

EGU22-8454

<https://doi.org/10.5194/egusphere-egu22-8454>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Using Generative Adversarial Networks (GANs) to downscale tropical cyclone precipitation.

Emily Vosper, Dann Mitchell, **Peter Watson**, Laurence Aitchison, and Raul Santos-Rodriguez  
University of Bristol, School of Geographical Sciences, UK

Fluvial flood hazards from tropical cyclones (TCs) are frequently the leading cause of mortality and damages (Rezapour and Baldock, 2014). Accurately modeling TC precipitation is vital for studying the current and future impacts of TCs. However, general circulation models at typical resolution struggle to accurately reproduce TC rainfall, especially for the most extreme storms (Murakami et al., 2015). Increasing horizontal resolution can improve precipitation estimates (Roberts et al., 2020; Zhang et al., 2021), but as these methods are computationally expensive there is a trade-off between accuracy and generating enough ensemble members to generate sufficient high impact, low probability events. Often, downscaling models are used as a computationally cheaper alternative.

Here, we downscale TC precipitation data from 100 km to 10 km resolution using a generative adversarial network (GAN). Generative approaches have the potential to well reproduce the fine spatial detail and stochastic nature of precipitation (Ravuri et al., 2021). Using observational products for tracking (IBTrACS) and rainfall (MSWEP), we train our GAN over the historical period 1979 - 2020. We are interested in how well our model reproduces precipitation intensity and structure with a focus on the most extreme events, where models have traditionally struggled.

### Bibliography

Murakami, H., et al., 2015. Simulation and Prediction of Category 4 and 5 Hurricanes in the High-Resolution GFDL HiFLOR Coupled Climate Model\*. *Journal of Climate*, 28(23), pp.9058-9079.

Ravuri, S., et al., 2021. Skilful precipitation nowcasting using deep generative models of radar. *Nature*, 597(7878), pp.672-677.

Rezapour, M. and Baldock, T., 2014. Classification of Hurricane Hazards: The Importance of Rainfall. *Weather and Forecasting*, 29(6), pp.1319-1331.

Roberts, M., et al., 2020. Impact of Model Resolution on Tropical Cyclone Simulation Using the HighResMIP-PRIMAVERA Multimodel Ensemble. *Journal of Climate*, 33(7), pp.2557-2583.

Zhang, W., et al., 2021. Tropical cyclone precipitation in the HighResMIP atmosphere-only experiments of the PRIMAVERA Project. *Climate Dynamics*, 57(1-2), pp.253-273.