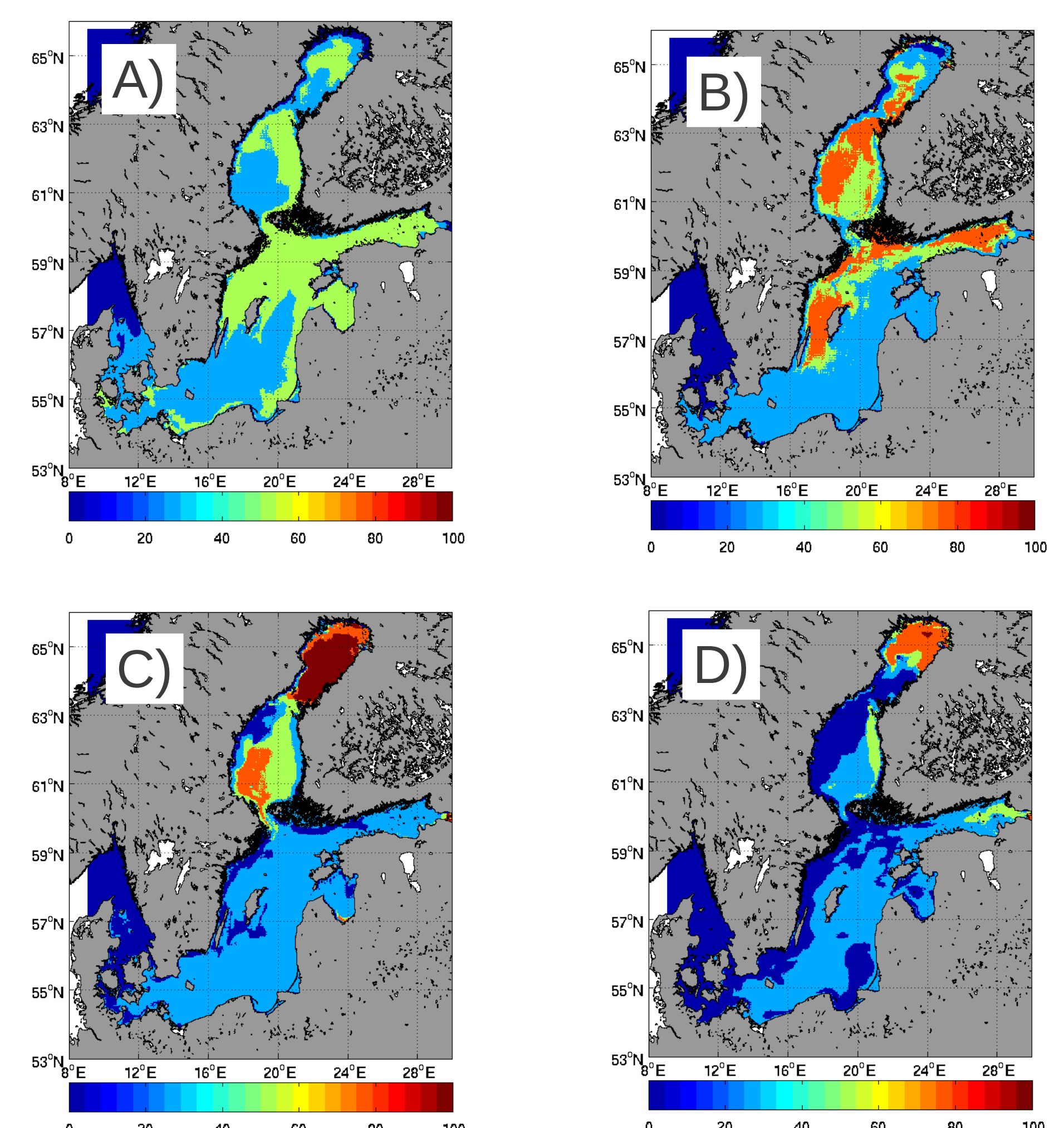


Fig. 3. Probability maps for seasonal SST increase larger than 3 °C from present climate until 2090-2100, A) December-February, B) March-May, C) June-August and D) September - November.