

Supplementary file

for

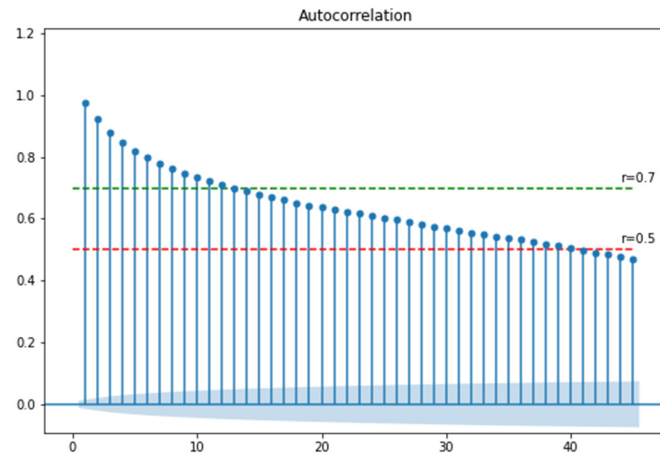
**Multi-step ahead probabilistic forecasting of daily
streamflow using Bayesian Deep Learning: A multiple
case study**

Fatemeh Ghobadi and Doosun Kang*

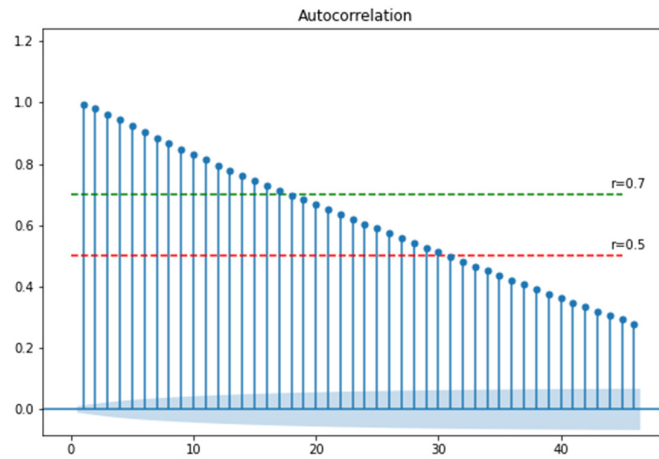
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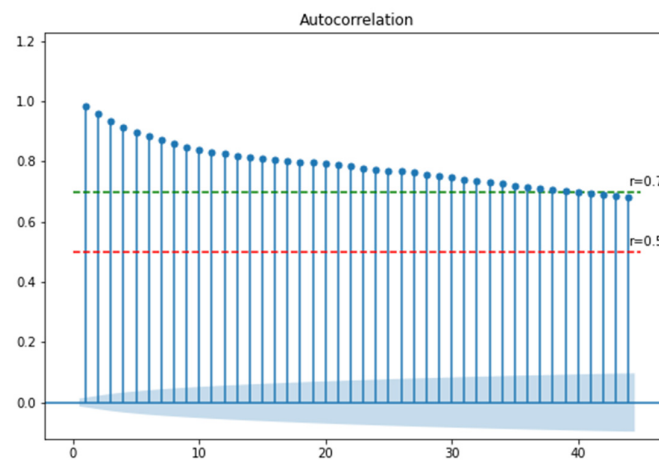
S1 Autocorrelation analysis



(a)



(b)



(c)

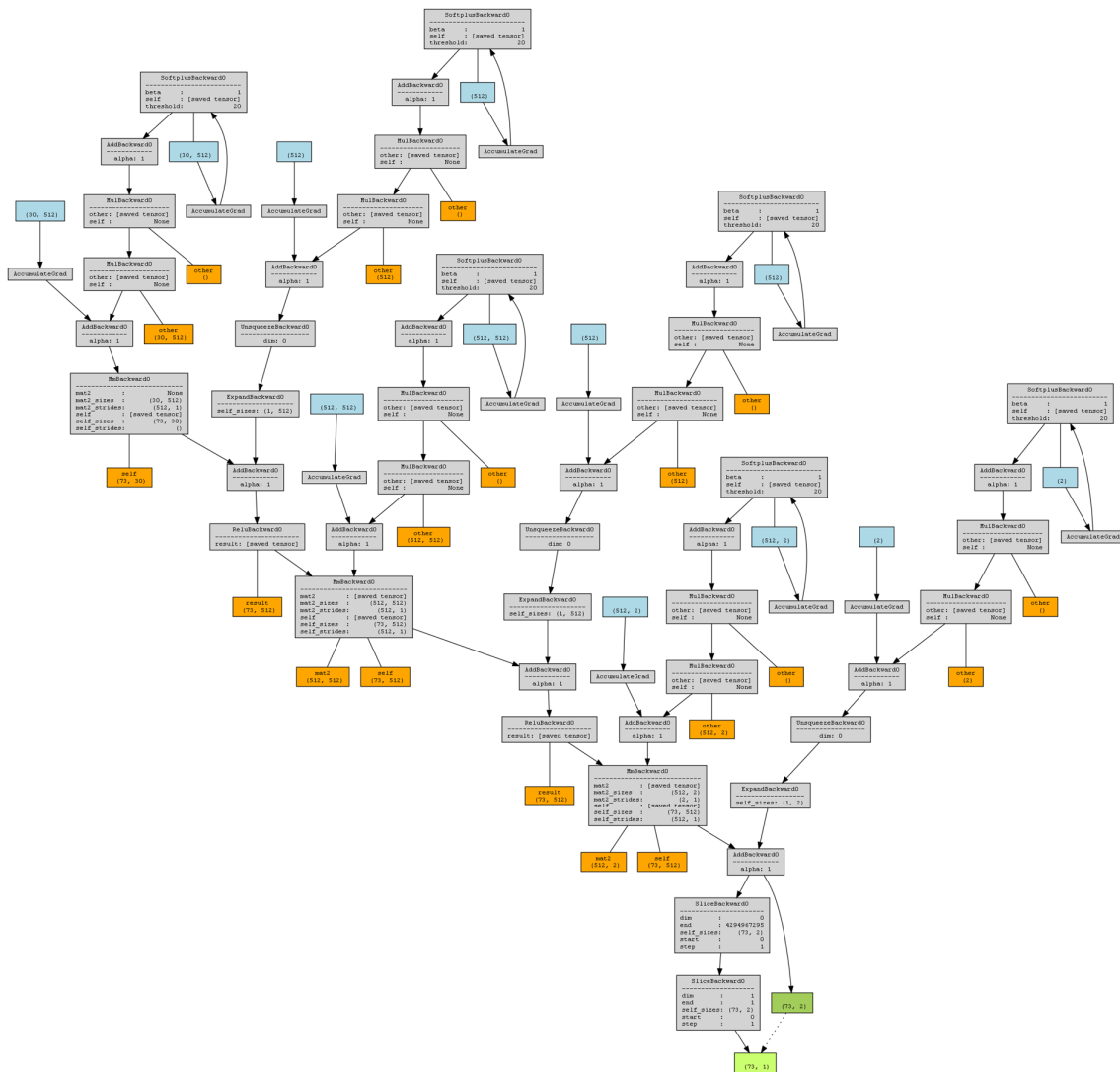
Figure S1. Autocorrelation function plots of transformed-streamflow timeseries: (a) case study I, (b) case study II, and (c) case study III.

S2 Structure of the prediction models

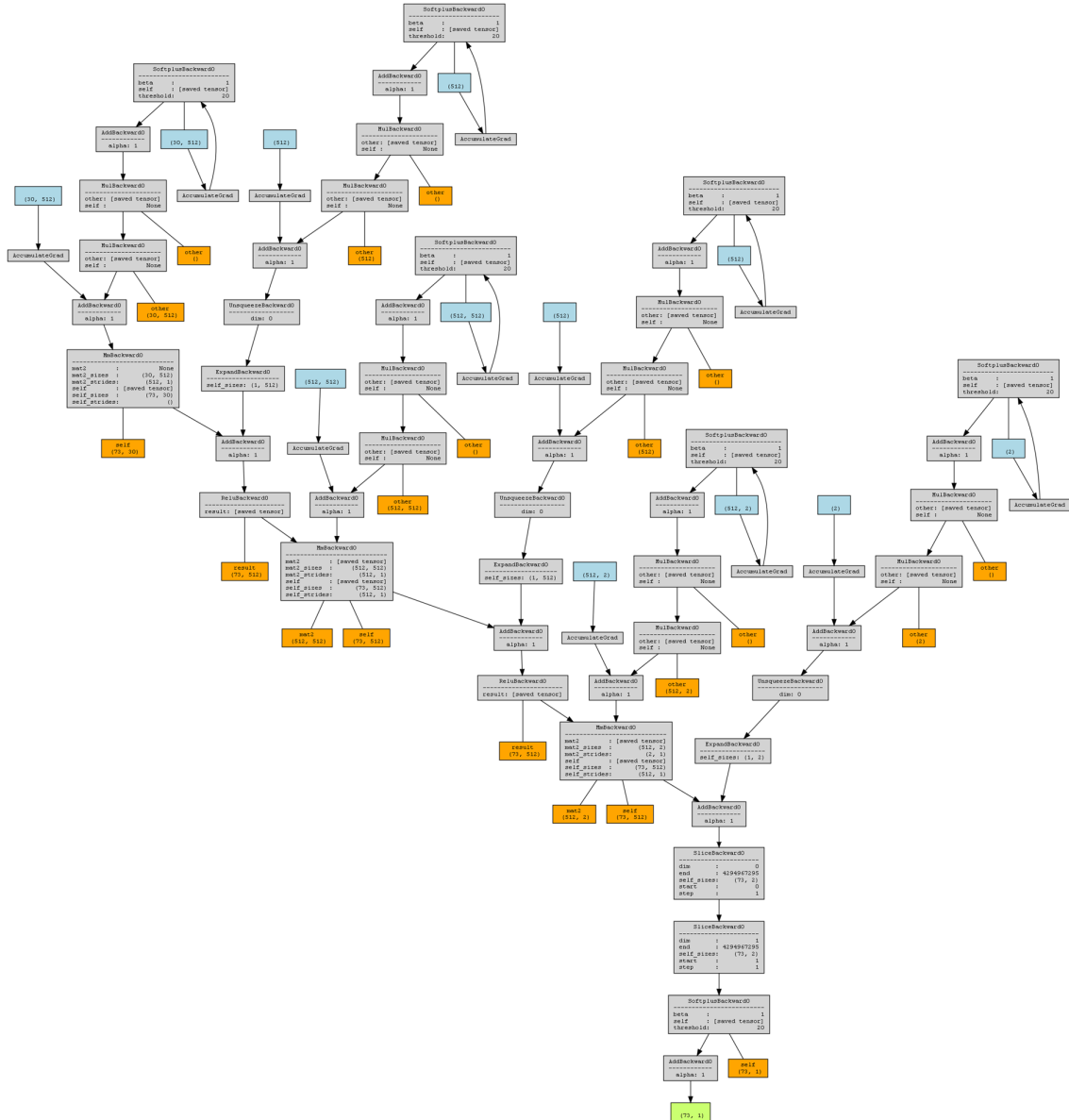
Table S1. General structures of deep neural networks

Model	Network structure
BLSTM	BLSTM_Network((0): BayesianLSTM((weight_ih_sampler): TrainableRandomDistribution() (weight_hh_sampler): TrainableRandomDistribution() (bias_sampler): TrainableRandomDistribution() (weight_ih_prior_dist): PriorWeightDistribution() (weight_hh_prior_dist): PriorWeightDistribution() (bias_prior_dist): PriorWeightDistribution()) (1): Linear(in_features=128, out_features=2, bias=True) (Softplus): Softplus(beta=1, threshold=20) (act): ReLU(inplace=True)))
LSTM-BNN	LSTM_BayesianNetwork((0): LSTM(1, 128, num_layers=2, batch_first=True) (1): BayesianLayer() (2): BayesianLayer() (Softplus): Softplus(beta=1, threshold=20) (act): ReLU(inplace=True)))
BNN	BayesianNetwork((0): BayesianLayer() (1): BayesianLayer() (2): BayesianLayer() (Softplus): Softplus(beta=1, threshold=20) (act): ReLU(inplace=True)))
LSTM-MC	LSTM_MontCarloNetwork((0): LSTM(1, 128, num_layers=2, batch_first=True) (1): LSTM(128, 32, num_layers=2, batch_first=True) (fc): Linear(in_features=32, out_features=2, bias=True) (Softplus): Softplus(beta=1, threshold=20)))

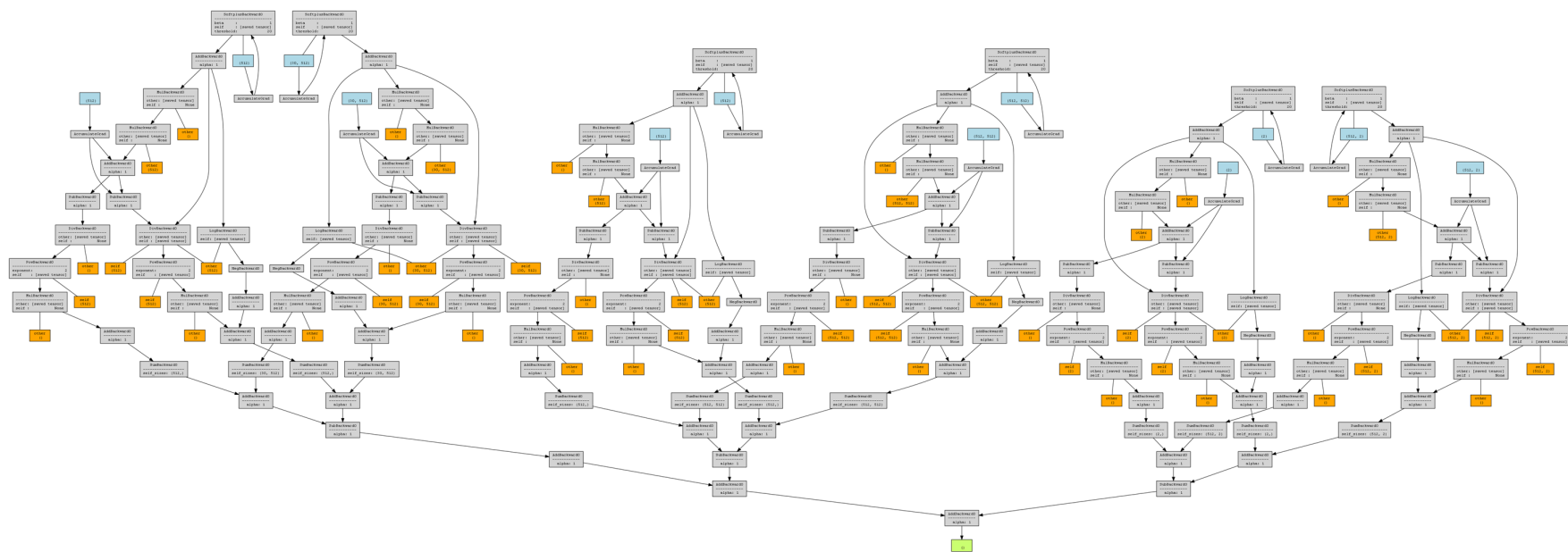
S3 Graphical scheme of the prediction models



(a)

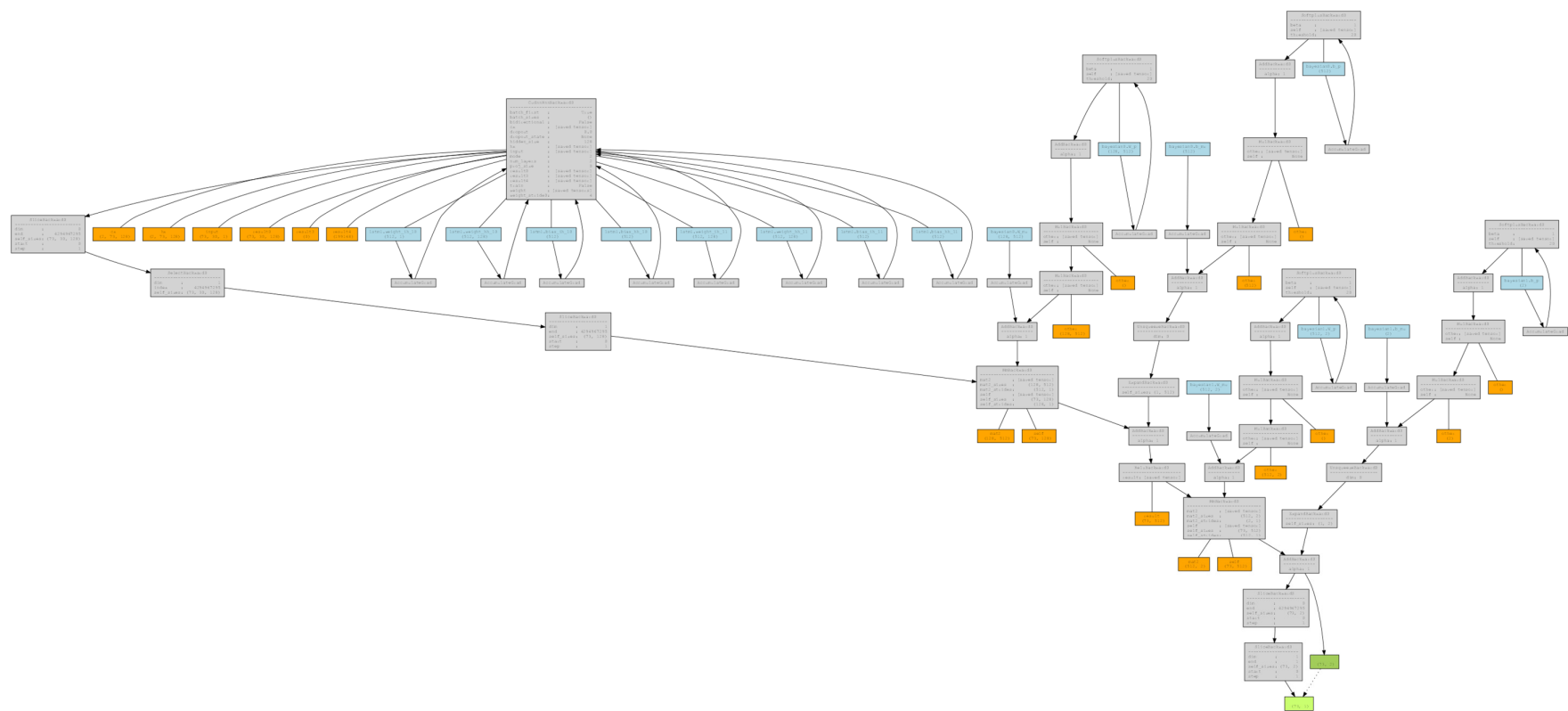


(b)

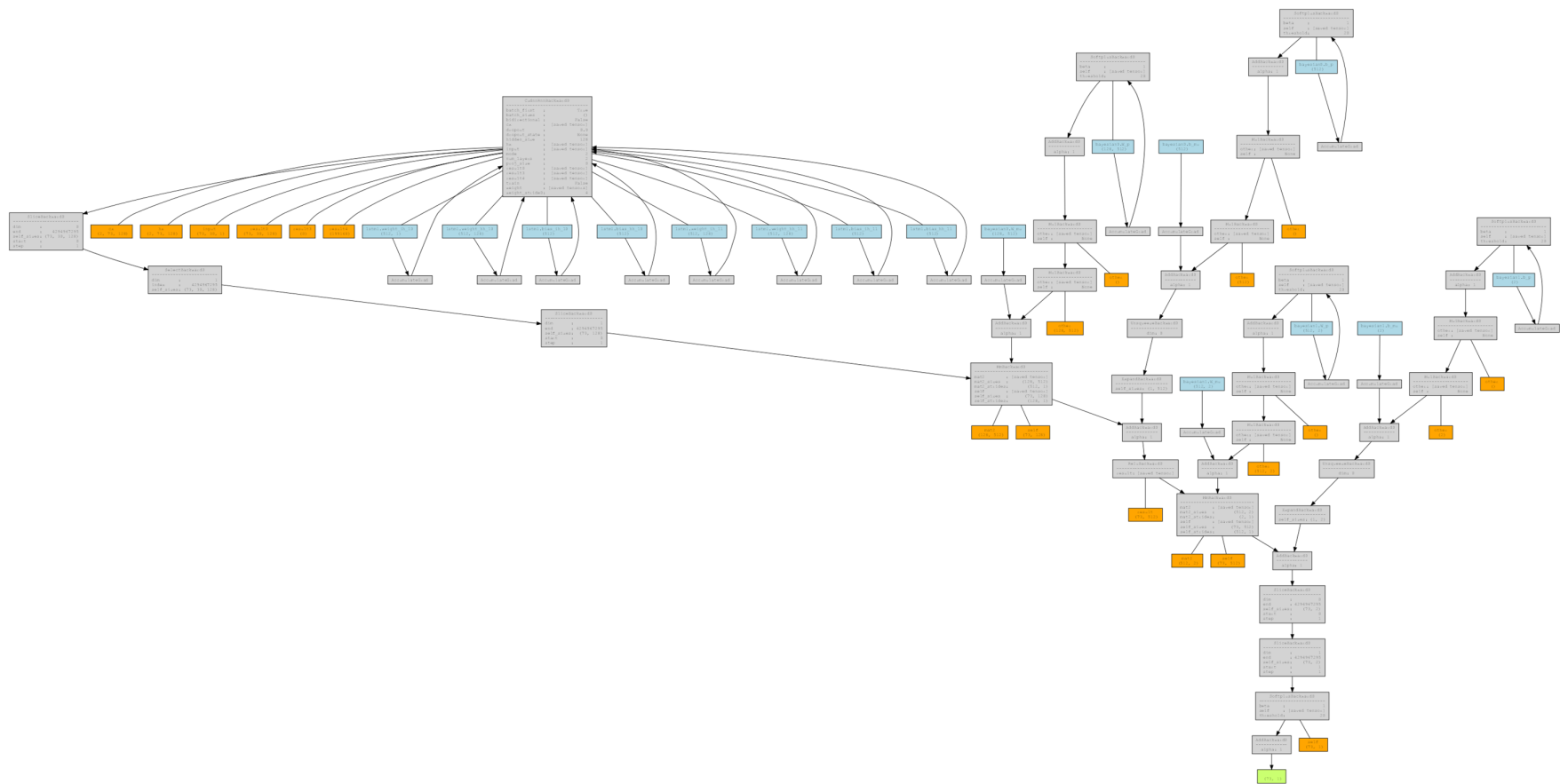


(c)

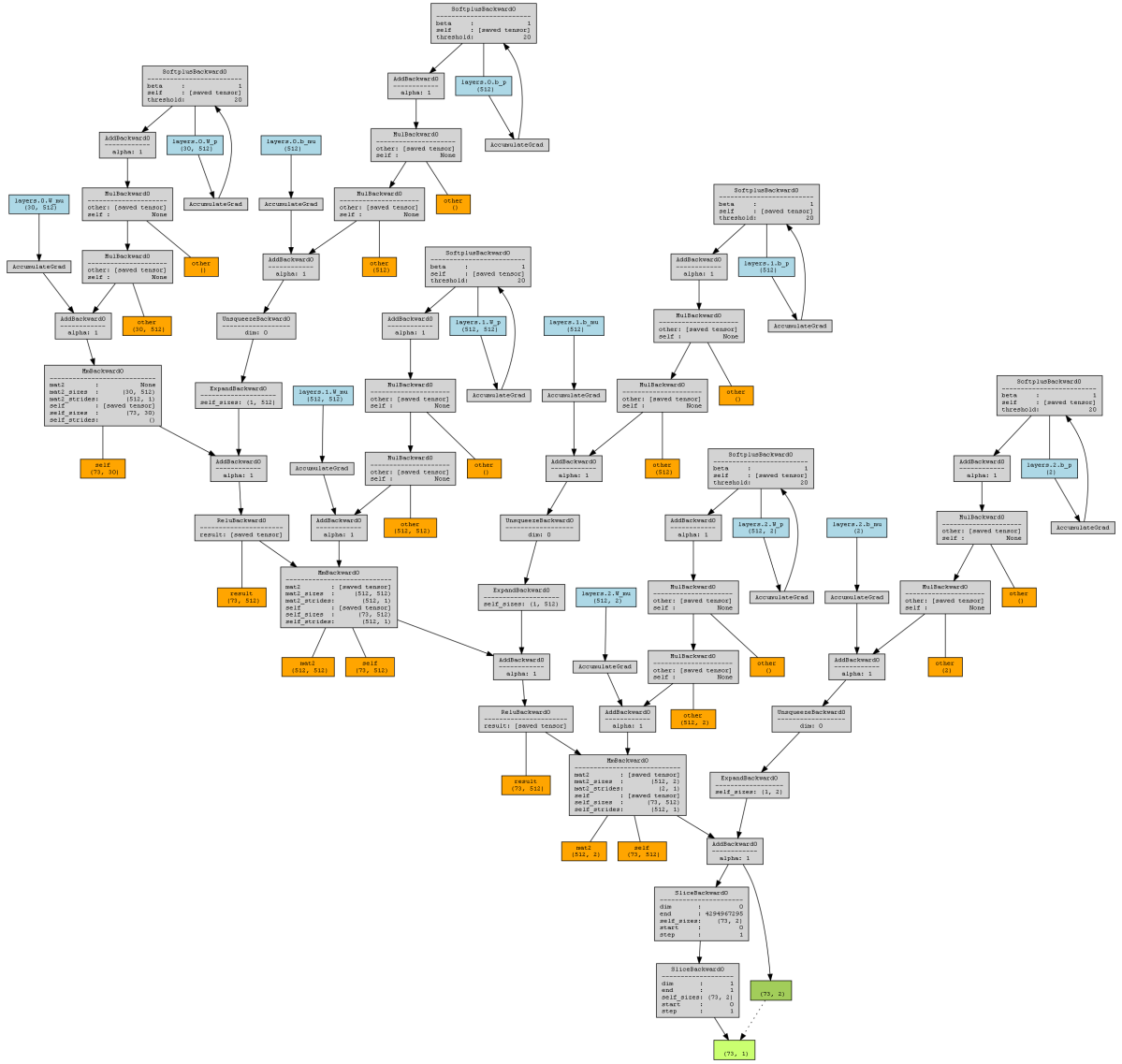
Figure S2. The visualizations of network execution graphs and traces for BLSTM models' outputs: (a) mean of prediction, (b) standard deviation of prediction, and (c) loss function.



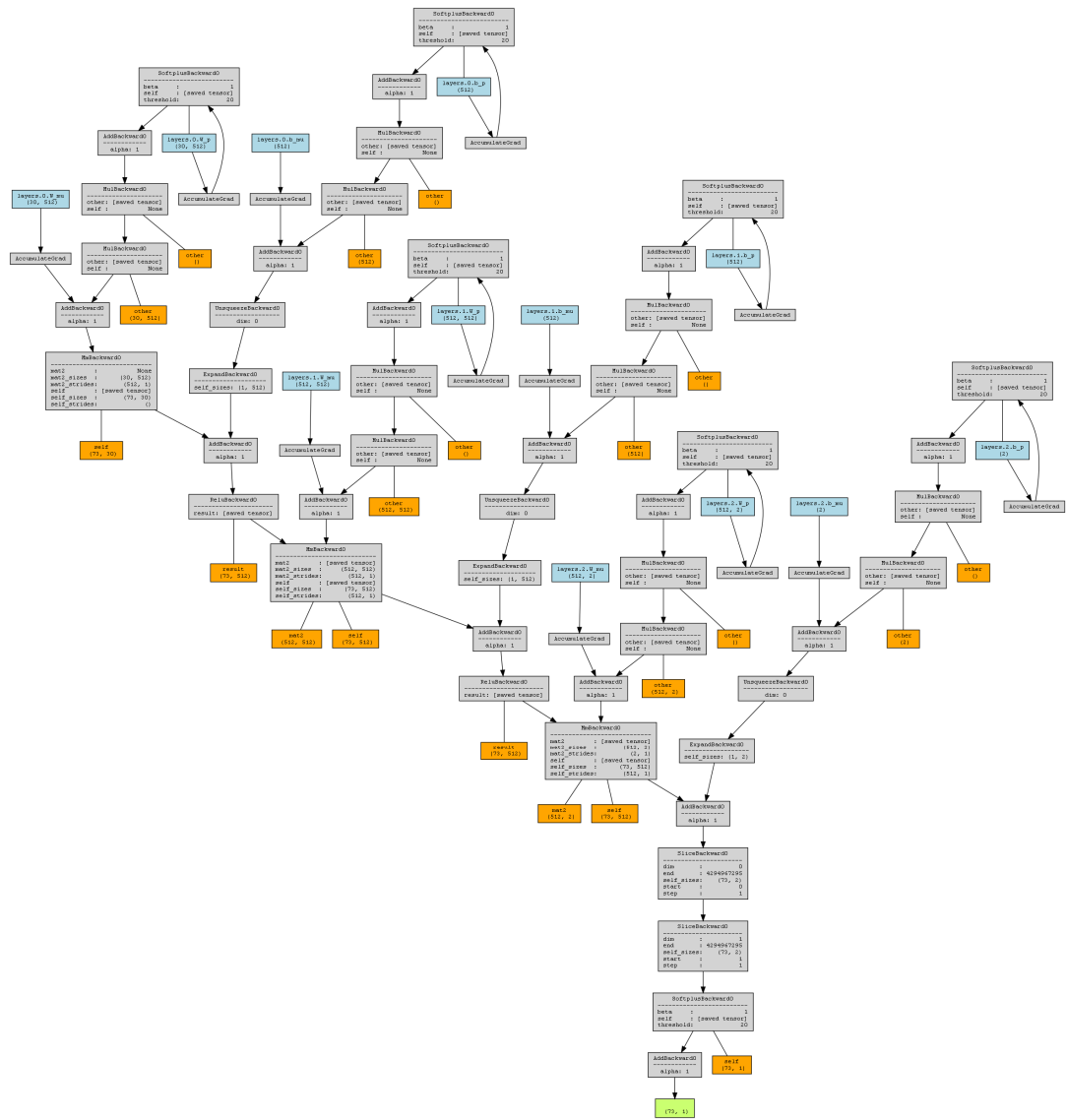
(a)



(b)



(a)



(b)

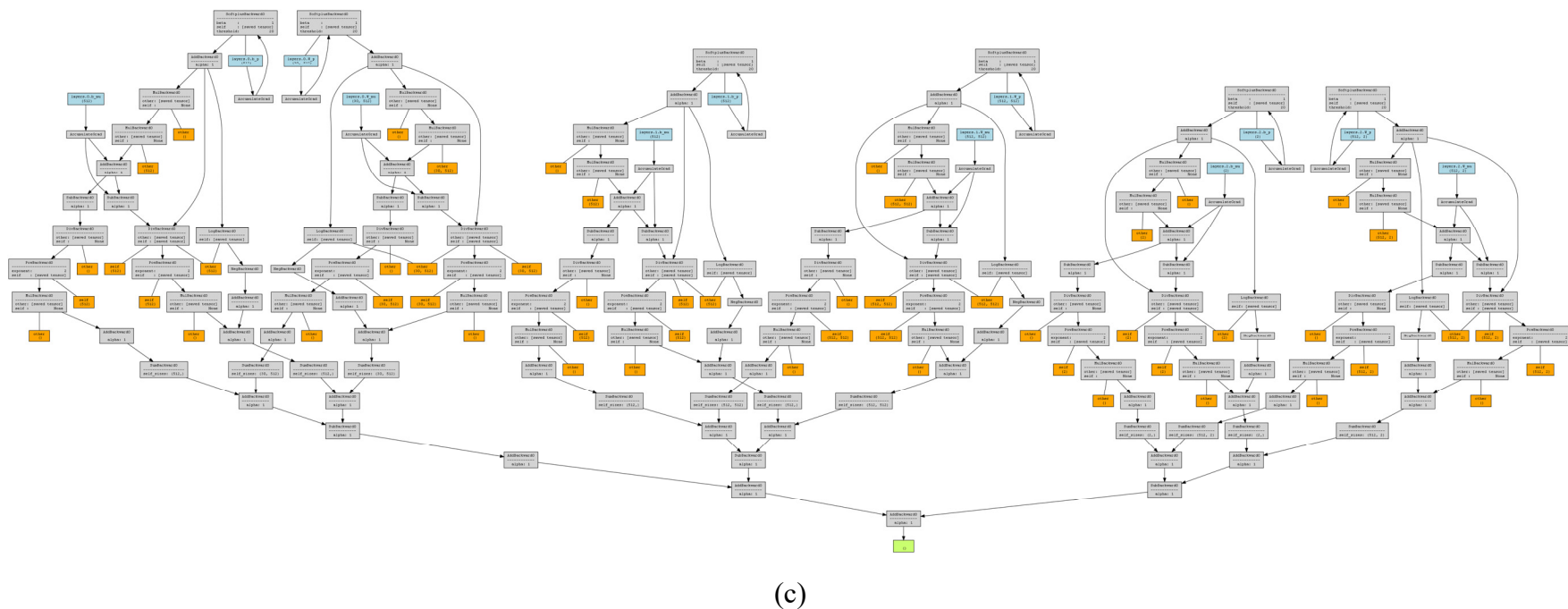
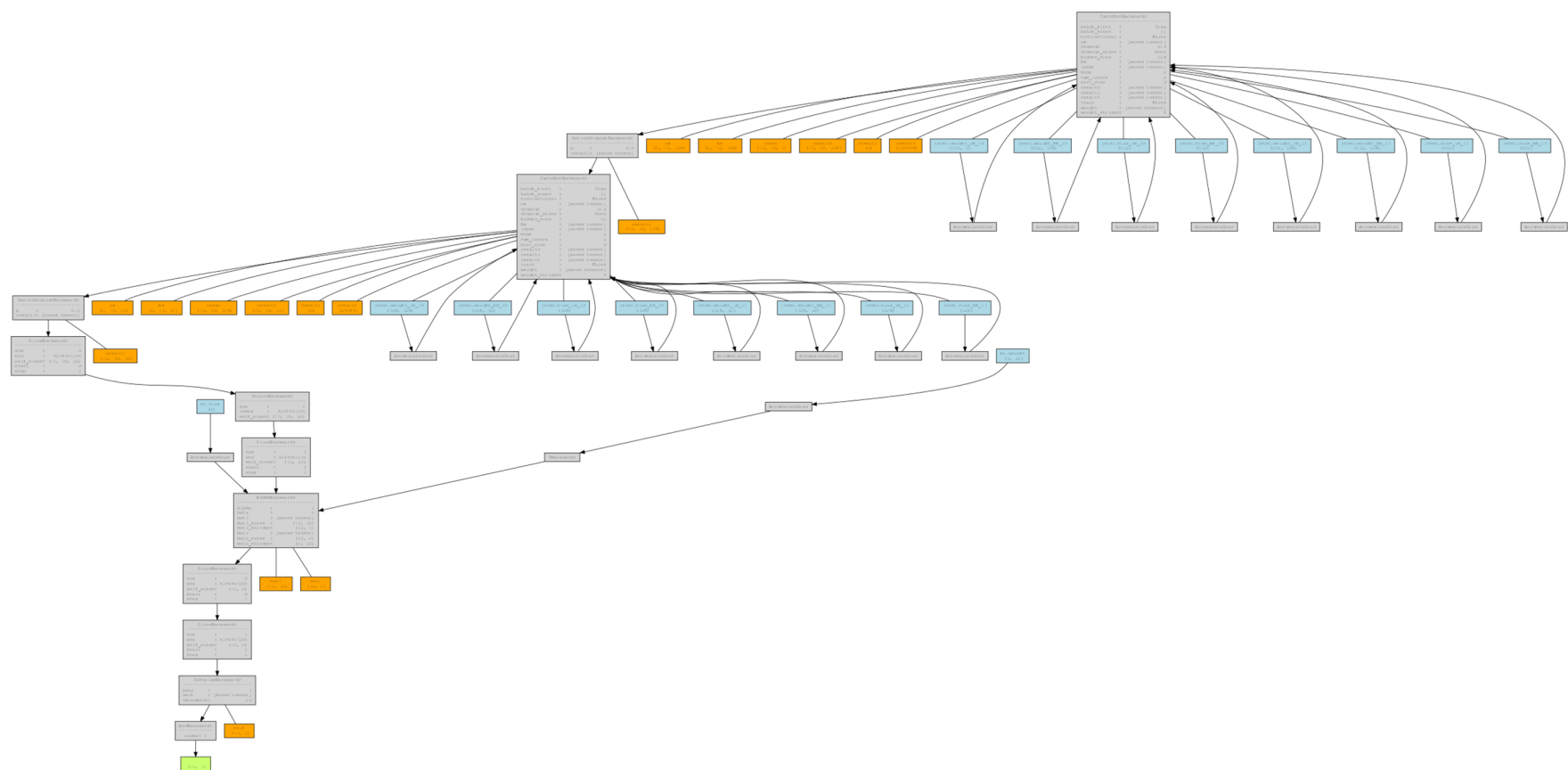


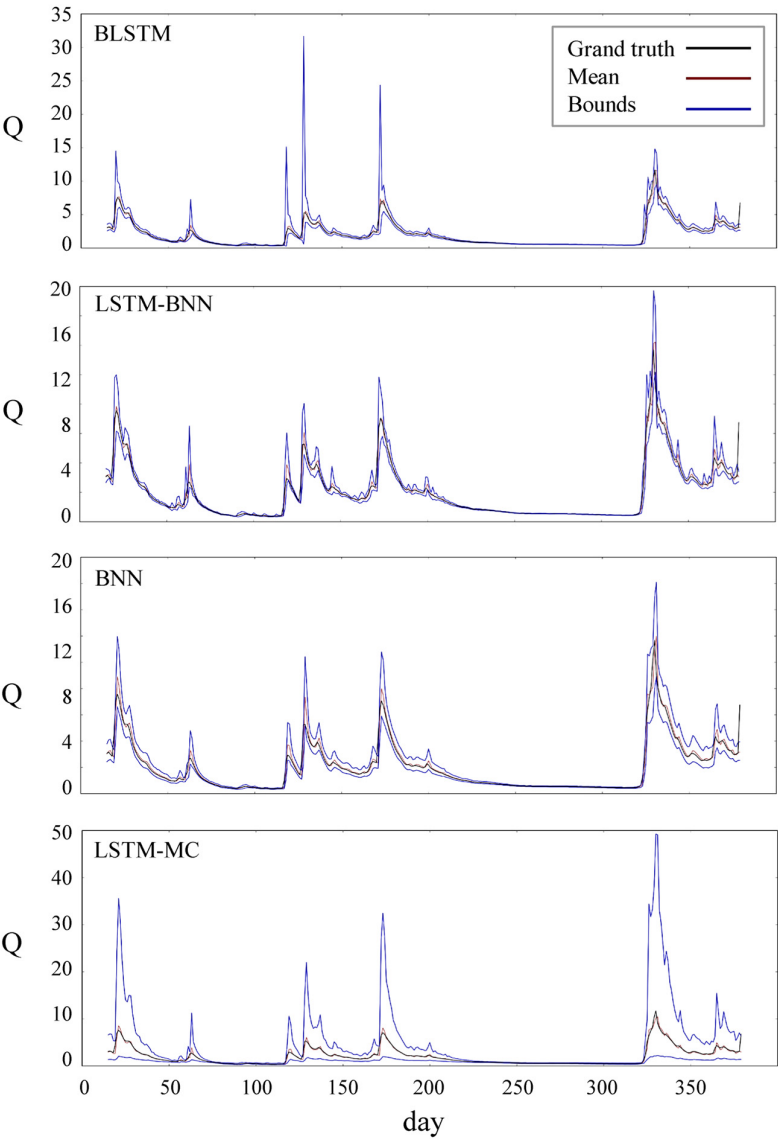
Figure S4. The visualizations of network execution graphs and traces for BNN models' outputs: (a) mean of prediction, (b) standard deviation of prediction, and (c) loss function.



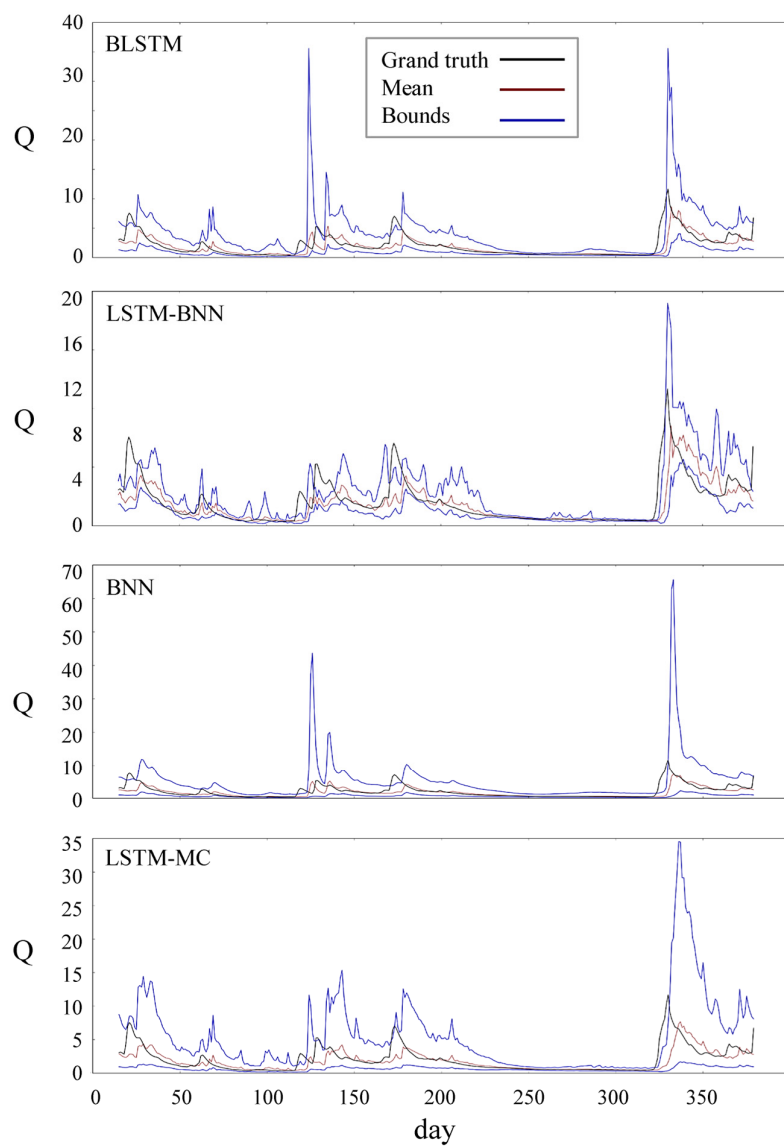
(b)

Figure S5. The visualizations of network execution graphs and traces for LSTM-MC models' outputs: (a) mean and (b) standard deviation of prediction.

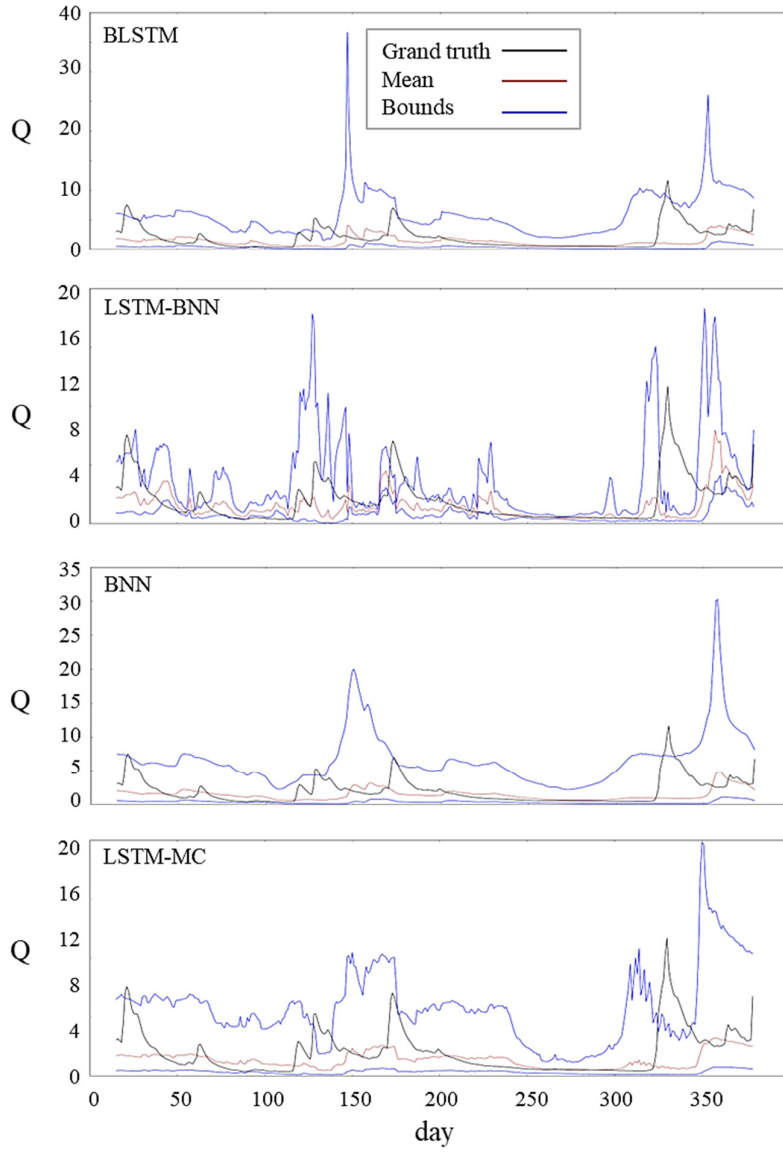
S4 Comparison of all the model performances for case study II in three scenarios



(a)



(b)



(c)

Figure S6. Prediction results of all models for case study II for (a) forecast horizon 1, (b) forecast horizon 7, and (c) forecast horizon 30.