



# Climate change impacts on hydrological regime and water resources management Kolubara & Toplica river basins

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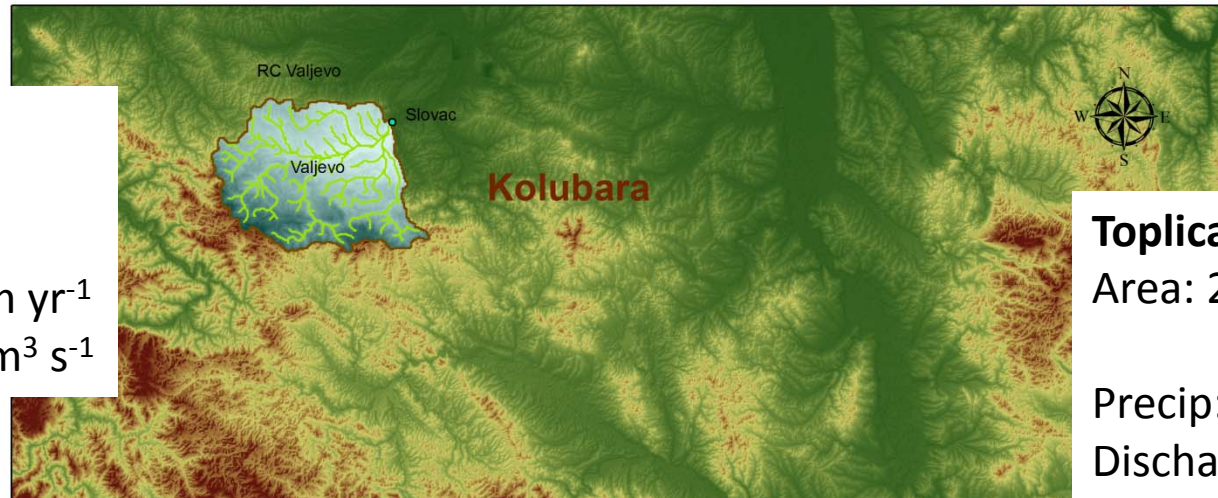
# Pilot Catchments

## Kolubara

Area: 991 km<sup>2</sup>

Precip: 836 mm yr<sup>-1</sup>

Discharge: 11 m<sup>3</sup> s<sup>-1</sup>

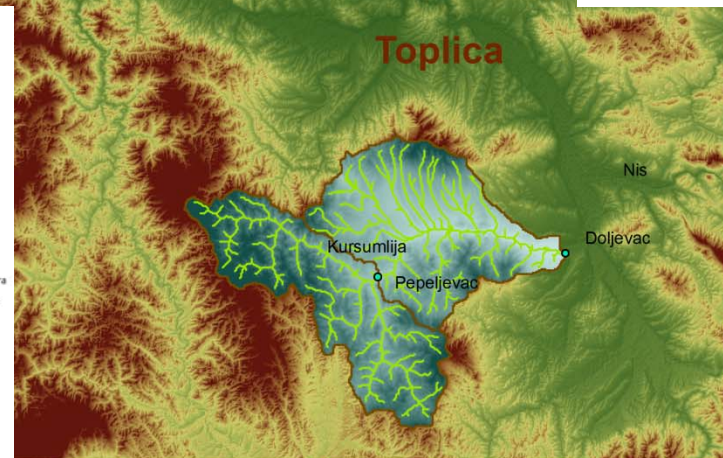


## Toplica

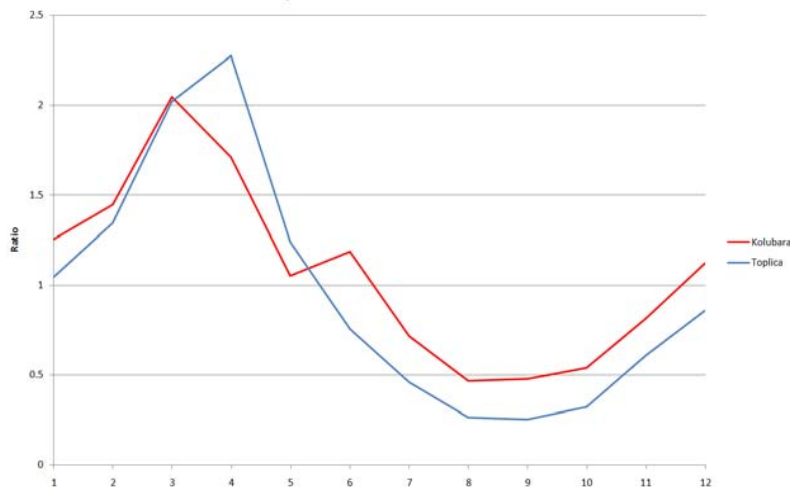
Area: 2231 km<sup>2</sup>

Precip: 508 mm yr<sup>-1</sup>

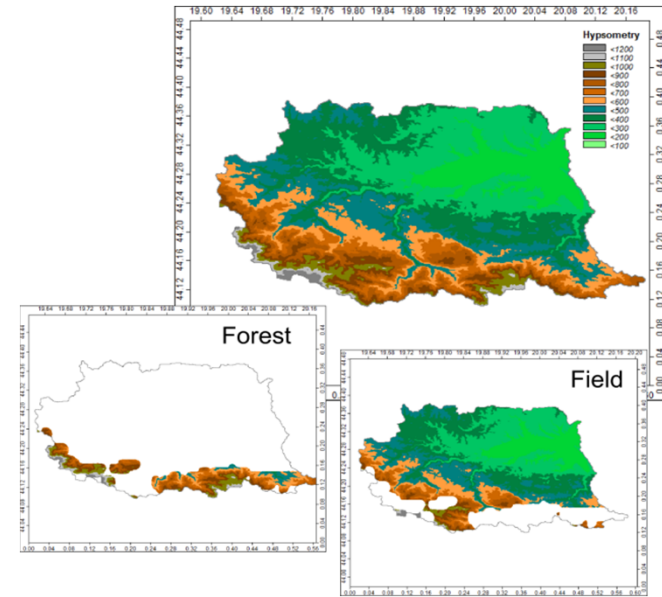
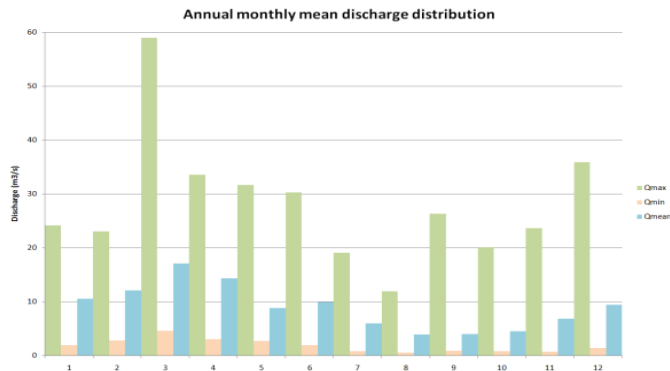
Discharge: 10.5 m<sup>3</sup> s<sup>-1</sup>



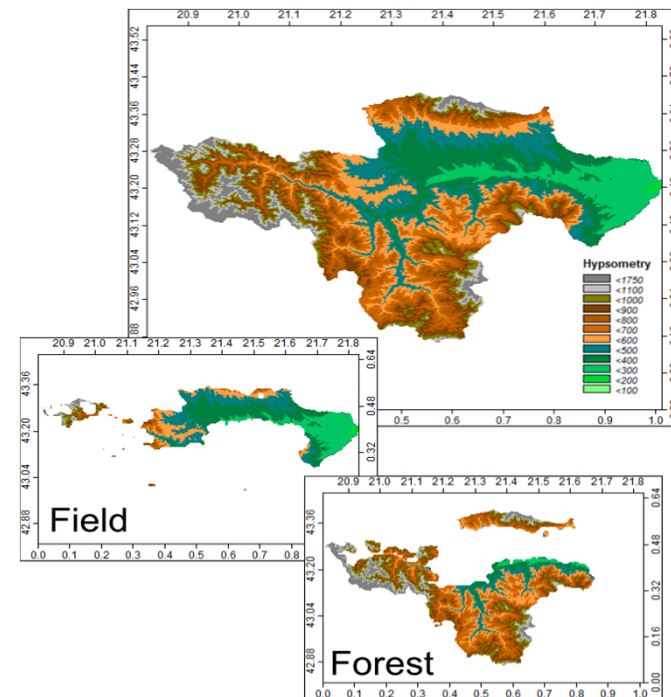
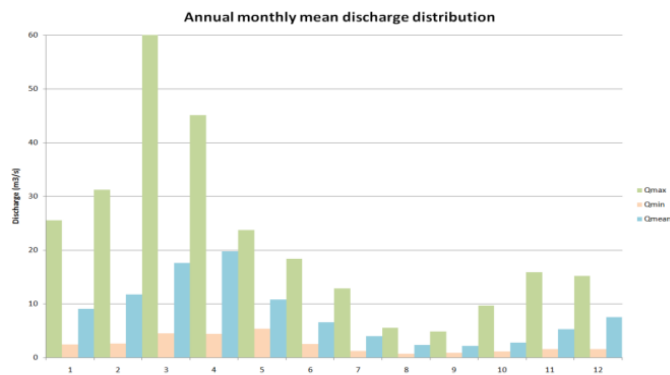
Mean Monthly Flow as a Ratio of Mean Annual Flow



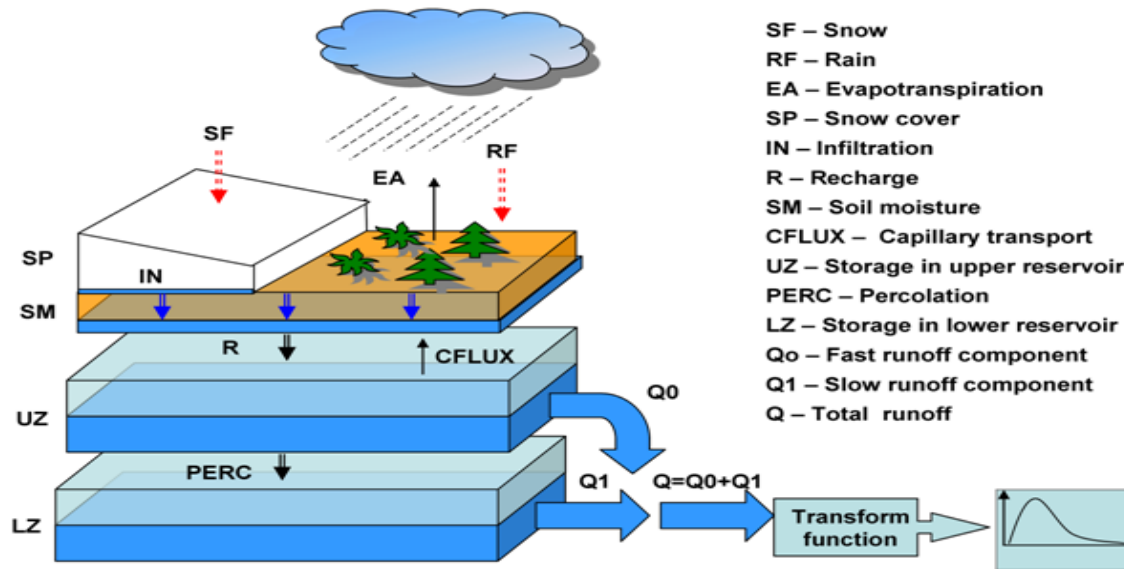
- Hydrological data- Slovak
- Meteorological data – Valjevo, RC Valjevo



- Hydrological data- Doljevac
- Meteorological data – Kuršumlija, Niš

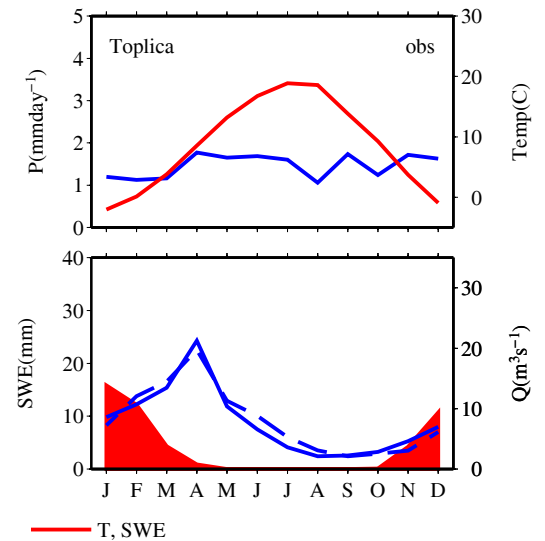
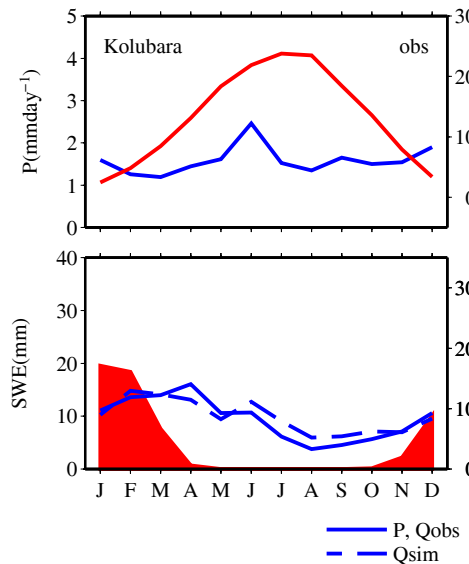


# Hydrological modeling: HBV model



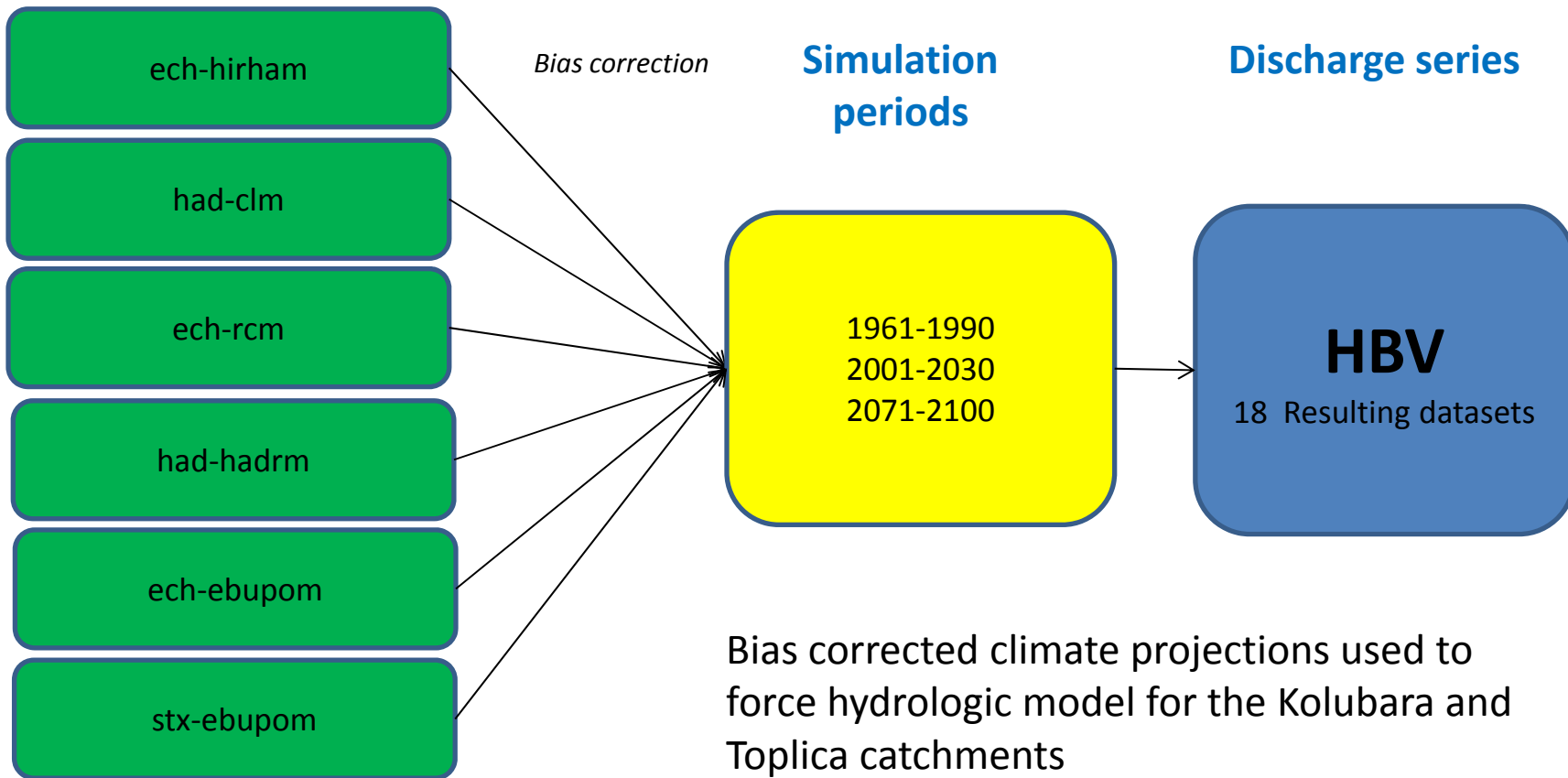
**HBV calibration**  
based on observed

- precipitation,
- temperature and discharge

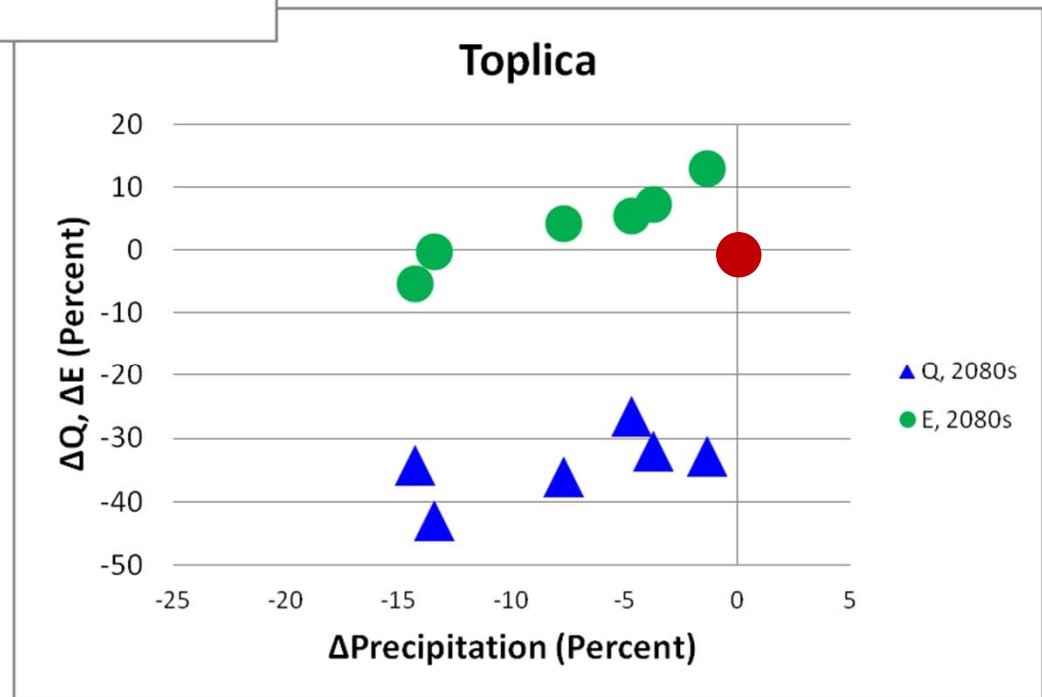
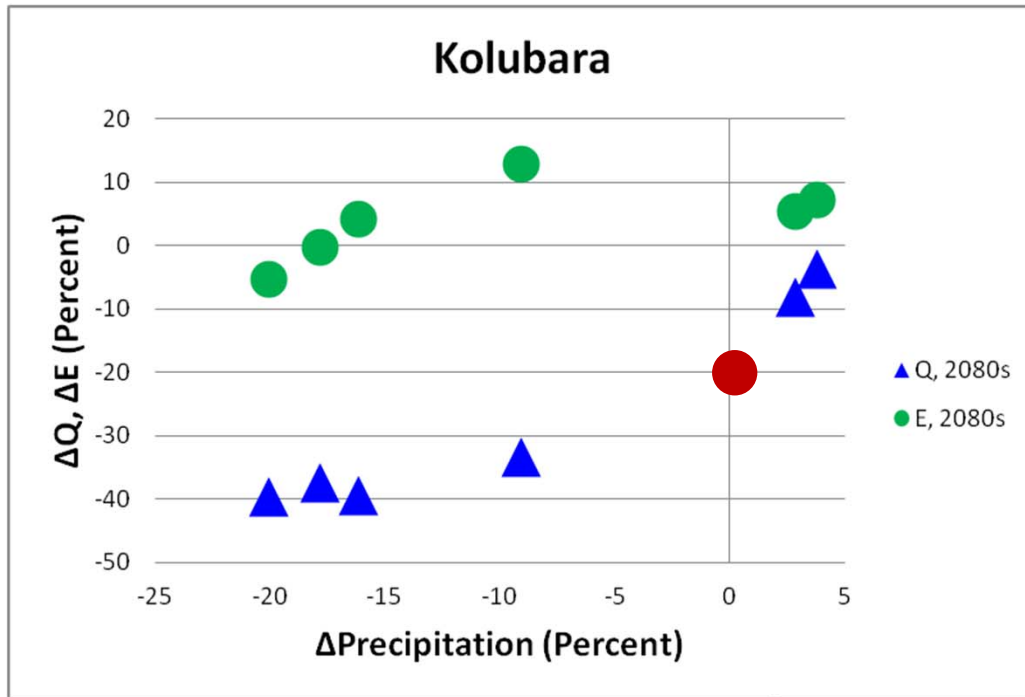


# Climate modeling

## Used GCM-RCM models

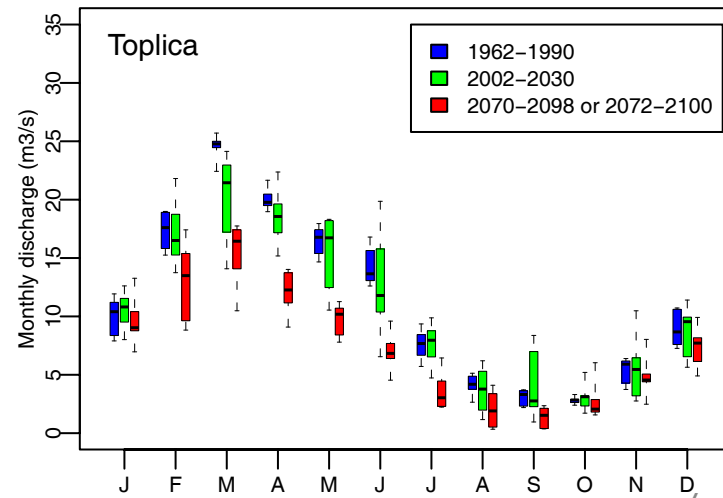
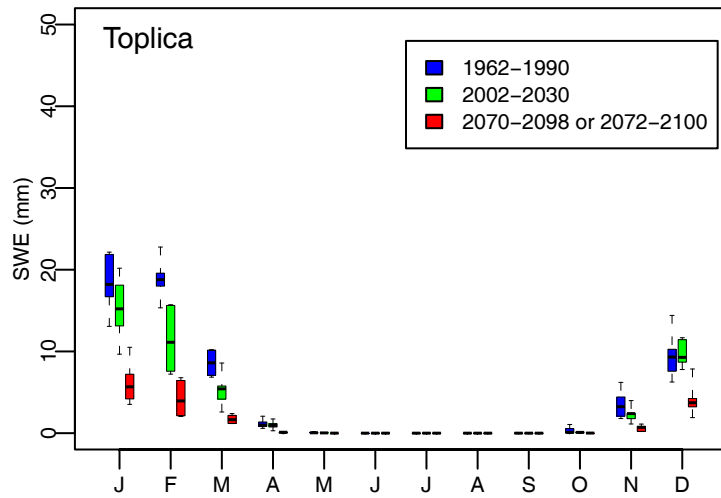
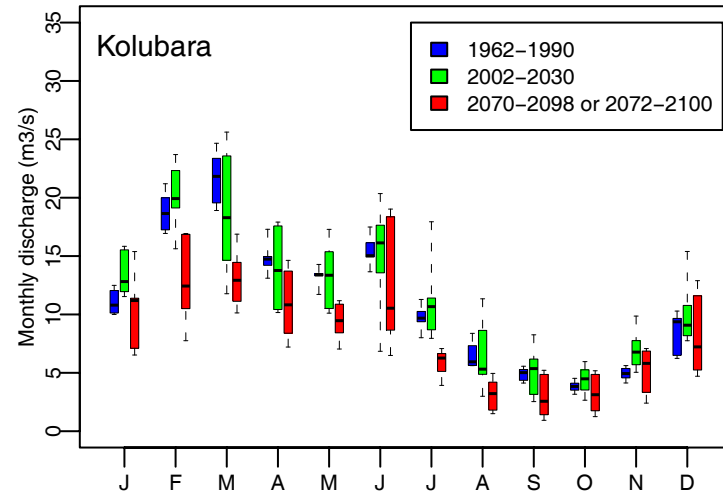
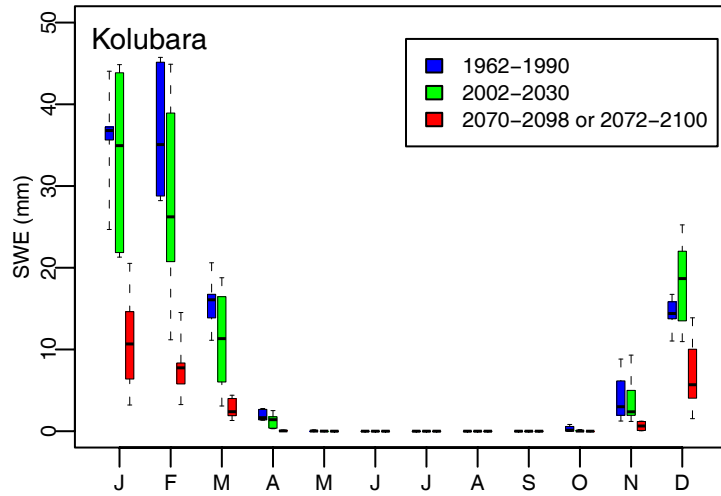


# Annual Water Balance



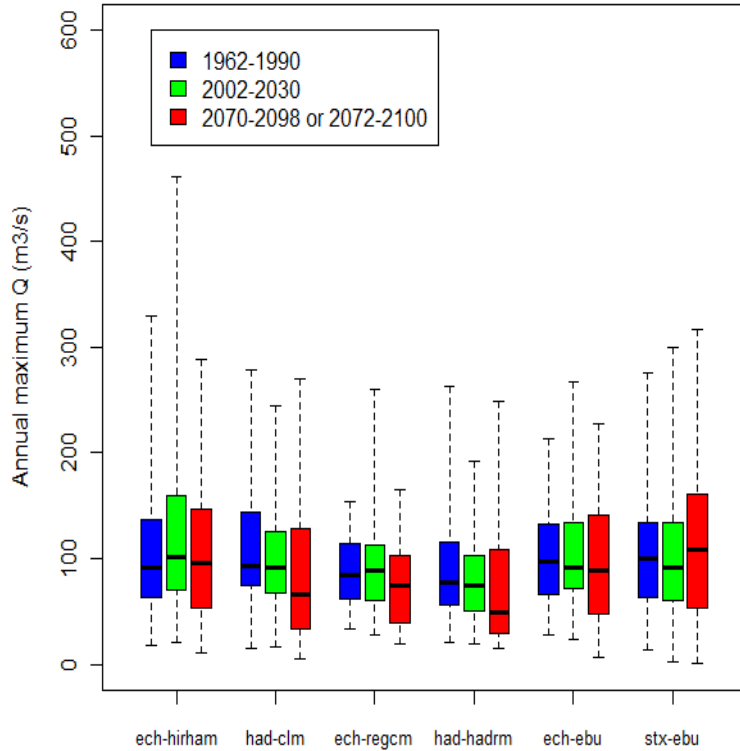
- Mean annual changes in water balance fluxes (compared to control period)
- Pronounced decrease in precipitation and runoff by the end of the century
- Evapotranspiration increases

# Snow & Runoff

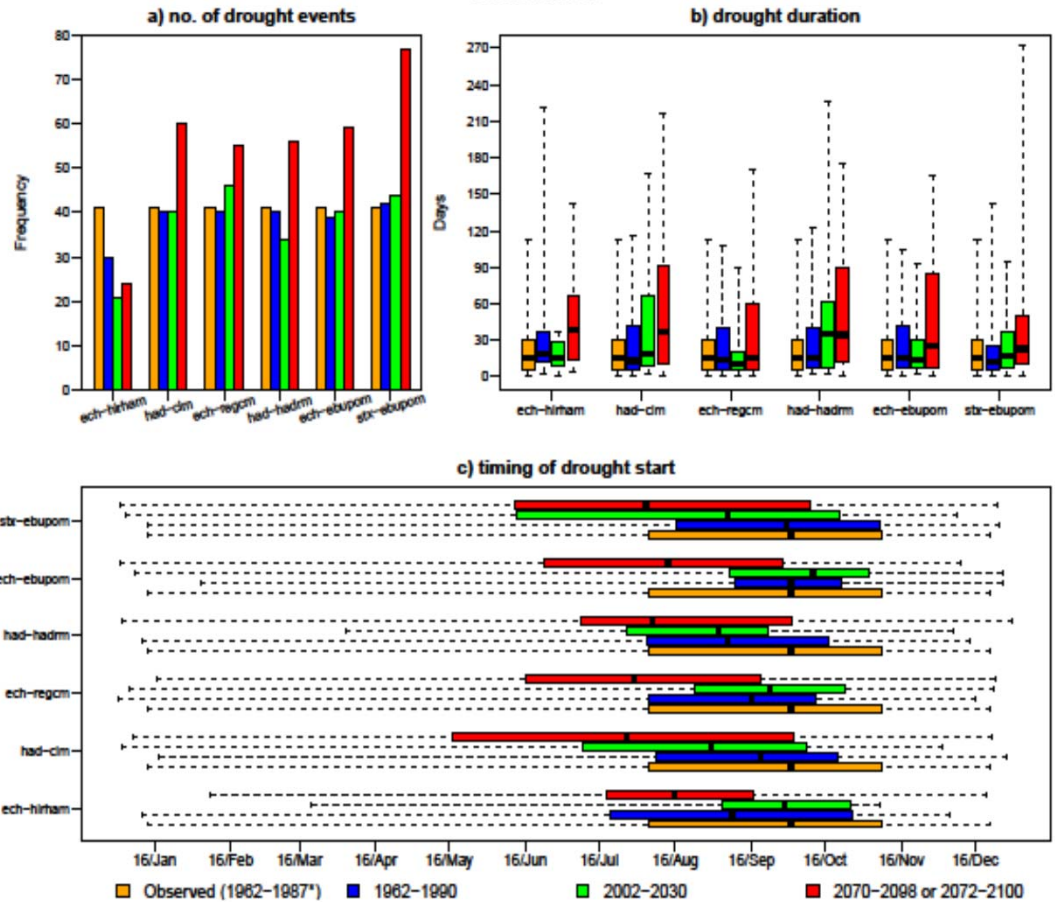


# Floods & Droughts

Toplica



Kolubara





# Conclusions and comments

- Annual water balance:
  - Annual runoff will most likely decrease by 30 to 40 percent by the end of the century
- Floods:
  - Little change or small reduction in median value by the end of the century
- Droughts:
  - Number of droughts will increase by the end of the century
  - Droughts will start earlier in the summer
  - Longer drought durations are expected
- The projected changes are a result of increased temperature and reduced precipitation (especially in summer). Increased evapotranspiration.
- The bias-correction method used may have an influence on the estimated changes
- Report: [http://webby.nve.no/publikasjoner/rapport/2013/rapport2013\\_62.pdf](http://webby.nve.no/publikasjoner/rapport/2013/rapport2013_62.pdf)