A New Probabilistic Hurricane Forecasting Service

Abstract

Atmospheric and Environmental Research, Inc. (AER) and EQE International/EQECAT have teamed to develop a new family of hurricane forecasting services to serve the various sectors of the weather risk management market. The first of these services, EQETRAC, went into operation in July 2000, addressing both the information needs of the property insurance industry and coastline facility managers, including those responsible for critical power plant operations. EQETRAC uses a probabilistic modeling system to forecast tropical storm landfall, intensity, damage, and insured losses.

The probabilistic approach to a forecasting system is of particular value to managers used to dealing with operational risks quantified statistically. EQE's US WINDS, a model of damage from destructive winds licensed to a number of corporate clients, is a probabilistic model and was incorporated into EQETRAC. The probabilistic approach allows for a quantitative treatment of the inherent uncertainties in the forecast of hurricane landfalls and destructive winds. EQETRAC has two major components: probabilistic forecasts of meteorological parameters at landfall and the resultant estimates of dollar damages and insurance losses.

The hurricane forecast makes use of the ensemble forecasting technique to provide landfall and hurricane intensity forecasts. Despite substantial research on atmospheric and oceanographic steering of tropical storms, landfall prediction errors remain substantial and, in and of themselves, unpredictable. Assembling and differentially weighting a variety of forecast model tracks with known characteristics, however, can provide a quantitative measure of forecast confidence. The more tightly grouped the forecast landfalls of the various models, the greater will be the track confidence. In addition, EQETRAC models for each forecast track the likely intensification of the storm over its unique trajectory. A coupled ocean-atmosphere model developed by MIT Professor Kerry Emanuel predicts intensification based not only on vertical wind shear and sea-surface temperatures, but also the trans-thermocline ocean mixing induced by the storm. This innovative physical model represents a significant advance over current National Hurricane Center (NHC) statistical intensification models and can also be run many times quickly over an ensemble of tracks.

EQETRAC was designed to generate the ensemble of track probabilities and intensities in under two hours, providing timely adjustments to the forecasts over time. The output is a statistical representation of landfalling points and maximum wind fields, enabling decision making over a range of risk mitigating actions instead of the purely binary actions driven by the NHC's singular, official forecasts. In addition, the technically superior intensity model, tested through the hindcasting of storms since 1990, provides demonstrably greater skill in the forecasting of destructive winds as compared with NHC models. In fact, the NHC is currently testing the model for integrating its output into their single track forecast.

This paper describes the modeling and the information delivery systems which provide critical advanced information on a major threat to facility operations. For operators of nuclear plants on the eastern seaboard, obtaining the best objective risk assessment can ensure continued safety procedure compliance while limiting unnecessary outages. We provide model output for Hurricane Floyd in 1999, demonstrating the forecast detail that would have been available as compared with NHC's consensus forecasts. The paper will also show results from the 2000 hurricane season.

Randy McNeely, Manager, Climate Risk Unit, AER will present the paper.