

Wind fields over the Gulf of Riga

WP2 - Wind energy fields and ice conditions

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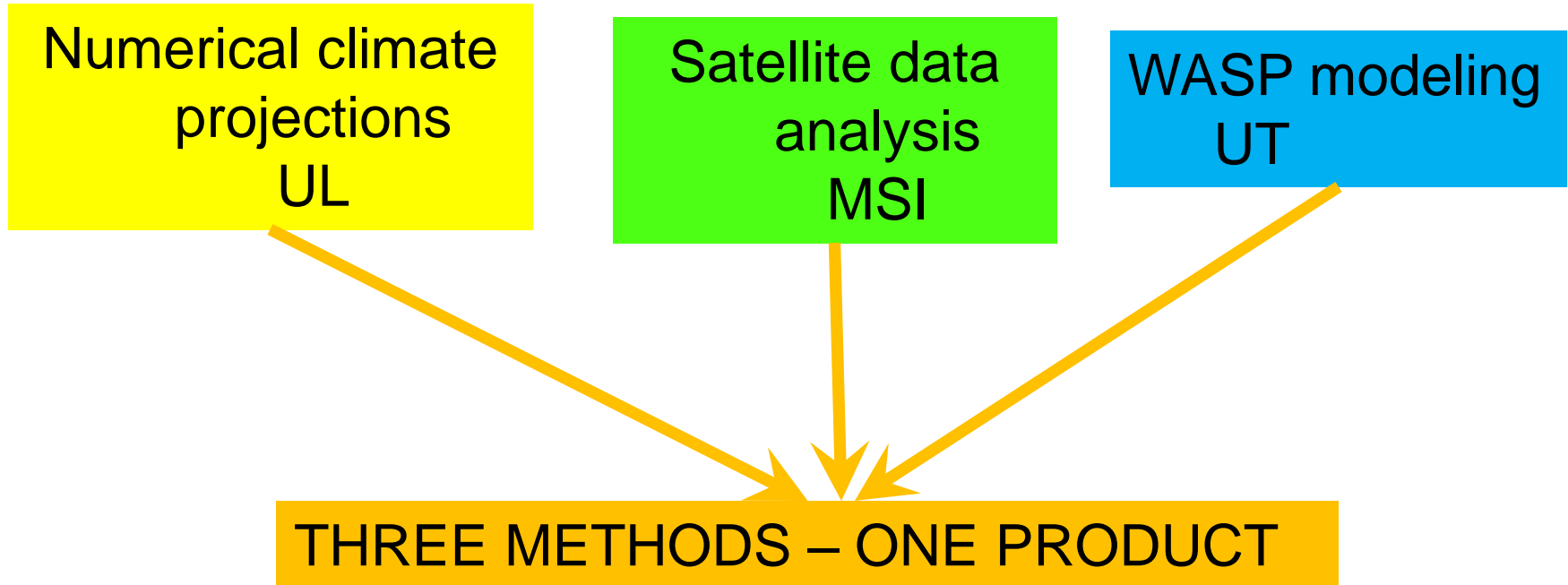
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1. AIMS AND PARTNERS



Research and quantification of wind and ice climate for GoR

Analysis and production of wind/ice maps

Production of contents for spatial planning tool

2. TIME SCHEDULE VS TASKS

STAGE 1: mobilisation

Data collection, planning XI/10-IV/11

STAGE 2: methods

Research, development of data processing methods, production of sample outputs V/11-X/11

STAGE 3: production

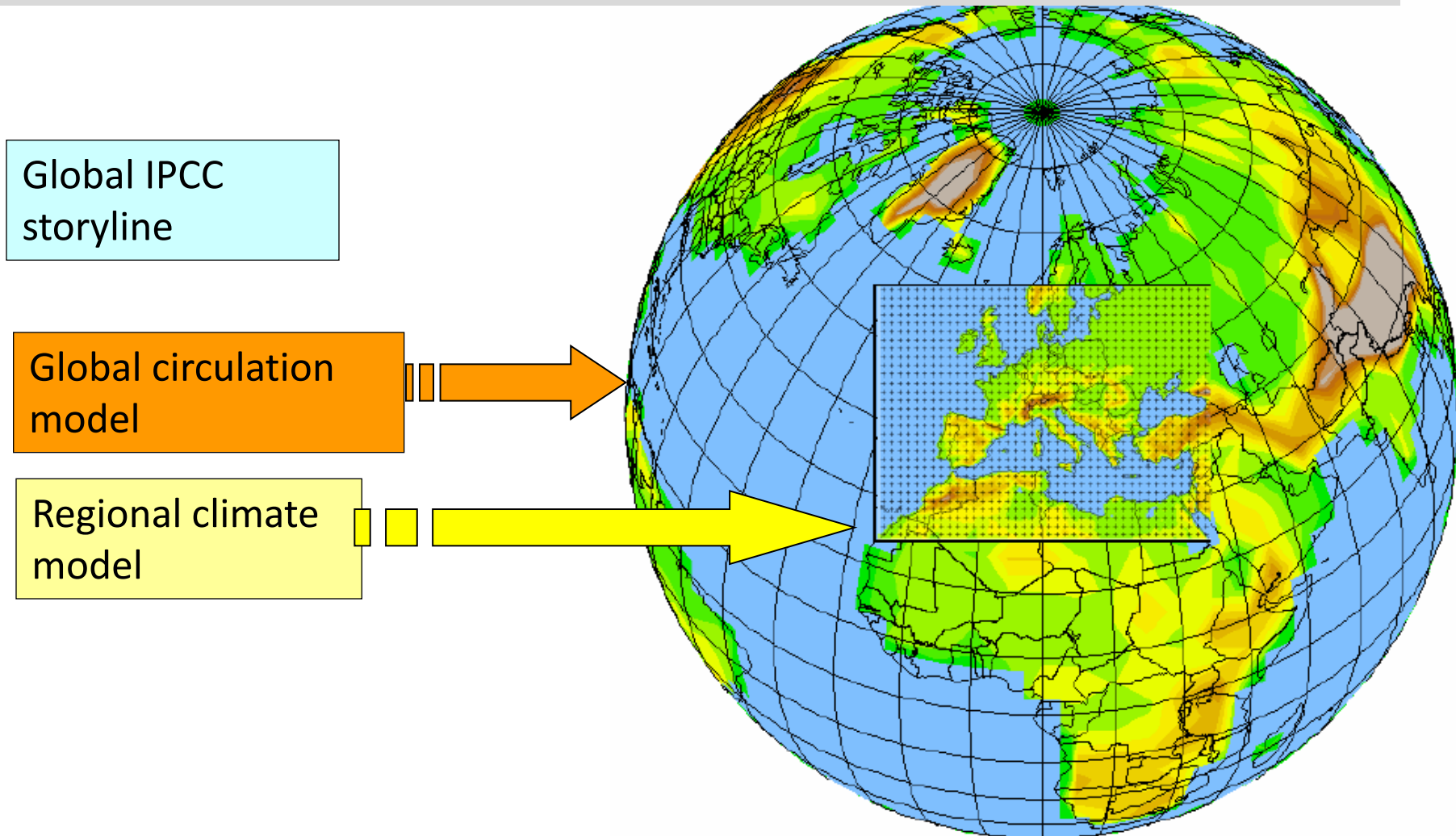
Implementation of developed methods, production of parameter sets relevant for wind farming XI/11-IV/12

STAGE 4: postproduction

Assistance to other WPs, comparison of methods, research V/12-X/12

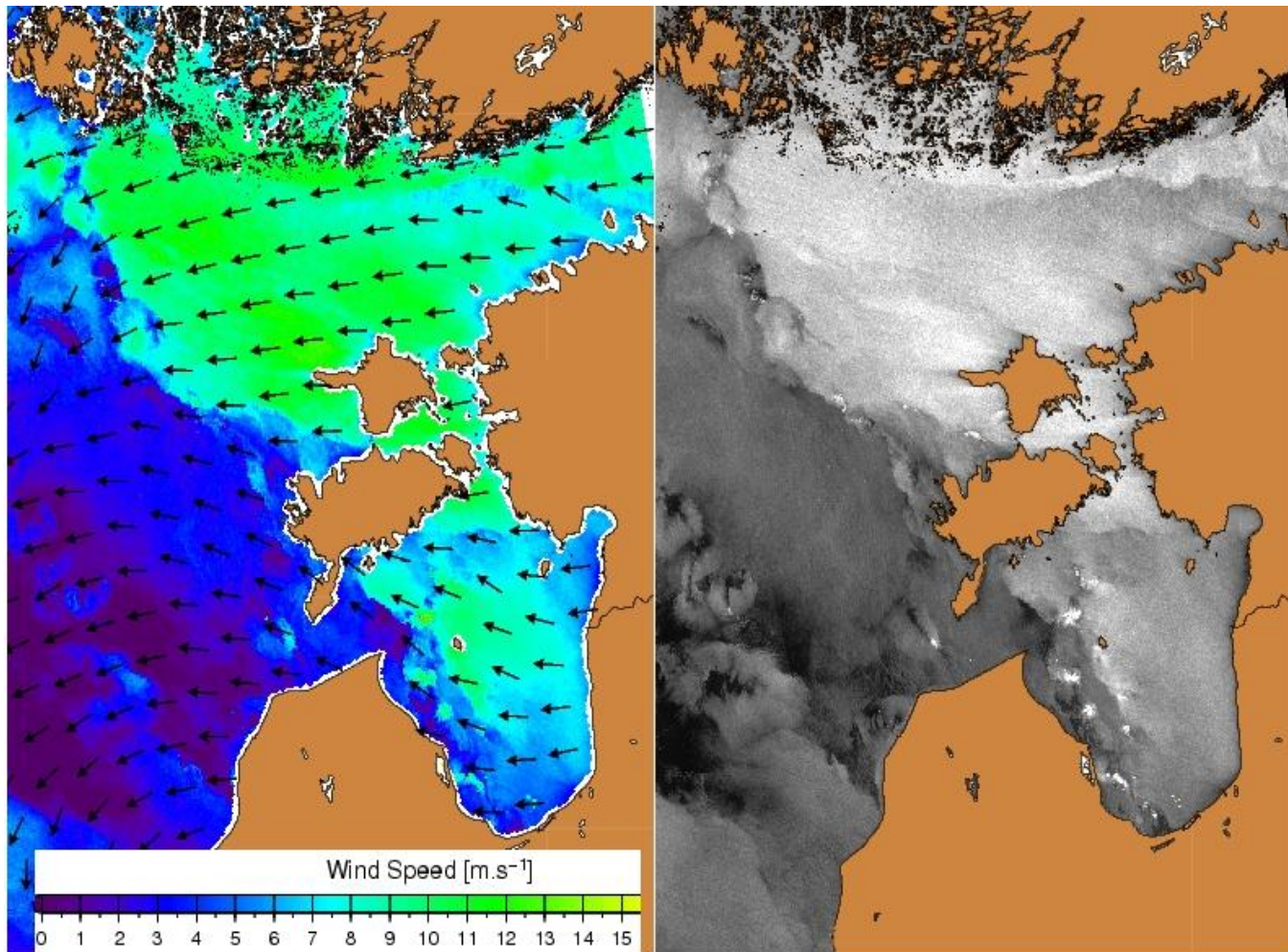
3. ILLUSTRATION OF METHODS : RCM

Regional climate models provide long time series including future climate projection



3. ILLUSTRATION OF METHODS : SAT

Backscatter images of Synthetic Aperture Radar can be calibrated for mapping wind fields



3. ILLUSTRATION OF METHODS : WASP

WASP model spatially extends observation statistics accounting for terrain



4. COMPARISON OF METHODS

Numerical climate projections:

- + physical model, future projections
- biases, low spatial resolution

Satellite data analysis:

- + arbitrary spatial resolution, innovative
- ice, calibration

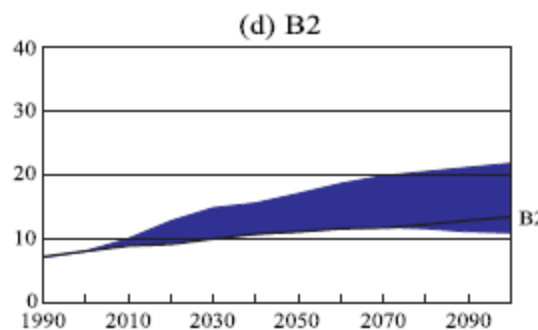
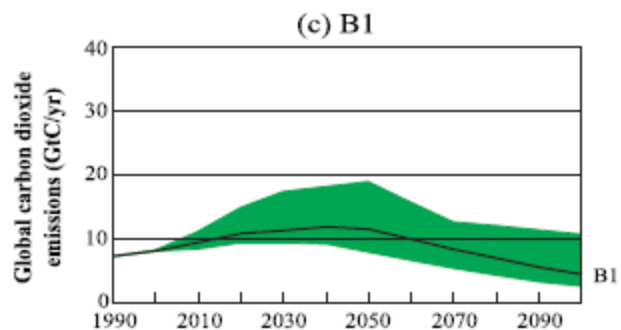
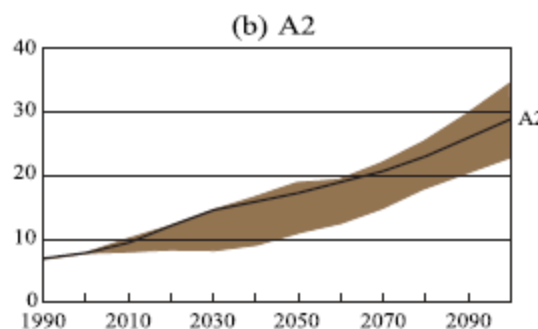
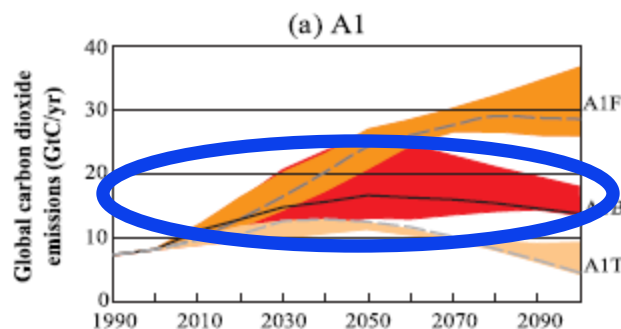
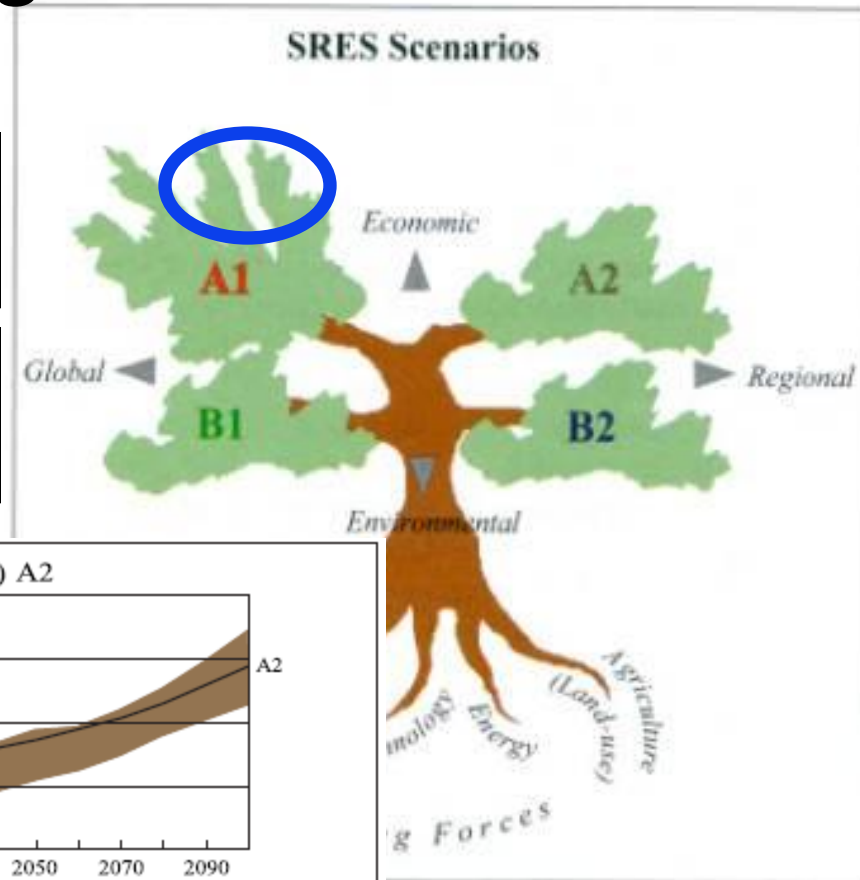
WASP modeling:

- + industrial standard, includes all relevant parameters
- semi-physical, requires observation series

5. INSIGHT: RCM ANALYSIS

PRUDENCE (2006) – A2, B2, time slices (1961-90, 2071-2100)

ENSEMBLES (2009) – A1B, continuous time (1951-2100)

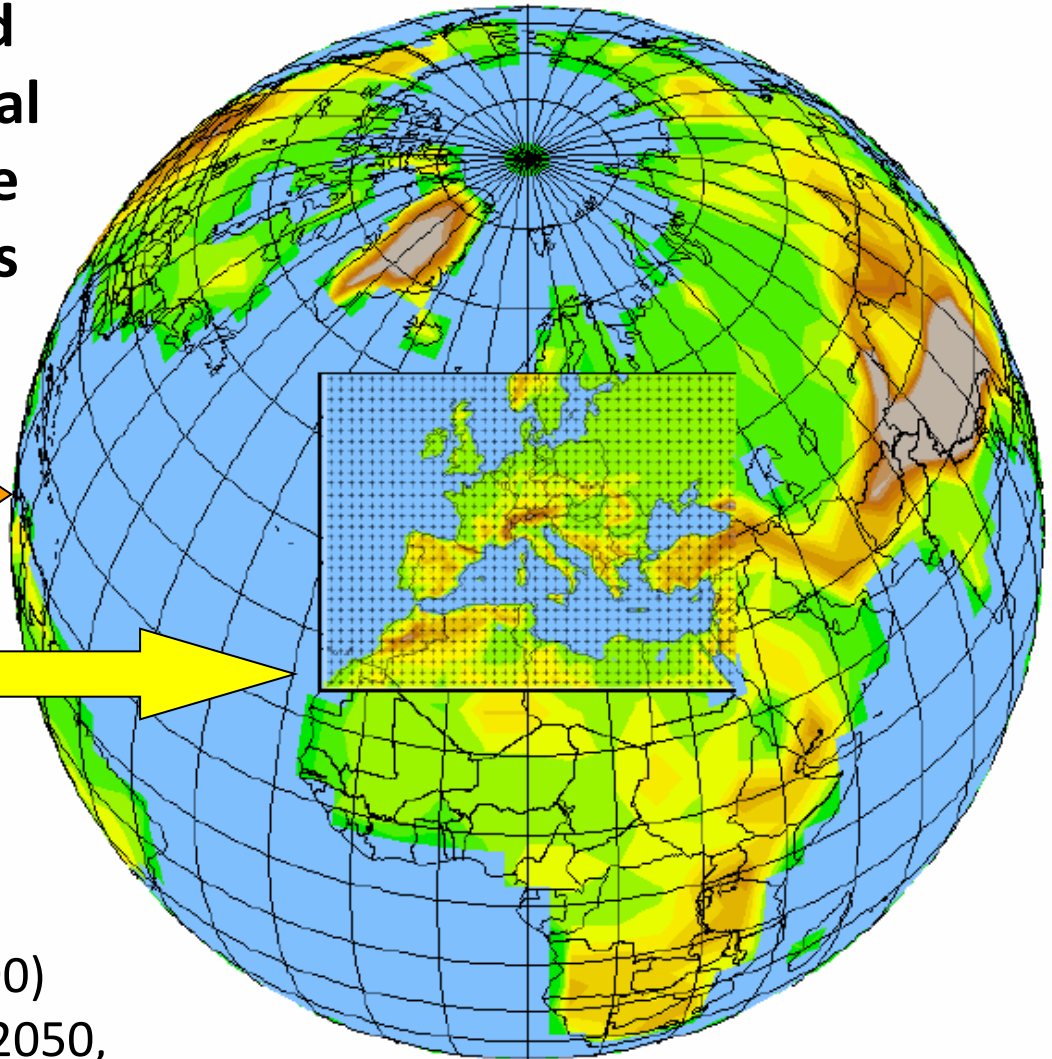


Global and regional climate models

Global IPCC storyline

Global circulation model

Regional climate model



“RUN” = Storyline+GCM+RKM

Time slices:

“Contemporary climate” (1961-1990)

“Climate change scenarios” (2021-2050,
2071-2100 – near and far future)

OR

“Continuous climate”

PRUDENCE, ENSEMBLES (~40 “runs” for A1B)

RCM data

ENSEMBLES

“The ENSEMBLES project (contract number GOCE-CT-2003-505539) is supported by the European Commission's 6th Framework Programme as a 5 year Integrated Project from 2004-2009 under the Thematic Sub-Priority "Global Change and Ecosystems". “...develop an ensemble prediction system for climate change based on the principal state-of-the-art, high resolution, global and regional Earth System models developed in Europe, validated against quality controlled, high resolution gridded datasets for Europe, to produce for the first time, an objective probabilistic estimate of uncertainty in future climate at the seasonal to decadal and longer timescales”.

<http://ensembles-eu.metoffice.com/index.html>

Model data sets for the A1B scenario are given for the time period 1961 – 2100.

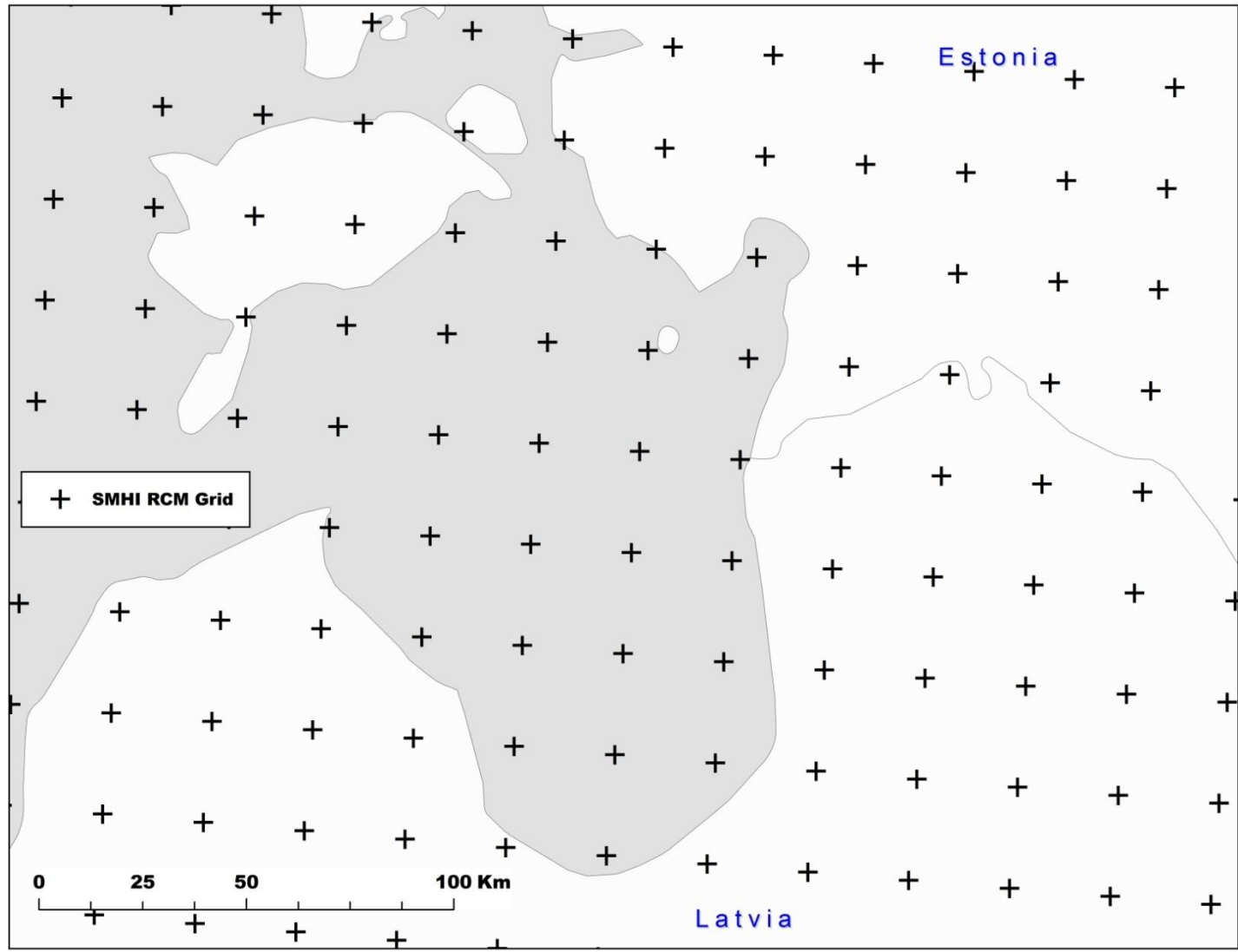
23 model runs were considered.

Institution	GCM	RCM
C4I	HadCM3Q16	RCA3
CNRM	ARPEGE	Aladin
CNRM	ARPEGE_RM 5.1	Aladin
DMI	ARPEGE	HIRHAM
DMI	ECHAM5-r3	DMI-HIRHAM5
ETHZ	HadCM3Q0	CLM
GKSS	IPSL	CLM
HC	HadCM3Q0	HadRM3Q0
HC	HadCM3Q16	HadRM3Q16 (high sensitivity)
HC	HadCM3Q3	HadRM3Q3 (low sens.)
ICTP	ECHAM5-r3	RegCM
KNMI	ECHAM5-r3	RACMO
KNMI	ECHAM5-r3	RACMO
KNMI	MIROC	RACMO
METNO	BCM	HIRHAM
METNO	HadCM3Q0	HIRHAM
MPI	ECHAM5-r3	REMO
SMHI	BCM	RCA
SMHI	ECHAM5-r3	RCA
SMHI	HadCM3Q3	RCA
UCLM	HadCM3Q0	PROMES
VMGO	HadCM3Q0	RRCM

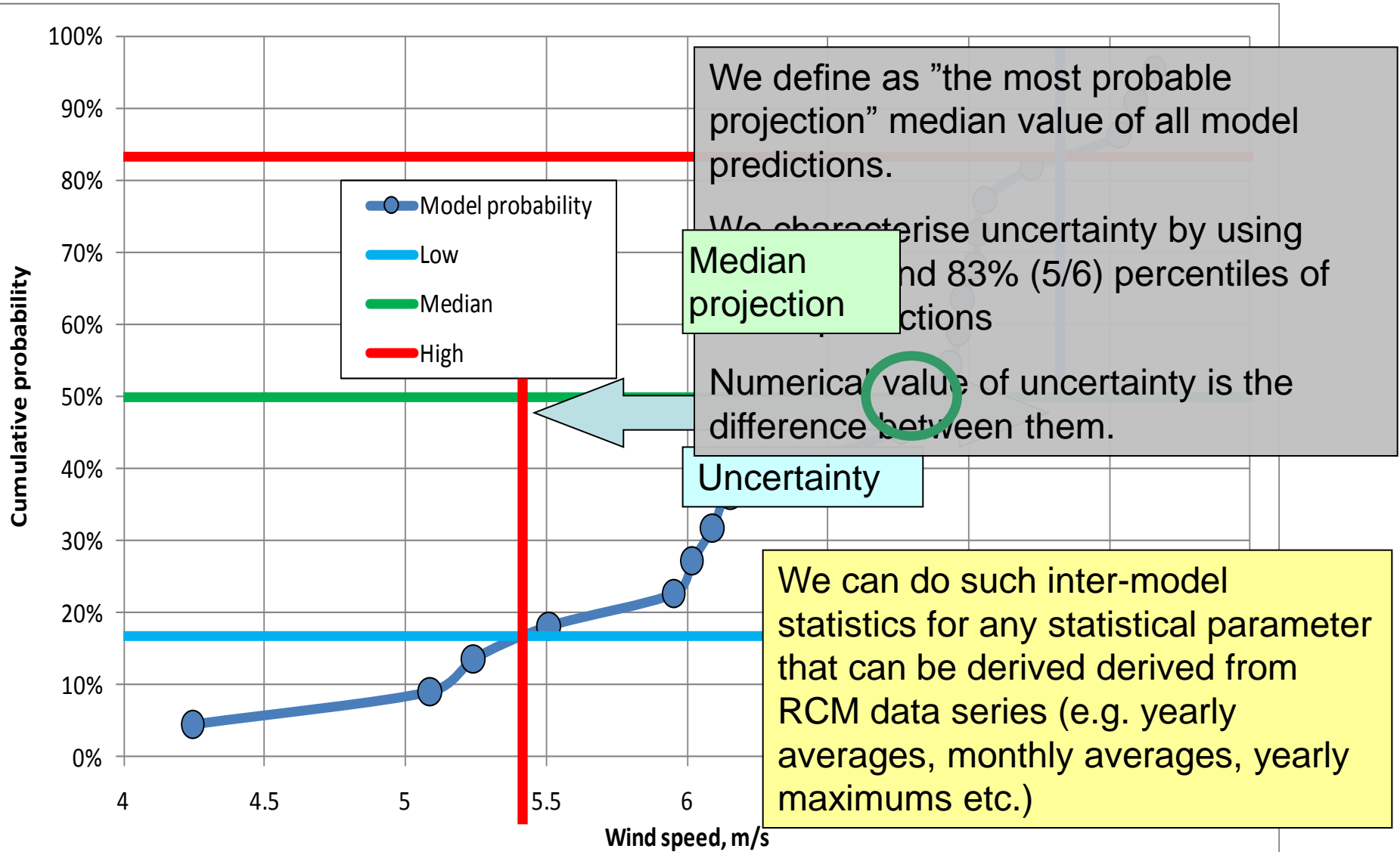
DECISIONS / RESULTS SO FAR

RCMs: ENSEMBLES, A1B storyline, list of parameters – W10m (u, v, W), maxW, maxGust, T2m, p0m. & “3d fields = u,v @ different p”, land/sea fraction

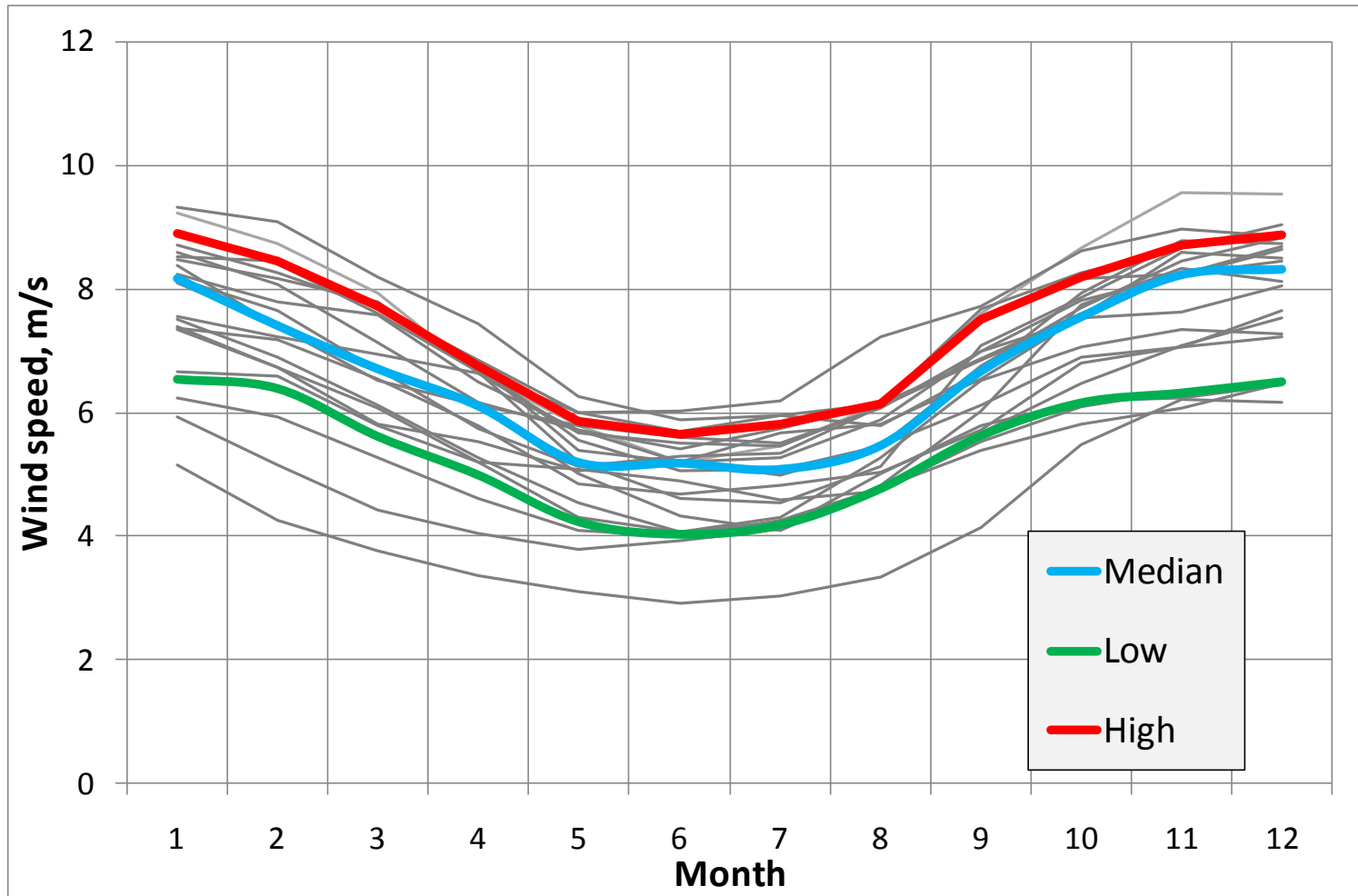
Time periods:
1981-2010
(contemporary)
2021-2050
(near future)



Inter-model statistics



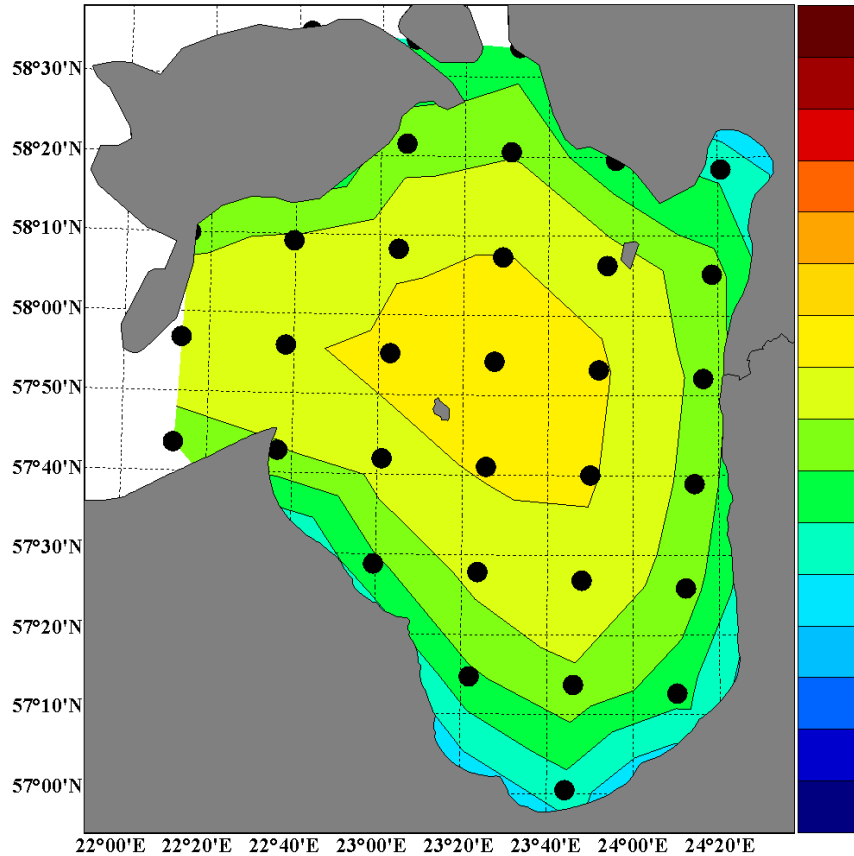
Average wind data from ENSEMBLES



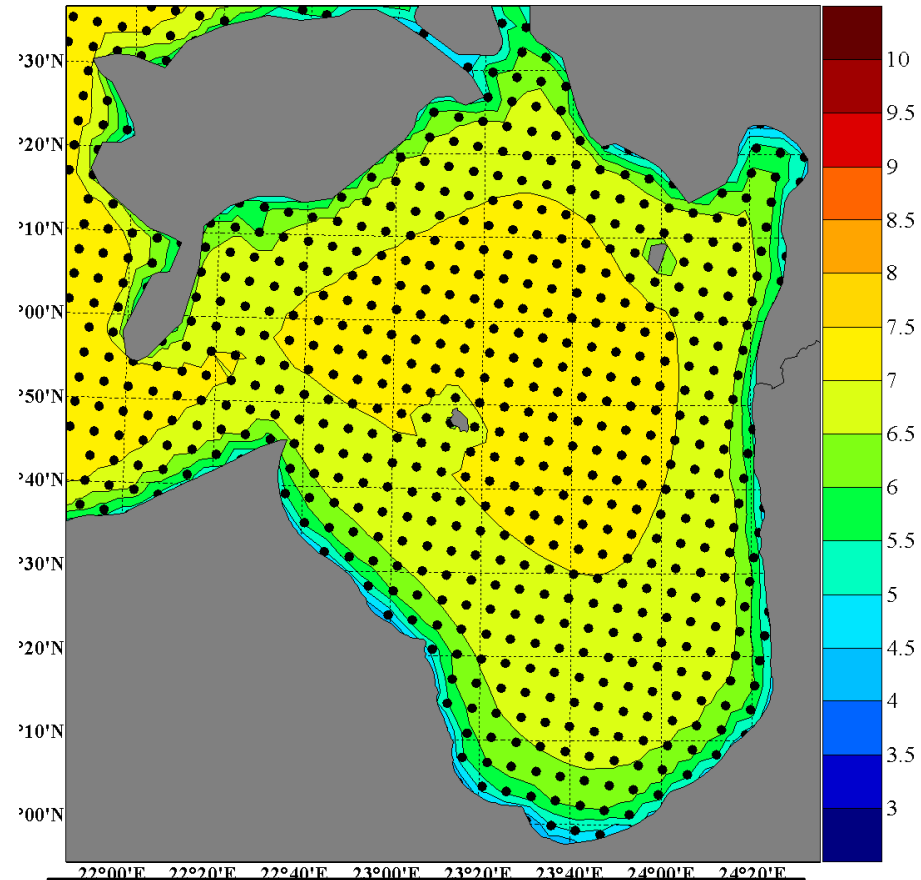
Monthly average wind speed (Ruhnu), data from ENSEMBLES transient runs for the period 1961-1990. Gray lines – model data (23 models), colored lines – median, 17% and 83% percentiles.

6. SAMPLE RESULTS

Comparison of operational HIRLAM model and RCM

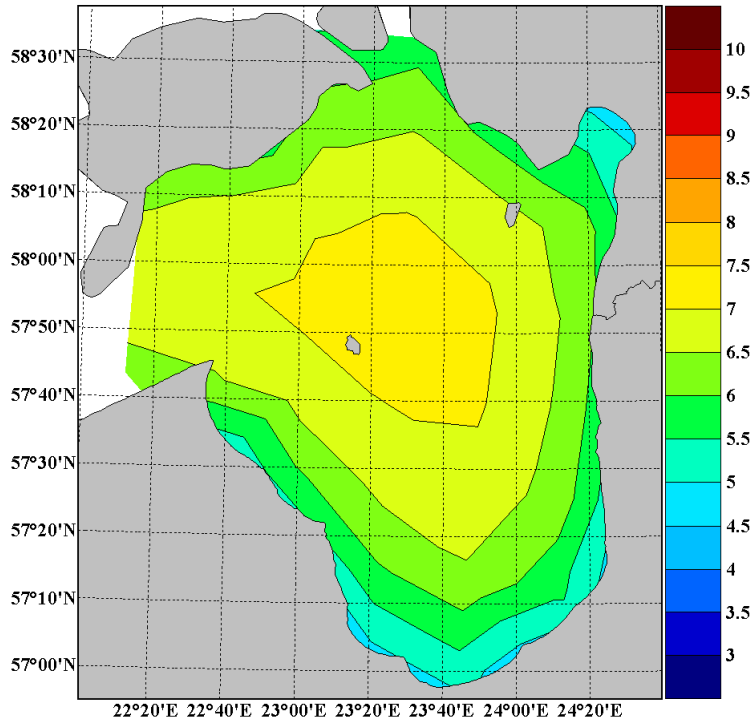


Median of annual wind speed calculated by RCM (1961-1990)

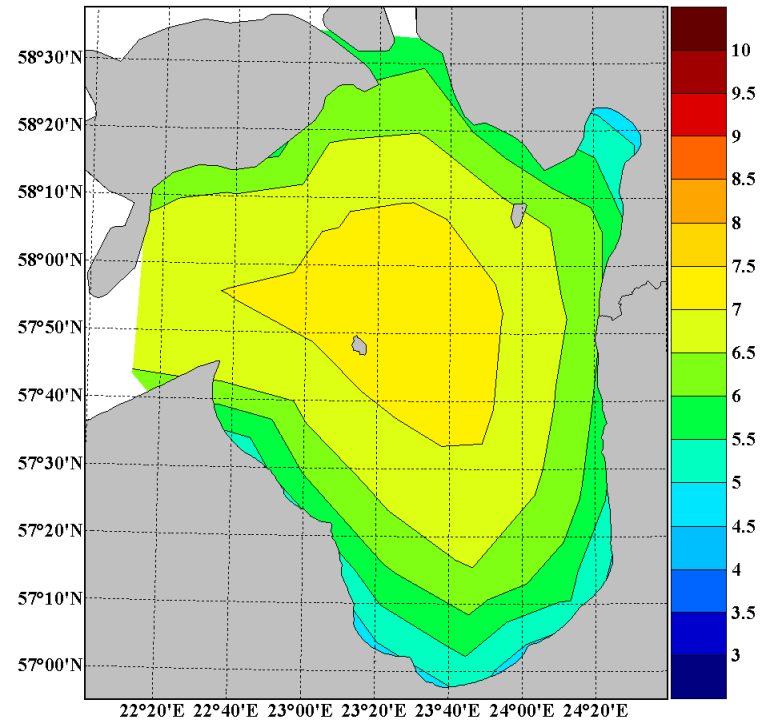


Annual average wind from DMI HIRLAM 2008-2010 at 10m

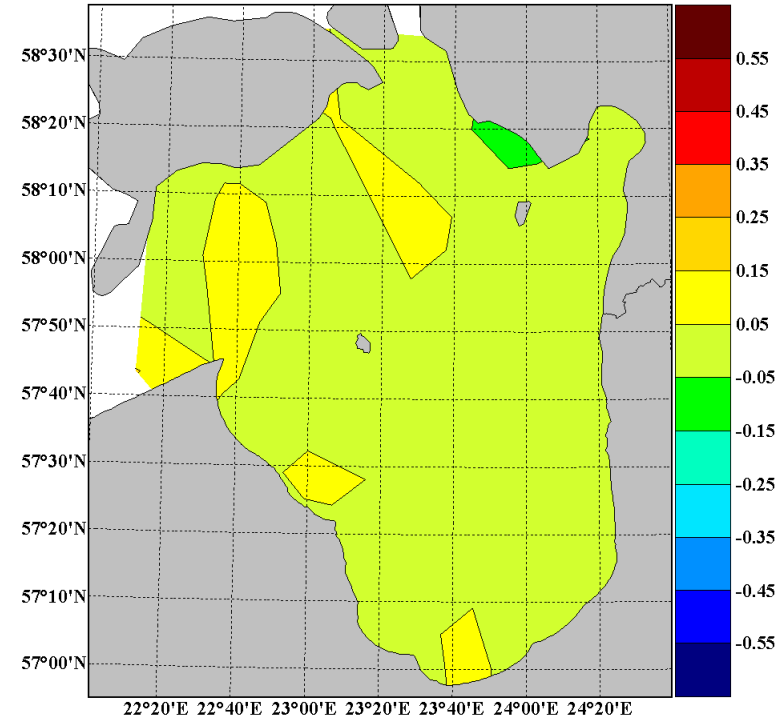
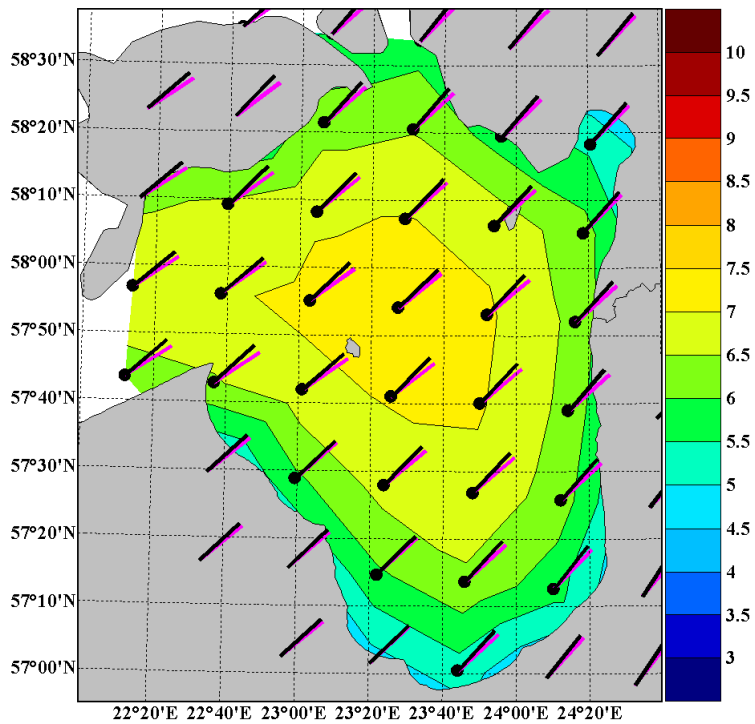
Annual average wind



1981-2010



2021-2050



Annual ave direction

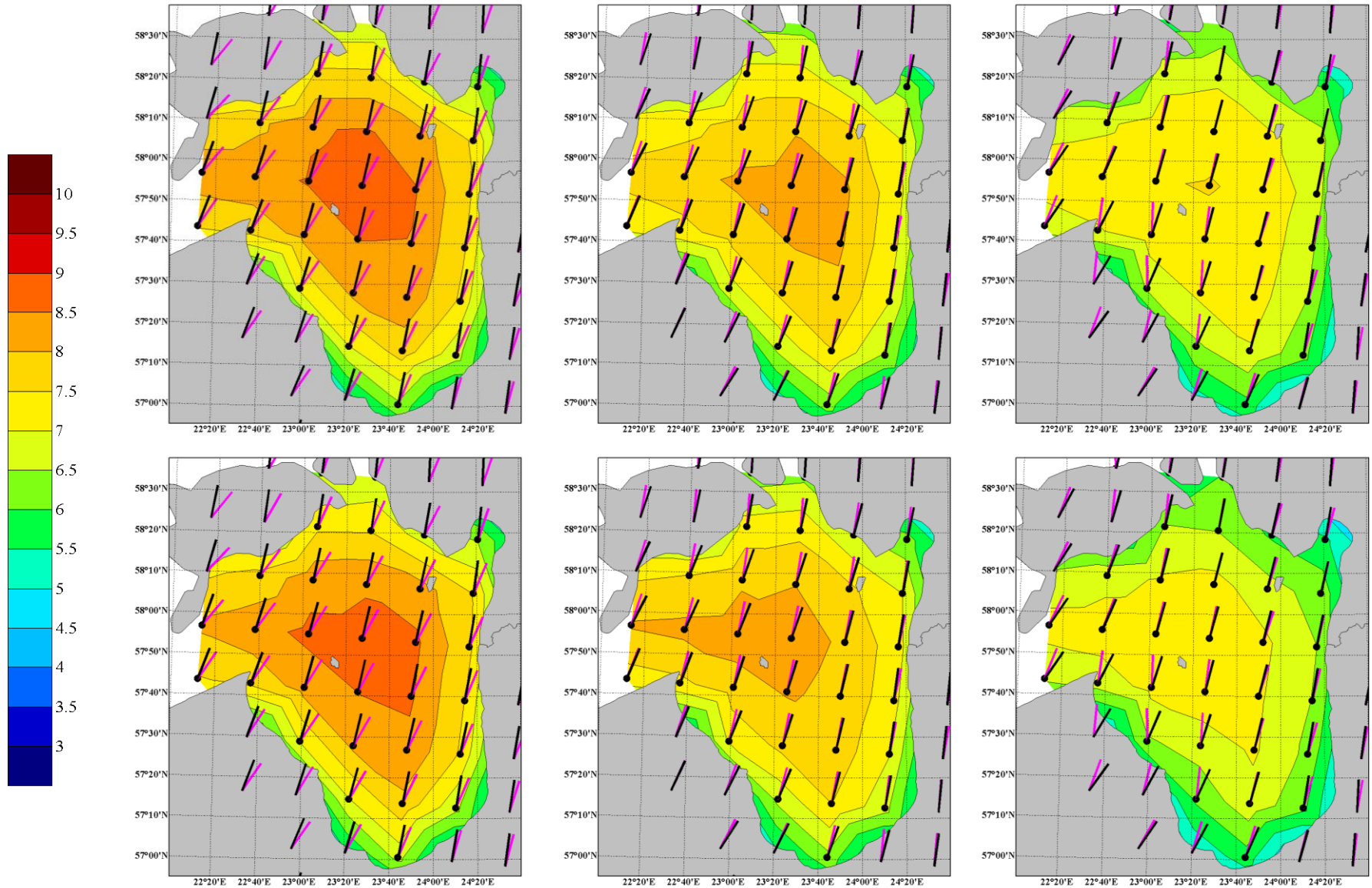
Black – 1981-2010

Magenta – 2021-2050

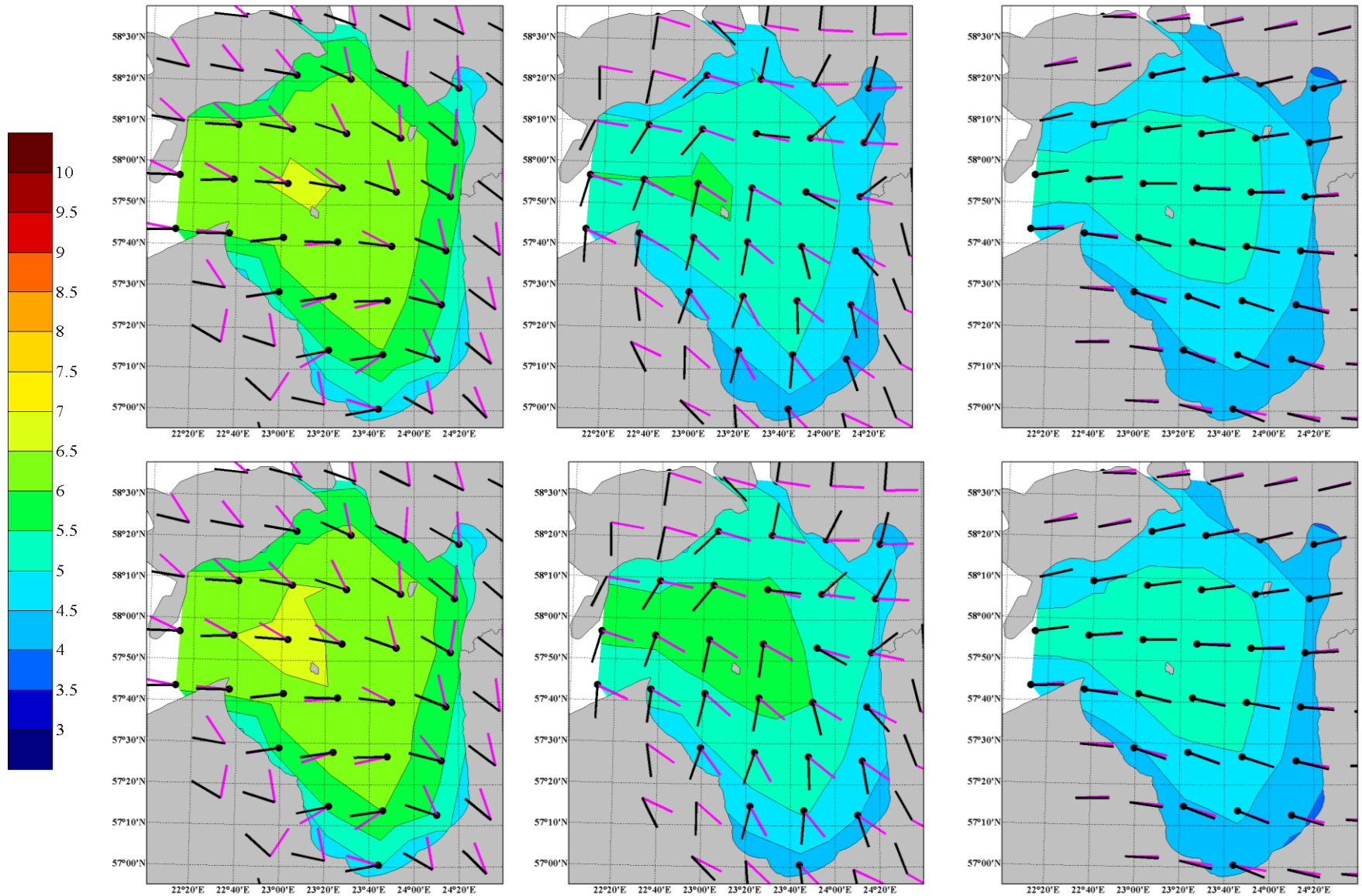
Colors – wind speed 1981-2010

Changes in
annual wind
speed

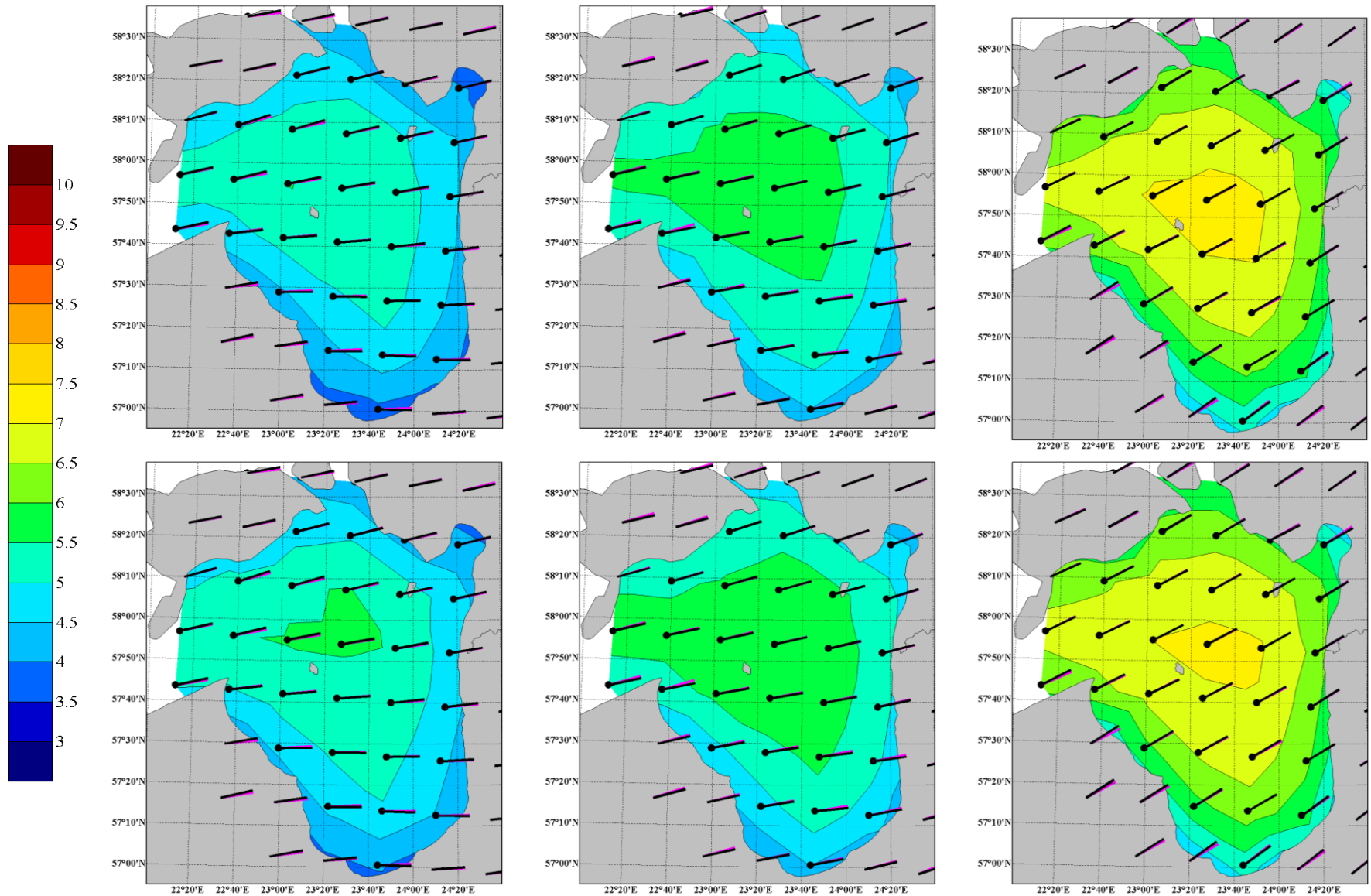
Jan, Feb, Mar, upper – 1981-2010, lower 2021-2050



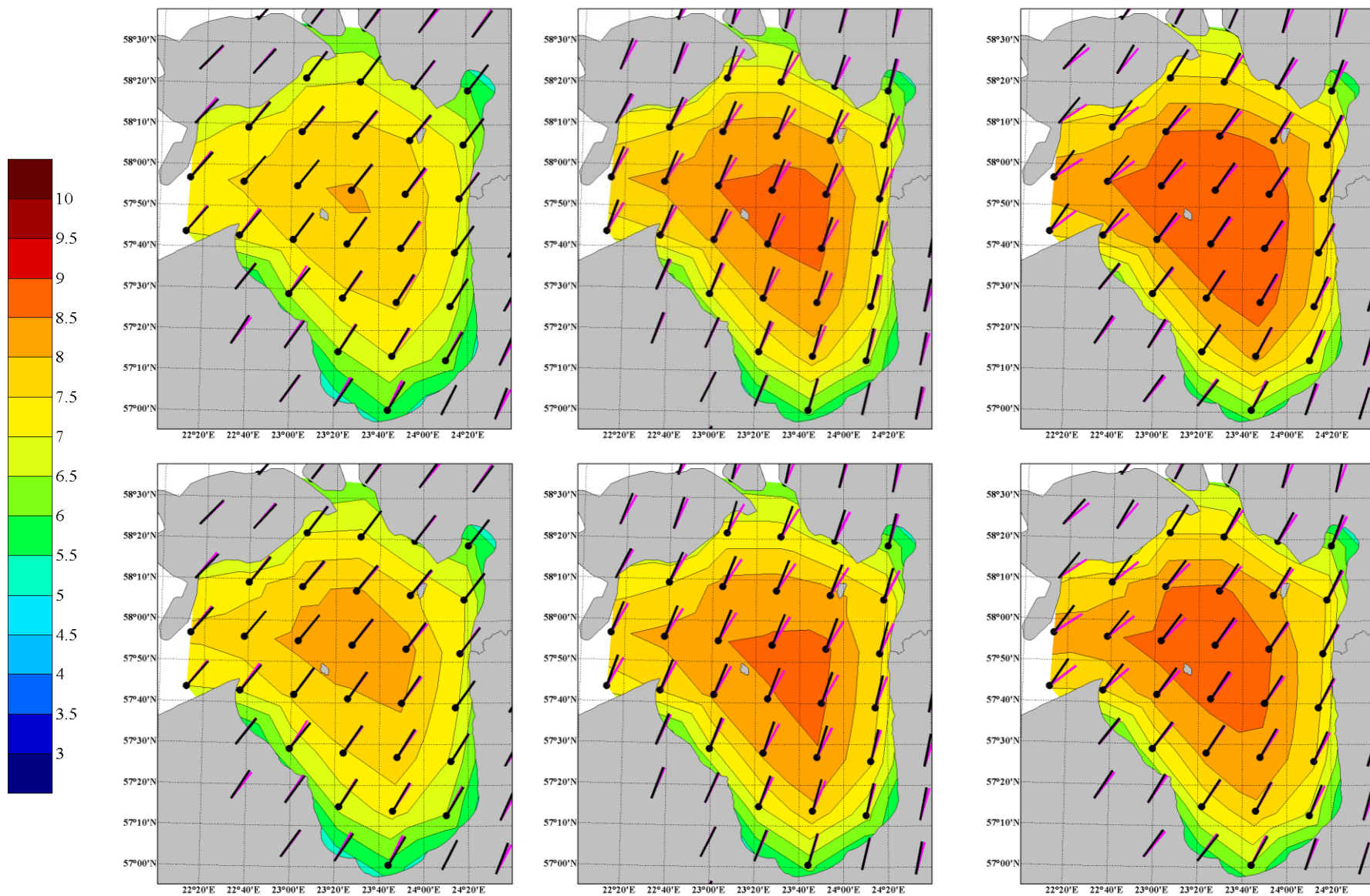
Apr, May, Jun, upper – 1981-2010, lower 2021-2050



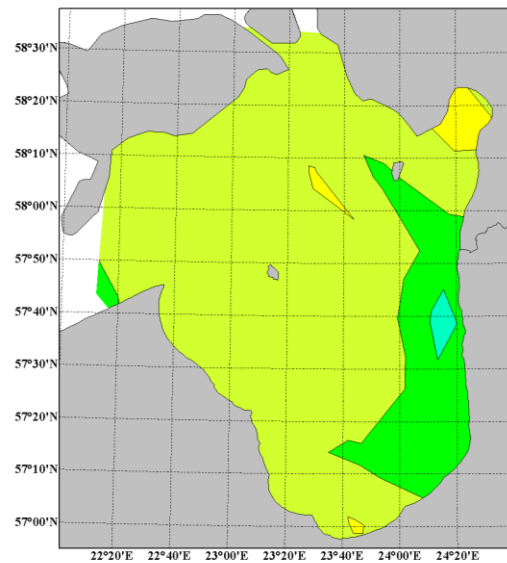
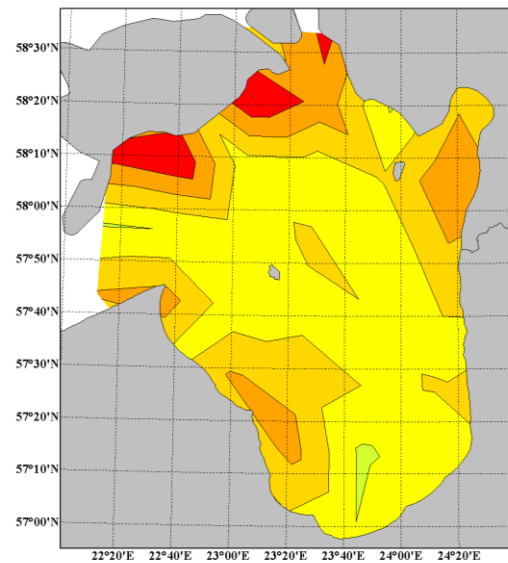
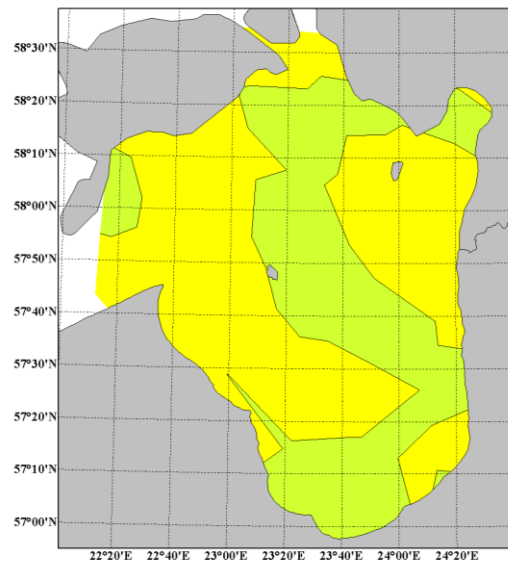
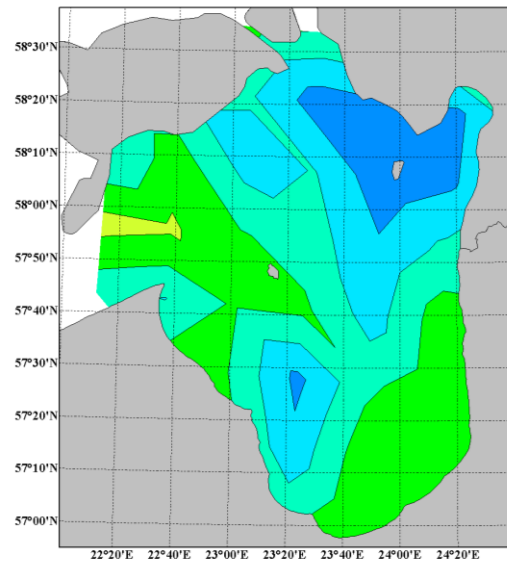
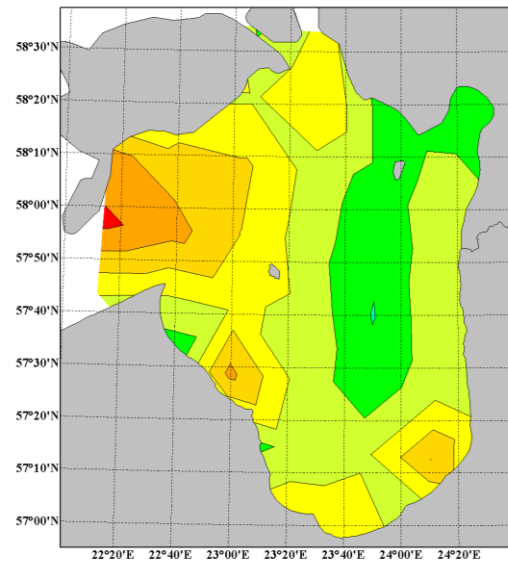
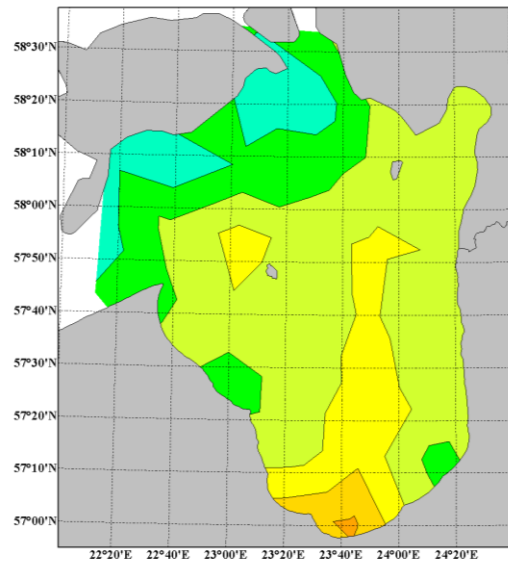
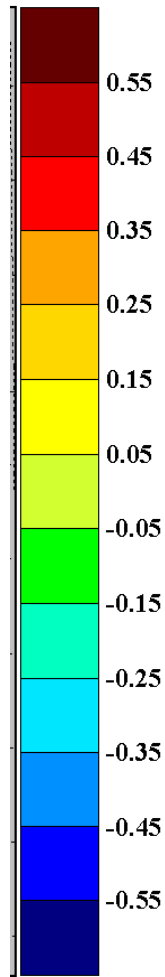
Jul, Aug, Sep, upper – 1981-2010, lower 2021-2050



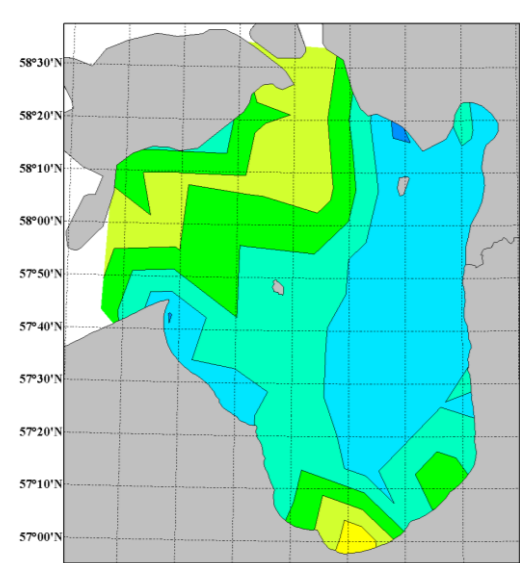
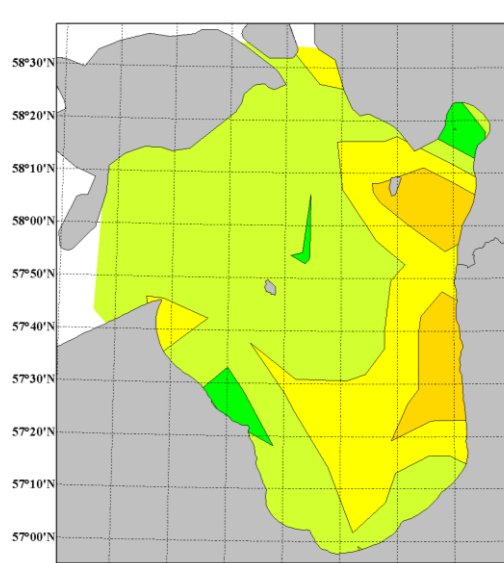
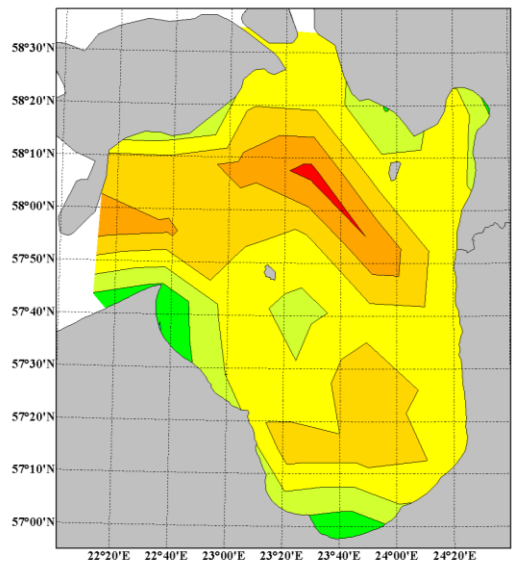
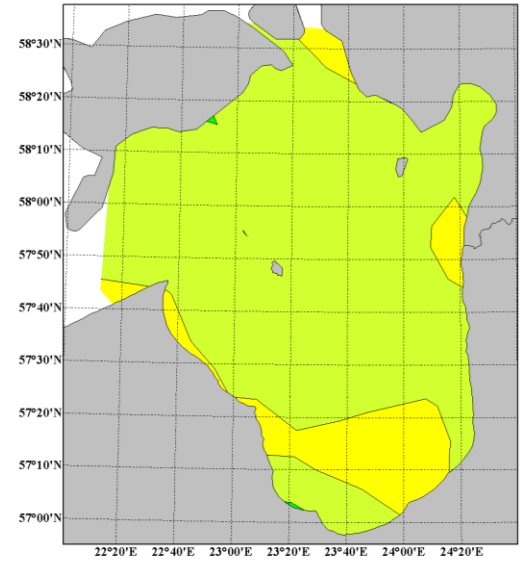
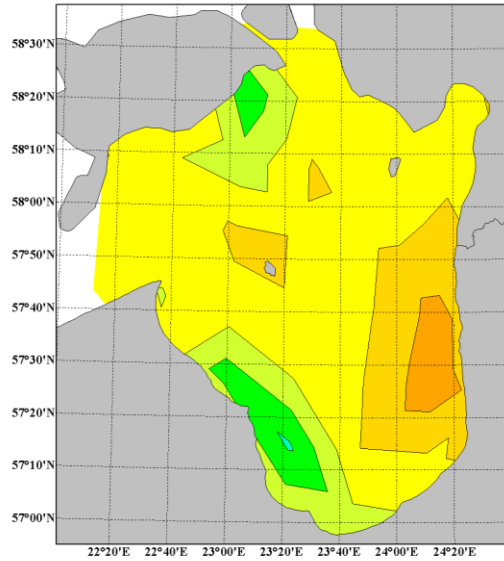
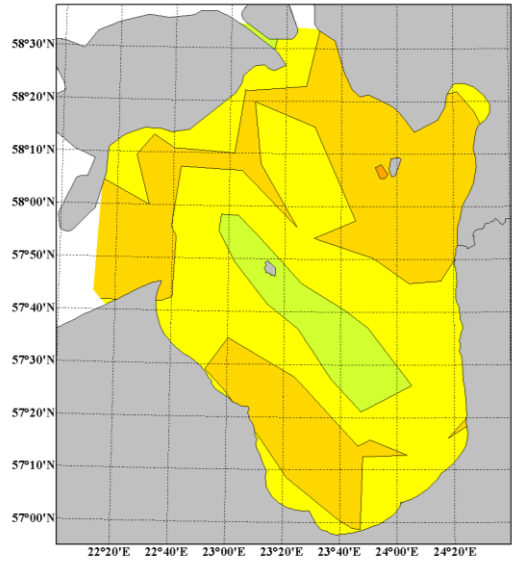
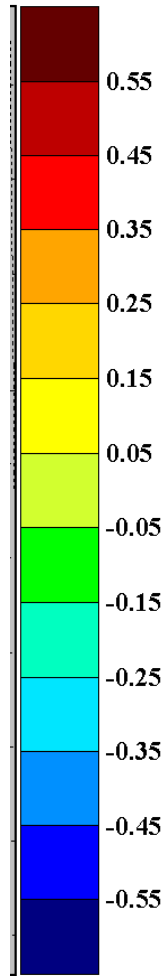
Oct, Nov, Dec, upper – 1981-2010, lower 2021-2050

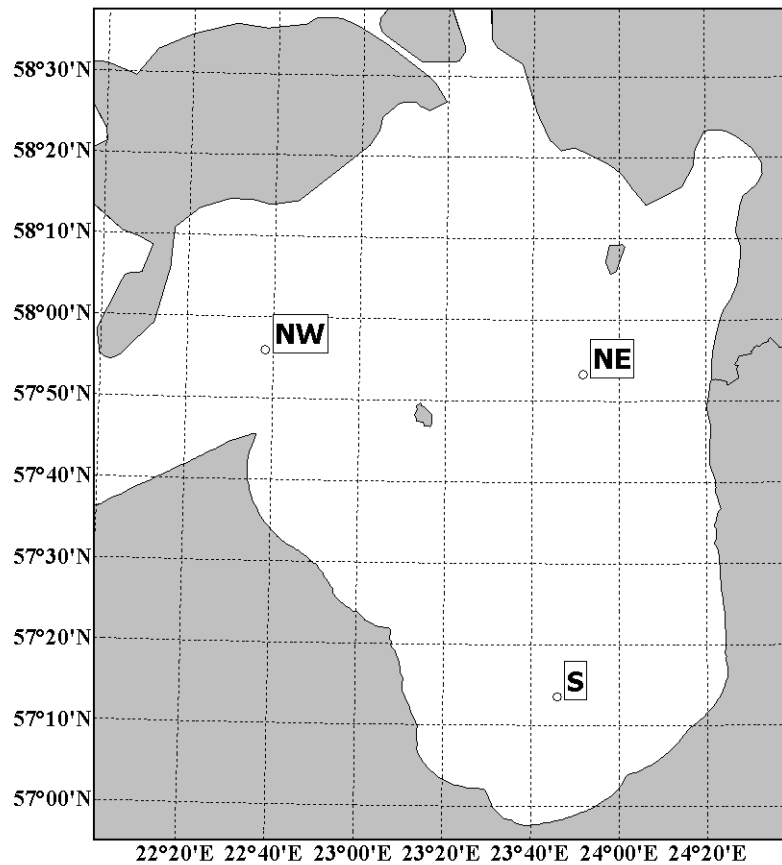


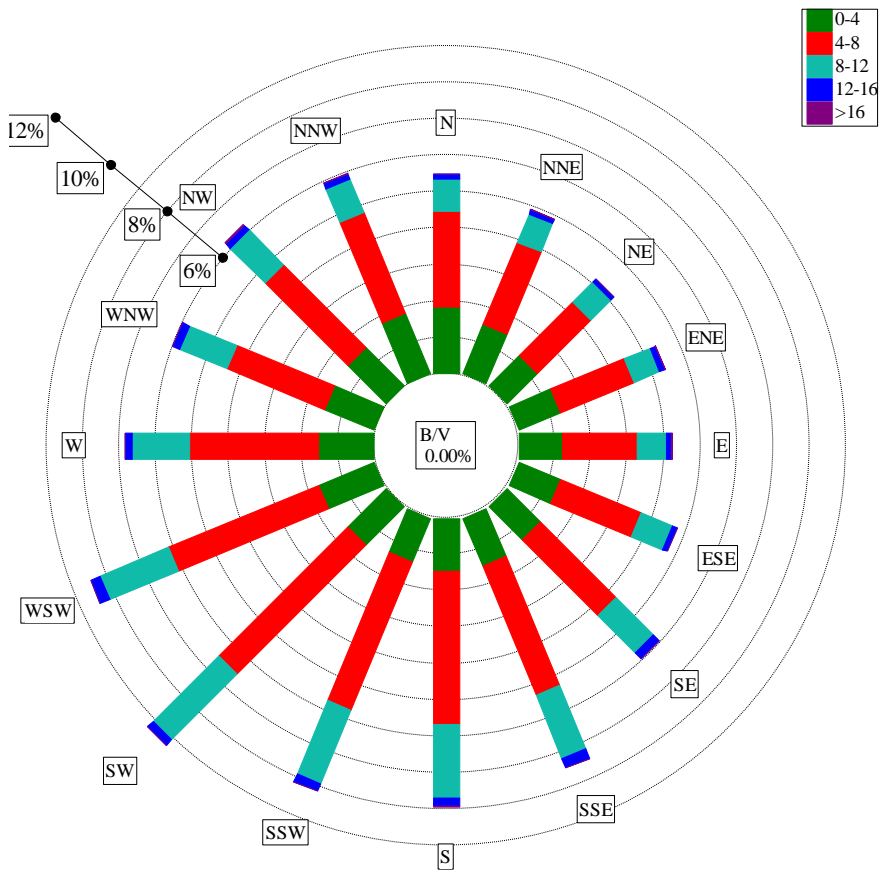
Wind speed changes, Jan, Feb, Mar, Apr, May, Jun



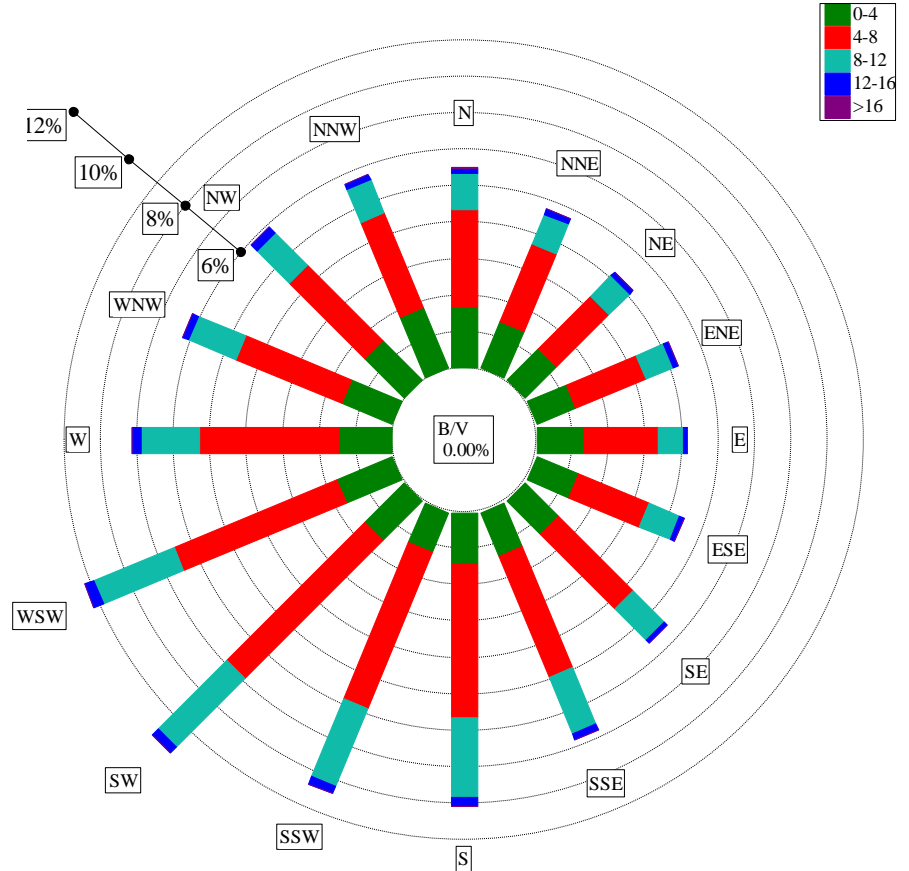
Wind speed changes, Jul, Aug, Sep, Oct, Nov, Dec





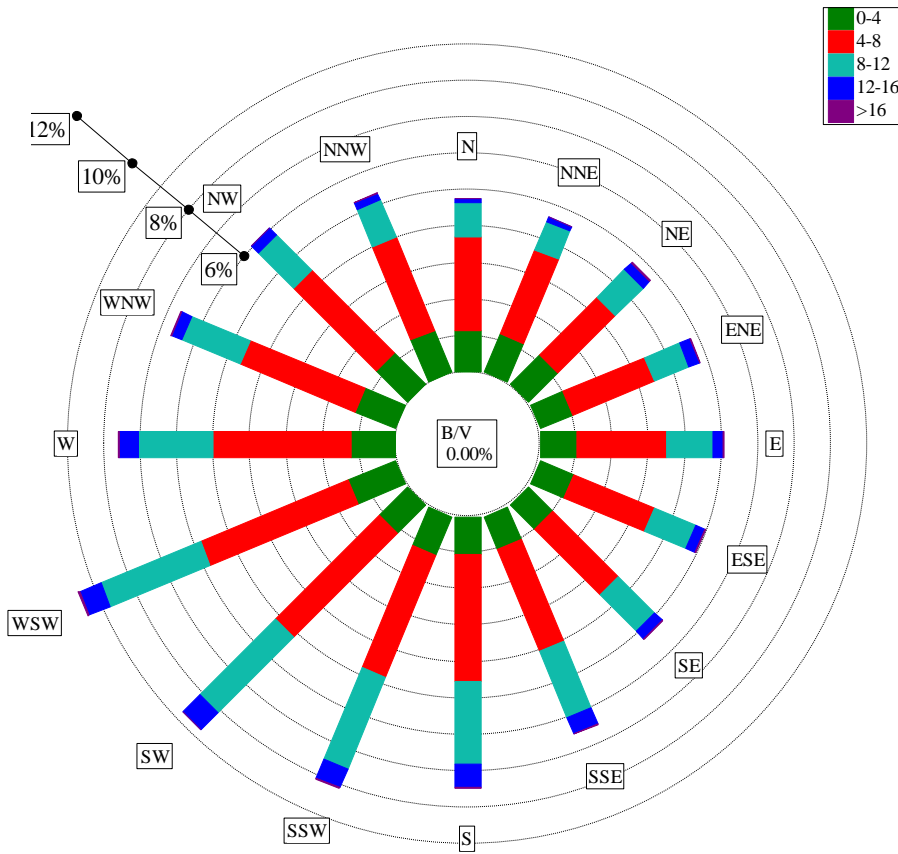


GoR South, 1981-2010

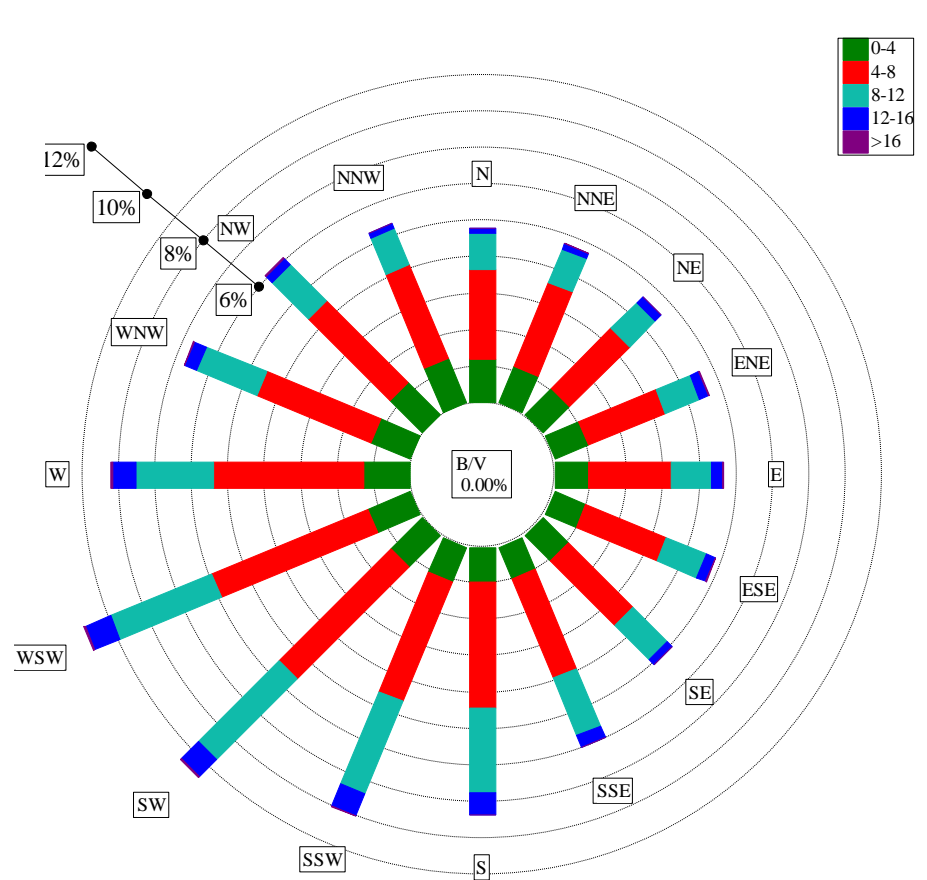


GoR South, 2021-2050

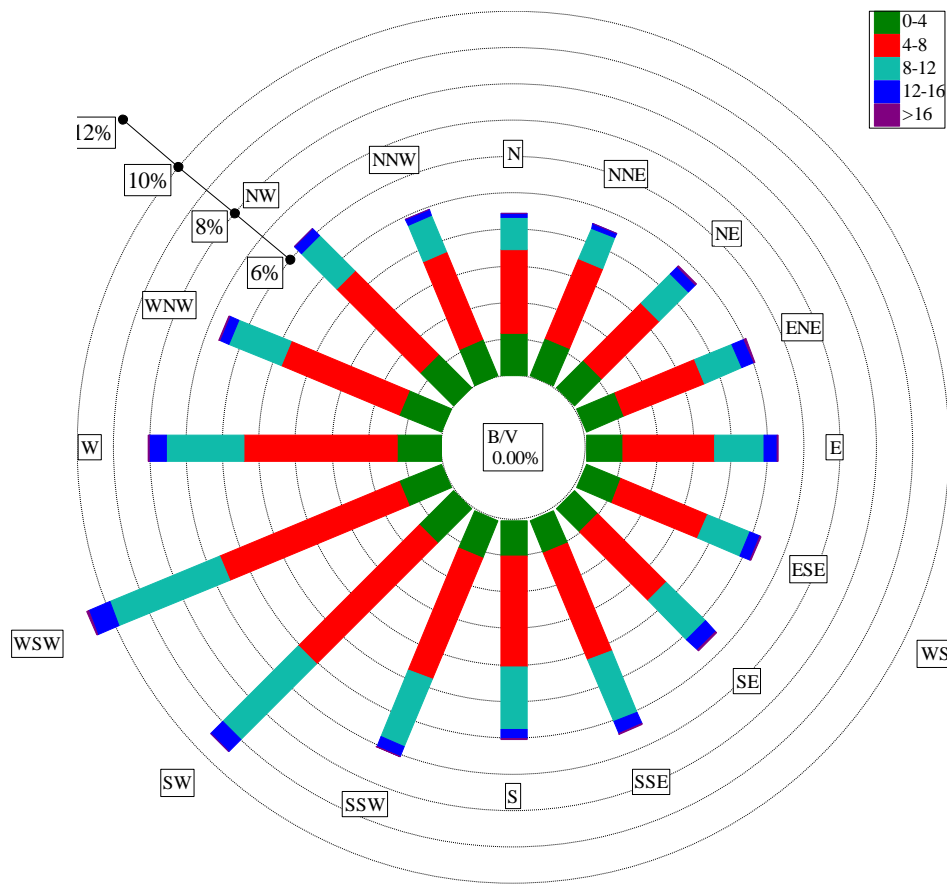
SPATIAL DIFFERENCES HIGHER THAN CLIMATE CHANGE IMPACT



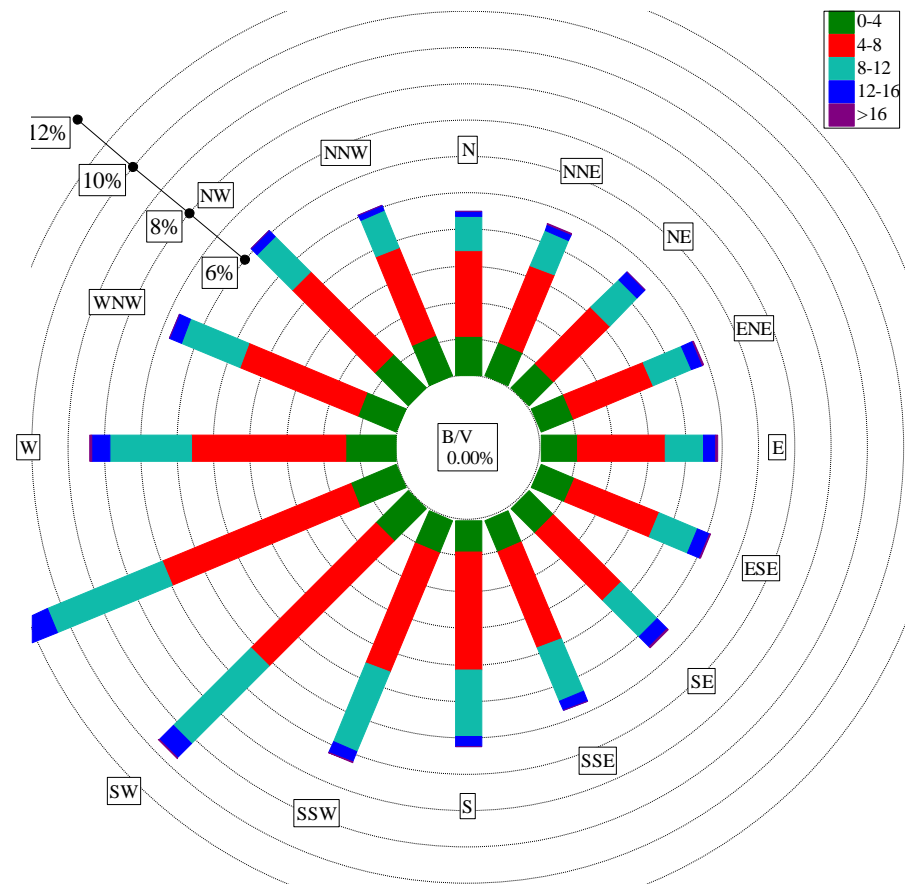
GoR NE, 1981-2010



GoR NE, 2021-2050



GoR NW, 1981-2010



GoR NW, 2021-2050