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Solid Earth Discussions

Interactive comment on "Geomagnetic jerks characterization via spectral analysis" *by* B. Duka et al.

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This paper looks for the combination of filtering and/or spectrum analysis techniques that best allows the discovery and timing of geomagnetic jerks; it covers a very large field which this reader (now in his dotage) found hard to follow. You are reporting on the end result of what has obviously been a very large amount of exploratory work, so there is the problem of how much of this exploration you should report. Personally I would have been happier if you had condensed the description of the exploration, summarised what combination of filtering and spectral analysis you found most useful, and then given more attention to explaining clearly just what characteristics of the resulting spectra you were using to identify jerks. For example I really do not know if you are looking for spectral power maxima (or minima?) at a particular frequency, or some

other change of pattern.

Your actual data are essentially point samples of a value/time curve of otherwise unknown shape; I suspect that you have sometimes misled yourselves by working with graphs that join these points by lines. Similarly the resultant spectra are known at only a few frequencies; again this is camouflaged by the smoothing and contouring of the display process.

Your Eq, (2) is what you told the computer to do, but for your reader it would be much simpler to remove the algebra and to say something like "we obtain 'annual mean' SV values every month, by subtracting the mean of 12 consecutive monthly values from the mean of the next 12 monthly values. (Although the text implies that you tried different lengths for the mean, in this context the whole point about using annual means is that this removes most of the comparatively large annual variation. And the description of the equation does not leave the length arbitrary, but fixes it at 12 months.) So instead of producing only one annual mean (that for the calendar year) every 12 months, what you are very sensibly doing is producing a 12-month running mean every month. (Yes, this is numerically the same as defining a new sort of SV, say SV*, obtained by taking the difference between monthly means 12 months apart, and then doing a 12-month running smoothing of these SV*. But I think my approach would be easier for the reader to understand.) The legend of Fig 4 is wrong in that what is plotted is not " monthly means" but "12-month SV values taken every month". There are many other places where I think you are making a similar mistake in notation; you need to be clearer about the distinction between the value of what is plotted, and how often it is plotted. Your nomenclature hides the fact that the only difference between the SV graph of Fig 1 and that of Fig 4 is that the latter inserts (fairly smoothly) 11 points between each annual point of Fig 1. This would not alter the low-frequency part of the spectrum, so I was puzzled by the apparently much smoother nature of the Fig 4 spectrum. Then I realised that (a) you had used the (presumably default) setting of a frequency scale going from zero to 0.5 times 1/data interval. So the scale was 0-0.5/year in Fig 1, which

is 1/12 of the scale (0-0.5/month) in Fig 4. And (b) going to monthly points allowed a finer resolution in time, and the noise in the spectrum is now also on a much shorter time scale. (Even with the spectrum of Fig 4, I doubt if you would have picked out 1990 if you did not know the date beforehand!) With your 12-month time span, presumably there are only power values at 6 frequencies for each time step. I think you should tell the reader that the plots you publish have been contoured by interpolation.

page 142, line 19 You have "it is not possible to distinguish the separation between spectrogram lobes representing two very close different slopes", does this mean that the sharper the V in the SV/time graph, the more difficult it is to detect it in the spectrum plot? In some cases the most obvious spectral changes coincide with small local disturbances, and not with longer-scale jerks; this is something that is probably inevitable when using techniques that emphasise high frequencies.

page 146 line 14 (and later paragraphs) " Monthly values of SVy have been estimated at NGK" Presumably what you actually did was a calculation; are you saying that this calculated value is an estimate of something else? Do you mean the actual slope of the Y/t graph at monthly intervals, the differences between instantaneous Y values a month apart, the differences between two consecutive smoothed monthly means, or something else?

page 148 If a time interval of 1 year gave "some oscillations", these oscillations are still present when you sample every 2.5 years. If these oscillations are some sort of noise, increasing the sampling interval has not reduced this noise! You have chosen a particular start time for your 2.5-year sampling; I am pretty sure that another choice would have moved many maxima/minima by a year or more! I am very dubious about the results of this Section: I think it would probably have been better to have (in effect) taken a point every year, and then used one of your de-noising techniques before plotting.

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