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Geoscientific Model Development Discussions
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Interactive comment on "Earth Orbit v2.1: a 3-D visualization and analysis model of Earth's orbit, Milankovitch cycles and insolation" *by* T. S. Kostadinov and R. Gilb

Anonymous Referee #1

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This paper does not provide new scientific breakthrough however it has two important contributions. On the one hand it gives an accurate and detailed overview of the science behind the computation of the solar energy received at the top of the atmosphere (insolation). This first part of the paper is more theoretical. All the different parameters involved in the computation of the insolation are clearly identified and explained. Some more critical aspects are also pointed out. A second part of the paper is devoted to the explanation of the software allowing the users to make this computation easily. The interface and the output are described in detail. Moreover, the figures and graphs displayed have also an educational dimension. At last a section is devoted to the validation of the tool.

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General comments

1. Paillard, D., L. Labeyrie and P. Yiou (EOS, 1996) developed a tool including the computation of the orbital parameters and the insolation (although it is not the major purpose of the tool). This tool also includes a graphical interface. I would like to suggest the authors to mention this work and to point out their additional contribution.

2. The authors propose two starting dates for the calendar, either vernal equinox (20 March) or perihelion (3 January). The first one is commonly used while the second one is hardly used for the paleo purpose. Could the authors elaborate on the significance of choosing one or the other. Although I think that astronomers commonly use the second choice, I can hardly imagine how it can be used for computation of past insolation.

3. This is a technical comment but I think it is really very important. Through the paper and even in the software, time units are sometimes yr and sometimes kyr. This is very confusing. I urge the authors to use one OR the other (not both).

4. Insolation is depending on the latitude, the day in the year and the time. The authors provide insolation computation for a given time and the corresponding figure, either absolute values or deviation from present. They also provide insolation computation for a given latitude and the corresponding figure for the absolute values (but not for the deviation from the present). At last, there is no computation and no figure in the case of a given day, which is scientifically very important as well. Therefore I was wondering whether the 'missing' possibilities could be added or will be added in forthcoming releases.

5. Along the same line, it would be interesting to add the possibility to compute the insolation integrated over several days.

Specific comments

P5949 – l17-28 : the discussion about the period of insolation variations is a bit fuzzy. Short period (11-yr sunspot cycle) and multi-millennial variability are discussed. How-

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ever, the short term variability of the orbital parameter is not mentioned. Moreover, the amplitude of these variations and their relative importance in insolation changes is not discussed.

P5950 – l2 : . . . the longitude of perihelion relative to the moving vernal equinox . . .

P5950 – l8 : kyr should be used (and maybe defined) instead of Ky.

P5950 – l17 : ". . . derived for several tens of million years . . .". Of course the mathematical computation can be done over such period. However, it would be more interesting to given an order of magnitude for time interval of validity/reliability of the solutions. Berger's (1978) is definitely much less than several tens of million years.

P5952 – l4 :"insolation computation logic". I do not understand what the authors are referring to.

P5955 – equation 1. There is some potential confusion here. The authors mention that the model uses a heliocentric Cartesian coordinate system. However, the equation is the equation of the ellipse in a polar coordinate system with one of the foci at the origin. Moreover, it seems (although I may be wrong) that the authors discuss several coordinate systems, depending on what they are computing.

L5961 – l25 : please remind the reader what J2000 means.

P5963 – l3 : 'Figure 2b illustrate an imaginary orbit . . .' It would be nice to discuss further this orbit. It is indeed very surprising at first to see that July 1 occurs already during Fall.

P5964 – l2-6 : I wouldn't have added some data at this stage. The software is indeed very interesting for the computation of the orbital parameters and the insolation, but the data (whatever they are) are a completely different story, very complex as well. In particular the chronology of the data is a full story by itself. On the other hand I can hardly see the added value of these specific data. Why not choosing other data? For example, Lisiecki and Raymo (2005) provide a much longer climate record.

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P5966 l7 : “+10000 yr since present”. Does it mean in the future?

P5966 – l18 : the assumption already discussed should be reminded instead of quoting the section where they are discussed.

P5966 – l23 : The time interval of reliability of the solutions should be reminded here.

P5967 – l27 : “K-12 classroom”. I do not know what it is. Does it correspond to the age of some pupils/students?

Table 1 and figure 1 : the value of the AU is not the same in the table and in the figure.

Figure 5 : Does the authors really mean 1σ computed over three data points? Is it meaningful? Wouldn’t it better to give the values for each of the three dates? Or (if possible) make the computation over 365 days.

Figure 6 : What causes the discontinuity? Is it related to February 29?

Interactive comment on Geosci. Model Dev. Discuss., 6, 5947, 2013.