Abstract

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The impact of asymmetrical distribution of solar activity on geomagnetic indices throughout five solar activity cycles

The irregularity of the solar activities based on sunspot numbers (SSNs) and areas (SSAs) over the solar disk has been considered. More activities phenomena occurred in one of the solar hemispheres than the other at the same time, which they are referred to as the North-South (N-S) asymmetry of solar activity. Daily averages of geomagnetic indices aa, Ap, Kp, and Dst over the period 1967–2016 have been examined according to the asymmetrical distribution of both solar hemispheric activities. The possible connection between the geomagnetic activity disturbances and the sign of non-uniformity of solar activity, i.e. the N-S asymmetry for each geomagnetic index has been confirmed. The dependence of the sign of geomagnetic disturbances on the solar activity cycle, has been examined. We have classified the considered data into two groups according to the activity of northern (N) southern (S) solar hemisphere. The solar cycles 20 and 24 have northern hemisphere dominance. These activities shifted from northern to southern hemisphere in solar cycles 21, 22, and 23. The geomagnetic disturbances exhibited significant asymmetrical states at different periods. The most significant northern and southern peaks occurred at/near the minimum of the solar cycle in periods of descending phase of the solar cycle. The geomagnetic activity has southern dominance during solar cycle 22 and it favoured the northern activity during solar cycle 23. The dependence of the geomagnetic activity disturbance of aa, Ap, Kp, and Dst indices over the solar activity cycle is confirmed and the sign of the asymmetry changes from one solar cycle to another.