



## **Modes of low-frequency variability in the Northern Hemisphere in winter: A comparison of geomagnetic and solar effects**

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Our recent results indicate that the shapes, spatial extent, and intensity of modes of low-frequency variability of atmospheric circulation (also called ‘teleconnections’) in the Northern Hemisphere in winter are significantly affected by the phase of the 11-yr solar cycle. Here we extend the analysis to the geomagnetic activity, and compare the results with the solar activity. The winter months and 10-day periods are stratified by the geomagnetic activity into three classes, low, moderate, and high. The teleconnections are determined by rotated principal component analysis separately in each class of geomagnetic activity. The lags between the geomagnetic activity and atmospheric circulation from zero to five days are involved. Detected are all the modes known to exist in the Northern Hemisphere mid and high latitudes, including among others the North Atlantic Oscillation, Pacific / North American pattern, West Pacific Oscillation, and North Asian pattern. The effects of geomagnetic activity are similar to those of solar activity in that they include a tendency to zonalization of the modes, their larger spatial extent, and relatively greater intensity of the zonal modes under a high activity. The effects of the geomagnetic and solar activity are similar in magnitude, with the lagged geomagnetic effects being somewhat stronger than the unlagged ones.