HURRICANE FORECASTING

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Abstract

A key factor in response to the threat of a landfalling hurricane is how well the system is forecast. Forecasts of the track and intensity of the storm have been made for decades while more recently specific impact forecasts of wind speed, storm surge and rainfall have been incorporated in the process.

Early hurricane forecasting relied heavily on empirical techniques using climatology and persistence. While some success in forecasting the track for 24 hours existed using this technique, error quickly increased at longer time frames. Advancements in observations starting with aircraft reconnaissance and continuing with satellite technology provided some improvements from the 1950s through the 1970s. Major improvements followed the ability of computer forecast models to successfully model the steering currents that dictate hurricane movement. Currently track forecasts have considerable skill out 5 days. Improvements in track forecasting continue through the present as model resolution and computer power increase.

The same cannot be said for intensity forecasting. The above mentioned observations led to early improvement in short term intensity forecasts but challenges still exist. There still is uncertainty in the basic science behind what causes changes in hurricane intensity and because of this attempts to model these changes still lag the skill in track forecasting. This is particularly true for rapid change in intensity, which proves to be a commonly occurring yet still poorly forecast aspect of major hurricanes. Solving this important issue and developing subsequent computer models to provide meaningful guidance is one of the lead issues still facing hurricane forecasting.

Impact forecasting is very important for key decisions being made concerning preparations and evacuation. Storm surge forecasting has seen considerable advances in the past decade and the National Hurricane Center has implemented a specific warning program for this hazard for the 2017 season. Key challenges are tied to forecasts of the track, intensity, and size of the hurricane. Because of advances in forecasting these hurricane parameters especially in the 24-48 hour time frame, skillful probabilistic forecasts of storm surge can now be made with lead times important to decision makers. Wind forecasts are challenging due to the complex interaction of the storm with land mass characteristics at landfall, where turbulence (gustiness) becomes a major factor. Research in the late 1990s determined a useful decay function that helps forecast winds after landfall.

The heavy rainfall that accompanies most landfalling tropical cyclones continue to be a leading cause of loss of life due to the catastrophic flooding that sometimes follows the rain. Rainfall forecasts are now made specifically for storms making landfall. The absolute amounts expected are forecast with some skill. The problem is pinpointing where the heavy rainfall and flooding will occur. To date this is a mesoscale issue and is best forecast over a 0 to 6 hour time scale. Another issue with response is that rainfall amount is not correlated with the intensity of the storm with some of the most prodigious rainmakers being weak tropical storms which people have a tendency to let their guard down for.

The presentation will briefly look at the history of forecasting, discuss the success story of track forecasting and the challenges of intensity and impact forecasting.