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Dependence of ensemble prediction skill on blocking instability regimes

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The skill of ensemble prediction during blocking regime transitions is examined for Northern Hemisphere flows within two atmospheric models. An ensemble prediction scheme based on fast growing perturbations has been implemented for conformal-cubic and spectral general circulation models. The methodology uses a breeding method, based on an implicit linearization of the models, in which perturbations likened to leading Lyapunov vectors are obtained and used to perturb the initial conditions. Detailed comparisons of the skill of ensemble mean forecasts with control forecasts have been carried out for Northern Hemisphere initial conditions in October and November 1979. A particular focus has been the variability of forecast skill during the development, maturation and decay of the large-scale blocking dipoles that occurred in the major blocking regions over Europe, over the Gulf of Alaska, over the North Atlantic and as well over North America. On average, the ensemble mean forecast performs better than the control forecast for forecast times longer than 3 or 4 days. Average error growth curves in the two models are quite similar with the conformal-cubic model ensemble generally performing slightly better than for the lower resolution spectral model. Both ensemble and control forecasts initiated twice daily exhibit considerable variability in forecast skill that is shown to be related to instability regimes of particular synoptic events. At a given forecast lead time, errors tend to be larger for forecasts validating when blocks are developing or decaying and smaller for mature blocks. The spread of ensemble member forecasts has been studied and related to likely forecast skill. Comparison of results from the conformal-cubic and spectral models initialized with two different analysis data sets has allowed the determination

of the robustness of our findings relating error growth to instability regimes.