Investigating atmospheric blocking and related extreme events in Austria over the past decades

Moritz Pichler[1], Andrea K. Steiner[1]

1 Wegener Center for Climate and Global Change, University of Graz

Atmospheric blocking events are persistent high-pressure systems in the mid-latitudes that can block the westerly flow usually prevailing in this region. They have previously been demonstrated to be connected to extreme weather events. We analyzed trends in the frequency of blocking events over the northern mid-latitudes and investigated the connection between blocking and extreme weather events specifically in Austria. We used ECMWF Re-Analysis Version 5 (ERA5) data (1950–2019) and applied a blocking detection algorithm and ordinary linear regression to detect trends. The connection between blocking and extreme weather was investigated using ERA5 and WATCH Forcing Data ERA 5 (WFDE5) (1980–2018) by applying a Monte-Carlo algorithm. The resulting trends in blocking frequency vary by region and season. Since 1950, blocking frequency decreased longitudinally by 2 % per decade over the North Atlantic (January–May) and Asia (February) while it increased by 2 % and 4 % per decade over Europe (September) and East Asia (June), respectively. Some of these changes represent spatial shifts. Since 1979, regional blocking trends represent an increase over the British Isles in March and a decrease over the North Atlantic in November. We find a connection between blocking over Central and Eastern Europe and increased heatwave frequency in Austria and between blocking over Northern Europe and decreased heatwave frequency in Austria. We also demonstrate a connection between blocking over Northern Europe, the North Atlantic and Greenland and more frequent cold spells in Austria. Finally, blocking over Russia is connected to more frequent heavy precipitation events while blocking over the British Isles and the North Sea is associated with less frequent heavy precipitation events in Austria. Our findings can help stakeholders better understand changes in blocking frequency over the northern hemisphere in the recent decades and effects on extreme weather in Austria.