COMPARISON OF EXPLORER 33 AND EXPLORER 35 MAGNETOMETERS. M.J. Wiskerchen,* and C.P. Sonett, Univ. of Arizona, Tucson, Az. 85721 (*On leave at NASA Hdqrs.)

Significant differences in the time series' from the Apollo 12 Lunar Surface Magnetometer (LSM) and the NASA Ames (ARC) and NASA Goddard (GSFC) magnetometers on Explorer 35 lunar orbiter have been reported.[1] More recently Daily and Dyal[2] have compiled a comparative study of magnetometers from a large array i.e., Apollo 12, 15, and 16 LSM's and ARC and GSFC magnetometers on Explorer 35. The differences can be significant for those investigations of lunar magnetism using one or more of these magnetometers.

The reported differences between the LSM's and Explorer can partially be attributed to environmental processes (which are those supposed to be investigated by the instruments). In attempting to minimize such effects and for confirmation of possible differences between the Explorer 35 instruments (ARC-35; GSFC-35) we have applied an independent set of tests to the two Explorer 35 magnetometers. The initial results comprise power spectral densities for the three magnetic field components measured by each instrument. As an internal check on consistency we have included in these tests the two magnetometers carried on the sister spacecraft Explorer 33 (ARC-33; GSFC-33). This spacecraft (nearly identical to Explorer 35) was launched one year earlier. The attempt at lunar orbit failed by the resulting trajectory, a high looping orbit, came near to the Moon once every six months. During the close passage a conjunction with Explorer 35 took place.

We report here the PSD's for 22 hours covering two conjunctions when the spacecraft were within 10^4 km of one another. The close approach is intended to provide data where the spatial correlation between magnetometers is a maximum. Thus, differences due to the solar wind are expected to play a diminished, though not necessarily insignificant role, at these distances.

We have divided the data from each of the four magnetometers into 22 one hour swaths for each of the three components of the magnetic field (solar ecliptic coordinates are used exclusively for each instrument). We therefore have a total of 12 vector time series'. PSD's were computed using a Singleton FFT routine on the undecimated time series'. Ratios of PSD's were then computed between common components for each of the six possible combinations of instrument.

The results of these calculations show that spectral lines likely associated with switching transients in the data systems are common to all the instruments. In particular, the ARC Explorer 35 (ARC-35) magnetometer shows such lines, which however, contain little energy because of their narrowness. The most obvious result of these calculations is a clear indication, by a process of elimination, that the GSFC-35 magnetometer contains spurious signal power over a broad band extending from 2×10^{-4} to 4×10^{-2} Hz and consisting of broad lines with amplitude one to two orders larger than the nominal value, determined from ratios between ARC-33, ARC-35, and GSFC-33 in various combinations. Our conclusion is that use of the GSFC-35 magnetometer for lunar magnetic research in the above frequency range will likely result in significant contamination. Effects at lower frequency are not clear from our preliminary analysis. Although the GSFC-35 results are the most significant, careful editing of the ARC-35 data is also required; and regard should be observed of possible effects from the switching tones we have observed, which are hypothesized to arise from losses in high impedance FET switches.

References:

[1]King, J.H., and Ness, N., (1978) Lunar Science VIII, p. 546.

[2]Daily, W.D., and Dyal, P., (1978) J. Geophys. Res. (preprint).

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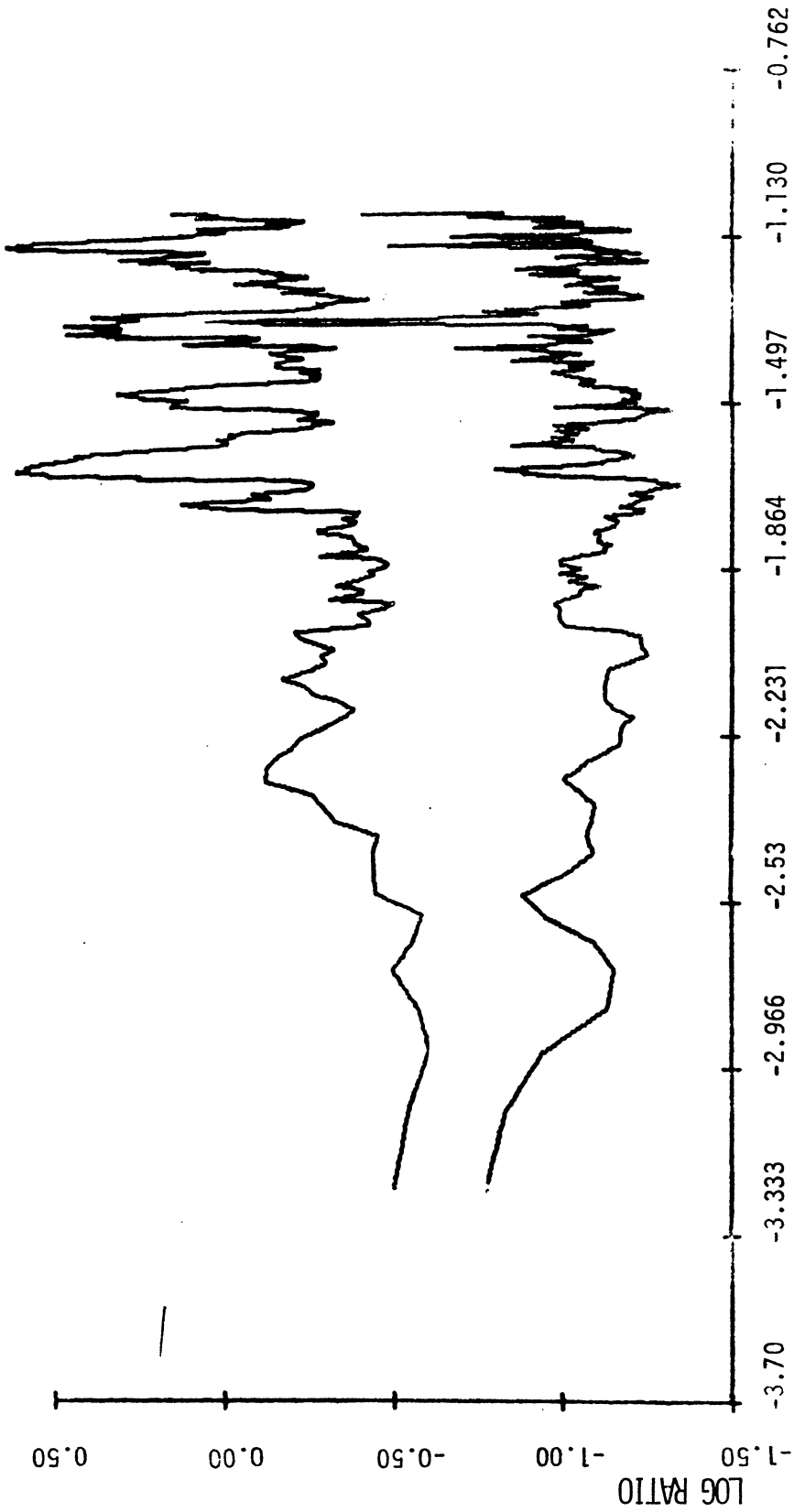

Fig. 1. Ratios of power spectral densities (PSD) for the y component of magnetic field using respectively the Goddard Explorer 33 and 35 and the Ames Explorer 35 data, the y component refers to the ecliptic plane component of magnetic field in the direction opposite to planetary motion (solar ecliptic coordinates). The particular coordinate chosen is representative of the data in all three components. The figure is restricted to one component and two ratios for reasons of brevity in the abstract and are intended as examples rather than a tight logical demonstration. The upper panel shows the ratio (GSFC-33)/(GSFC-35) and the lower (ARC-35)/(GSFC-33). The upper panel shows four prominent spectral lines which generally appear in all ratios where GSFC-35 is in either the numerator or denominator. In the lower panel the prominent line at f=0.05 Hz ARC-35 is involved. The ordinate reflects only relative values.