Projected trends of objective weather types over Central Europe

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An overall global increase in temperature and precipitation is projected by global climate models (GCMs) in the 21st century. However, the regional manifestation of this climate transition is highly influenced by shifts in regional weather types. Thus, the impact of climate change can vary significantly between different regions. Knowledge about the frequency and behavior of weather types is essential, since weather periods like cold or warm and dry or wet spells as well as various kinds of extreme meteorological events are often linked to specific weather types. We examine the trends in such weather types for the 21st century over Central Europe (Germany) by applying the objective weather type classification (oWTC) of Deutscher Wetterdienst (DWD) to four CMIP5 GCMs under the consideration of two Representative Concentration Pathways (RCP 2.6 and 8.5). The objectivity of this classification refers to the categorization of weather types depending on preassigned thresholds of atmospheric meteorological parameters which are anytime reproducible with the same result. Meteorological parameters for this classification are the advection of air masses (mean flow direction), the cyclonality (curvature of the geopotential field) and humidity of the troposphere (integrated precipitable water), leading to numerical indices from which the weather types are derived. Altogether, this results in 40 different weather types on a daily time scale. First, we evaluate the ability of the GCMs to reproduce the oWT statistics of the NCEP Reanalysis for the period 1950-2005. Subsequently, we focus on weather types which already show a high probability for weather threats in the present climate and study the differences in future trends between RCP 2.6 and 8.5.