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Interactive comment

Interactive comment on "On the nonlinear and Solar-forced nature of the Chandler wobble in the Earth's pole motion" *by* Dmitry M. Sonechkin et al.

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Indeed, the small parameter of the nonlinear Euler's equations is quite small. Therefore, it isn't unexpected that solutions of these equations after their linearization look similar to solutions of the nonlinear equations if both kinds of the solutions are received numerically and if measures are taken for suppression of instabilities of the solutions of the nonlinear equations. However, it is strictly established fact in mathematics that a decrease in the order of the system of differential equations with a small parameter implies a qualitative change in the character of the system solutions. It is obviously evident that all solutions of the Euler system after its linearization are embedded into a two-dimensional plane. Such solutions can be either steady or pure periodic. Any complexity of these solutions can arise from an external forcing only. In contrast, the

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Discussion paper

solutions of the nonlinear Euler's system are embedded into a three-dimensional phase space. They can be complex with no external forcing in principle. Thus, I can not agree with the reviewer2 that the afore-mentioned solutions of the nonlinear and linear equations are similar with each other. Besides, one can mention that the Pole motion itself affects the atmospheric/ oceanic dynamics (the so-called Pole tides). Perhaps, a similar influence exists on the mantle dynamics. Therefore, some interactions between the Pole motion and the dynamics of other Earth's spheres must be taken into consideration when the Chandler wobble problem is analysed. The present-day models mentioned by the reviewer2 ignore this circumstance. So, they can not be properly reliable. In a corrected text of my paper I demonstrate that the nonlinear Euler's system can be represented by a sum of a Dueffing's cubic nonlinear oscillator and a regulator (Eqs. (9) and (10) in the corrected text). It is well known that solutions of the Dueffing oscillator are very complex. In particular, such form of the Euler's equation representation demonstrates that the momentary frequency of the oscillator vary in time. It well corresponds to the time-variable period of the Chandler wobble known from astronomical observations. Moreover, if an external forcing is taken into consideration the eigen frequency of the Dueffing oscillator is affected by this forcing multiplicatively. This fact represents a substantiation of the form of Eq. (8) (Eq. (11) in the corrected text). On this way I could obtain the period of 433 days in excellent agreement with observations when a solar activity effect was taken into consideration. It is why the latest part is included into the text of my paper even if the number of available heliomagnetic data is very limited, and the elimination of a part of these data is questionable really.

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