Improving post-processing of East African precipitation forecasts using a generative machine learning model

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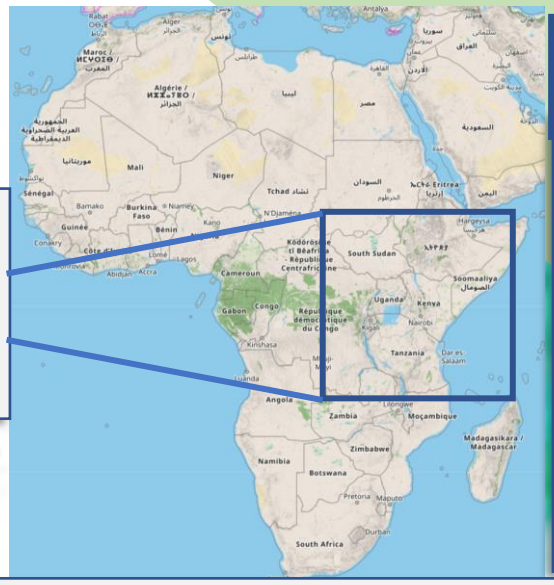
Region

Equatorial East Africa.

Prone to severe drought, and extreme rainfall.



Problem / Motivation

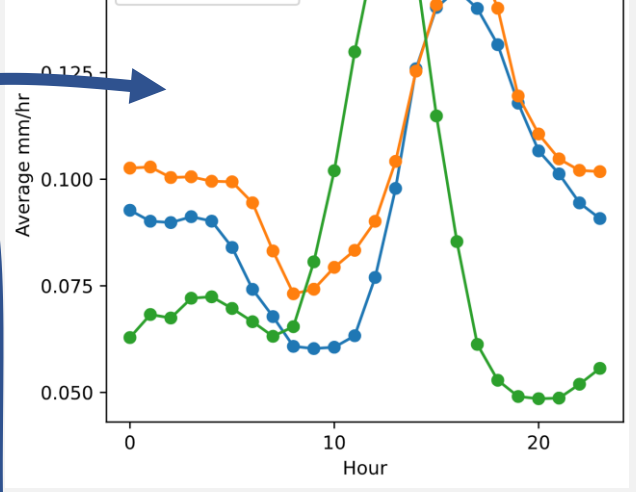
- Historically, forecast skill for precipitation in East Africa is low, particularly in the diurnal cycle and rainfall intensity.
- Can machine learning techniques improve the quality of these forecasts?
- Do these models allow us to better forecast extreme rainfall events?
- How well do machine learning models cope with convective rainfall?

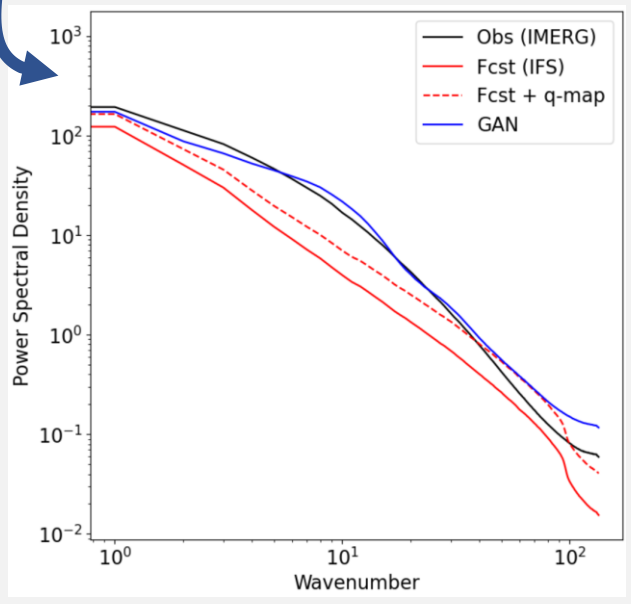
Results

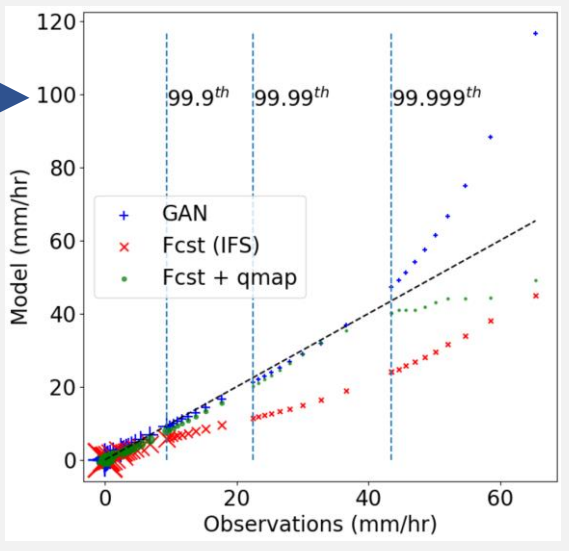
Improves spatial structure

Corrects diurnal cycle

Corrects quantile biases







But: extreme tails are too heavy

Methods

Following [1, 2], we use a conditional GAN (cGAN).

- Training on 20 IFS variables at 6-18h lead times
- Use IMERG observations as ground truth.
- Apply quantile mapping to IFS as baseline.

Further Work

Continue to improve the training. Improve performance on extremes.

Assess on a held-out test set (including extremes).

Investigate how the model is learning.

[1] Leinonen, J., Nerini, D., & Berne, A. (2020). Stochastic super-resolution for downscaling time-evolving atmospheric fields with a generative adversarial network. *IEEE Transactions on Geoscience and Remote Sensing*, *59*(9), 7211-7223.

[2] Harris, L., McRae, A. T., Chantry, M., Dueben, P. D., & Palmer, T. N. (2022). A generative deep learning approach to stochastic downscaling of precipitation forecasts. *Journal of Advances in Modeling Earth Systems*, *14*(10), e2022MS003120.