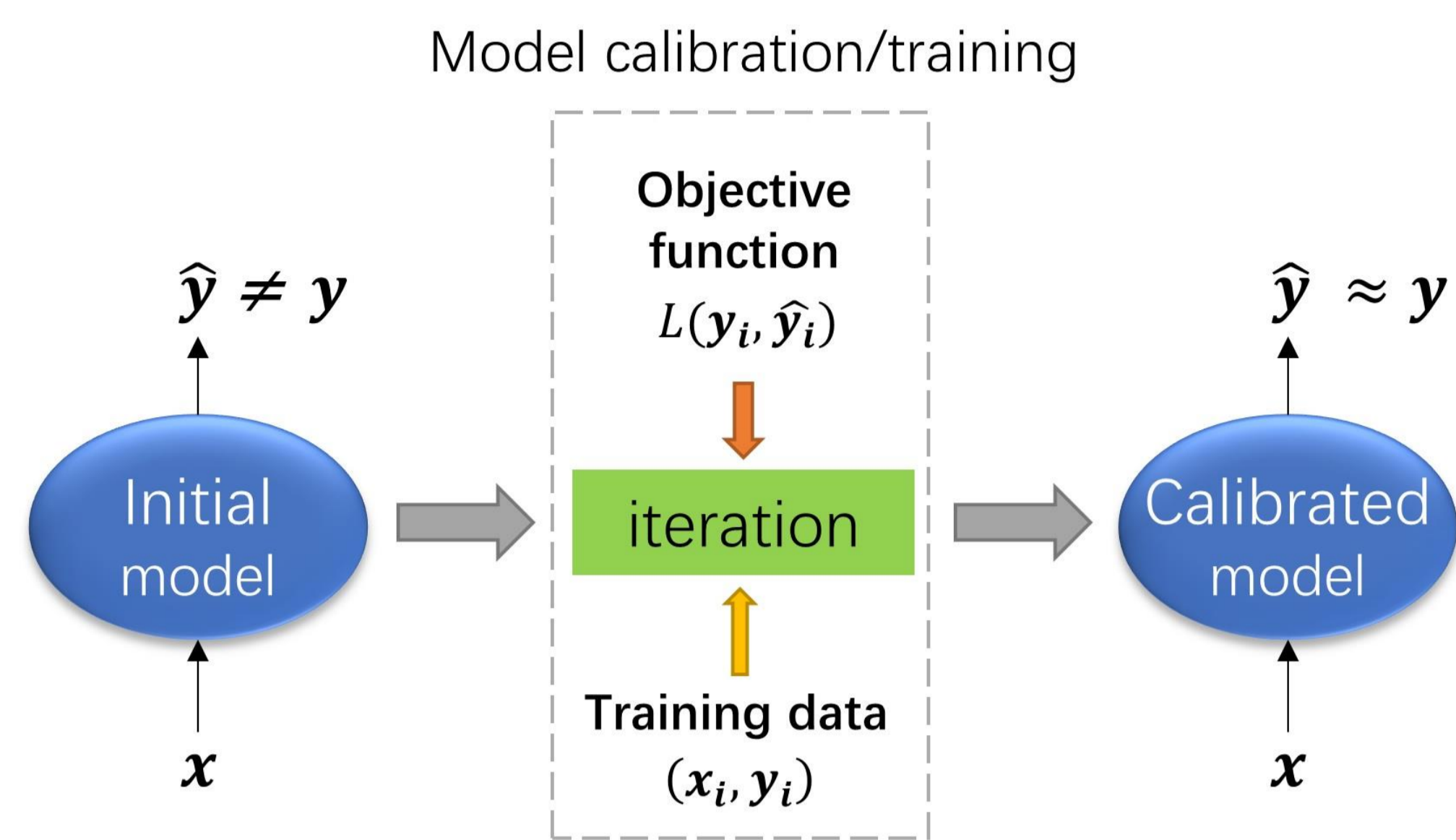


# Improving streamflow forecasting from the perspective of objective function

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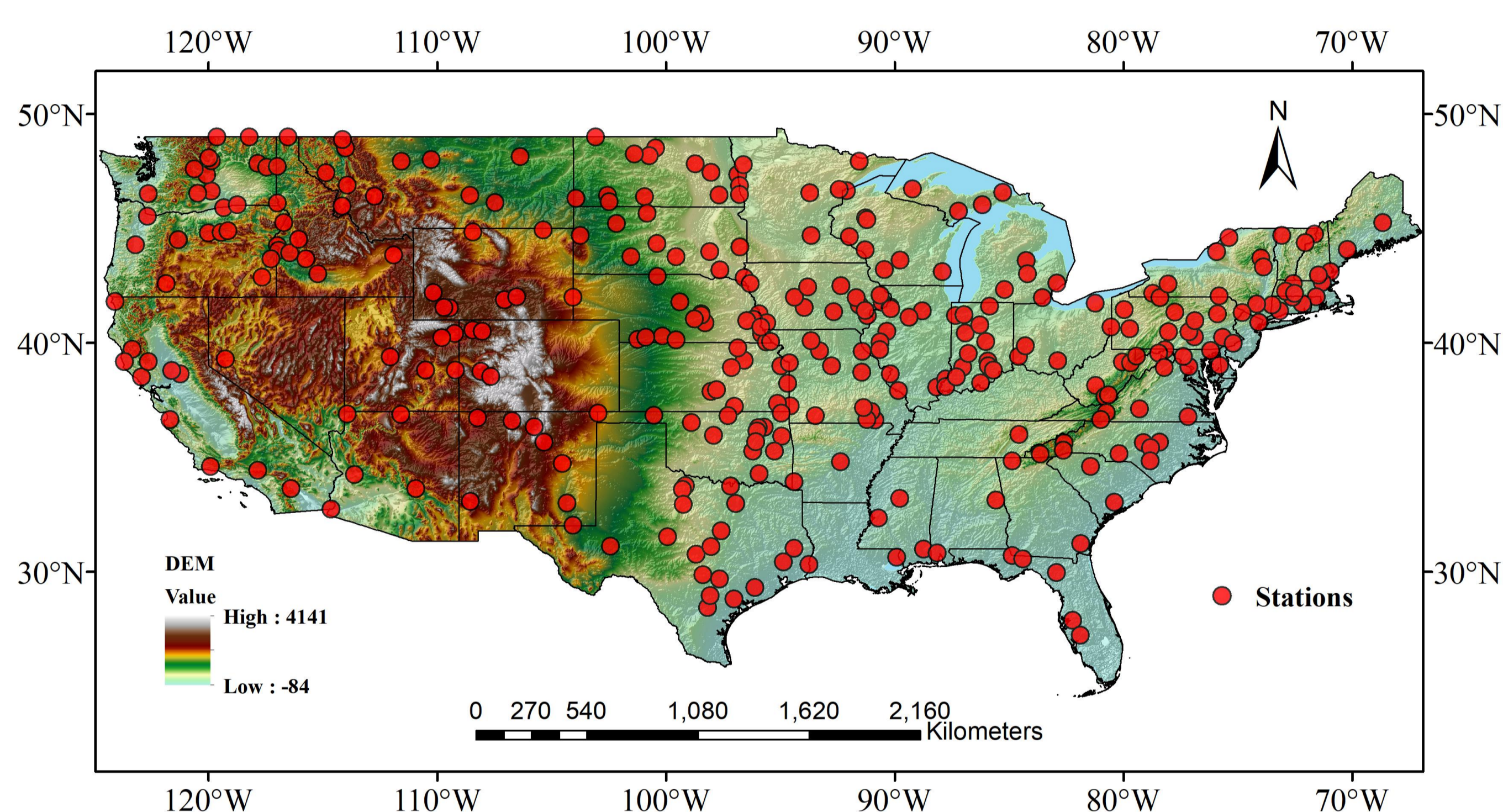
## Introduction



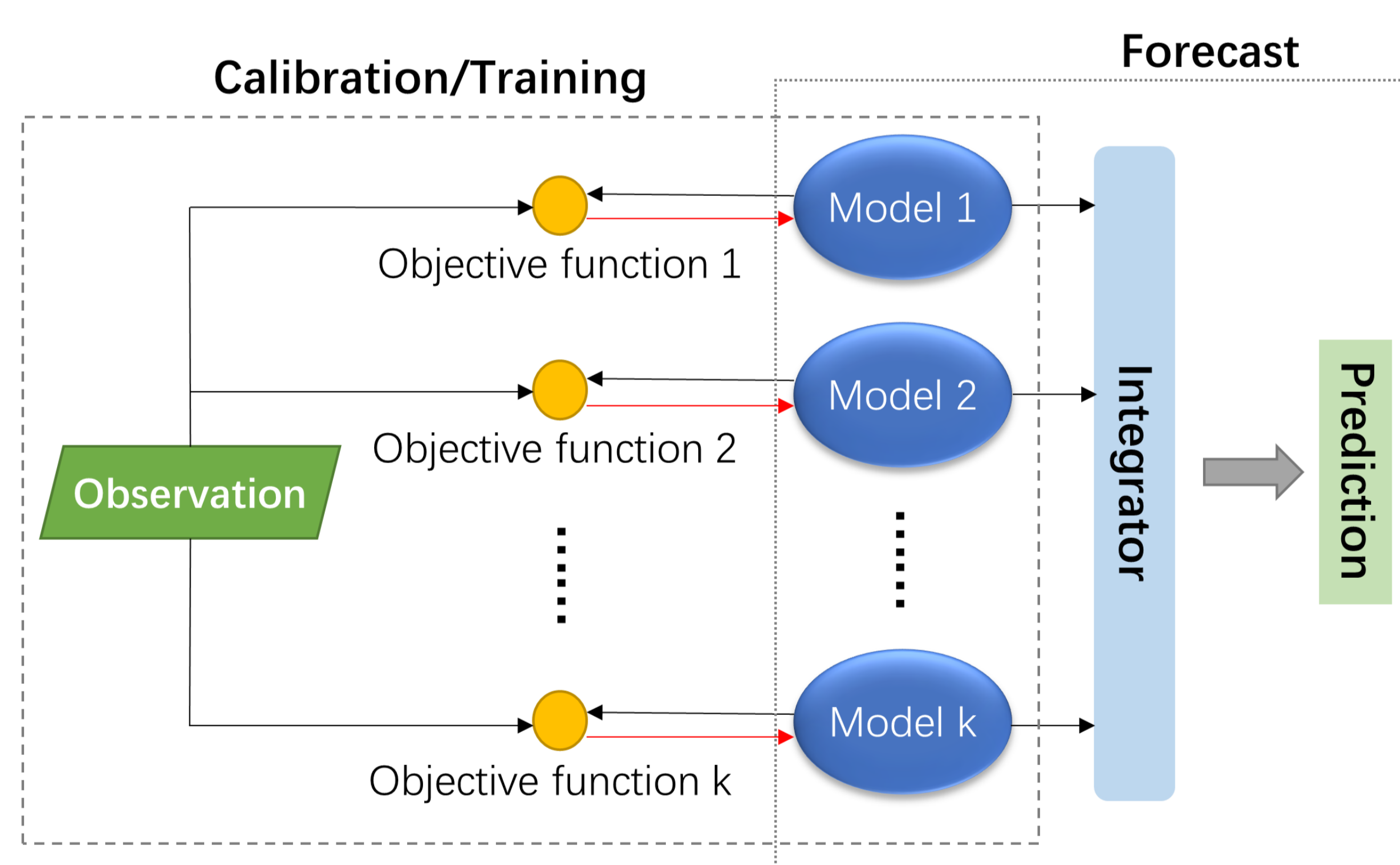
The objective function plays an important role in hydrological model calibrations/training.

## Study area

273 catchments in USA with 1982-2018 daily scale data.



## Methods



### Objective function-based Ensemble Model (OEM):

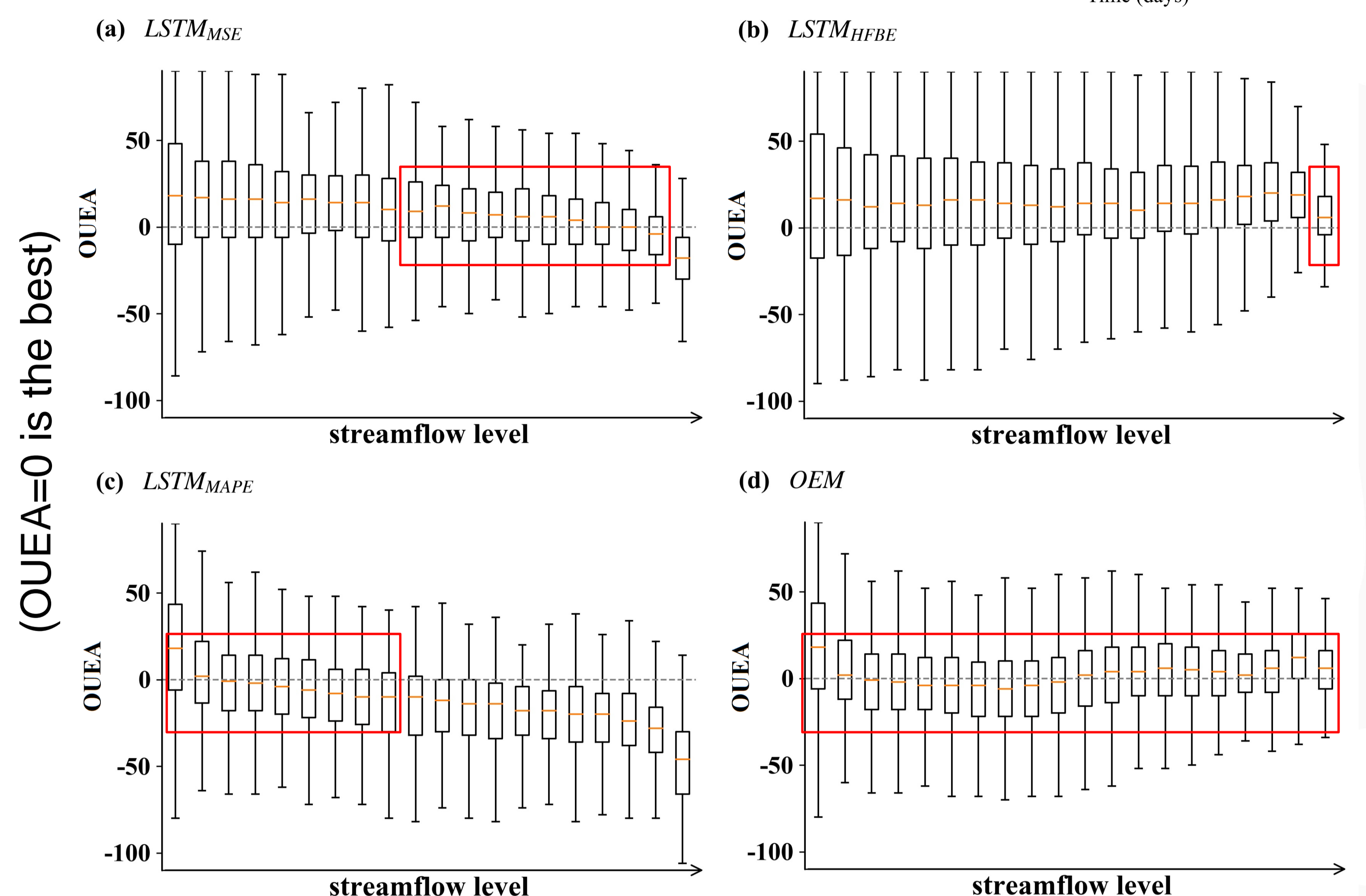
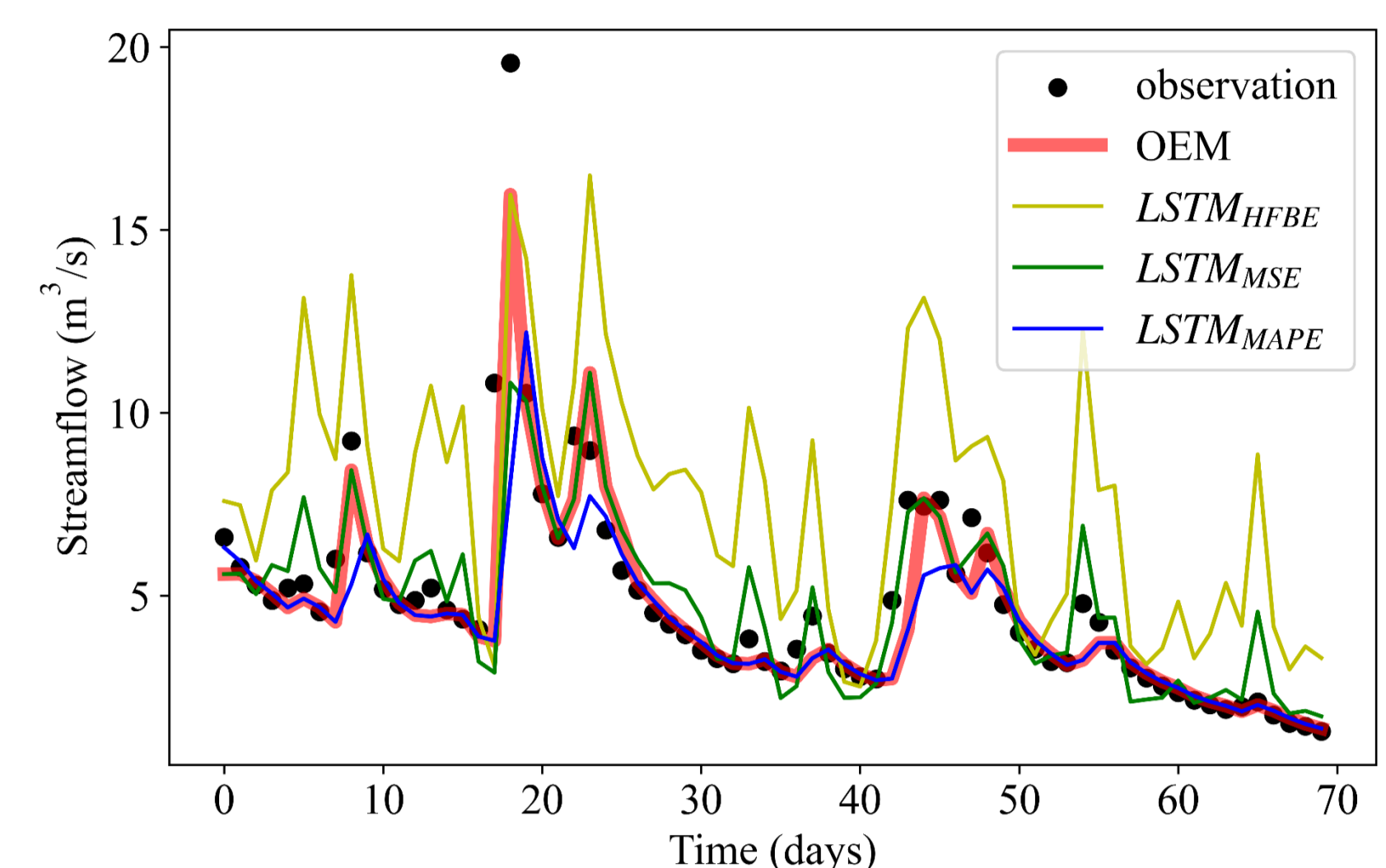
- Firstly, multiple base models are trained using objective functions with different emphases.
- Secondly, the base models are integrated based on their respective strengths.

### Application-orientated Objective Functions:

- HFBE: designed for high-flow forecasting
- MAPE\*: designed for low-flow forecasting

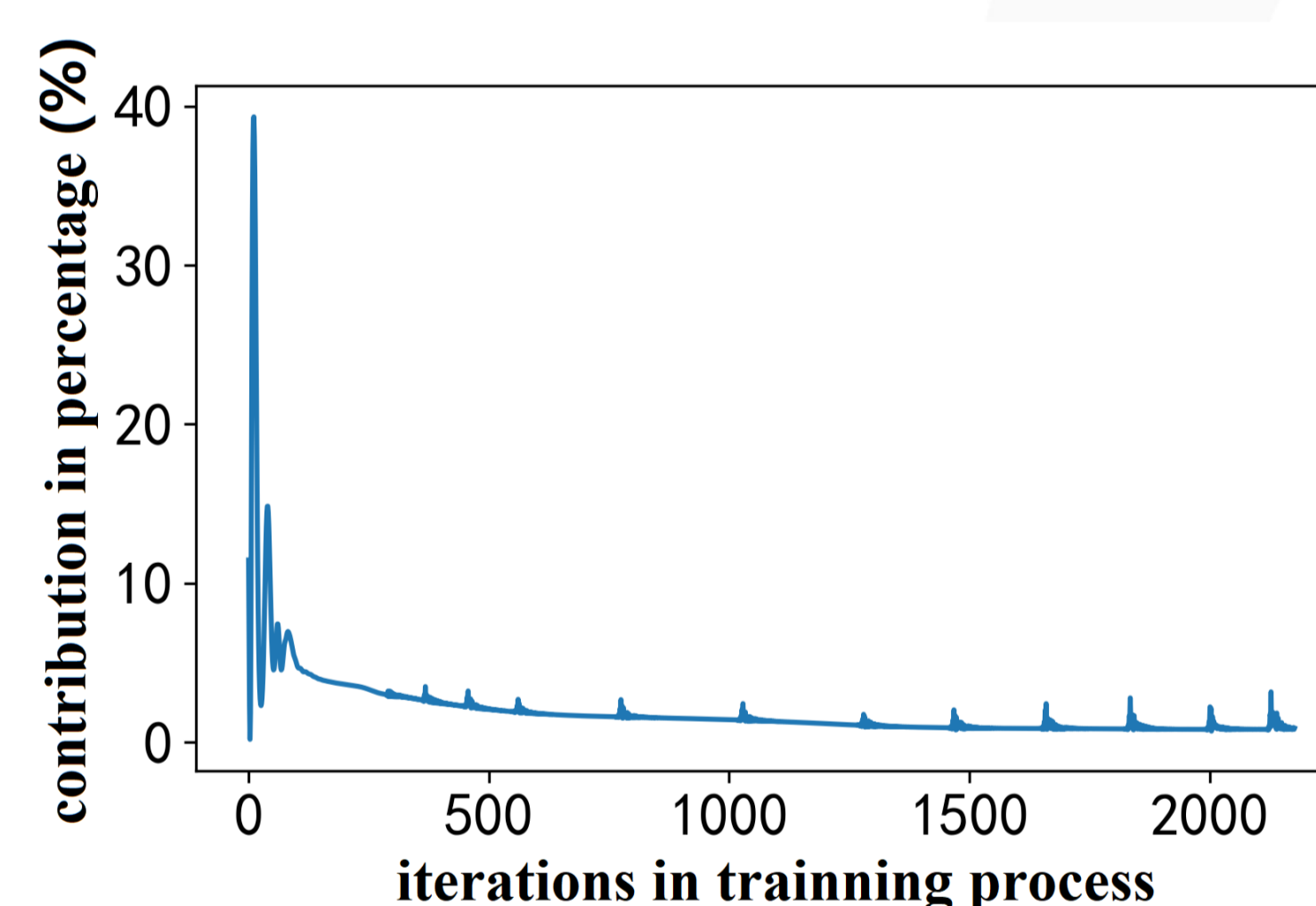
## Results

- The forecasting ability of LSTMs trained with different objective functions (HFBE, MSE and MAPE\*) is different under different streamflow levels.
- OEM well absorbs the advantages of these three base models.

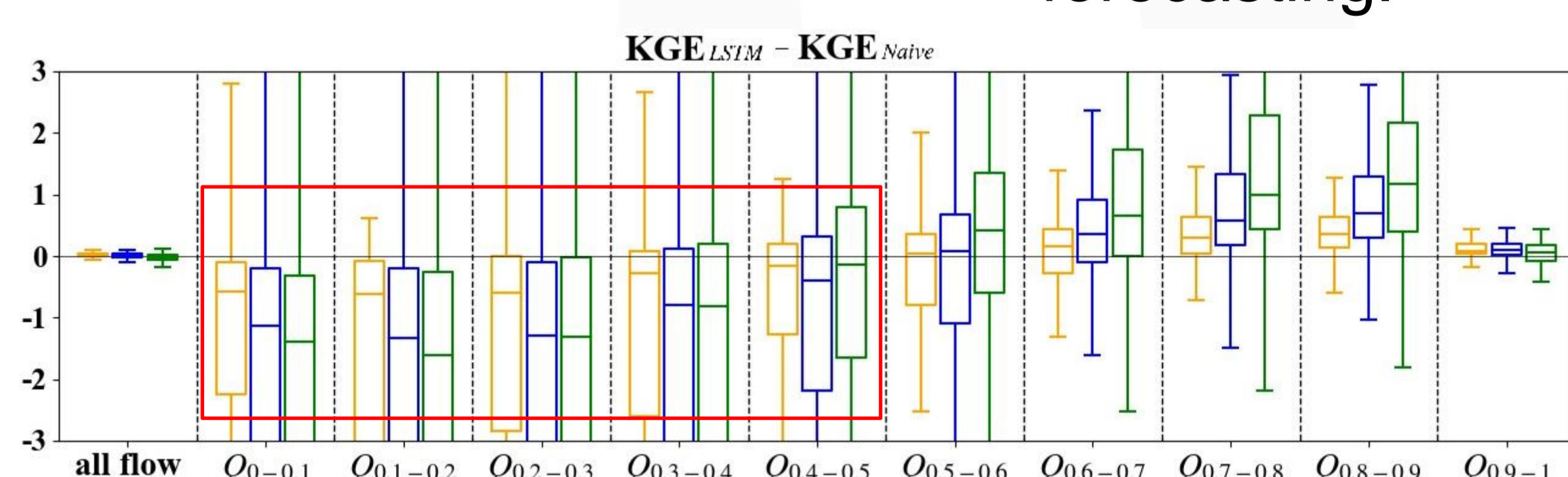


## Discussion

### The flaw of MSE as objective function



- Training samples with low streamflow value make little contribution to the loss function during model training.
- LSTM<sub>MSE</sub> significantly underperform the naïve method (shift of the observed streamflow) for low-flow forecasting.



### Relative importance between objective function and algorithm

- MLP is inferior to LSTM with the same objective function in low-flow forecasting.
- MLP<sub>MAPE</sub> is significantly superior to LSTM<sub>MSE</sub> in low-flow forecasting.

