

Origins of Persistence in Energetic Neutral Atom Time Series from IBEX

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We show the persistence of energetic neutral atom (ENA) fluxes recorded by the Interstellar Boundary Explorer (IBEX) from the north and south polar regions by examining the correct time order for the 14 yr of IBEX data. To this end, we employ the Hurst R/S method, the detrended fluctuation analysis (DFA), the centered moving average (CMA) analysis, and the fluctuations of natural time (FNT) under time-reversal. We further explore the origins of this persistence by comparing the time series of the ENA fluxes obtained from the near-Earth with the time series of the solar wind flow pressure at 1 au. We show that even when removing all periodic trends from the flux time series, the remaining fluctuations exhibit DFA exponents compatible with those found for the solar wind pressure time series, indicating a causal relation between the two time series. Finally, we apply the DFA technique to the ENA time series of the polar spectral indices, an exponent related to the thermodynamic kappa and the stationary state of the source protons. This reveals that the plasma proton thermodynamics in both north and south polar regions share the same DFA persistence, despite the hemispheric asymmetry between the generated ENAs.

