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Feasibility of blocking detection in observations from radio occultation

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Blocking describes an atmospheric situation in which the climatological westerly flow at mid latitudes is weakened or reversed. This is caused by a persistent high pressure system which can be stationary for several days to weeks. In the Northern Hemisphere blocking preferably occurs over the Atlantic/European and the Pacific regions. In recent years blocking has been under close scientific investigation due to its effect on weather extremes, triggering heat waves in summer and cold spells in winter.

So far, scientific literature mainly focused on the investigation of blocking in reanalysis and global climate model data sets. However, blocking is underestimated in most climate models due to small-scale processes involved in its evolution. For a detection of blocking, most commonly applied methods are based on the computation of meridional geopotential height gradients at the 500 hPa level. Therefore measurements with adequate vertical, horizontal, and temporal resolution and coverage are required.

We use an observational data set based on Global Positioning System (GPS) Radio Occultation (RO) measurements fulfilling these requirements. RO is a relatively new, satellite based remote sensing technique, delivering profiles of atmospheric parameters such as geopotential height, pressure, and temperature. It is characterized by favorable properties like long-term stability, global coverage, and high vertical resolution. Our data set is based on the most recent WEGC RO retrieval. Here we report on a feasibility study for blocking detection and analysis in RO data for two exemplary blocking events: the blocking over Russia in summer 2010 and the blocking over Greenland in late winter 2013. For these two events about 700 RO measurements per day are available in the Northern Hemisphere. We will show that the measurement density and quality of RO observations are favorable for blocking analysis and can therefore contribute to blocking research.