



Classification of circulation type sequences applied to snow avalanches over the eastern Pyrenees (Andorra and Catalonia)

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Using data associated with accidents or damages caused by snow avalanches over the eastern Pyrenees (Andorra and Catalonia) several atmospheric circulation type catalogues have been obtained. For this purpose, different circulation type classification methods based on Principal Component Analysis (T-mode and S-mode using the extreme scores) and on optimization procedures (Improved K-means and SANDRA) were applied. Considering the characteristics of the phenomena studied, not only single day circulation patterns were taken into account but also sequences of circulation types of varying length. Thus different classifications with different numbers of types and for different sequence lengths were obtained using the different classification methods. Simple between type variability, within type variability, and outlier detection procedures have been applied for selecting the best result concerning snow avalanches type classifications. Furthermore, days without occurrence of the hazards were also related to the avalanche centroids using pattern-correlations, facilitating the calculation of the anomalies between hazardous and no hazardous days, and also frequencies of occurrence of hazardous events for each circulation type. Finally, the catalogues statistically considered the best results are evaluated using the avalanche forecaster expert knowledge. Consistent explanation of snow avalanches occurrence by means of circulation sequences is obtained, but always considering results from classifications with different sequence length. This work has been developed in the framework of the COST Action 733 (Harmonisation and Applications of Weather Type Classifications for European regions).