

Initial Condition Uncertainty and its Impact on Medium-Range Forecasts of a Winter Cyclone that Impacted Western Europe on 16 December 2011

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Forecasts from several deterministic and ensemble numerical weather prediction systems, initialized between 9 and 10 December 2011 consistently forecasted a strong mid-latitude cyclone landfalling along the east coast of the United Kingdom (UK) on 16 December 2011. For example, 29 of the 51 members of the ECMWF Ensemble Prediction System (EPS) initialized at 0000 UTC on 10 December 2011 predicted a cyclone with a minimum sea-level pressure below 950-hPa. This consistency among different models and run to run consistency gave many forecasters enhanced confidence that a significant winter cyclone could impact Western Europe around 16 December 2011. However, subsequent forecasts initialized after 10 December 2011 predicted a much weaker cyclone landfalling in the UK and these weaker forecasts are what ultimately verified.

The goal of this study is to investigate the role of initial condition errors in creating the noted large, medium-range forecast errors associated with the winter cyclone that impacted Western Europe on 16 December 2011. To accomplish this goal, ensemble sensitivity analysis was utilized to evaluate the relationship between initial condition errors and forecast errors. Preliminary results suggest that the large forecast errors produced by models initialized between 9 and 10 December 2011 for the 16 December 2011 cyclone event stem from initial condition errors associated with disturbances that were embedded within the circulation of an upper level low centered near the Aleutian Islands at the initialization time. These initial condition errors spread downstream across northern North America and the northern Atlantic Ocean during the subsequent forecast. Ultimately, these incorrect model forecasts of the strength and structure of the downstream, upper-level flow over the Northern Hemisphere created an erroneously favorable environment for rapid cyclongenesis over the North Atlantic around 15 December 2011 and resulted in forecasts that overpredicted the strength of the winter cyclone that impacted Western Europe on 16 December 2011.