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Seasonal variation of geomagnetic field and TEC at mid-latitude region

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Our study is focused on the analysis of the geomagnetic variability of the H and Z components for two local times, night and noon (corrected by the night time level), recorded by 22 permanent observatories distributed at midlatitude over Europe and North America during 2000-2003. We used Principal Component Analysis (PCA) in order to identify the spatial and temporal variations of the geomagnetic field components. This technique produces a quite compact representation of the data by defining an orthonormal base derived from correlation within the data set. This helps us to identify possible causes of seasonal variations and anomalies, linking them with already observed currents. More than 90% of the original signal is reconstructed using the first two and three modes for Europe and North America respectively.
To improve our conclusion, PCA analysis is also applied on Total electron content parameter (TEC), obtained from observations of Global Navigation Satellite System network and termostheric vertical wind (V) from HWM07 model.
Combining the variabilities of geomagnetic field, TEC and thermospheric wind, our study relates the different main currents with the pattern show by each parameter' variation.
At nighttime PCA first mode reconfirm the existence of a latitudinal dependence in the geomagnetic components, associated with the ring current, the second mode in Z component shows geomagnetic variation, which is correlated with the second PCA mode on TEC, this variability could be related to gravity-driven current and diamagnetic plasma current.
During noon, the first mode represents the dominant component of the Sq current. The second and third modes highlighted the existence of other currents that could be related with the variability of TEC distribution, and then with gravity and diamagnetic ionospheric current systems.