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Characteristics of the N-component of the heliospheric magnetic field observed by IMP and ACE over 46 years

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Ab initio modulation models use a turbulence spectrum as input, and changes in this spectrum over multiple solar magnetic cycles can have significant effects on the calculated level of modulation. In this project, turbulence quantities are calculated for 27-day intervals and then binned and presented in 378-day intervals, using IMP and ACE magnetic field data from late 1973 to the last solar minimum in late 2020. For the N-component of the magnetic field, we find that the average spectral index of the inertial range is 1.69±0.06 and that of the energy range 1.03±0.22. The breakpoint between the energy- and the inertial range is at a timescale of around 68 min but with a large spread; this quantity is believed to be solar-cycle dependent but difficult to resolve accurately. The spectral levels of both the energy- and the inertial range show a clear solar-cycle dependence for ACE data, but this dependence is much less obvious for IMP data before 1998. The lowest yearly-averaged magnetic field magnitude and the lowest magnetic variance since 1974 occur in the interval that includes the 2020 solar minimum, 4.16 nT and 4.4 nT^2 respectively; both quantities are lower than the corresponding 2009 solar minimum values. The ratio of the square root of the average variance to the average magnetic field magnitude, δB/B, is remarkably constant at 0.52±0.03 over the 46-year period.

Keywords

IMP spacecraft; ACE spacecraft; heliospheric magnetic field; turbulence; spectral index; spectral level; magnetic variance

Collaboration

other Collaboration

Subcategory

Theoretical Results

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