Extended-range TC Forecasting: Opportunity and Challenge

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Extended-range forecasting of the geneses and occurrences of Tropical Cyclones (TC) become possible largely due to the fact that TC activities are strongly modulated by large-scale circulations associated with tropical intraseasonal variability: for example, Madden-Julian Oscillation (MJO), Boreal Summer Intra-Seasonal Oscillation (BSISO), Easterly waves and Convectively-Coupled Equatorial Waves (CCEW). In recent years, the collective efforts of weather and climate communities on the way to pursue seamless prediction have led to significant advancement of intraseasonal forecasting capability at major operational weather and climate forecasting centers. The useful skills on forecasting the gross features of the MJO in some global models (e.g., NCEP, ECMWF, et al.) have reached beyond two weeks. Increasing successful case studies have shown that current numerical models are capable of forecasting some TC occurrences (e.g., Debby in late June over the Gulf of Mexico and Daniel in early July over the Eastern North Pacific) with a lead time of one-to-three weeks.

These successful stories offer an opportunity to issue extended-range TC forecasting with numerical models. The establishment of this early warming capability will have great benefits for coastal communities and maritime activities (e.g., oil drilling industry in the Gulf of Mexico). National Centers for Environmental Prediction (NOAA NCEP)/Climate Prediction Center (CPC) has been a pioneer on issuing "Global Tropical Hazards/Benefits Outlook" weekly since 2007[1], which highlights potential TC risk areas two weeks in advance. NCEP/National Hurricane Center (NHC) is also planning to issue extended-range (5 days and beyond) Hurricane forecasting in near future. The potential societal benefits of extended-range TC forecasting are tremendous. At the same time, great efforts are still needed to make routine extended-range forecasting of tropical cyclones more useful for applications. *At the sub-seasonal time scale, current model forecasting of tropical cyclones still have various uncertainties: such as too many false alarms, some missing events and "jumpy" forecasts at different lead times.*

In order to reduce the uncertainties of extended-range TC forecasting, continuing efforts from both weather and climate communities are necessary to further advance the understanding, modeling, and prediction of tropical intraseasonal variability and its modulations of tropical cyclones. Towards this end, the newly-formed USCLIVAR extreme WG, YOTC, DYNAMO/CINDY/AMIE, MJO Task Force, and the newly-launched Subseasonal-to-Seasonal Prediction Initiative as well as other TC-related Initiatives are making synergetic effort to address this grand challenge. At the same time, some new research fronts are emerging. For example, what are the major factors leading to TC false alarms and how to reduce TC false alarms in operational extended-range forecasting models? What cause the "jumpiness" in extended-range TC forecasting? Will multi-model ensemble approach significantly reduce the afore-mentioned uncertainties?

[1] NCEP/CPC Global Tropical Hazards/Benefits Outlook is available online: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php