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Flood prediction in ungauged basins with machine learning and satellite precipitation data

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Global hydrologic climate assessments posit increasing flood risk. Hydrologic forecasting is critical in both gauged and ungauged basins having implications not only for hazard assessments and the development of mitigation strategies but also for informing the design and operation of critical infrastructure. The hydrology community grapples with the need to predict floods particularly in ungauged basins where the absence of continuous and spatially representative precipitation and streamflow data are enunciated.

Global precipitation observations from satellite constellations combined with recent advancements of hydrologic forecasting with machine-learning (ML) models, offer an attractive solution for addressing flood prediction in ungauged regions. Towards that end, in this work, we investigate a) the performance of ML flood prediction models integrated with satellite precipitation estimates and b) the transferability/applicability of ML models trained in data rich regions for flood prediction in ungauged regions. We use NASA IMERG precipitation dataset for ML-based predictions and we train the ML models for ~600 catchments from different hydroclimatic zones in Contiguous US. The performance of the ML-IMERG predictions are then evaluated for a large number of catchments (~1000) in the UK, Brazil, Chile and Australia. Predictive performance is evaluated with respect to climate and catchment characteristics in each region. Results suggest that despite the variability in the performance across regions, there is great promise on the integration of global satellite precipitation estimates with ML models for flood prediction in ungauged basins.