

Interactive comment on “Seiche excitation in a highly stratified fjord of southern Chile: the Reloncaví fjord” by Manuel I. Castillo et al.

Anonymous Referee #2

Received and published: 6 October 2016

General comment

This is an interesting paper which describes the internal seiches in a Chilean fjord on the basis of a data set extending over three months. The analysis follows standard procedures, is competently executed and the results are clearly presented. As far as I can see, there are no arresting, novel results but given the sparsity of observations of internal oscillations in fjords, especially in the extensive fjords of the Chile coast, there would seem to be a fair case for publication in Ocean Science.

I sense that, before publication, there are a number of aspects, detailed below, in which the analysis and presentation of the results could be improved and the interpretation enhanced.

Specific issues

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1) My main concern about the paper is that it does not clearly identify the relative importance of the seiche in the overall dynamics and mixing processes in the fjord. There is a strong barotropic tidal forcing which, flowing over the sills, will tend to induce a small (?) M2 internal tide. As the authors indicate, there is also an energetic Estuarine Circulation in response to the considerable freshwater input to the fjord as well as wind-driven motions, notably at the diurnal frequency. In this situation it would be good to know the contribution of the internal seiches in relation to the other components of flow. This might be done by including a plots over time of the kinetic energy in each component (as in fig 7 but for all components).

2) The log-log plots of spectral energy density are not suitable for comparison of the relative variance contribution and could, with advantage, be replaced by “equal variance plots” in which you plot $P(f) \times f$ versus $\log f$ which do demonstrate the relative magnitude of the energy in different peaks.

3) Differences in the spectral peaks at ~ 12 h (fig 4) suggest that there is a significant internal tidal response as has been observed in other fjords (e.g. Allen and Simpson, Winant 2010). You could isolate this component either by projecting on to the modes or by cross-spectral analysis of flow in the upper and lower layers.

4) The paper emphasises the consistency of the density structure but it does vary somewhat ($\sim 20\%$) and it would be useful to relate this variation to the changes in stratification due to variations in freshwater input and surface heating/cooling. Presumably salinity is the main control on density but surface heat exchange may also be playing a role ?

5) I was surprised that there is not more evidence of the external seiche which was clearly represented in Gullmar fjord of (Arneborg and Liljebldh 2001) Presumably it is apparent in your results as a weak peak in the sea level spectra which scarcely shows in the velocity data. Is this because your noise level is rather high due to your long sampling interval of 20 minutes which doesn't allow averaging if you want to detect a

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78 minute seiche ?

6) The paper is generally well written but the English, which is not always clear and idiomatic, needs some attention. References

Winant C.D. (2010): Two-Layer Tidal Circulation in a Frictional, Rotating Basin, JPO 40(6), 1390-1404.

Allen, G., and J. Simpson, 1998: Reflection of the internal tide in Upper Loch Linnhe, a Scottish fjord. *Estuarine Coastal Shelf Sci.*, 46, 683–701.

Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-42, 2016.