Reply to referees

Thanks to both anonymous referees for their encouraging reviews. In a final (non-discussion) version of this paper, the individual points can be addressed thus:

Referee#1

1. Change of title – the “1/4” can certainly be changed as suggested

2. I’d respectfully ask to retain the explicit information regarding the Hurst exponent, just in case the readers expect to find this; the final sentence in the Abstract relates to the physics, as requested.

3. In the final paragraph, the abbreviations can indeed be spelled out as requested; furthermore, this paragraph could be made into a “conclusions” section, if the referees and editor fell it appropriate.

Referee#2

1. Agreed, the removal of the running 1-day average does not alter the “noise” character of the data – this was the very purpose of the two panels in the figure. Furthermore, the filtering did not remove the non-stationary nature - this being a finding of the study which is explained by the physics. A new version of the figure can incorporate a different portrayal of the data, e.g. a detailed plot of a selected shorter section as suggested (replacing the visually redundant bottom panel), and the text can include the above explicit interpretation.

2. and 3. First, it should be noted that the prime analysis method is really spectral density because the spectral subranges are more easily identifiable with the underlying physics, at any rate for a physicist. It can be seen (figure 3. left-hand panel) that the spectrum flattens and contains more spikes at sub-minute timescales, and that from hour to day timescales there is a slightly flatter slope, and with the dependence more poorly defined as timescales approach 1 day. These features of the spectrum have influenced the choice of timescales in the DFA analysis. For the DFA, there is good linearity at larger scales, until after about 12 hours the curve begins to flatten (as could be anticipated from inspection of the spectrum. This linearity starts around 10 minutes (examination of the figure), however the density of points is low at the small-timescale region (the plot is logarithmic) such that the fitting of the straight line is essentially unaffected by including points between 1 and ~10 min. So in answer to the referee’s question, the DFA scaling range is chosen as a result of examination of the spectrum and with an a priori knowledge of the physics of the geomagnetic component. Although the DFA approach yields “clean” plots that in turn are conducive to apparently reliable linear fitting, the spectral method keeps us in closer contact with the physics and reliability of identification of different subranges for linear fitting. This explanation can be incorporated in a new version of the paper, specifically in the analysis section before and in the presentation of the DFA.