Modeling Climate Change in CA

Tackling climate change through increased regional cooperation

Dr. Bijan Fallah

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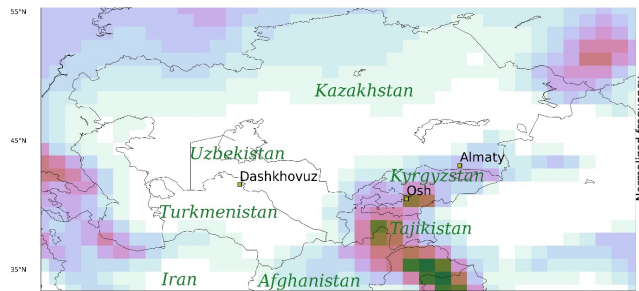
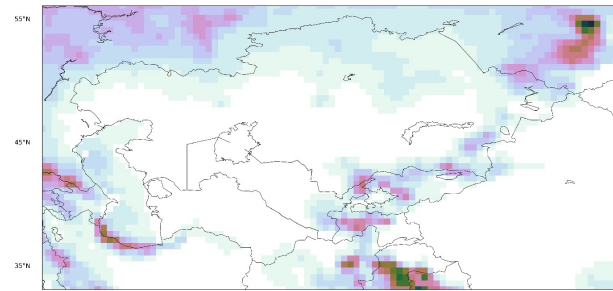# Challenges

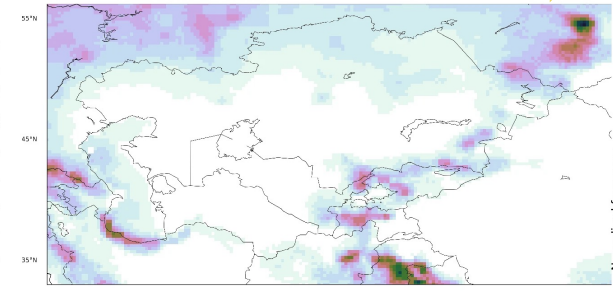- Climate impact assessment needs local climate information

Global resolution → Regional resolution

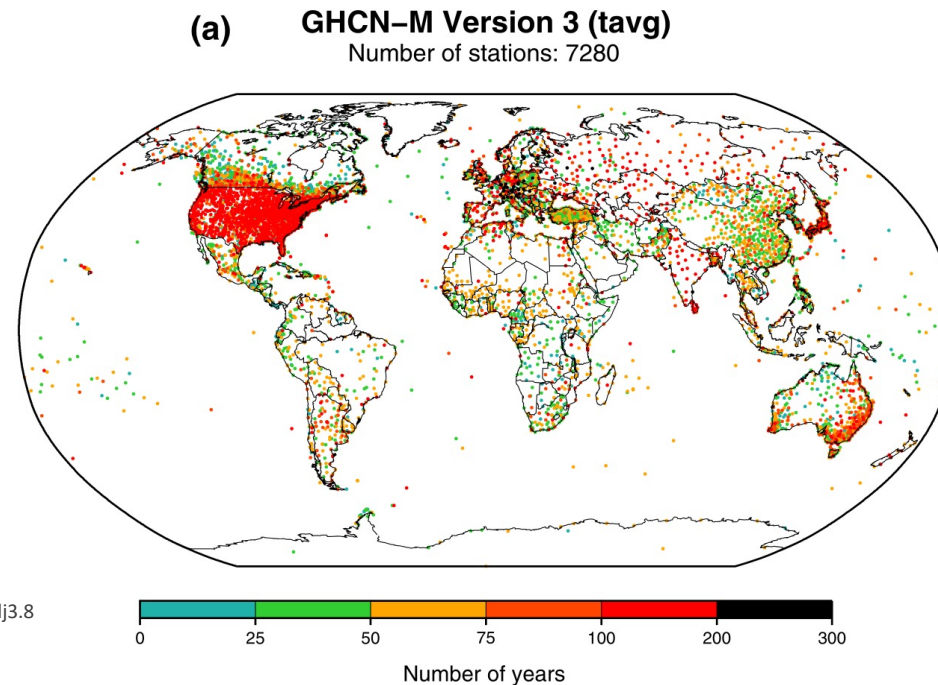(a) precipitation climatology for GFDL−ESM4_r1i1p1f1 model

(c) precipitation climatology from ISIMIP for the GFDL−ESM4_r1i1p1f1 model

(e) precipitation climatology for the ISIMIP-BASD GFDL−ESM4_r1i1p1f1 model

Precipitation [mm d^{-1}]

Challenges

- Climate impact assessment needs local climate information

- **Central Asia has a sparse climate observation network**

(a) **GHCN–M Version 3 (tavg)**
Number of stations: 7280

| 0 | 25 | 50 | 75 | 100 | 200 | 300 |

Number of years

Challenges

- Climate impact assessment needs local climate information

- Central Asia has a sparse climate observation network

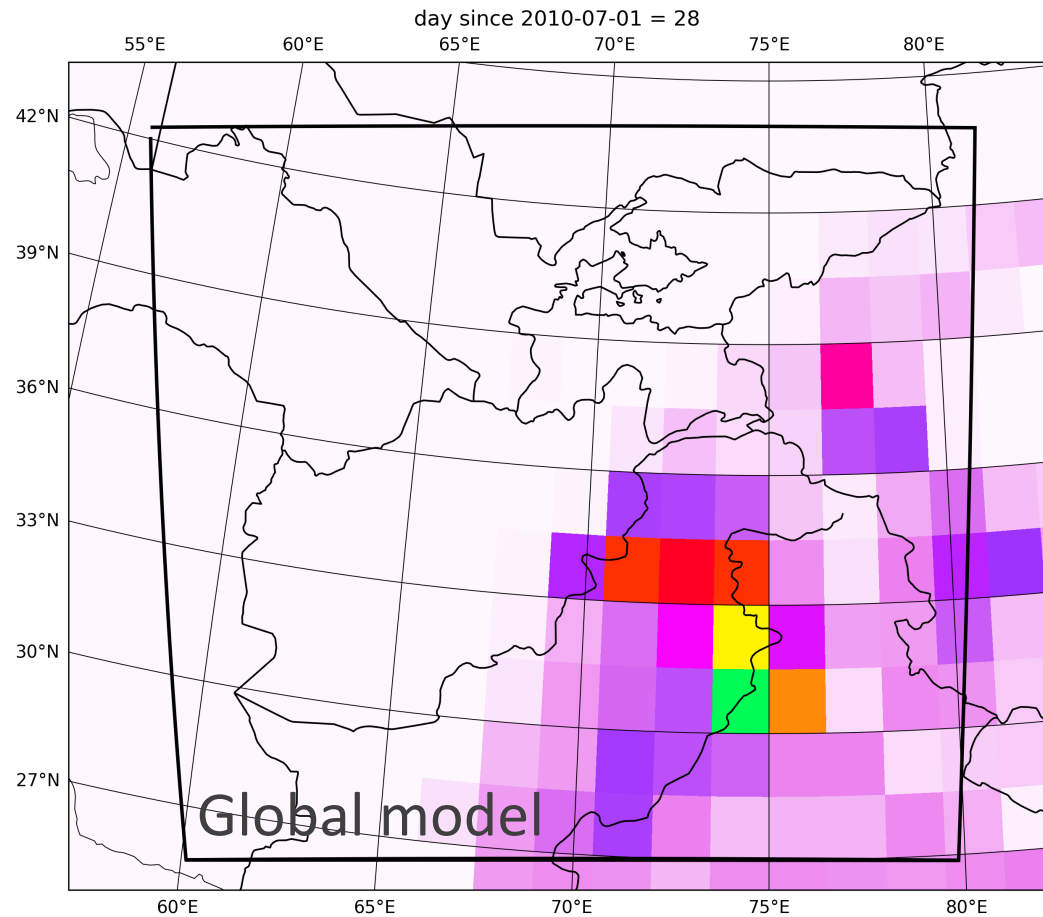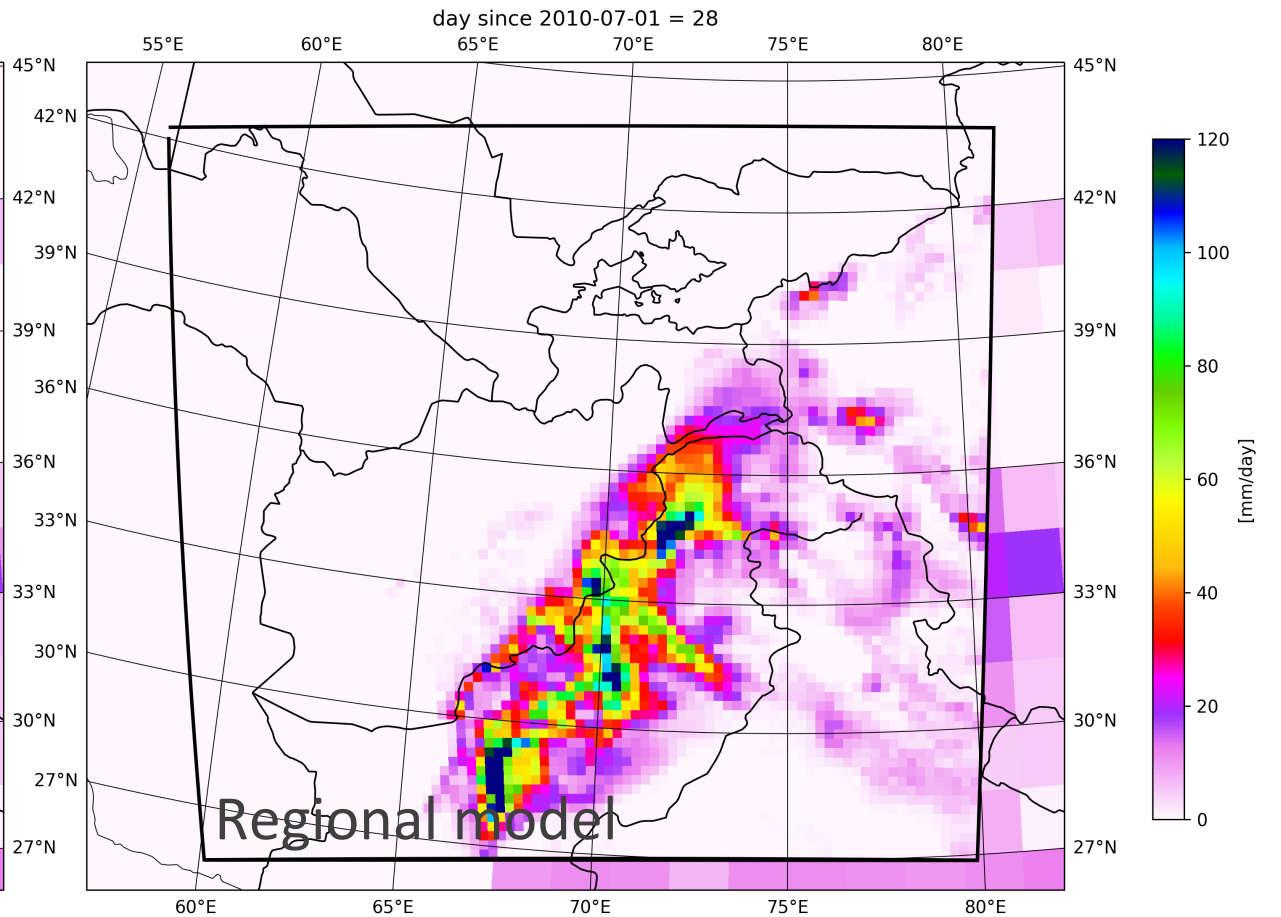- **The topography of CA is very complex**
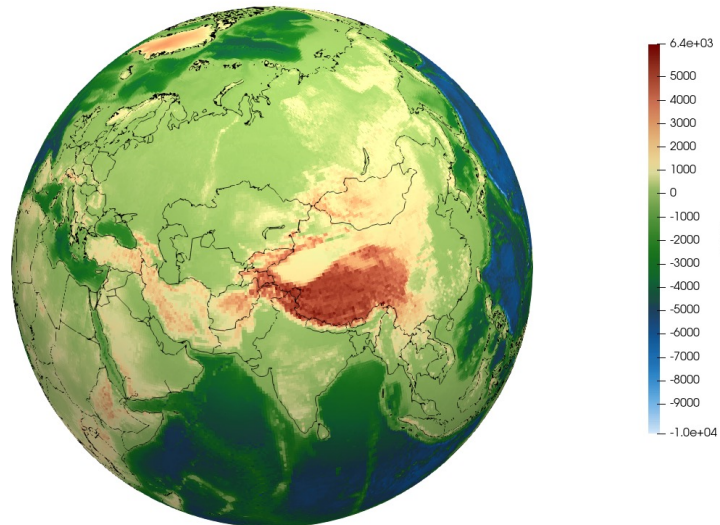
Challenges

- Climate impact assessment needs local climate information

- Central Asia has a sparse climate observation network

- The topography of CA is very complex

- **Number of regional climate impact studies available in CA**

Challenges – Downscaling with regional models

What we have

What we need

Global model

Regional model

Challenges – Downscaling with statistical models

What we have

What we need

4x4   8x8   16x16   32x32   64x64   topography
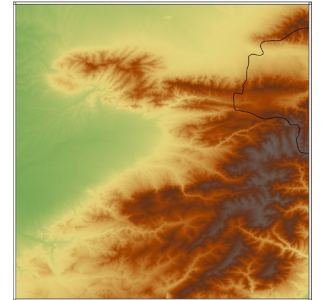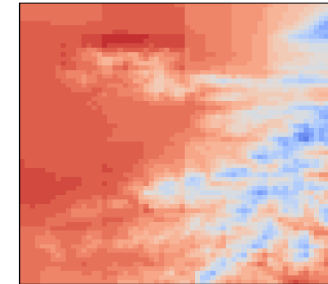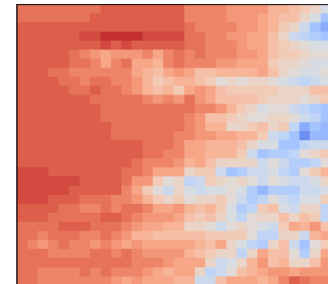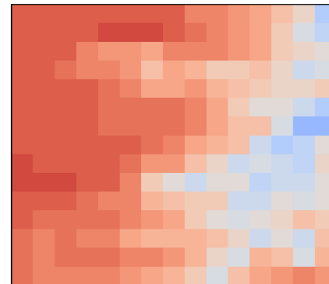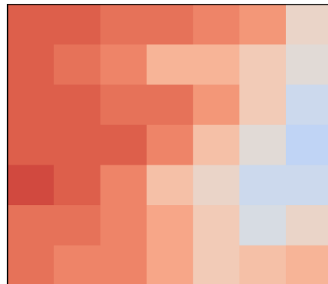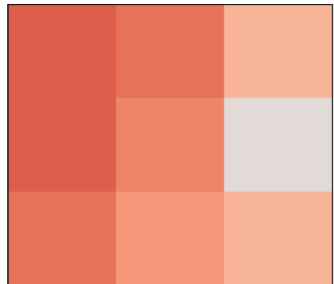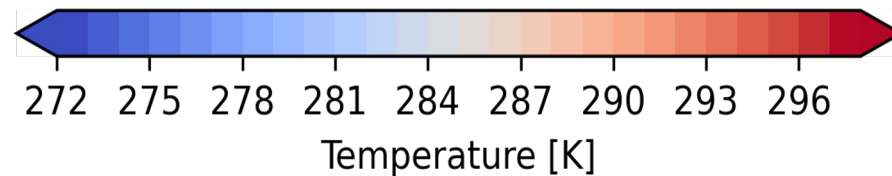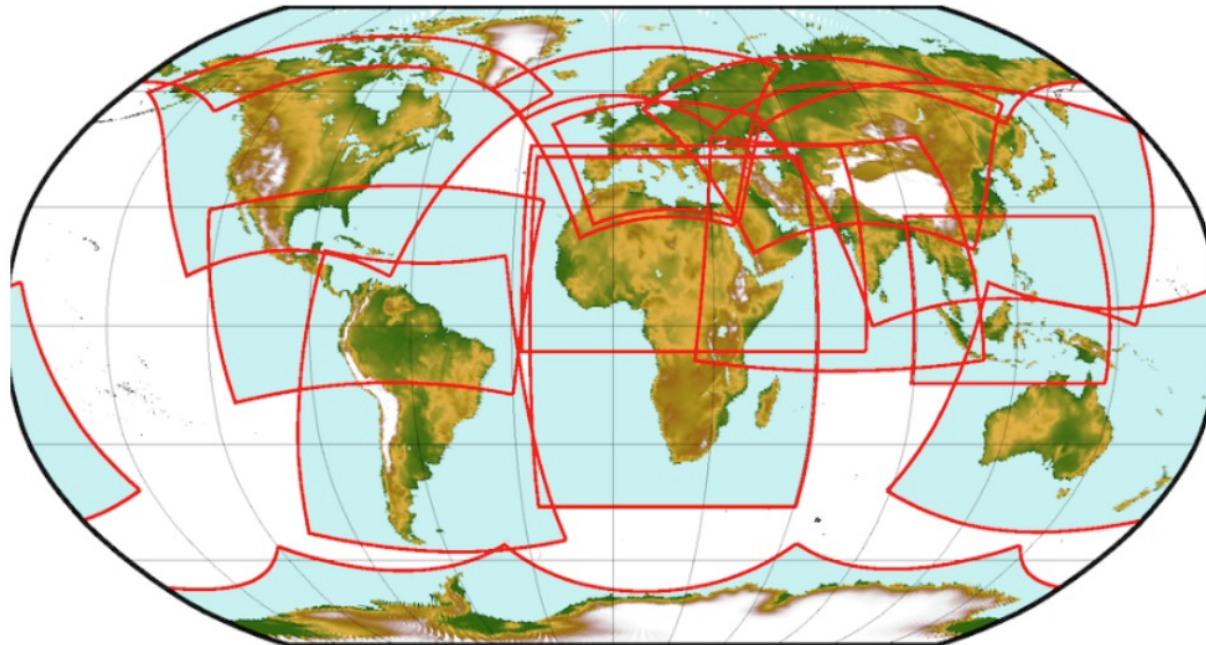
Ensemble mean (5 ISIMIP3b models) of tas ssp585 2070-2100

Temperature [K]

Challenges
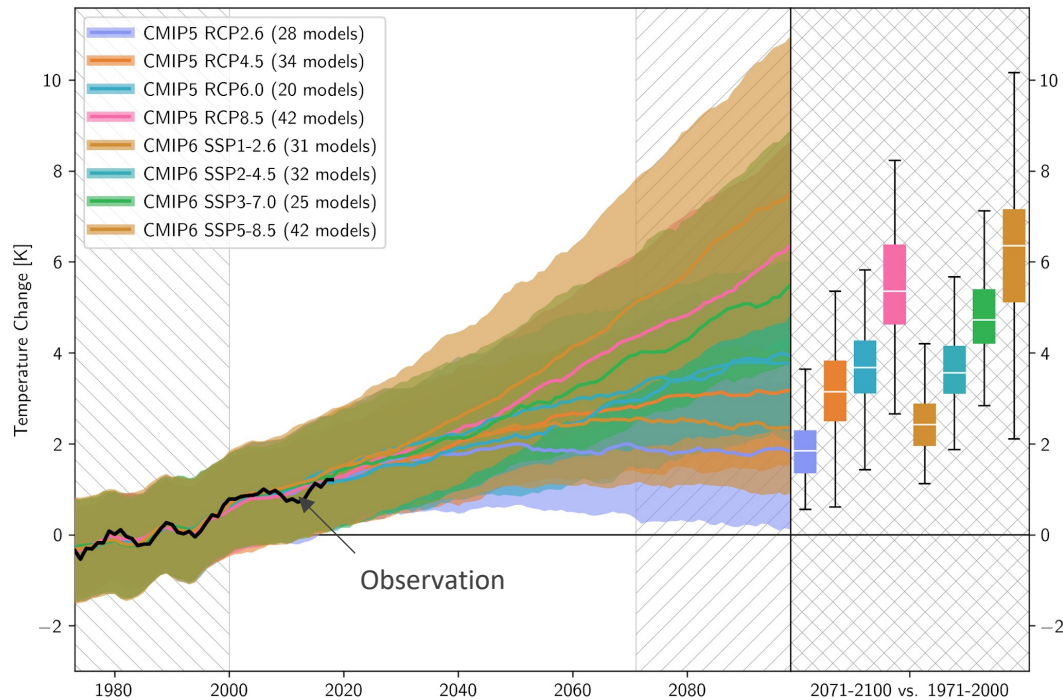
CORDEX CMIP6 downscaling plans

- Central Asia   8   simulations done by PIK
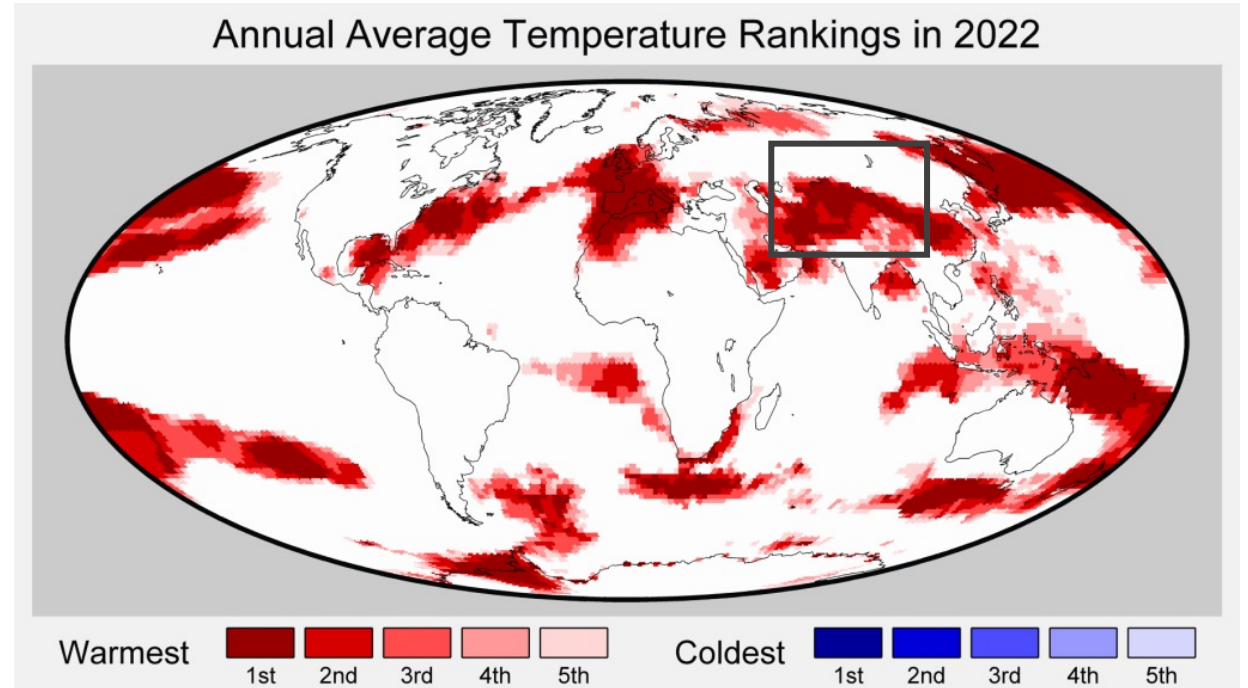- Europe   193   simulations

Region 1: South America
Region 2: Central America
Region 3: North America
Region 4: Africa
Region 5: Europe (EURO)
Region 6: South Asia
Region 7: East Asia
Region 8: Central Asia
Region 9: Australasia
Region 10: Antarctica
Region 11: Arctic
Region 12: Mediterranean (MED)
Region 13: Middle East North Africa (MENA)
Region 14: South-East Asia (SEA)

Warming trend in CA

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Annual Average Temperature Rankings in 2022
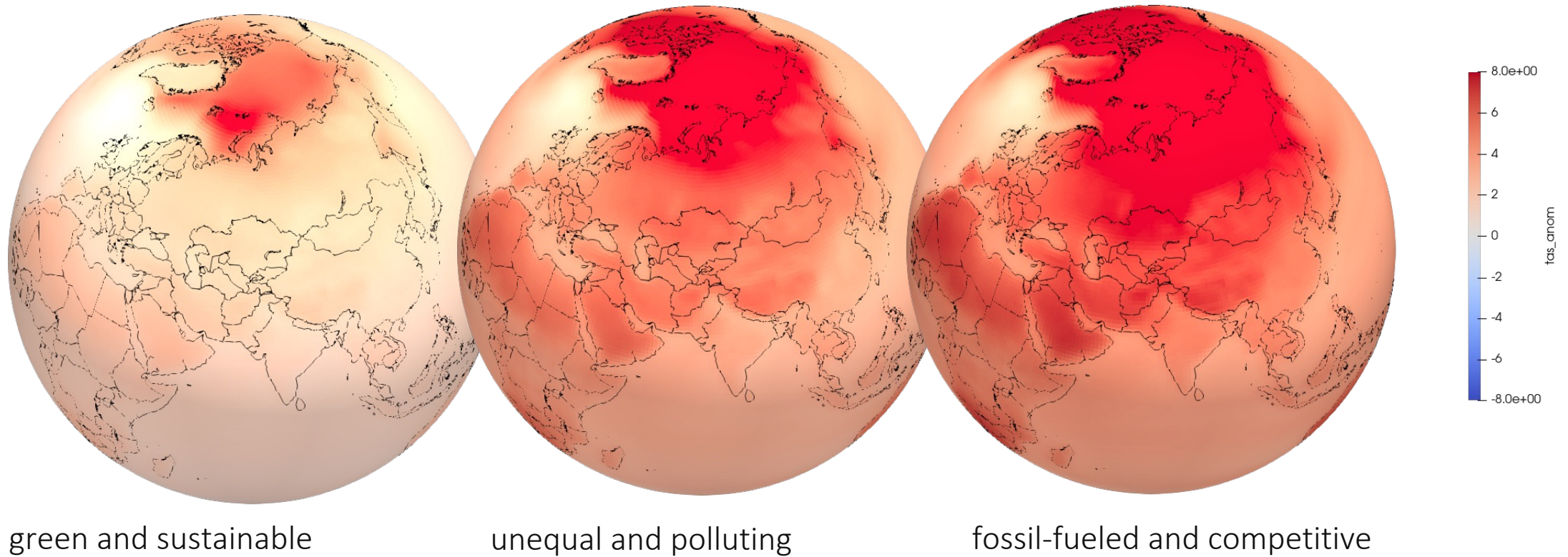
Since 1850
https://berkeleyearth.org/global-temperature-report-for-2022/

Projections - Temperature change

Long Term (2081-2100) SSPs (rel. 1850-1900) - Annual (33 models) climate change.

green and sustainable   unequal and polluting   fossil-fueled and competitive

©Bijan Fallah, PIK

Projections - Total Precipitation change

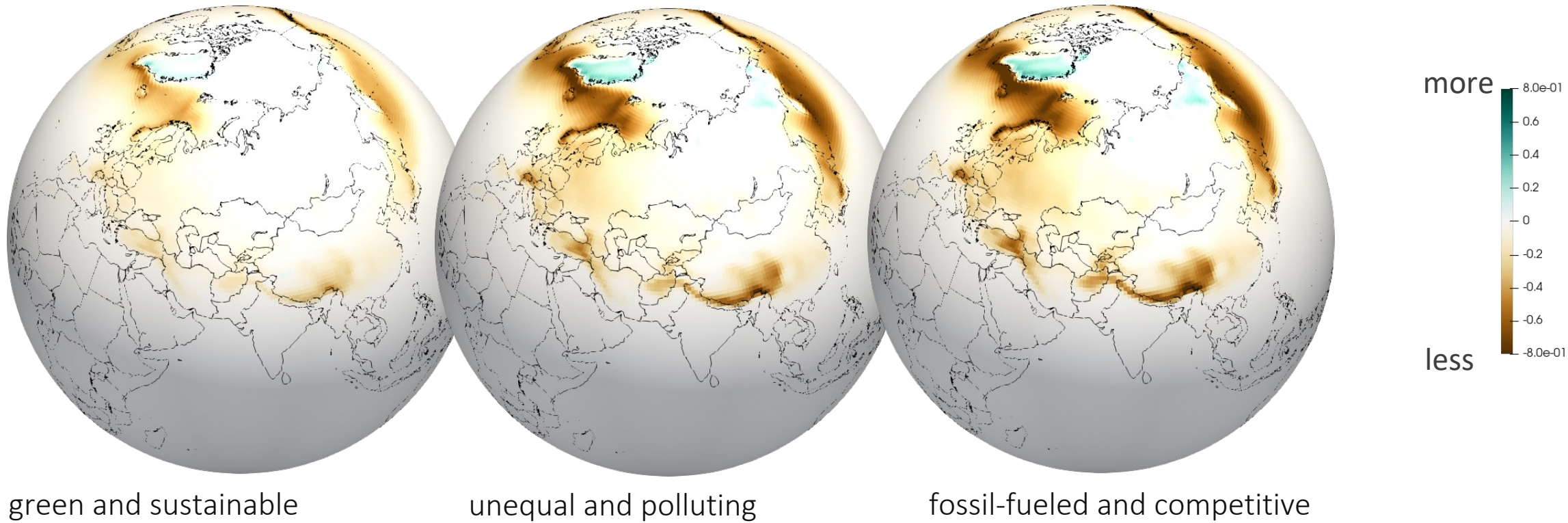Long Term (2081-2100) SSPs (rel. 1850-1900) - Annual (33 models) climate change.
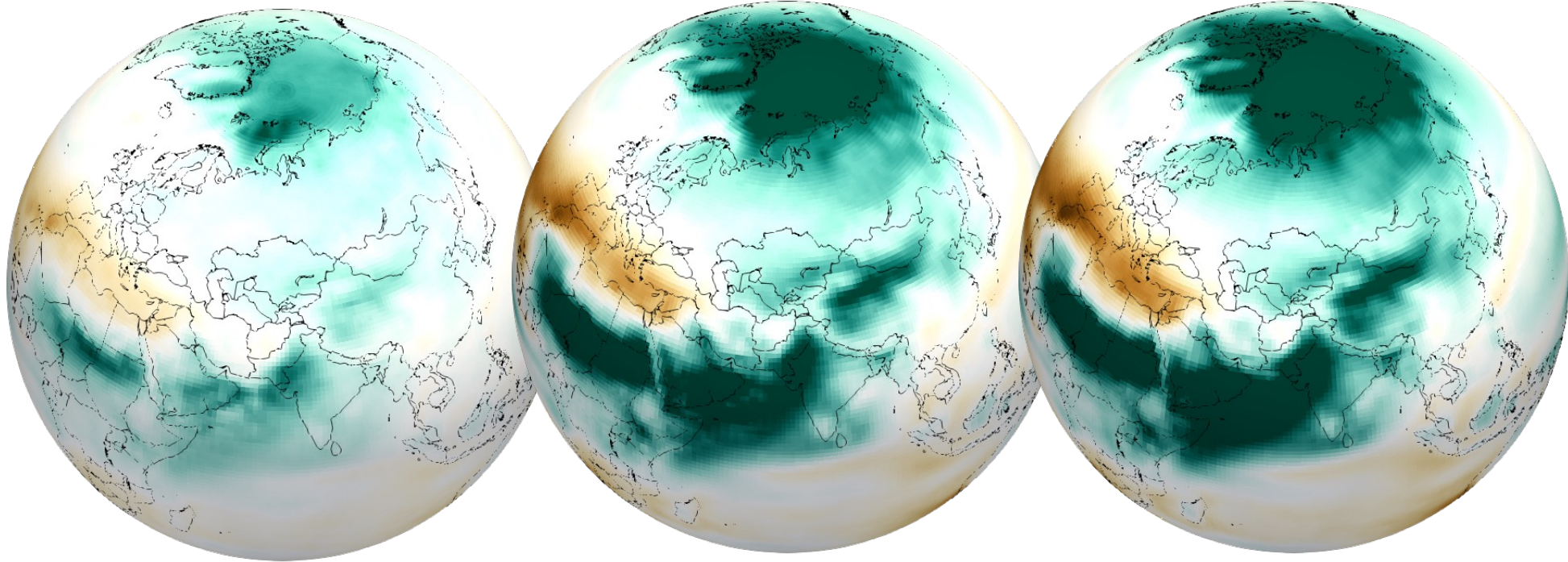
green and sustainable   unequal and polluting   fossil-fueled and competitive

©Bijan Fallah, PIK

Projections – Snow Fall change

Long Term (2081-2100) SSPs (rel. 1850-1900) - Annual (33 models) climate change.
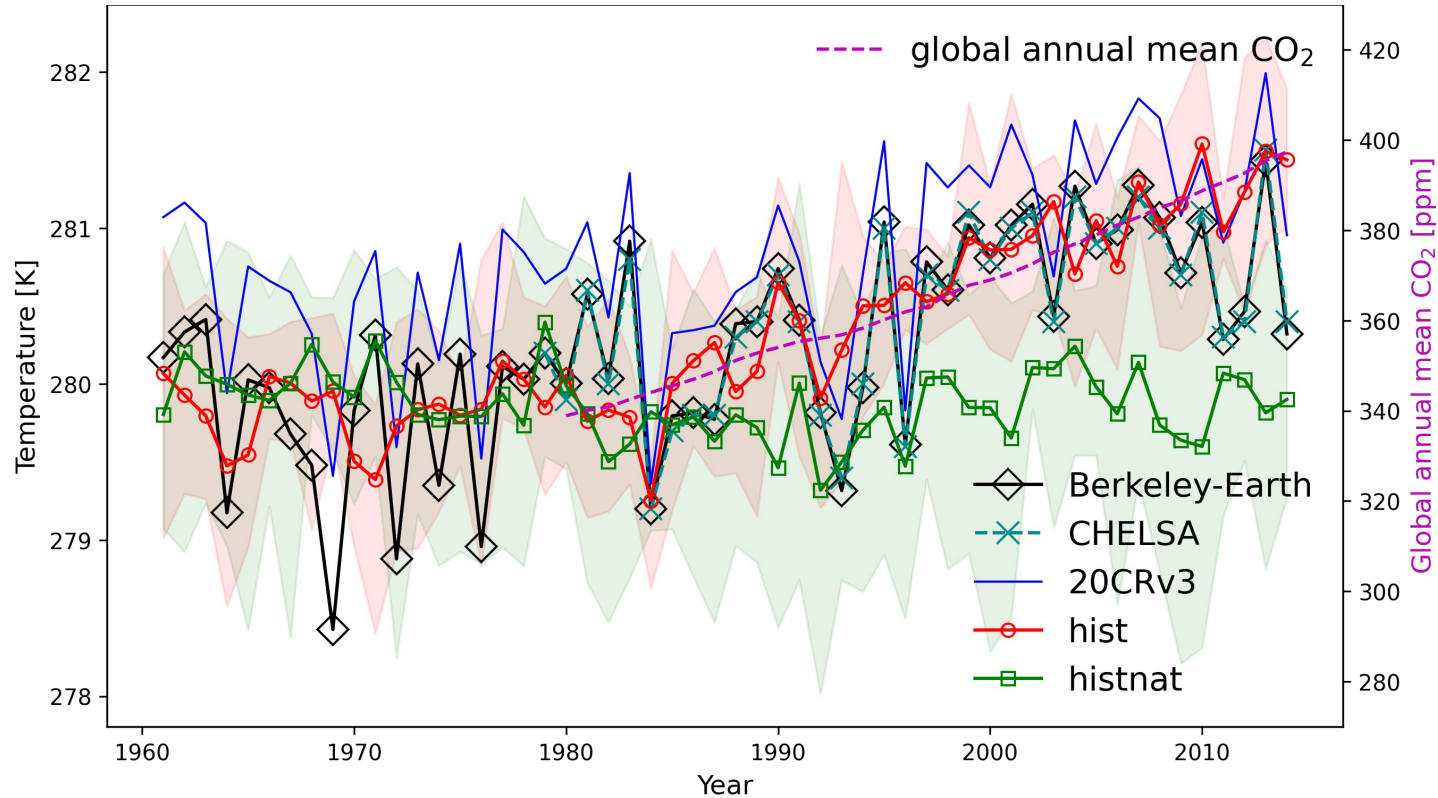

green and sustainable   unequal and polluting   fossil-fueled and competitive

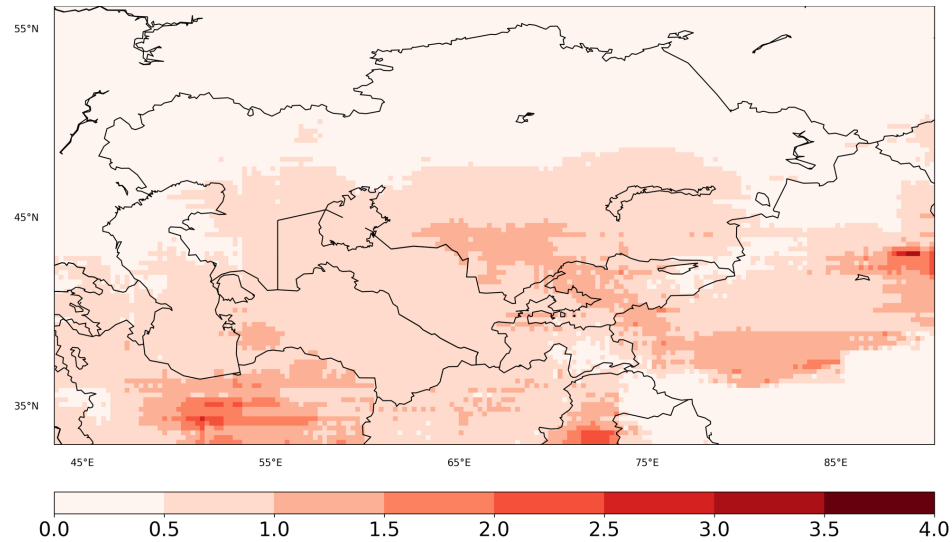©Bijan Fallah, PIK

Human-induced changes?

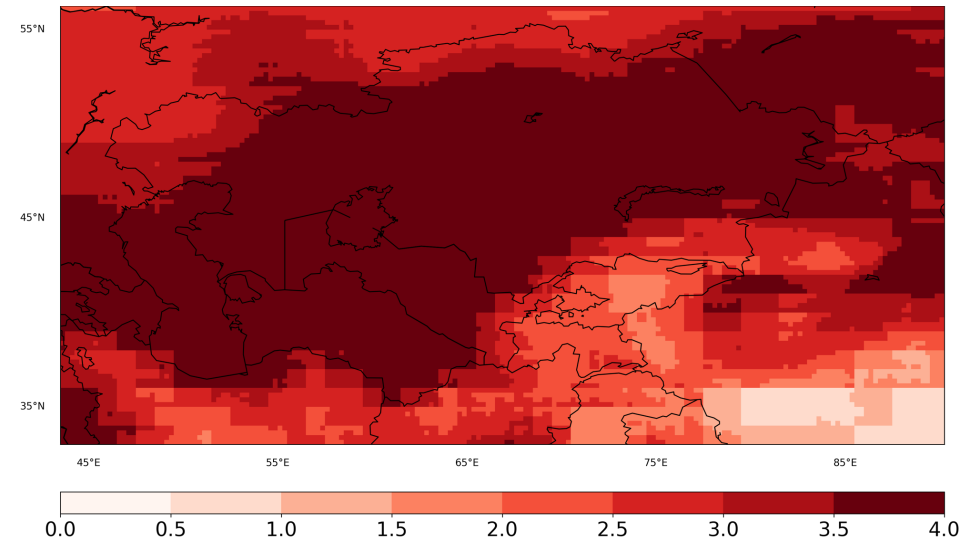hist = natural + anthropogenic forcing
histnat = natural forcing

Human-induced changes?

Signal-to-noise ratio $\sim \mu/\sigma$

Without Human Activity

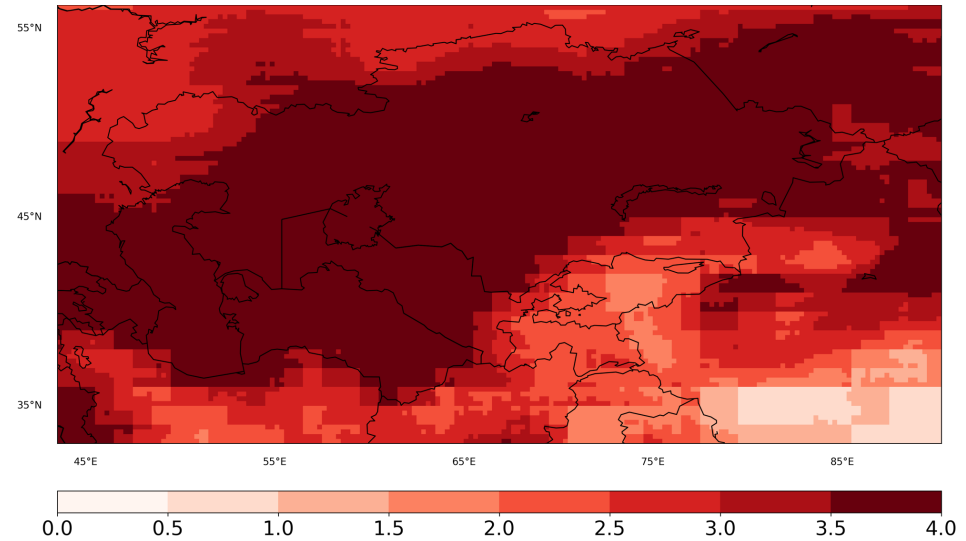With Human Activity

Human-induced changes?

Annual Average Temperature Rankings in 2022

Warmest — 1st 2nd 3rd 4th 5th   Coldest — 1st 2nd 3rd 4th 5th

Since 1850
https://berkeleyearth.org/global-temperature-report-for-2022/

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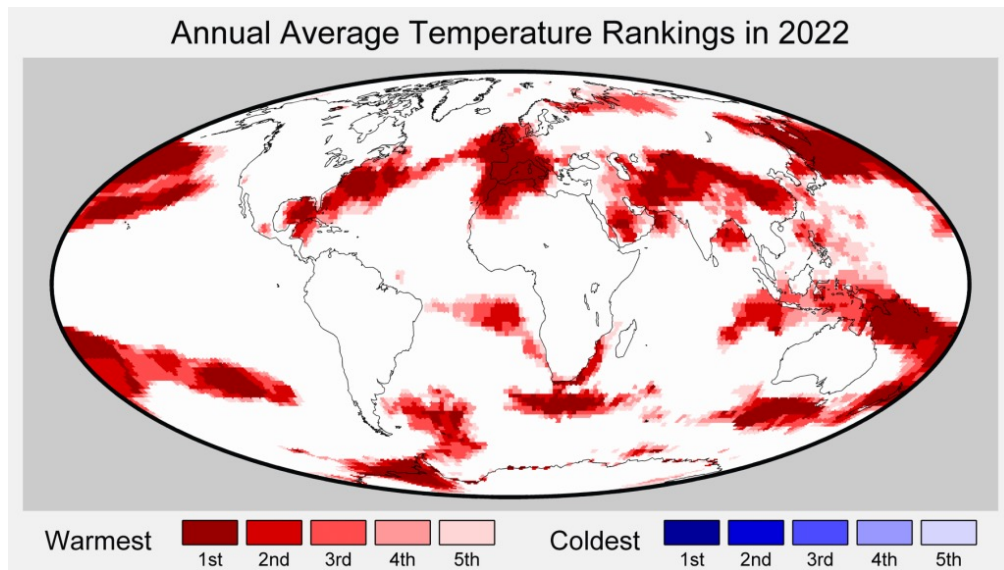
Climate Modelling at PIK

- Increase cooperation with local scientists

- Statistical downscaling and bias adjustment

- Dynamical downscaling using RCMs

- next phase: focus on joint-publications with the local scientists

- Capacity building & Frequent workshops in CA and at PIK

- Flood forecasting

- …

Thank you

QA

- How can the Potsdam Institute's research help Central Asian countries adapt to climate change, especially dealing with glacier shrinkage and water variability?

- Can you share some insights from your research that could be useful for Central Asia's climate policies?