The Cryosphere Discuss., 4, C941–C943, 2010
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The Cryosphere Discussions

Interactive comment on "The imbalance of glaciers after disintegration of Larsen B ice shelf, Antarctic Peninsula" *by* H. Rott et al.

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Received and published: 18 October 2010

Rott and his co-authors have constructed a clear and useful analysis of the change in mass flux of the glaciers flowing into the disintegrated sections of the Larsen B Ice Shelf. The disintegration occurred in 2002; to assess the change, the authors compared pre-breakup InSAR ice velocities (aquired in 1995 and 1999) with post-breakup data from SAR image feature-tracking (spanning 2007-2009, using TerraSAR-X).

The result is an assessment of the change in surface flow speed, and an estimate of flux changes, in the period prior to breakup versus a snap-shot of time after disintegration. The authors show that mass flux change has been considerable, and is mainly coming from the Hektoria-Green and Crane Glaciers. However, the net flux they measure is far less than was reported earlier by Rignot et al. (2004).

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Interactive Discussion
Discussion Paper

Some of the commentary below is based on elevation change assessments and ice flow measurements that are currently submitted as manuscripts to Journal of Glaciology and Annals of Glaciology.There are also some new observations of accumulation rate (not yet published) that inform the comments.

A good part of the Rignot-Rott discrepancy may come from a gradual decrease in flow speed from the Larsen B glaciers after an initial large surge in speed immediately following break-up. In fact, with each significant ice front retreat (not just the disintegration event), a large increase in flow rate is observed, that gradually declines over the course of the subsequent few years (e.g. Hulbe et al 2004). This is similar to the behavior of glaciers in southeastern Greenland (e.g. Howat et al., 2007 Science). So the estimated 2008 mass flux, and net imbalance, may be low relative to the first few years post-disintegration.

In the measurement of the bathymetry that Rott et al cite (Zgur et al. 2007), the Crane Glacier ice front was in fact observed to be afloat at the glacier centerline, with an ice depth of about 900m. This could slightly reduce the net flux they calculate. (p1615, lines 7-21).

With regard to all the accumulation (and, therefore, net imbalance measurements) it should be noted that the Larsen B system appears to have a very large accumulation gradient from ridge crest to ice shelf (as Rott indicates from the available measurements). I don\'t think this can possibly justify the mean accumulation rate proposed by Rignot et al. 2004 (Rott points out that their assumptions result in an -average- accumulation of 1886 kgm-2a-1 for the glacier trunk). The value Rott reports, 1036 kgm-2a-1 seems more reasonable – but it has to be viewed in the context of the very large gradient, and the fact that Crane Glacier has a lot of its surface area near the ridge. The Crane accumulation rate is probably -not- transferable to the other glaciers directly. In particular, the 20% reduction for the shorter, more eastern glaciers may not be enough (50 to 70% might be better). Given this, a 3-fold increase in speed -would- lead to thinning, as Rott et al insist (page 1618, bottom); and would result in a

TCD
4, C941–C943, 2010

drawdown of twice the accumulation rate; but that accumulation rate is small. ICESat observations indicate surface lowering, but at $\sim$1m per year.

On pages 1619-1620, a rather quick statement about the net sea level contribution of the areas of formerly grounded glacier ice lost to calving should be expanded, and some details about the source of the bathymetry(?) data given. Either it should be explained further, or removed.

The paper is very well-written and clear; I had no important minor comments or changes to suggest.

Interactive comment on The Cryosphere Discuss., 4, 1607, 2010.