Abstract

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North–South Asymmetry of Solar Diurnal Variations of Cosmic-Ray Intensity Throughout the Period 1975?–?2013

Hourly cosmic-ray intensities, recorded by 15 neutron monitor detectors in both Earth hemispheres, have been analyzed according to the interplanetary magnetic field (IMF) polarity sense (Toward (T) Away (A)) to examine the asymmetry of solar diurnal variations (amplitudes and phases) during the time interval from 1975 to 2013. The vertical geomagnetic cut-off rigidity of these detectors is Ro?13 GV. Previously, the north–south asymmetries of cosmic-ray intensity, between the northern and southern sectors with respect to the neutral sheet, have been studied for different periods to give an explanation as regards the cosmic ray flow in the direction parallel to the rotation axis of the Earth. The observed cosmic ray asymmetries between the two sectors were related to a corresponding N–S asymmetry of solar activity. Our results showed that during the years of minima and maxima solar activity cycles, asymmetric of latitudinal southward northward gradients have been observed at both hemispheres. In addition, the southward and northward cosmic ray latitudinal gradients were frequently observed at stations on both hemispheres during the active period of the northern and/or southern hemispheres of the Sun. On the other hand, the differences in the solar diurnal (T–A) vectors show that the time of maximum depends on latitude at the point of observation. In addition, when the interplanetary magnetic field IMF was directed away from the Sun north of the current sheet, the northern solar diurnal vectors (T–A) shifted to later hours. Moreover, when the solar magnetic field is reversed, the phase of solar diurnal (T–A) vectors changed from 1 to 11 h, and from 3 to 9 h for northern and southern observations, respectively.