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The influence of upstream cyclones on forecasts of block onset

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Atmospheric blocking has a large influence on a region's weather and, due to its persistence and scale, can have severe surface weather impacts. Blocking has been repeatedly shown to be a phenomenon that models struggle to predict accurately, particularly the onset of a blocked state following a more zonal flow¬. This struggle is, in part, due to the lack of complete dynamical mechanism by which blocking occurs. Cyclones have been studied as a potential candidate for triggering block onset: they can transport air masses with low potential vorticity that constitute blocks upwards and polewards into the regions where blocks most frequently form.

Here, we evaluate the impact cyclone representation had on the forecast of block onset in a case study that occurred during the NAWDEX field campaign in autumn 2016, as well as in 20 of the most unpredictable block onsets over Europe in medium-range forecasts from the European Centre for Medium-range Weather Forecasts. The 6-day forecast of the NAWDEX block onset is shown to be sensitive to changes in the forecast location and intensity of an upstream cyclone in the days preceding the onset. Ensemble sensitivity analysis reveals that this is often the case in unpredictable block onset cases. A one-standard deviation change in 1000-hPa geopotential height in the region of an upstream cyclone 2 or 3 days prior to block onset is associated with around a 25% change in block area on the analysed onset day in three quarters of the onset cases. These results imply that improvement in the forecasts of upstream cyclone location and intensity may be a route to improving forecasts of block onset.