Investigating the Dynamics of Error Growth in ECMWF Forecast Busts

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The European Centre for Medium Range Weather Forecasts (ECMWF) has noted a number of events when their global forecast model has experienced large errors (busts) around day-6 over Europe (Rodwell et al. 2013). Using the ERA-interim forecast as a fixed model, they identified 584 cases in a 22-year period fit the ECMWF criteria for a bust. A recurring feature in the initial conditions of these cases is a synoptic pattern supportive of mesoscale convective systems (MCSs) over the eastern two thirds of the USA. The pattern associated with the forecast bust was the onset of blocking over Europe. The suggestion was that errors resulting from convective parameterization schemes and the handling of associated mesoscale features result in forecast busts in the large-scale features. This upscale growth of errors appears to be amplified by bifurcations in atmospheric evolution, such that one particular regime, such as a block, becomes favored over the verifying regime.

This study examined the sensitivity of these regimes to initial conditions through an ensemble sensitivity analysis based on the ERA-interim initialization. The development of errors in the bust cases was then approached from a potential vorticity (PV) perspective and analyzed by both an absolute difference and a correlation between the forecast field and analysis field. The contribution of error from MCSs over the USA was investigated using the PV principles of conservation and inversion. In addition to effects of latent heat release in height tendency, diabatic Rossby vortex generation may play a role in forecast error growth. The treatment of convection within the model will be addressed through comparisons between the evolution of the observed and simulated convective systems.

Rodwell, et al. 2013: Characteristics of occasional poor medium-range weather forecasts for Europe, Bull. Amer. Meteor. Soc, (early release)