GFDL One-Page Research Summary

Multi-year Predictions of North Atlantic Hurricane Frequency: Promise and Limitations

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North Atlantic hurricanes are a major climate hazard to North America, and have exhibited variability and change on multi-year timescales. Therefore, understanding and predicting the future multi-year hurricane activity is central to NOAA's mission and highly relevant to society.

We use a hybrid statistical-dynamical hurricane prediction scheme developed at NOAA-GFDL to assess predictions of multi-year hurricane frequency over since the early-1960s, focusing on predictions of the frequency of Atlantic hurricanes averaged over the five and ten years following the beginning of the forecast.

The principal results of this study are that:

1) Accounting for past changes in radiative forcing and the initial state of the global oceans leads to skillful retrospective predictions of five-year and nine-year averages of Atlantic hurricane frequency.

2) Forecast quality is improved by combining multiple models.

3) The multi-year skill comes from predicting temperatures over the northern tropical Atlantic minus those in the tropics.

4) The 1994-5 shift in hurricane frequency is the dominant contributor to forecast skill.

5) Changes in observing networks and a relatively short data record (the effective sample size is much smaller than the fifty years of data available) are key limits to confidence in multi-year foreacsts of hurricane frequency.

These results suggest that radiative forcing changes and internal climate variations have contributed to past changes in North Atlantic hurricane frequency, and that efforts to understand the likely future course of North Atlantic hurricane activity should focus on using initialization and radiative forcing together to improve the ability of global climate models to represent the processes that control patterns of sea surface temperature change. Further improvements to climate models could improve these predictions, such as through enhanced representation of fundamental process (e.g., cloud physics, atmospheric convection and oceanic processes), the response to diverse forcing (e.g., aerosols) and enhancing model fidelity through spatial resolution.