Analysis of dynamically downscaled climate simulations over the Baltic Sea drainage basin

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Future scenarios

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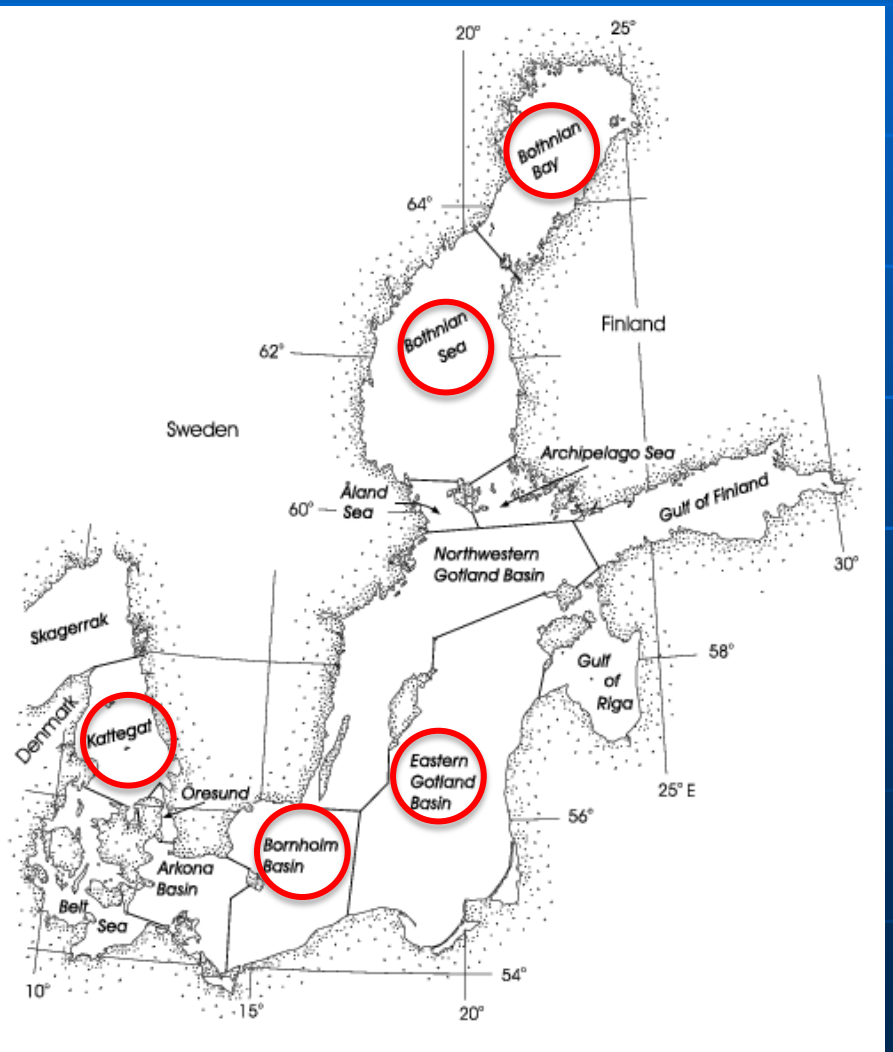
1	*GCM*	*SRES narrative*	*Ensemble member*	*Land cover*	*Nutrient loads*	*GCM bias correction*	**Factor addressed**
1	ECHAM5	A1B	#1	present-day	present-day	none	(baseline scenario)
2	ECHAM5	A1B	#2	present-day	present-day	none	natural variability
3	ECHAM 5	A1B	#3	present-day	present-day	none	natural variability
4	HadCM3	A1B		present-day	present-day	none	climate system
5	CCSM3	A1B		present-day	present-day	none	climate system
6	ECHAM5	A2		present-day	present-day	none	emissions (higher)
7	ECHAM5	B1		present-day	present-day	none	emissions (lower)
8	ECHAM5	A1B	#1	GRAS	present-day	none	land cover change
9	ECHAM5	A1B	#1	present-day	“medium”	none	nutrient loads change
10	ECHAM5	A2		BAMBU	“business as usual”	none	multi-factor, “business as usual”
11	ECHAM5	A1B	#1	GRAS	“medium”	none	multi-factor, “balanced policy”
12	ECHAM5	B1		SEDG	Baltic Sea action plan	none	multi-factor, “environmental”
13	ECHAM5	A2		BAMBU	“business as usual”	yes	bias-corrected version of Scenario 10
14	ECHAM5	A1B	#1	GRAS	“medium”	yes	bias-corrected version of Scenario 11
15	ECHAM5	B1		SEDG	Baltic Sea action plan	yes	bias-corrected version of Scenario 12

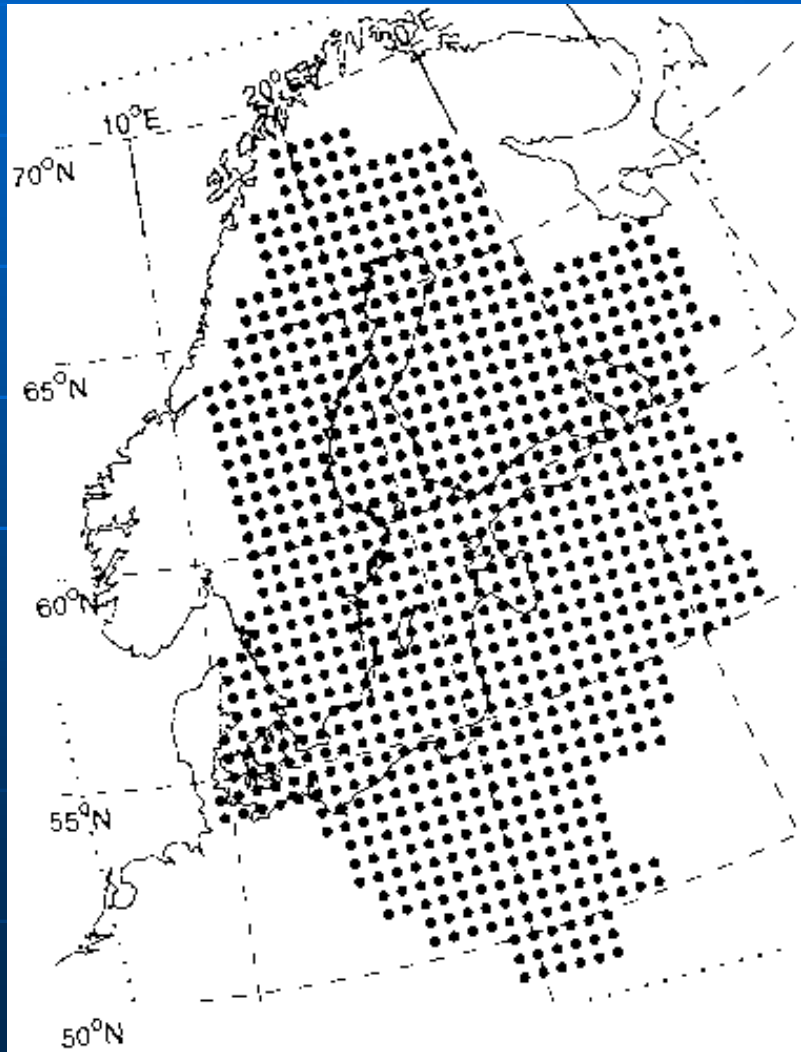
Global coupled atmosphere–ocean general circulation models (AOGCMs)

- ECHAM5, 1.875° : A1B (3 runs), A2, B1
  - Run 1 has same initialization as for other scenarios
- HADCM3, 2.5° x 3.75° : A1B
- CCSM3, 1.4° : A1B

Our evaluation of control period 1961-2005

Performance in control period (1961–2005)





Conclusions - Control period

- Natural variability is well simulated for all scales
- Some biases: clouds and precipitation overestimated
- "Best" model choices, based on means for the catchment area
  - SST / Geostrophic wind speed: ECHAM5 and HadCM3
  - T2 / RH2: ECHAM5 (for trends in E. Go basin ECHAM5r1 bad)
  - Total cloudiness: ECHAM5 and CCSM3
  - Precipitation: HadCM3
- Problem: Model sensitivity to greenhouse gases will change scores in future a present weighting not valid
- Another solution with its drawbacks: Delta-change method

Delta-change

- Variability of scenario runs are kept but changed
- Based on monthly averages for the period 1961-1990

	Land	Sea
Temperature	E-obs	ERA-40/RCA
Precipitation	E-obs	Raw ERA-40
Cloudiness/radiation	CRU	None

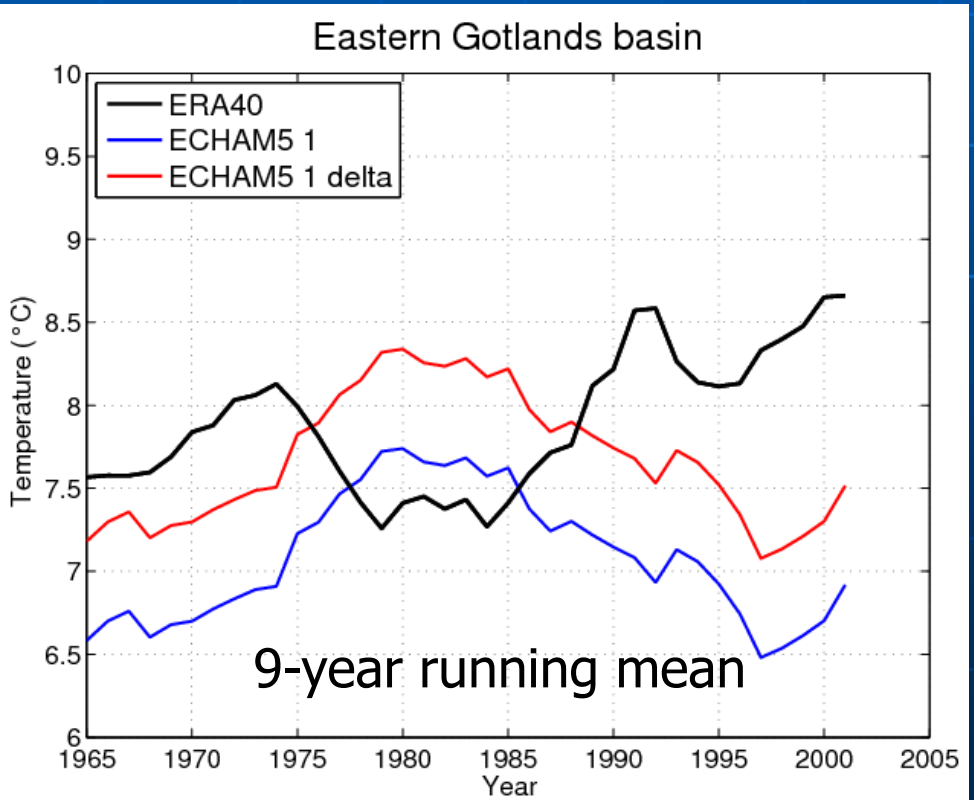
- ECHAM 5: A1B, A2, B1
- Precipitation based on ratio

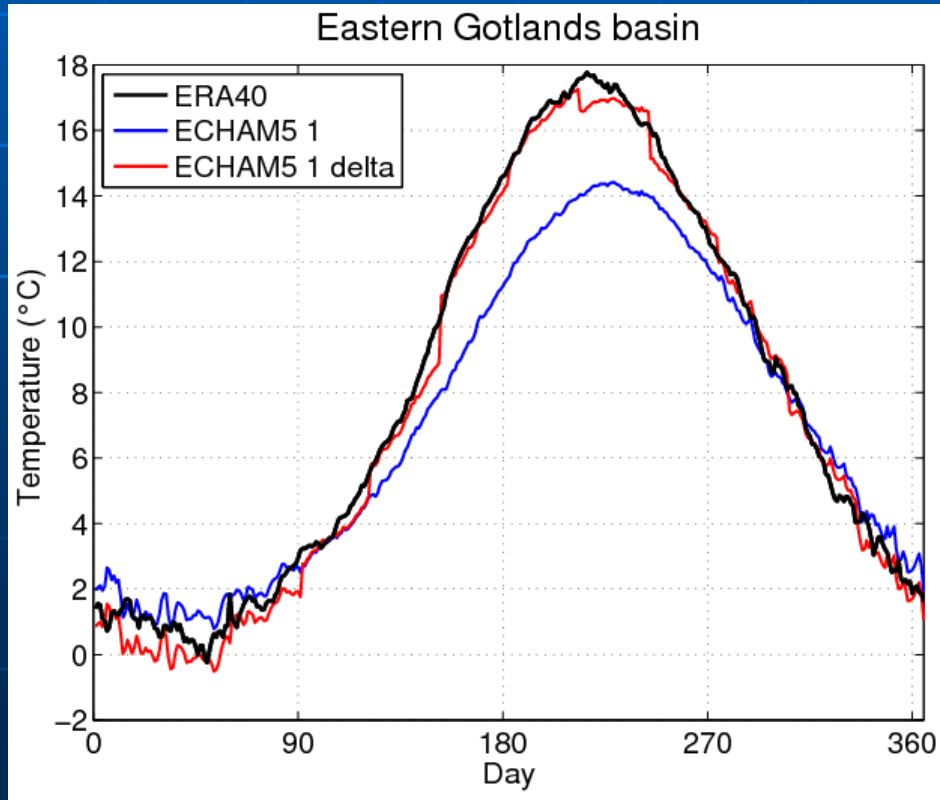
Re-analysis data

- ERA-40
  - Atmospheric model using observations
  - Not downscaled: better for precipitation
  - Downscaled by RCA3: better for other variables
- E-obs (land), same grid as RCA 0.44°
  - Landbased 3-D (terrain) interpolation of observations
- CRU, 0.5°
  - Landbased 2-D? interpolation of observation

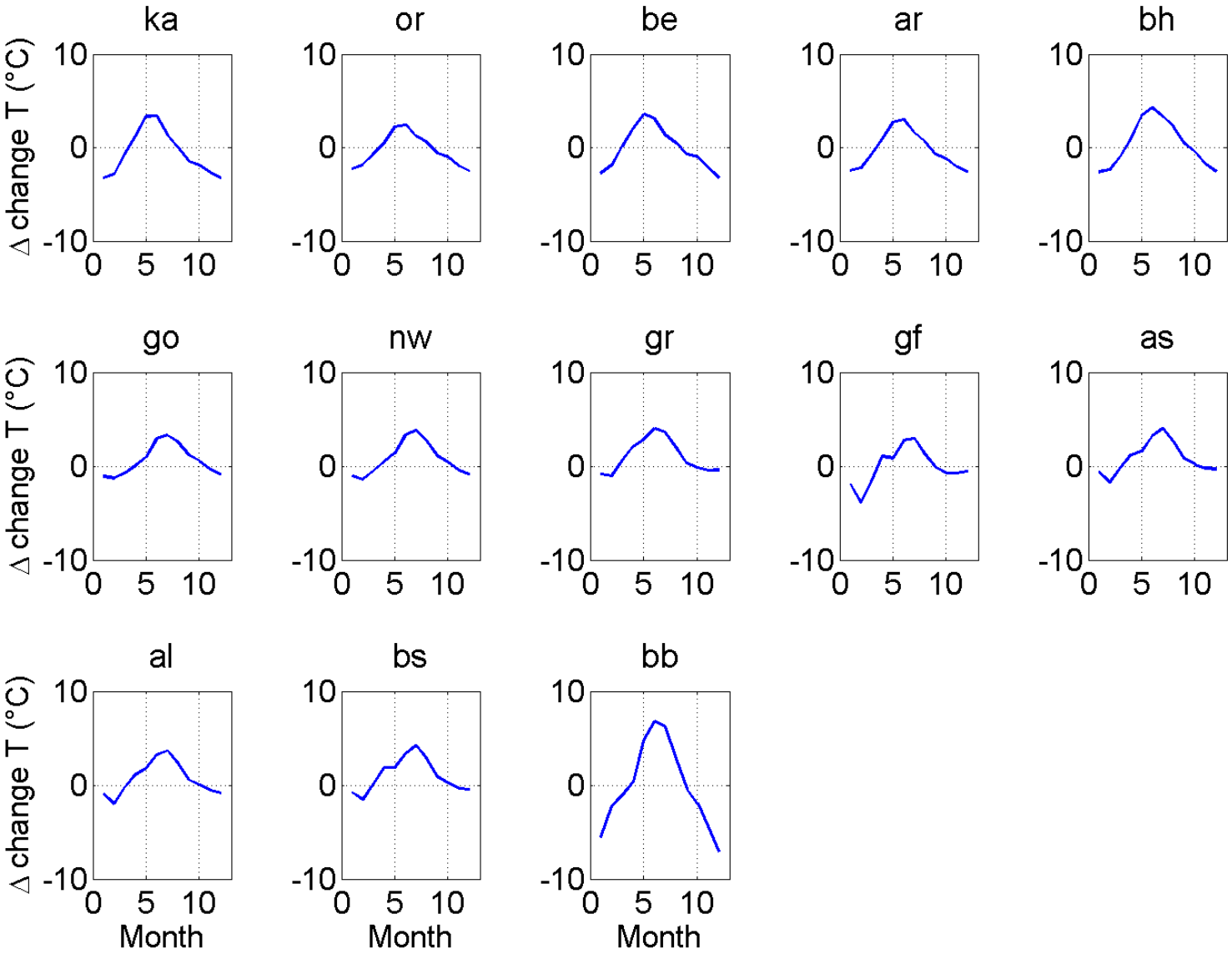
Delta-change

- Karta

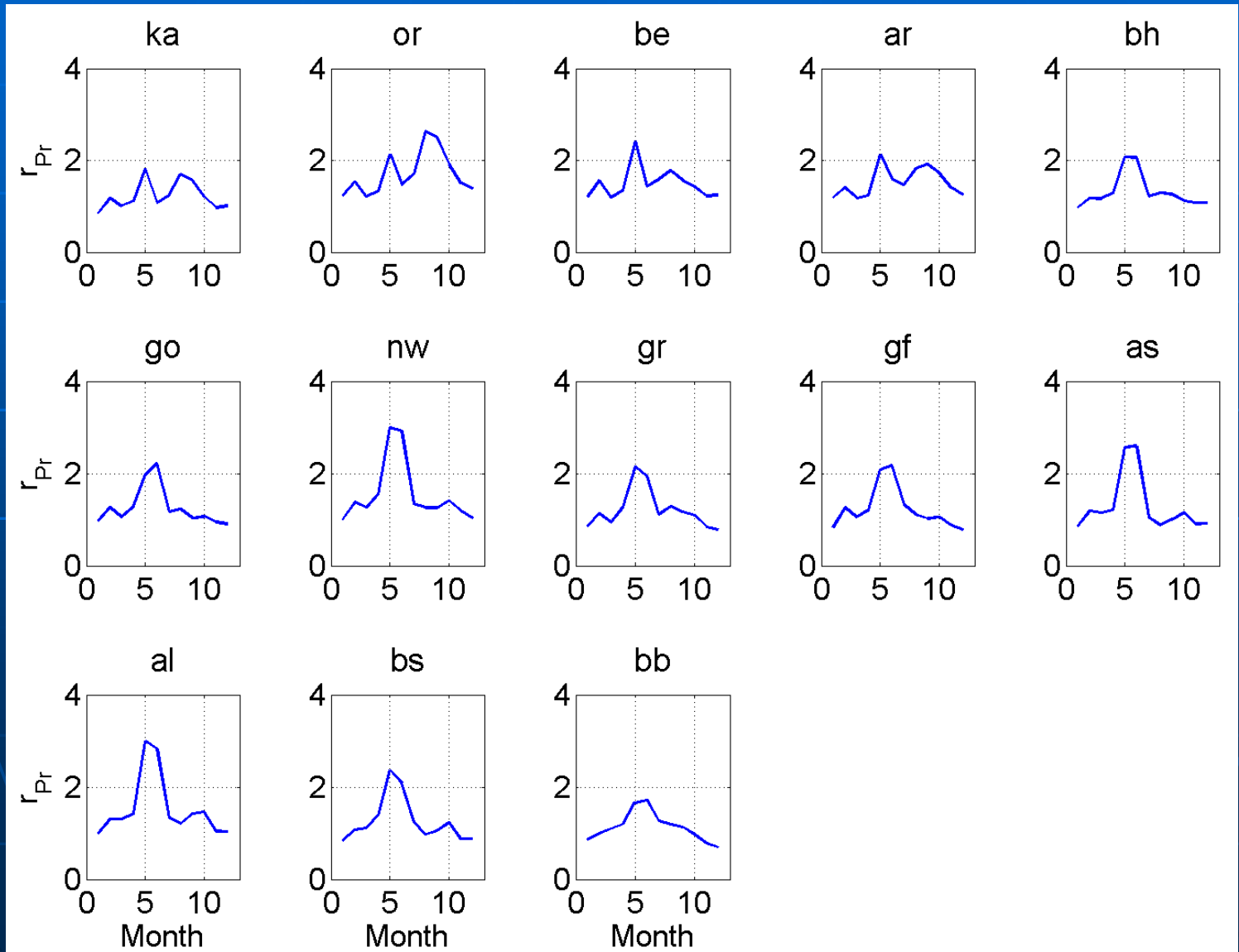




Delta-change temperature



Delta-change precipitation



Future climate simulations 2005-2099

A summary of different scenarios and the effect of delta-change

Temperature, wind precipitation

Climate scenarios

- Storyline A1: Rapid economic growth, population peaks in mid-century, new technologies, reduction in regional differences.
  - A1B-balance across energy sources.
- Storyline A2: Heterogeneous world, continuously increasing populations, economic developments regionally oriented. WORST CASE
- Storyline B1: Service and information economy, improved equity, population as in A1. BEST CASE

Temperature

- Maps
- Trends or 30 last years
- Return values?

Precipitation

- Maps
- Trends or 30 years
- Distribution
- Return values
- Inkl. Delta-change

Wind

- maps
- Significant?
- Return values

Conclusions