

Interactive comment on “Recent summer sea ice thickness surveys in the Fram Strait and associated volume fluxes” by T. Krumpfen et al.

Anonymous Referee #2

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This paper describes the sea-ice thickness distribution in Fram Strait as acquired from ground-based and airborne electromagnetic sea-ice thickness measurements between 2001 and 2012. From a combination of the measured the sea-ice thickness and an analysis of sea-ice drift and sea-ice concentration, the authors also investigate the sea-ice volume flux through Fram Strait and discuss their findings in context with other recent publications. The presented results will contribute to the general understanding of the characteristics and dynamics of sea ice in the main export gate for sea ice from the Arctic Ocean. Future studies concerning sea-ice area and volume fluxes in the Arctic will definitely benefit from what is presented here.

The paper is written in a very straight-forward way, the presented data analysis is sound and easy to follow. Thus, I think that this manuscript merits publication in The

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Cryosphere pending some (mostly) minor revisions that I itemize below.

Abstract

P5172, L 8: “... and the estimated age ...” sentence needs to be rephrased.

P5172, L 9: “thinning” ... of sea ice.

P5172, L 13: “decrease” ... of what specifically?

Introduction

P5172, L 24: remove “annual”

P5173, L 3: Is there also a reference for “a decrease of net ice growth rates”?

P5174, L 1: “intraannual” ... do you mean seasonal?

Data

P5176, L 3-4: It is not quite clear here, in how far the thickness pdf allows to draw conclusions about the boundary conditions of ice formation. What is meant by “boundary conditions”?

P5176, L 23: I think the Warren et al. (1999) reference is not suitable for this statement.

P5176, L 25: I think that the “snow bias” deserves a more detailed discussion. How was the snow treated in the ground-based measurements? Were coincident snow-thickness measurements conducted? Does aerial photography from the AEM measurements support the statement “...led to a significantly reduced snow cover or no snow cover at all.”?

P5177, L 9: “interpretation” ... I guess you mean “interpretation in a larger spatial context”?

P5178, L 12-26: Please state more clearly why it is necessary to complement your preferred sea-ice drift data set (CERSAT) with the NSIDC data set. Does this approach

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raise an inconsistency that is potentially problematic?

P5179, L 6: "... assumed to be melted". Since you're following the ice backwards I guess you assume that it rather formed when before the $\leq 15\%$ constraint applies?

Results

P5181, L 17: "... reduction in the deformation history" ... needs to be explained in more detail.

P5182, L 10-12: This statement needs some more explanation. For the reader it would be interesting to see the thickness PDFs for GEM and AEM, respectively.

P5183, L 20: What exactly do you mean by "equally distributed leads". Is it that the along-gradient floe size distribution can be assumed constant?

P5183, L 24: "air temperature is not the only driver for surface melt, gradients in short- and longwave radiation might have an influence, especially if also gradients in the surface albedo are potentially present.

P5184, L 10-13: I think this is a rather strong statement given that this observation is still a snapshot, even if the profile is 170 km long.

Discussion

P5188, L 3: replace "trends in" by "trends is".

General comment:

Assuming that the sea-ice thickness PDFs are quite accurate, the flux estimates will still be very sensitive to uncertainties in sea-ice concentration. Especially an increase in areas with very thin ice - maybe associated with an increased lead fraction or a change in floe size distribution in Fram Strait – could introduce a bias that is promoted by the cut-off value for thin-ice thickness values that is applied here, potentially amplified by the fact that the PMW sea-ice concentrations might be too coarse to resolve these

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changes. This point merits some additional discussion in the context of volume flux estimates.

Figure 4: It is quite hard to distinguish symbols in the legend from data points. The reader might think that it is data points for the year of 2009 (at least in my printout).

Figure 7: What is the difference between gray and black curves?

Interactive comment on The Cryosphere Discuss., 9, 5171, 2015.

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