Natural Hazards
and Earth System
Sciences

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Interactive comment on "Numerical modeling of the 2013 meteorite entry in Chebarkul Lake, Russia" *by* Andrey Kozelkov et al.

Anonymous Referee #2

The scientific article 'Numerical modeling of the 2013 meteorite entry in Chebarkul Lake, Russia', by Andrey Kozelkov, Andrey Kurkin2, Efim Pelinovsky, Vadim Kurulin and Elena Tyatyushkina presents a study of the meteorite impact that occurred in Lake Chabarkul on the 15th of February 2013. Analysis of the meteorite entry inside a confined body of fluid has been performed by means of the Volume of Fluid method. A two-fluid system, namely air and water has been considered. The authors perform a preliminary analysis, using formulas from the relevant literature, regarding the formation of craters on the surface of the water during meteorite entry. Their analysis results to a relatively good approximation of the ice-hole diameter that was observed after the impact. Possible reasons for the discrepancies between the theoretical estimation and the actual size of the crater in the ice cover are also identified. A more detailed and accurate analysis, taking into account the mechanical behaviour of the ice-cover and

the pressure distribution acting on it, follows and more accurate simulation results are obtained.

The presented study is thorough and of good quality. The subject addressed is very interesting and within the scope of 'Natural Hazards and Earth System Sciences'. Some issues must be addressed in order to further improve the quality of the manuscript. In particular:

It is mentioned (last line, page 3) that both air and water are considered to be incompressible. Although incompressibility is a good assumption for water, air is a compressible fluid. How is the approximation of incompressibility for air justified? Is this assumption valid for the present application? Some comments on the magnitude of the Mach number might be appropriate.

In figure 4, the time instant t=0.2 sec is presented before the time instant t=0.1 sec.

In the case of the ice-covered lake, the authors use the condition 'rigid wall' to account for the ice on the surface. The ice plate has a thickness of the order of magnitude of 1m but extends for hundreds of meters. It can therefore be assigned the attributes of a slender plate. Is the 'rigid wall' approximation justified under these conditions? Flexural waves generated by the impact, propagating as hydroelastic waves, might be significant for the phenomena at the vicinity of the entry area. Several models and methods of solution for hydroelastic interactions have been proposed in the literature. It might be interesting to comment on the applicability of these models, in conjunction to the simulation strategy employed by the authors, for future studies.

Some minor typos:

Page 9, line 21 'counti8ng'

Page 2, line 15 'Also is made the estimation of the wave heights, the description of the stages of the meteorite collapse and as well as the generation of waves emanating from the source'. This sentence should be rephrased, as it is difficult to follow.

To summarise, the present scientific article is interesting and should be considered for publication as long as the above comments are addressed. A proof reading of the manuscript is also necessary in order to improve the syntax, correct typographical errors and thus maximise the potential impact of this study.

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