EGU22-11110, updated on 09 Aug 2022
https://doi.org/10.5194/egusphere-egu22-11110
EGU General Assembly 2022

Physics-informed LSTM structure for recession flow prediction

Prashant Istalkar[1], Akshay Kadu[2], and Basudev Biswal[3]
[1]Indian Institute of Technology Bombay, Department of Civil Engineering, Mumbai, India (istalkarps@gmail.com)
[2]Indian Institute of Technology Bombay, Department of Civil Engineering, Mumbai, India (akshaykadu5626@gmail.com)
[3]Indian Institute of Technology Bombay, Department of Civil Engineering, Mumbai, India (basudev@civil.iitb.ac.in)

Modeling the rainfall-runoff process has been a key challenge for hydrologists. Multiple modeling frameworks have been introduced with time to understand and predict the runoff generation process, including physics-based models, conceptual models, and data-driven models. In recent years the use of deep learning models like Long Short-Term Memory (LSTM) has increased in hydrology because of its ability to learn information in the sequence of input. Studies report LSTM outperforms the well-established hydrological models (e.g. SAC-SMA), which led authors to question the need for process understanding in the machine learning era. In the current study, we claim that process understanding helps to reduce LSTM model complexity and ultimately improves recession flow prediction. Here, we used past streamflow information as input to LSTM and predicted ten days of recession flow. To reduce LSTM complexity, we used insights from a conceptual hydrological model that accounts for storage-discharge dynamics. Overall, our study re-emphasizes the need to understand hydrological processes.