UNIVERSITÄT BERN

OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

ClimTip

Quantifying the impact of tipping points on regional climate within the ClimTip project framework

TRAMPAS/HYDROMED meeting 4-5/06/2025

Tipping points

Initial stable state

Forcing reduce the stability of the initial state

Transition to an alternative stable state after crossing a tipping point

Tipping points in ClimTip

- Polar ice sheet

- Atlantic Meridional Overturning Circulation (AMOC)

- Amazon rainforest

Tipping points are imposed in the simulations:

- Hosing to produce an AMOC collapse or

- Amazon rainforest artificially removed

Overview of the project

WS1: Advance tipping elements understanding and model representation

WS2: Model characteristics of climate and ecosystem tipping elements (global ESM simulations)

WS3: Climate and ecosystem impacts of crossing tipping points (regional climate modeling and impact assessment)

WS4: Mitigation, adaptation and socioeconomic costs of tipping points

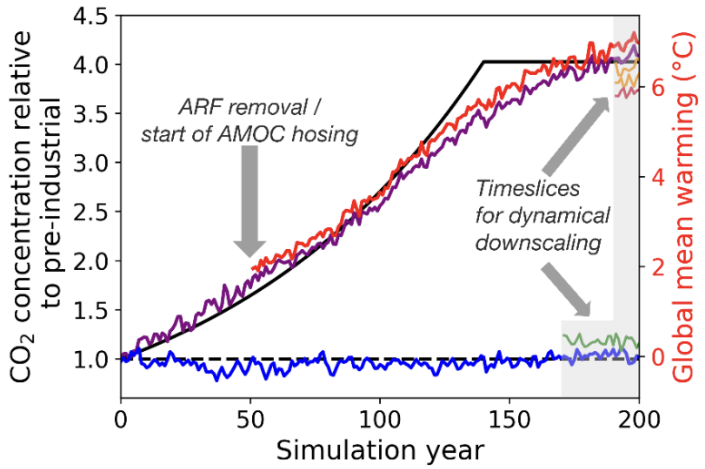
WS5: Outreach and management

Global simulations

CESM1	MPI-ESM	HadGEM
~ 1° resolution	~ 0.9° resolution	~ 0.6° resolution

Simulations:

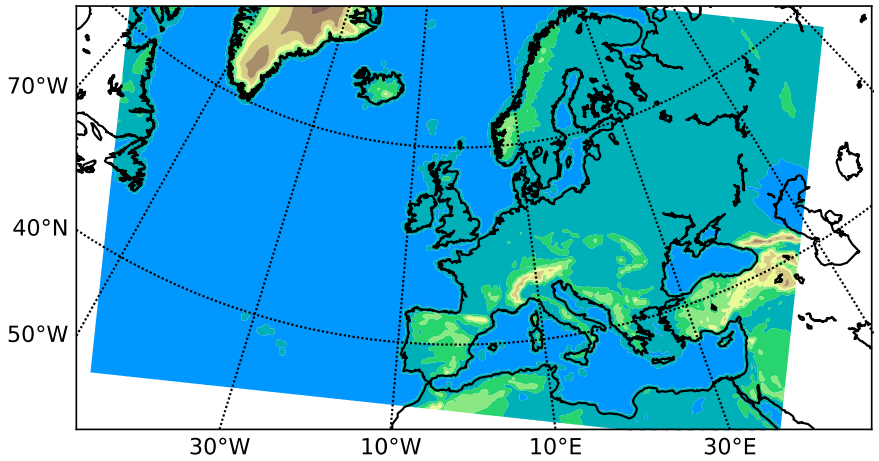
- Preindustrial control
- Stable warming (2 K)
- Warming + AMOC collapse
- Warming + Amazon rainforest removal

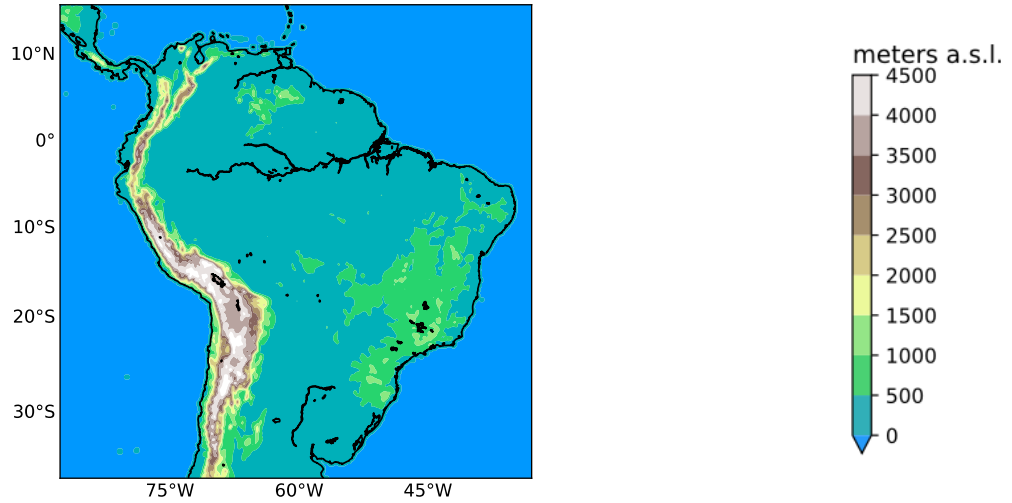


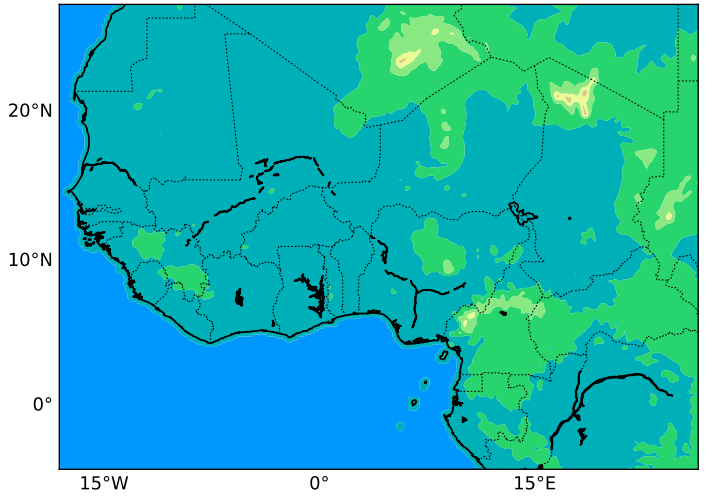
Dynamical downscaling

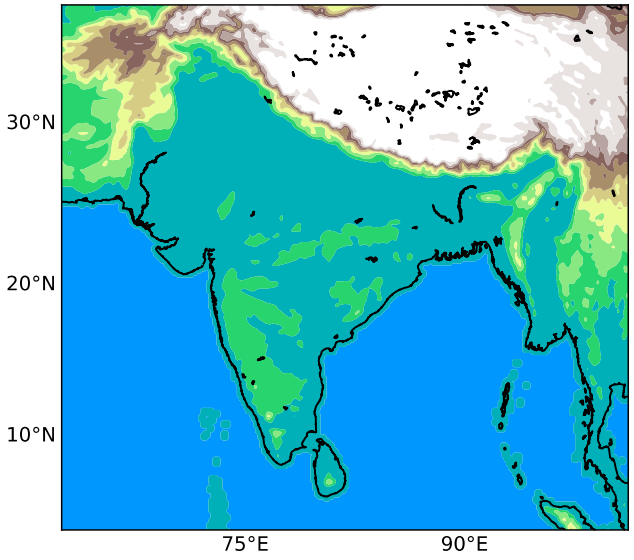
- WRF model
- 15 km resolution
- 20-year simulations + spin-up for each experiment
- 5 regions: Europe, Amazon, West Africa monsoon, Indian monsoon and East Asian monsoon

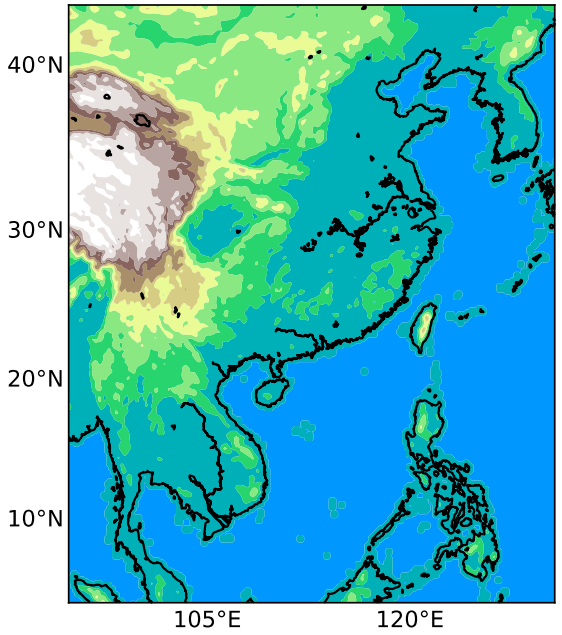
Regions


70°W
40°N
50°W
30°W
10°W
10°E
30°E

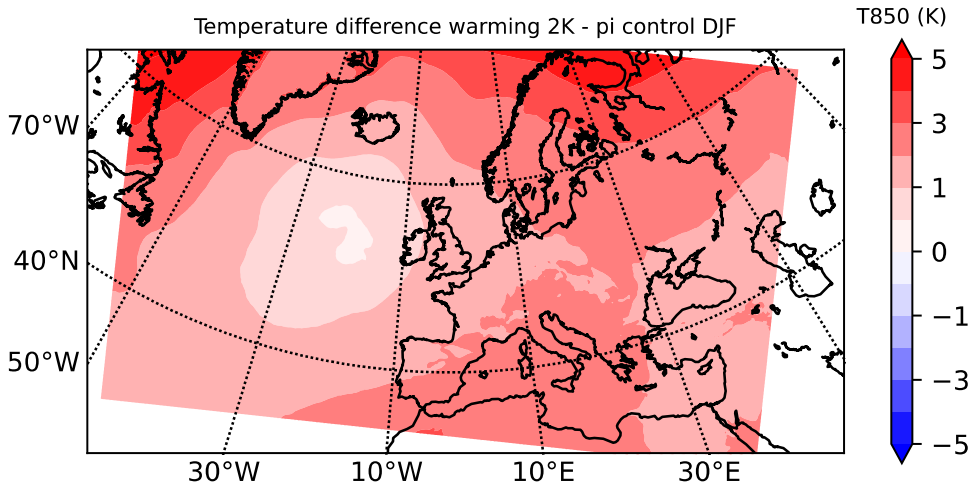

10°N
0°
10°S
20°S
30°S
75°W
60°W
45°W
meters a.s.l.
4500
4000
3500
3000
2500
2000
1500
1000
500
0


20°N
10°N
0°
15°W
0°
15°E

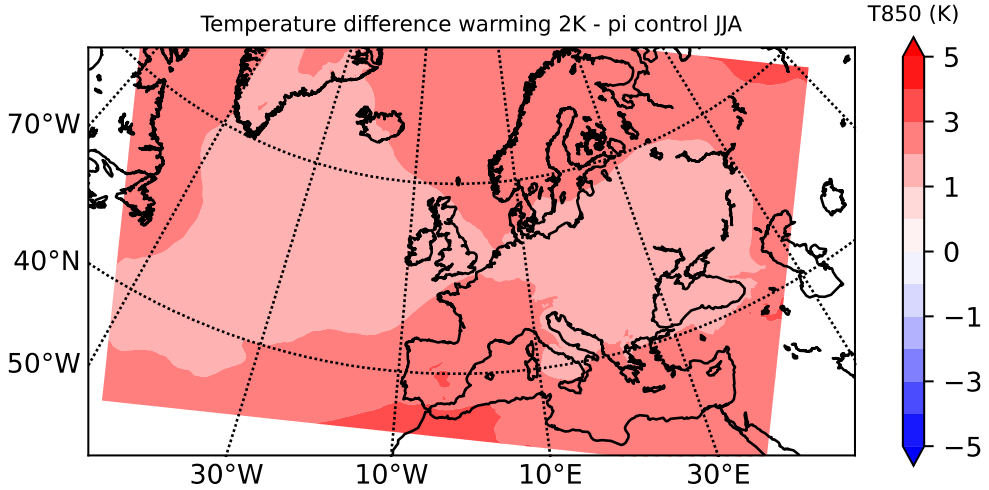

30°N
20°N
10°N
75°E
90°E


40°N
30°N
20°N
10°N
105°E
120°E

T2 stable_2K - piControl

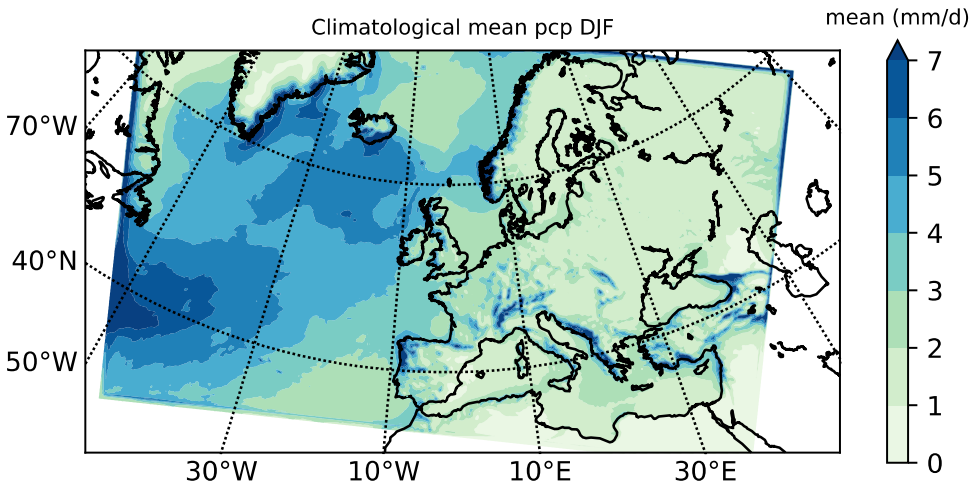


DJF

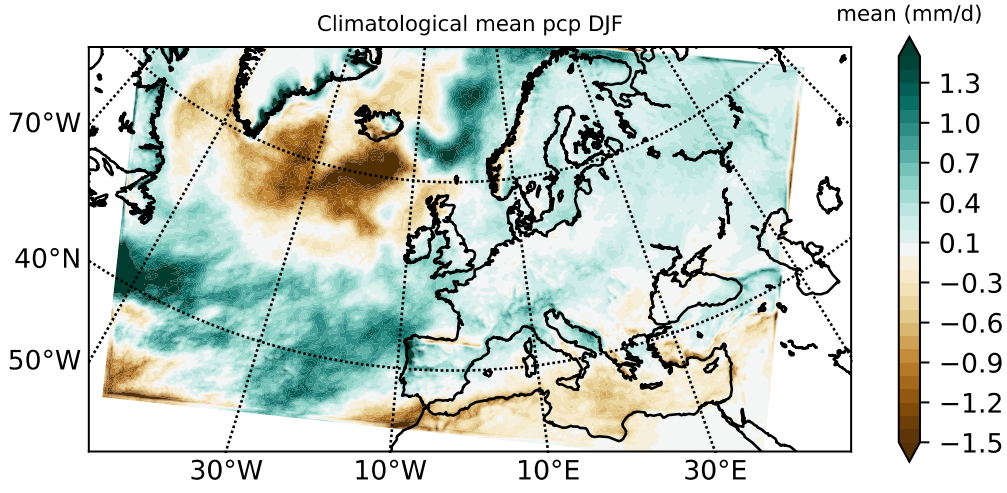


JJA

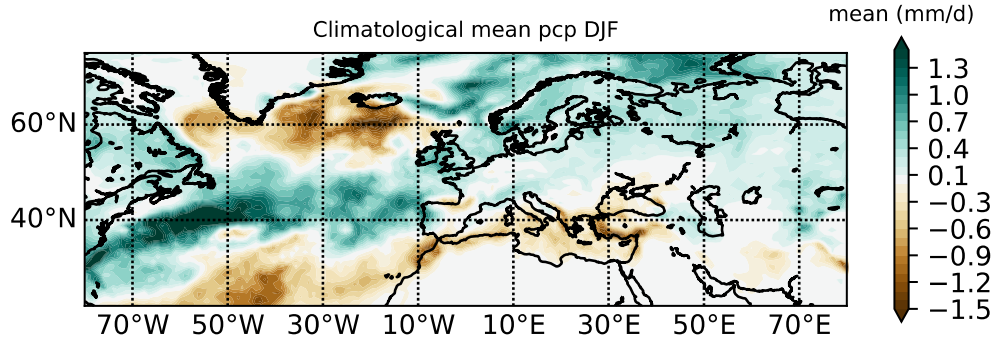
Mean precipitation stable_2K – piControl (DJF)



piControl

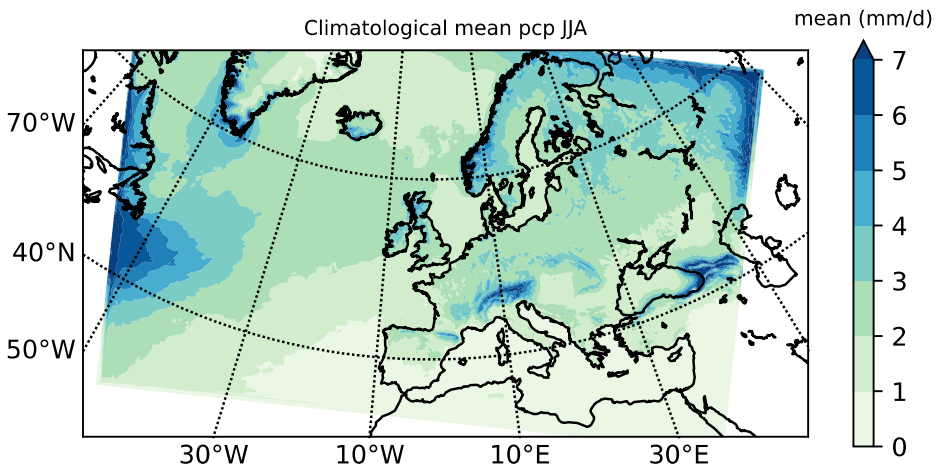


Difference

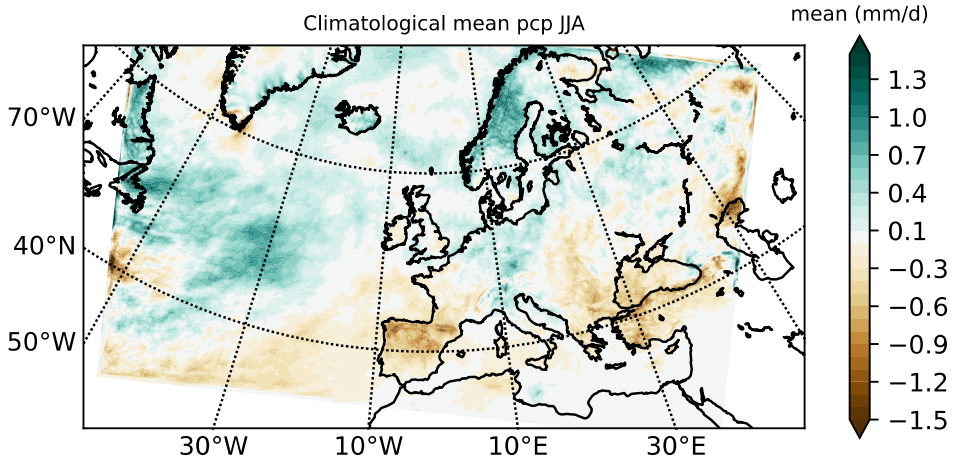


Global model

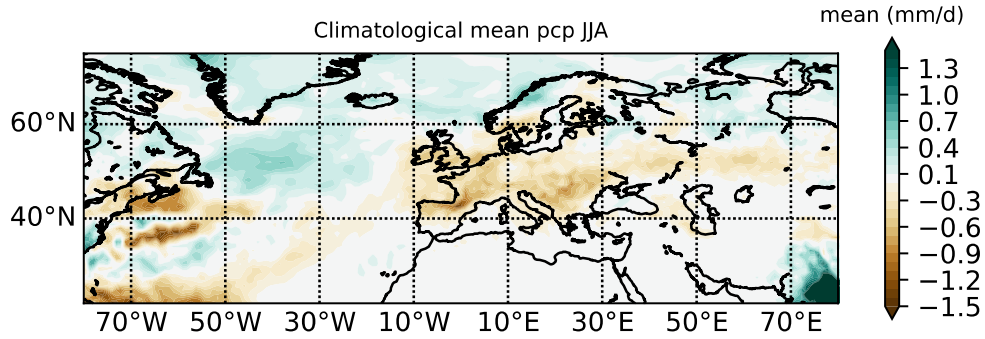
Mean precipitation stable_2K – piControl (JJA)



piControl

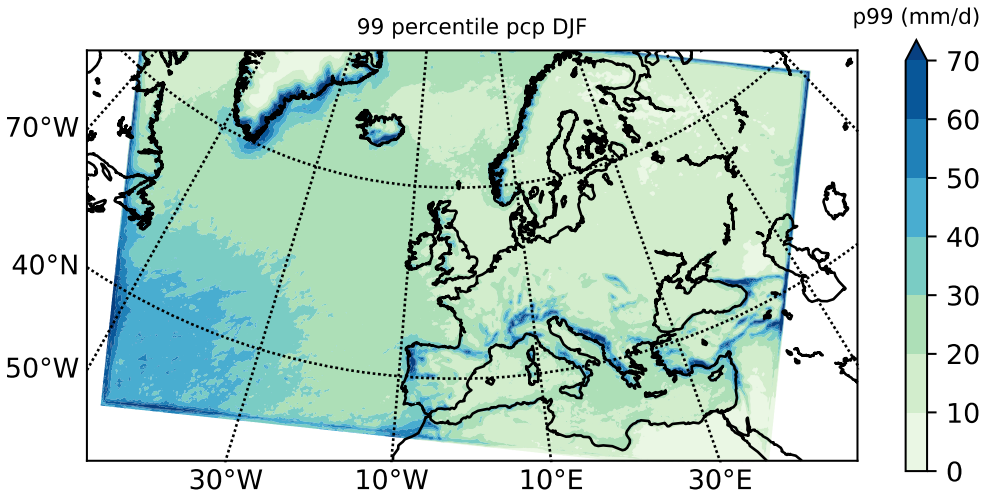


Difference

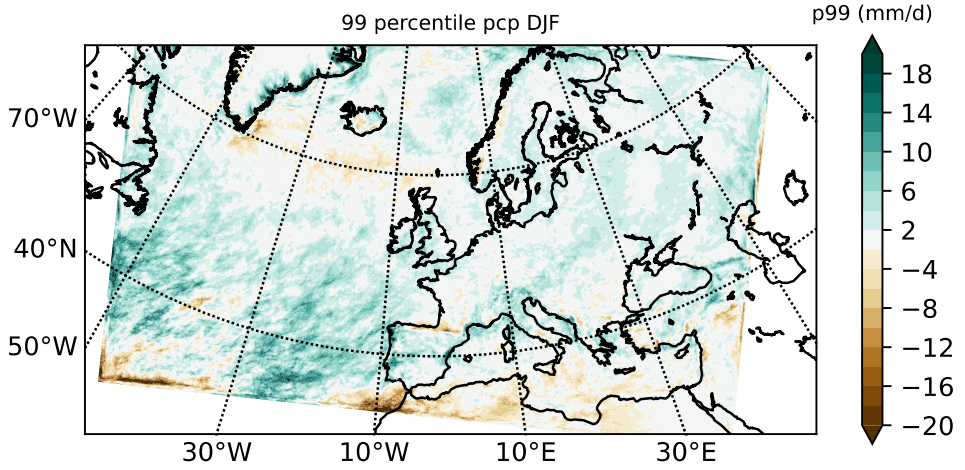


Global model

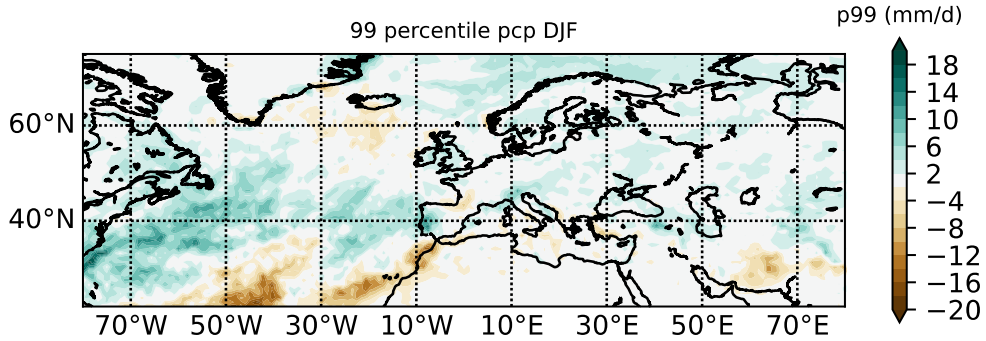
p99 stable_2K – piControl (DJF)



piControl

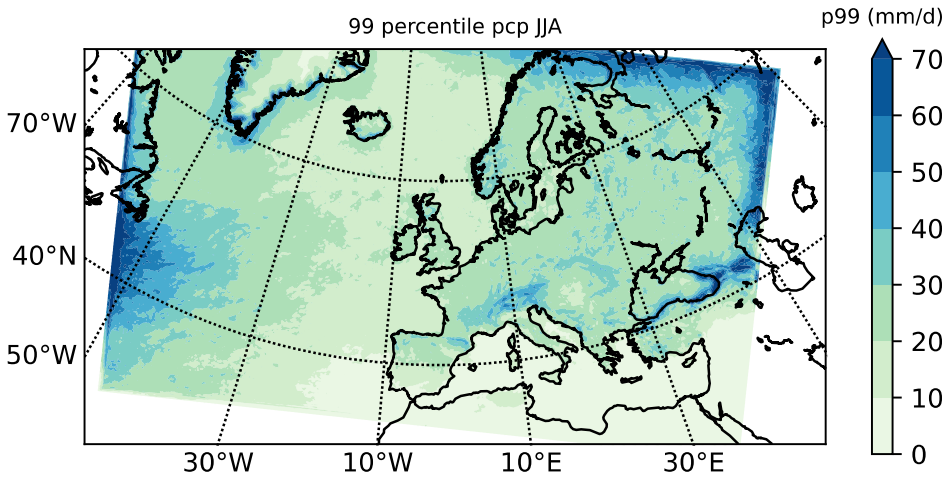


Difference



Global model

p99 stable_2K – piControl (JJA)



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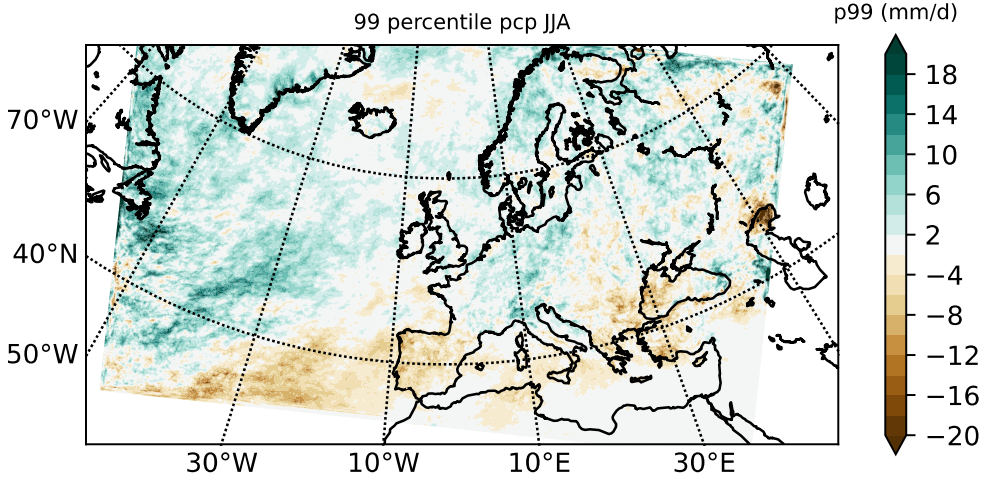

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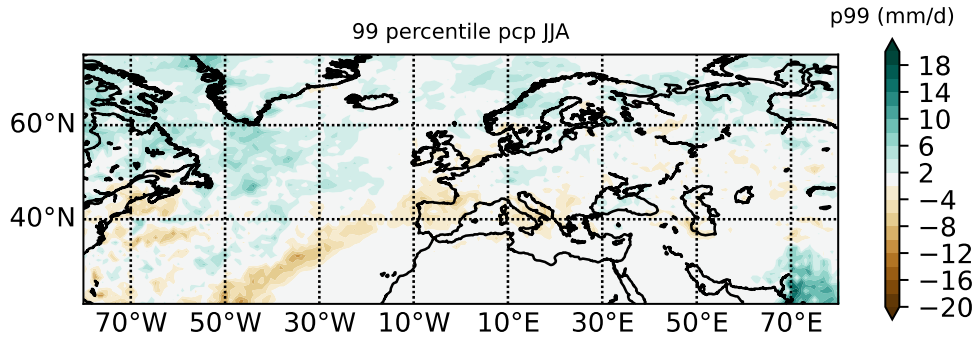
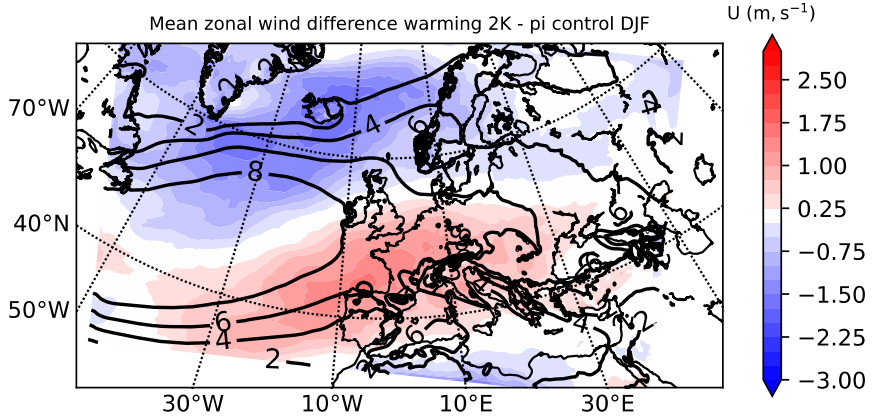
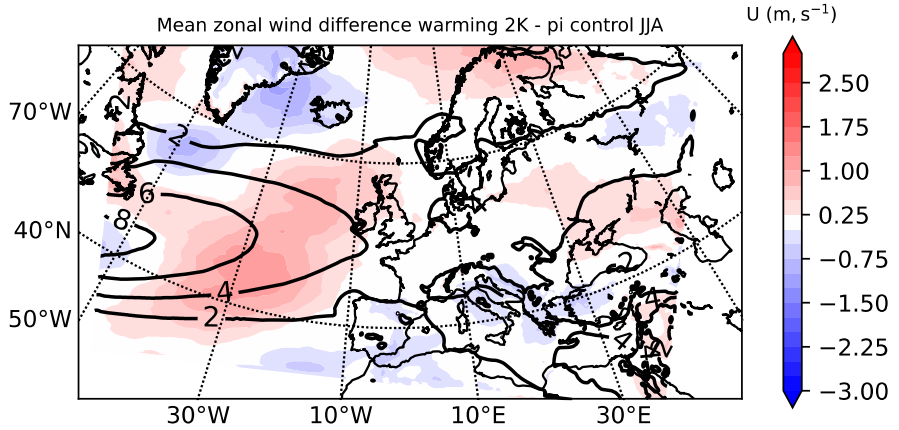


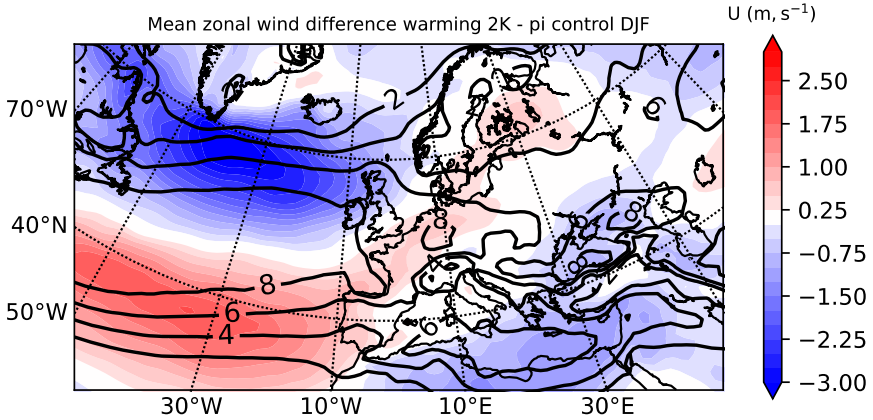
Global model

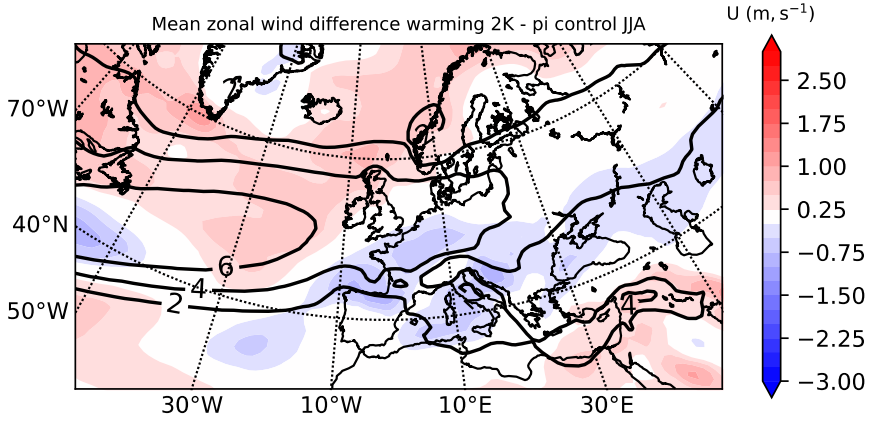
U850 stable_2K - piControl





Downscaling



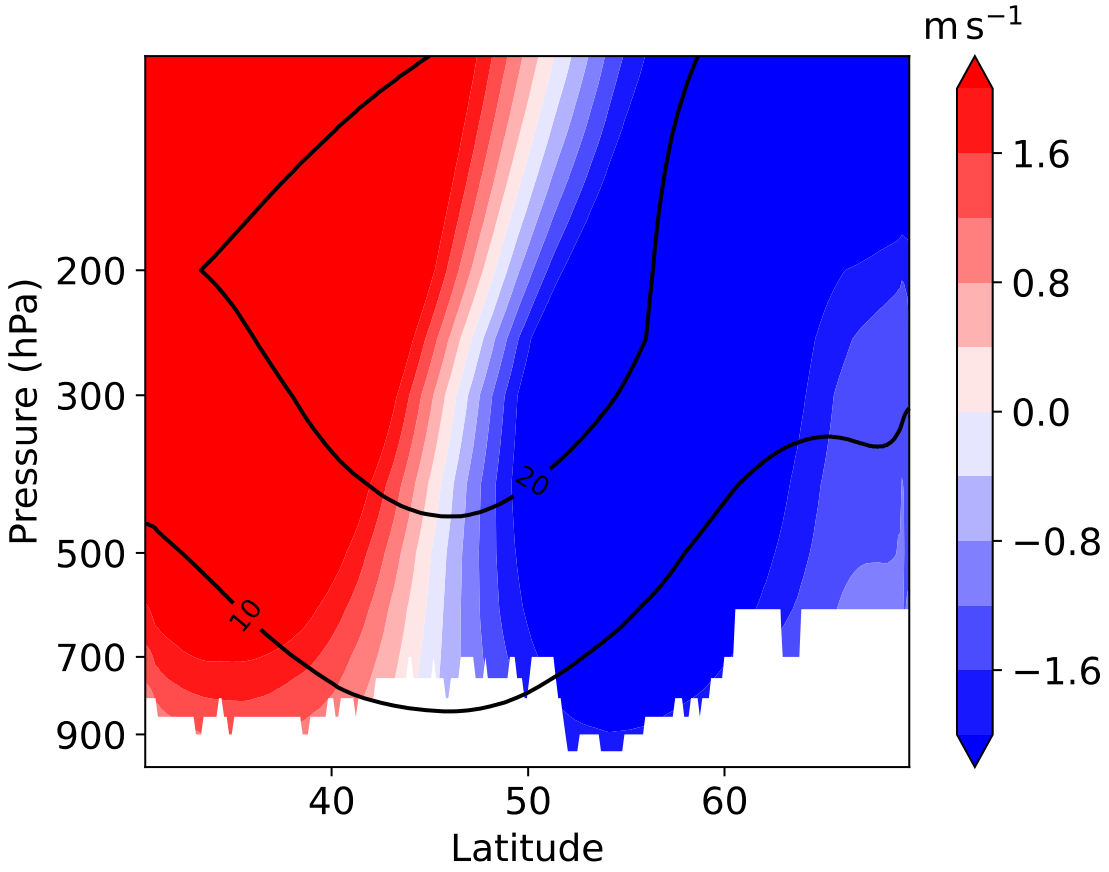


Global model

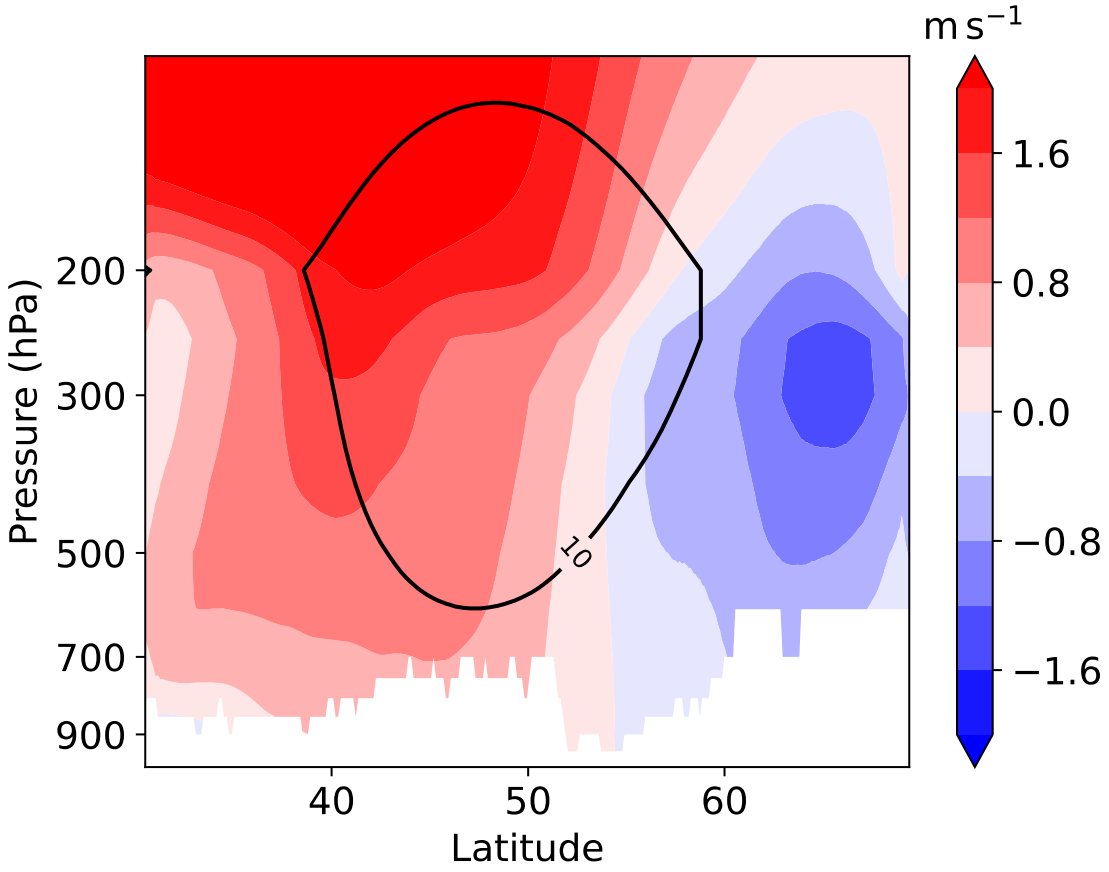
DJF

JJA

U vertical cross-section stable_2K - piControl



DJF

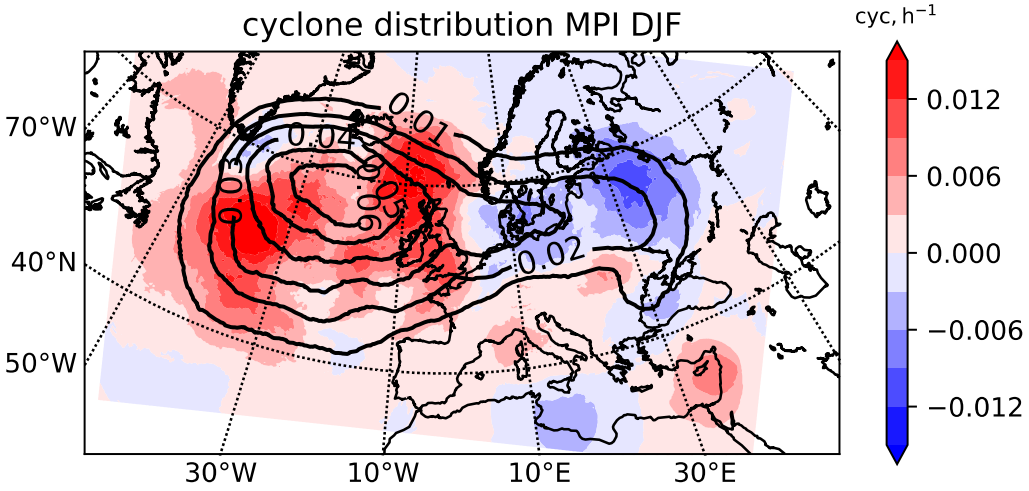


JJA

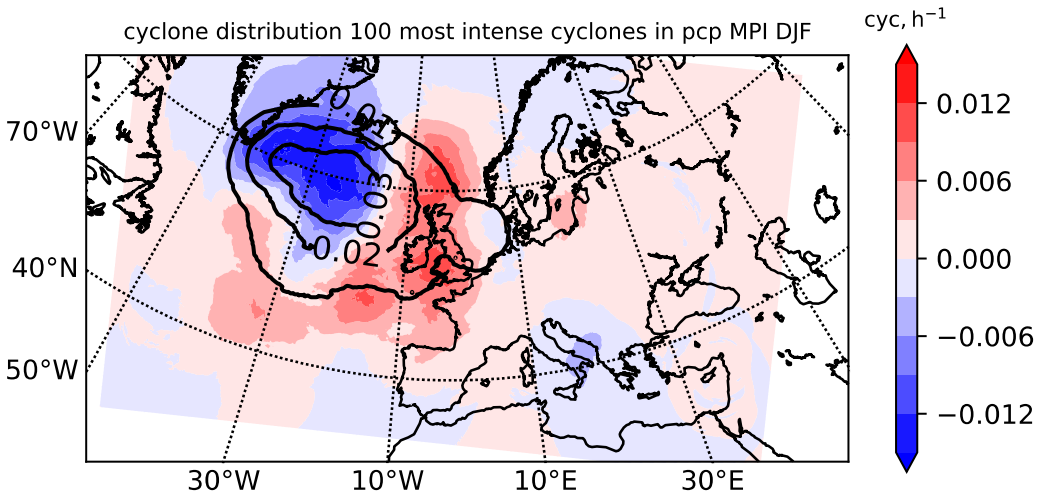
Cyclone tracking

- Minima in geopotential at 850 hPa (100 km resolution)
- Geopotential gradient of at least 150 m/1000km
- Minimum lifetime of 24 h
- Tracking excluded over regions with high orography

Cyclone frequency stable_2K – piControl (DJF)

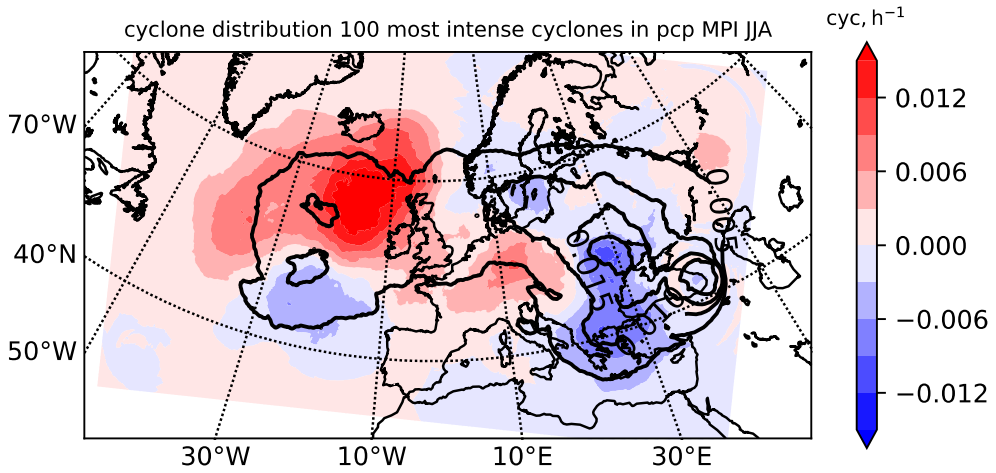


“All” cyclones



100 most extreme cyclones in precipitation

Cyclone frequency stable_2K – piControl (JJA)



100 most extreme cyclones in precipitation

Collaborations with HYDROMED

- Simulations with global warming/tipping will be available
- Specific impacts can be assessed
- Extreme hydrometeorological events in different scenarios
- Possibility to run further simulations for reduced domains and time periods

Acknowlegements

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