

# 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**

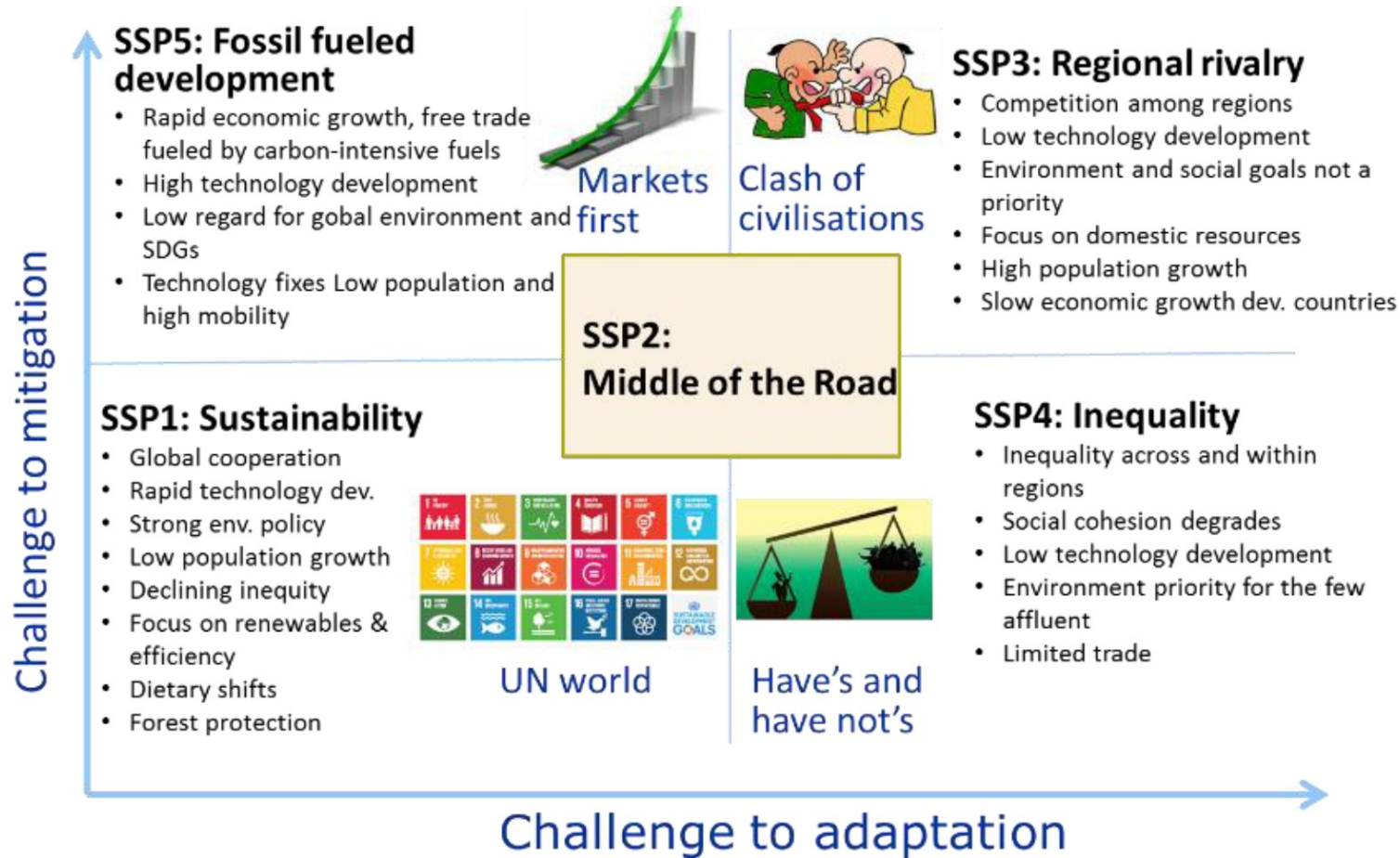
<https://github.com/nilshempelman/limdatatutorial/>

## **Objectives:**

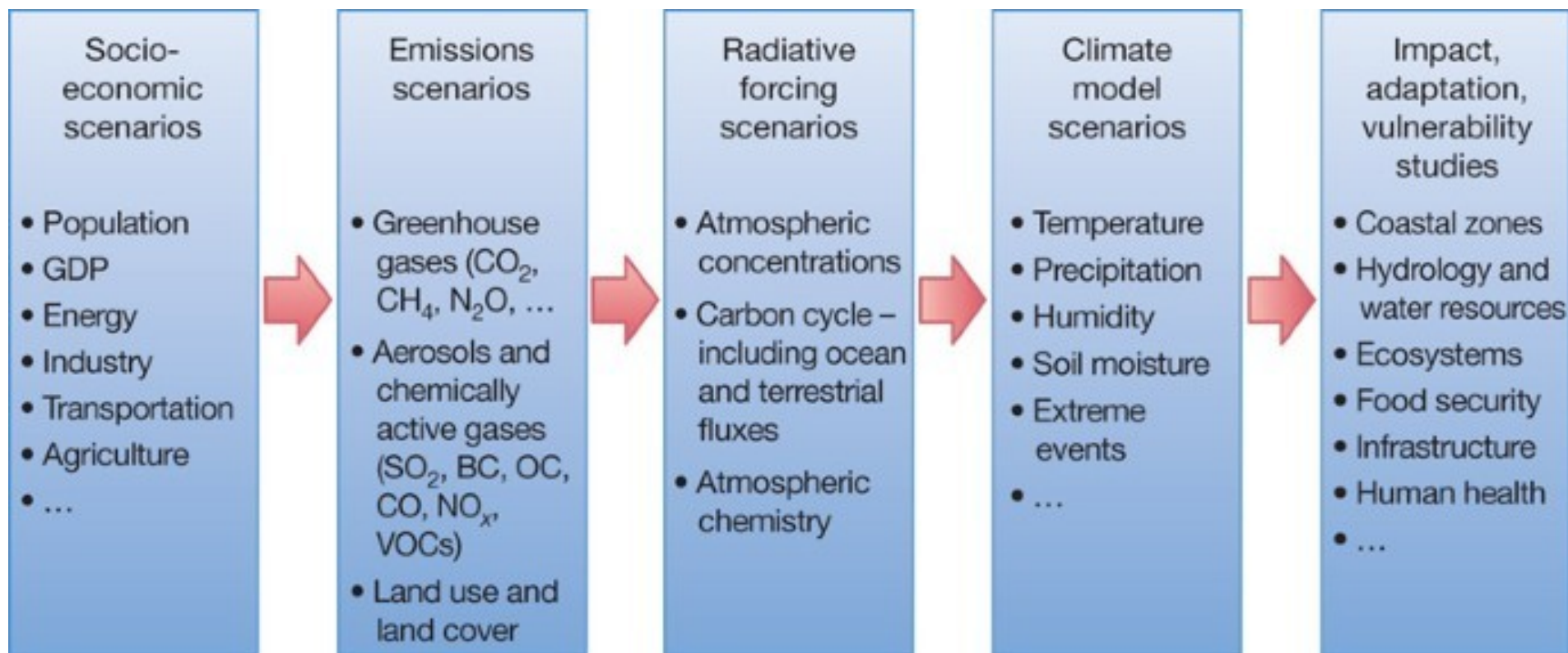
- Wrap up of last days
- Understanding of scenarios of change concepts
- Concept of Downscaling
- Climate indices
- Climate signals and their uncertainty



# Shared sozio-economic Pathways (SSP)



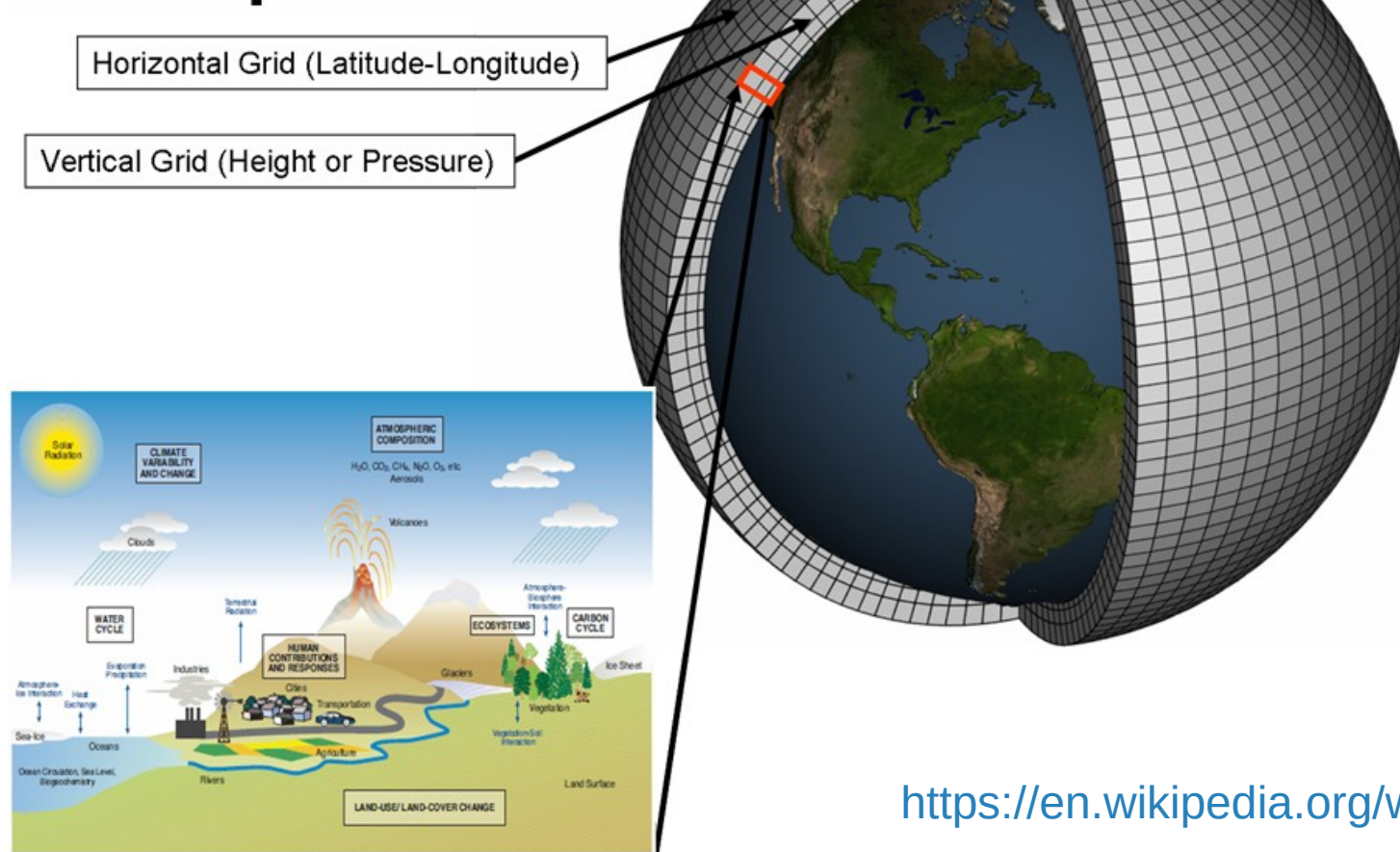
# Reliable data production



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](https://en.wikipedia.org/wiki/Climate_model)

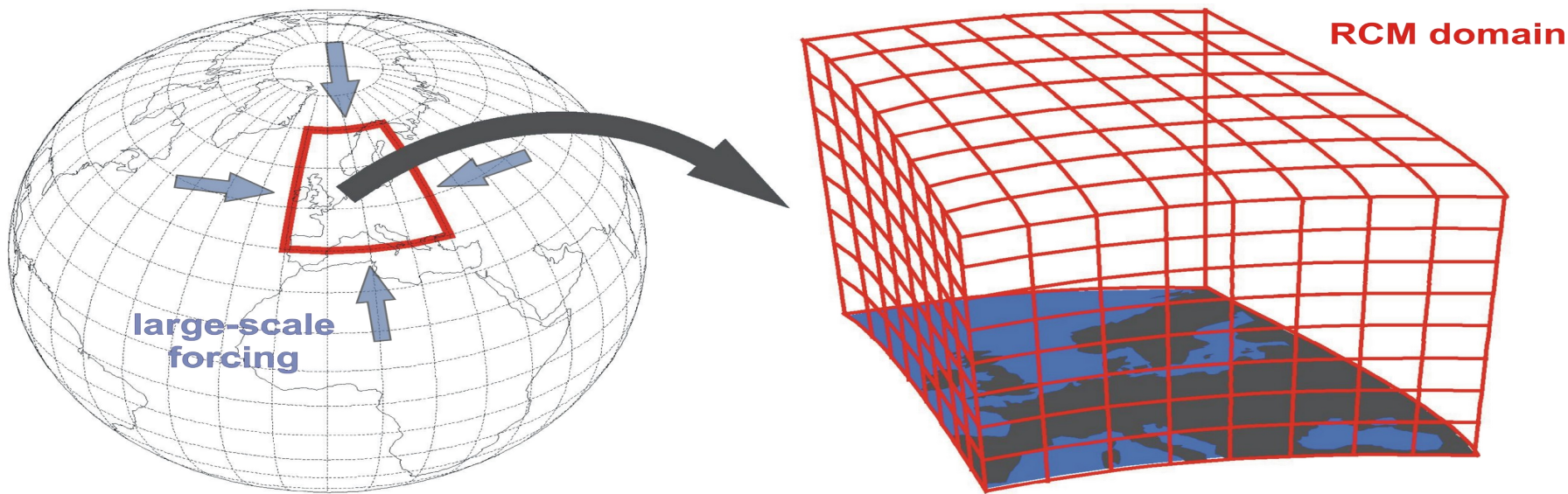




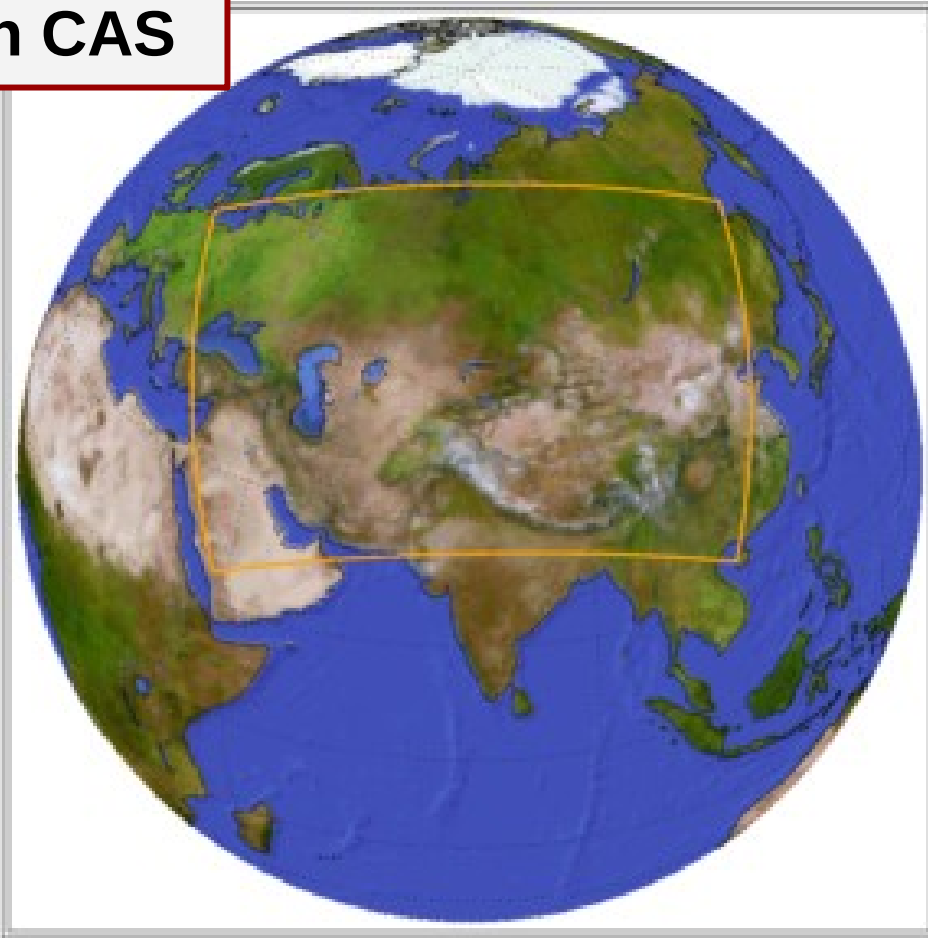
# Downscaling

## Regional Climate modelling

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

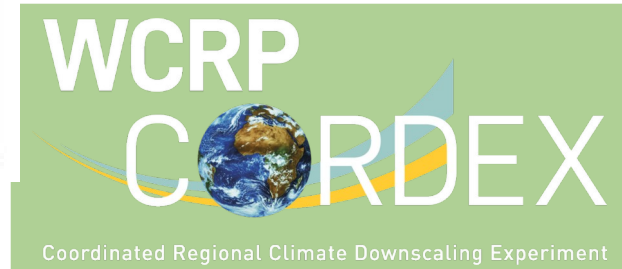
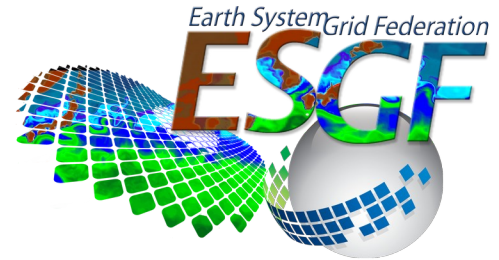


# CORDEX Domain CAS



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	<a href="http://meteo.unican.es/work/3bff54a2">http://meteo.unican.es/work/3bff54a2</a>		<a href="https://projeta.cptec.inpe.br/#/dashboard">https://projeta.cptec.inpe.br/#/dashboard</a>	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	

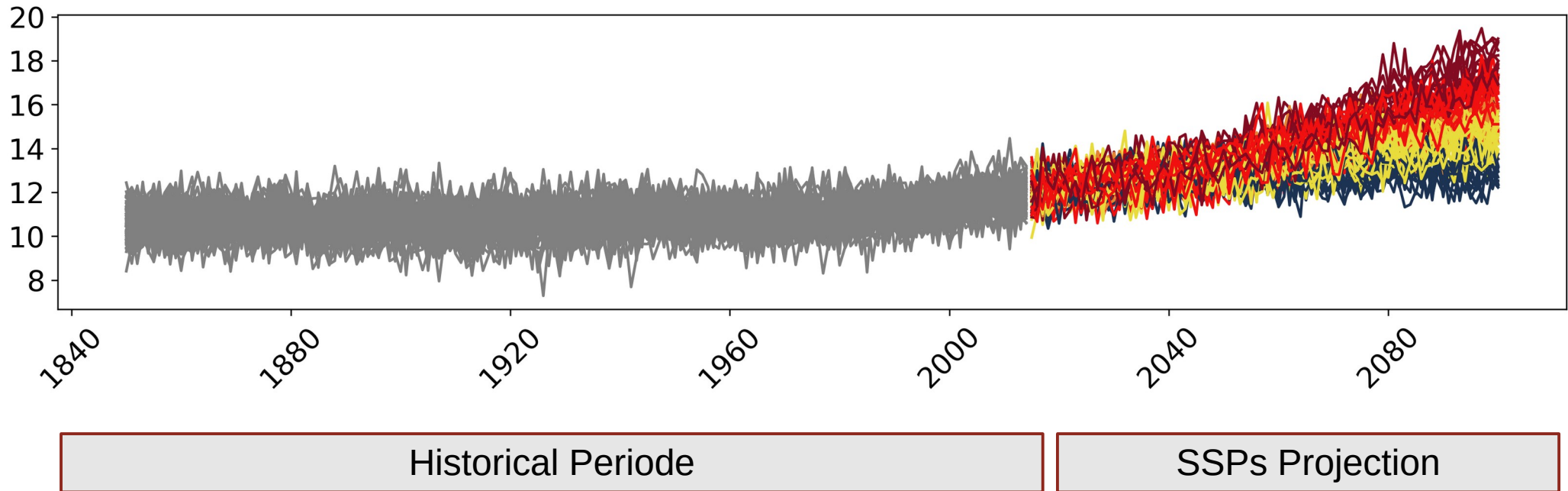
Tércio Ambrizzi 2018: The state of the art and fundamental aspects of regional climate modeling in South America: <https://doi.org/10.1111/nyas.13932>





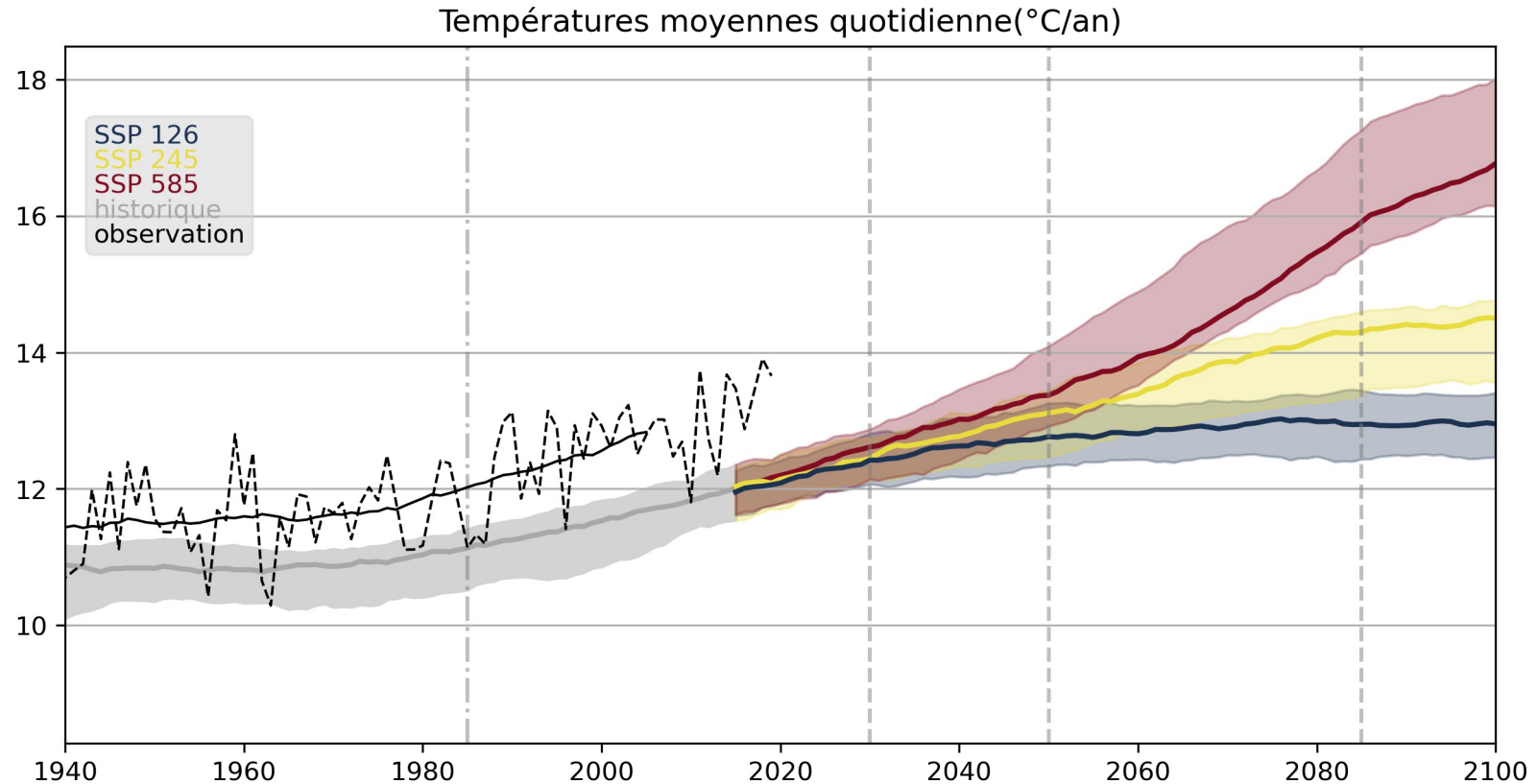
# Multi-Model Ensemble

Processing based on variable  
**tas: Temperature at surface**

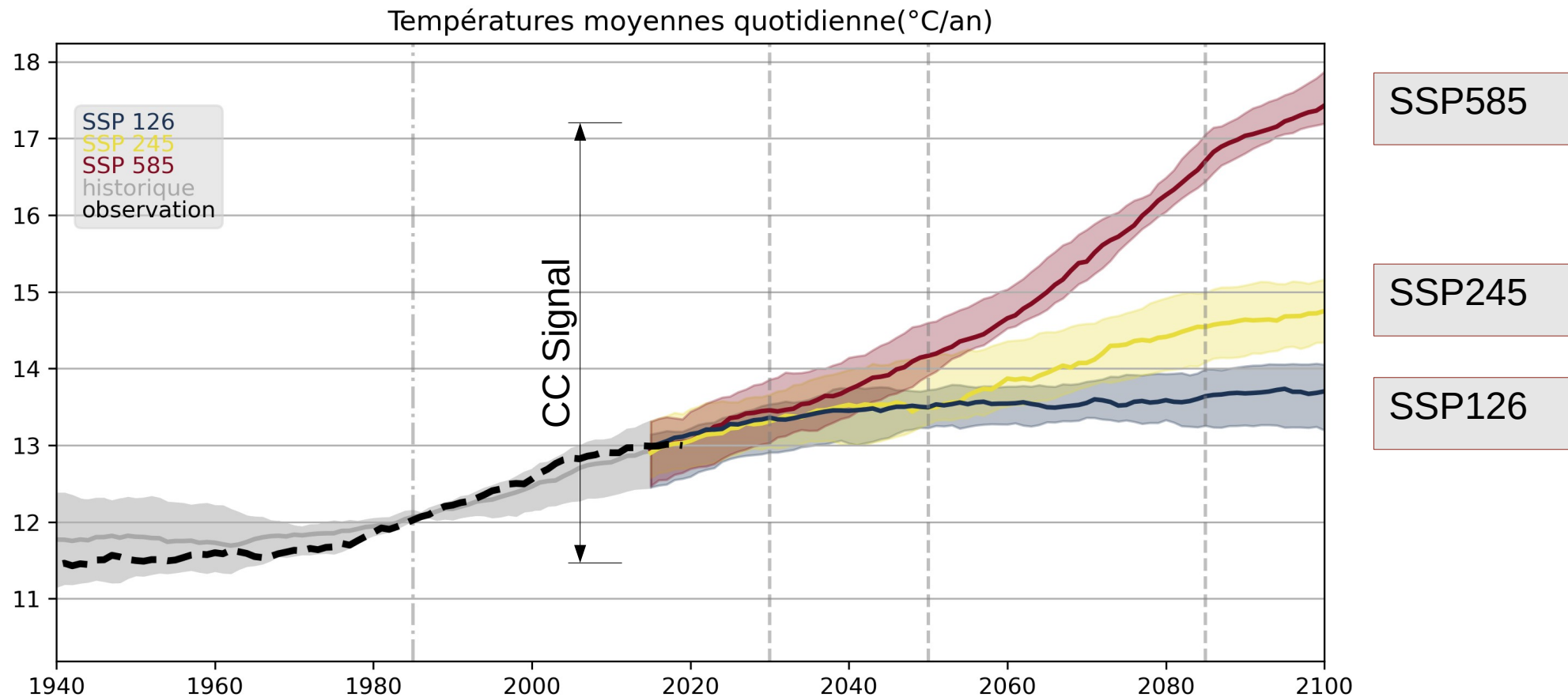


# 30 Year running mean incl. Uncertainty

Multimodel ensemble  
In comparison to meteo Observation



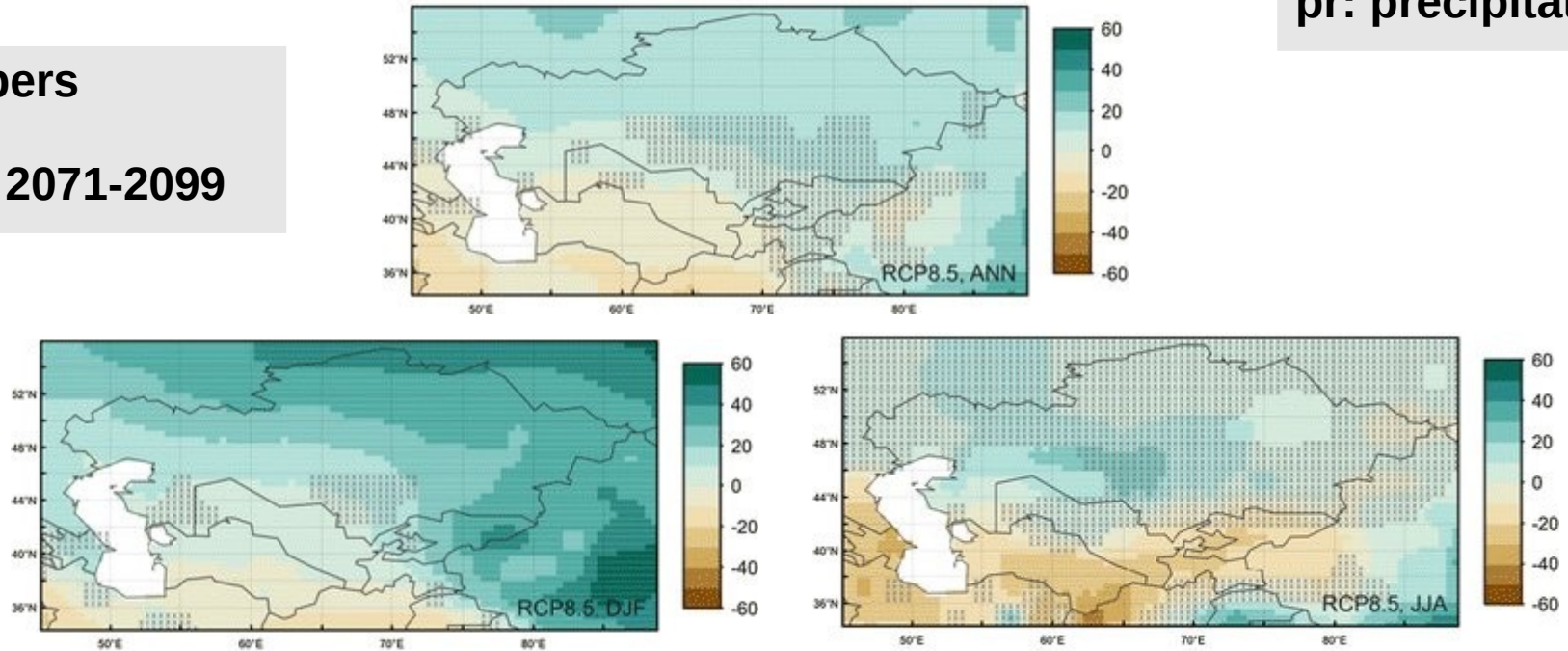
# Bias adjusted



# 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/](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 projection**

