Helios Magnetic Field Data (Experiment E2)

The Helios magnetic field data are given as components in solar-ecliptic coordinates (X towards the sun, Z towards the northern ecliptic pole, Y completing the right handed coordinate system) in nT. They have been measured spin–synchronously, where the spin frequency has been fixed quite accurately at 1 Hz with the spin axis parallel to the Z-axis for Helios-1 and anti-parallel to the Z-axis for Helios-2 . The sampling frequency ranged up to 4 Hz , which was realized for long time intervals primarily during the primary missions. Thus the corresponding Nyqvist –frequency ranged up to 2Hz. In very rare time intervals the sampling frequency even ranged up to 8Hz.

The sensor-outputs in the rotating frame were subjected to an analog anti-aliasing filter . Its complex filter transfer function was

$$T(f) = 1/(1+2^{1/2} X i - X^2)$$

with $i=(-1)^{1/2}$ and $X=f/f_o$ with frequency f and the corner frequency f_o =4Hz of the filter , which is also the Nyqvist frequency for the sampling rate of 8 samples per second.

During the data processing the data were only corrected for small frequencies in the inertial frame , i.e. $f << f_s$= 1Hz = spin frequency. The aliasing filter is clearly applied in the rotating frame, however, where very low frequencies in the inertial frame correspond to a narrow frequency band around f_s = 1Hz for the two components in the spin plane perpendicular to the spin axis in the rotating frame. The effect of the filter on the vectors at low frequencies in the non-rotating inertial frame was mainly a slight damping of the two components PAYLX and PAYLY in the spin plane and a rotation of the vector (PAYLX, PAYLY) in the spin plane by 20.6 ° (from T(1Hz)) in the direction of rotation, which was opposite for Helios 1 and 2.Thus the data must be properly corrected in the spinning frame to take into

account T(f) . This will ， for example , affect the wave amplitudes and polarization geometry and propagation directions for frequencies above a few 0.1Hz depending on the accuracy requirements.

For sampling frequencies above 1Hz (2 Hz, 4 Hz and rarely 8 Hz) the slowly varying zero-offsets can be several nT in the Z-axis and in all three components for lower sampling frequencies.

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