International Institute for Applied Systems Analysis
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Exercise 1: looking at model results

Uncertainties from models, Climate Change Zambezi catchment

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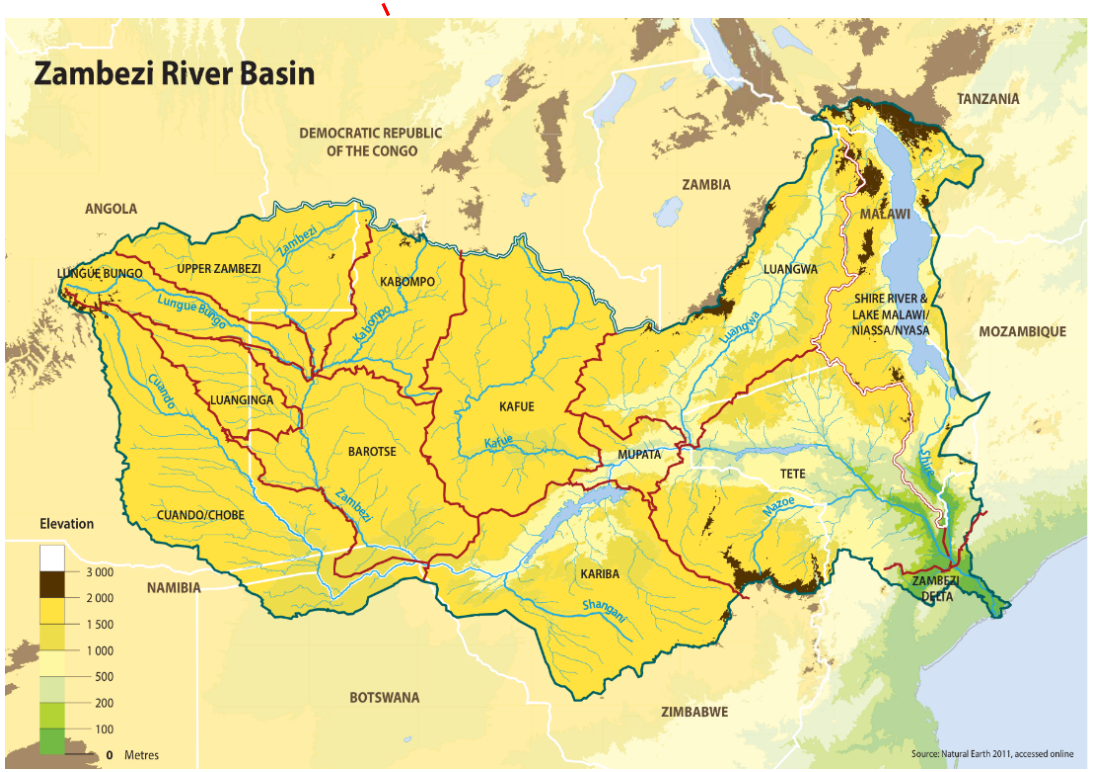
Study area: Zambezi Basin

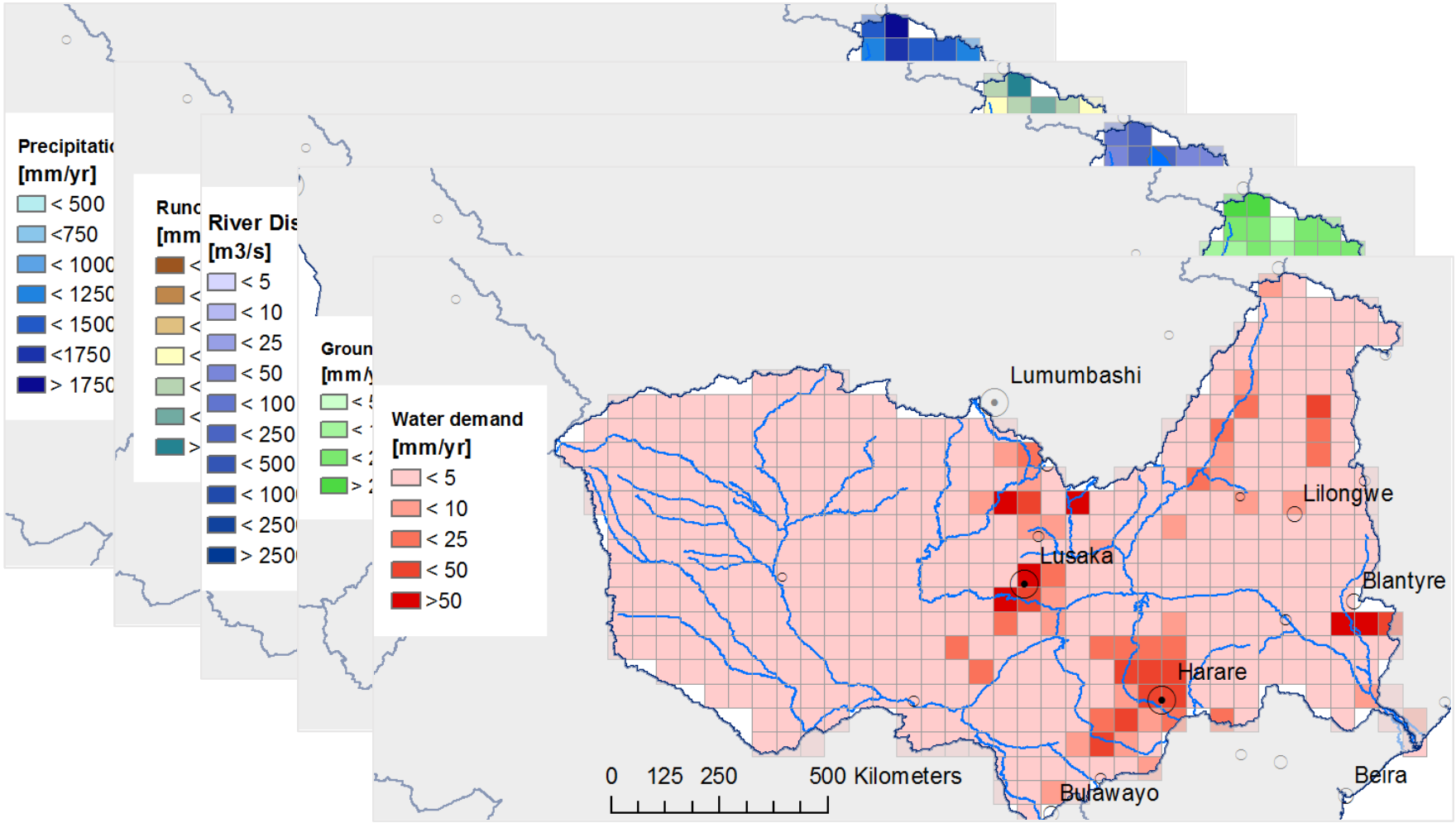
- One of the largest river basins in Africa, covering an area of 1.4 million km^2 and home to around 40 million people.
- A transboundary basin spanning over eight countries and 21 subbasins.
- Existing governance structure: ZAMCOM
- Growing population and economy
- Considerable potential for agriculture and hydropower development

ZAMCOM

win-win cooperation / cooperacao, ganhas tu, ganho eu

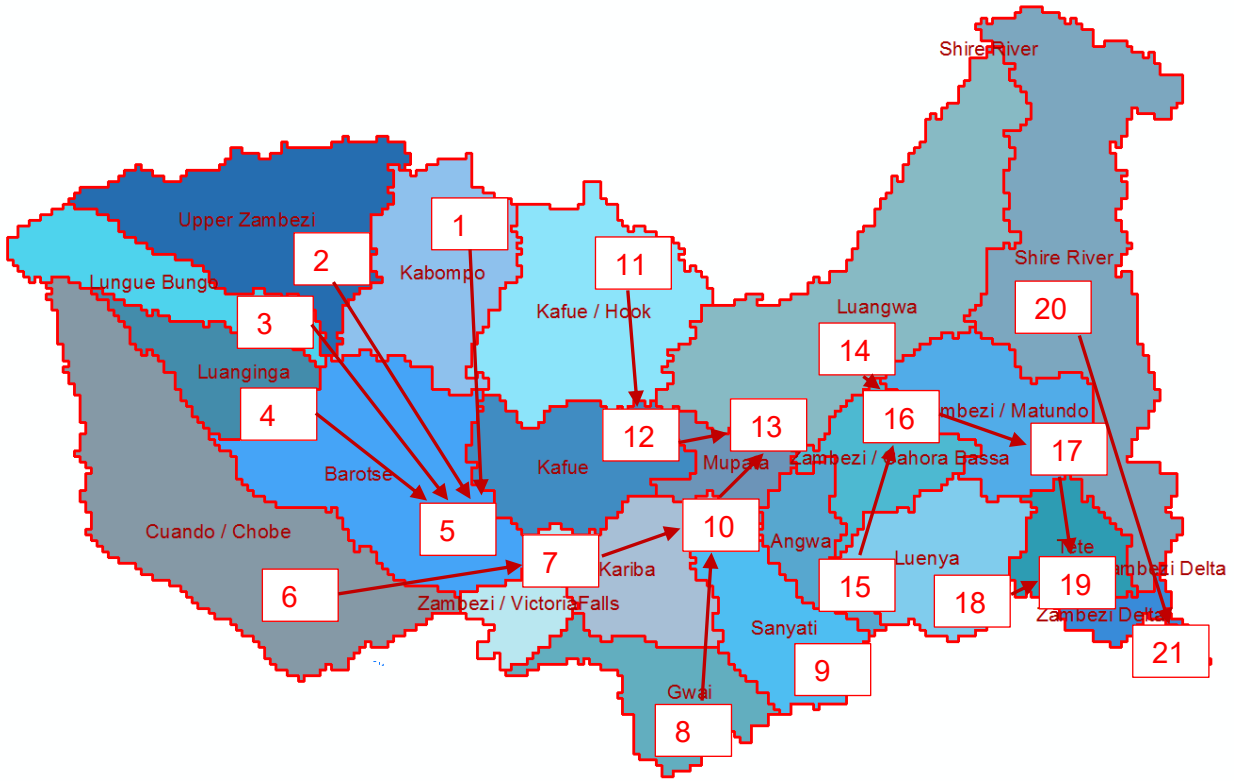


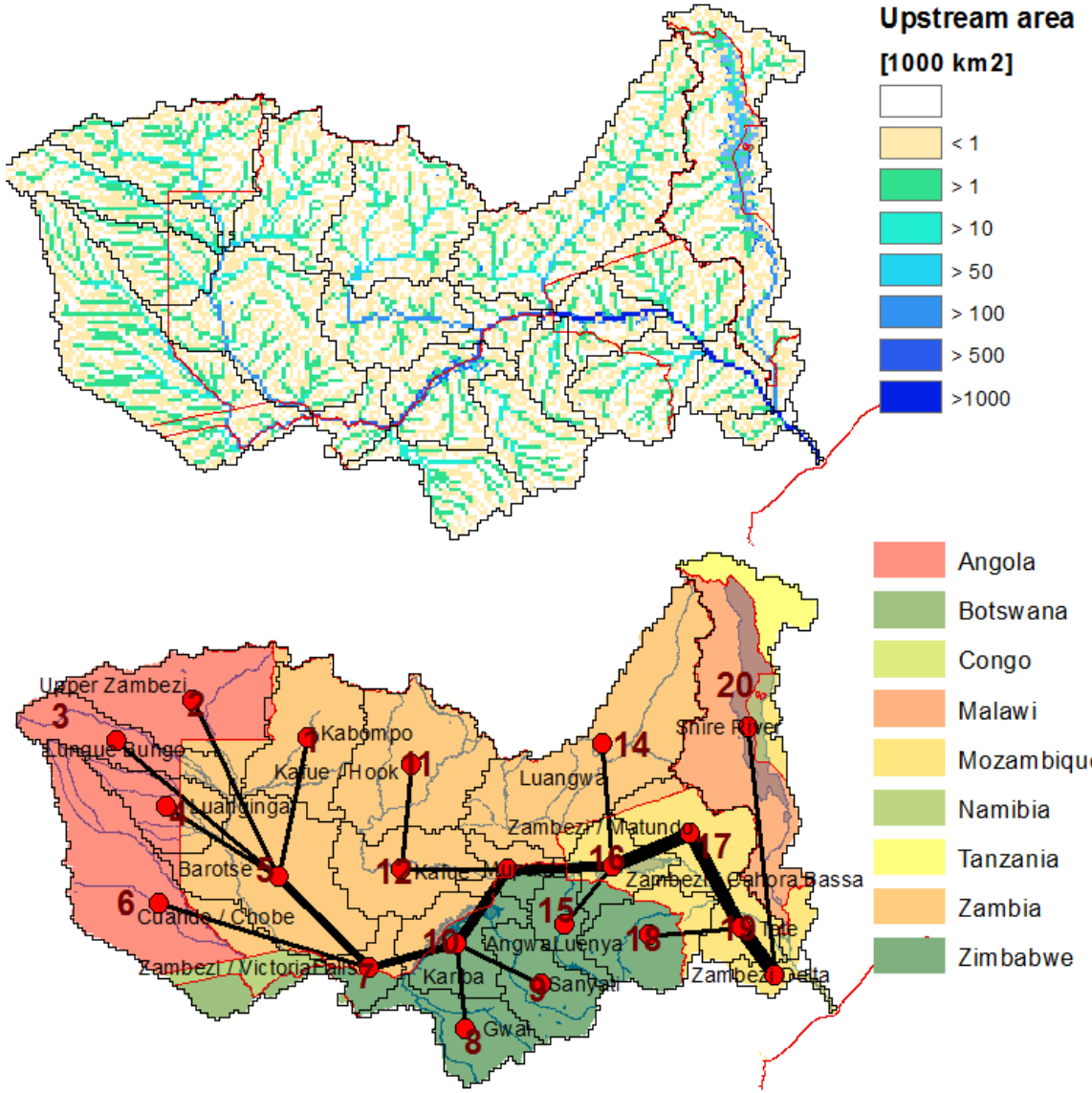
Using the calibrated hydrological model to calculate input data for the hydro-economic model



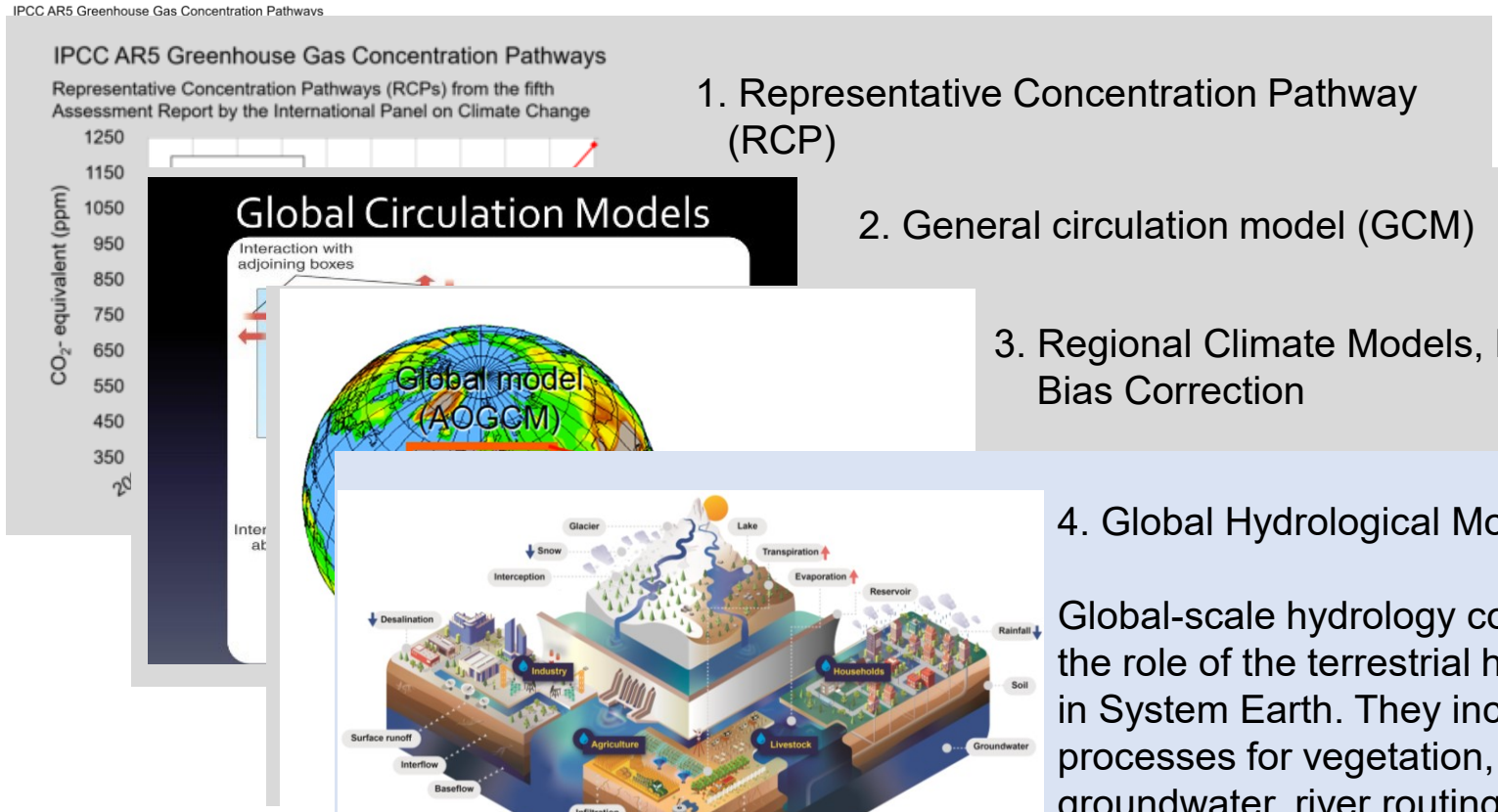
Node-Link Network for Optimization

Sub-basin network





Climate Modeling Chain



1. Representative Concentration Pathway (RCP)

2. General circulation model (GCM)

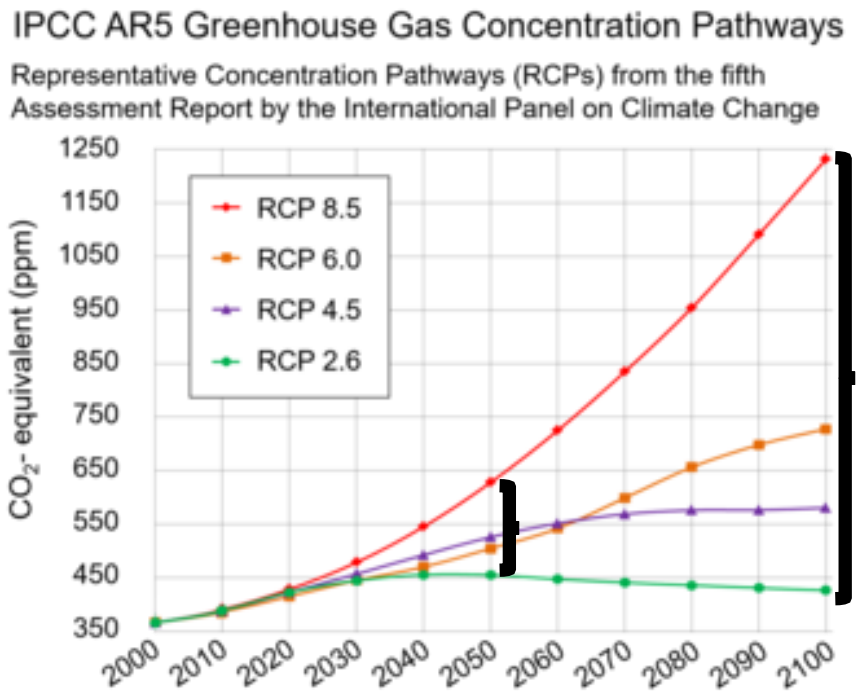
3. Regional Climate Models, Downscaling, Bias Correction

4. Global Hydrological Models (GHMs)

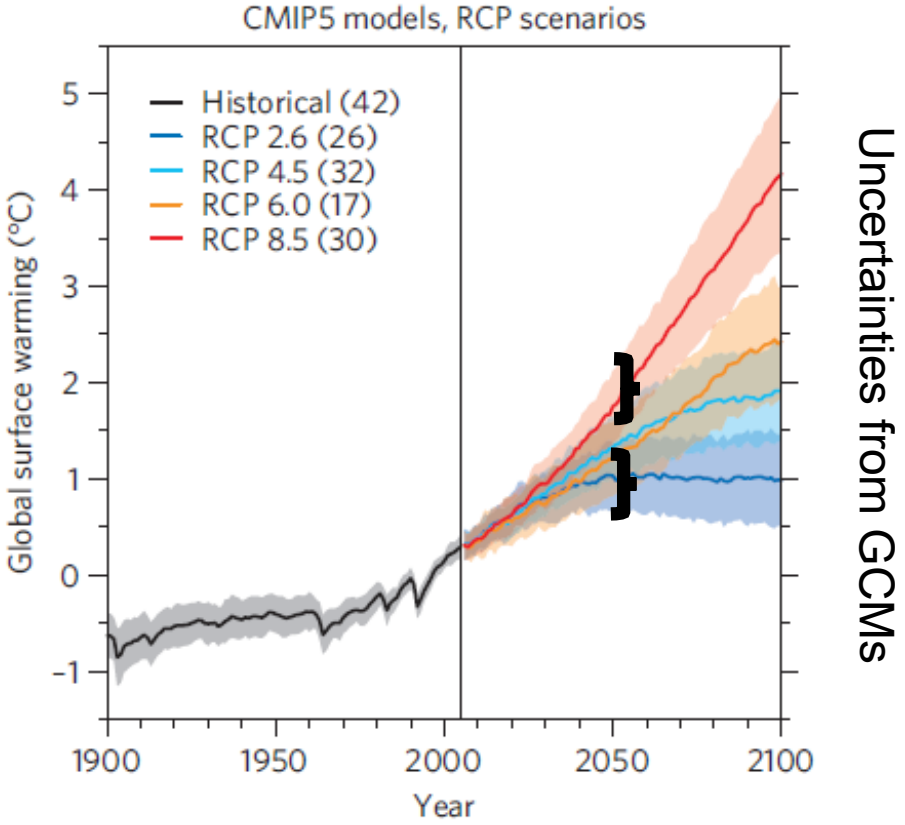
Global-scale hydrology concentrates on the role of the terrestrial hydrological cycle in System Earth. They include the processes for vegetation, soil, groundwater, river routing etc.

Climate projection

RCPs and GCMs

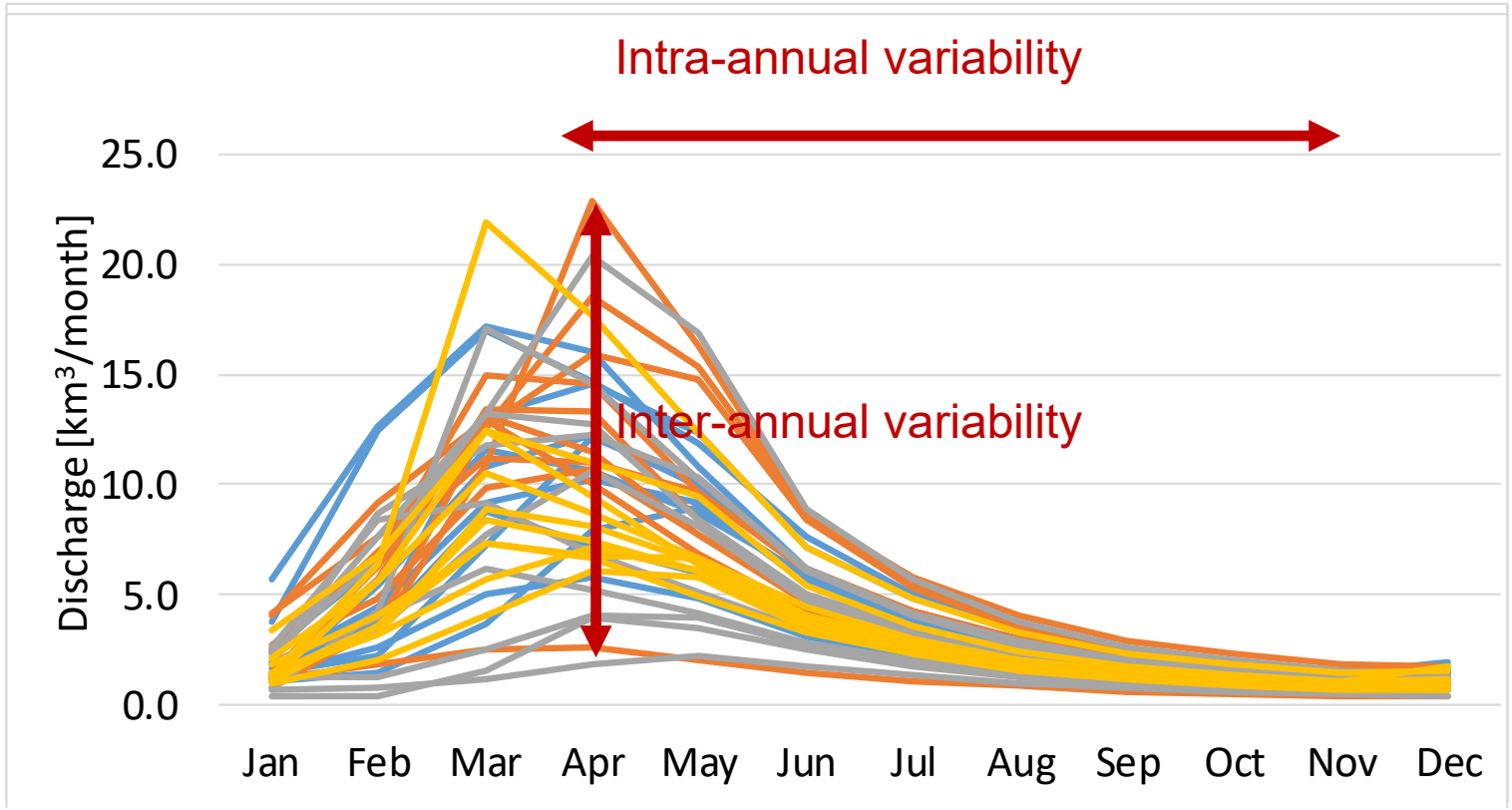


Uncertainties from RCPs

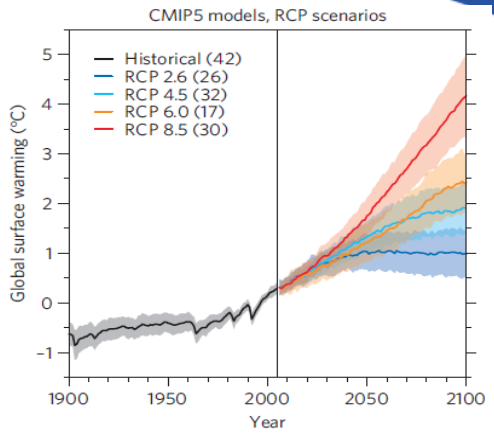


Uncertainties from GCMs

Climate & Hydrological uncertainty



Zambezi results from Community Water Model - Station: Katima
Period 2006-2015 – Ensemble of 40 members
Discharge [km³/month]



Scenario RCP 4.5
CMIP5 Ensemble

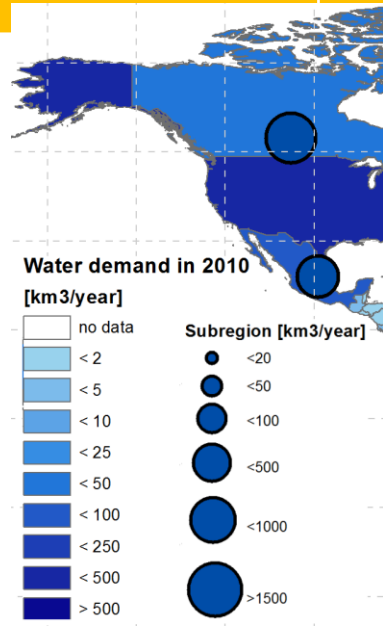
4 General Circulation Models

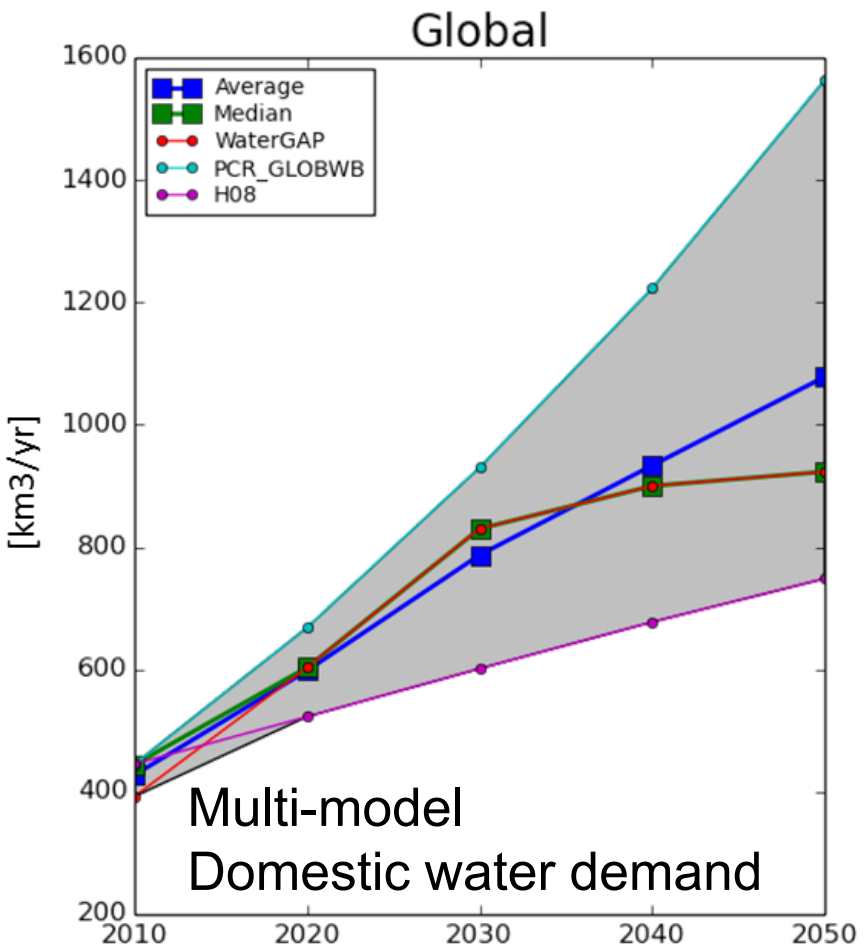
- GFDL-ESM2m
- HadGEM2-ES
- IPSL-CM5A-LR
- MIROC5

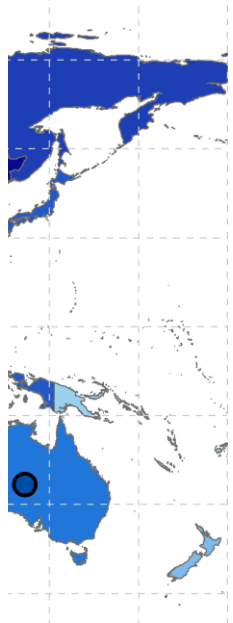
Hydrological model (CWATM)

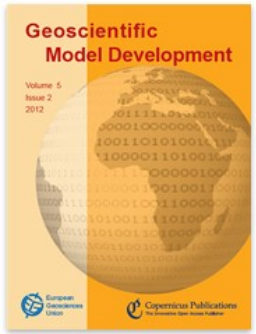
Multi-model Assessment: Water Demand

Models	Ins
WaterGAP	Kas
H08	Nat
PCR-GLOBWB	Utr









Wada Y, Floerke M, Hanasaki N, Eisner S, Fischer G, Tramberend S, Satoh Y, van Vliet M, Yillia P, Ringler C, Burek P. and Wiberg D (2015), Geoscientific Model Development

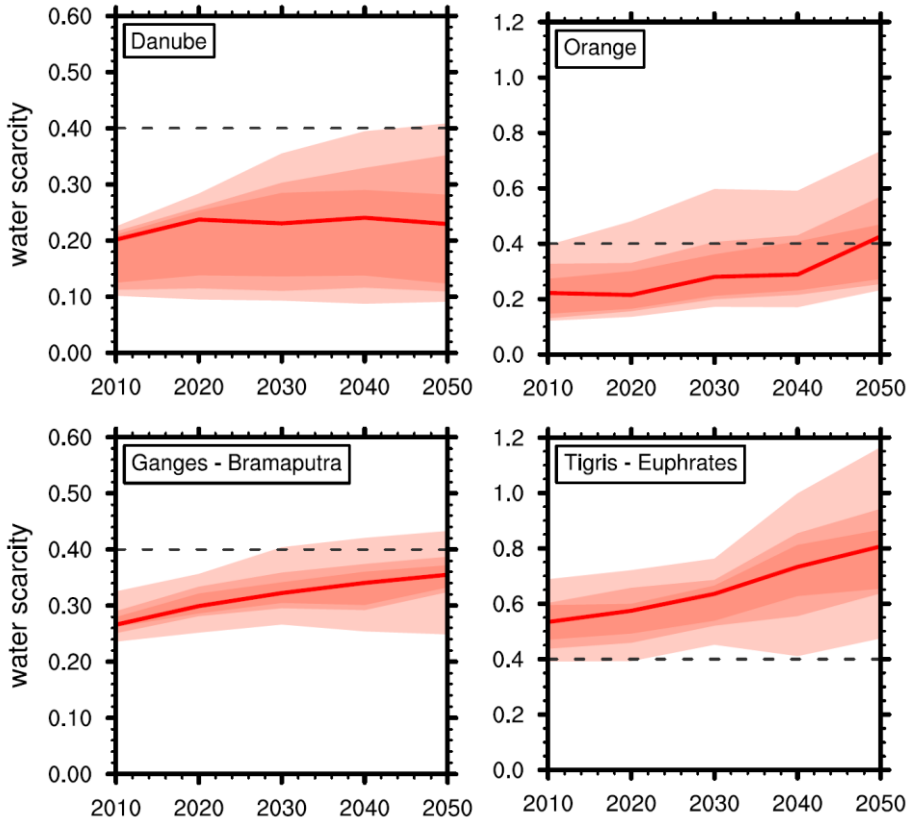
Approach

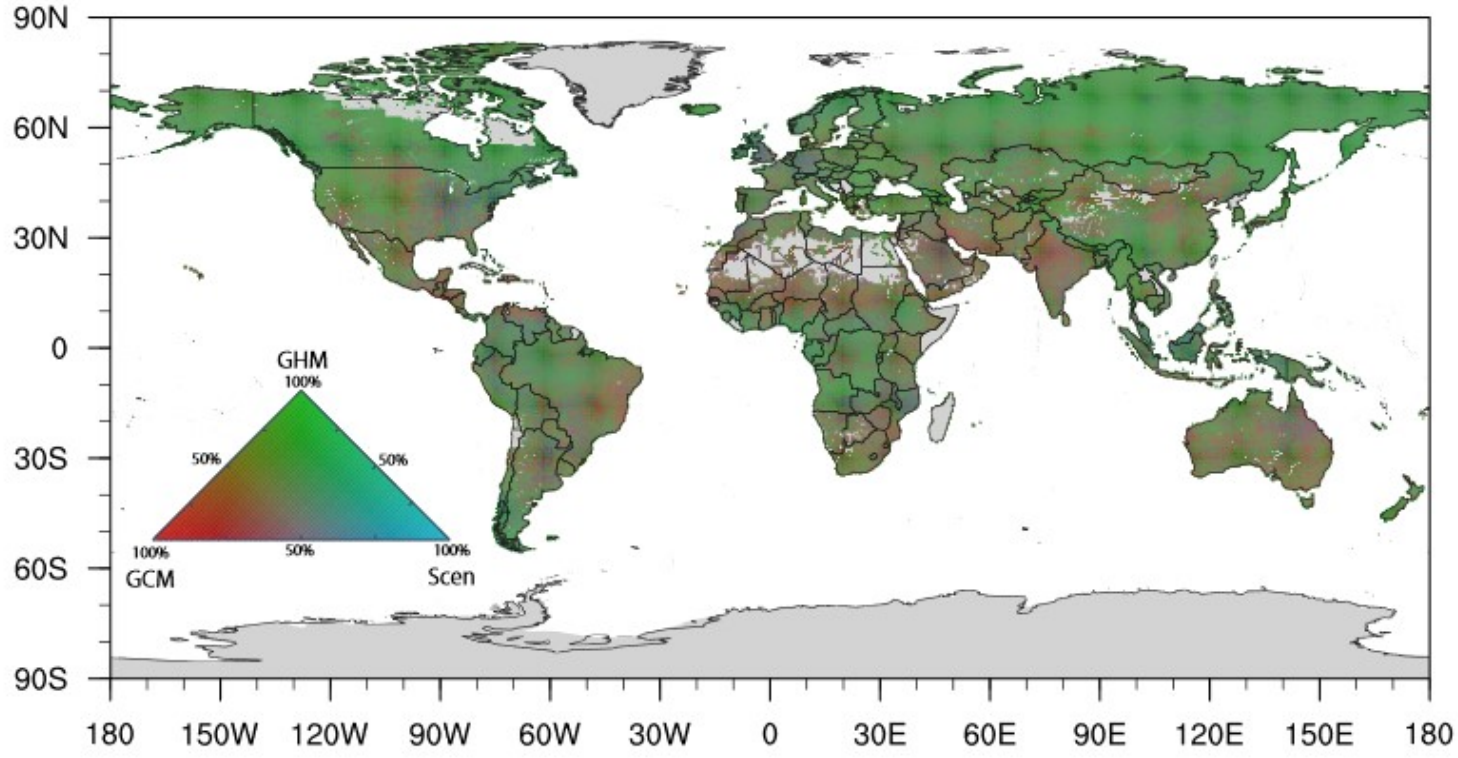
Communicate Uncertainty

Ensemble hydrological impact simulations

3 Global Hydrological Models forced by **5 Global Climate Models** under **3 Water scenarios** provide an ensemble of

45 global water scarcity estimates (water demand to supply ratio) (from 2005 to 2055, 0.5deg)





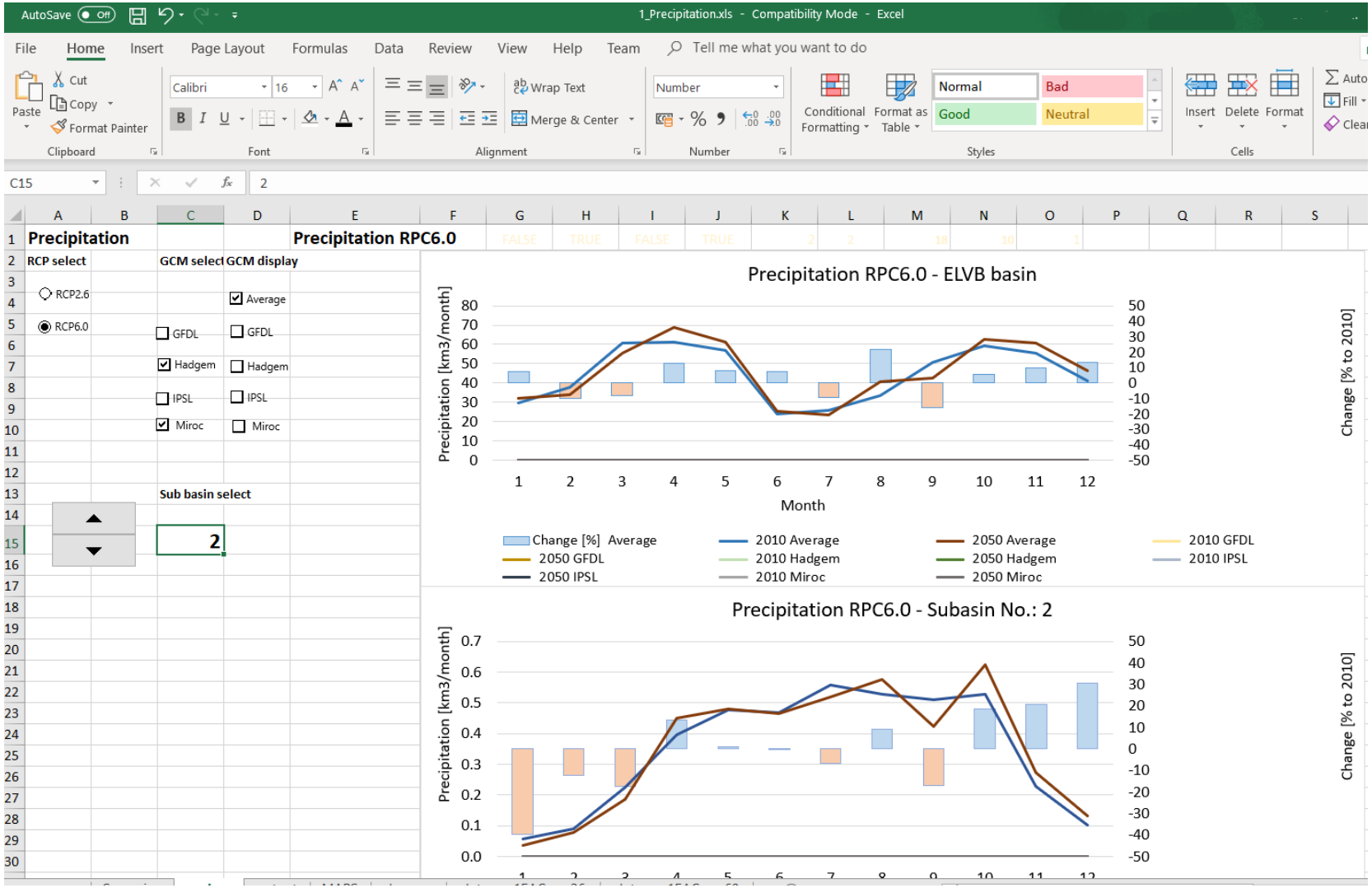
[Greve et al. 2018]

Results explorer - Excel

- Based on existing knowledge
- Easy to understand and manipulate on different levels of experience
- Database and Excel spreadsheats available for stakeholders

Compare and explore scenarios:

- Time
- Sub-catchments or country
- Sectors
- Technologies
- Policies & scenarios

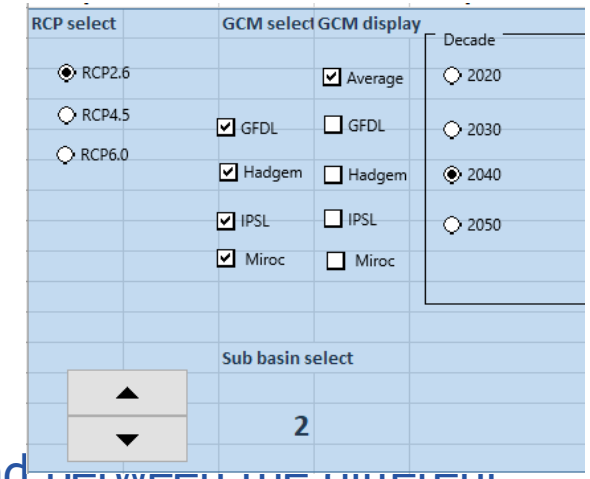


Results explorer - Excel
Hands on

- Look at a different excel file

  1_temperature.xls, 2_precipitation.xls, 3_ runoff.xls, …

- Use the options in the analyse sheet

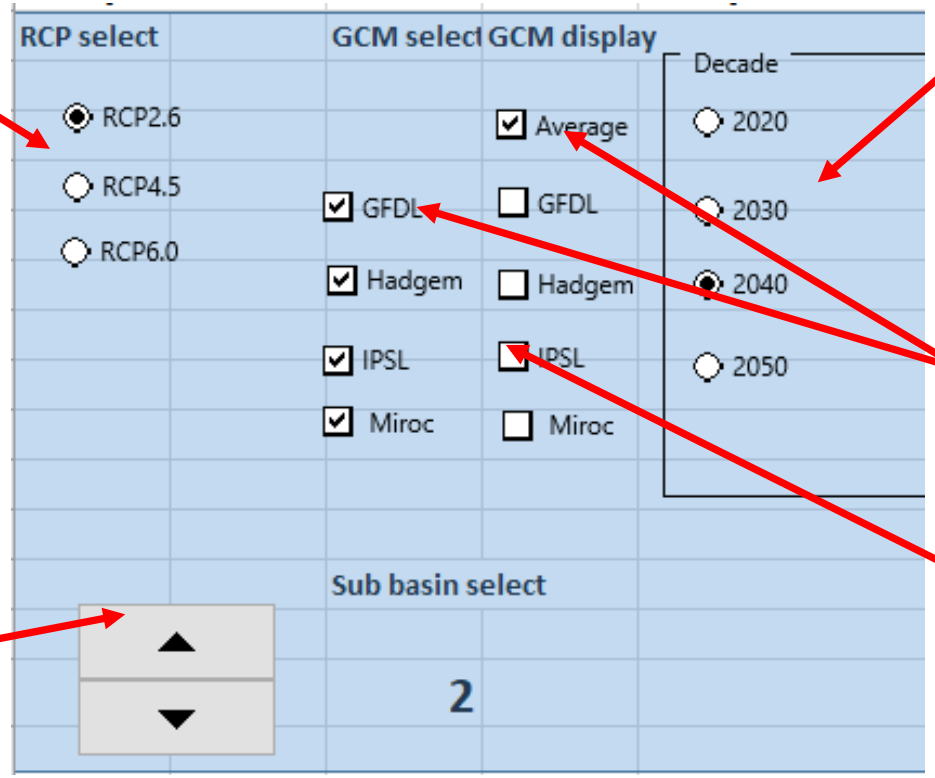


- Questions:
  1. Do you see a difference trend between the different RCPs and between the different years? Are all sub-basins showing the same trend?
  2. Tell about the change. Are some months more affected? Is the rainy season getting dryer/wetter/warmer …. What happen to the dry season
  3. Are the different GCM telling the same story?
  4. Can you tell something about uncertainty?
  5. Can you tell something about climate change?

Results explorer - Excel

- Use the options in the analyse sheet

Change the RCP
RCP 2.6
RCP 4.5
RCP 6.0



Change the decade
2020: from 2016-2025
..
2050: from 2046-2045

Which GCMs should be used to calculate the average?

These GCMs (or the average) are displayed

Scroll through the 21 sub-basins

Results explorer - Excel

1. Do you see a difference a trend between the different RCPs and between the different years? Are all sub-basins showing the same trend?
2. Tell about the change. Are some months more affected? Is the rainy season getting dryer/wetter/warmer …. What happen to the dry season
3. Are the different GCM telling the same story?
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