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Ocean Science
Discussions

Interactive comment on "Upper ocean stratification and sea ice growth rates during the summer-fall transition, as revealed by Elephant seal foraging in the Adélie Depression, East Antarctica" *by* G. D. Williams et al.

Anonymous Referee #2

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GENERAL COMMENTS

Review of "Upper ocean stratification and sea ice growth rates during the summer-fall transition, as revealed by Elephant seal foraging in the Adelie Depression, East Antarctica," by G.D. Williams, M. Hindell, M.-N. Houssais, T. Tamura, and I.C. Field.

In this paper the authors use CTD observations from instrumented Elephant Seals of the Antarctic coastal ocean off of Adelie and George V Land during the summer-

fall transition during two separate years (2005 and 2010). The 2005 observations are primarily used to examine modified Circumpolar Deep Water along the continental shelf edge. The 2010 observations are primarily used to examine the time variability of upper water properties during the summer-fall transition in Commonwealth Bay and use this to estimate the sea-ice growth in the Commonwealth Bay polynya during this time period. There is also some speculation as to what these observations show about the foraging habits of the seals.

In general, I thought this paper was well written and the subject matter and results are interesting (to me anyway and I would think to a wide group of high latitude researchers) and certainly appropriate for publication. I have several concerns, but these are all minor and should be easily dealt with by the authors. My summary recommendation is to publish once the editor is satisfied that the concerns listed below have been addressed.

SPECIFIC COMMENTS

1917/11-12: Did the MGT really extend all the way out to the continental shelf break? The pre-calving northern end looks to be at about 66.7S on Figure 2b while the shelf break is north of 66.0S.

1917/17: Can the authors label Buchanan Bay, Watt Bay and Commonwealth Bay (at least Commonwealth Bay) on either Figure 1 or 2?

1918/9-10: Do the authors have access to any of the results from the ALBION project and, if so, do they show any salinities > 34.77?

1922/8: What value was used for the heat capacity?

1921/26-1922/2: Do the authors have any error estimate for the location data?

1922/10-15: I believe Charrassin et al. (2008) estimate that the biggest error in their method for estimating sea-ice production was due to ignoring surface precipitation. I am not familiar with the precipitation in this area, but I imagine it is much much less

than the $\sim$ 10 cm/d of sea-ice growth the authors estimate. However, as the authors point out, this is an area with exceedingly strong winds and lots of surface advection of ice (hence the polynya). I would think there might be some horizontal salinity advection here too. Do the authors have any thoughts on error estimates of this method in this particular location, especially since this is a one-d method and ignores advective processes?

1924/24-26: Do the authors know of a reference that shows that the weaker spring mCDW signal relative to August is due to the increase in shelf water from August-October through the sea-ice growth season? Any possibility that this could just be variability in the on-shelf intrusions of the mCDW?

1928/5-6: How is the blue line in Figure 8c computed? It looks too straight to be a flux computed from the 8-day running mean in Figure 8b. Is it just a linear fit to the dashed line? Also, if it is, the high temporal resolution ocean heat content flux (dashed line) for the last part of the time series (past 18 Apr.) certainly does not look like the flux has decreased "to 0 at the end of April."

1928/6-7: Wouldn't this imply little or no "net" advection of heat into the region? There could still be heat advecting in from below in April that equals the heat mixed out from above. Note that any heat from mCDW would likely be coming in to the region from below 200m (see Fig. 5).

1929/11: What exactly does "de-trended" mean here? That is, what kind of trend is removed: linear, sinusoidal annual cycle, something else?

1929/10-13: I guess that the correlation at each point of the time series shown in Figure 9b is the correlation between the temperature and pressure over some window centered on the time plotted. If so, can the authors give the window range? If not, can they provide more details?

1929/21-24: Same questions as above, but for Figure 9d. Also, which of the three ice

concentrations presented in Figure 9c was used for the correlation calculation?

1931/9-13: I think the result is promising too, but it seems really difficult to tell without the 2010 Tamura estimates. If 2010 is a normal year, then it seems that the satellite method underestimates ice growth by a significant fraction. I like the idea of plotting the 1-sd range for the satellite estimates, but I think it would also be helpful for the reader if the authors could provide a mean value of the ice formation over this time period for all four (6-200m salt balance, 6-300m salt balance, Tamura w/ NCEP2 forcing, Tamura w/ ERA-Interim forcing) estimates.

Figure 1: It is difficult to distinguish the grey seal tracks from the bathymetry in some areas.

Figure 2: I had to really really blow up the figures to see the details on my screen (no way anyone could see some of these in a print version). I suggest breaking this figure up into two larger ones. I never did find the labels for Adelie Bank (AB) and Adelie Depression (AD) on either figure. Last sentence of figure caption is confusing: Either it is only meant for figure 2b (and the previous sentence is only meant for 2a) or there is a typo ("Pre-calving" should be "Post-calving") in which case it is only appropriate for 2a (where the only outline is post-calving).

Figure 3: Please label or describe the different black lines (i.e. 28.00 and 28.27 neutral density, surface freezing point, etc.) in 3e.

Figure 5: I think decreasing the contoured temperature range would help visualize the different water masses. Right now, it is hard to tell much difference below -1.5 and I think the maximum value could be reduced from 0.0 (-0.5 maybe?) and still have the two warm locations in 5e stand out.

Figure 6: Do the vertical dashed lines near 145 and 146.5 represent the extent along C-28?

Figure 10: What is the dotted black line near the bottom of the shaded ERA-Int esti-

mate?

TECHNICAL CORRECTIONS

1914/11: "year" should be "year's"

1914/19: I think the units should be cm/d not cm/s

1916/29: "estimates" should be "estimate"

1917/23: I think there should be a comma after "Bathymetrically"

1918/5: "as detected in during" seems awkward, perhaps remove "in"

1918/19: I am used to seeing neutral density displayed as gammaˆn, not gamma_n x. Is this a typo or a different way of symbolizing neutral density? Also, please provide a reference for this density definition of mCDW (I think this is what Alex Orsi uses, correct?).

1922/1: Typo, "prefect".

1924/28: "show" should be "showed"

1926/7-8: It states that seal I2 is indicated by Fig. 6c-d, but 6c and 6d are from two different seals. Did the authors mean Fig. 6b and 6d?

1926/13-14: Please be consistent with seal names. Here the authors use I1 and I2 on line 13 and then in the next line use 44 and 52 for the same seals.

1928/17: The figure caption implies that salinity in Fig. 8d is a 4-day running mean ("(d) as in (a)" and (a) is stated to be a 4-day running mean) as opposed to the 8-day running mean mentioned here. One of these has to be incorrect.

1929/12-13: "there is shift to" should be "there is a shift to"

1931/10: "there was no estimates available" should be "there were no estimates available" (or "there was no estimate available")

1932/18: "profiler" should be "profilers"

1933/6: "to region" should be "to the region"

1935/25-26: I think "in addition to previously documented." is missing a word at the end of the sentence.

Figure 7: I think this plot is great. In the last sentence of the figure caption, "Color scale on all panels" should be "Color scale on panels D-F".

Figure 8: The description of the window for the running mean for Figure 8d (same as 8a, so 4-day) is different from the description in the manuscript text.

Interactive comment on Ocean Sci. Discuss., 7, 1913, 2010.