

Title: Systematic error in the forecast of atmospheric blocking and upper-level Rossby-waves.

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The forecast of atmospheric blocking has been a known problem for medium-range weather forecasts for numerous years. Several studies have shown that the frequency of blocking is generally underpredicted in forecasts with lead times greater than 7 days from several numerical weather prediction centres. Ensemble prediction systems have also been shown to struggle to predict the onset and decay of blocking accurately for lead times up to one week.

The performance of ensemble prediction systems in the forecast of blocking is assessed for forecasts from the Met Office, ECMWF and the Korean Meteorological Administration (KMA) for winters 2012-16 extracted from the TIGGE archive. Forecasts from KMA are included for a comparison with the Met Office since this centre also runs the Met Office Unified Model, but until recently at an older configuration. We find that models still cannot accurately represent the onset, decay and frequency of blocking in forecasts of lead time 7 days. The link between the forecast of blocking and the representation of Rossby waves at the tropopause is studied for winters 2012-2016. Systematic error in the representation of atmospheric blocking in ensemble prediction systems is shown to be associated with the systematic error in the representation of Rossby waves at the tropopause. A systematic decrease in the area of ridges with lead time is consistent with an underestimation of the frequency of atmospheric blocking. An improvement in the representation of Rossby waves with the introduction of a new dynamical core in the Met Office model in 2014 is shown to result in an improvement in the forecast of ridge area and blocking.