The Cryosphere Discuss., 4, C1226–C1228, 2010
www.the-cryosphere-discuss.net/4/C1226/2010/

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: 30 November 2010

We want to thank Ted Scambos for his positive response to the manuscript and the very useful comments. It is interesting to hear that new glaciological observations have been made in the region, and that manuscripts reporting on these observations have been submitted to Journal of Glaciology and Annals of Glaciology.

Specific issues: "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." Response: The data sets available to us (or described in the open literature) do not indicate that the flow speed of glaciers above Larsen-B decreased since 2004. The same is the case for glaciers above Larsen-A. On Drygalski glacier we observe similar velocities in 2007 (12 years after Larsen-A break up) from

TerraSAR-X data as in 1999 (ERS) 4 years after break-up (Rott et al., 2008). For the central flowline of Hektoria Glacier at gate H1 we derived a velocity of 1420 m/year from an Envisat-ASAR image pair of 12 May to 16 June 2004 (Riedl at al, 2005). The velocity at this point from our TerraSAR-X analysis 2008 – 2009 is 1545 m/year. Figure 3 of Rignot et al. (2004) shows a velocity of about 1200 m/year (about 3-fold acceleration compared to pre-collapse). On the other hand, in Table 2 Rignot et al. report 7.2 to 8.7 fold mean acceleration for an area of 400 km2 on the terminus of Hektoria-Green-Evans glaciers, based on Radarsat data in early, mid and late 2003, but the position of this area is not shown. Also on Crane Glacier there is no sign of slow down. At our gate C1 of Crane glacier Rignot et al. (Fig. 3) show a velocity of about 700 m/year in late 2003 which is a 1.3 fold increase compared to our 1995-1999 values, whereas for 2008-09 we obtain a velocity of 1882 m/year.

Observation of Crane glacier front ice thickness by Zgur et al.: This is a valuable hint, but according to our knowledge this information on frontal glacier thickness has not been published in the open literature. However, in the meanwhile ice sounding data on a profile along the central flowline of Crane Glacier have been made available on-line by the Center for Remote Sensing of Ice Sheets (CReSIS), University of Kansas. These data from an airborne radar sounding survey on 4 November 2009 show an ice thickness of 772 m in the center of our profile C1. This is remarkably similar to our estimate of 760 m (for end of 2008) based on extrapolation from very limited data. Assuming thinning of about 20 m between the two dates, the ice thickness in late 2008 was about 790 m. On the other hand, the bathymetric data in front of the fjord (Zgur et al.) suggest that the lower base of the cross profile is slightly narrower than we assumed, which would largely compensate for the greater thickness. In any case, the new data reduce the error bar for the ice flux.

Accumulation: The information on accumulation gradients is also very valuable, confirming our conclusion from very limited field data. I agree that the shorter, more eastern glaciers may have more than 20% reduction in mean accumulation rate relative

to Crane Glacier, but the precise number is difficult to quantify with the present data base. The main difference in accumulation rate would be in the upper reaches of the accumulation area, whereas in the lower parts towards the previous ice shelf it should be rather similar. Based on the comment, we decided to perform additional work on estimating the mean accumulation of the individual drainage basins, taking into account the area-altitude distribution and the distance to the main divide.

Statement about the net sea level contribution of the areas of formerly grounded glacier ice lost to calving: This number is based on detailed investigations, described in the diploma thesis of R. Sandner. A digital version of the thesis is available at http://imgi.uibk.ac.at/main/publications.html. We will add this links to the reference. The retreat of the grounded areas refers to the pre-collapse grounding line determined by ERS InSAR. Assumptions regarding the ice thickness are explained in the thesis. Information from various sources was used, including ice shelf thickness near the grounding line and altimetric data on the glaciers. Even if there is some uncertainty in this estimate, I believe it is important to mention the order of magnitude showing that ice export through the flux gates is more relevant.

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