

Baltic Sea wave conditions under climate change scenarios

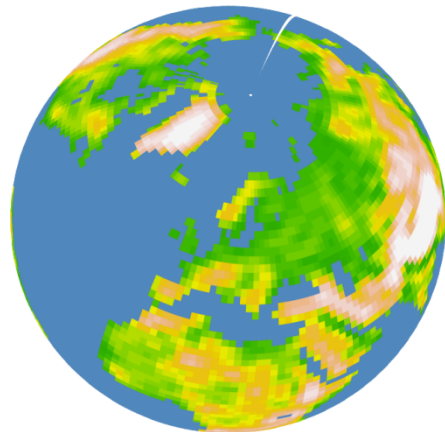
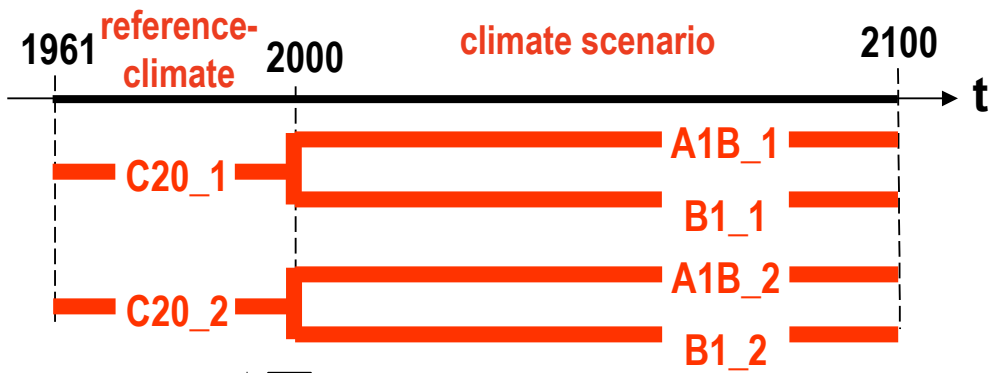
Nikolaus Groll, Birgit Hünicke, Ralf Weisse

13.6.2013 / Borgholm, Öland, Sweden

Content

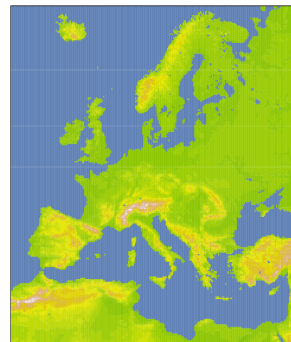
- ensemble setup and model chain
- wind speed for different periods
- wave height for different periods
- wave spectra for some locations

Ensemble setup and model chain



ECHAM5-MPI-OM
(about $1.875^\circ \times 1.875^\circ$)
MPI-Hamburg

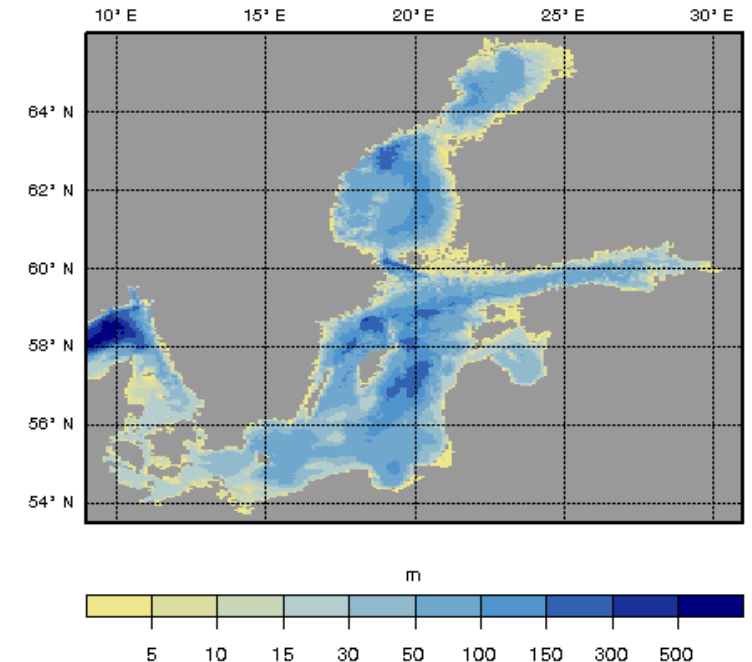
3D ecosystem model
of the Baltic Sea (3x3nm)
IOW



COSMO-CLM
(ca. $18 \times 18 \text{ km}$)
SGA/ M&D/ DKRZ

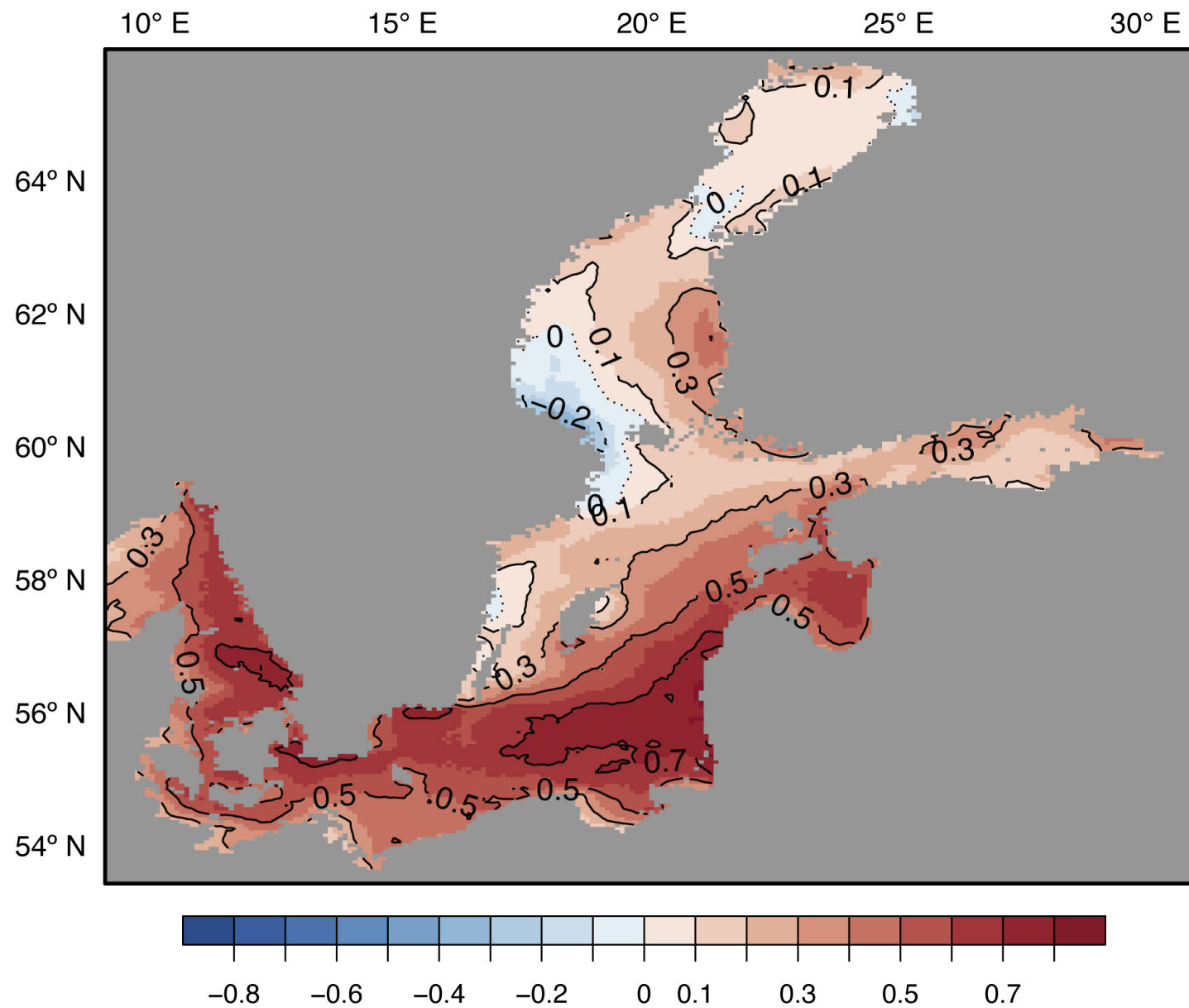
sea ice
coverage

wind fields

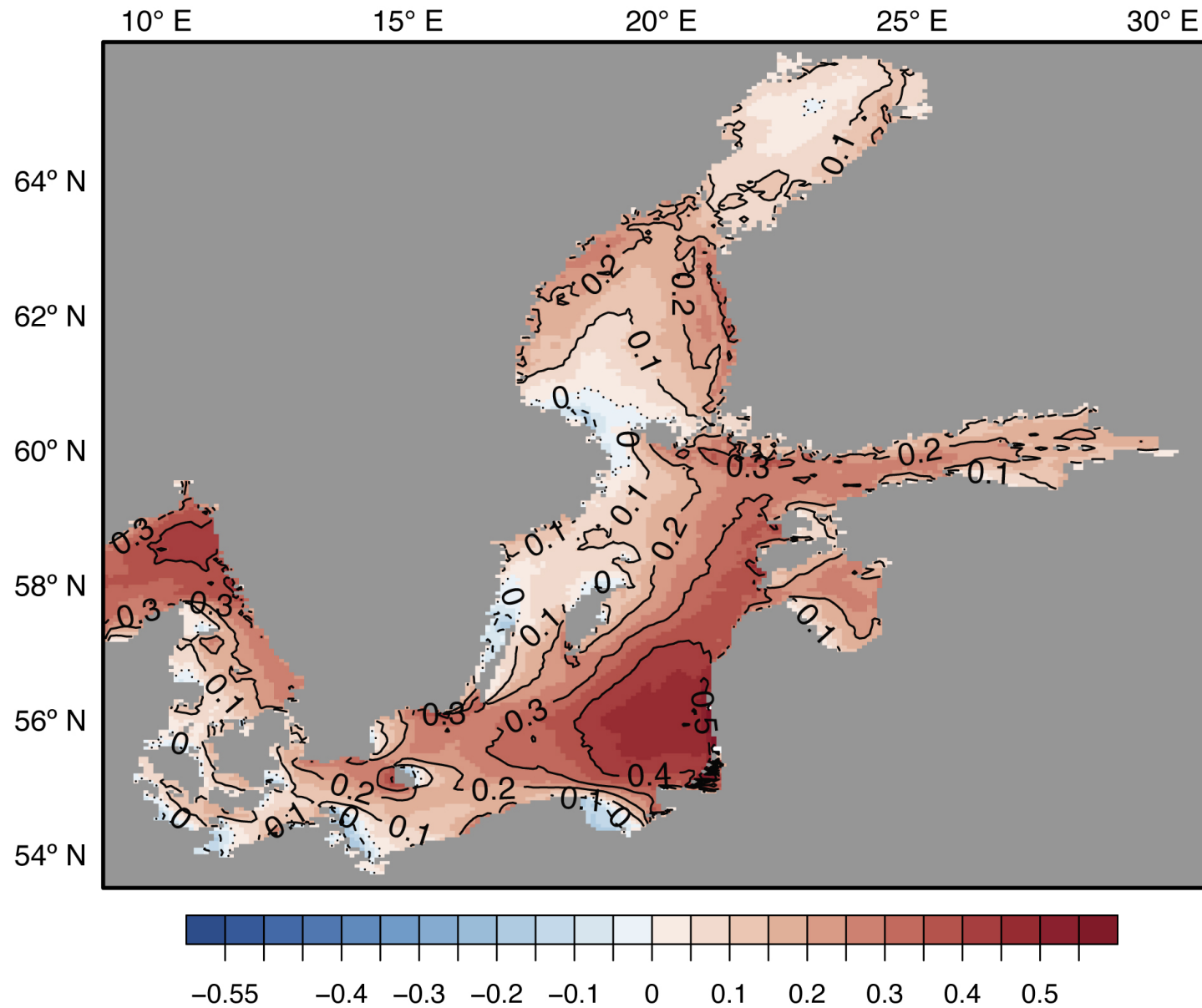


wave model WAM
(ca. $5.5 \times 5.5 \text{ km}$);
35 frequencies (0.04-1.07Hz), 24 directions

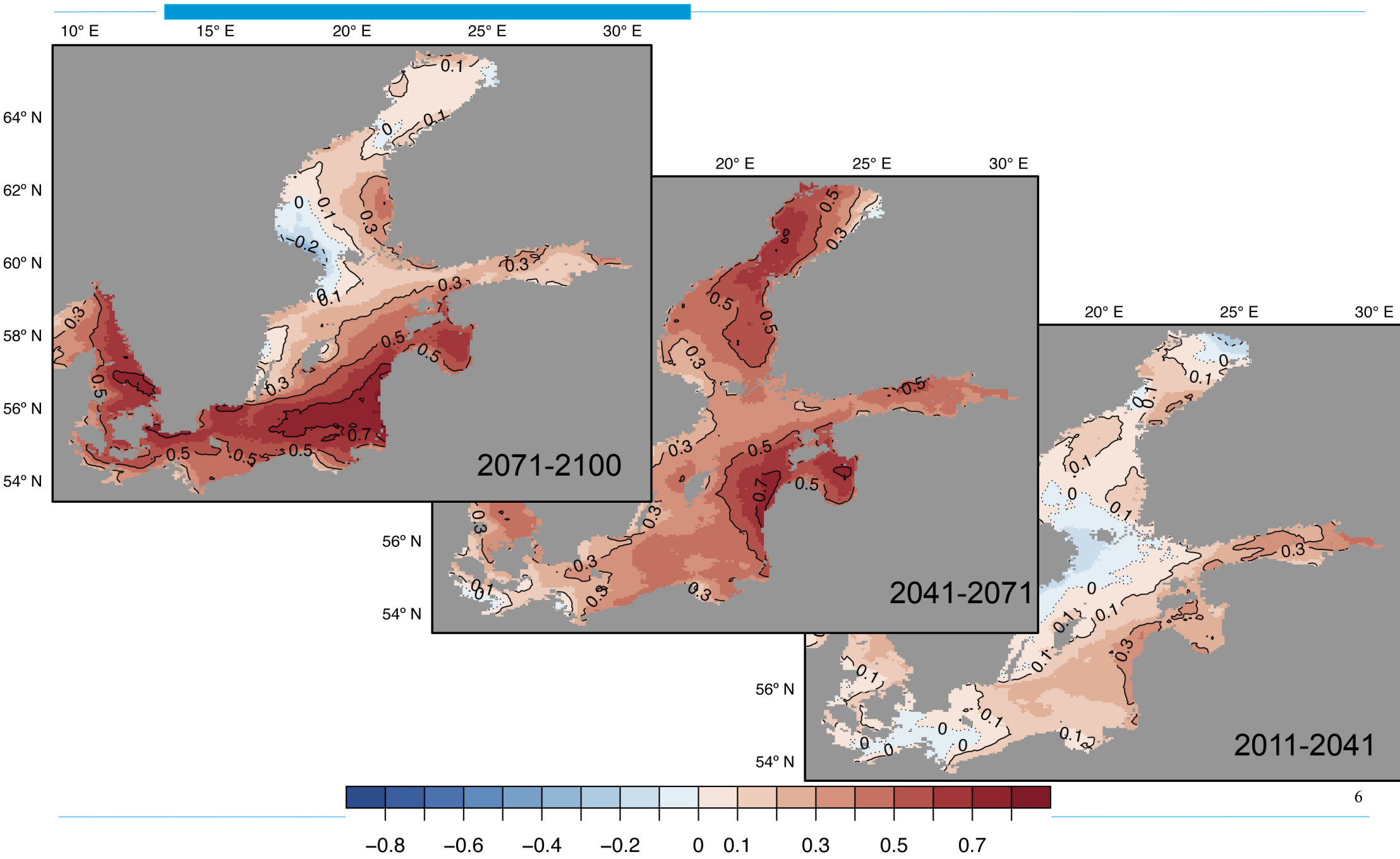
Climate change signal of the 99 percentile of **wind speed** in A1B_1
2071-2100 ./. 1961-1990



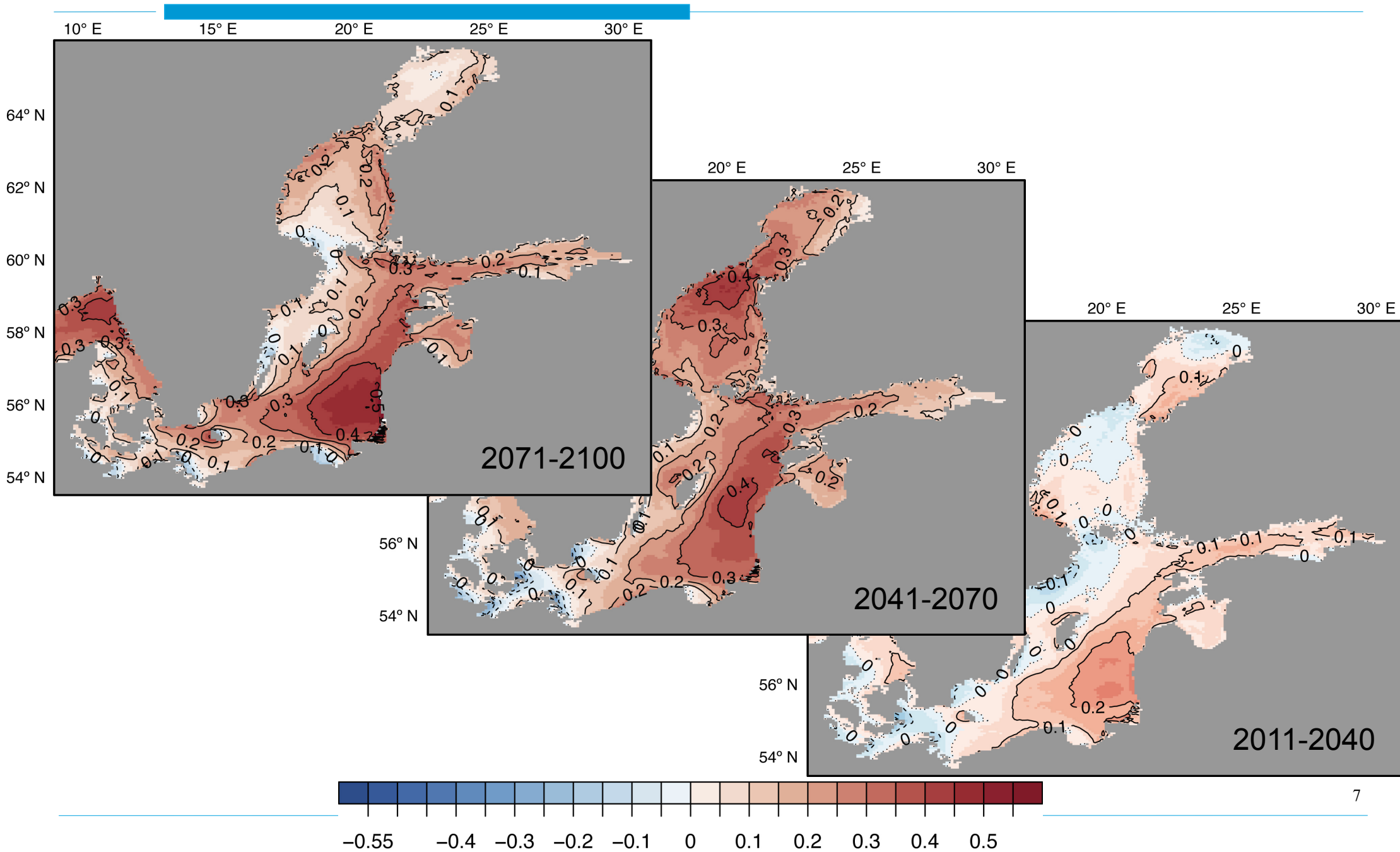
Climate change signal of the 99 percentile of **significant wave height** in A1B_1
2071-2100 ./ 1961-1990



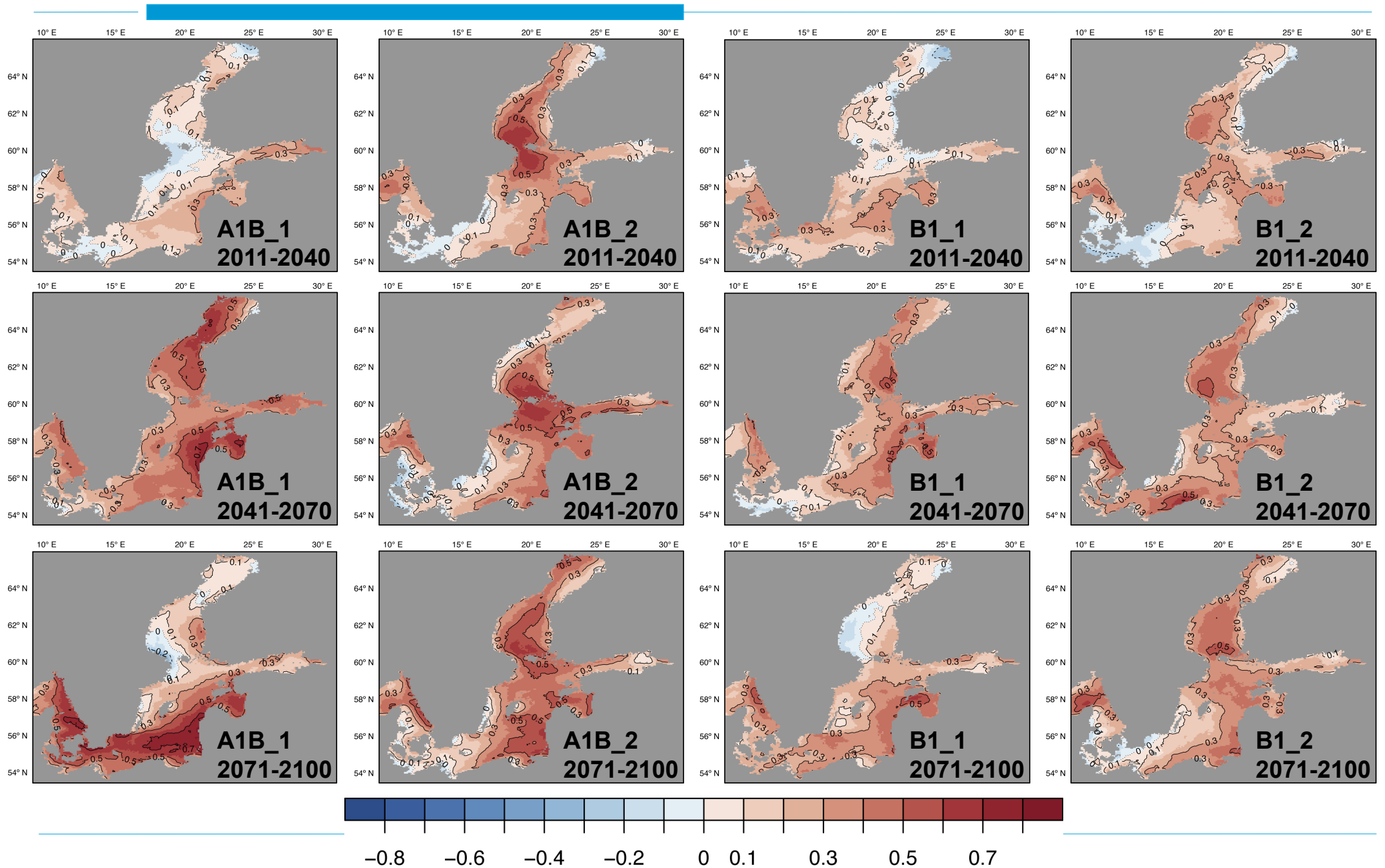
Climate change signal of the 99 percentile of **wind speed** in A1B_1
2011-2041; 2041-2070; 2071-2100 ./. 1961-1990



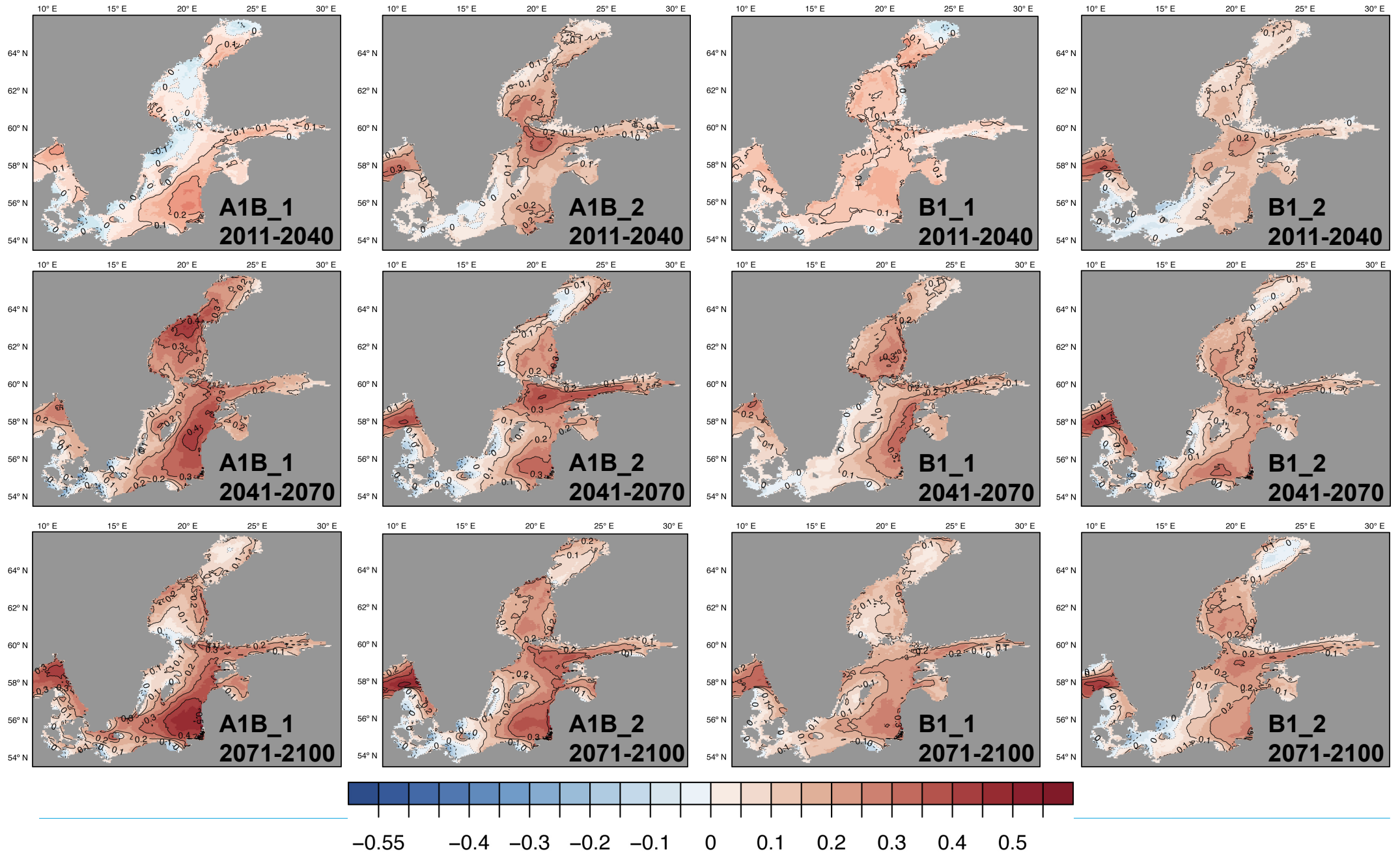
Climate change signal of the 99 percentile of **significant wave height** in A1B_1
2011-2040; 2041-2071; 2071-2100 ./. 1961-1990



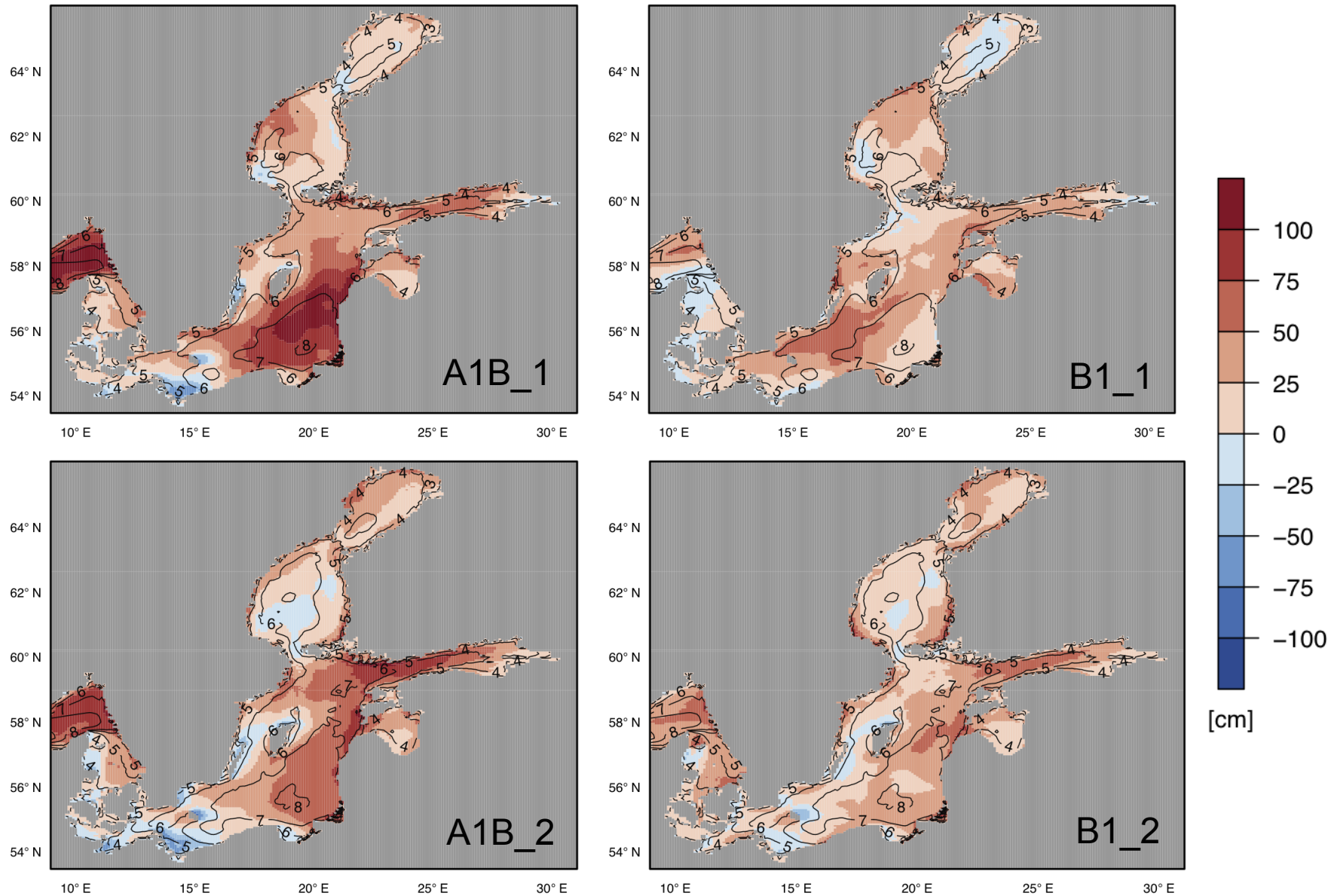
Climate change signals of the 99%ile wind speed in four realizations (2x A1B, 2x B1) 2011-2040; 2041-2071; 2071-2100 ./. 1961-1990



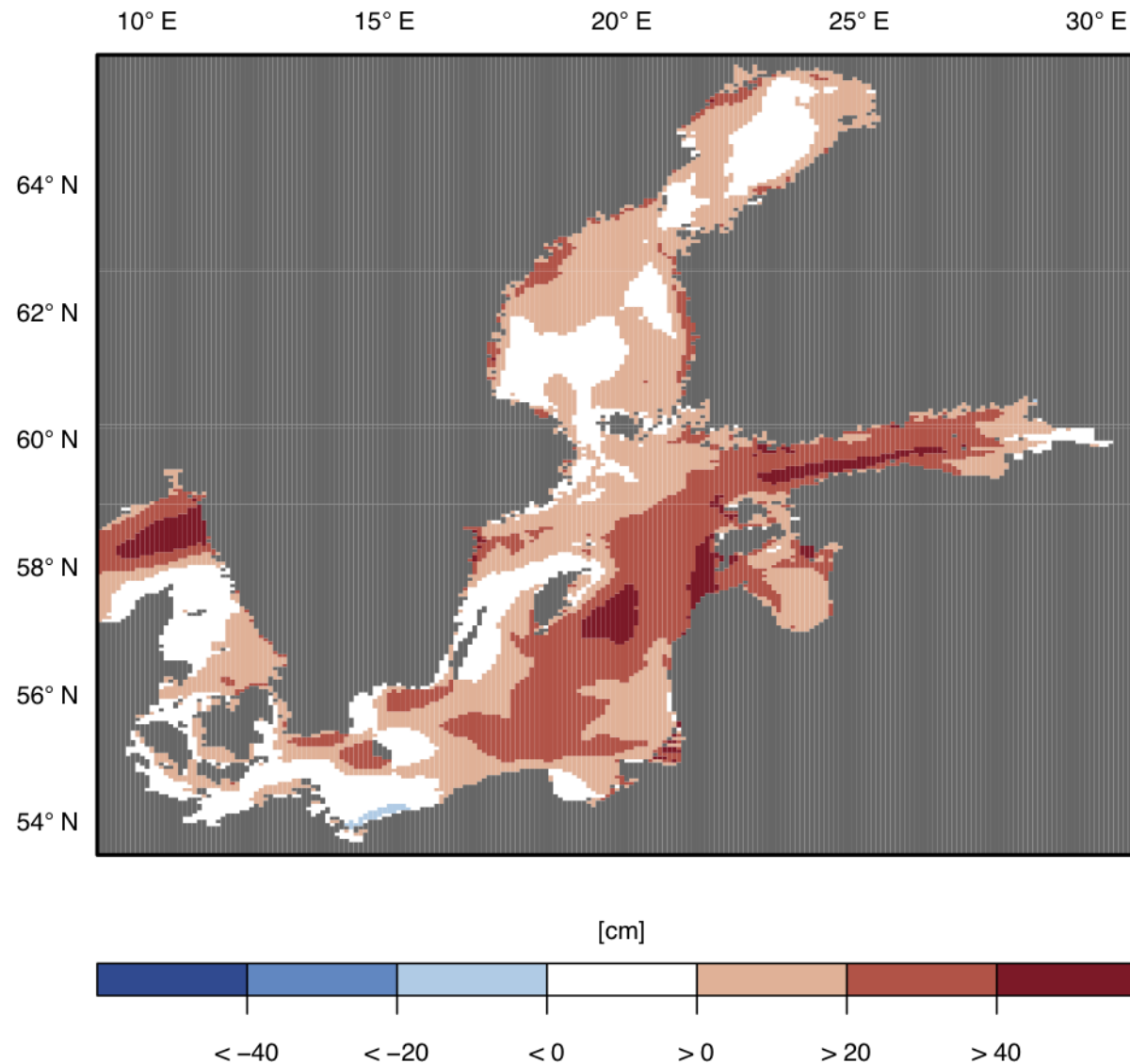
Climate change signals of the 99%ile significant wave height in four realizations (2x A1B, 2x B1) 2011-2040; 2041-2071; 2071-2100 ./. 1961-1990



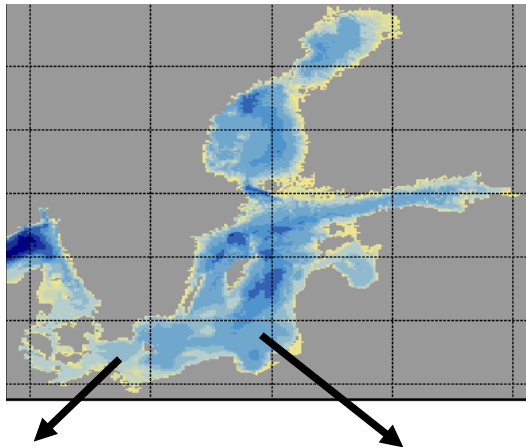
Climate change signal of the annual maxima of **significant wave height**
in four realizations (2x A1B, 2x B1) 2071-2100 ./. 1961-1990



Common climate change signal of the annual maxima of **significant wave height** in four realizations (2x A1B, 2x B1)2071-2100 ./ 1961-1990

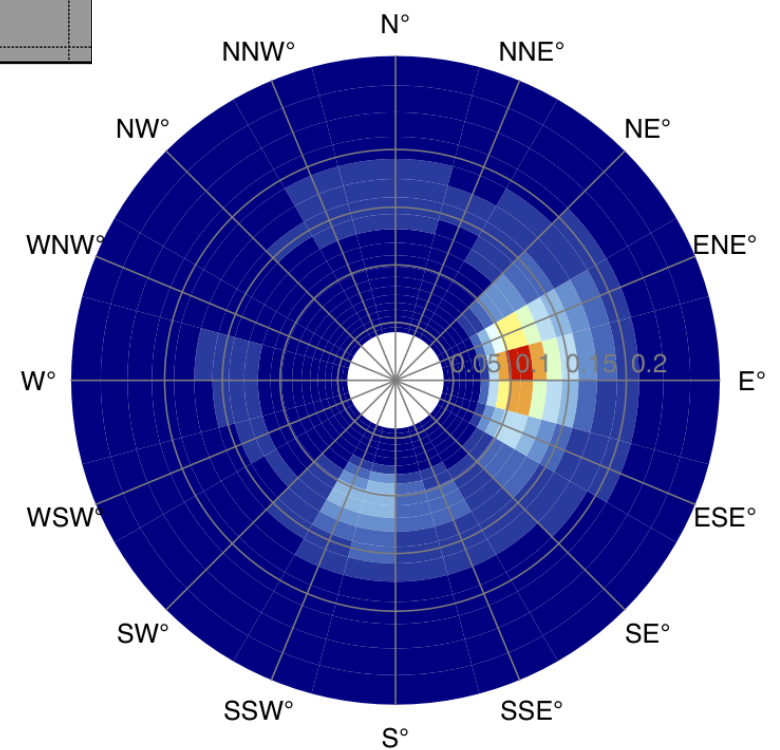
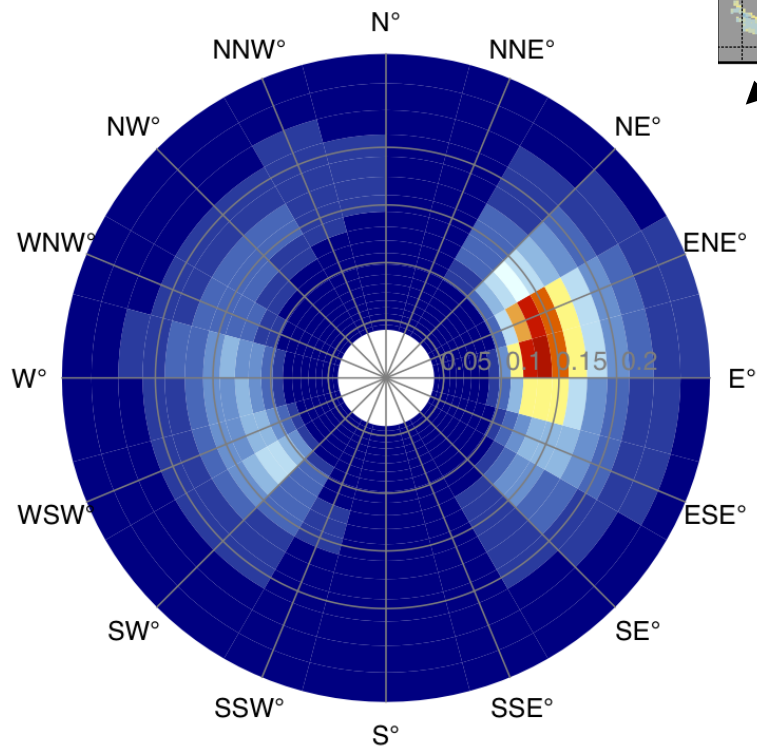


Average directional **wave spectra** in C20_1 1961-1990



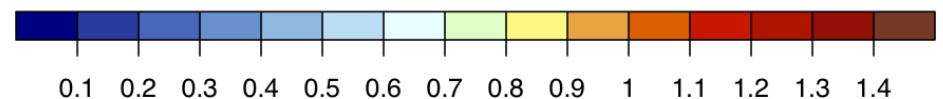
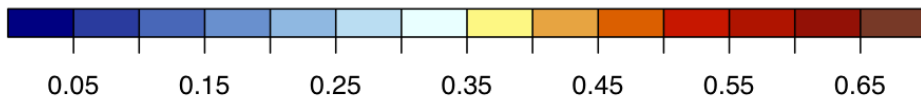
Arkona Basin

South East Baltic



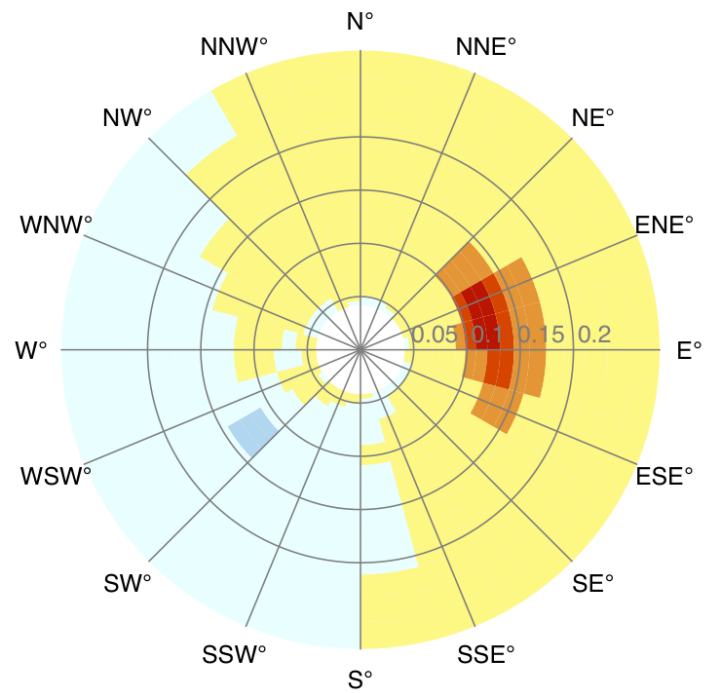
[m^2s^{-3}]

[m^2s^{-3}]



Climate change signal of the average **wave spectra** in A1B_1 2071-2100 ./ 1961-1990

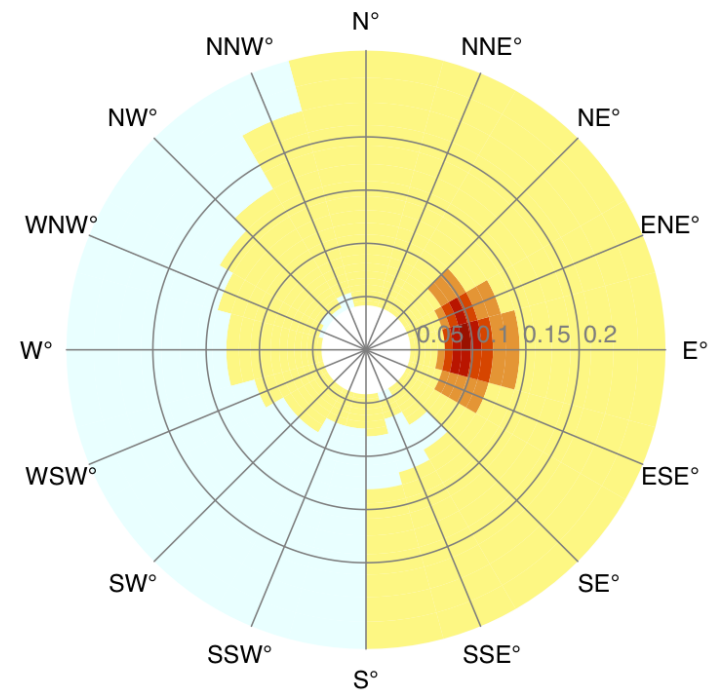
Arkona Basin



[m2s]

-0.25 -0.15 -0.05 0.05 0.1 0.15 0.2 0.25

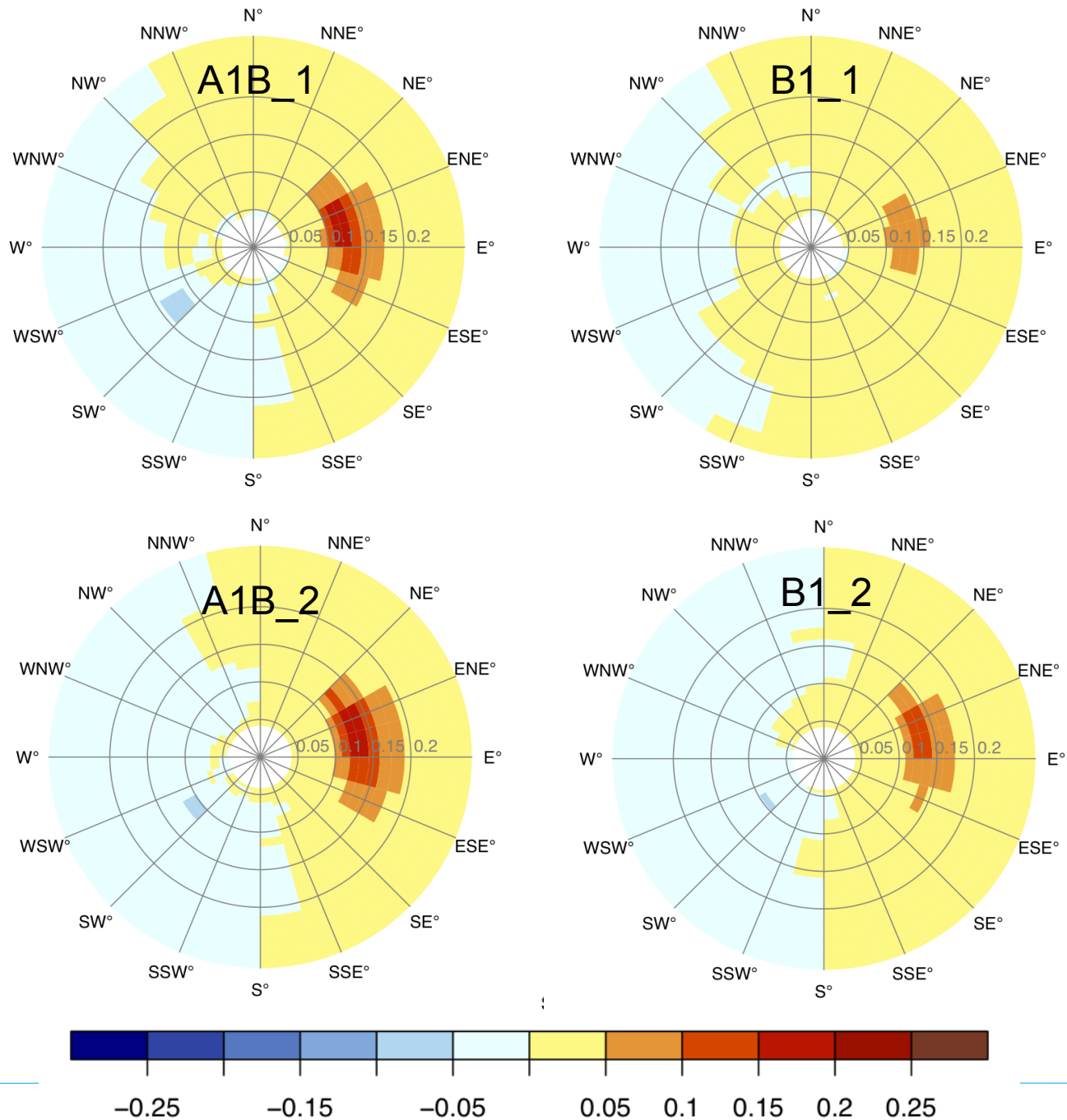
South East Baltic



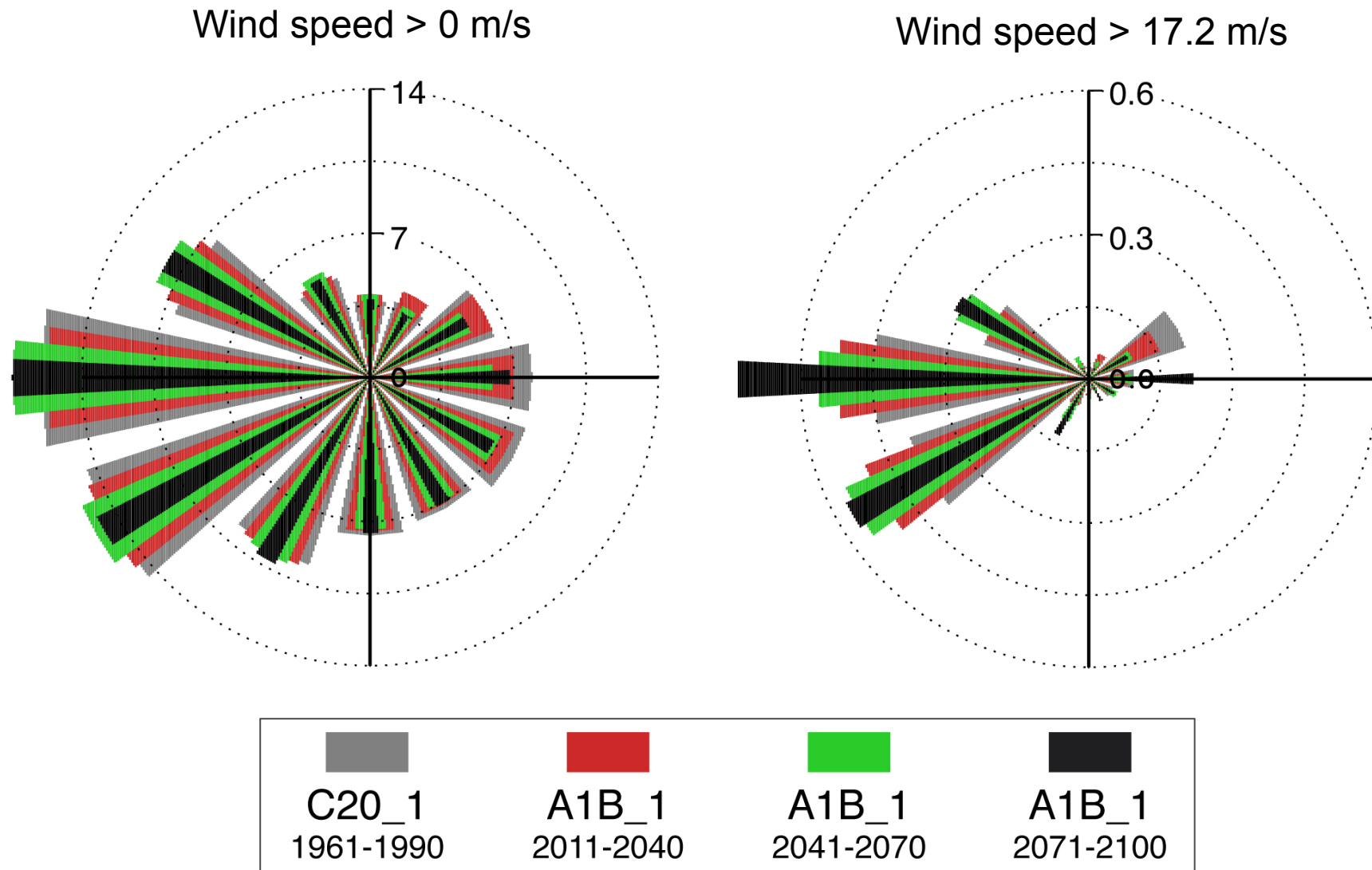
[m2s]

-0.5 -0.4 -0.3 -0.2 -0.1 0.1 0.2 0.3 0.4 0.5

Climate change signal of the average **wave spectra** for the Arkona Basin in four realizations (2x A1B_1, 2x B1) 2071-2100 ./ 1961-1990



Distribution of wind direction for the Arkona Basin under the climate change scenarios A1B_1



Summary

- Increase of the 99 percentile of wind speed and significant wave height towards the end of the 21st century, more pronounced in the Southern Baltic Sea
- Spatially and temporally differences between different periods and realisation
- Realizations agree in an increase of wave height over large areas but not in the magnitude of change.
- Mean wave spectra show an increase of energy density throughout all wave periods for waves heading East, small decrease of waves heading West