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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A criterion to discriminate between solar and cosmic ray forcing of the terrestrial climate" *by* H. Fichtner et al.

Anonymous Referee #2

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This paper suggests that a physical mechanism relating solar variability to climate might be identified by differentiating between signals of the 11-year and 22-year activity cycles. The basis of the idea is that, while solar irradiance varies with the 11-year cycle, the solar magnetic field varies with the 22-year cycle so that effects of solar irradiance might be differentiated from those of cosmic rays (which are modulated by the solar magnetic field).

This is a plausible argument but the paper does not provide strong evidence. Furthermore, while the reader is informed in the Introduction (p.10812 line 25 - p.10813 line1) that "We do not intend to enter a discussion of the credibility of any given correlation, because the mere proof of its existence will not give too much insight into its actual physical cause" (an entirely valid sentiment) the rest of the paper merely presents the

existence of a range of other signals.

No original results are presented and the fact that the paper is a review/compilation should be made clearer in the Abstract.

Much of the evidence presented is in the form of frequency analyses and it is suggested that the 22-year signal is stronger than the 11-year signal in many cases. This is barely supported by the climate parameters presented and some of the discussion is disingenuous. For example it is stated (p.10818 line 24) that there is “strong evidence of a 22-period” in tree ring width in Fig.7 but that the 22-year cycle in solar irradiance is “marginal” (p.10821 line 26) in Fig. 11. An alternative (and equally prejudiced) view might be that there are no 22-year spikes in Fig.7 and that at least the 22-year cycle exceeds the 95% confidence limit in Fig. 7. What is not included is a spectrum analysis of cosmic rays which I suspect would not look much different to the irradiance curve.

In any case, there is no need to be obsessed by cycles when regression analysis can be used to investigate correlations with different parameters without any assumptions concerning cyclicity. Indeed the idea in the paper, that the different shapes of the sunspot and cosmic ray signals could be interesting, could be investigated in just this way (and this has, indeed, been done - see e.g. the discussion on clouds below).

The discussion on irradiance mechanisms on p.10813 (lines 11-27) ignores previous work which has suggested that it is changes in solar UV (having larger amplitude variations than total irradiance) which act on the stratosphere and produce climate signals through atmospheric coupling mechanisms (see e.g. Haigh, 1996)

There are two plots showing the Svensmark work on clouds. It should be made clear that they present different geographical regions and cloud types. Both have had the latter part of the cloud datasets shifted upwards; in the first case arbitrarily because of a lack of inter-calibration of two datasets and in the second because of a stated discontinuity in the calibration of the ISCCP D2 dataset although this has never been documented. Kristjansson et al (2002, 2004) present analyses of cloud data and show

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better correlation with solar irradiance than with cosmic rays.

Some of the figures are of poor quality. The two panels of Fig.5 should be aligned so that equivalent dates can be compared. Insufficient information is given concerning the information in the top panel.

References:

Haigh J D (1996) The impact of solar variability on climate. Science, 272, 981-984.

Kristjansson JE, Staple A, Kristiansen J, Kaas E (2002) A new look at possible connections between solar activity, clouds and climate Geophysical Research Letters. 29 (23): Art. No. 2107

Kristjansson JE, Kristiansen J, Kaas E (2004) Solar activity, cosmic rays, clouds and climate - an update. Advances In Space Research 34 (2) 407-415

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