



A comparison of geomagnetic and solar effects on tropospheric circulation in the Northern Hemisphere in winter

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Our previous results on solar effects on tropospheric circulation in the Northern Hemisphere in winter, characterized i.a. by modes of low-frequency variability (teleconnections), are extended to the geomagnetic activity. The winter (December to March) months and 10-day periods are stratified by the geomagnetic activity into three classes, low, moderate, and high. The variability modes are determined in the 500 hPa geopotential height field by rotated principal component analysis separately in each class of geomagnetic activity. The effects of geomagnetic activity on winter mid-tropospheric variability modes are significant and considerably differ from those of solar activity. Under high geomagnetic activity, zonal modes (in particular North Atlantic Oscillation, East Atlantic mode, and West Pacific Oscillation) intensify and their eastern flanks become more meridional, which results in a weakened westerly circulation over central Europe. The effect of geomagnetic activity depends on the time scale: it is more pronounced for monthly than 10-day mean data. A time lag introduced between the geomagnetic forcing and tropospheric response contributes to a slight strengthening of the effects detected. The separate analysis conducted for days with a quiet or unsettled geomagnetic field only, suggests that most of the solar effects on tropospheric circulation are direct, that is, not mediated through geomagnetic activity. The research is supported by the Grant Agency of the Czech Academy of Sciences, project A300420805.