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Climate of the Past Discussions

Interactive comment on "An astronomical correspondence to the 1470 year cycle of abrupt climate change" *by* A. M. Kelsey et al.

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This paper motivates an astronomical origin of a 1470 year cycle observed in the variability of the paleoclimatic records, especially in ice cores and in ocean sediment cores. As also Eric Wolff (EW) commented, the first sentence of the abstract: "The existence of a $\sim$ 1470 year cycle of abrupt climate change is well-established, ..." is unwarranted. On the contrary, as I have shown in the papers below [1],[2] (referenced by EW in his comment): The null hypothesis of the apparent 1470 year cycle seen in ice-core records being purely coincidental cannot be rejected. This should be discussed or at least mentioned in the manuscript.

My personal view is that the apparent 1470 year period is coincidental and the way it gets "well-established" is through the usual chain of references-in-references tracking

back to loose conjectures. Examples of this are the reference to a 1490 $\pm$ 10 year cycle in the Pacific (not 1480 year as states p 4897 line 11) with reference to Turney et al., 2004 [3]. In this paper coherence (from cross-spectral analysis) between the 1470 year cycle in the GIPS2 ice core and the 1490 year period in the Australian peat record is at the 80 % level, which is not impressive for a cycle of no known origin. This is a level that is easily observed for some period in uncorrelated records. Furthermore, as EW also mentions, the 1470 year spectral peak in Greenland ice cores is much weakened with the improved GICC05 dating [4].

Even worse is the notion of a $\sim$ 1470 $\pm$ 532 year cycle stated in Bond et al., 1997 [5]. This is an important and well-cited paper, but the statistical analysis is close to meaningless: What they actually state is that they find a period in the Holocene benthic foraminiferal isotope record of 1374 $\pm$ 502 years and a period of 1536 $\pm$ 563 years in Stage 2, these two they average to the period above. (See Ref. 5, Fig. 7A). In the power spectral density for the full record, they actually have a broad peak at 1800 years (Ref. 5 Fig. 7c).

All this said, and even though I am not convinced about the findings, I still find the paper interesting and worthy of publication. However, since CP is a journal primarily aimed at the climate and paleoclimate community it would be useful with a little more elaboration of the astronomical parts for non-experts. It would strengthen the authors case if they clearly explained which periods were related to changing insolation and which are related to changing gravity, which influence the climate through the changing tides. We do not exactly know how important the tides are for climate through internal wave breaking and ocean upwelling, but it would be relevant to get at least a feeling for the relative strengths of the climate impact from different cycles. It would also be nice to have a clearer distinction between known astronomical periods (eclipses, orbital changes etc.) and observed or conjectures periods (such as periods in solar irradiance).

As a final wish for revision, I think it would be instructive with a paragraph or two on

how the harmonic relationships and combinations of frequencies are obtained.

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[2] Ditlevsen, P. D., Andersen, K. K., and Svensson, A.: The DO-climate events are prob- ably noise induced: statistical investigation of the claimed 1470 years cycle, Climate of the Past, 3, 129-134, 2007

[3] Turney, C. S. M., Kershaw, A. P., Clemens, S. C., Branch, N., Moss, P. T., and Keith Fifield, L.: Millennial and orbital variations of El Nino/Southern Oscillation and high-latitude climate in the last glacial period, Nature, 428, 306–310, 2004.

[4] Svensson, A., Andersen, K. K., Bigler, M., Clausen, H. B., Dahl-Jensen, D., Davies, S. M., Johnsen, S. J., Muscheler, R., Parrenin, F., Rasmussen, S. O., Röthlisberger, R., Seierstad, I., Steffensen, J. P., and Vinther, B. M.: A 60 000 year Greenland stratigraphic ice core chronology, Clim. Past, 4, 47-57, doi:10.5194/cp-4-47-2008, 2008.

[5] Bond, G., Showers, W., Cheseby, M., Lotti, R., Almasi, P., deMenocal, P., Priore, P.,Cullen, H., Hajdas, I., and Bonani, G.: A Pervasive Millennial-Scale Cycle in North Atlantic Holocene and Glacial Climates, Science , 278, 1257-1266, 1997.

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