Probabilistic Prediction in Tropical Cyclones and the Madden-Julian Oscillation Relationship in the S2S dataset

Chia-Ying Lee(1), Suzana J. Camargo(2), Frédéric Vitart(3), Adam Sobel(2),(4)

(1) International Research Institute for Climate and Society, Columbia University, Palisades, NY
(2) Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY
(3) European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom
(4) Department of Applied Physics and Applied Mathematics, Columbia University, New York, NY

A seamless prediction approach for intraseasonal forecasts of tropical cyclones (TCs) shows promise. For such forecasts, atmospheric models need to adequately simulate both TCs and the primary intraseasonal forcing - the Madden-Julian Oscillation (MJO) - as well as the link between them. As efforts to develop dynamical intraseasonal TC forecasts are still in the early stages, it is important to have a better understanding of how the TC-MJO relationship depends on model characteristics and lead time. The multi-model S2S dataset is ideal for this task.

Our goal is to systematically analyze the TC-MJO relationship in the S2S dataset. The data from six models, NCEP, ECMWF, JMA, MetFr, CMA, and BOM are first examined at six forecast lead-times, from Week 1 (days 1 to 7) to Week 6 (days 35-42). We start by verifying the simulated TC activity (genesis, intensity, and seasonality) against the best-track data from global and basin perspectives. Models' accuracy and reliability are summarized quantitatively using various skill scores. We also discuss the dependence of these skill scores on sample size, i.e., number of members, and data length. Results suggest that model skill in prediction storm occurrence and accumulated cyclone energy (ACE) is not sensitive to lead time, but is sensitive to the sample size. Most of the six models are skillful (after bias correction) at predicting ACE, but not so much in predicting occurrence. ECMWF performs the best followed by BoM. Generally speaking, models have better skill at predicting the Northern Hemisphere TC activities than that in the Southern Hemisphere. In addition to the verification of probabilistic prediction of TC activity, we examine the MJO prediction in the S2S data. Different to the TC prediction, models skill at predicting MJO decreases with leadtime. Models are better in predicting MJO phases than strength. In this talk, we will also explore the dependence of the TC activity forecasts’ skill scores on the MJO phase.