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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Surface seiches in Flathead Lake" *by* G. Kirillin et al.

Anonymous Referee #1

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In this paper, the two–dimensional seiches characteristics in Flathead Lake have been explored and their potential influence on shoreline erosion, floods, sediment transport and species invasion have been discussed. Based on the outputs from a two-dimensional numerical model (the Princeton Ocean Model), a spectra method (maximum spectrum estimation) was used to determine the seiche frequencies. Subsequently, the harmonic analysis was adopted to extract the spatial distributions of water level and velocity. Generally, the paper is well organized and the contents are suitable for the publication in HESS. While the proposed methodology and the subject matter are of importance for both scientific and engineering implications, I still have some concerns on this paper, which are listed below.

1.Section 2.2: calibration and verification of the numerical model.

The authors only provided limited information about the numerical model, which is

the basis for the subsequent analysis. Particularly, it is important to demonstrate that the numerical model is well calibrated and verificated against the observed data (e.g., water level, velocity) and the calibrated parameters (e.g., Manning's coefficient) are reasonable. The cited reference (Schimmelpfennig et al., 2012) only presented details on the model configuration applied to Lake Tegel in Berlin. Meanwhile, how sensitive of the numerical model for different wind field conditions? As far as my understanding, the lake hydrodynamics should be closely related to wind conditions, especially in a lake with complex geometry. Is the chose numerical simulation representing the typical wind condition? Is there any seasonal variation of the wind condition?

2.P13548, L23: Did the simulation with the south-north initial slope coincide with the prevailing wind direction as well?

3.Section 3: Results

According to the analysis presented in this section, it seems that the seiches characteristics are only determined by the geometry of the lake. However, wind is one of the main forcing that affects the lake hydrodynamics. Is there any connection between wind and seiches characteristics in Flathead Lake?

4.P13550, L9-15: Since a spectral analysis was adopted at every grid point of the model domain, there exists a spatial variation of the determined significant frequencies. How did the authors determine the selected 16 frequencies? Did you have an average over the model domain?

5.P13550, L1-18: Does the good correspondence between numerically computed periods (63.0, 32.4, 21.6, and 14.2 min) and those estimated from the Merian formula (66, 33, 22 and 16.5 min) indicate that the topography of Flathead Lake can be well represented by a simple rectangular basin of length 44 km and of uniform depth 50 m? With regard to the 117 and 48.5 min longitudinal modes, it is possible to adjust the length scale and to explain them with the Merian formula? In other words, how does different 'lake-wide modes' response to realistic geometry?

Minor comments:

P13542, L9: “primitive equation model”==”numerical model”?

P13546, L3: “characterize” replaced with “characterized”.

P13548, L20: I suggest to provide more details about the calculation of the rotary coefficient R.

References

Schimmelpfennig, S., Kirillin, G., Engelhardt, C., and Nützmann, G.: Effects of wind-driven circulation on river intrusion in Lake Tegel: modeling study with projection on transport of pollutants, Environ. Fluid Mech., 12, 321–339, 2012.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13541, 2014.