



Research findings of PRUDENCE

(climate change scenarios for Europe)

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Outline

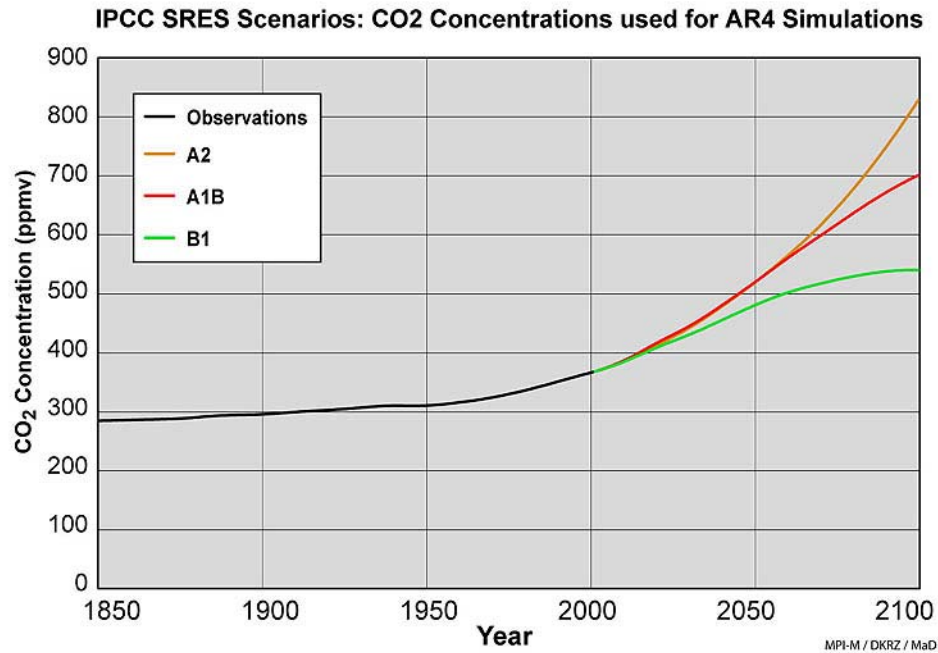
- Concept of regional climate change simulations
- PRUDENCE
- Research beyond PRUDENCE
- -> Table of existing climate change simulations for Europe
- Outlook





Concept of regional climate change simulations

Emission scenarios (IPCC)



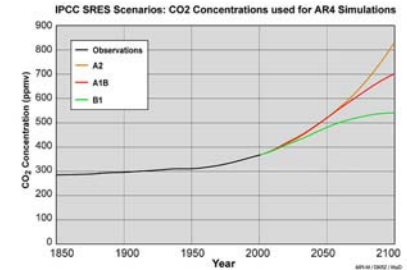


Concept of regional climate change simulations

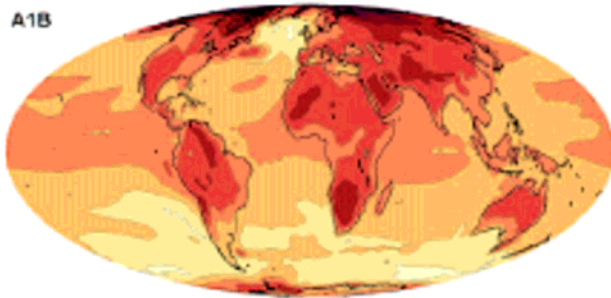
Emission scenarios (IPCC)



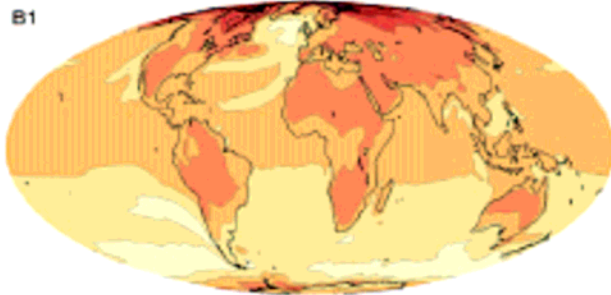
Global Climate Change Scenarios (GCMs)



A1B



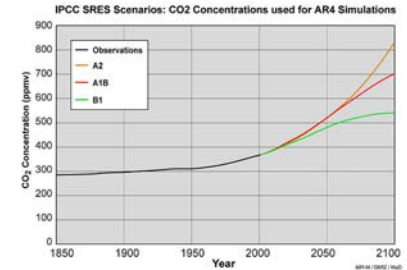
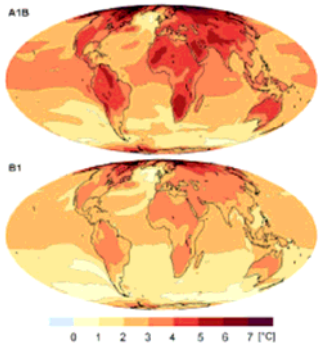
B1





Concept of regional climate change simulations

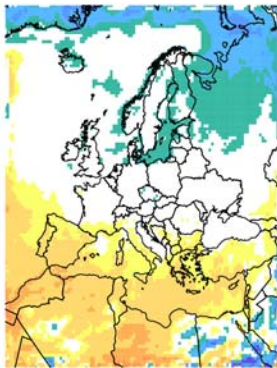
Emission scenarios (IPCC)



Global Climate Change Scenarios (GCMs)

Regional Climate Change Scenarios (RCMs)

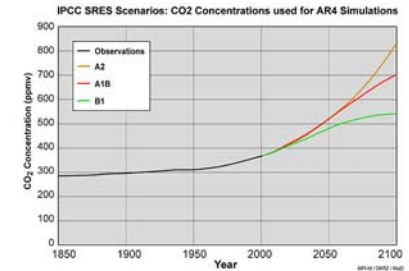
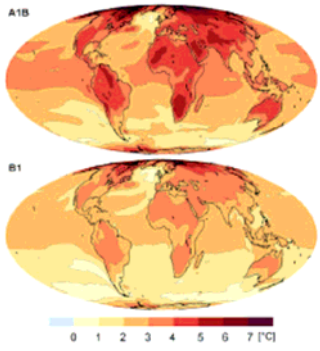
change in total precipitation [%]:
2071 to 2100 - 1961 to 1990: REMO/A1B-3 0.44





Concept of regional climate change simulations

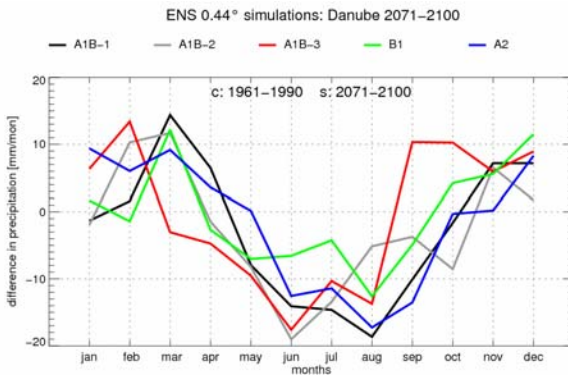
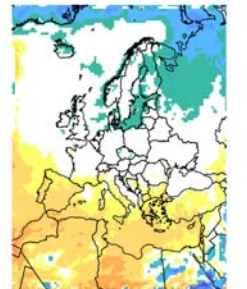
Emission scenarios (IPCC)



Global Climate Change Scenarios (GCMs)

Regional Climate Change Scenarios (RCMs)

change in total precipitation [K]:
2071 to 2100 - 1961 to 1990: REMO/A1B-3 0.44



Regional climate change signals

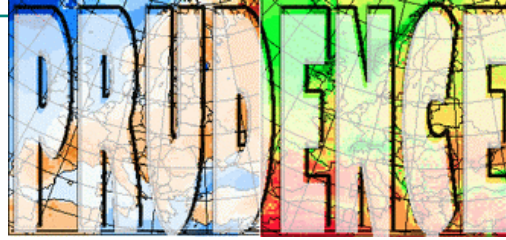




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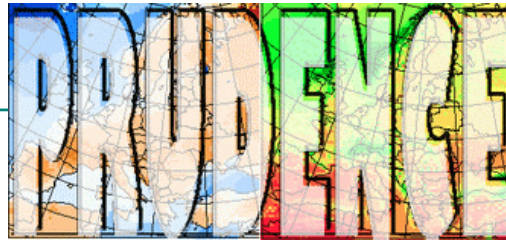


PRUDENCE stands for “Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and Effects”

PRUDENCE website: (<http://prudence.dmi.dk>)

PRUDENCE special issue: Climatic Change (2007) Vol. 81





PRUDENCE:

Compute climate change signal using **many** Regional Climate Models (>10) all driven by **one** Global Model (HadAM3H GCM) under **one** IPCC emission scenario (A2).

⇒ Assessment of uncertainty introduced by the use of different RCMs

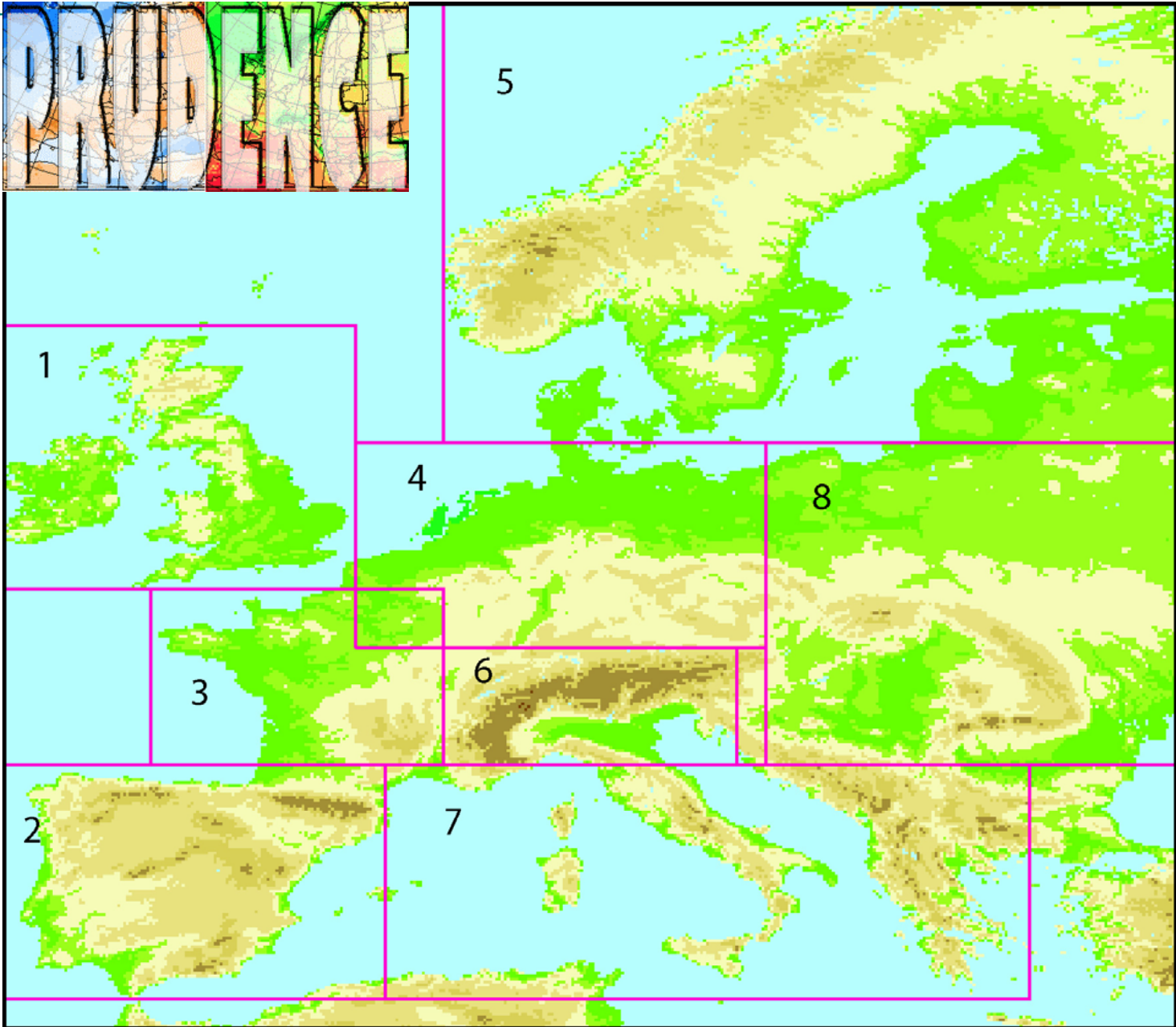
Time slices: 1961 to 1990 (control climate period)
2071 to 2100 (future climate period)

50 km horizontal resolution





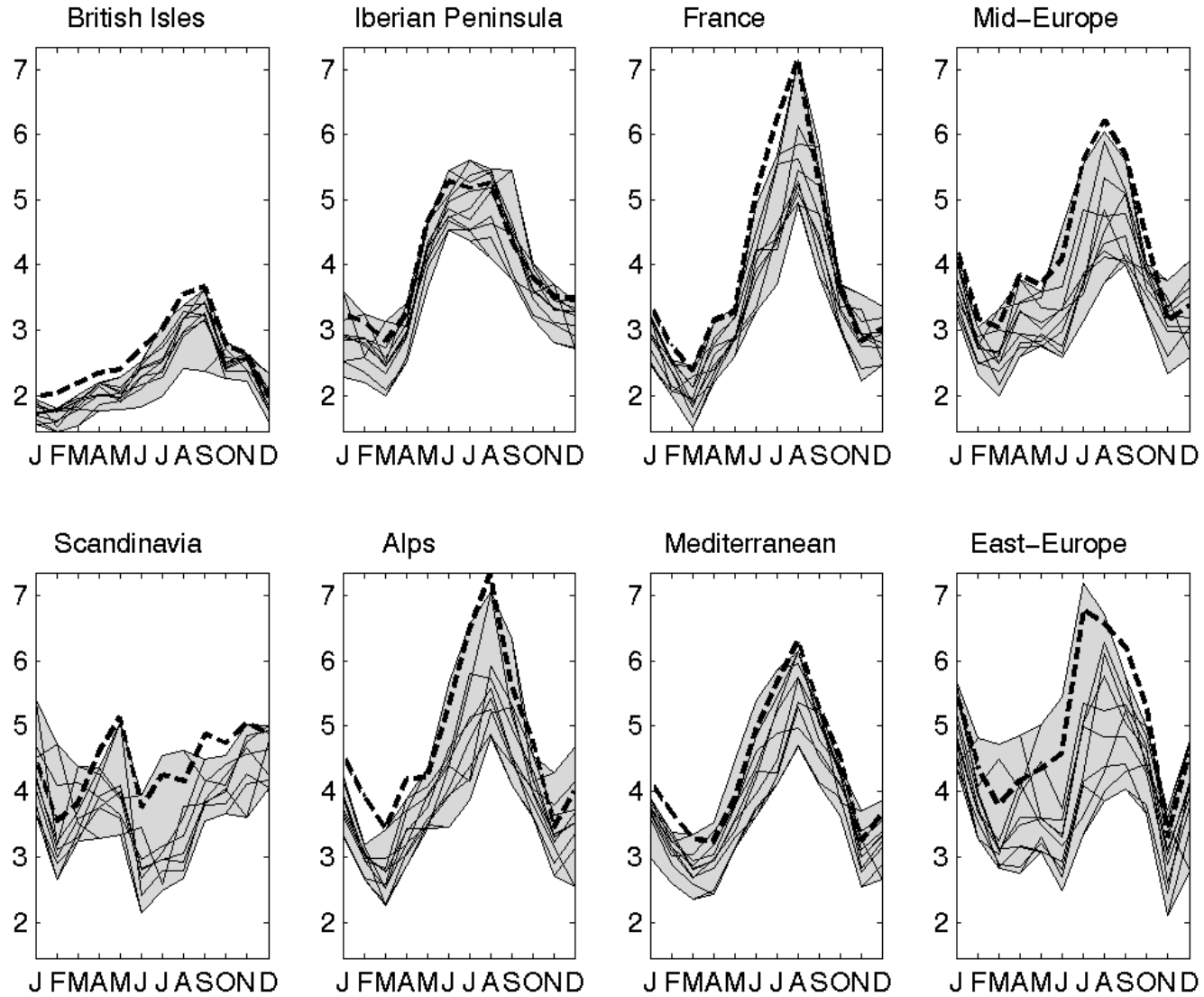
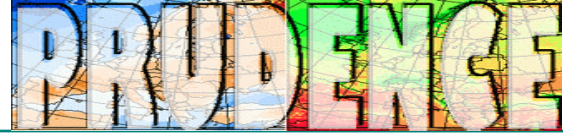
PROVİNLER





PRUDENCE: Signal in 2m-Temperature

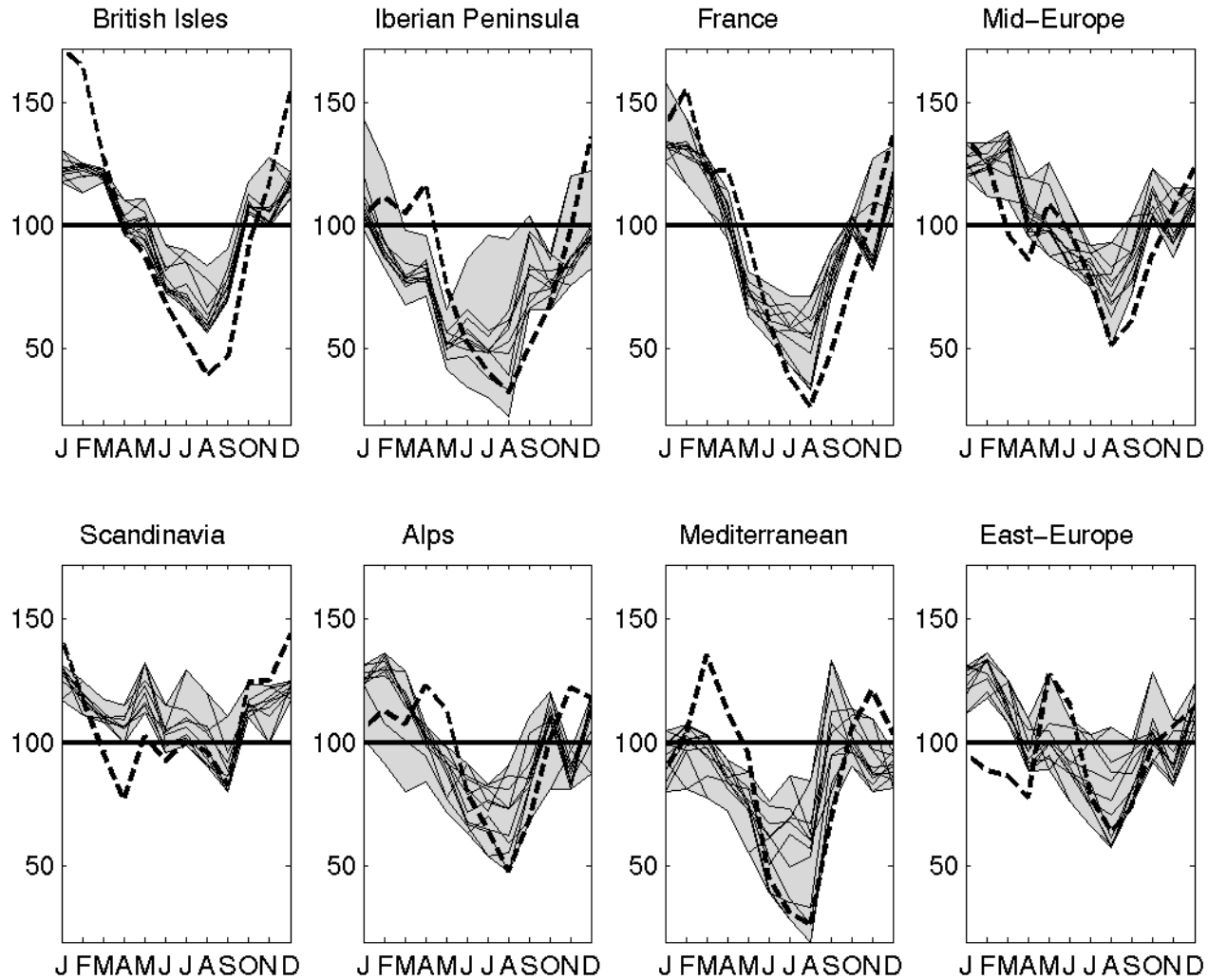
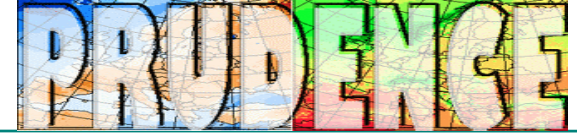
2071-2100 minus 1961-1990, A2





PRUDENCE: Signal in Precipitation

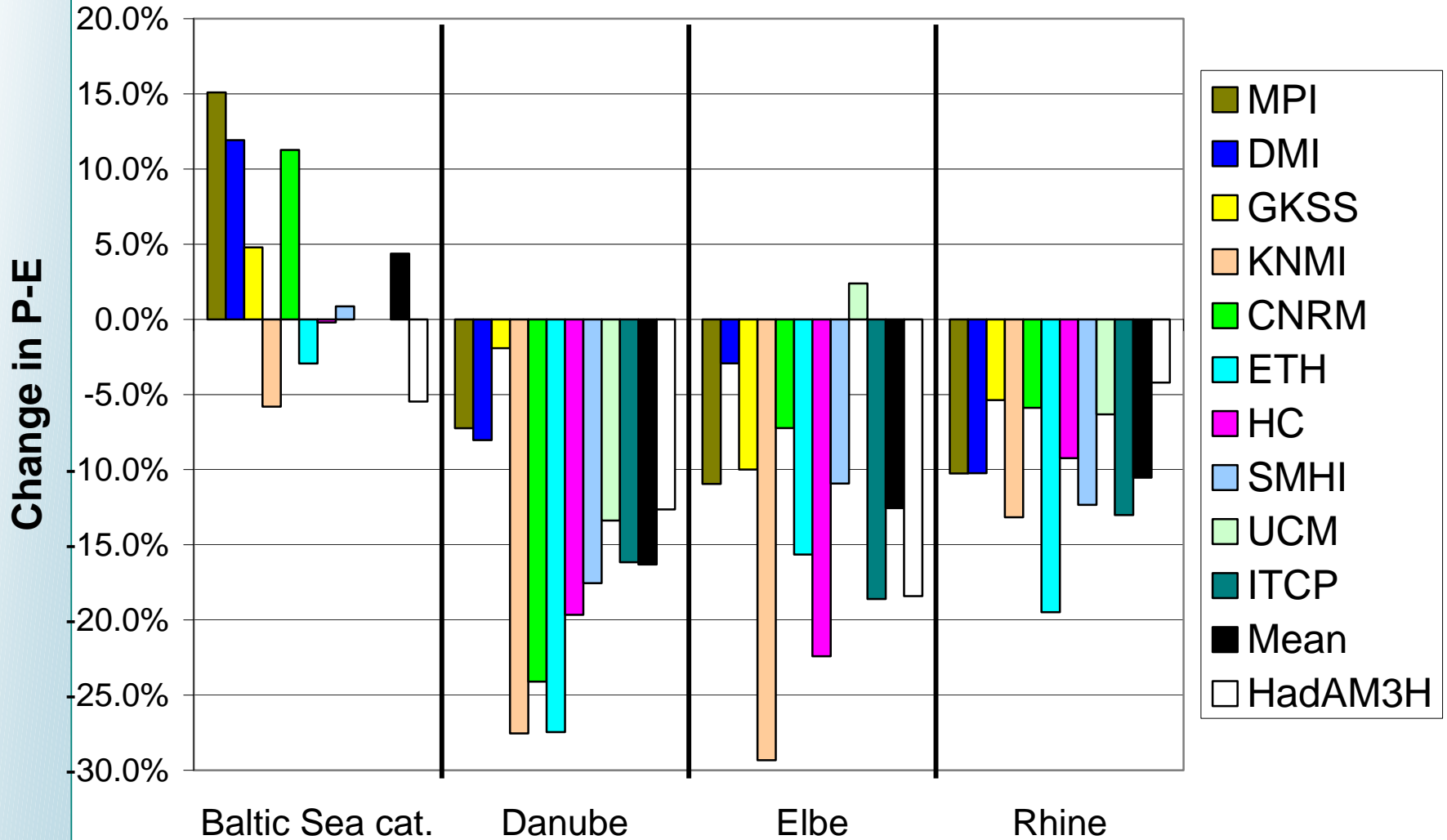
2071-2100 minus 1961-1990, A2





PRUDENCE

2071-2100: A2 (P-E=Runoff) changes





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ENSEMBLES stands for “ENSEMBLE-based Predictions of Climate Changes and their Impacts”

ENSEMBLES website: (<http://www.ensembles-eu.org>)

RT2b – Formulation of very high resolution Regional Climate Model Ensembles for Europe

Data will be available for scientific use soon





ENSEMBLES:

Compute climate change signal using **many** Regional Climate Models driven by **different** Global Models assuming **one** IPCC emission scenario (A1B).

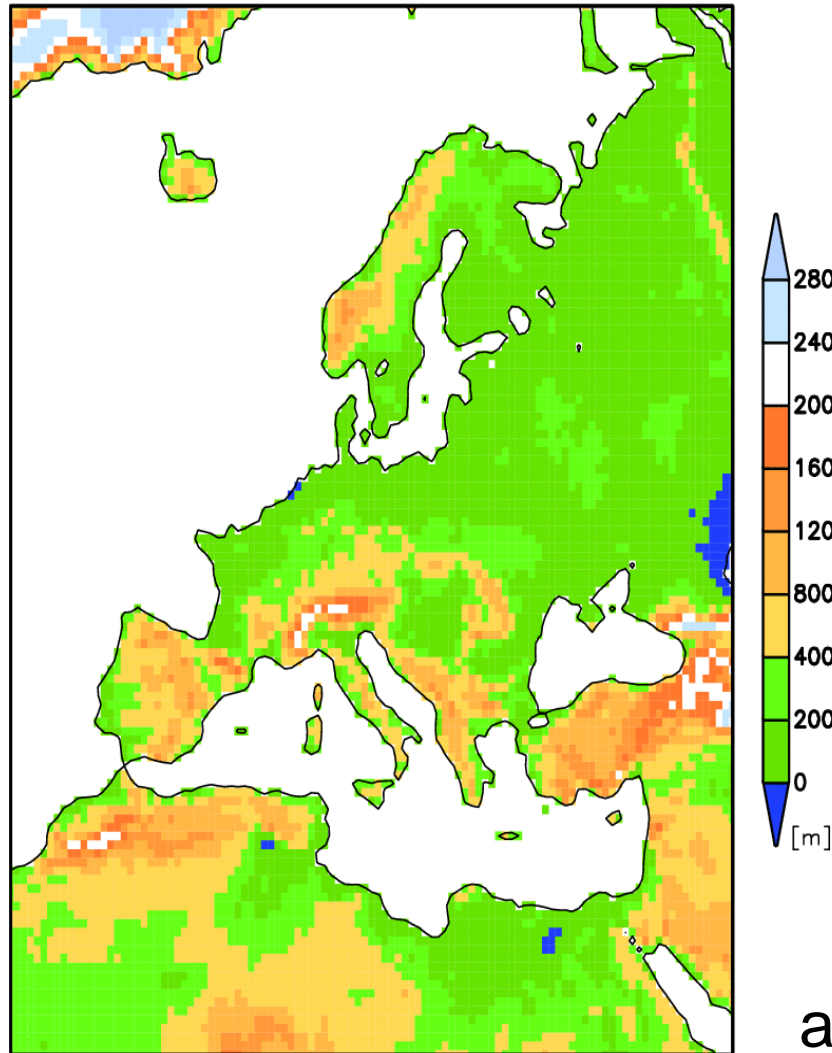
⇒ Assessment of uncertainty introduced by the use of different RCMs + uncertainties introduced by different GCMs



Transient simulations: 1950 to 2050 (2100), 25 km



MPI-M Simulations: one RCM, different IPCC scenarios



- 3 realizations control climate: 1950 – 2000
- 3 realizations A1B SRES scenario 2001- 2100 (“moderate”)
- 1 A2 scenario 2001 – 2100 (“pessimistic”)
- 1 B1 scenario 2001 – 2100 (“optimistic”)

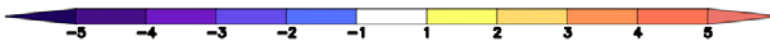
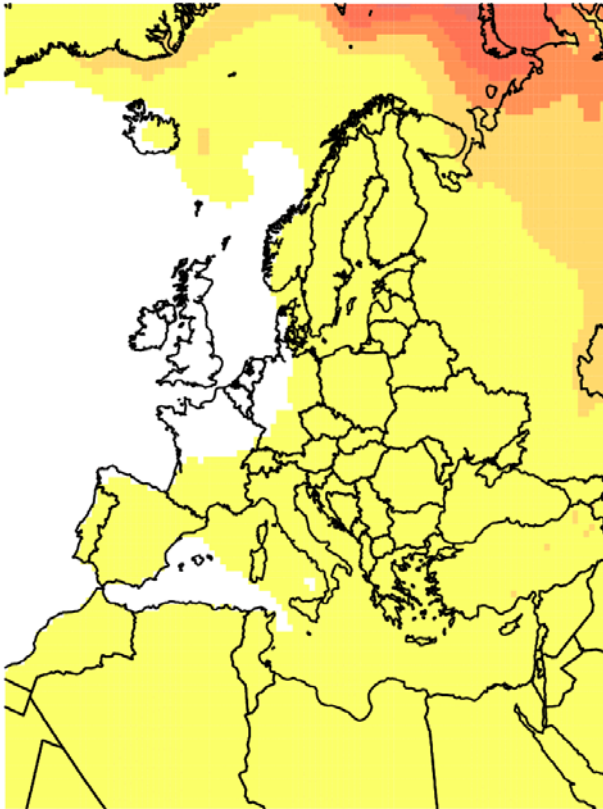
all driven by ECHAM5/MPI-OM IPCC runs



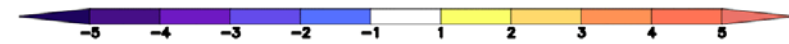
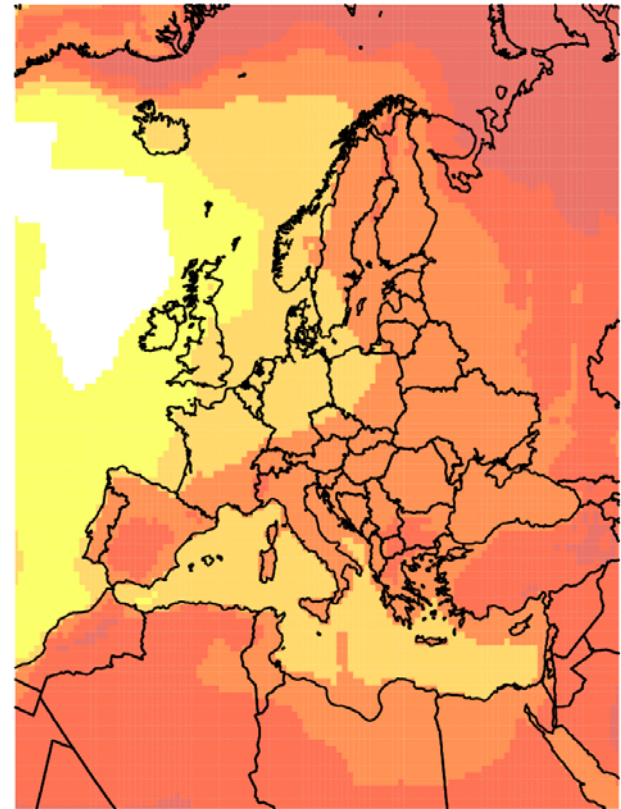


Changes in 2m-temperature: A1B (“moderate”)

change in 2-meter temperature [$^{\circ}$ C]:
2021 to 2050 – 1961 to 1990: REMO/A1B 0.44



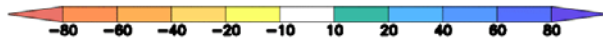
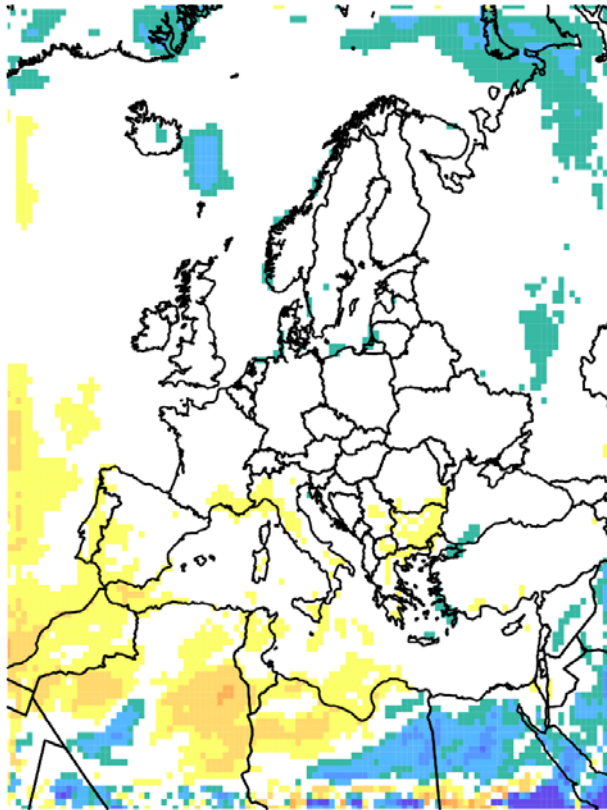
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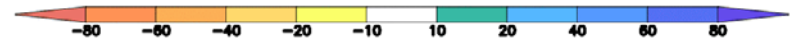
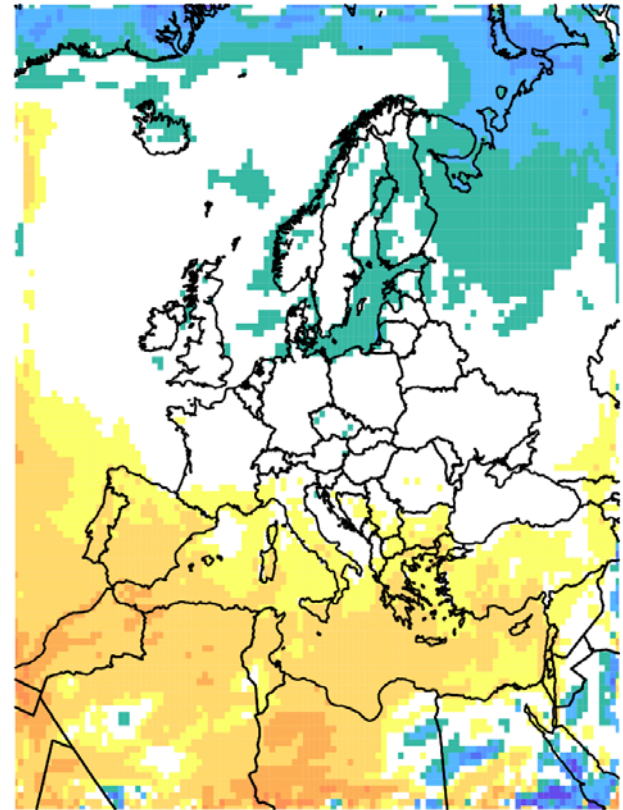


Changes in precipitation: A1B (“moderate”)

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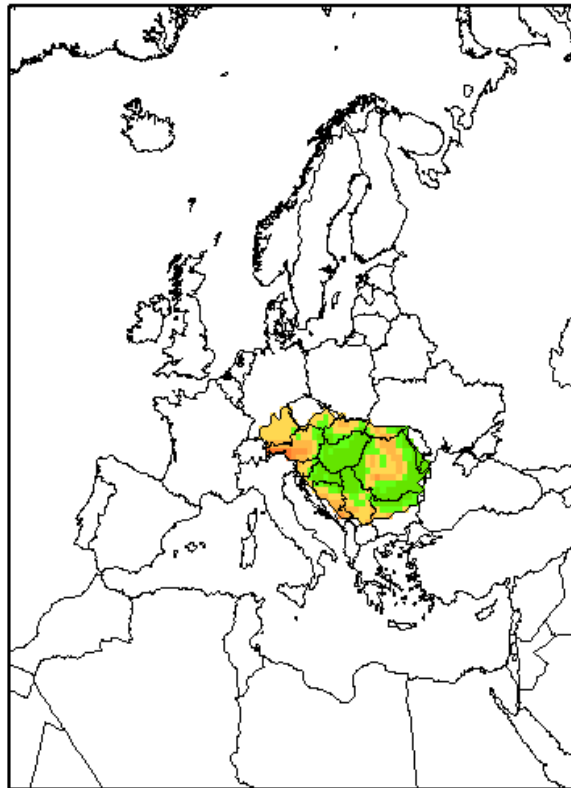


change in total precipitation [%]:
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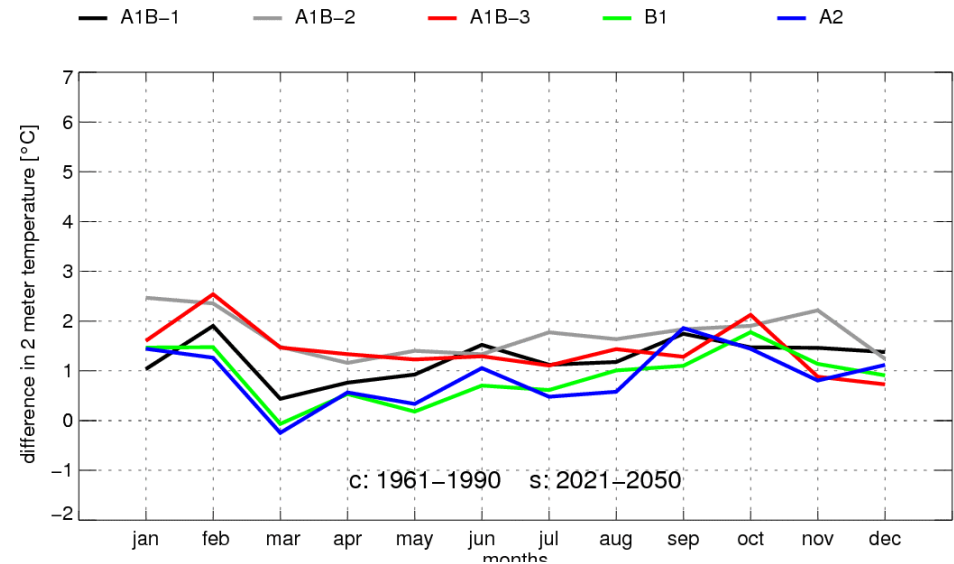


Climate change signal: 2-meter temperature

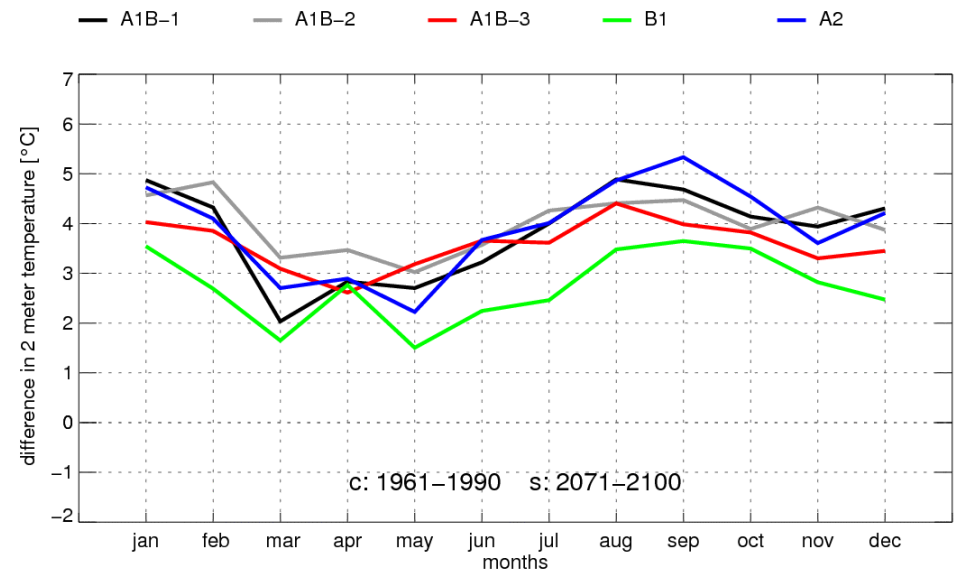


Analysis area:
Danube Catchment

ENS 0.44° simulations: Danube 2021–2050

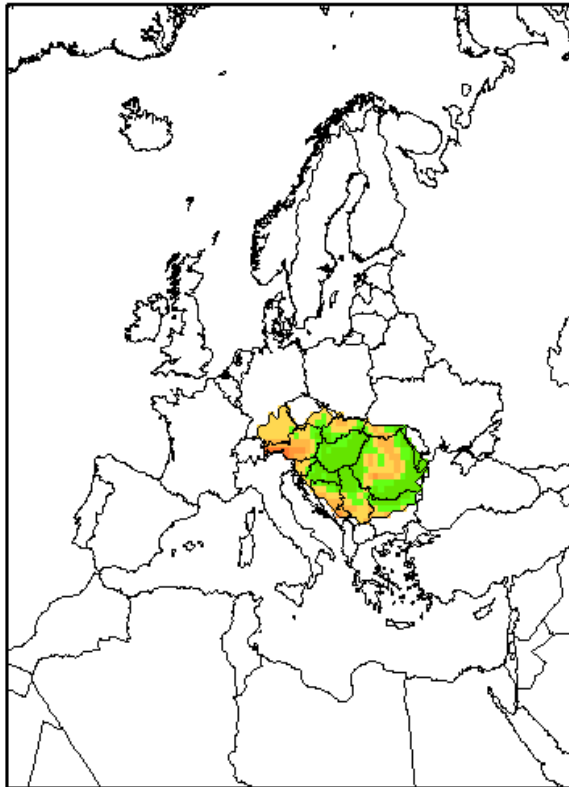


ENS 0.44° simulations: Danube 2071–2100



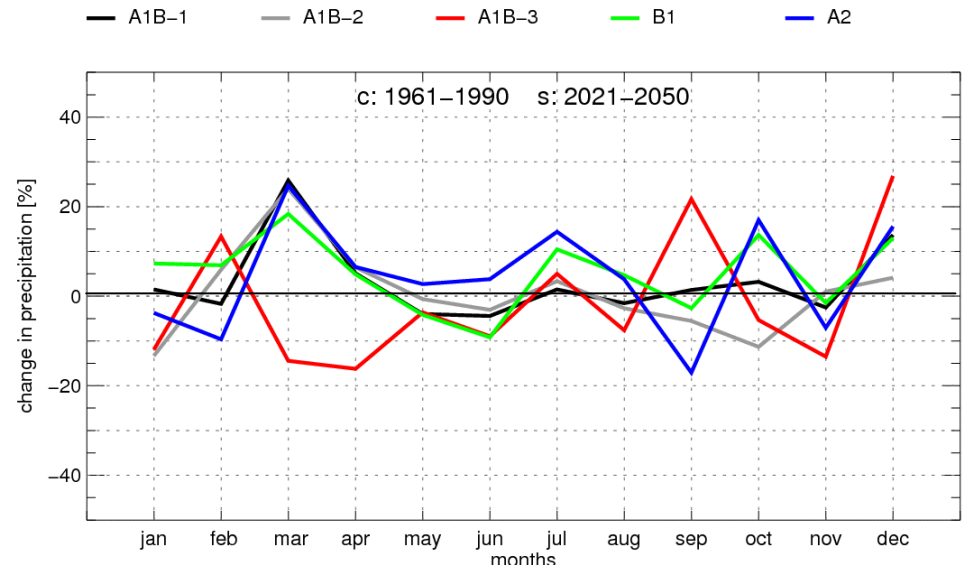


Climate change signal: precipitation

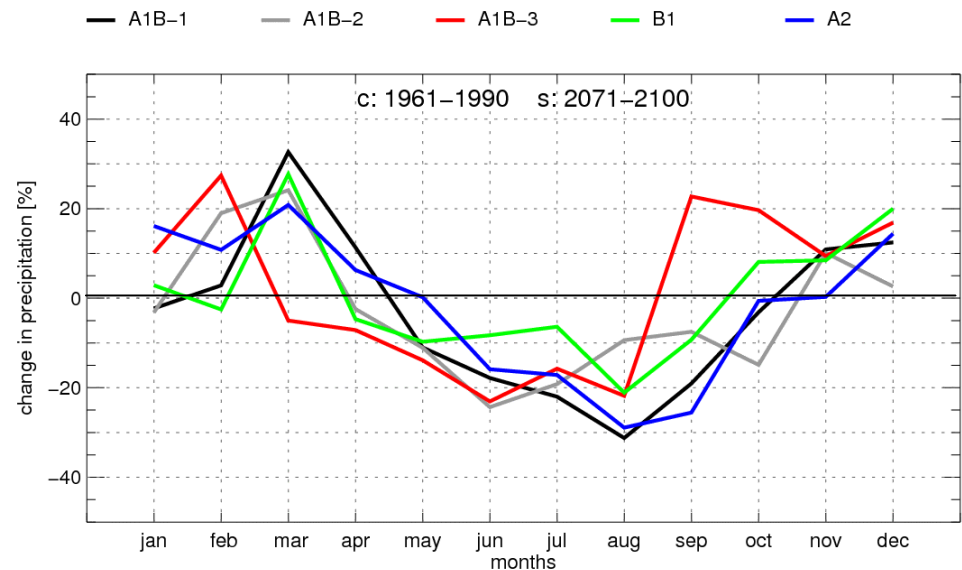


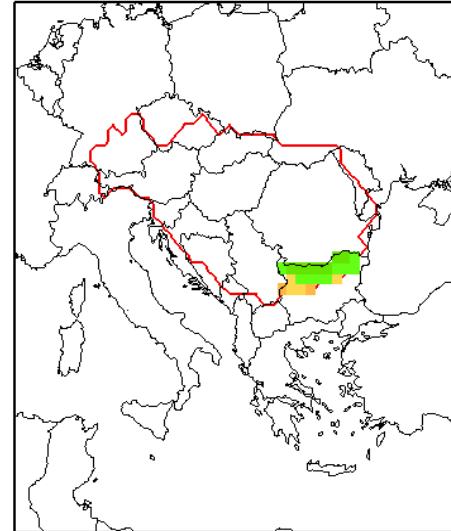
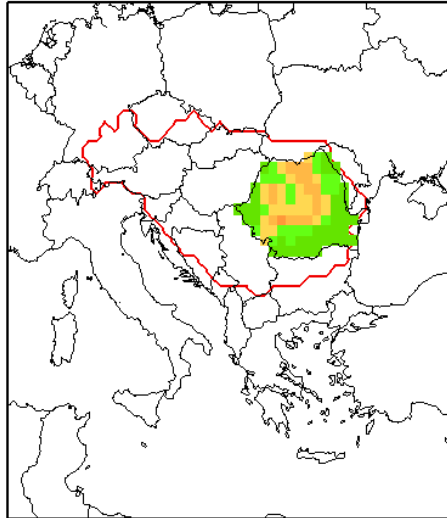
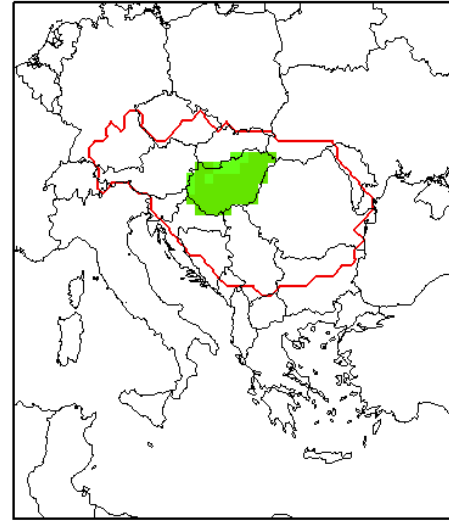
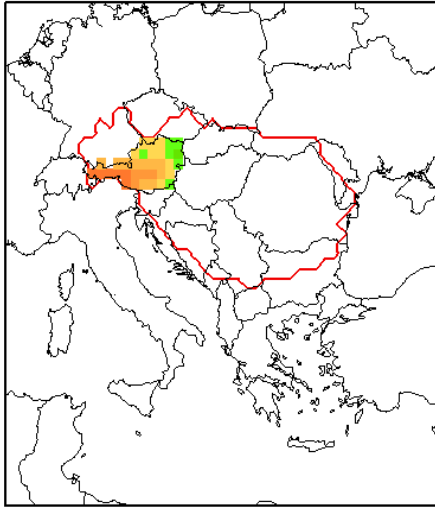
Analysis area:
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ENS 0.44° simulations: Danube 2071–2100

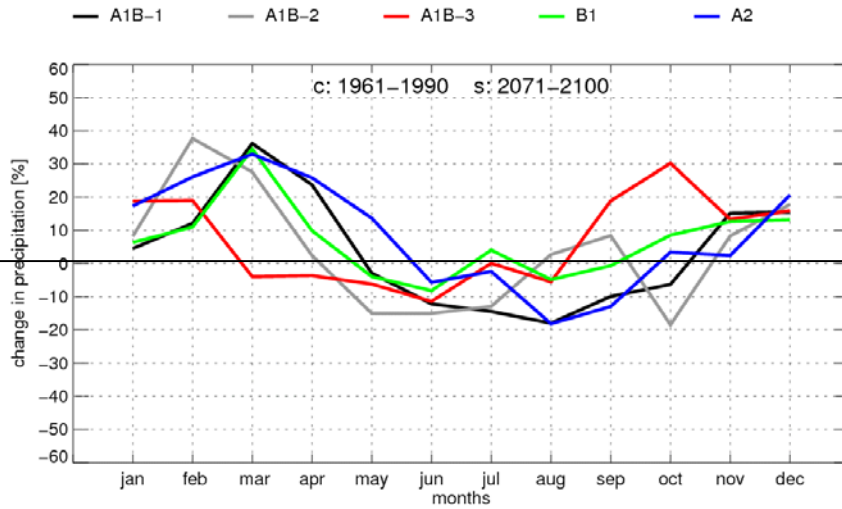




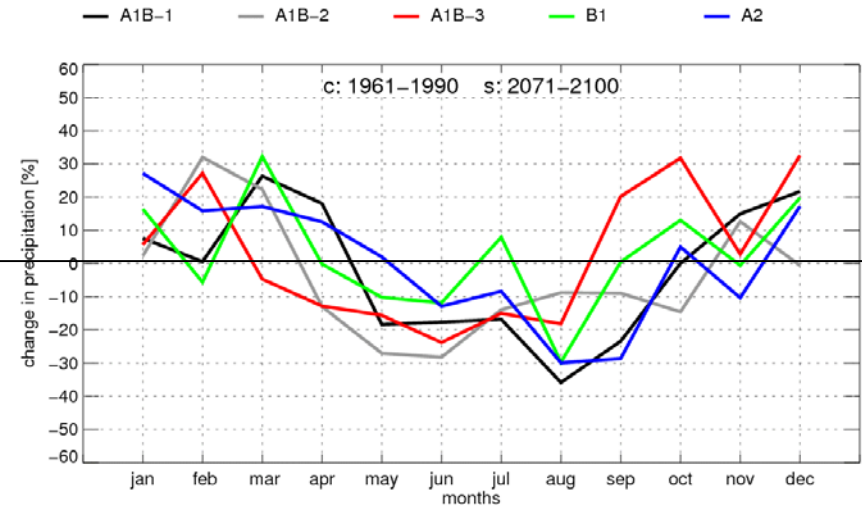


Climate change signal: precipitation

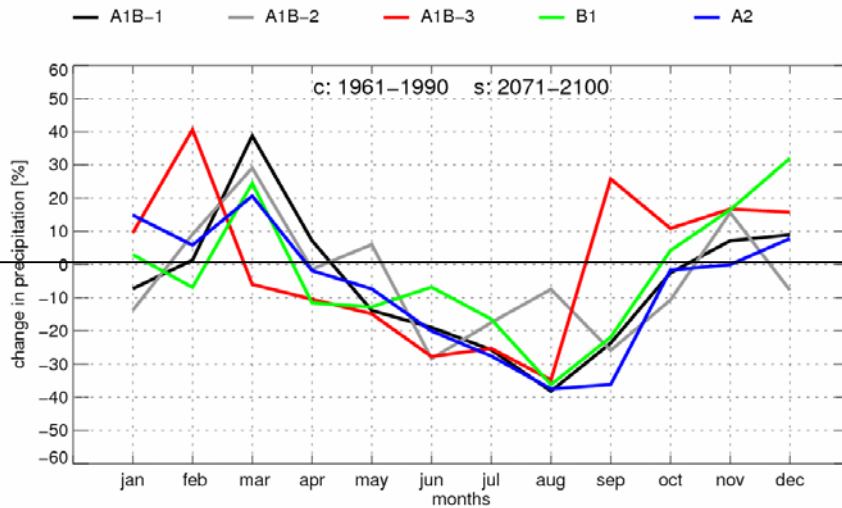
ENS 0.44° simulations: Danube_Austria 2071–2100



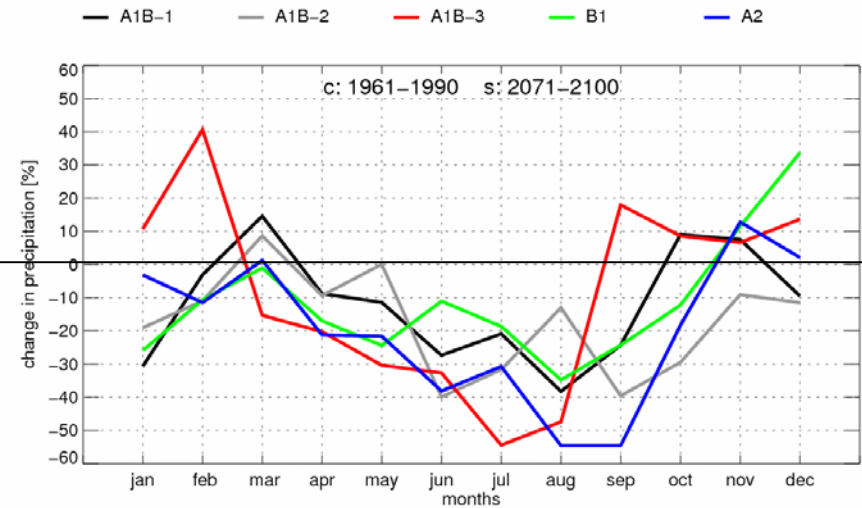
ENS 0.44° simulations: Danube_Hungary 2071–2100



ENS 0.44° simulations: Danube_Romania 2071–2100



ENS 0.44° simulations: Danube_Bulgaria 2071–2100





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Name of model/project/institution	Model(s)	Simulation period/model domain	Horizontal resolution/ Driving data	Temporal resolution Of available data	Availability (date /source)
ENSEMBLES	RCA3, ALADIN HIRHAM, HadRM RegCM, RCA, RACMO2, REMO, PROMES	Europe, 1950 to 2050 (2100)	0.22° (~25 km), different GCMs, A1B	Monthly, daily	~End of 2007, ENSEMBLES data server
PRUDENCE	ARPEGE, CHRM CLM, HadRM3H HIRHAM, RACMO RCAO, RegCM REMO, PROMES	Europe 1961 – 1990 2071 - 2100	0.5° (~50km), HadAM3H, A2	Monthly, daily	Available, PRUDENCE data server
PRUDENCE	ARPEGE, HadRM3H HIRHAM, RCAO RegCM, PROMES	Europe 1961 – 1990 2071 - 2100	0.5° (~50km), HadAM3H, B2	Monthly, daily	Available, PRUDENCE data server
PRUDENCE	HIRHAM, RCAO	Europe 1961 – 1990 2071 - 2100	0.5° (~50km), A2 and B2, ECHAM4/OPYC3	Monthly, daily	Available, PRUDENCE data server
MPI-M	REMO	Europe, 1950 to 2100	0.44° (~50km), ECHAM5/MPI-OM	Monthly, daily, hourly	Available at MPI-M





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Outlook

- Higher resolution multi model ensembles for the region (-> CLAVIER, CECILIA,...)
- Include possible land use changes into the Climate Change simulations
- Direct connection to impact modeling communities and stakeholder

