

LUCCi Climate Data: Availability, Reliability, Usage

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Long-term regional climate projections

Population Growth, Economic Development & Technological Progress



Emission Scenarios
Greenhouse Gas Concentrations



Global Climate Models



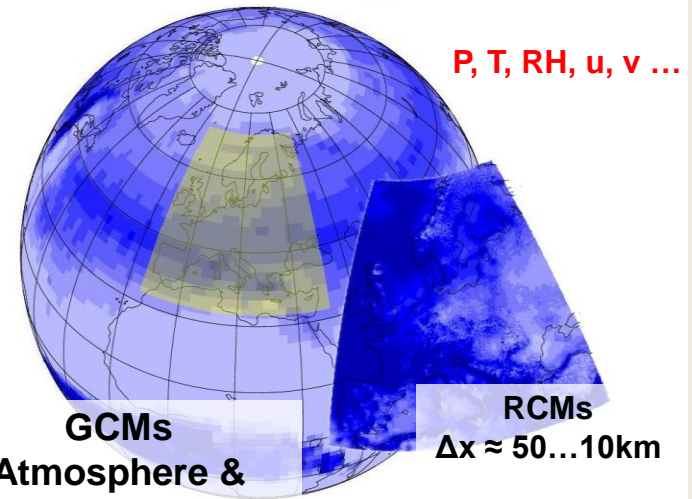
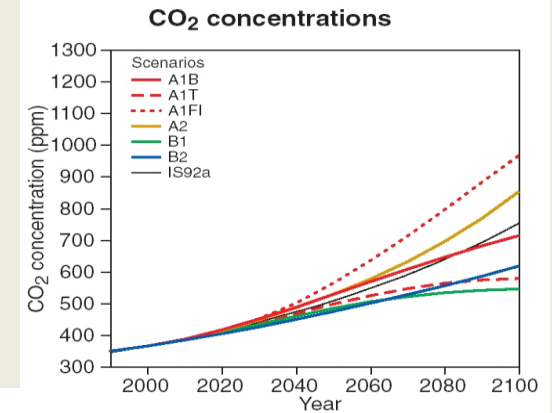
Global Climate Scenarios



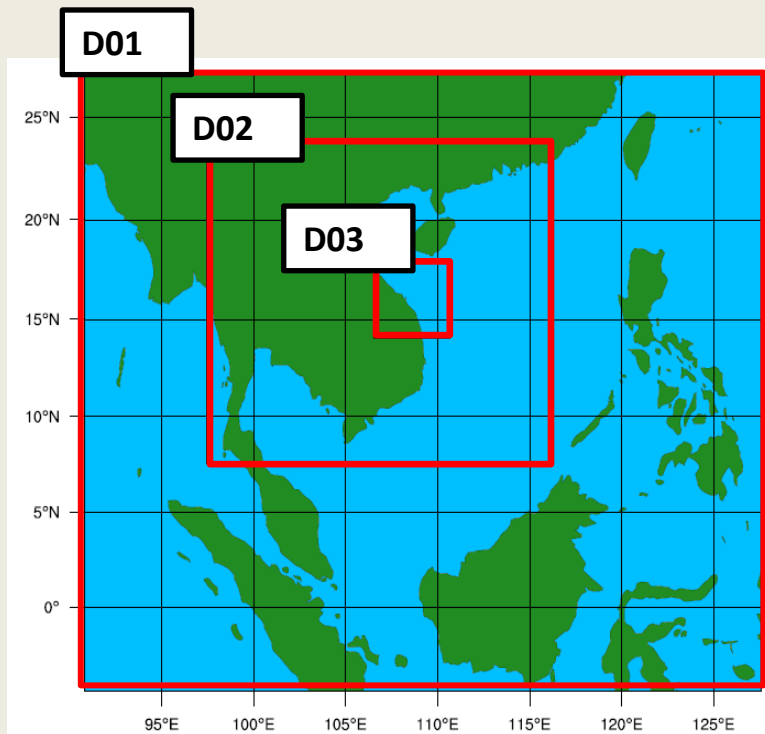
Downscaling Methods



Regional Climate Scenarios



LUCCi: Downscaling setup



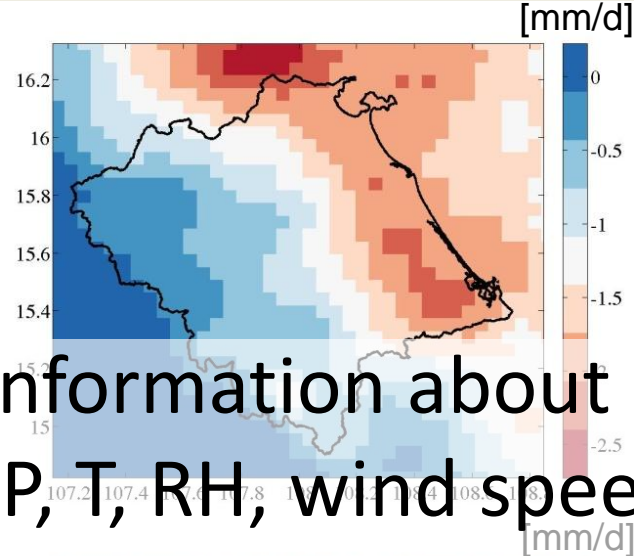
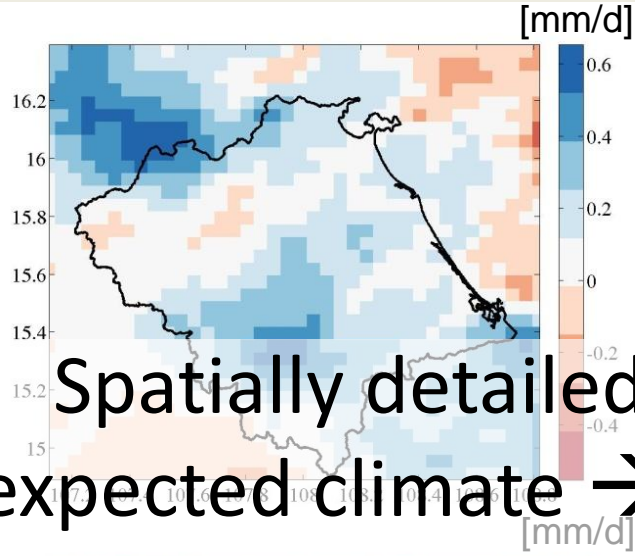
- **Domain 1**
 - horizontal: 99 x 99 grid points with a resolution of **45 km**
 - vertical: 50 layers up to 50 hPa
 - time step: 180 s
- **Domain 2**
 - horizontal: 142 x 145 grid points with a resolution of **15 km**
 - vertical: 50 layers up to 50 hPa
 - time step: 120 s
- **Domain 3**
 - horizontal: 66 x 75 grid points with a resolution of **5 km**
 - vertical: 50 layers up to 5000 Pa
 - time step: 30 s

VGTB: Expected rainfall change

2001-2030

2021-2050

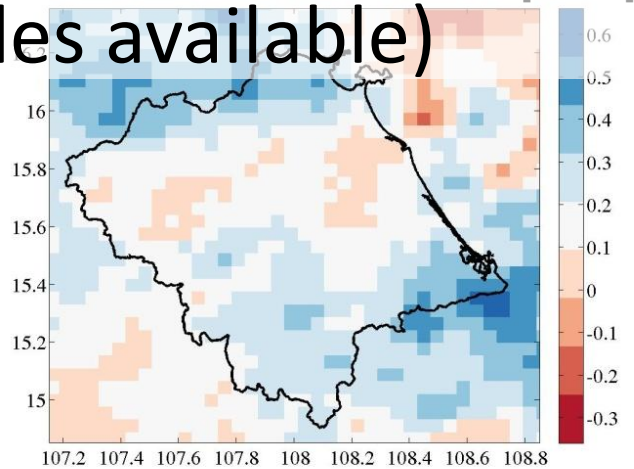
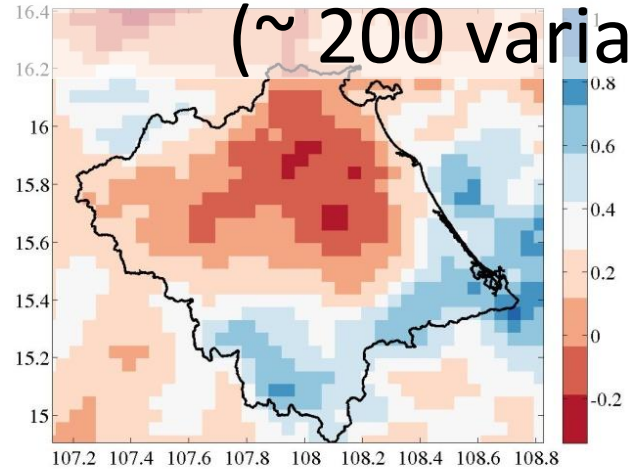
A1b



Spatially detailed information about expected climate → P, T, RH, wind speed

(~ 200 variables available)

B1

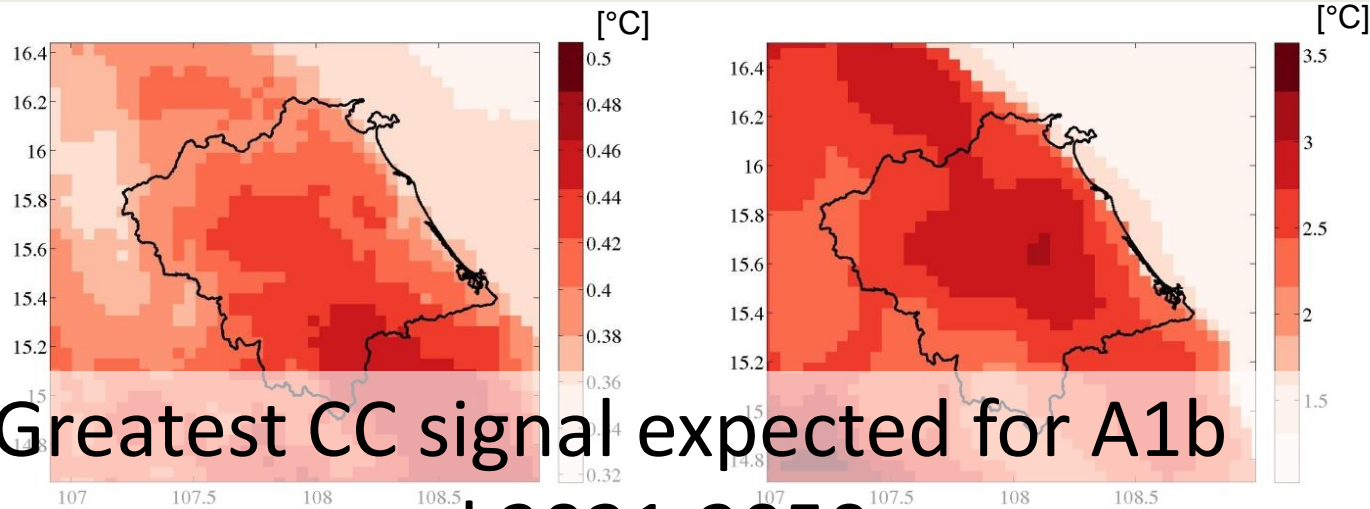


VGTB: Expected temperature change

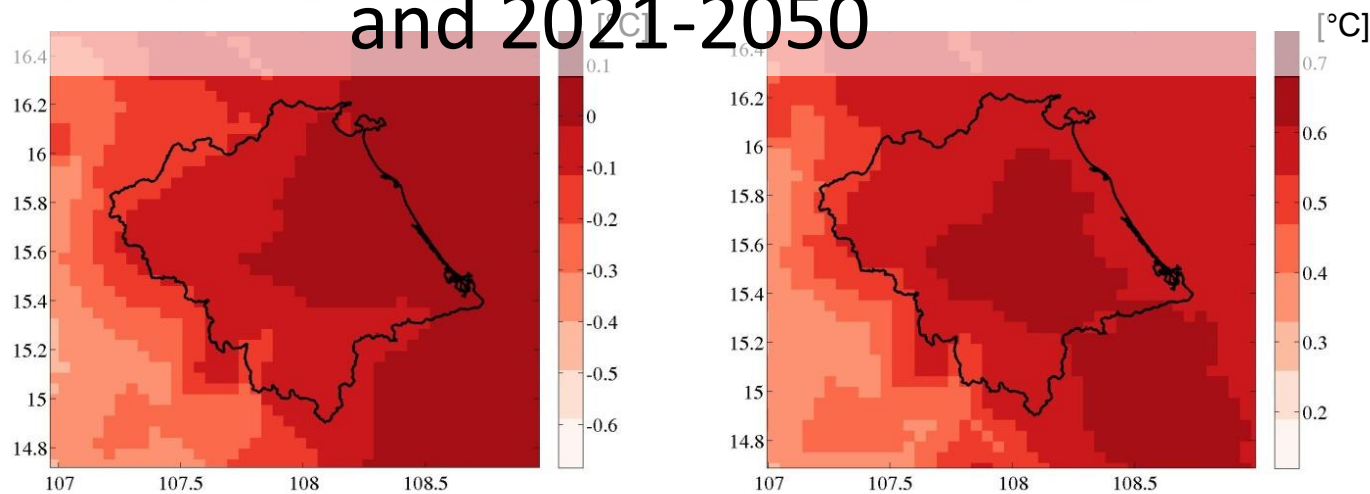
2001-2030

2021-2050

A1b



B1



Availability & access of climate data



Climate data products (~ 25 TB of raw data, 6(1) h resolution):

- Downscaled **ERA40 Reanalysis** (WRF-ERA40) for the period 1971-2000
- Downscaled **ECHAM5 control run** (WRF-EH5-CTRL) for 1971-2000
- Downscaled **ECHAM5 A1B future projections** (WRF-EH5-A1B) for 2001-2050
- Downscaled **ECHAM5 B1 future projection** (WRF-EH5-B1) 2001-2050

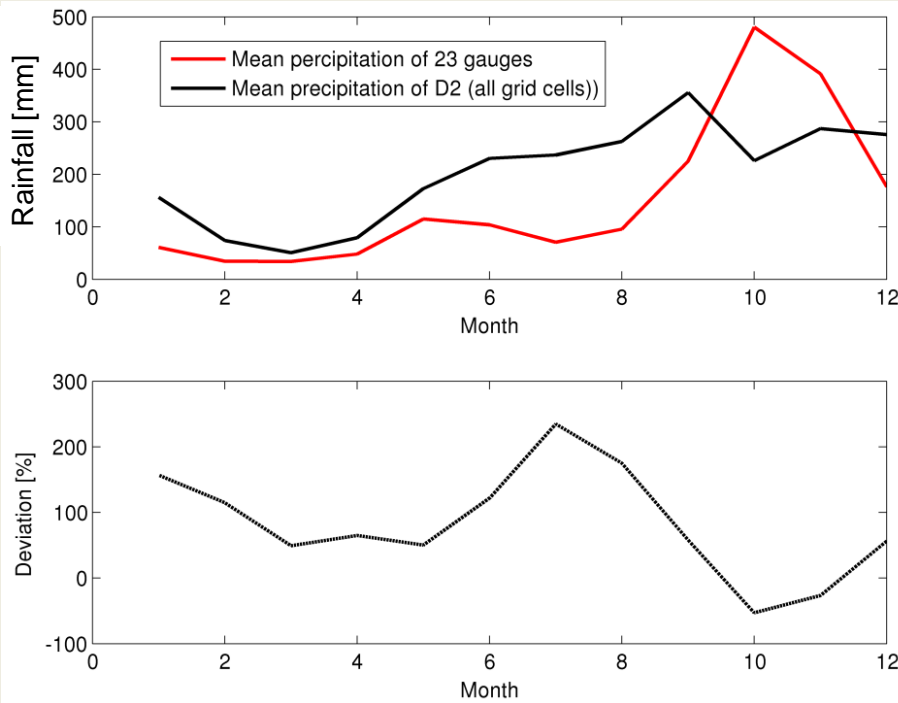
How to obtain:

- **RBIS database (Jena):** Common surface variables as **time series** (no fields) at location of observation stations (**few MB of surface variables**):
<http://www.lucci-vietnam.info/database>
- **Fields (netcdf, user specific format)** can be obtained on request (ask Jena group): e.g. [cluster@jupiter.geogr.uni-jena.de:~/lucci/](mailto:cluster@jupiter.geogr.uni-jena.de) (**few GB of surface variables**)
- **Full set of data at KIT/IMK-IFU (Tape archive)**

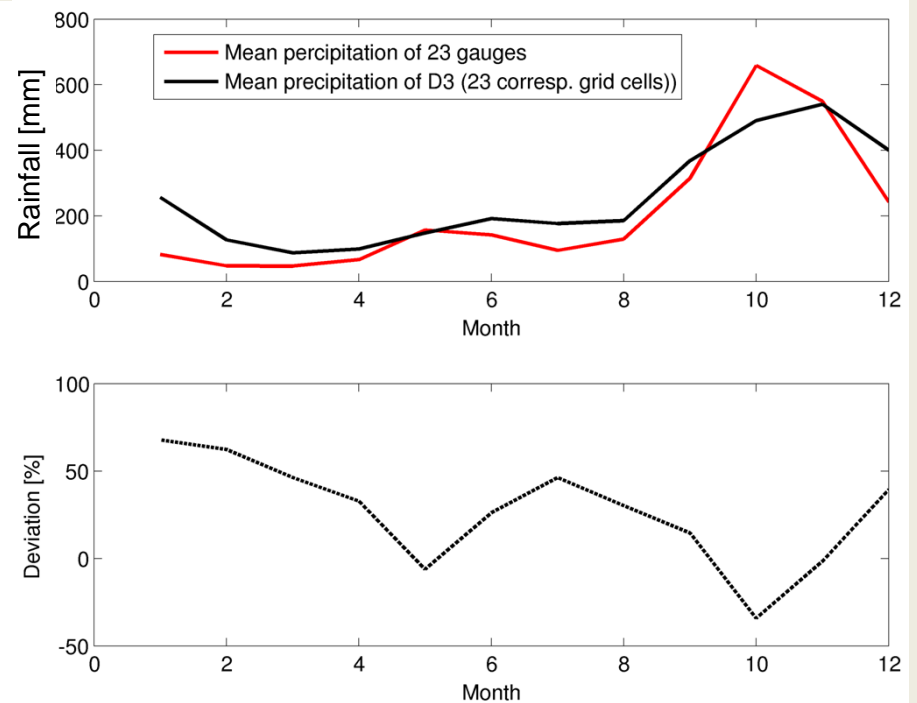
Performance gain of downscaling



D2 @ 15 km

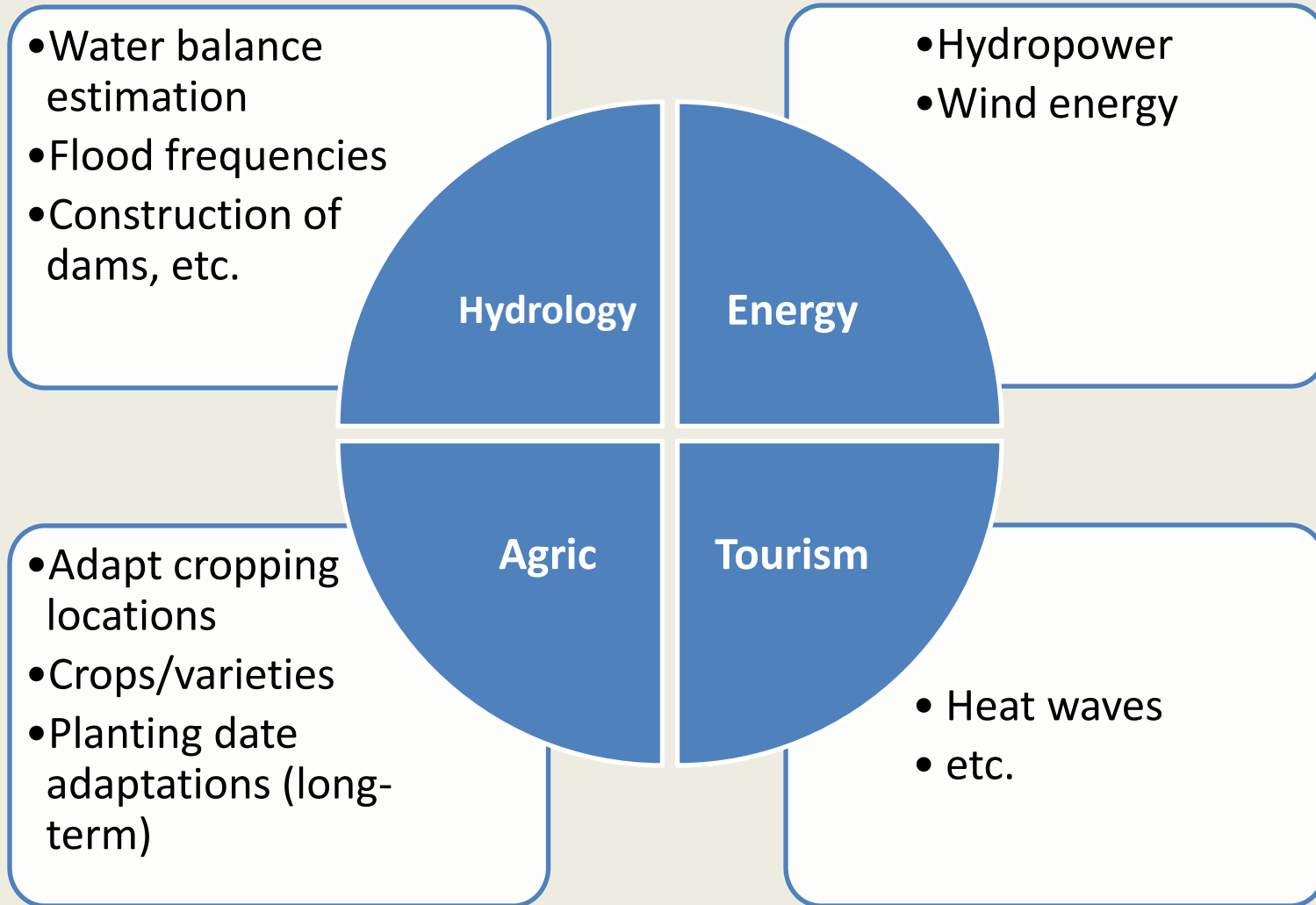


D3 @ 5 km



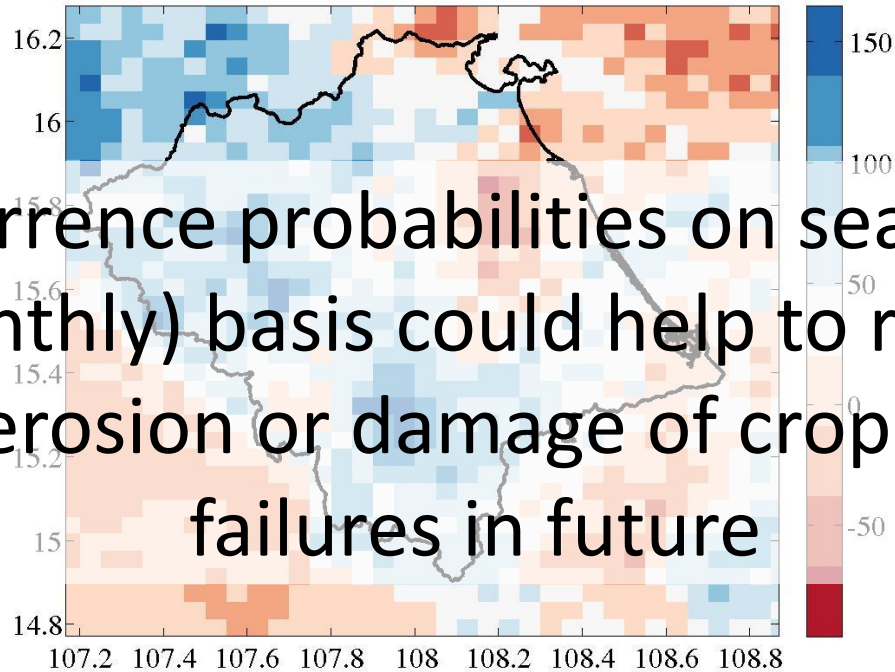
- D2: Seasonality not well captured, high deviations from observations
- D3: Improved seasonality, acceptable deviations

Potential applications of climate data



Agriculture: Erosive Rains

Occurrence probabilities on seasonal (monthly) basis could help to reduce soil erosion or damage of crops/crop failures in future

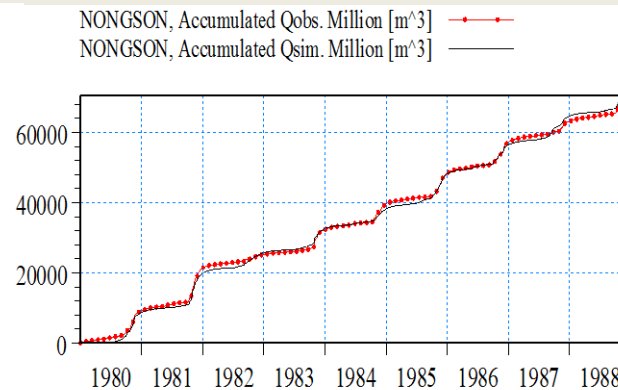
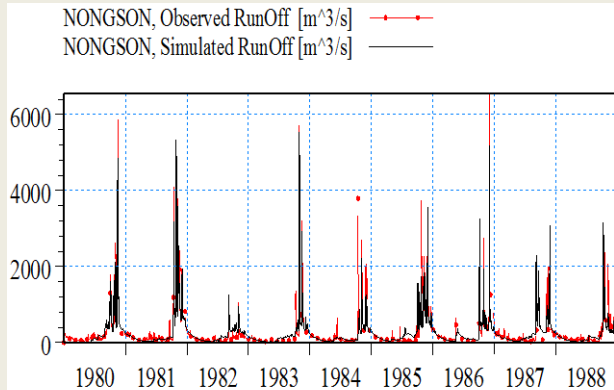


Expected changes in number of harmful rain events (precip > 20 mm) during 2001-2030 (A1b)

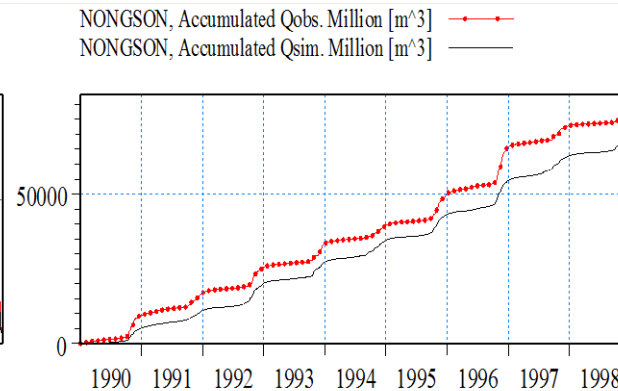
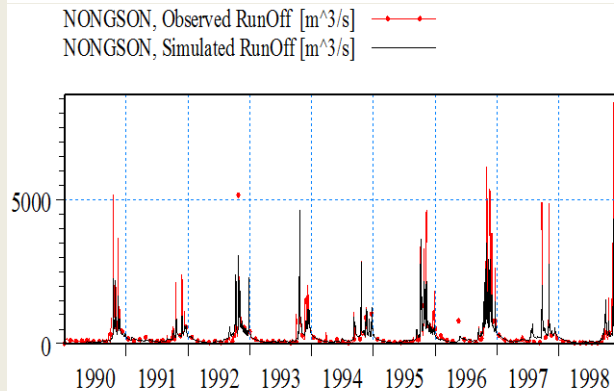
Hydrology: River discharge

Daily Discharge

Cumulated Discharge



D3 (5 km)



D2 (15 km)

Take Home



- WRF long-term climate simulations (T, P, Rad, RH, etc.) finished and **ready to be used** for impact studies: Data for model calibration and future climate projections available
- **WRF@D3** shows best performance if compared to local observation data: Recommended to be used **for CC impact studies in the VGTB**
- Specific **tailor-made information** (e.g. agricultural risk maps) can be delivered on request (Email me: patrick.laux@kit.edu)

Ongoing work



- **Statistical Downscaling for uncertainty estimation** of selected variables (T, P, etc.) coming from other GCMs and additional emission scenarios (next 6-12 months)
- **Impacts of land use change** on meteorological surface variables using updated LU maps in the climate simulations (PhD thesis of Nguyen Phuong, LUCCI)
- Identification of **optimized cultivation strategies** (rice, cash crop) and **sustainable water management strategies** in the VGTB river basin using coupled WaSim - Gams simulations (PhD thesis Dang Thinh, DAAD scholar)

... beyond LUCCI

- Improved **seasonal climate predictions** to assist farmers with cropping strategies (planting date, choice of crops/varieties, locations) → “more crop per drop”