

Climate data processing for climate resilience

Tajikistan and Kyrgyzstan

Data access, processing and methodological concepts

Webinar
17. - 27. 11.2020

DAY 08
Climate Change Indices



Objectives of Day 08

Date: 19.11

Presentation: Day08_Climate-Indices

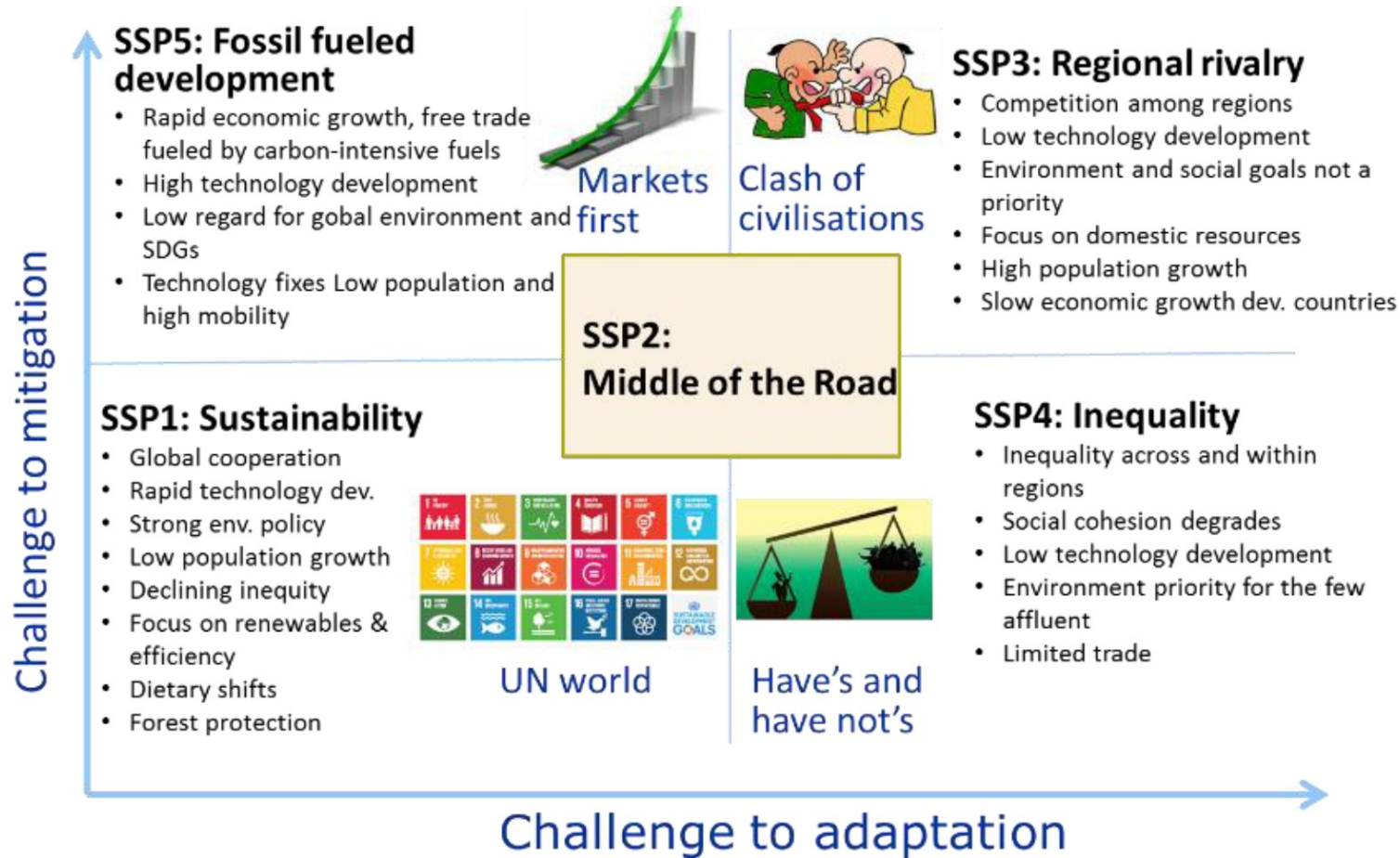
<https://github.com/nishhempelman/climdatatutorial/>

Objectives:

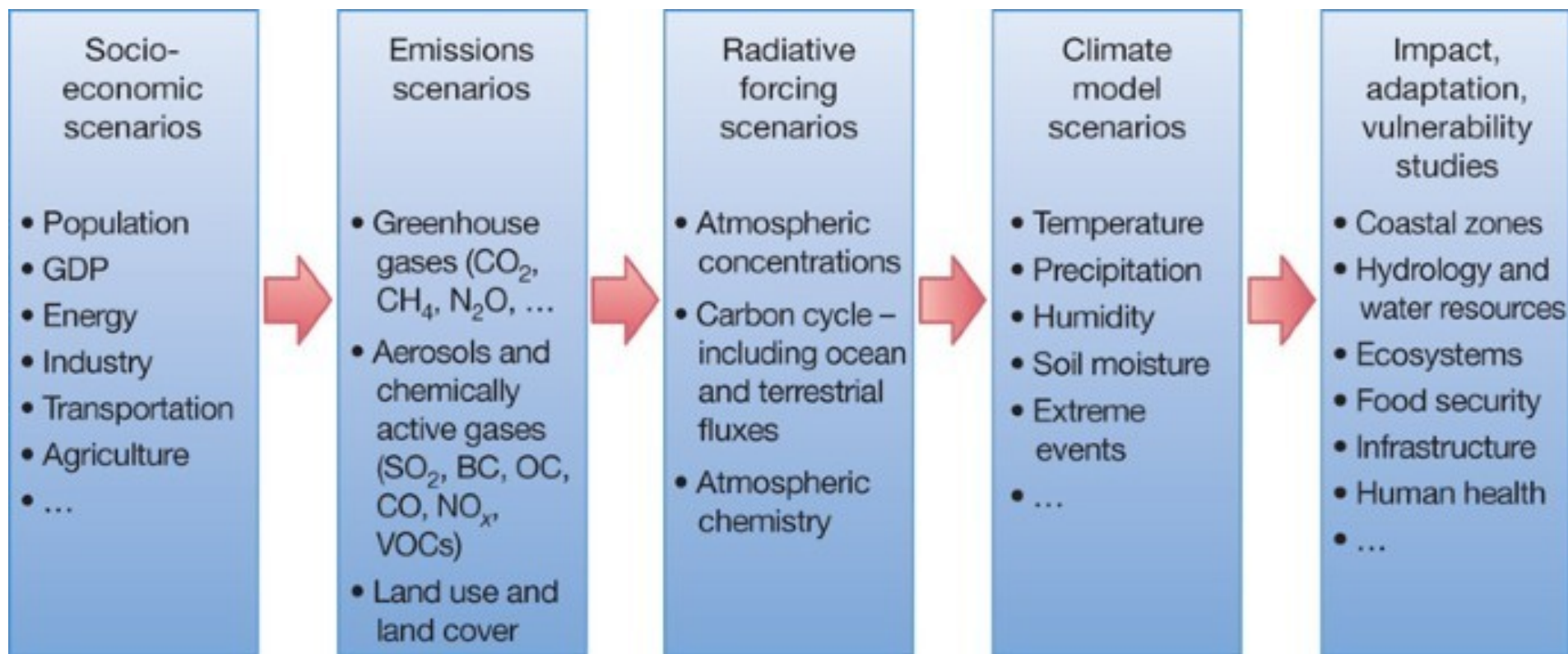
- Wrap up of last days
- Understanding of scenarios of change concepts
- Concept of Downscaling
- Climate indices
- Climate signals and their uncertainty



Shared sozio-economic Pathways (SSP)



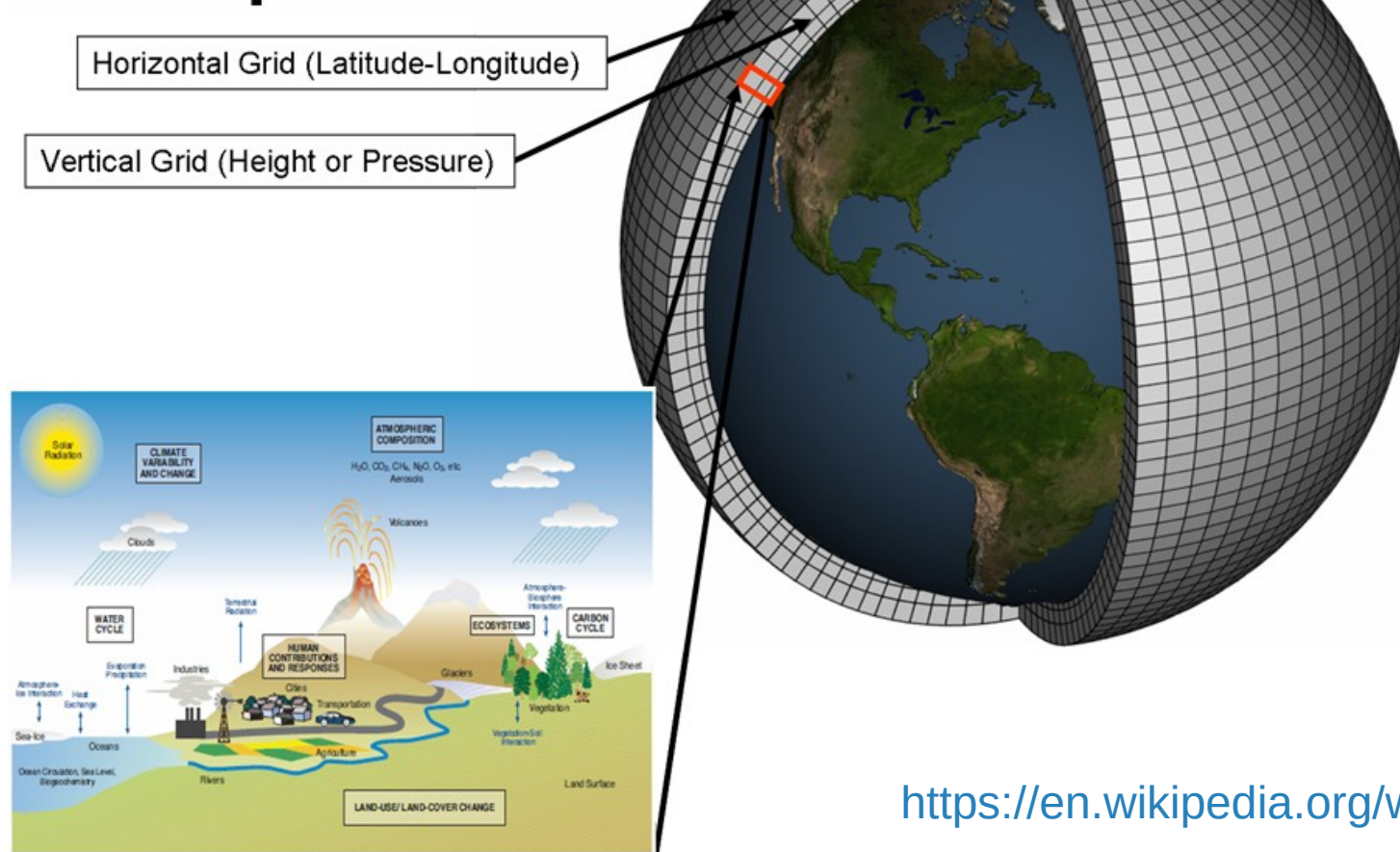
Reliable data production



Source: The next generation of scenarios for climate change research and assessment 2010
<https://www.nature.com/articles/nature08823>



Climate Model



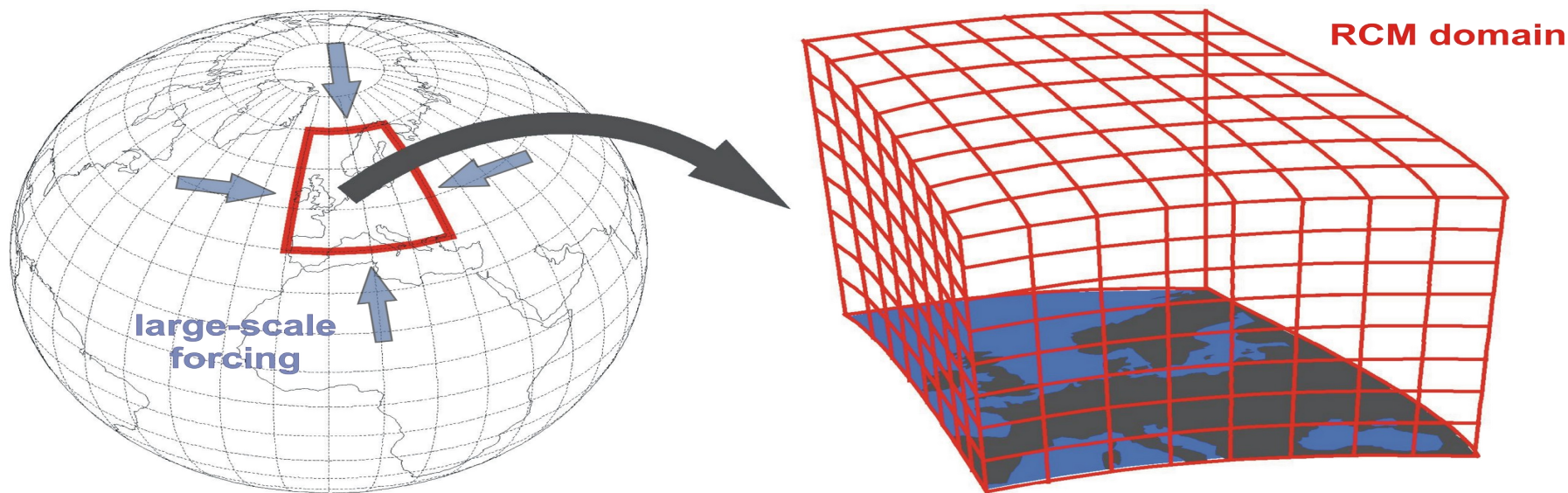
https://en.wikipedia.org/wiki/Climate_model



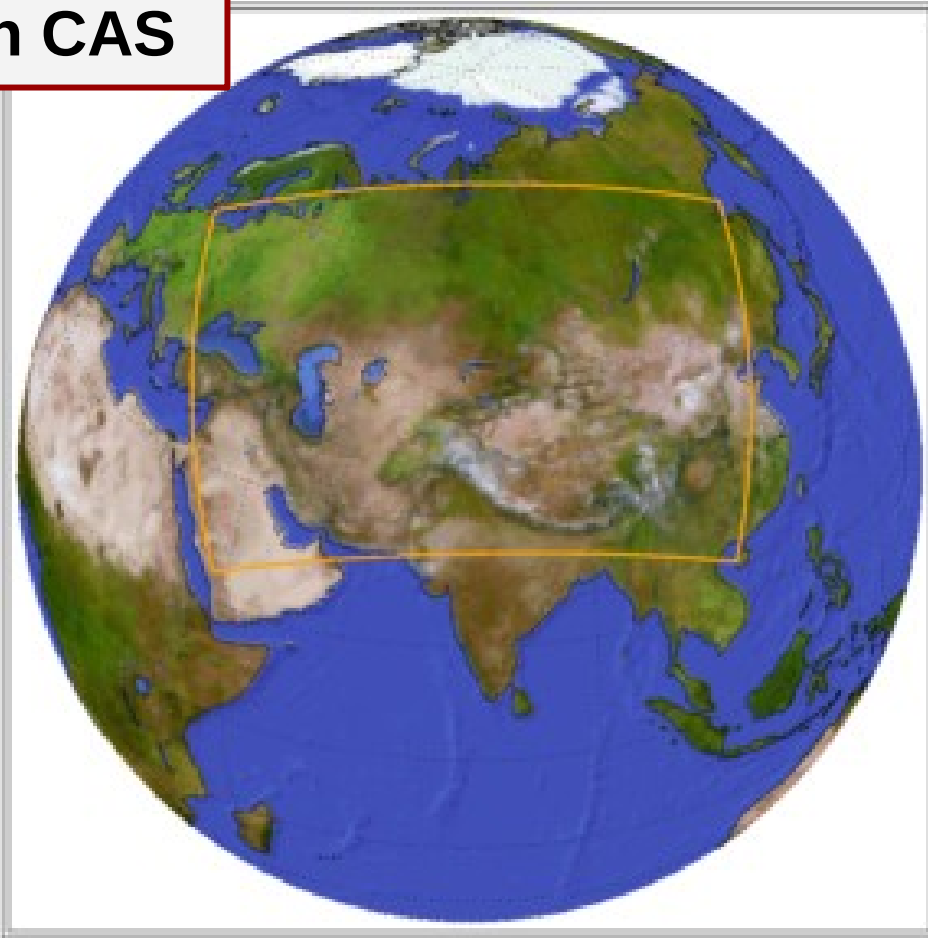
Downscaling

Regional Climate modelling

Global Model data as forcing data
Limited model domain
Spatial resolution (up to $\sim 10 \times 10$ km)

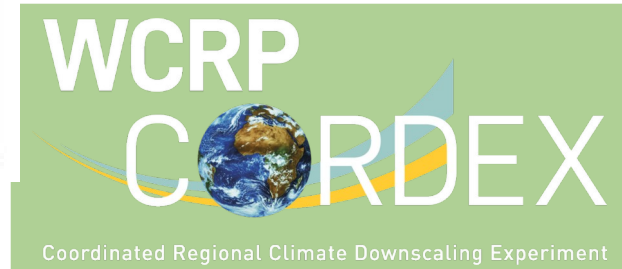
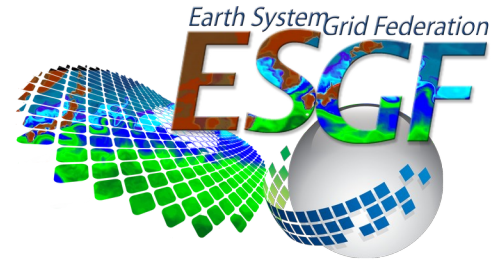


CORDEX Domain CAS



Further Infos:

<https://cordex.org/domains/region-8-central-asia/>



Example of GCM-RCM combination

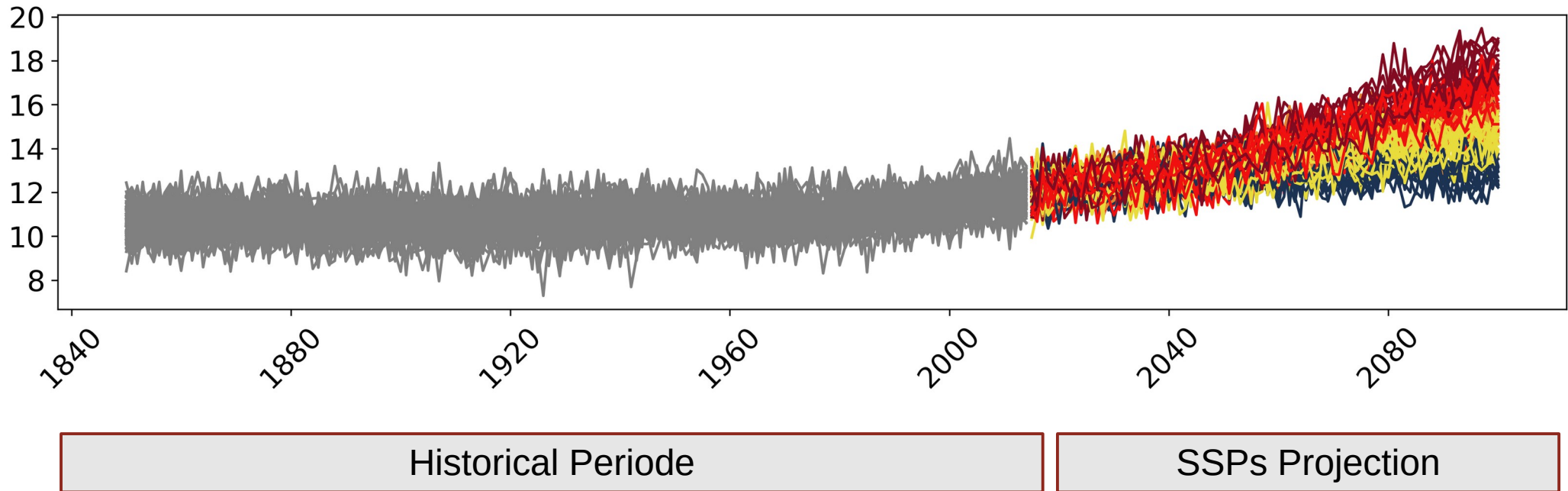
| Reanalysis/ GCMs | RCA4.V3 | REgCM4 | REMO 2009 | WRF3.4 | PRECIS | ETA | HadRM3P.V1 | RegCM4 | RCP |
|---------------------|-----------------|---------------------------|--------------------|---|-------------------|---|-----------------------|-------------------|--------------|
| ERA-Int | 0.44° | 0.44° | 0.44° | 0.44° | 0.22° | | 0.44° | 0.44° | |
| ICHEC-EC- Earth | 0.44° | | | | | | | 0.44° | 2.6/4.5/8.5 |
| MPI-ESM-LR | 0.44° | 0.44° | 0.44° | | | | | 0.44° | 2.6/4.5/ 8.5 |
| HadGEM-ES | 0.44° | 0.44° | | | 0.22° | 20 km | | | 2.6/4.5/ 8.5 |
| CanESM2 | 0.44° | | | 0.44° | | | | | 4.5/ 8.5 |
| GFDL- ESM2M | 0.44° | 0.44° | | | | | | | 4.5/ 8.5 |
| IPSL-CM5A- MR | 0.44° | | | | | | | | 4.5/ 8.5 |
| MIROC5 | 0.44° | | | | | | | | 2.6/4.5/ 8.5 |
| CSIRO Mk3 6.0 | 0.44° | | | | | | | | 4.5/8.5 |
| NorESM1-M | 0.44° | | | | | | | | 2.6/4.5/ 8.5 |
| Access | ESGF nodes | | ESGF nodes | http://meteo.unican.es/work/3bff54a2 | | https://projeta.cptec.inpe.br/#/dashboard | ESGF nodes | | |
| Institution | SMHI/ Sweden | ICT-/USP/ Italy-Brazil | GERICS/ Germany | Universidad de Cantabria / Spain | CR2/ DGF Chile | CPTEC / Brazil | Hadley Centre / UK | CR2/ DGF Chile | |

Tércio Ambrizzi 2018: The state of the art and fundamental aspects of regional climate modeling in South America: <https://doi.org/10.1111/nyas.13932>



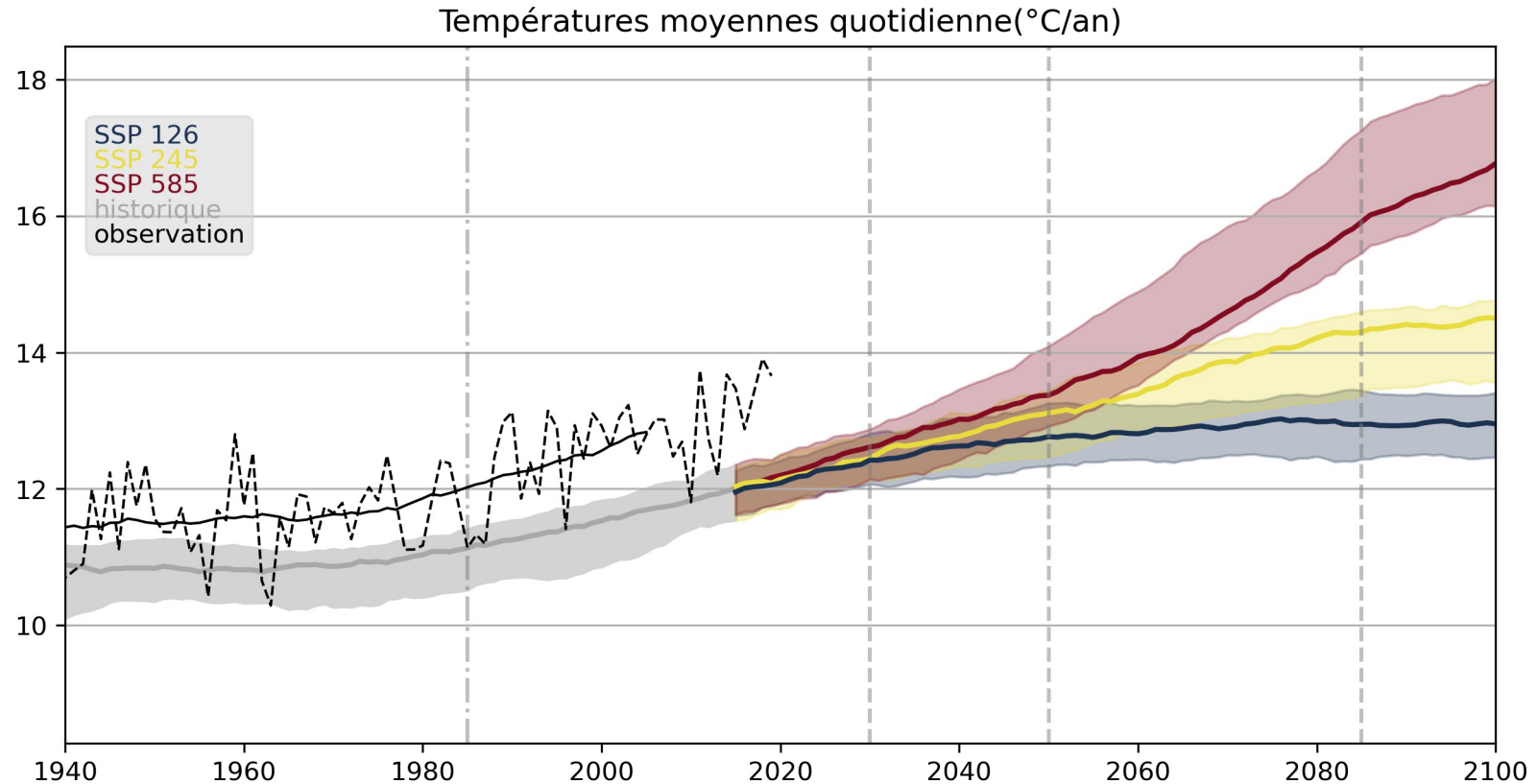
Multi-Model Ensemble

Processing based on variable
tas: Temperature at surface

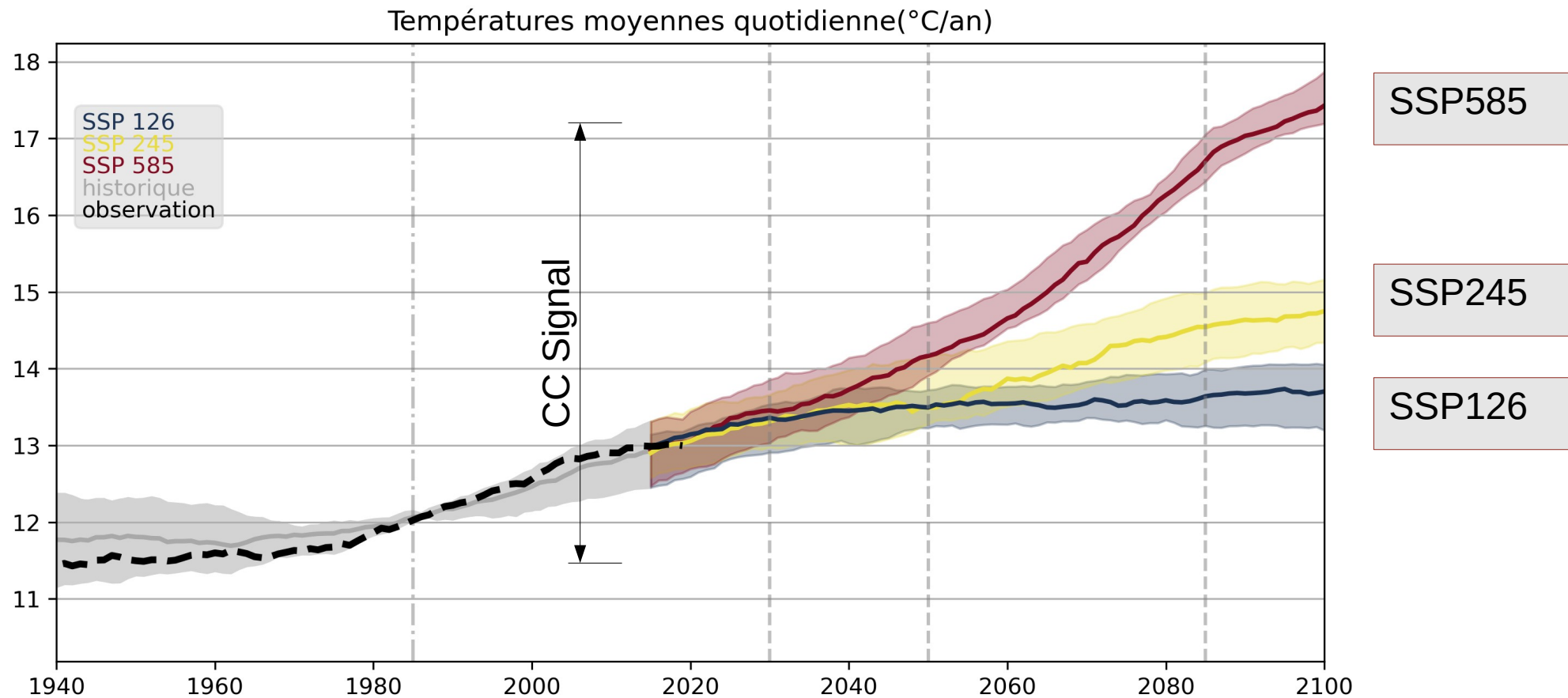


30 Year running mean incl. Uncertainty

Multimodel ensemble
In comparison to meteo Observation



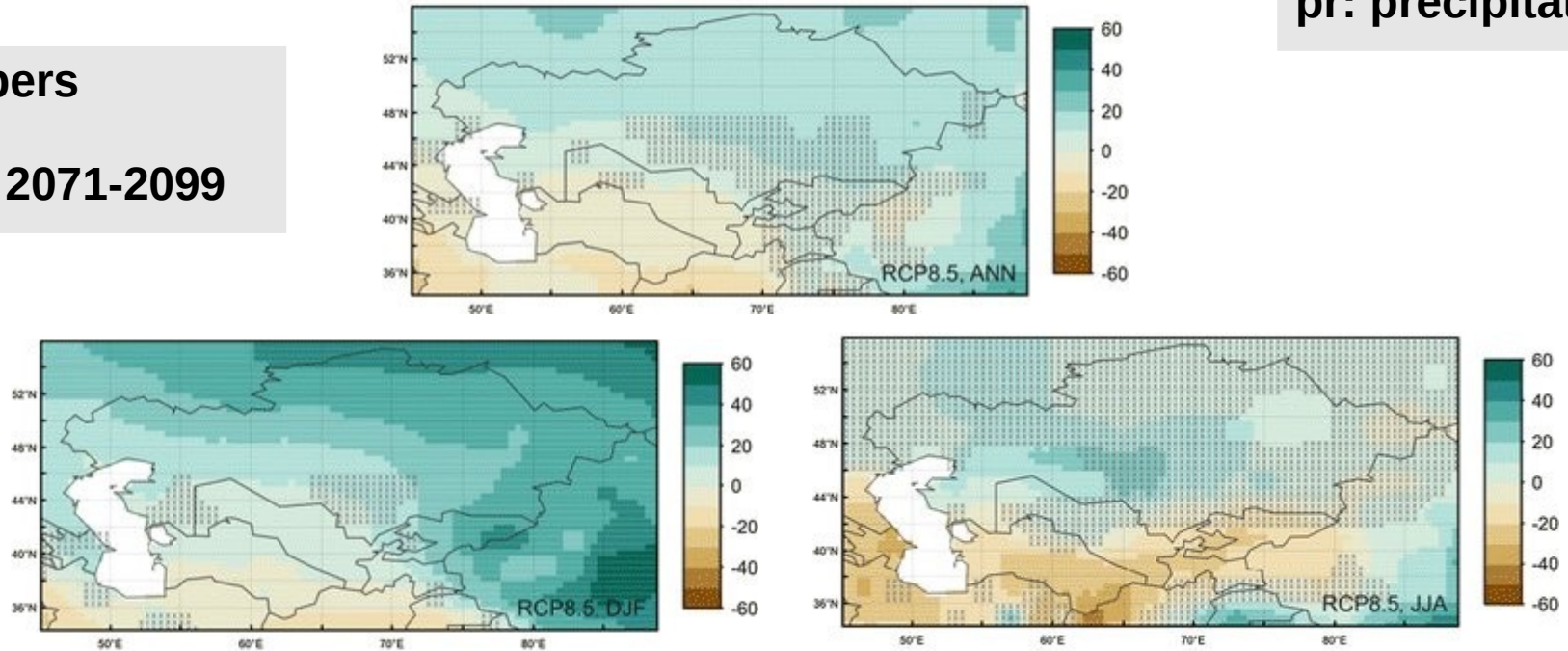
Bias adjusted



Multi-model Ensemble

Processing based
on variable
pr: precipitation

5 Members
RCP8.5
Signal: 2071-2099



Multi-model mean of the percentage change in winter (DJF, top), summer (JJA, middle), and annual (bottom) precipitation for RCP8.5 (4 °C world) for Central Asia by **2071–2099 relative to 1951–1980**. Hatched areas indicate uncertainty regions with two or more out of five models disagreeing on the direction of change. The multi-model analysis is based on GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, NorESM1-M **Source: Reyer 2017 Climate change impacts in Central Asia and their implications for development DOI:10.1007/s10113-015-0893-z**



Climate Indices

https://www.met.hu/en/omsz/tevekenysege/klimamodellezes/eghajlati_szelsosegek/

| Index | Name | Definition | Unit |
|------------------------|--------------------------------------|-------------------------------------|------|
| Crossing fix threshold | | | |
| Temperature | | | |
| FD | Frost days | $T_{\min} < 0\text{ °C}$ | days |
| TN-10LT | Extremely cold days | $T_{\min} < -10\text{ °C}$ | days |
| TX0LT | Winter days | $T_{\max} < 0\text{ °C}$ | days |
| TN20GT | Tropical nights | $T_{\min} > 20\text{ °C}$ | days |
| SU | Summer days | $T_{\max} > 25\text{ °C}$ | days |
| TX30GE | Hot days | $T_{\max} \geq 30\text{ °C}$ | days |
| TX35GE | Extremely hot days | $T_{\max} \geq 35\text{ °C}$ | days |
| DTR | Diurnal temperature range | $T_{\max} - T_{\min}$ | °C |
| Precipitation | | | |
| RR0.1 | Days with precipitation above 0.1 mm | $R_{\text{day}} \geq 0.1\text{ mm}$ | days |
| RR1 | Rainy days | $R_{\text{day}} \geq 1\text{ mm}$ | days |



Hands ON:

Time series future prediction

