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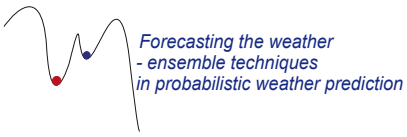

Spatial relevance and temporal development (1901–2010) of two manual atmospheric circulation classifications in Europe

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Classifying atmospheric circulation is the base and origin of synoptic climatology. This contribution focuses on two large-scale synoptic weather type classifications. The Grosswetterlagen (GWL) were mainly designed for Central Europe, while north-western Russia is the centre of the Vangengeim and Girs classification (VGC). Both are classified manually, i.e. synoptic maps of every day are evaluated by experienced meteorologists, who assign the daily cases to one of the predefined circulation types. The data are accessible from the late 19th century and thus allow an analysis for the period 1901–2010. Only three main types are usable for the VGC, representing one zonal and two meridional conditions. A much higher number of subtypes contain major inhomogeneities. The GWL comprise 29 subtypes that may be aggregated into e.g., ten Grosswettertypen, three forms of zonality and two types of cyclonality. Additionally, five GWL types, representing four directions of inflow and one anticyclonic situation over Central Europe, are used especially for the comparison of GWL with VGC.

The spatial relevance of the classification systems is identified using correlation maps. Displaying the correlations between air pressure and circulation patterns for the northern hemisphere also allows identifying teleconnections on a hemispheric level. Similar pattern in VGC and GWL may be identified qualitatively in the correlation maps. They are quantified by calculating correlation coefficients between the time series of both classifications, testing various combinations. Linear trends in the frequencies of circulation patterns are calculated to detect changes in atmospheric circulation. Their significance is tested using the Student t-test, while their temporal stability is evaluated using a moving trend matrix analysis. Inner-annual trends on a shifting daily basis, e.g., to detect changes in singularities, were analysed within different time frames.

Preliminary results show a high spatial relevance of both classifications for many parts of Europe, although the different focus regions of GWL and VGC are clearly discernible. VGC may also be used in other parts of the northern hemisphere due to their classification concept. In contrast, the hemispheric importance of GWL is limited. Correlations are generally higher in winter than in summer due to related higher atmospheric dynamics. Spatial correlations between the patterns of both classifications vary notably over time. During the last decades they slightly decreased. The frequencies of the main types of VGC and GWL clearly differ in their temporal variability, while for both types, hardly any stable long-term trends could be identified. Inner-annual structures often show similarities over time, but might also vary considerably for some of the patterns.

The results of our study are helpful in diagnosing spatiotemporal climate variations in Europe for the past 110 years. Based on the presented results, relations of the two classification systems GWL and VGC with regional surface climate parameters will be studied.