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Interactive comment on "A study on some basic features of seiches, inertial oscillations and near-inertial internal waves" *by* Shengli Chen et al.

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We are very appreciated for your detailed comments. We admit that the writing is too sketchy, so that many aspects have not been properly described, and many details are missing. We decide to clarify them in the response to your comments here at first, and will include them with more details in the new version of manuscript. The purpose of this study is:

1. Discuss the cross-shelf distribution of near-inertial energy. As mentioned in the Introduction (Lines 66-76), observations show the near-inertial energy is maximum near the shelf break, from which it declines onshore and offshore. There has been a couple of research on discussing it, but no common interpretation is reached. Nicholls

et al. (2012) simulated the near-inertial motion in the Caspian Sea, and found that the decrease of near-inertial energy depends on the distance from the coast, rather than correlated with the water depth. By solving the analytical model with a constant water depth, Pettigrew (1981) argued the near-inertial wave is responsible for the decline of near-inertial energy near the coast. Therefore, we set up a simulation with a constant water depth to explore their ideas. The water depth is shallow (60 m) as in the shelf seas. The basin is chosen to be very wide (600 km) to guarantee that the near-inertial waves generated at one end do not reach the other end during simulated duration. In our simulation, a gradual offshore increase of near-inertial energy is present in the case with only inertial oscillations. A small peak of near-inertial energy can be seen at $\sim$50 km offshore in the case including the near-inertial waves. We conclude that the boundary effect on inertial oscillations play a dominant role, and the effect of near-inertial wave is secondary. This result is quite different from previous research.

2. Clarify the difference between inertial oscillations and near-inertial waves. When I was still a PhD student several years ago, I was confused with these two stuff. Many research just mentioned them as near-inertial motions. Through comparison of these simple simulations with and without vertical stratification, I am right now very clear with their differences. In shelf seas, currents associated with inertial oscillations have opposite phases between the upper and lower layers. This property is very similar to the mode-1 structure of internal wave. Thus many research mistakenly related it to near-inertial internal waves. In our simulations, we can see this vertical structure is mainly induced by inertial oscillations (the case without stratification). The inclusion of near-inertial internal waves only produces a slight tilting of thermocline. We are sure such a comparison is valuable and easy to understand, especially for new researchers who are interested in the near-inertial motion, though this comparison is very simple.

3. Explore more detail about the two-layer structure of inertial oscillations. Yes, this feature is due to the condition of zero crossing flow toward the land boundary. Some study briefly mentioned the role of barotropic waves. But it is not clear how the barotropic

wave evolves to induce this structure. We checked out many references, but none has clarified this issue in detail. For such a fundamental property of inertial oscillation in shelf seas, it deserve a further study and a detailed interpretation. In our study, we give details on this process, many of which have not be shown in previous study. A new point is about the importance of the feedback between the barotropic wave and inertial currents.

4. Give a more physical interpretation of missing of even modes of seiches. About this missing of even modes, we do not find any other references besides Csanady's papers. Csanady got this result by using the Theorem of Residue during solving the equation with Laplace transform. It is a perfect result which is consistent with the simulation. However, it is purely mathematic. We still do not understand physically why the missing occurs. Thus, we give such an interpretation, which is more physical and easy to bear in mind. Actually, this property of seiches was not expected by us. We aimed to investigate the near-inertial motions, but just found it out and tried to understand it. As the seiches process is in a system with near-inertial motions, they are put together.

More response to specific comments :

1. 2m vertical seems quite coarse for the study. RE: We will run a simulation with 1 m in vertical to see the difference.

2. How long are the simulations? RE: 200 hours. We will add this to the manuscript.

3. Why the chosen magnitude of the wind? RE: The speed of 20 m/s is a normal value during passage of storm or clone, and is able to generate significant inertial oscillations and near-inertial internal waves.

4. It must also be noted that the barotropic Rossby radius is almost 500 km for the current set-up, so there will be interactions within the basin which must be quantified. RE: We will investigate this process and see how it works.

5. L223-224: show the computation and use SI units. RE: We will provide the computation and use SI units.

6. Appendix: this is textbook stuff and can be omitted. Instead a reference can be added. RE: Although this is quite textbook like, we think it will make the manuscript more readable if the reader does not need to look up the text book.

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