Advancing Streamflow Prediction by Integrating Diverse Data and AI Models

Scientific Challenge

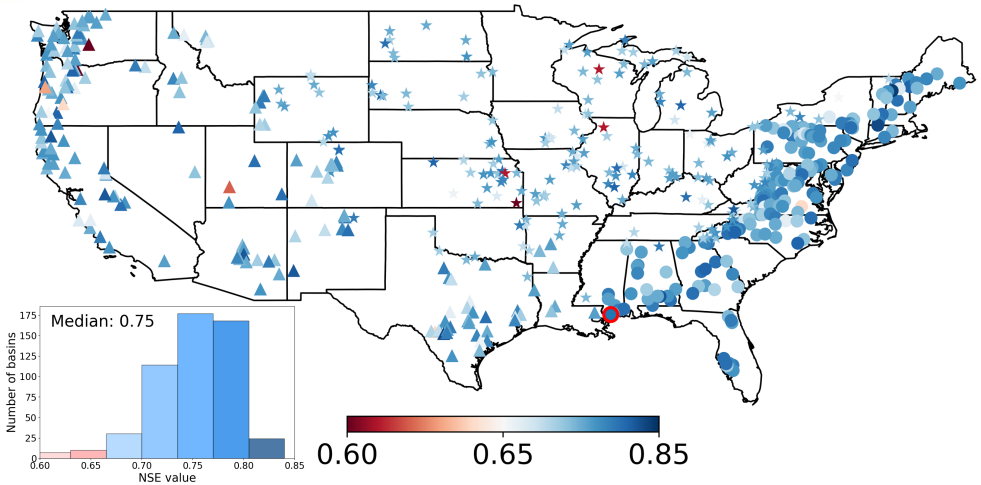
- Predicting accurate streamflow for ungauged basins under changing climate remains a global challenge.
- The complex calibration of process-based models and large data requirements of machine learning (ML) models, e.g., Long Short-Term Memory (LSTM) networks make the task more challenging.

Approach and Findings

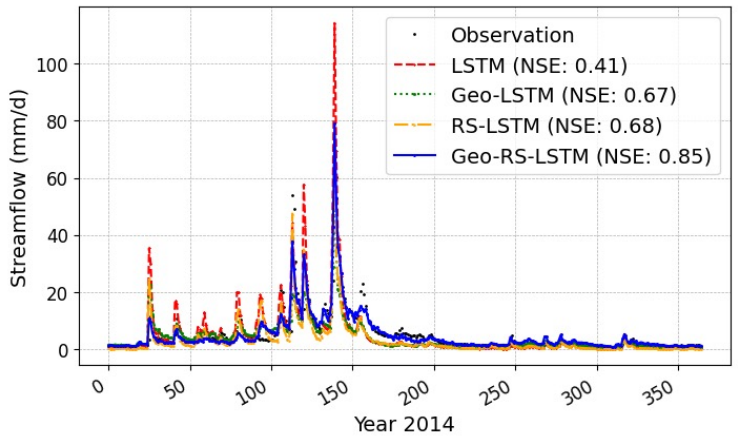
- This study developed a vision transformer ML model to extract basin attributes from widely available remote sensing images and integrate these attributes with hydrometeorological forcing into the LSTM model to advance streamflow prediction.
- Tests on 531 catchments across CONUS show the superior performance of our method compared to other baseline models.

Significance and Impact

- Our ML model integrating multiple data improves streamflow prediction across the CONUS under climate change.
- The method can be widely applied to advance our predictive understanding of ecosystem responses to climate change.



Our Geo-RS-LSTM model integrating remote sensing images, meteorological forcing sequences, and static catchment attributes accurately predicts streamflow at 531 basins across the CONUS.



Our Geo-RS-LSTM model outperforms other ML baseline methods in streamflow prediction.

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