

## ***Interactive comment on “Seasonal hydrography and surface outflow in a fjord with deep sill: the Reloncavi fjord, Chile” by M. I. Castillo et al.***

**Anonymous Referee #1**

Received and published: 14 December 2015

This paper reports on hydrographic and velocity observations in a fjord system in Chile from seasonal shipboard hydrographic measurements, moored ADCP observations, and meteorological and riverine data. The authors describe the seasonal cycle of hydrographic and wind properties in the fjord. The observations described are the most comprehensive to date for the region. They calculate outflow in an upper layer, which is used to infer and flushing time for the upper layer of the fjord.

Scientific Significance: 2 (good). The paper describes the circulation, hydrography, and forcing of an important Chilean fjord in more detail than previously available. The moored ADCP timeseries and repeat hydrographic surveys provide important information about variability on multiple time scales. Part of the motivation of the study was the intensive use of salmon aquaculture in Reloncavi fjord. It would be nice to see a few

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words in the conclusion stating how the findings of this study relate to the aquaculture issue.

Scientific Quality: 2 (good). Generally the discussion of the observations is good. I have some questions (outlined below) about the calculation of vertical salt flux, and about cross-fjord velocity variability.

Presentation Quality: 3 (fair). The paper is well structured, and the data is presented clearly. There are however some substantial grammatical and structural problems with the English of the text. I still found the text readable, and found that information was still conveyed without much confusion – so the language problems do not interfere with the papers message. However, I would suggest that the authors take a close look at the English, perhaps with the help of a very strong English speaker, to smooth out some of the errors. Again, though, I'd like to stress that the paper still is effective in communicating its message.

Specific comments:

When the vertical salt flux is calculated using the shear Richardson number, is the unfiltered velocity record used to calculate shear? In the text the authors says that they focus on sub-tidal and sub-inertial variability, and thus low-pass filter the velocity data. What are the tides like in the region? I would imagine that tides could play an important role in mixing, and thus vertical salt flux and the estuarine circulation. I'd like to see a small discussion of why, or if and when, the tidal velocities are neglected.

What are the errors, or sources of error associated with using the inferred (not measured) eddy diffusivity to obtain vertical salt flux? The  $N^2$  profiles must be calculated from the CTD casts, while the  $dV/dZ$  is calculated from the moored ADCPs – is that correct? Is an  $N^2$  profile near the ADCP mooring used to calculate  $Ri$ ,  $A_z$  and  $K_z$ ? How representative would that value be when used to calculate a uniform vertical salt flux by multiplying by the area of the fjord?

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The fjord is narrow with respect to the Rossby radius, but is there any evidence that there could be cross-fjord variability that might impact the estimates of the upper layer volume flux made from a point velocity profile?

In section 4.2 mean salinities and temperatures for layers are listed with some +/- values. What are the +/- indicating? Standard deviation? Standard error? These layers are all to some degree stratified, so there must be a large variation in temperature and salinity in the defined layers just based on the vertical stratification.

The Oxygen and Chlorophyll data is described in the Results section, but not really addressed in the Discussion or Conclusion. This is related to a point I made earlier, but can some explicit connections be made between this data and implications for aquaculture? I don't know much about this, but it'd be nice to see a little more discussion of the biologically relevant observations. Also, in section 4.2 sometimes the saturation of oxygen is referred to, but this saturation is obviously strongly dependent on temperature. It's not clear to me in the text if the saturation values (e.g. page 2544 line 19) are relative to the surface values, or are appropriately calculated relative to in-situ temperature and salinity.

Page 2546, line 14-16: The sentence says that the outflow in winter is "nearly half of R", but I think it should say "nearly double R" ?

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Interactive comment on Ocean Sci. Discuss., 12, 2535, 2015.