Climate Change Scenarios for Jinsha River Basin

Summary

Scenarios describing expected climate change (CC) in the Jinsha river basin (JRB) are of critical importance to understand how CC affects the sustainable use of water resources and water-related extreme events such as floods and droughts. Multiple general circulation model (GCM) projections and two statistical downscaling methods (delta change and LARS weather generator) were used. A set of CC scenarios were elaborated covering the near future and the far future and two green-house gas emission scenarios (RCP 4.5 and RCP 8.5). Each CC scenario consists of daily values over 30 years for average temperature and precipitation on a grid with a resolution of 0.5° covering JRB.

For the southern part of JRB a temperature rise of 1 – 2°C in the near future and 1.5 – 3°C (RCP 4.5) resp. 3 – 5 °C (RCP 8.5) in the far future are expected. Whereas the trend towards higher temperatures is unambiguous, the precipitation trend is more uncertain. Most CC scenarios show an increase in precipitation for the northern and middle part of JRB, whereas the change for the southern part of JRB is uncertain

Objective

- Selection of suitable GCMs for JRB
- Elaboration of CC scenarios for all selected GCMs, covering the near (2021-2050) and the far future (2070-2099) and two green-house gas emission scenarios.
- Investigate how CC affects expected future temperature and precipitation.

Approach

- Consider performance of GCMs for historical simulations, expected uncertainty and independence of GCMs to select suitable GCMs.
- Use of two statistical downscaling methods (delta change and LARS-WG) and the selected GCMs projection to elaborate high resolution CC scenarios.
- Application of statistical methods to analyze future climate change (2021-2050 and 2070-2099).

Results and Outcomes

Data collection and sub-catchments

Meteorological data at 55 stations were collected and interpolated to a grid of 0.5*0.5°. To show aggregated results JRB was divided into four sub-catchments (Fig.1).

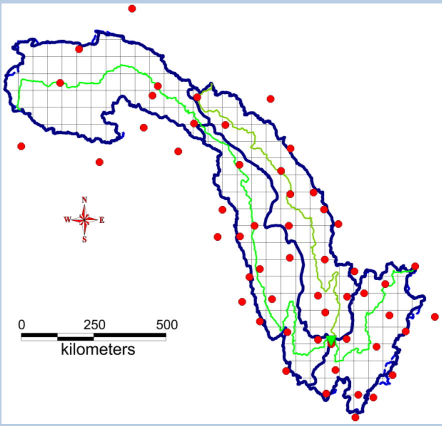

Fig. 1: Location of 55 meteorological stations and division of JRB into 4 sub-catchments

Selection of suitable GCMs

8 CC scenarios each for near (2021-250) and far future (2070-2099) as well as RCP 4.5 and 8.5 emission scenarios were selected based on 3 criteria:

- Performance of GCMs during the baseline period 1981 – 2010 (comparison of past simulations with measurements)
- Uncertainties of the selected GCMs (must be similar than that of all 36 CIMP5-GCMs)
- Independence of GCMs

GCM	Case 1: NF		Case 2: FF	Case 3: FF
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
ACCESS1-3			FF45-7	
BNU-ESM			FF45-5	FF85-5
CCSM4		NF-6		FF85-6
FGOALS-g2		NF-1	FF45-1	FF85-1
FIO-ESM	NF-7			FF85-7
GFDL-ESM2G	NF-8		FF45-8	
GISS-E2-H				FF85-8
HadGEM2-ES		NF-2	FF45-2	FF85-2
IPSL-CM5A-LR		NF-5	FF45-6	
IPSL-CM5B-LR		NF-3	FF45-3	FF85-3
MIROC5		NF-4	FF45-4	FF85-4

Fig. 2: Selected GCMs (NF/FF: near/far future)

Statistical downscaling

The daily gridded data for temperature and precipitation during the baseline (1981 – 2010), were downscaled using two statistical downscaling:

- Delta Change
- LARS-WG

Expected Climate Change

The expected CC changes for the RCP 8.5 emission scenario compared to the baseline (1981 – 2010) are shown in Fig. 3 for the dry and the wet season. The average changes are comparable with two downscaling methods, reflecting mainly the properties of GCMs.

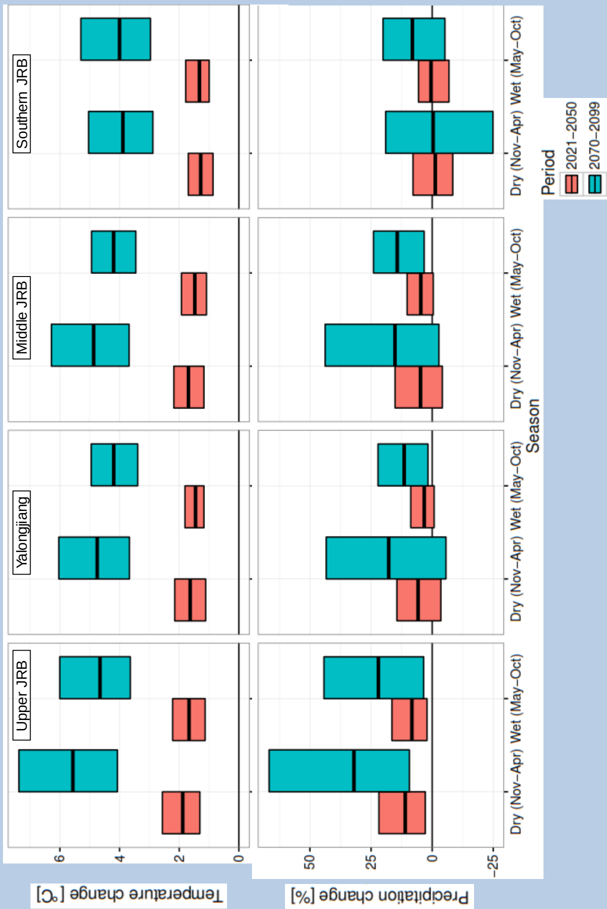

Fig. 3: Changes in temperature and precipitation for the RCP 8.5 emission scenario