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Hydrologic response to climate change: A case from a high-mountain river basin

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Abstract

INTRODUCTION

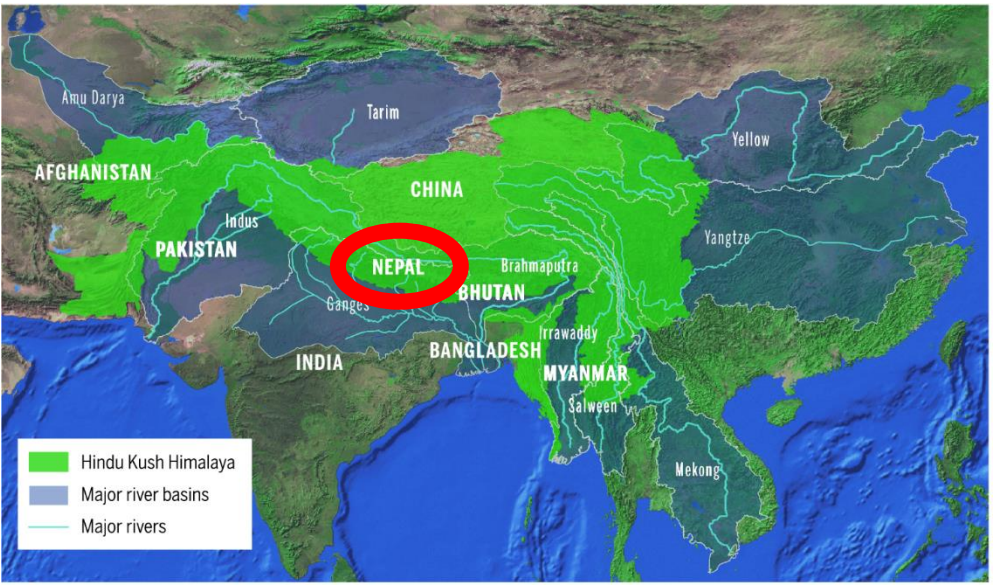
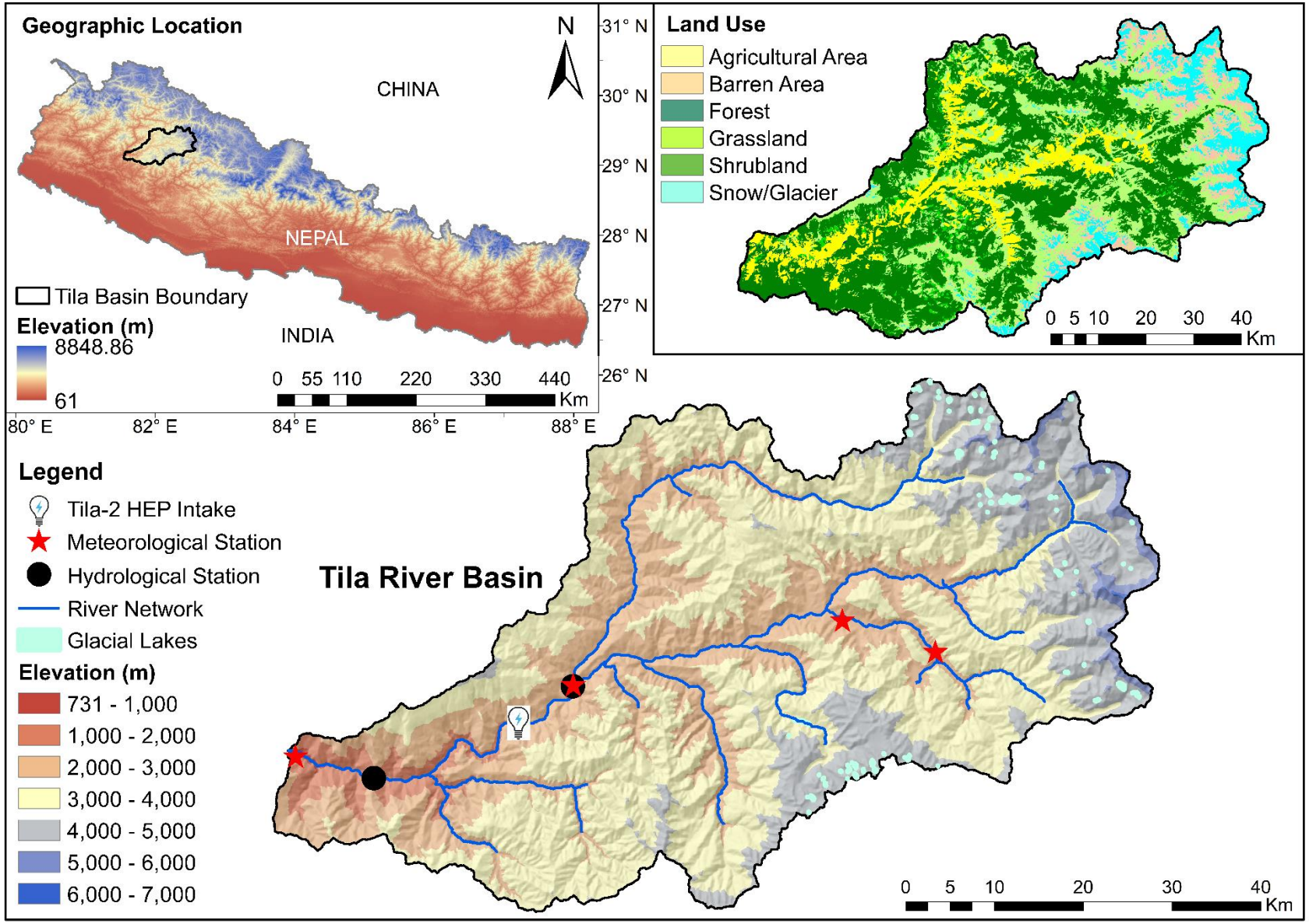


Figure: Hindu-Kush-Himalayan region (Source: *Sharma et al., 2019*)

STUDY AREA

Figure: Hindu-Kush-Himalayan region (Source: *Sharma et al., 2019*)



METHODOLOGY

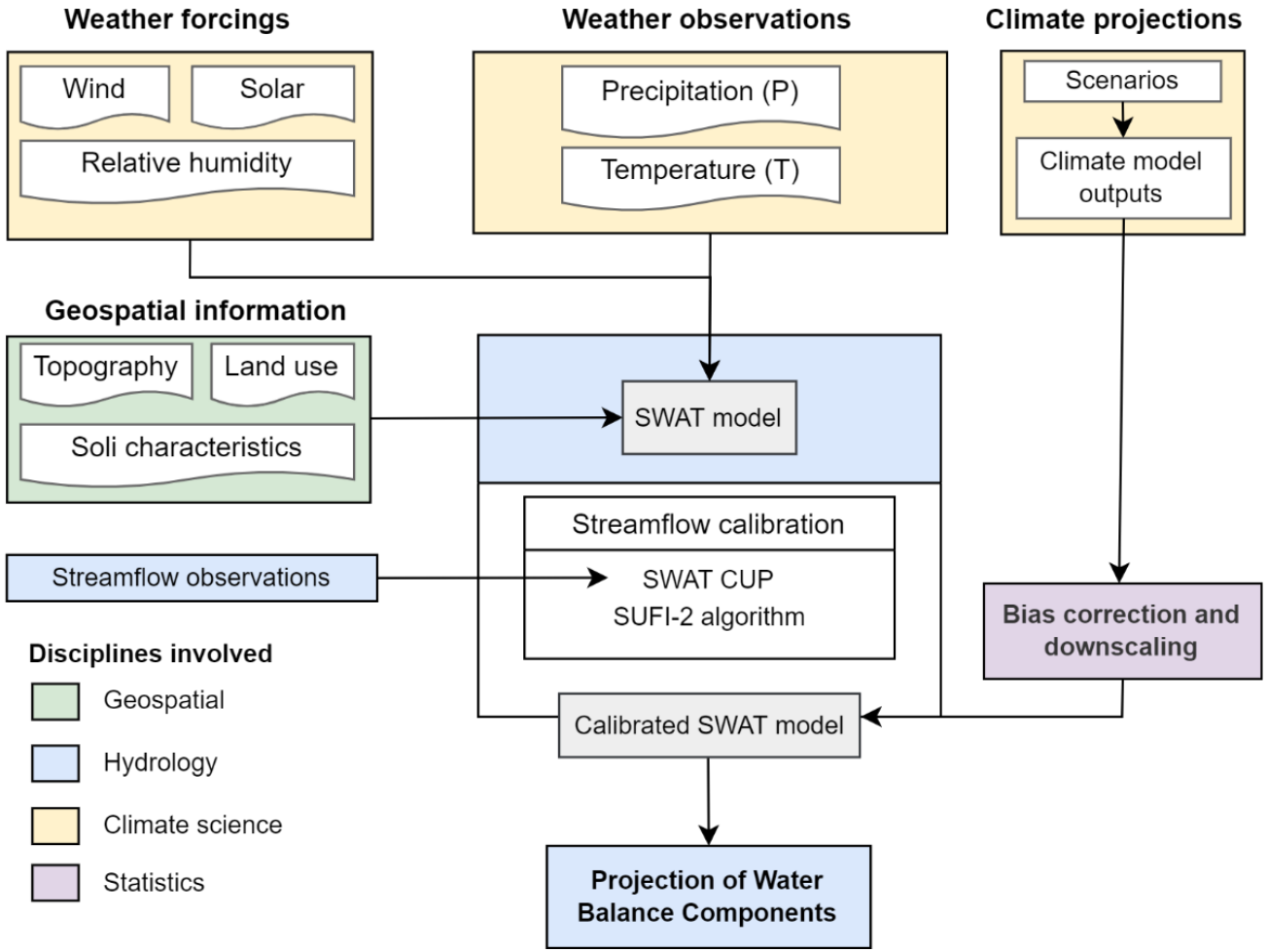
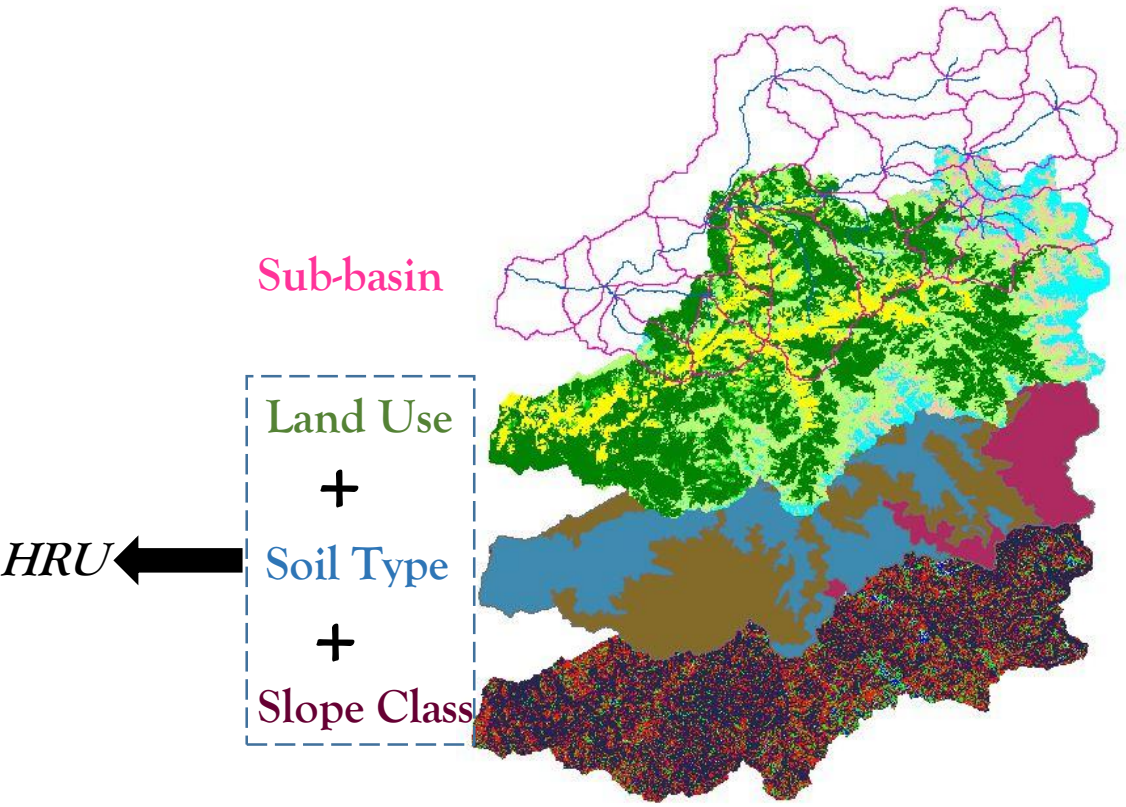


Figure: Overall methodological approach adopted in the study

SWAT Model



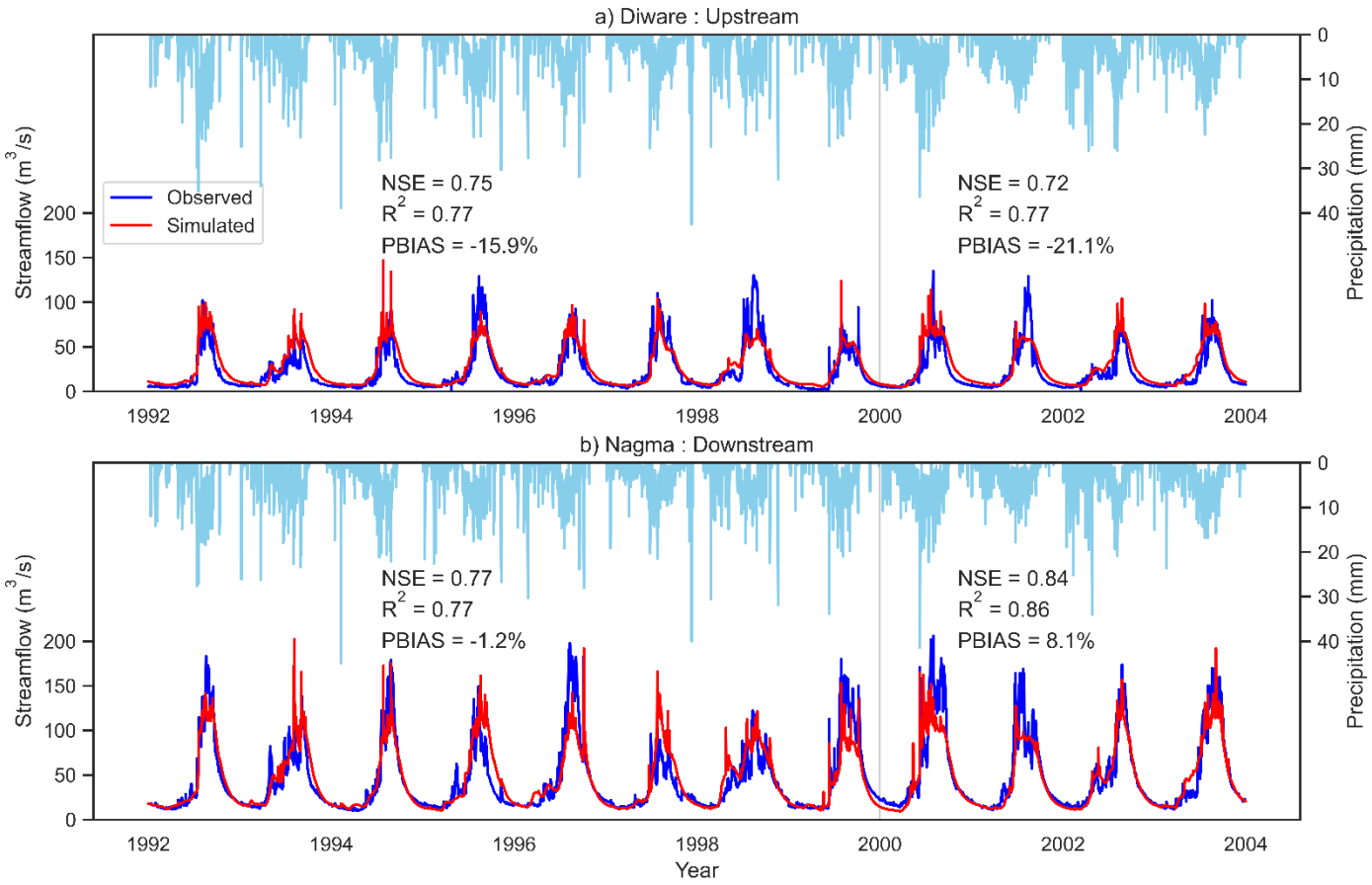


Figure: Comparison of observed and simulated daily streamflow hydrographs during calibration and validation periods at two hydrological stations (a) Diware (upstream) and (b) Nagma (downstream). The inverted bar shows precipitation.

Spatio-temporal variability of Water Balance Components

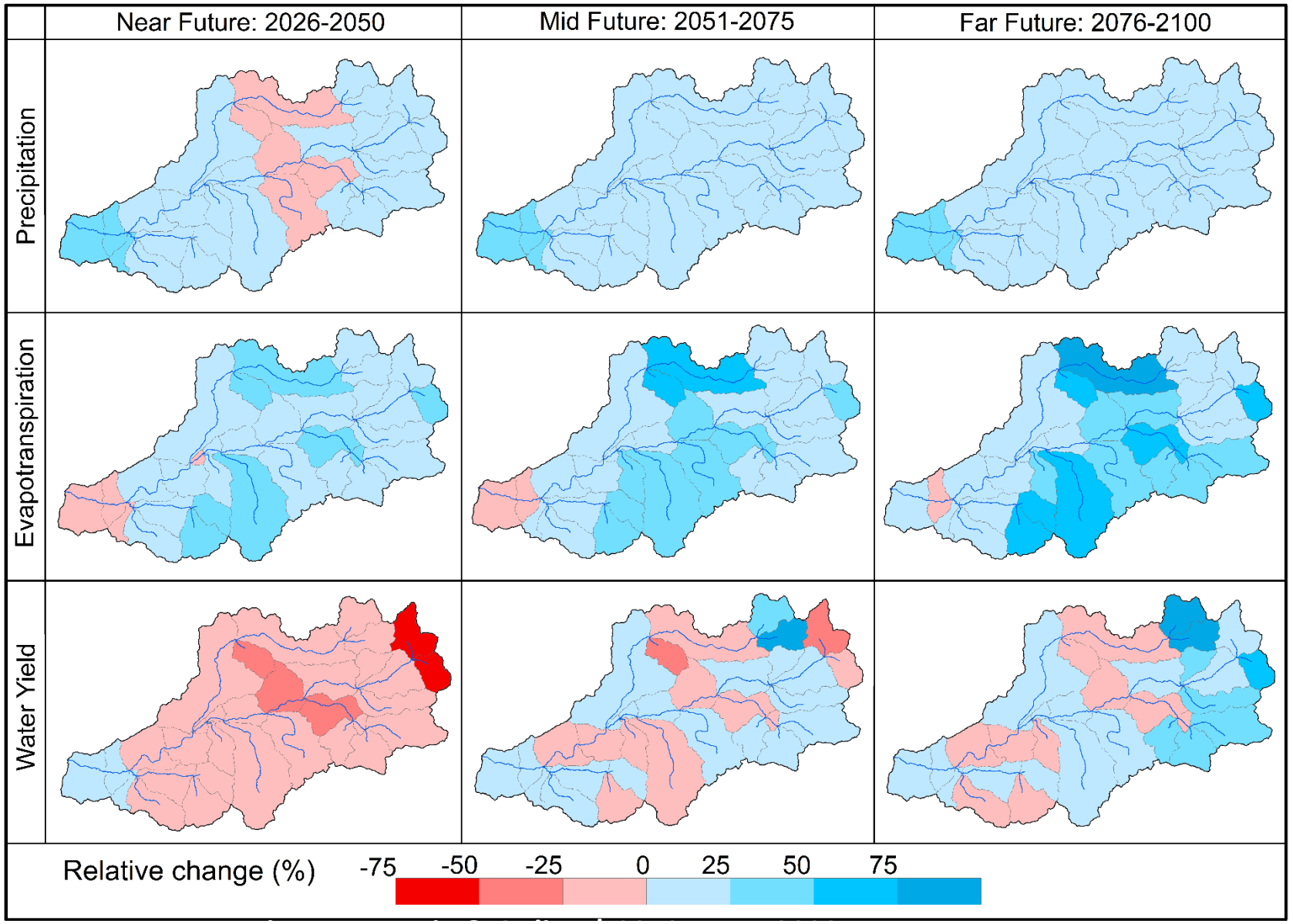


Figure: Relative changes in the annual values with respect to baseline period under SSP **245** scenario

Spatio-temporal variability of Water Balance Components

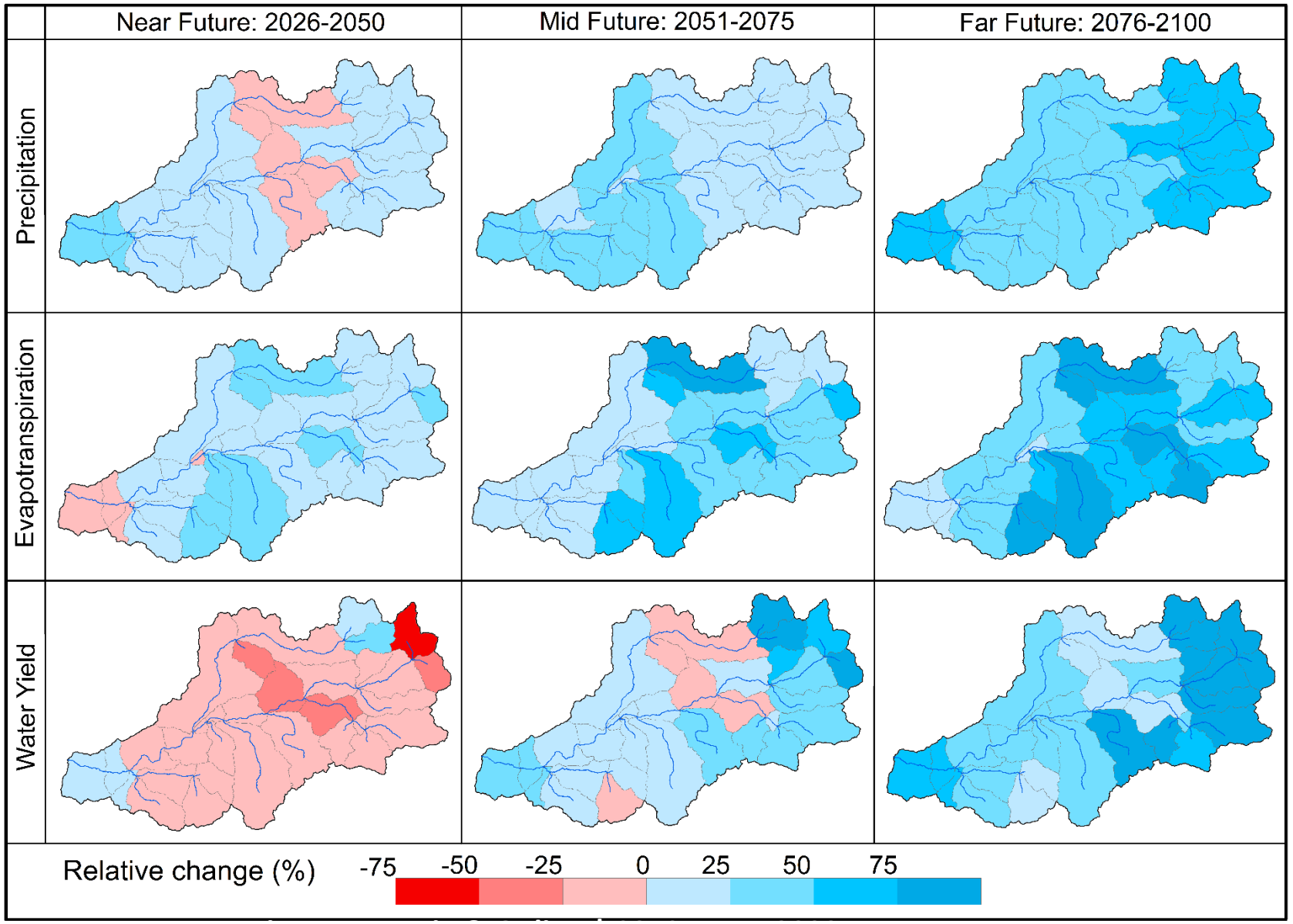


Figure: Relative changes in the annual values with respect to baseline period under SSP 585 scenario

Streamflow Projection

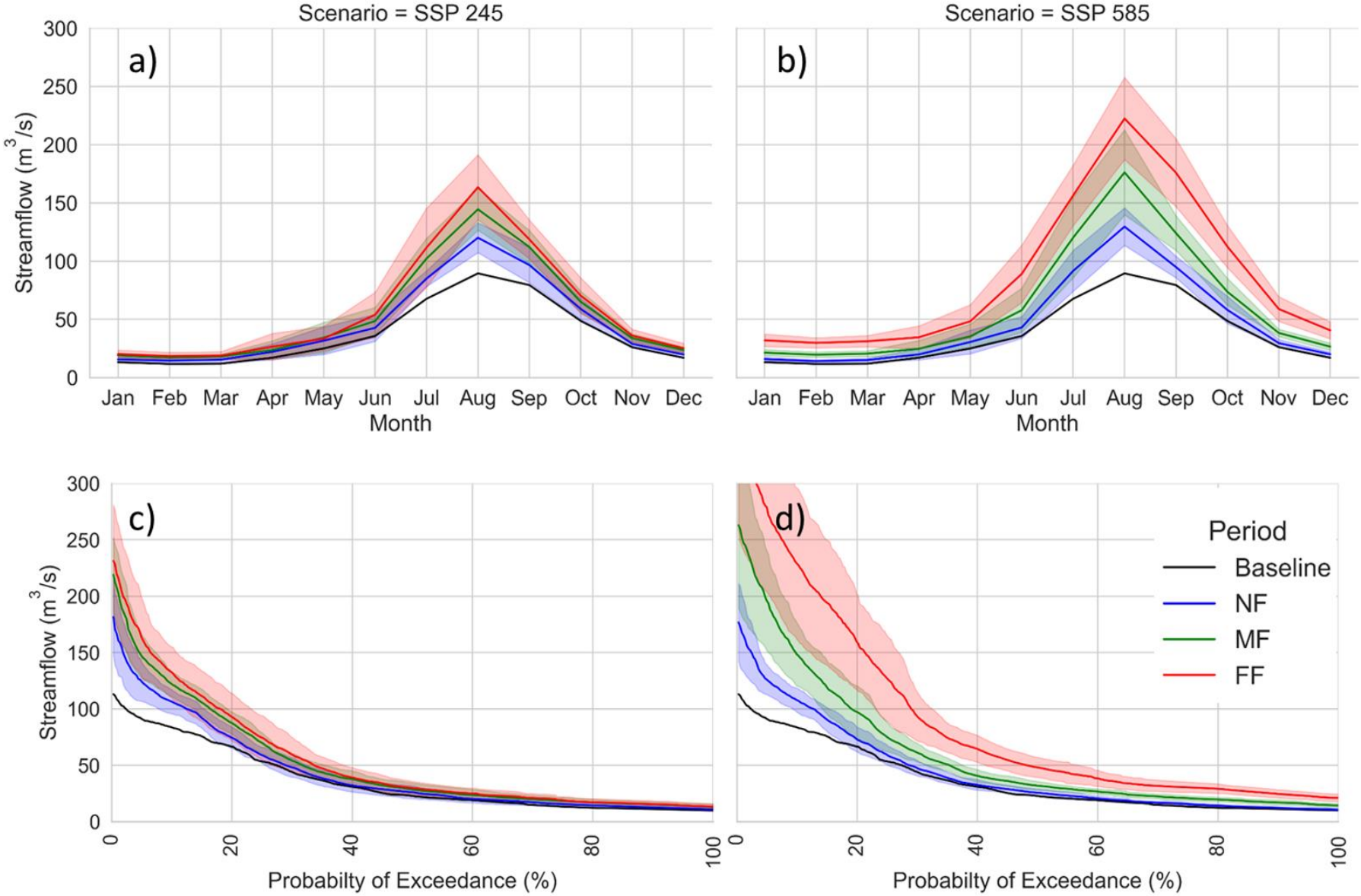


Figure a-b) Reference mean monthly streamflow (baseline) and projected mean monthly streamflow for the near, mid, and far future **c-d)** flow duration curves showing streamflow at a different probability of exceedance.

CONCLUSION

- Climate change can have a substantial impact on the hydroclimatic processes over the study basin, especially in the snow and glacier dominant higher altitude region.
- Annual precipitation and evapotranspiration across the basin show a gradually increasing trend with increments up to 51.2% and 44.4%, respectively, by the end of the century. Water yield is projected to decrease up to 9.2% during the near future but increase in later periods.
- Both high and low flows are expected to increase across all time scales.
- Severity of climate change impact is higher towards the end of century and under SSP 585 scenario.

REFERENCES

- Mishra, V., Bhatia, U., and Tiwari, A. D. (2020). "Bias-corrected climate projections for South Asia from Coupled Model Intercomparison Project-6." Scientific Data, Springer US, 7(1), 1–13.
- Sharma, E., Molden, D., Rahman, A., Khatiwada, Y. R., Zhang, L., Singh, S. P., Wester, P. (2019). Introduction to the Hindu Kush Himalaya Assessment. The Hindu Kush Himalaya Assessment, 1–16.doi:10.1007/978-3-319-92288-1_1

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- Department of Hydrology and Meteorology (DHM), Nepal
- Mishra et al. (2020) for sharing the bias-corrected CMIP6 data for South Asia, including Nepal.

THANK YOU

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Future Climate Scenarios

- We further downscale and bias-correct the retrieved data from *Mishra et al. (2020)* relative to monthly climatic data at each meteorological location, using a linear scaling method

GCM – CMIP6
ACCESS-CM2
ACCESS-ESM1-5
EC-Earth3
EC-Earth3-Veg
MPI-ESM1-2HR
MRI-ESM2-0

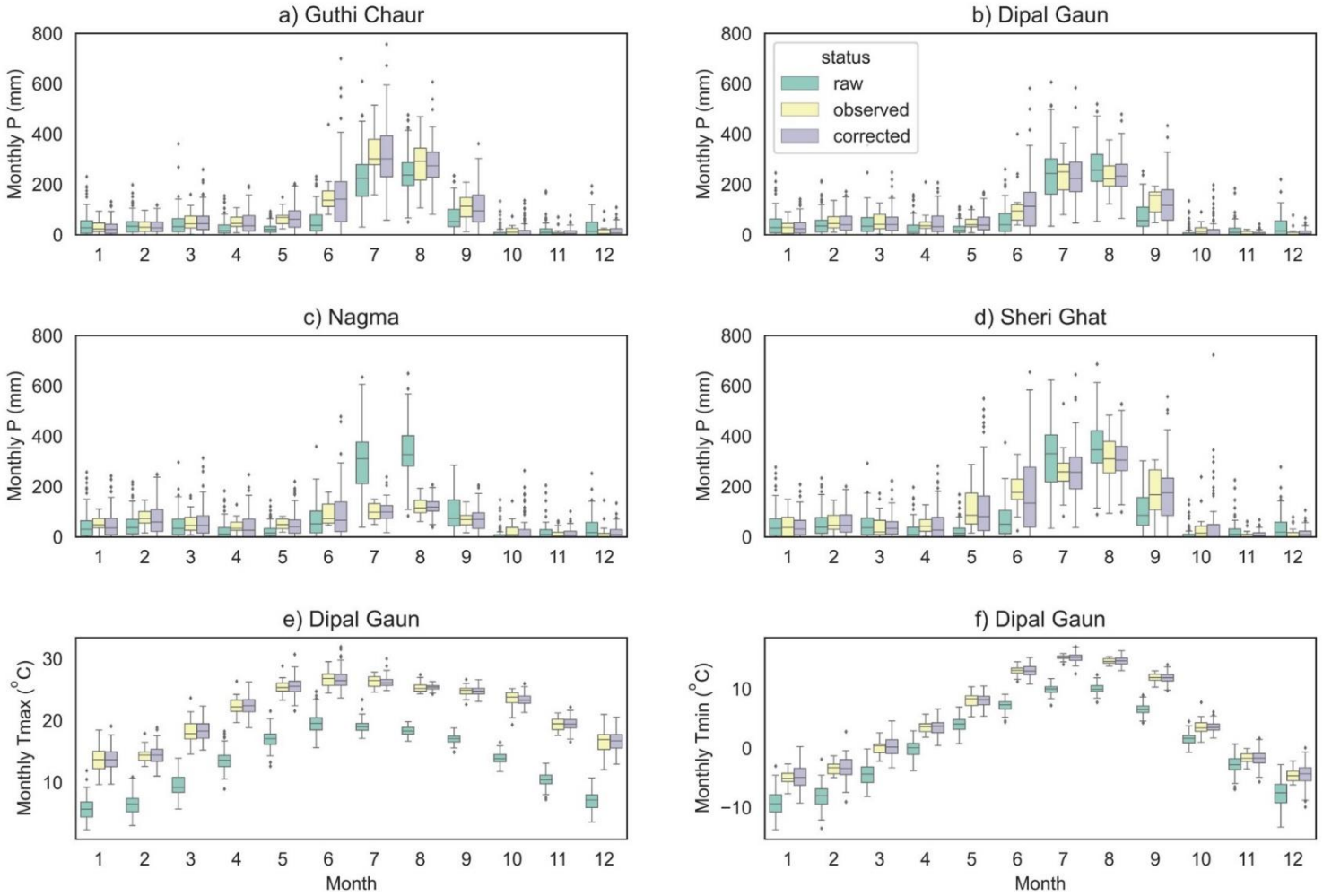

Figure: Comparison of observed monthly precipitation (a-d) and monthly temperature (e-f) with climate models retrieved from Mishra et al. (2020), i.e., raw and bias-corrected during the historical period at four precipitation stations and a temperature station across the Tila River basin. The box plot shows quantiles (Q1 and Q3), median (Q2), and range of variation.

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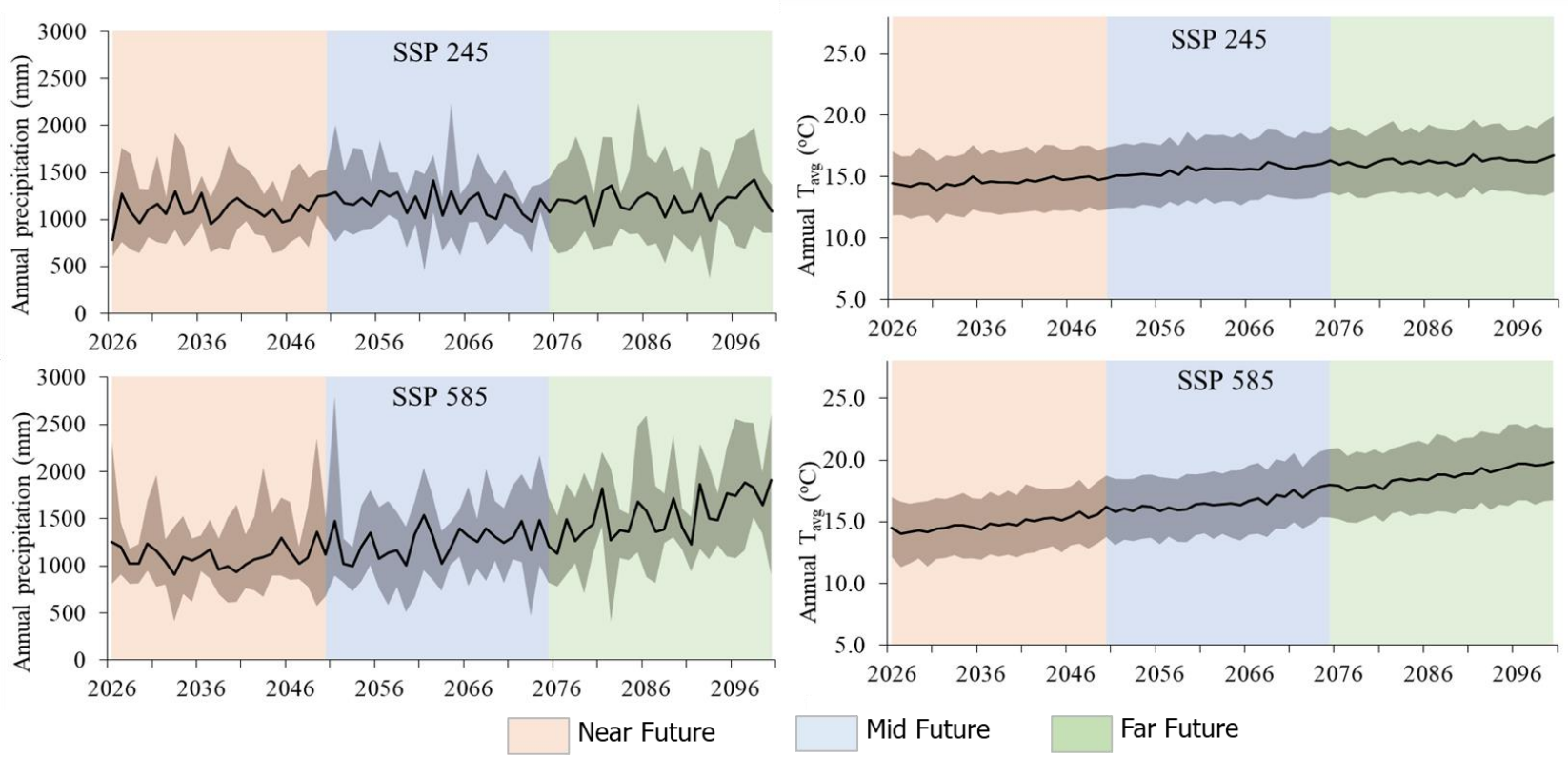

Figure: GCMs projection of annual precipitation and average temperature at Dipal Gaun (Station 310). The spread represents inter-model variability of the selected climate models, and the line represents the ensemble mean of the selected climate models.