Drift Effects and solar magnetic-cycle variation of Cosmic Ray Density Gradient

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By using the directional anisotropy of high-energy (˜50 GeV) galactic cosmic ray intensity observed with a global network of muon detectors on the Earth's surface, we deduce on hourly basis the spatial gradient of the cosmic ray density in three dimension. In particular,we analyze the gradient in the corotational interaction regions (CIRs) accompanied by the heliospheric current sheet (HCS) and examine the drift model which predicts different distributions of cosmic rays above and below the HCS in different polarity (A>0 or A<0) epochs of the heliospheric magnetic field. It is clearly shown that the observed latitudinal gradient (Gz) changes its sign from negative to positive on the Earth's HCS crossing from the northern to the southern hemisphere in A<0 epoch, while it changes from positive to negative in A>0 epoch. The average GSE-x component (Gx) is negative, while the average y component (Gy) is almost zero. These features are qualitatively consistent with the drift model prediction. The predicted polarity dependence of the magnitude of Gx, on the other hand, is not observed.