Uncertainties in atmospheric circulation processes at mid-latitudes during recent climate change

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Our knowledge of future European climate is considered uncertain because there is a large spread in current climate model projections. Europe is affected by a range of processes related to large-scale circulation and dynamic features like jet streams, storm track variability, and frequent blocking. Blocking describes a weather pattern in which the prevailing westerly winds and storms are blocked for longer than a few days by a persistent and stationary anomaly. The impacts are extreme events like dry spells and heat waves in summer and extended cold periods in winter. Recent research shows that the future climate over Europe and further north could be strongly affected by blocking. But models often underestimate its frequency and duration and observations have not yet been exploited to their full potential.

The main goal of this thesis is to analyze and better understand mid-latitude atmospheric processes relevant for the European climate, with a particular focus on the evolution and structure of blocking events. The research will be based on the investigation of observational and climate model data sets from 1980 to present regarding atmospheric circulation processes and the representation and uncertainty of blocking events. Main focus will be given on vertically well resolved observations from GPS radio occultation with the aim to gain a better insight into the vertical structure of blocking and a better process understanding.

The PhD candidate is expected to evaluate different data sets including recent re-analyses and climate model data with observations from GPS radio occultation complemented by radiosonde data sets. Process simulations with state-of-the-art models, such as the ECHAM6 model or the NCAR community climate model are planned. Surface and upper-air atmospheric parameters from the troposphere to the lower stratosphere such as pressure, geopotential height, temperature, and wind will be statistically analyzed to address the above questions.

[The project contributes to answering the DK research question 1](#)