Review of the paper by Vorobeva et al. “Microbarom radiation….”

This paper compares the results of the analysis (called vespagram-analysis) of the time dependencies for the time period from 2011 to 2016 of the amplitude, apparent horizontal velocity and azimuth of microbaroms (infrasound with frequencies of 0.1-0.6 Hz , which is assumed to be generated by the interacting counter-propagating sea surface waves) with the results of modeling of the generation and propagation of microbaroms. The comparison showed that the model used, in general, predicts well the temporal variations in the amplitude and azimuth of arrival of the stratospheric reflections of the mirobaroms with a fixed horizontal apparent velocity of 350 m/s. These results certainly deserve publication in the journal Annales Geophysicae.

The paper shows that a vespagram-analysis enhances a signal recorded by an array of infrasound sensors at the infrasound station IS37 (Norway), similarly to that as the beamforming method does, but it also enables to determine the azimuth or apparent horizontal velocity of the signal as a function of time. With this method, it was possible to conduct continuous monitoring of seasonal changes and sudden stratospheric warmings in the temporal variations of the microbarom amplitude and azimuth.

I found a number of minor remarks (below) which should be taken into account when revising this paper.

The microbarom model used is based on microbarom generation model that predicts the spatial distribution of the acoustic sources over the ocean surface, and on the atmospheric model that allows one to calculate the microbarom propagation from the microbarom sources to the receivers. Each of these models has its own drawbacks, which introduce errors in the prediction of the parameters of microbaroms at distances of thousands of kilometers from their sources.

One of the drawbacks of the propagation model, which the authors themselves pointed out, is the approximation of a horizontally homogeneous atmosphere. The presence in the real atmosphere of the horizontal inhomogeneities in the wind velocity and temperature significantly affects the azimuth of arrival of the signal at the reception point and the prediction of the source back-azimuth.

2) Another disadvantage of the propagation model used is that the wind velocity and temperature profiles derived from the European Center for Medium range Weather Forecasting (ECMWF) do not have sufficient vertical resolution to account for the effect of small-scale atmospheric irregularities on microbarom scattering and, as a result, on amplitude attenuation with increasing distance from a source for different directions of propagation.

3) When describing microbarom generation model the authors refer to the state-of-the-art microbarom radiation theory (De Carlo et al., 2020), which “…allows prediction of the location and intensity of the microbarom sources when applied to the Hasselmann integral.”

It would be important to note briefly in the paper of how are the frequency spectra of counter propagating waves derived in the wave model to calculate the Hasselmann integral, because the latter defines the distribution of the intensity of acoustic sources over ocean surface.

4) The parameters of microbaroms vs time were obtained for the fixed apparent

velocity of 350 m/s, which corresponds to the arrivals of the signals from the stratospheric altitudes. Are there in the detected signal the microbarom reflections from the lower thermosphere with another apparent velocity?

5) The amplitude obtained from the model in Fig.2a (red) in the time interval 200-201 DOY is two orders lower than the amplitude obtained by vespa processing. Could you explain the cause of such discrepancy?

6) Figure 2f and Figure 2j: Are the amplitudes (model and vespagram) in these figures normalized by the maximum amplitude?

7) The last expression in the right side of (3) defines rather a mean squared error (MSE), than a similarity index (SI), since this expression becomes zero (not 1) in case of full match between model and infrasound vespagram.

8)Line 185: “Going to higher frequencies, there is a pronounced change in the dominant direction of the source from the Atlantic in winter to the Barents Sea in summer (Figure 3).”

Do the higher frequencies react stronger on the change of wind direction in the stratosphere from eastward to westward than the lower ones? If yes, then why?

Igor Chunchuzov