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Evolution of the galactic cosmic ray electron to proton ratio: Ulysses COSPIN/KET observations

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The on-going Ulysses mission provides a unique opportunity to study the propagation and modulation of galactic cosmic rays (GCRs) in detail. The intensity of GCRs is modulated as they traverse the turbulent magnetic field embedded in the solar wind. These particles are scattered by irregularities in the interplanetary magnetic field and undergo convection and adiabatic deceleration in the expanding solar wind. The large-scale heliospheric magnetic field leads to drifts of GCRs in the interplanetary medium. The time history of electrons and protons is a suitable tool to investigate the importance of drifts in heliospheric modulation. In late 2000, the electron to proton ratio at rigidities of 1.2 GV and 2.5 GV was roughly the same as in the previous solar maximum, when the solar magnetic field reversed from an $A < 0$ to an $A > 0$-solar magnetic epoch, indicating that drifts are not of importance at solar maximum. After late 2001 the ratio began to increase and started to decrease in 2004, leading to the conclusion that drifts are becoming increasingly important again. In this paper we will discuss the Ulysses observations in context with numerical simulations.

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