Review of "Using spectral analysis to detect singular events such as jerks in the geomagnetic field time series" by B. Duka et al, submitted to Solid Earth Discussions

General comments:

This paper concerns the detection of impulse-like features in the temporal evolution of the Earth's magnetic field known as geomagnetic jerks, and an analysis of their spatial characteristics. The paper includes some methods which have not been tried before, and the most interesting new result is the possibility that these jerks are more dominant in the odd rather than the even spherical harmonic degrees. Another result is the detection of new jerks during the 20th century. These results may have some implications for understanding the geodynamo that generates the magnetic field. However I have a reservation concerning the use of the global models for detecting jerks, and fear this may jeopardise these results unless some additional work is done.

Specific comments:

Both global models used are based on splines which are continuous in their 2nd derivative. Applying discrete wavelet transforms (DWTs) which are designed to detect breakdown of the 2nd derivative to values derived form these models therefore seems unlikely to provide robust results. Would it be possible to provide supporting evidence that DWTs can be applied to such model values by comparing the results from DWTs on real observatory data with those on modelled data at the same locations? A similar comparison was done in Chambodut & Mandea (2005) where the CM4 model was used but is not directly applicable here because a different method of jerk detection was used, viz. piece-wise linear functions fitted to secular variation data. Wavelets only provided the *a priori* jerk dates in their work.

Due to the similarity of part of the section concerning the description of the discrete wavelet transform (section 3.2.1) to textbook material, it would be better placed in an appendix.

Is the use of c(j,k) on page 627 eq(8) for the discrete wavelet transform the same as c(a,b) on page 626 eq(6), where I interpreted c to stand for "continuous" wavelet transform? I've seen T being used elsewhere for the DWT.

The paper would benefit from a description of how this application of wavelets to detect jerks differs from Alexandrescu's application.

The interpretation of the results in Table 2 is a little subjective, particularly for degrees 1 and 2 and also given that 1986 is generally considered a poorly determined jerk. Given that this is the main new result of this paper, can it be made less subjective? For example could you score closeness of extremes to jerk dates, then sum the scores for each degree? The jerk dates could also be scored somehow, for example according to their global RMS d_1 amplitudes, and incorporated into the interpretation. Some tightening up of the interpretation is required here, given that this is probably the most interesting result in the paper.

In the discussions and conclusions, too much emphasis is put on the animation which is part of the supplementary material. Significant new points can be provided in this section but the main

description of the animation should remain in section 3.2.4. One of the points touched upon in the discussions and conclusions is the apparent prevalence of sectoral (spherical harmonic order=degree) terms over zonal or tesseral terms. Is this real and can the authors comment on this?

Technical corrections:

page 616, line 5 replace "being considered by" with "occurring in"

p616, l6 delete "secular variation"

p616, l8-10 replace "Finally, a spherical harmonic analysis of the secular acceleration power spectrum has been computed since 1960 to 2000, bringing new insights in understanding these rapid changes of the geomagnetic field and their origin." with "Finally, the spherical harmonic power spectra of the secular acceleration has been computed from 1960 to 2000, bringing new insights to understanding these rapid changes of the geomagnetic field and their origin."

p618, l7 replace "used data" with "data used"

p618, l8 replace "by" with "of"

p618, l10 replace "placed" with "located"

p618, l12 replace "find the better way" with "optimise"

p618, l24 replace "been also" with "also been"

p619, l2 insert "(before 1932 the observations were made nearby at Potsdam, then Seddin)" after "Niemegk Observatory"

p619, l10 replace "underlines" with "stimulates"

p619, l24 replace "of most" with "well"

p619, l25 replace "to go" with "going"

p621, l21-22 replace round right brackets with square right brackets for frequency ranges

p622, l26 replace "found results" with "results found"

p623, l13 replace "kind" with "kinds"

p624, l4-5 replace" not so clear evidences" with " little evidence"

p625 when explaining shifting also use the word "translating", and for scaling "dilating"

p627, l4-5 replace "dilates and translates" with "translations and dilations"

p628, l15-16 replace "resulted to be" with "was" and delete commas after "wavelets" and "(3)"

p628, l19 delete "great"

p629, l7 replace "likely" with "like"

p629, l20 replace "...dipper the slopes are, the narrower separations are" with "...steeper the slopes are, the narrower the separations are"

p630, l21 replace "be detected" with "detect"

p630, l24 replace "makes" with "is"

p631, l6 replace "showed evidences" with "show evidence"

p631, l9-11 this last sentence seems unnecessary given section 3.2.2 – synthetic data

p631, l21 replace "near by" with "nearby" or (better) "close to"

p631, l22 replace "render difficulties" with "be difficult"

p632, l17 replace "way of analyses for" with "methods of analyses"

p632, l25 replace "make very difficult the detection of" with "make it difficult to detect"

p633, l12 replace "even" with "also"

p634, l18 replace "underline" with "illustrate"

p635, l15 replace "Power Spherical Harmonic Spectra (PSHS)" with "Spherical Harmonic Power Spectra (SHPS)"

p635, l20 replace "neglected" with "negligible"

p636, l13-14 replace "This extreme analysis is made because we believe that are the temporal extremes..." with "This extremes analysis is made because we believe that there are temporal extremes..."

p636, l24 replace "this odd degrees prevalence" with "this prevalence of odd degrees"

p637, l11-12 replace "Over the last years, rapid changes of the geomagnetic field have been largely investigated, mainly due to the difficulty to explain the origin of such events." with "Understanding the origin of rapid changes of the magnetic field arising from inside the Earth is challenging."

p638, l7-9 replace "Apart of above mentioned events, corresponding to geomagnetic jerks already noted in literature the d_1 coefficients..." with "Apart from these events corresponding to geomagnetic jerks already noted in the literature, the d_1 coefficients...

p638, l16 replace "underline" with "illustrate"

p638, l19 delete "very"

In figure captions replace "up" with "upper" and "down" with "lower"

In figures 2, 3, 5, 6 & 7 captions add that these spectrograms are derived from either application of STFT or discrete wavelet transforms (to differentiate them)

In figure 10 1880 should be 1890 on the x axis

In figure 11 only one scale bar is necessary

In figure 12 explain what the vertical lines are