

Comments on “Pioneers of the Ice Age Models: A Brief History from Agassiz to Milankovitch”, by Ateş

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0 Foreword

I have been invited to review this manuscript by the author, himself. I and Ateş are colleagues and friends, working at the same campus.

1 General comments

The manuscript presents a concise and adequate summary of the astronomical theory of ice ages. It first gives us the wider picture of previous ice ages and explains the plate tectonics and climate relation with examples. While the plate tectonics theory is newer, it constitutes an envelope for the long term climate change. Therefore, Ateş decides to start from the past ice ages of the world, and convinces the reader about why there were times that the world was ice-free. Then, the manuscript presents us the history of the discovery of Quaternary ice ages by starting from Agassiz. Then presents astronomical solutions proposed, namely, by Adh mar, Croll and Milankovitch, as a cause or for the oscillations of Quaternary ice ages. Then the article concentrates on Milankovitch’s theory, its history and its outputs.

The article and presents us a different perspective for the subject. I believe, It is written well and it is adequate. My general comments are listed below;

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1. The article gives the impression as the ice age concept is proposed by Agassiz. But, unlike Agassiz, the text should also give credit to Venetz, de Charpentier (see, [Berger, 2012](#)) or even to Hutton (see, [Davies, 1968](#)) and Playfair (see, [Seylaz, 1962](#)). Furthermore, mentioning Jens Esmark ([Andersen, 1992](#), pp. 102) as the first scientist to propose an astronomical solution (even it is very primitive) would be better.
2. In the 6th section the astronomical parameters (lines between 201–254) are given with too much detail. They can be simplified. Furthermore, figures 3, 4 and 5 can be presented in a single figure.
3. The formulas between 2 to 9 distorts the integrity of the text. I believe these formulas and the paragraphs describing them should be rewritten from scratch just by referencing the original sources.
4. In text it is sometimes written *the earth* and sometimes *Earth*. It should be consistent. If I were Ateş, I would follow the recommendation of [Şengör \(2017\)](#) and use it as *the earth* not *Earth*.

2 Line based recommendations

Below you can find my specific recommendations.

- Line 38 (L38): Change “our climate is subject to certain periodical changes” to “the earth’s climate is subject to certain quasi-periodic changes”
- L41-42: Change “Whether periodically or not, the Earth has witnessed, and probably will continue to witness numerous glacial and interglacial periods.” to “Whether periodic or not, the earth has witnessed, and probably will continue to witness numerous glacials and interglacials.”
- L45: “than their previous ones?” or “than some other ones?”
- L49: I would delete the first sentence of this paragraph, starting with “There are many causes of major glaciation,...”.
- L50: Consequently, I would change the sentence “ Among all these, however, the main cause responsible to initiate an ice age period is plate tectonics.” to “Without the feedback mechanisms initiated by plate tectonics, long term oscillations of climate (as illustrated in Figure 1) would be completely different.”

- L51: A comma after meteorologist.
- L51: “this hypothesis”, which hypothesis?
- L52: Change *had* to *was*.
- L53: This sentence is odd. The first part, till the comma, the reader understands it as Wegener’s theory revealed the mechanisms of ice ages. Maybe it can be, “He spent his time primarily in Greenland and his field research was mainly focused on continental drifts that led him to develop the revolutionary theory of plate tectonics, which brought a useful explanation for long term climate changes.”
- L58: Don’t use “beneath”, maybe “south” is better.
- L81: Delete “has”.
- L82: Change “an extensive ice age about 350–250 million years ago, also the era when Pangaea existed. This can also be seen in (Fig .1), where one of the lowest points of the curve denotes this period.” to “an extensive ice age about 350–250 million years ago, also the era when Pangaea existed (Fig .1)”
- L93: Referencing a first year textbook, Lutgens et al. (2012)... I am not sure if it is a good idea. Furthermore, this is the second time up to now and these are direct quotations.
- L124–L129: The story about Agassiz is not that innocent ([Berger, 2012](#), pp. 109, 2nd column)
- L149: How would it be to change the wording here from “discovery” to “hypothesis”?
- L167: Comma after Milankovitch.
- L176: “Until the era of Milankovitch, the mainstream methodology on particular issues in geology was descriptive.”, is this sentence necessary? Or, even true?
- L189–L193: “Milankovitch approached the problem was quite original.”, but in this paragraph what you explain is similar to Croll’s approach. What is original?
- L217: There is no need to show the computational line. The second line can be given in text, of course without that much precision, such as $e = 0.016$.

- Fig3: Please note that it is today's condition.
- L236: Are following sentences really necessary? "This tilt can be measured easily at solstices and equinoxes. In order to do that, it is sufficient to take the inverse tangent of the value which is found by dividing an object's height by its shadow length, at that particular time."
- L243: Yes, it is true that the precession of the equinoxes cycle lasts approximately 26,000 years. However, the climate is not affected by the sole effect of precession, but by the effect of the precession of the equinoxes modulated by the changes in the eccentricity of the earth's orbit. On average, its period is 21,700 yrs. Please see [Berger](#) (Table 1 in [1977](#)).
- L245: Will Polaris once again be the North Star after 13,000 years or after 26,000 years? I suspect, there is a small mistake here.
- L255-261: It would be appropriate if you give original references of these studies.
- L275: I am not sure, but would it be OK to add that Croll was aware of the continental distribution of the earth?
- L321: "It is because all three cycles operates independently of each other.", I didn't understand the causality of being independent and being in a superposition of these cycles for a significant global climate change.
- L323: "When the quantity of the heat decreases, a glacial period begins. In the opposite situation, when the quantity of heat increases, the global temperature significantly rises up and an interglacial period begins consequently.", I don't think this is true. Insolation is not the marker of beginning of glacials and interglacials (cf. [PAGES, 2016](#)). I believe, these are all of Milankovitch's ideas or part of Milankovitch's model. They are not true for today. Therefore it should be explicitly emphasized.
- L395: "This could be evaluated as an indication of a relatively cold summer *for the northern hemisphere*."
- L399: Is the following sentence correct? "Both scientists were already presented their results in a graph."

- L418: Is it true with human effects? Please check this. See also Fig. 6 of Paillard (2010) for possible future scenarios.

References

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