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Hydrology and Earth System Sciences Discussions

Interactive comment on "Double diffusion in meromictic lakes of the temperate climate zone" *by* C. von Rohden et al.

Anonymous Referee #2

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General comments

This paper shows two examples of meromictic lakes in Germany where double-diffusive processes strongly influence the mixing processes and stratification in the monimolimnia. Double diffusion is forced by seasonal mixing in the mixolimnion. The paper is well structured and easy to read. However, the title of the paper does not really reflect its contents. The title suggests a review of the importance of double diffusion in temperate meromictic lakes, whereas the paper is rather a case study of two relevant examples.

Abstract

The abstract contains a few rather long sentences that might be simplified or split up.

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Interactive Discussion
Discussion Paper

Introduction
The paper should be better embedded in other published studies by the same authors on the same lakes. Also it is not very clear which research questions are addressed by this paper. Furthermore, some of the following publications should be mentioned which previously described double diffusive steps in temperate lakes: Osborn et al. (1973) (maybe not a very clear case), Sanchez and Roget (2007), España et al (2009).

Methods
Add information about average profiling speed and response time of sensors. This is relevant for judging whether the observed gradients may be influenced by the sensor response. Also add information about the spatial scale that was used to calculate N2 and Rrho.

Conclusions
Page 7492: lines 12ff: I am not convinced that the forcing is necessarily stronger in temperate than in tropical climates. In tropical lakes, temperature variations may be smaller, but the thermal expansion coefficient is much higher. The resulting density effects of temperature variations may be comparable.

Page 7492, lines 17ff: I would even think that the stratification is supported by the double diffusive processes, as heat (the destabilizing component) is removed from the monimolimnion faster than salts (the stabilizing component).

Figures
Figure 3: indicate that the dotted lines depict temperature

Figure 4: why don't you use the same scale for conductivity here as in figure 3, which would allow seeing the steps?

Figure 6: there are 3 lines per site, what does that mean?

Figure 7: Is most of the variability in N2 and Rrho true or can a significant part be caused by noise in the measurements or misalignment of temperature and conduc-

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tivity? In the latter case it would be preferable to increase the lengths scale used for calculating the gradients from which N2 is calculated. In any case this would be preferable for the calculation of HKelly. It somehow does not make much sense to calculate this value for vertical scales that are much smaller than the resulting HKelly.

Technical

Page 7484, line 7: seasonally (or remove “changing")

Page 7484, line 19: redistribution of what?

Page 7484, line 25: extent

Page 7484, line 25: give area in m2, rather than ha.

Page 7484, line 28: particulate

Page 7487, line 2: “summer" is a bit confusing here, because during most of summer, the lakes are thermally stratified. Convective mixing may begin in late summer, but happens mostly in autumn.

Page 7488, line 7: Boehrer and Schulze is sufficient as a reference. Remove Karakas et al.

Page 7491, lines 3ff: unclear sentence.

References

Osborn (1973), Journal of Physical Oceanography 3, 302-307

España et al. (2009). Mine Water and the Envorinment 28: 15-29

Sanchez and Roget (2007), Journal of Geophysical Research C: Oceans 112, C02012

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 7483, 2009.