

Author's comment on “Candidates for multiple impact craters?: Popigai and Chicxulub as seen by EGM 08, a global 5x5' gravitational model” by J. Klokocník et al.

J. Klokocnik, Final Response Phase
jklokocn@asu.cas.cz

Our paper deals with the new, high quality and resolution gravity field model EGM 08 and its functionals, namely its gravity anomalies and second radial derivatives T_{zz} . We used the model and these functionals to check all known impact craters on the Earth with diameter larger than about 30 km. At this opportunity we found possible candidates for DOUBLE not single impact craters in the case of Chicxulub and Popigai. In our text we stated that we are not geologists (p. 71), that the final confirmation is on geologists and geophysicists (p. 70, line 15; p. 71 line 16 and 25; p. 84 lines 16), that we know that circular features discovered by EGM 08 are not automatically impact craters, that other data are needed to confirm this judgment (e.g., p. 84). We supported our conclusions by point mass modelling (Sect. 4.4.3) to show that the particular circular „gravity signatures“ in Chicxulub and Popigai might be caused by a crater-like objects, and by information from astronomy about the binary asteroids-impactors (Sect. 4.5).

D. Chambers (Referee) supported our paper, the method and the choice of data and he even recommended to publish this paper (...“well written and easy to follow...”) as is. He wrote:...“ I think it is worth publishing in order to motivate further studies using other methods“.

G. Christeson recalled existing seismic profiles mostly from recent literature (2008-9) which we unfortunately did not use. He wrote:...“ These data show no evidence for a secondary crater [at Chicxulub]...a more likely explanation for the perturbation in the gravity field is that it is associated with a pre-existing Cretaceous basin proposed for this location [Gulick et al., 2008].“ We were not aware of this very recent literature (see also Fig. 1 in Christeson et al, 2009, *Earth & Planet. Sci. Letts* 284, 249-257). We have to admit that this is an alternative explanation for what the EGM 08 shows at Chicxulub. However, we have seen no such contradictory indication that Popigai is not what it appears to be from EGM 08's survey, namely a chain of impact structures in line with the established one.

Ch. Foerste supported our manuscript (after the dead-line for the SED discussion period, however). He suggested many smaller changes which we would implement in the final version of our paper.

D. Naar (Editor) „would like to see this (manuscript) as an Solid Earth article“, but we have to do „a substantial revision that focuses on the fact that the analysis of EGM 08 is able to detect features such as second impact craters, or as discovered in this case at Chicxulub, can detect a previously existing basin.“ Both is possible with the gravity data alone, the task does not provide a unique solution. We are able to change our text accordingly.

Enclosed we show T_{zz} in the Hudson Bay, where one would be inclined to believe in an impact crater. Geologists however refuse this alternative. On the contrary, T_{zz} in the Alamo

structure, agreed by geologists as the impact crater, show nothing „circular like crater“. One has to be very careful, and we hope we were and are to avoid totally wrong conclusions. We have not, however, any geological or geophysical data, we do not understand them and we cannot therefore to rework our manuscript to implement them. Moreover, such data for example for Popigai, the past Soviet goulag with huge diamant mining place, hardly will be available. The main purpose of our work was (besides the unusual test of EGM 08) to present a possible inspiration for others to test our conclusions with other data and this happens (Christeson) and may happen only when the manuscript will be published.

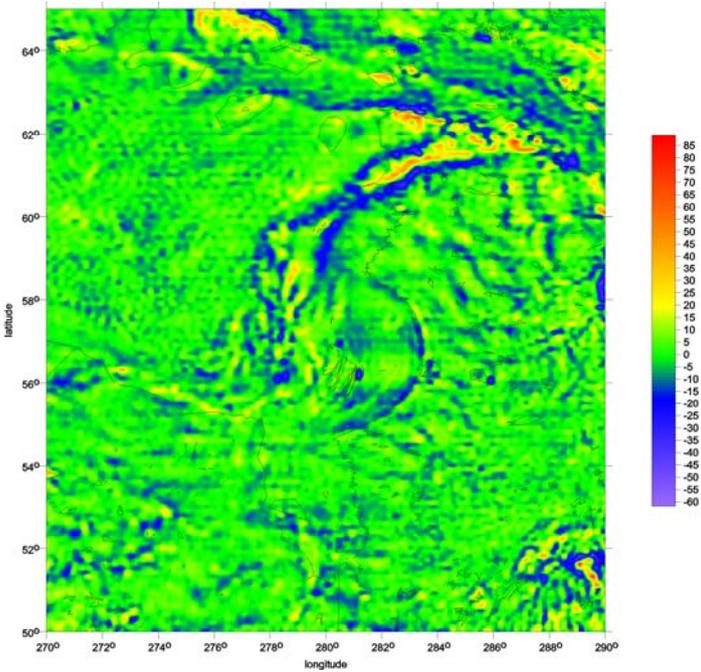


Fig. 1. The second radial derivatives T_{zz} in the area of the Hudson Bay. See the circular pattern in the middle. No impact crater confirmed by geologists. Scale in [E].

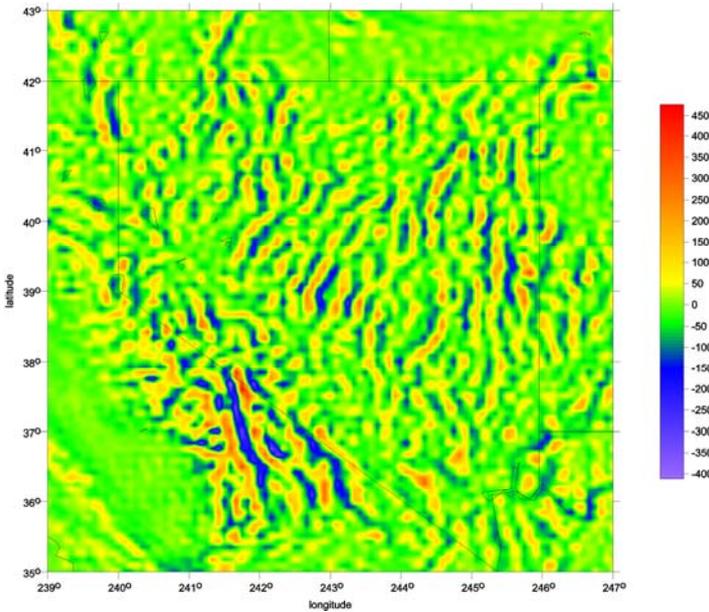


Fig. 2. The second radial derivatives T_{zz} in the area of the Alamo impact crater proved but without characteristic circular-like pattern. Scale in [E].

END