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
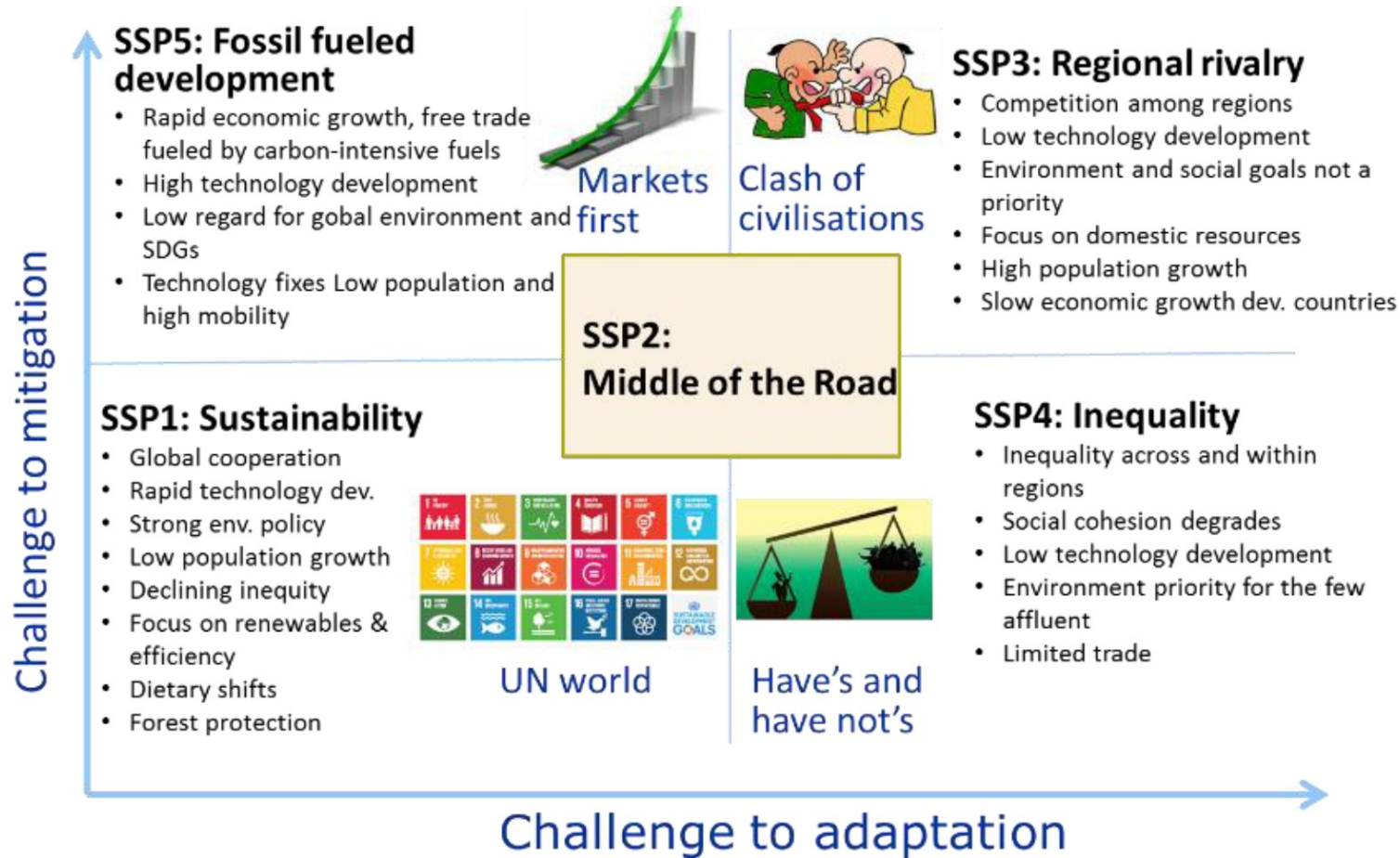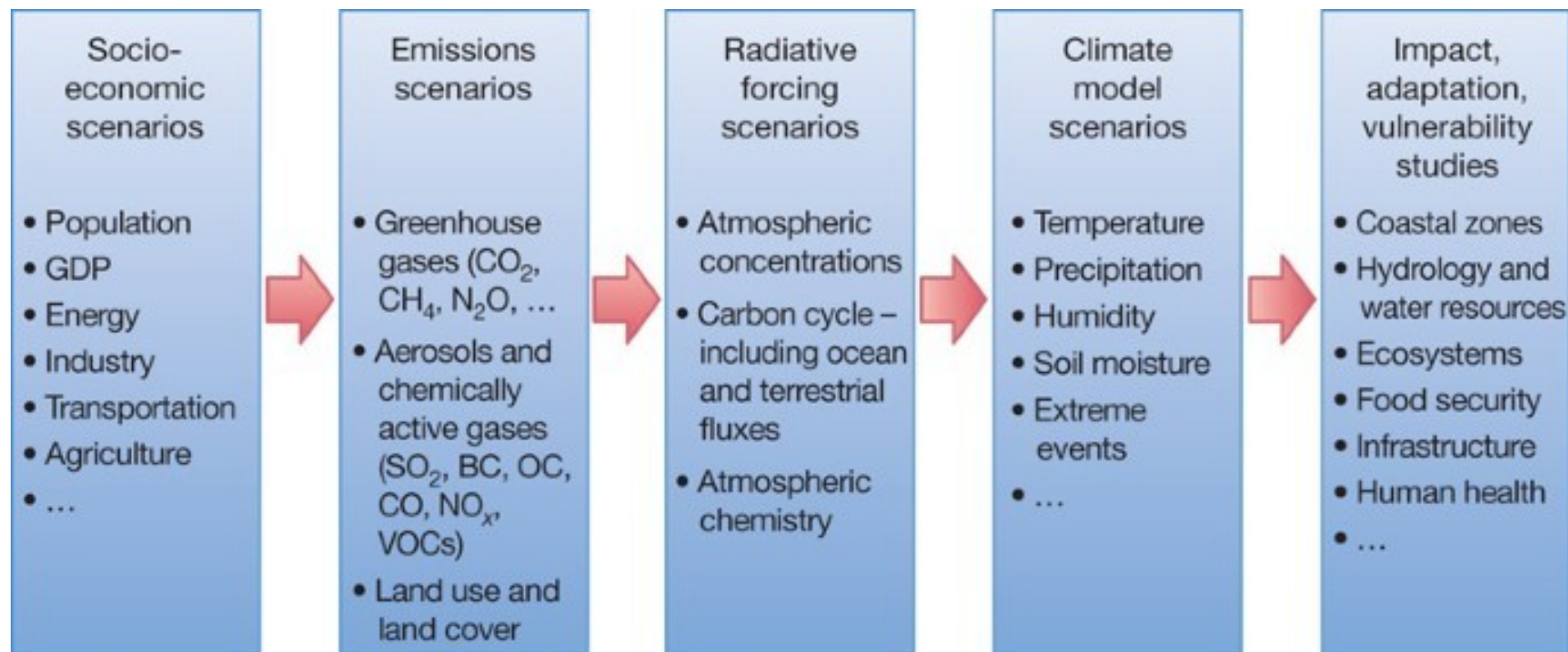https://github.com/nilshempelmann/climdatatutorial/

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

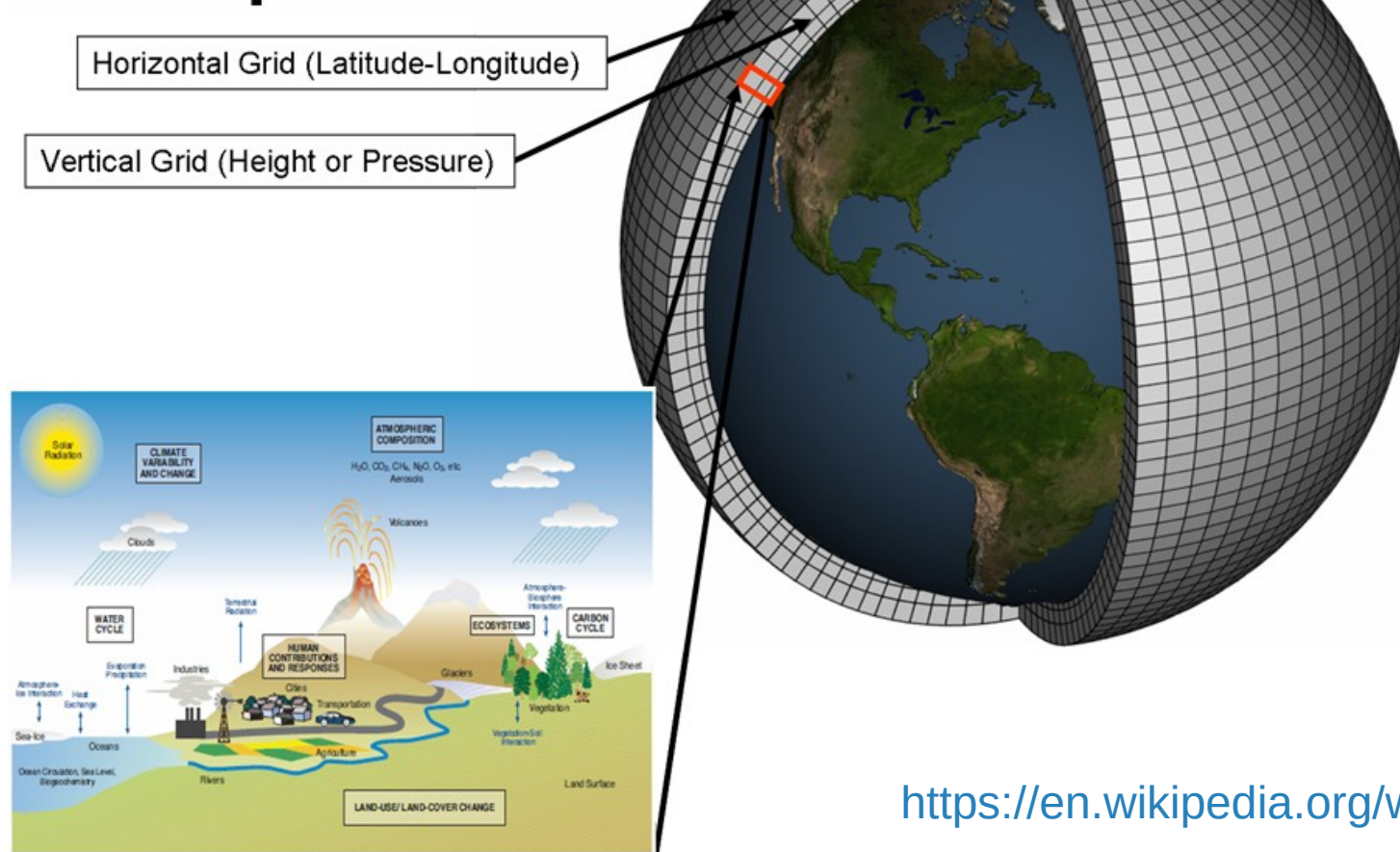# Shared sozio-economic Pathways (SSP)

Reliable data production

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

Climate Model

Horizontal Grid (Latitude-Longitude)
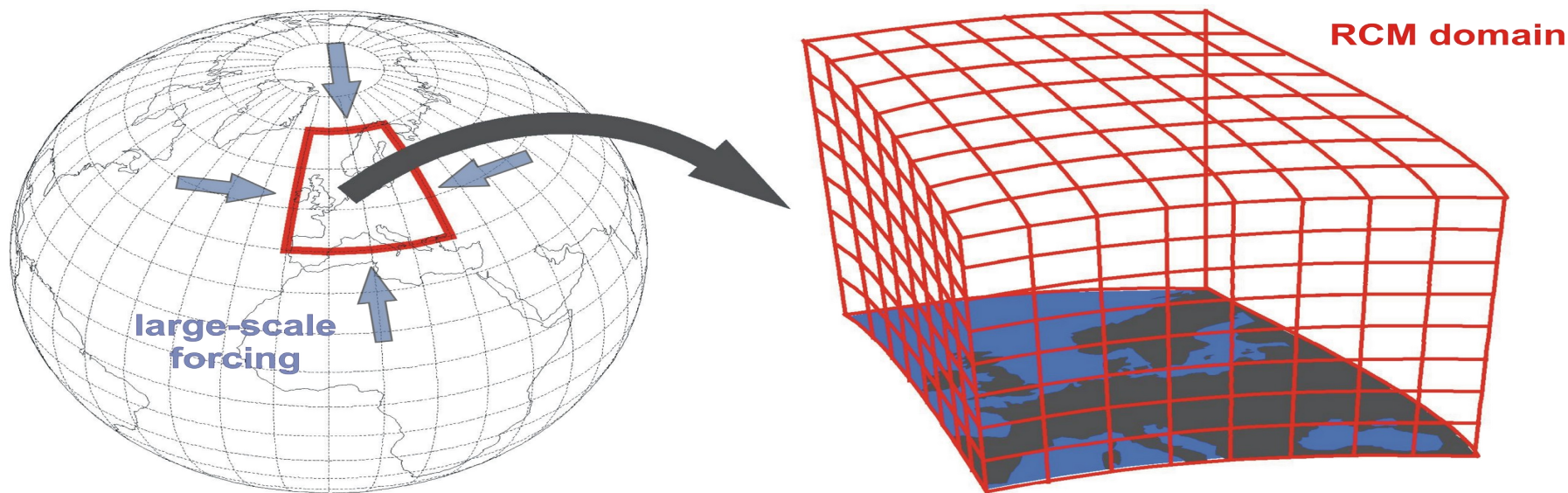
Vertical Grid (Height or Pressure)
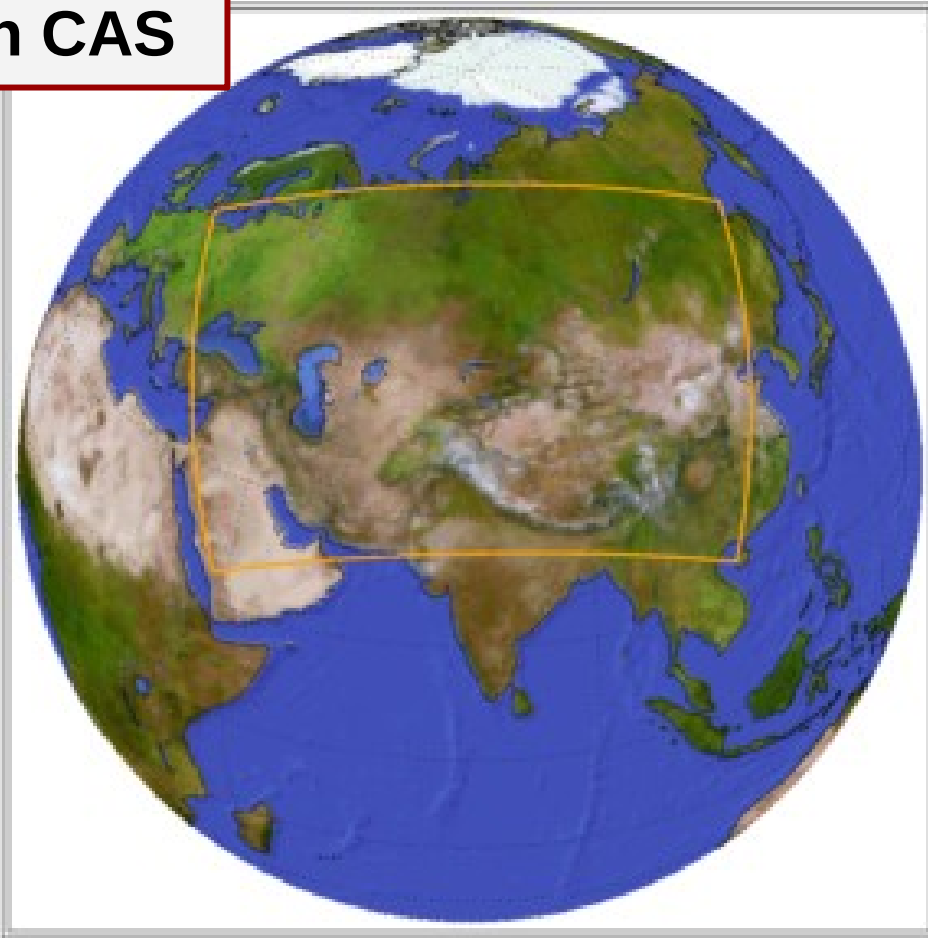
https://en.wikipedia.org/wiki/Climate_model

Downscaling

Regional Climate modelling

Gobal Model data as forcing data
Limited model domain
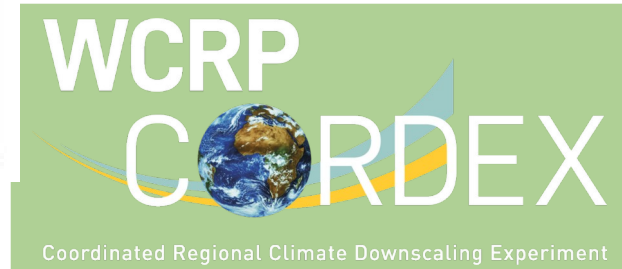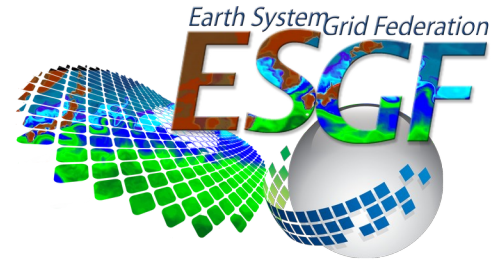Spatial resolution (up to ~10x10 km)

large-scale
forcing

RCM domain

CORDEX Domain CAS

Further Infos:
https://cordex.org/domains/region-8-central-asia/

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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
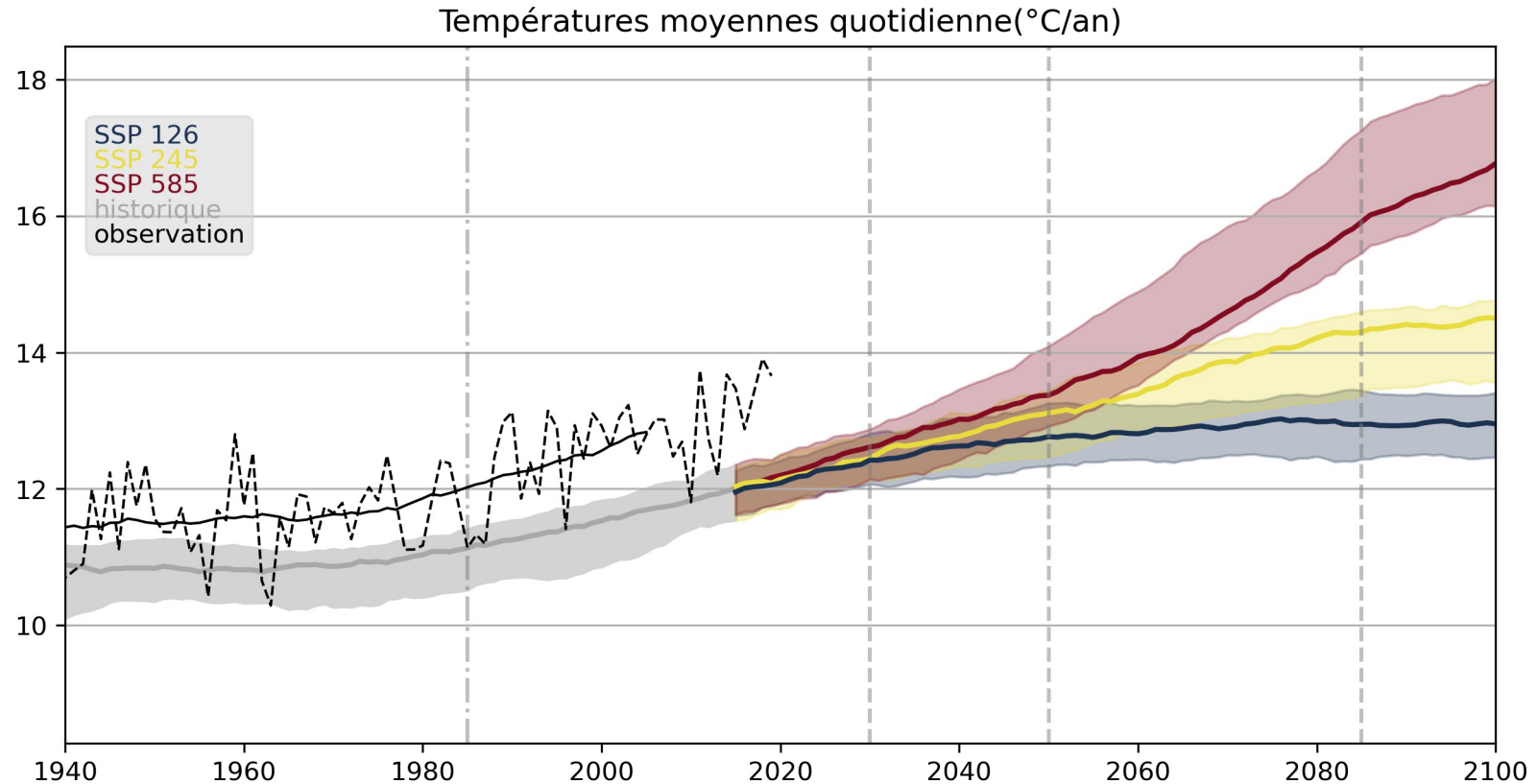
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Multi-Model Ensemble

Processing based on variable
tas: Temperaure at surface

Historical Periode

SSPs Projection
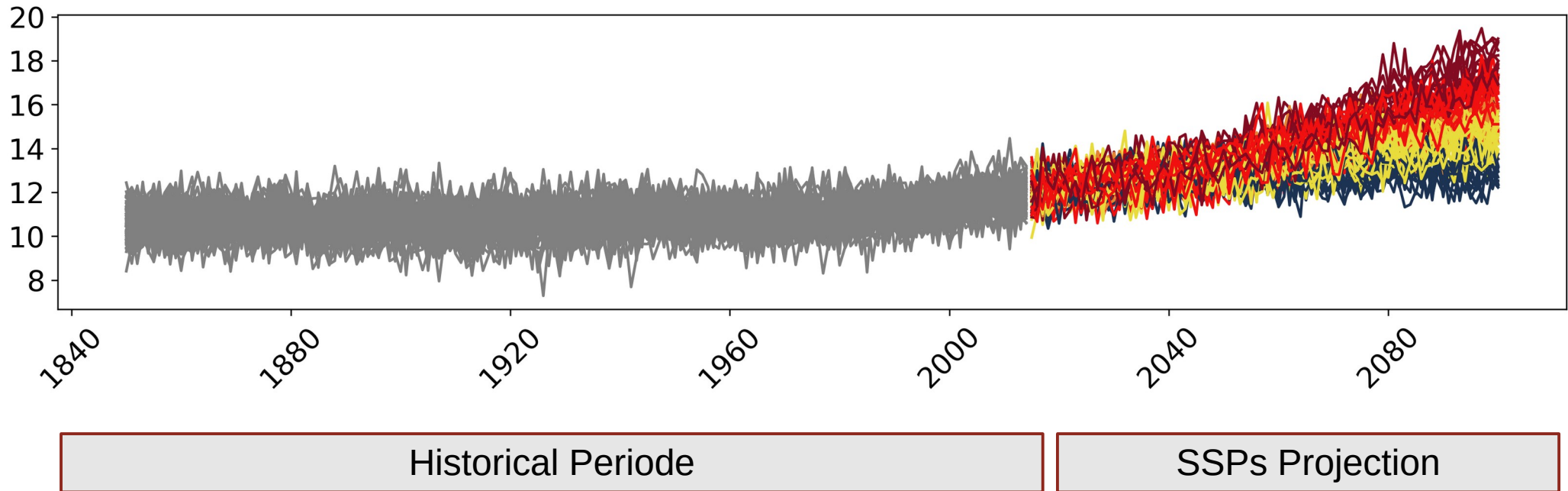
30 Year running mean incl. Uncertainty

Multimodel ensemble
In comparison to meteo Observation

Températures moyennes quotidienne(°C/an)

Legend:
- SSP 126
- SSP 245
- SSP 585
- historique
- observation

Bias adjusted

Températures moyennes quotidienne(°C/an)

Legend:
- SSP 126
- SSP 245
- SSP 585
- historique
- observation

CC Signal

SSP585

SSP245

SSP126

Multi-model Ensemble

**5 Members
RCP8.5
Signal: 2071-2099**
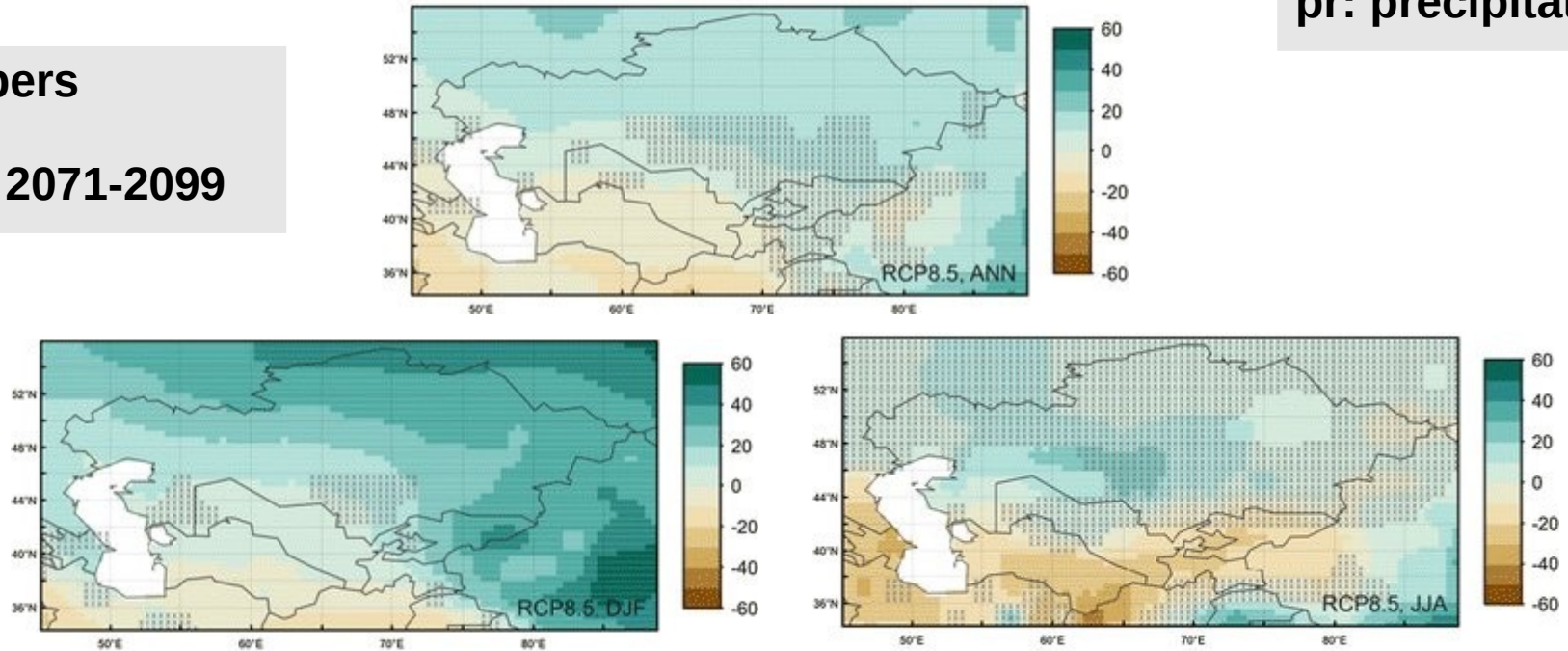
Multi-model mean of the percentage change in winter (DJF, top), summer (JJA, middle), and annual (bottom) precipitation for RCP8.5 (4 °C world) for Central Asia by **2071–2099 relative to 1951–1980**. Hatched areas indicate uncertainty regions with two or more out of five models disagreeing on the direction 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**

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Climate Indices

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

STAY OPEN

STAY F.A.I.R.

Hands ON:

Time series future projection