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Classification of synoptic-scale weather patterns in southernmost South America using self-organizing maps

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Approaches of generalizing and categorizing synoptic-scale circulation patterns are mostly dealing with multi-dimensional input domains. Recognizing groups of similar patterns within this input domain is still a challenging task and requires a suitable method to identify similar features. In this study self-organizing maps (SOM) were used in order to detect and classify regularities and correlations in the data. SOMs reduce the input vector domain to a low-dimensional grid which displays the essential features of the high-dimensional data.

Since no assumptions regarding the underlying data are required, SOMs present an objective clustering procedure which is able to map any arbitrary linear or non-linear data distribution. The proposed technique was applied to classify the synoptic-scale weather patterns for southernmost South America on a localized domain between 10-80˚S and 110-40˚W. By means of SOM the state of the atmosphere was characterized on the basis of National Centre of Environmental Prediction (NCEP) / National Centre of Atmospheric Research (NCAR) daily reanalysis data from 1999 to 2001 using sea level pressure (SLP) as well as the 500hPa pressure level. The results obtained from the two year training period were subsequently compared to a semi-objective classification as proposed by Schneider and Frank (poster submitted to the EGU conference 2007, same session). All of the 10 synoptic weather types that were retrieved using the semi-objective classification were as well clearly distinguished by the SOM. Furthermore, 9 additional subtypes were gained by the SOM.

Moreover, the obtained low-dimensional grid offers a great potential for further analysis such as frequency analysis, trajectories in time and space or the analysis of local

weather conditions. This analysis is subject to ongoing investigations. The results presented here demonstrate that SOMs can be easily applied to classify atmospheric states without making any subjective assumptions as is the case with most other synoptic-scale weather pattern classification schemes. Thus SOMs can also be an useful tool of representing dynamic multidimensional atmospheric features in Geographic Information Systems.