Towards regional predictions of tropical cyclone activity and hydroclimate

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Seasonal to decadal prediction systems have demonstrated skill at predicting some aspects of large-scale climate, such as temperatures over the equatorial Pacific and North Atlantic, and even the statistics of some extremes aggregated over large regions, such as the basin-wide number of hurricanes in the Atlantic. However, information at smaller space scales and of more targeted quantities is a more desirable prediction target both for decision support and for testing our understanding of processes controlling regional hydroclimate. Prediction of regional climate depends on both correct simulation and prediction of large-scale climate drivers, as well as of regional processes.

Potential for skillful seasonal prediction at the regional scale is highlighted using a new high-resolution (50km atmospheric/land resolution) global coupled climate model, targeted to the understanding, intraseasonal-to-decadal prediction and near-term projection of regional and extreme climate. Initialized predictions of global hurricane activity show skill on regional scales, comparable to the skill on basin-wide scales, suggesting that regional seasonal TC predictions may be a feasible target. The variation and prediction of regional hydroclimate globally, with a focus on the Caribbean/Gulf of Mexico and surrounding land regions are explored, including methods for maximizing prediction skill. It is shown that mean-state errors are a key constraint on the simulation and prediction of variations of regional climate and extremes, and methodologies for overcoming model biases are explored. Improvements in predictions of regional climate are due both to improved representation of local processes, and to improvements in the large-scale climate and variability from improved process representation.