Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-3-RC1, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Meteotsunami occurrence in the Gulf of Finland over the past century" *by* Havu Pellikka et al.

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Received and published: 4 February 2020

This paper gives some results of a highly meritorious and probably unprecedented work: the use of several procedures to obtain a very long (secular) series of meteotsunamis events in the Gulf of Finland. Some of the results are remarkable. The frequency of meteotsunamis in the Baltic Sea area is much higher than it was in principle thought. The meteorological origin of large amplitude sea level oscillations is well established and so the name of meteotsunamis is justified. Particularly interesting is that the meteorological origin in most of the cases is some kind of perturbation derived from convective (thundery) activity. Meteotsunamis in the Gulf of Finland are mostly related with thunderstorms.

The paper is well organised and well written and it is certainly worth of publication, although the clarification of some points can be convenient.

As general observations, less conclusive (less explained) than the already mentioned results are those referred to differences between the eastern (Hanina) and western part (Hanko) of the Gulf of Finland: the frequency of meteotsunamis and also the time increasing of this frequency is higher in Hanina. These results are mentioned (and can be important), but they are not clearly explained. On the other hand, are both important results (higher frequency and higher increase if the frequency in Hanina) susceptible to be related? Have the authors any idea about this, although not demonstrated?

The following are some more specific points that can also be taken into account for improvement of the text or for better understanding. Probably not all of the open questions have a clear response. Trying to respond the points is more a suggestion than a mandatory requirement:

- It seems that the authors of the paper consider that the meteorological cause of meteotsunamis has to be a single pressure jump of a considerable magnitude, no other kind of perturbation; but in Mediterranean cases, for instance, smaller magnitude rapid pressure oscillations related to atmospheric gravity waves are claimed as the cause of many meteotsunamis (Monserrat et al, 1991; Jansa et al, 2007). Therefore, could some of the cases not confirmed by the authors as meteotsunamis be related with non-convective pressure oscillations connected with pure gravity waves? On the hand, the cases illustrated in Fig. 5 would suggest than single pressure jumps can occasionally be accompanied by less amplitude gravity wave signal. Finally, is there an alternative (no meteorological) origin if a rapid large amplitude sea level oscillation is observed in the Gulf of Finland? A. Jansa, S. Monserrat, and D. Gomis: The rissaga of 15 June 2006 in Ciutadella (Menorca), Adv. Geosci., 12, 1–4, 2007 Monserrat, S., Ibbetson, A., and Thorpe, A. J.: Atmospheric gravity waves and the "rissaga" phenomenon, Q. J. Roy. Meteor. Soc., 117, 553–570, 1991. - Have the authors an estimation of periods involved in the large and rapid sea level oscillations identified as meteotsunamis? I

suppose not, but can a compatibility of periods do exist with the eigenperiod of the Gulf of Finland itself? (If so, higher amplitude and higher frequency of meteotsunamis over thresholds in Hanina than in Hanko could be more understandable)

- To hypothesize about these differences, the authors seem to argue that the variability of the sea level series in Hanina is higher than in Hanko; but why can be this an explanation? On the other hand, I do not understand which are the series they have used to say that; the standard deviation values given (page 7) seem to be very large.

- Are the Hanko or Hanina sea level stations within some kind of inlet, channel or harbour susceptible to produce some kind of local resonance?

- External resonance (Proudman and other) could produce larger amplification in Hanina than in Hanko if the atmospheric perturbation moves along the Gulf of Finland or with a component in this direction, in which the meteorological cause and the marine response could be coupled more time than if the movement is transverse to the Gulf. With surprise, it seems the transverse is the direction of propagation of the atmospheric cause at least in some cases (Pillikka et al, 2014). Probably it is not easy for a large amount of cases, but have the authors considered the question of the propagation (speed and direction)? This aspect seems to be quite critical for non-local amplifications (Lizer et al, 2017)

Lizer, M., B. Mourre, C. Troupin, A. Kristemeyer, A. Jansa, and J. Tintoré: Numerical study of meteotsunamis generation and propagation under synthetic gravity wave forcing, Ocean Modelling 111, 38-45, 2017.

- Regarding the objective detection of meteotsunamis with data every 15 minutes, it seems the method runs quite well, but I am a little surprised, because I do not understand well how this detection is possible, unless the period of the sea level oscillations is much longer than 15 minutes.

- With regard to the cases between 1980-89, I do not understand well why if the visual

method catches 3 cases in Hanko, why the objective method misses two of them: if the instrument is not correctly running neither one, nor the other method would have catched the cases.

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