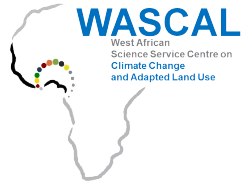
Universite Joseph Ki-Zerbo

Ecole Doctorale Informatique et Changements Climatiques

West African Science Service on Climate Change and Adapted Land Use



Predicting Discharge in Catchment Outlet Using Deep Learning

Case Study of the Ansongo-Niamey Basin

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Outline

- Water-related disasters (floods and droughts) account for an overwhelming 90% of all-natural disasters globally and are expected to increase due to climate change [Aich et al., 2016].

Physical based vs data driven hydrological models

Study Area

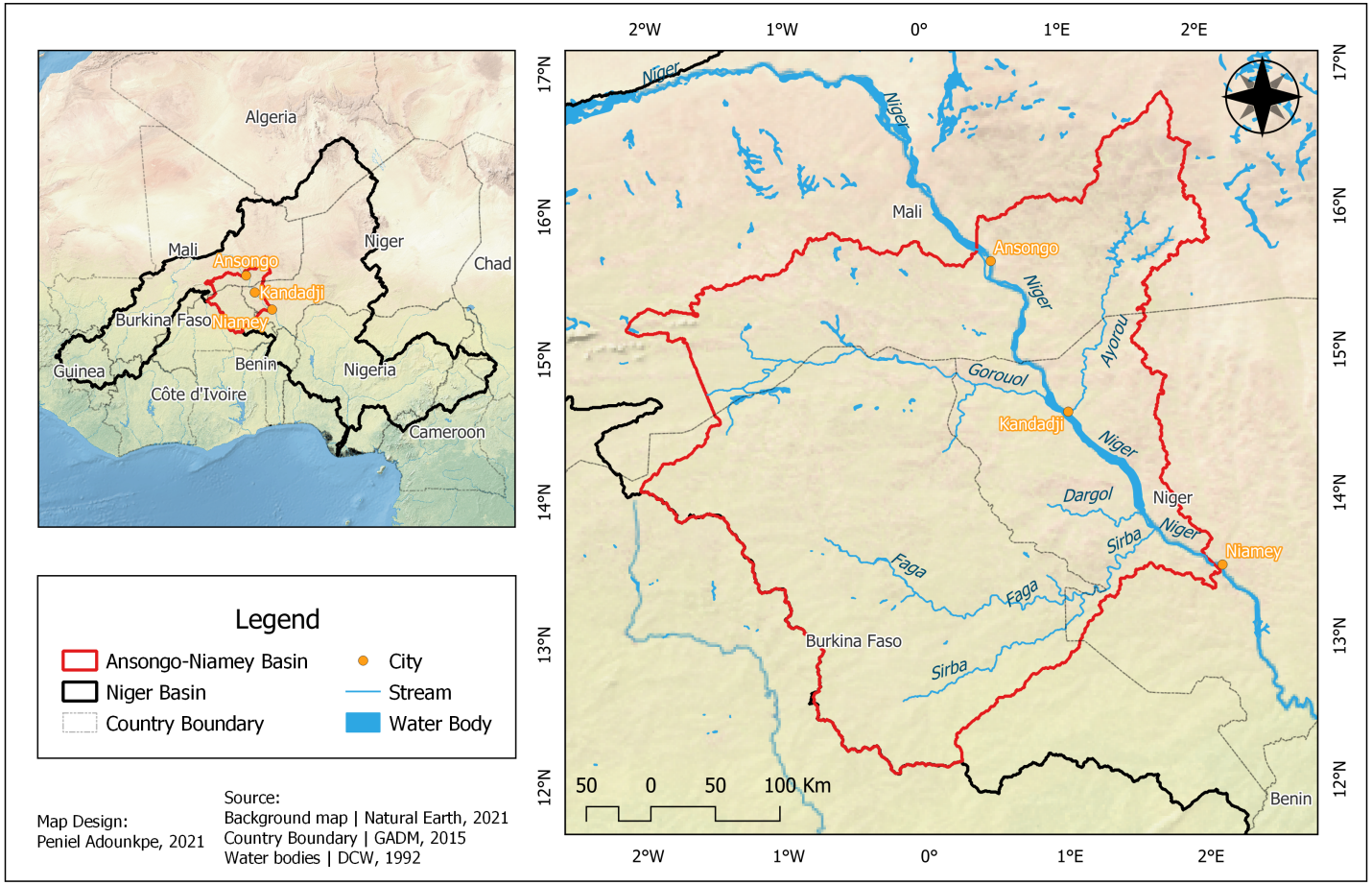

Figure 1: Map of Ansongo-Niamey basin

Methods

- Data preprocessing (precipitation, temperature and discharge from 1981 to 2010)
- Hyperparameter optimization using Scikit-Optimize
- Model training and testing using TensorFlow

Results

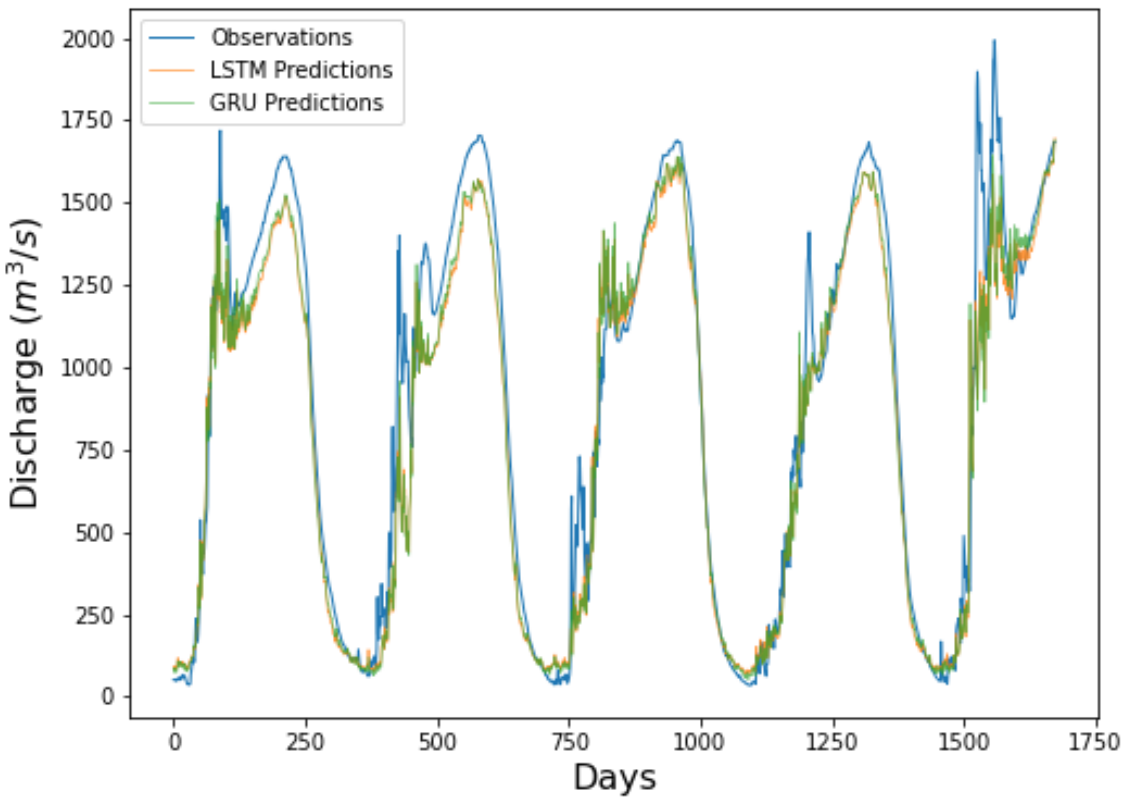

Figure 2: Discharge predictions of LSTM and GRU models at Niamey from June 2006 to December 2010

Discussion

Table 1: Performance of hydrological models at Niamey

Model	Paper	Performance
LSTM	This article	NSE: 0.933
GRU	This article	NSE: 0.935
Niger-HYPE	[Andersson et al., 2017]	NSE: 0.72
ISBA-TRIP	[Casse, 2015]	NSE: 0.93
SWAT	[Pomeon et al., 2018]	KGE: 0-0.5
HGS	[Boko et al., 2020]	Good

Conclusion

- The DL models trained and evaluated were able to achieve high accuracy and efficiency while maintaining a low computational cost and using fewer data.
- As expected, the GRU performed slightly better than the LSTM.
- The trained DL models matched and even outperformed classical hydrological models at predicting historical river flow at Niamey.

Perspectives

- The extreme discharge could have been better simulated
  - if additional variables were added to the model (data-centric approach) or
  - if the model was tweaked in a manner that predicts easier extreme events (model-centric approach).
- Regionalize a DL model over West Africa to simulate ungauged catchments

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