Climate data processing for climate resilience

Tajikistan and Kyrgyzstan

Data access, processing and methodological concepts

Webinar
17. - 27. 11.2020

DAY 03
Scenarios of Change

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Objectives of Day 03

Date: 19.11

Presentation: Day03_ScenariosChange

https://github.com/nilshempelmann/climdatatutorial/blob/master/presentations

Objectives:

- Wrap up of yesterday
- Understanding of scenarios of change concepts
- Concept of Downscaling
- Get familiar with netCDF data format
- Understanding the metadata

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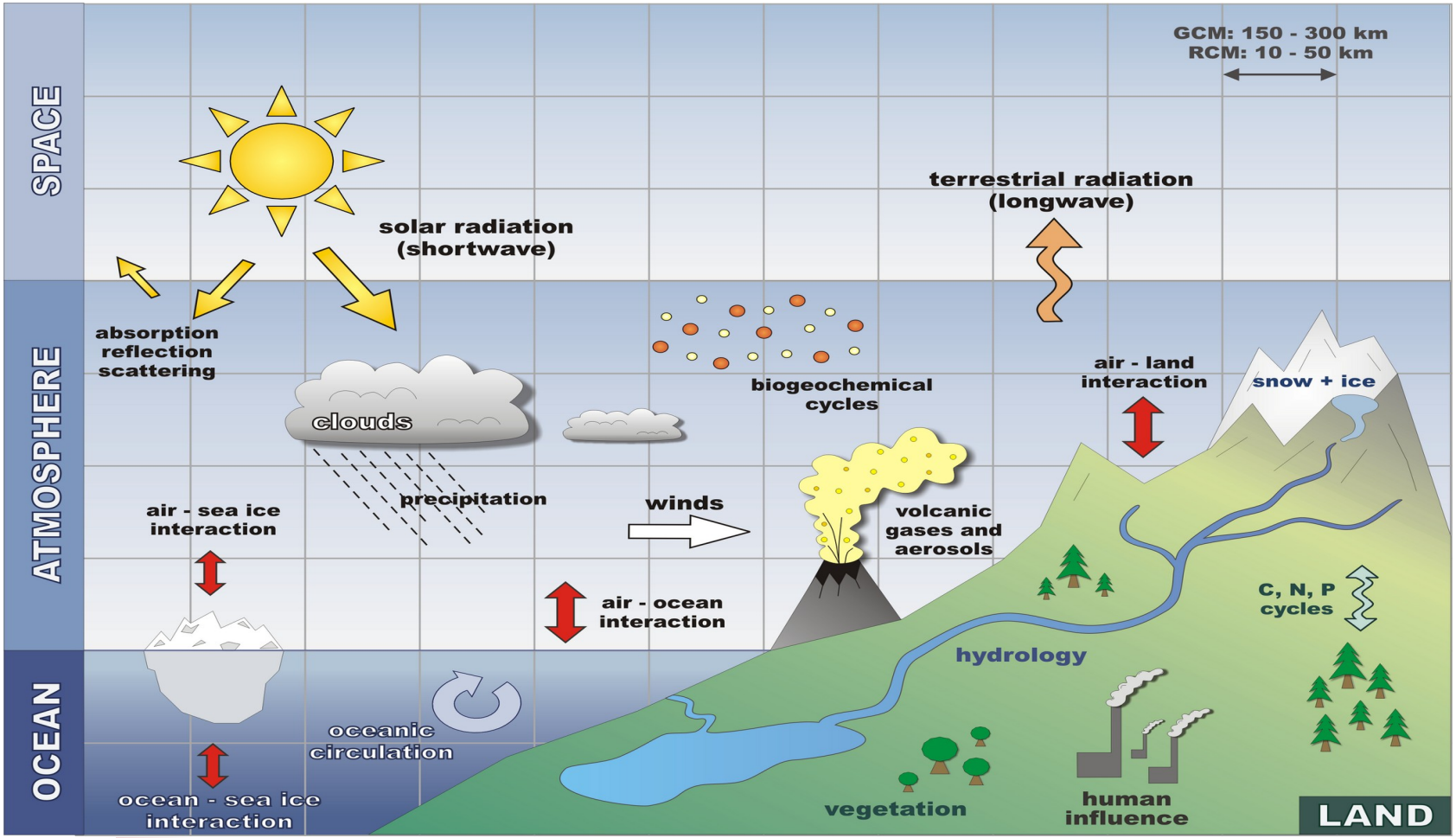
Earth System



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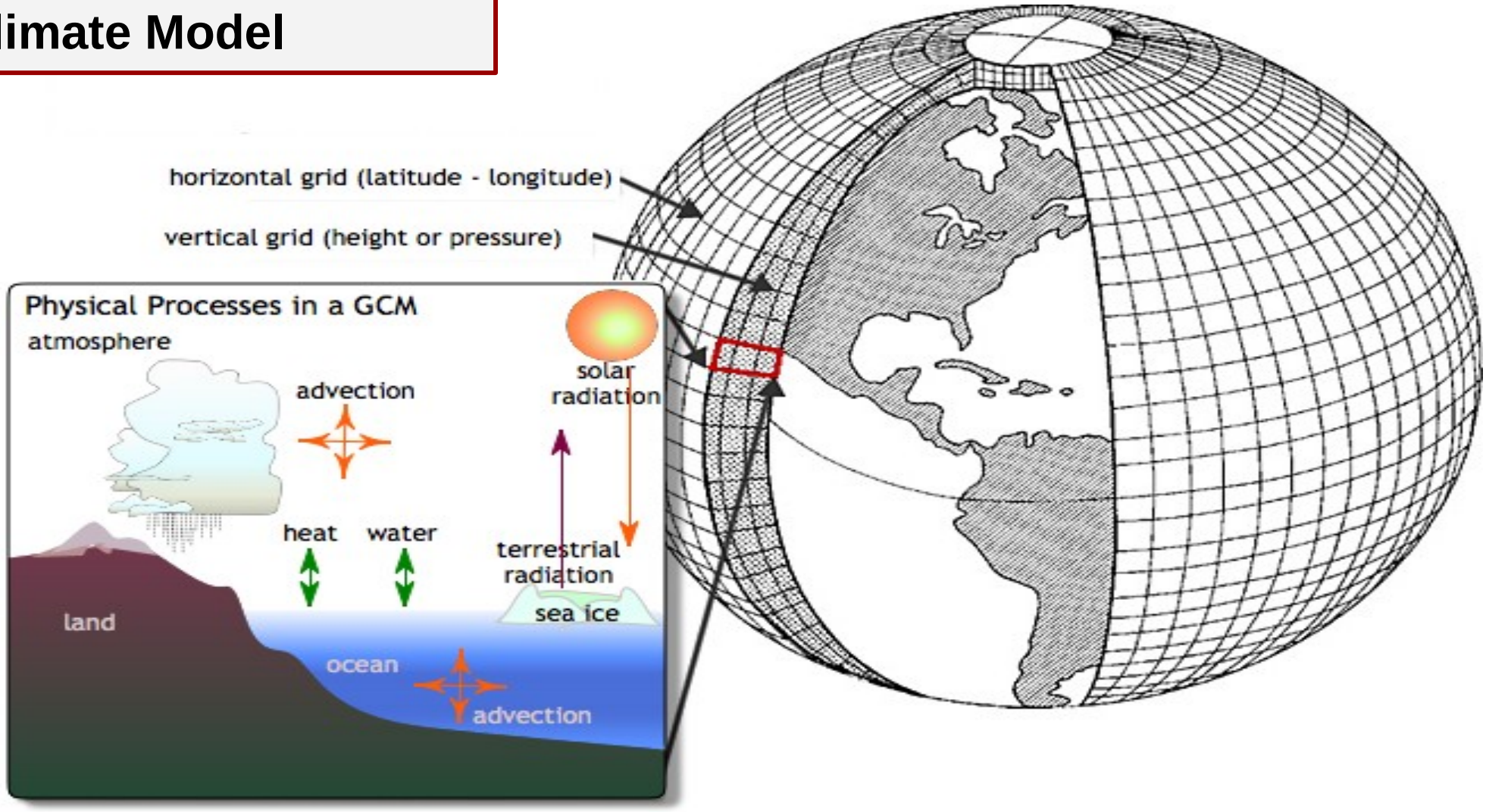
Climate Model



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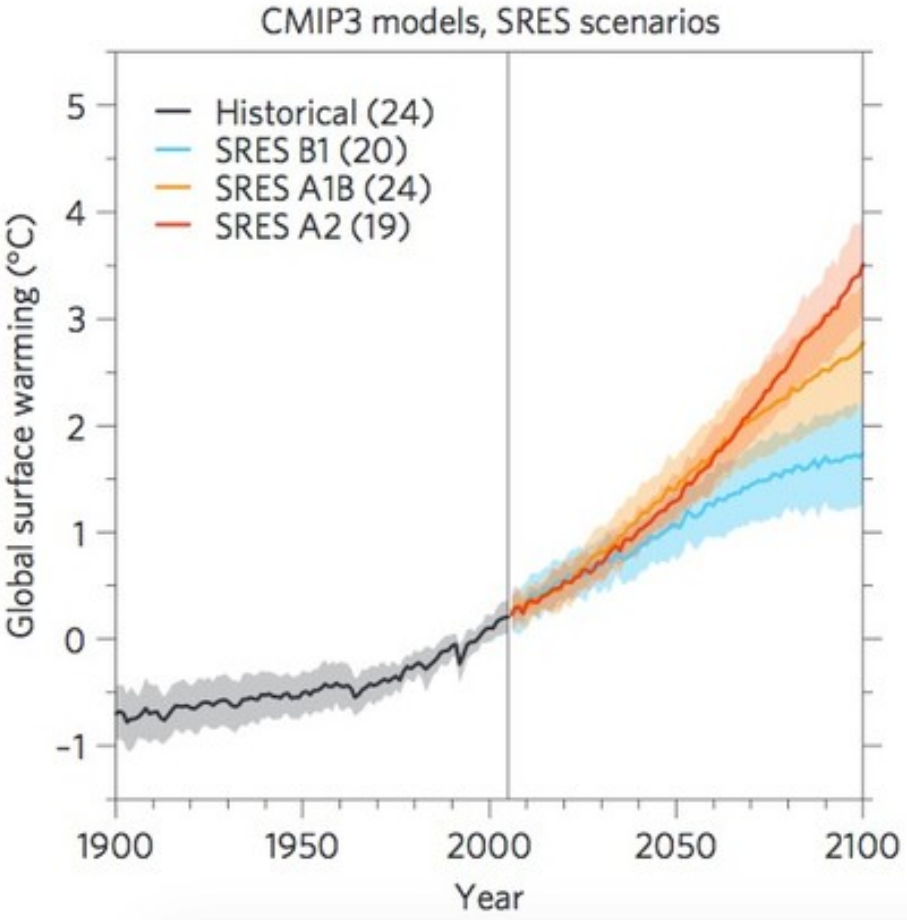
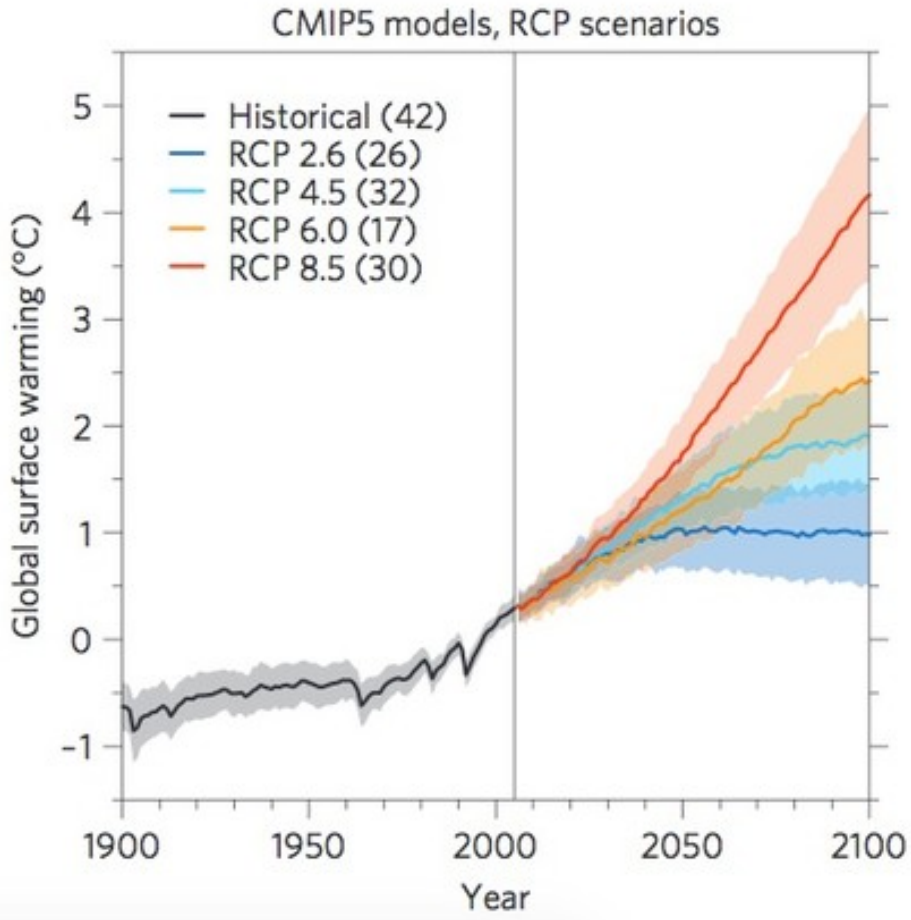
Future predictions





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Logic of the Shared sozio-economic Pathways (SSP)

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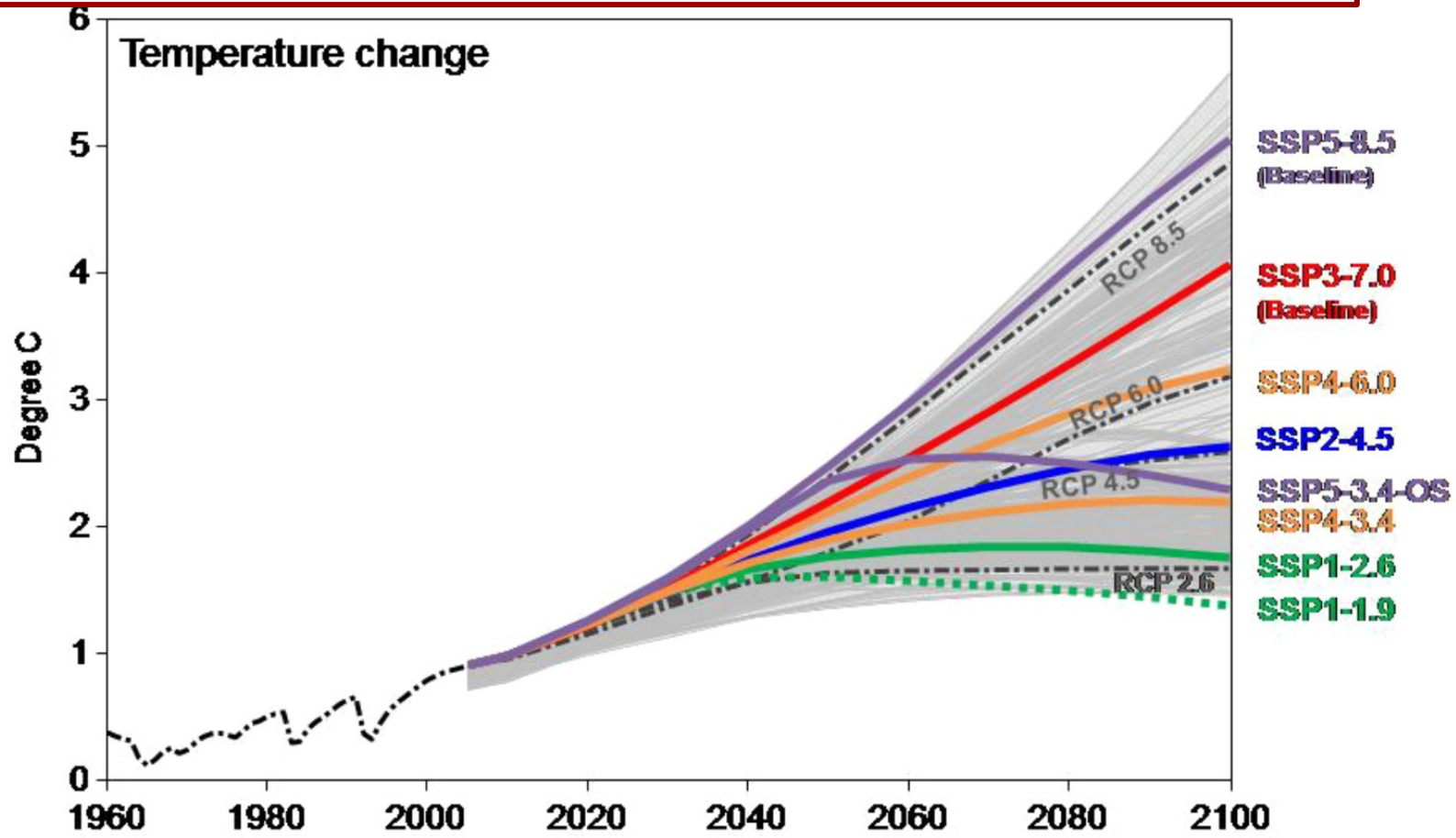
IPCC AR6 Shared Socioeconomic Pathways



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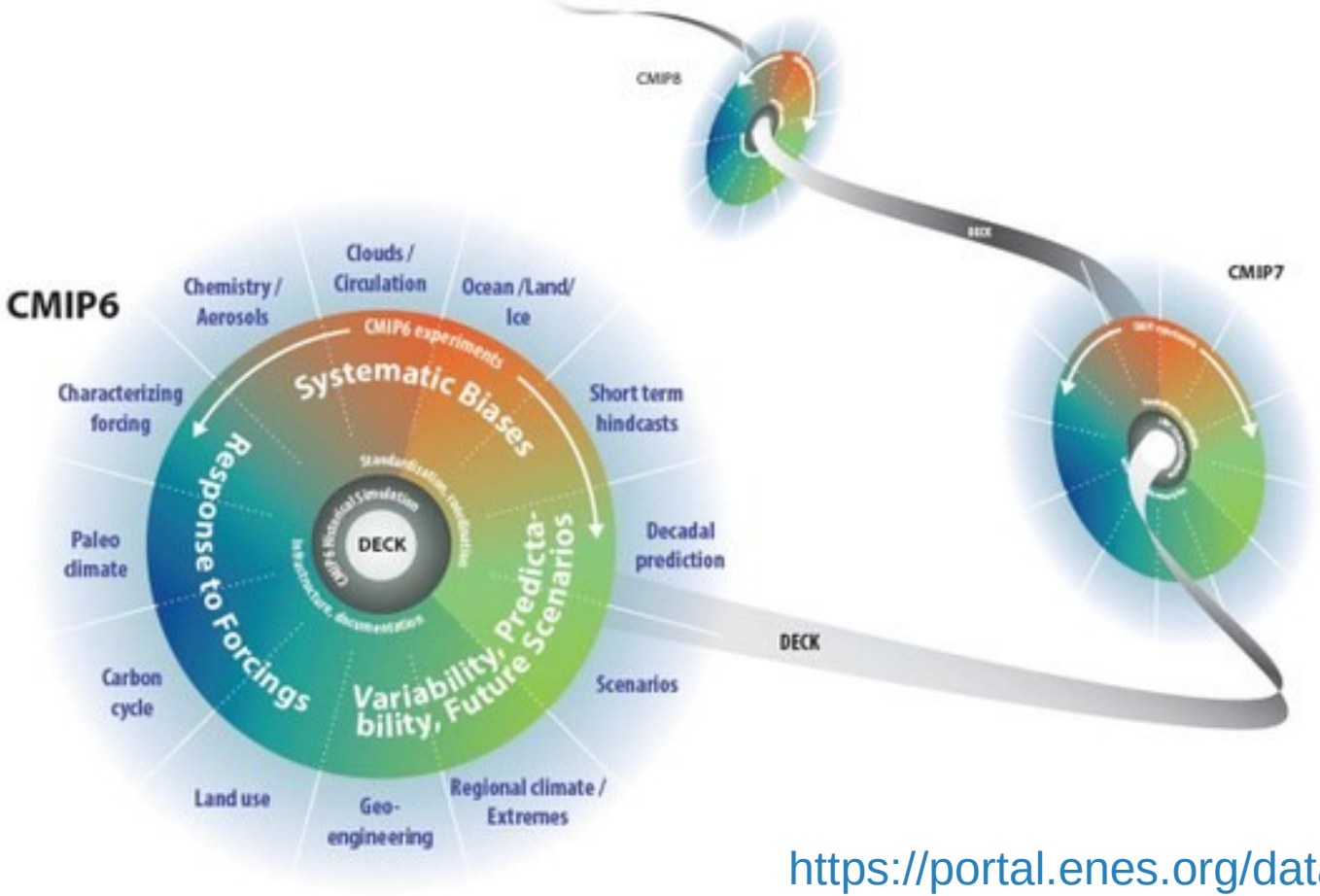
Climate Model Generations



https://portal.enes.org/data/enes-model-data/cmip6

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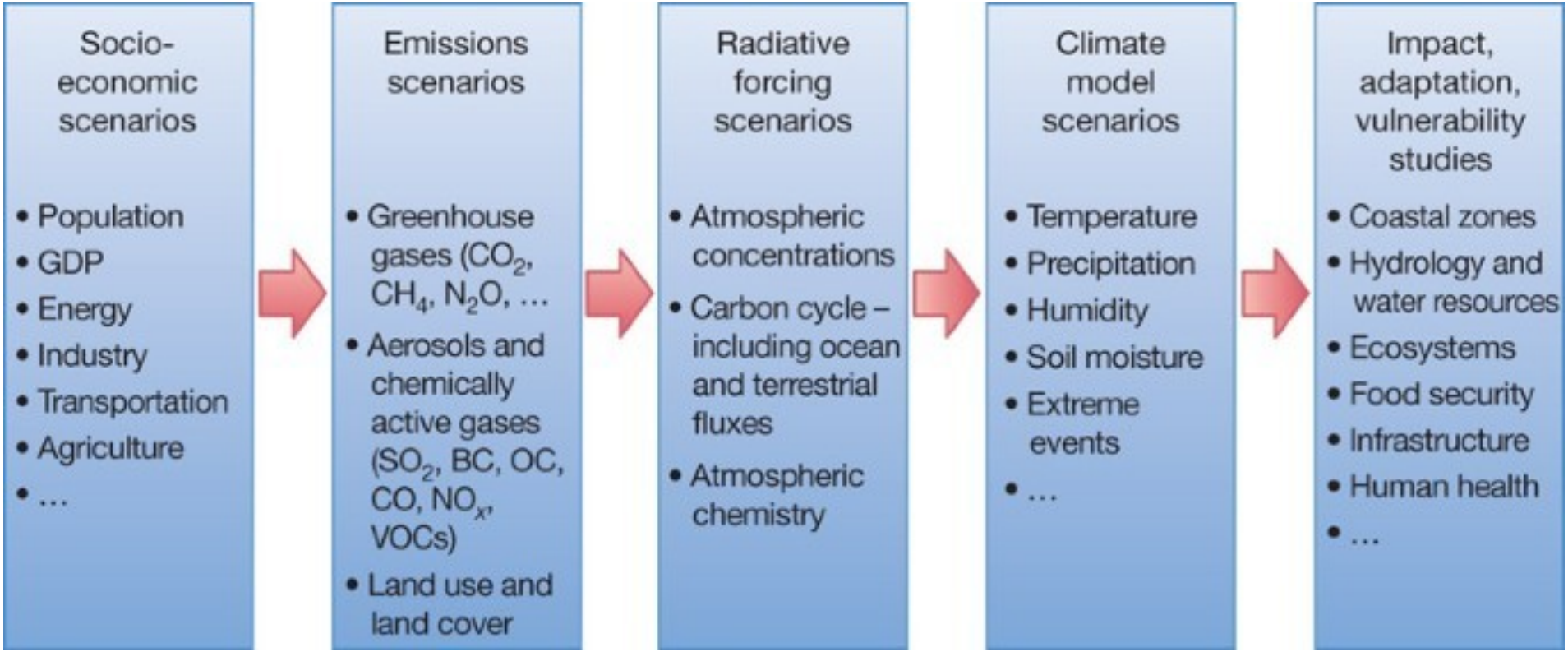
Model Chain

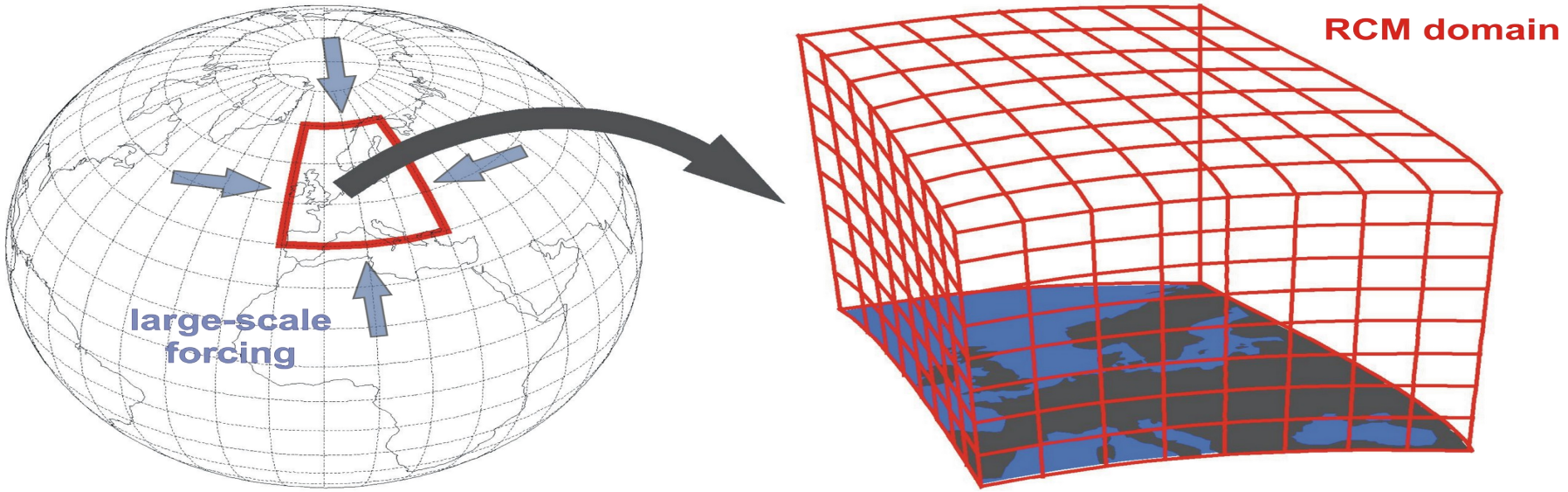


Source: The next generation of scenarios for climate change research and assessment 2010
https://www.nature.com/articles/nature08823

Downscaling

Regional Climate modelling

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



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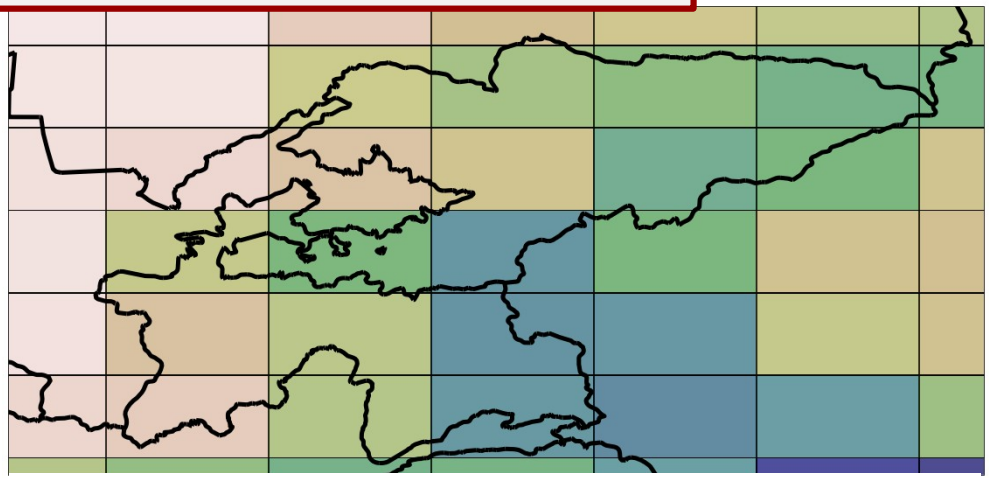
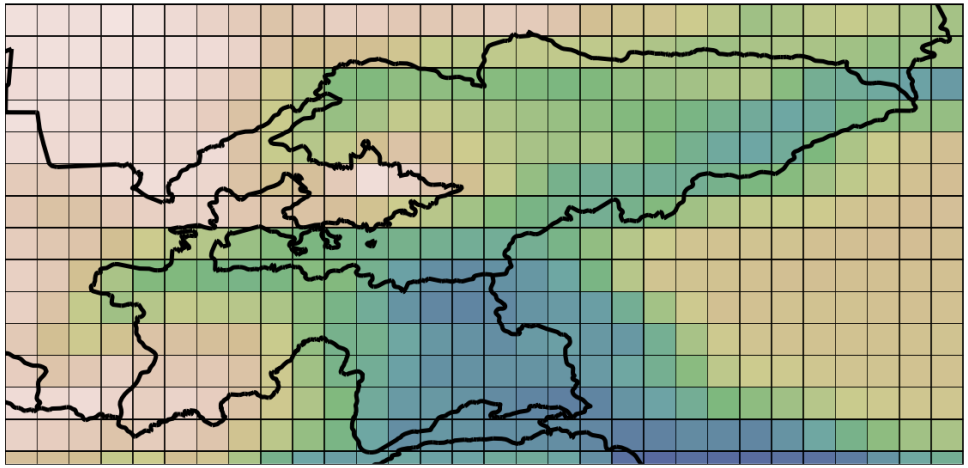
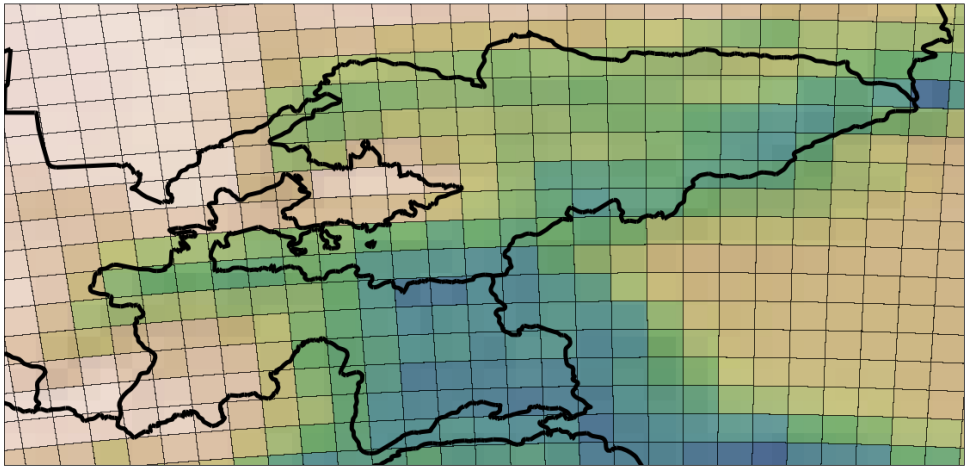
Downscaling



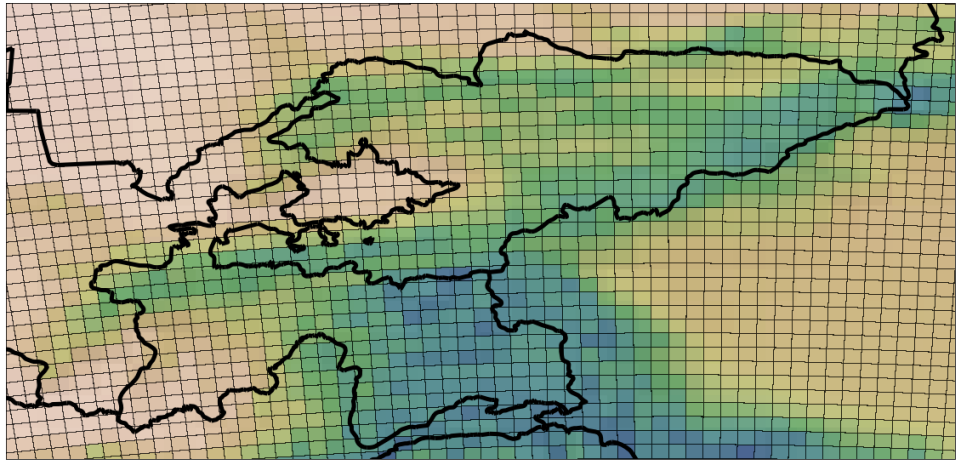
CMIP6 HR



CORDEX CAS-44



CORDEX CAS-22



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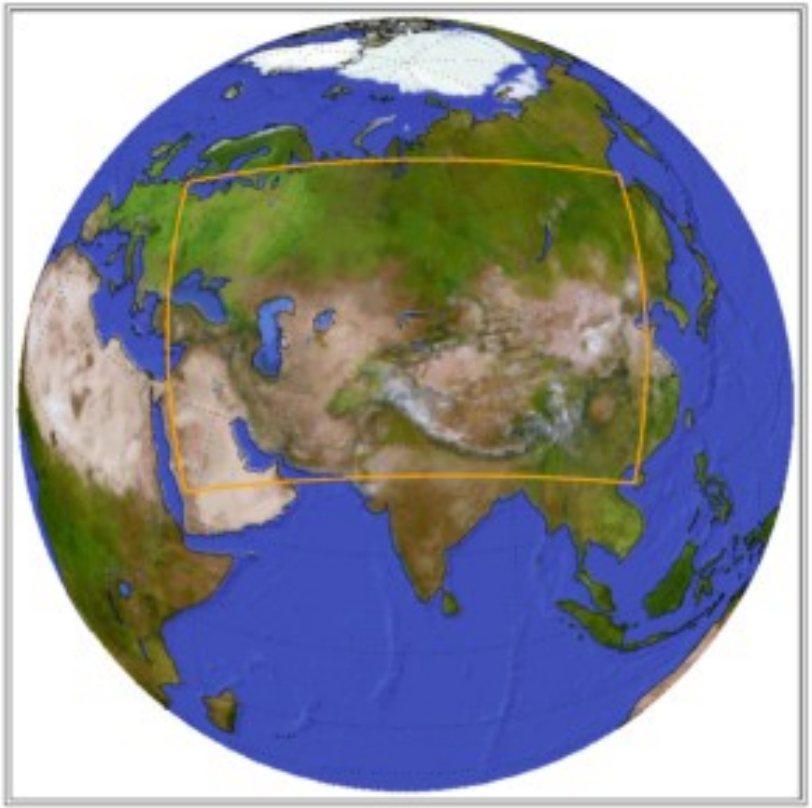
CORDEX Domain CAS



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

WCRP CORDEX
Coordinated Regional Climate Downscaling Experiment

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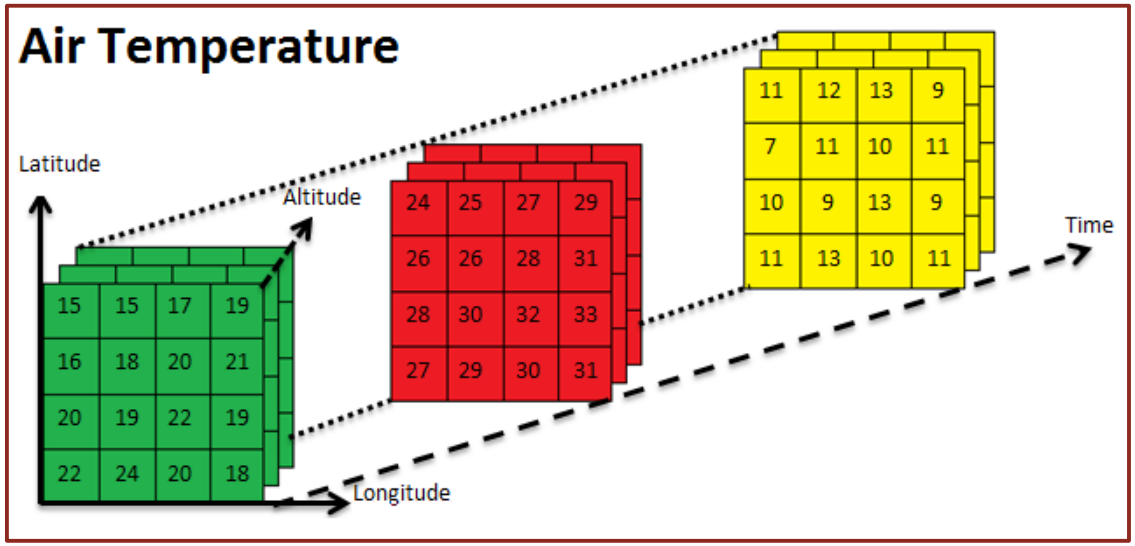
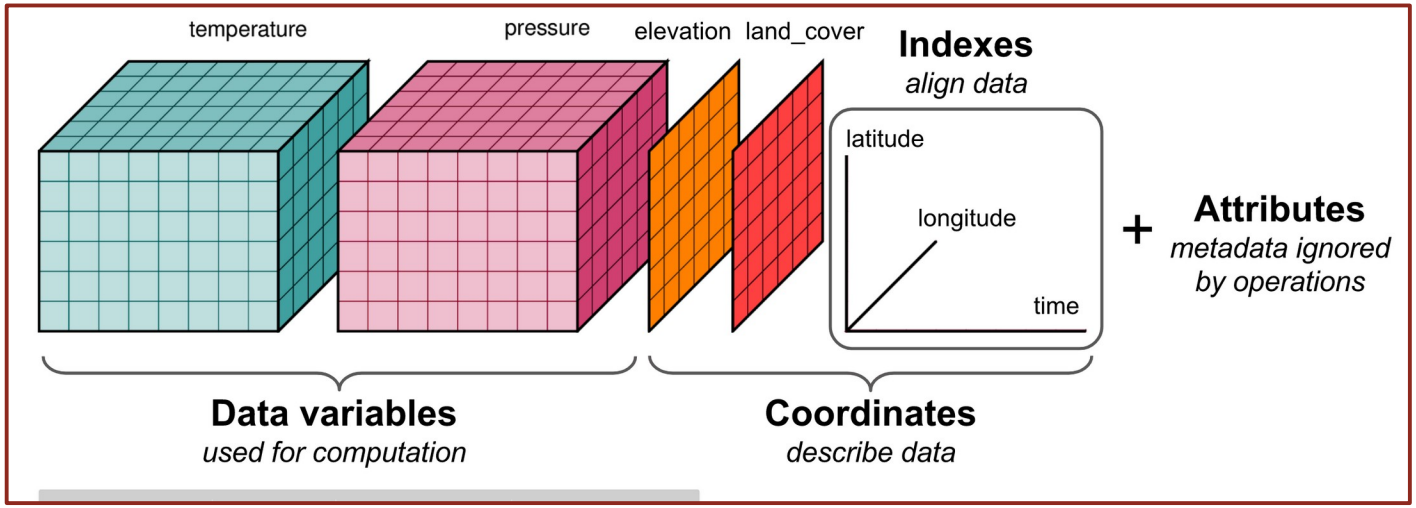
Multidimensional data format netCDF





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netCDF Metadata

```
tas_day_IPSL-CM6A-LR_ssp585_r3i1p1f1_gr_20150101-21001231_sub.nc
tas_day_IPSL-CM6A-LR_ssp585_r4i1p1f1_gr_20150101-21001231_sub.nc
tas_day_IPSL-CM6A-LR_ssp585_r6i1p1f1_gr_20150101-21001231_sub.nc
(base) nils@dove:~/ramboll/paris/data/tas$ ncdump tas_day_IPSL-CM6A-LR_ssp585_r6i1p1
c -h
netcdf tas_day_IPSL-CM6A-LR_ssp585_r6i1p1f1_gr_20150101-21001231_sub {
dimensions:
        time = UNLIMITED ; // (31411 currently)
        lat = 1 ;
        lon = 1 ;
        axis_nbounds = 2 ;
variables:
        float lat(lat) ;
                lat:_FillValue = NaNf ;
                lat:axis = "Y" ;
                lat:standard_name = "latitude" ;
                lat:long_name = "Latitude" ;
                lat:units = "degrees_north" ;
                lat:_ChunkSizes = 143 ;
        float lon(lon) ;
                lon:_FillValue = NaNf ;
                lon:axis = "X" ;
                lon:standard_name = "longitude" ;
                lon:long_name = "Longitude" ;
                lon:units = "degrees_east" ;
                lon:_ChunkSizes = 144 ;
        double height ;
                height:_FillValue = NaN ;
                height:name = "height" ;
                height:standard_name = "height" ;
                height:long_name = "height" ;
                height:units = "m" ;
                height:axis = "Z" ;
                height:positive = "up" ;
        float time(time) ;
                time:_FillValue = NaNf ;
                time:axis = "T" ;
                time:standard_name = "time" ;
                time:long_name = "Time axis" ;
                time:calendar = "gregorian" ;
                time:units = "days since 2015-01-01 00:00:00" ;
                time:time_origin = "2015-01-01 00:00:00" ;
                time:bounds = "time_bounds" ;
                time:_ChunkSizes = 1 ;
        double time_bounds(time, axis_nbounds) ;
                time_bounds:_FillValue = NaN ;
                time_bounds:_ChunkSizes = 1, 2 ;
                time_bounds:coordinates = "height" ;
```

```
                tas:interval_write = "1 d" ;
                tas:standard_name = "air_temperature" ;
                tas:description = "near-surface (usually, 2 meter) air temperature" ;
                tas:long_name = "Near-Surface Air Temperature" ;
                tas:history = "none" ;
                tas:units = "K" ;
                tas:cell_measures = "area: areacella" ;
                tas:_ChunkSizes = 1, 143, 144 ;
                tas:coordinates = "height" ;
                tas:missing_value = 1.e+20f ;

// global attributes:
                :name = "/ccc/work/cont003/gencmip6/lurtont/IGCM_OUT/IPSLCM6/PROD/ssp585/CM61-LR-scen-ssp585-r6/C
MIP6/ATM/tas_day_IPSL-CM6A-LR_ssp585_r6i1p1f1_gr_%start_date%-%end_date%" ;
                :Conventions = "CF-1.7 CMIP-6.2" ;
                :creation_date = "2019-10-22T10:11:29Z" ;
                :tracking_id = "hdl:21.14100/48775d11-08bb-4ee6-a33e-82594be14654" ;
                :description = "Future scenario with high radiative forcing by the end of century. Following appr
oximately RCP8.5 global forcing pathway but with new forcing based on SSP5. Concentration-driven. As a tier 2 opt
ion, this simulation should be extended to year 2300" ;
                :title = "IPSL-CM6A-LR model output prepared for CMIP6 / ScenarioMIP ssp585" ;
                :activity_id = "ScenarioMIP" ;
                :contact = "ipsl-cmip6@listes.ipsl.fr" ;
                :data_specs_version = "01.00.28" ;
                :dr2xml_version = "1.16" ;
                :experiment_id = "ssp585" ;
                :experiment = "update of RCP8.5 based on SSP5" ;
                :external_variables = "areacella" ;
                :forcing_index = 1 ;
                :frequency = "day" ;
                :further_info_url = "https://furtherinfo.es-doc.org/CMIP6.IPSL.IPSL-CM6A-LR.ssp585.none.r6i1p1f1"
 ;
                :grid = "LMDZ grid" ;
                :grid_label = "gr" ;
                :nominal_resolution = "250 km" ;
                :history = "none" ;
                :initialization_index = 1 ;
                :institution_id = "IPSL" ;
                :institution = "Institut Pierre Simon Laplace, Paris 75252, France" ;
                :license = "CMIP6 model data produced by IPSL is licensed under a Creative Commons Attribution-No
nCommercial-ShareAlike 4.0 International License (https://creativecommons.org/licenses). Consult https://pcmdi.ll
nl.gov/CMIP6/TermsOfUse for terms of use governing CMIP6 output, including citation requirements and proper ackno
wledgment. Further information about this data, including some limitations, can be found via the further_info_url
 (recorded as a global attribute in this file) and at https://cmc.ipsl.fr/. The data producers and data providers
 make no warranty, either express or implied, including, but not limited to, warranties of merchantability and fi
tness for a particular purpose. All liabilities arising from the supply of the information (including any liabili
ty arising in negligence) are excluded to the fullest extent permitted by law." ;
                :mip_era = "CMIP6" ;
```


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Hands ON:

Open a netCDF file in panoply

Plot resolution of CMIP and CORDEX files

Time series future prediction

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