Tropical Cyclones in the NASA GEOS-5 Model and MERRA-2 Reanalysis

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Climate models generate tropical cyclones, which can be tracked in their output and used to better understand the relationship of tropical cyclones with climate modes of variability, as well as to make projections of how their characteristics will shift in the future decades as a result of anthropogenic climate change. But using climate models to make future projections of tropical cyclones relies upon having a baseline of the characteristics of model storms under the current climate. This requires comparing the characteristics of the model tropical cyclones to observed data in order to assess how well the model simulates the current climatology of tropical cyclones. This project focuses on two high resolution datasets – the NASA GEOS-5 Model (Goddard Earth Observing System Model, Version 5) and the MERRA-2 Reanalysis (Modern-Era Retrospective analysis for Research and Applications, Version 2). These datasets are chosen because they both use the same atmospheric model, but are forced with different data. GEOS-5 is a free-running model forced with observed sea surface temperature, while MERRA-2 assimilates observed conditions into the model. By comparing tropical cyclones tracked in these datasets to each other and the historical record, this project aims to evaluate the sensitivity of this model to how it is forced and how well the GEOS-5 and MERRA-2 tropical cyclones replicate the observed tropical cyclones' characteristics. The results show that both GEOS-5 and MERRA-2 show a bias towards fewer and less intense storms than in the observed record. Additionally, despite the data assimilated into the reanalysis dataset, there is no significant difference in the performance of the GEOS-5 Model and the MERRA-2 Reanalysis when simulating tropical cyclones.