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Longitudinal variations of the magnetic flux in the heliosphere

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The heliospheric magnetic flux is determined from the radial component of the magnetic field vector measured onboard interplanetary space probes. Earlier Ulysses research has shown remarkable independence of the flux from heliographic latitude. Here we investigate whether any longitudinal variation exist in the 50 year long OMNI magnetic data set. When determining the heliographic longitude of the plasma source, correction was applied for the solar wind travel time. Significant recurrent enhancements of the magnetic flux was observed during the declining phase of the solar cycles. These flux enhancements are associated with co-rotating interaction regions (CIRs), lasting several years. The recurrence period equals the equatorial rotation period of the Sun. The same, long lasting recurring features can be observed in the deviation angle of the solar wind velocity vector from the radial direction. However, the deviation angle is small, in the order of few degrees, which cannot account for the observed flux increases. An increase of the magnetic field is clearly caused by the plasma compression associated to CIRs, however the increase of the radial component is not obvious. It is suggested that the origin of that increase is caused by the compression of the plasma in the direction perpendicular to the Parker field line rather than the radial direction. The longitudinal variation of the magnetic flux during the declining phase of the solar cycle has impact on the modulation of cosmic rays as well as on the frequency and intensity of space weather events.