Atmospheric blocking describes asynoptic conditions that effectively block the prevailing, synoptic weather systems. They are often characterized by regions of quasi-stationary high-pressure near the surface. In the northern hemisphere two distinct blocking maxima occur in the Northern Pacific and Western Europe, with a secondary maximum south of Greenland. Blocking can be influential year round, but the winter-time peak is most pronounced with a 20-25% occurrence. The relative stationarity and asynoptic nature of blocking results in significant impacts in terms of extreme events. Locally, as during the 2009-2010 European winter, this can manifest as extreme cold temperatures and snowfall amounts that extended into Western Russia. However, blocking can also have an impact on extreme surface temperatures in Summer as seen during the 2003 and 2006 European heat waves. Each of these events were associated with a significant increase in mortality.

Historically, GCMs have been poor at representing the frequency and characteristics of blocking events. Possible reasons for this include insufficient model resolution, unresolved tropical-stratosphere interactions and excessive extratropical jet and baroclinic activity. The Community Earth System Model (CESM) has seen significant improvements in the representation of blocking compared to previous model versions. In particular, summer-time blocking and European Spring-time blocking in Western Europe show reduced biases. However, Winter-time European blocking remains poorly simulated with occurrence being only half that observed. Given changes in atmospheric model physics, dynamics and resolution leading up to CAM5 we identify the key components responsible for blocking improvement and how it relates to both local and non-local influences on blocking. We also speculate on the cause of persistent blocking biases. In the CESM RCP8.5 large-ensemble there is a general decrease in the frequency of winter-time blocking, particularly in western Europe. However, this reduced frequency may be offset by longer and stronger blocking events.

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