



Solar effects on circulation types over Europe: an analysis based on a large number of classifications

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Recently, effects of the 11-year solar cycle on various aspects of tropospheric circulation in the Northern Hemisphere in winter have been recognized. One of our previous studies showed a significant solar effect on the frequency of synoptic types from the Hess-Brezowsky catalogue. Here, we use a large collection of varied classifications of circulation patterns, defined over central Europe, assembled within the COST733 Action "Harmonization and Applications of Weather Types Classifications for European Regions" to detect the solar effect on the frequency of synoptic types. The advantage of this multi-classification approach is that peculiarities or biases present in any single classification (catalogue) that might influence the detected solar signal are eliminated once a large ensemble of classifications is used. We divide winter months (December to March) into three groups according to the mean monthly solar activity, quantified by the solar 10.7 cm flux. The three groups correspond to the minima of the 11-year solar cycle, a moderate solar activity, and solar maxima. Within each group, frequencies of occurrence of individual circulation types are calculated. Differences in the occurrence of individual classes between solar activity groups indicate the presence of a solar activity effect on atmospheric circulation over Europe. Statistical significance of these differences is estimated by a block resampling method. An enhanced frequency under solar minima and a reduced frequency under solar maxima are observed almost exclusively for the types with easterly flow over central Europe. On the other hand, a reduced frequency under solar minima and an enhanced frequency under solar maxima are found for the types with westerly flow over central Europe. The research is supported by the Grant Agency of the Czech Academy of Sciences, project A300420805, and by the Ministry of Education, Youth, and Sports of the Czech Republic, contract OC115.