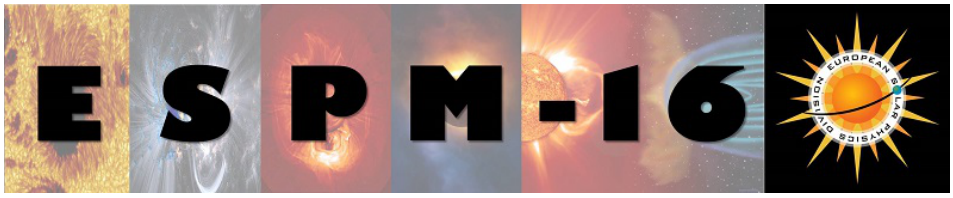

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Reconstruction of solar magnetic field during Cycles 15–19 based on proxies from Kodaikanal Solar Observatory

Monday 6 September 2021 11:50 (13 minutes)

The regular observation of the solar magnetic field is available only for about last five cycles. Thus, to understand the origin of the variation of the solar magnetic field, it is essential to reconstruct the magnetic field for the past cycles, utilizing other datasets. Long-term uniform observations for the past 100 years as recorded at the Kodaikanal Solar Observatory (KoSO) provide such an opportunity. We develop a method for the reconstruction of the solar magnetic field using the synoptic observations of the Sun's emission in the Ca IIK and Hα lines from KoSO for the first time. The reconstruction method is based on the facts that the Ca II K intensity correlates well with the unsigned magnetic flux, while the sign of the flux is derived from the corresponding Hα map which provides the information of the dominant polarities. Based on this reconstructed magnetic map, we study the evolution of the magnetic field in Cycles 15–19. We also study bipolar magnetic regions (BMRs) and their remnant flux surges in their causal relation. Time-latitude analysis of the reconstructed magnetic flux provides an overall view of magnetic field evolution. We identify the reversals of the polar field and critical surges of following and leading polarities. We found that the poleward transport of opposite polarities led to multiple changes of the dominant magnetic polarities in poles. Furthermore, the remnant flux surges that occur between adjacent 11-year cycles reveal physical connections between them.

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