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The Cryosphere Discussions

Interactive comment on "Getting around Antarctica: new high-resolution mappings of the grounded and freely-floating boundaries of the Antarctic ice sheet created for the International Polar Year" *by* R. Bindschadler et al.

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A precursor to the detailed mapping by Bindschadler et al. here, and to ICESat-based maps of the grounding zone by Brunt et al. (2010), Fricker et al. (2009), and Horgan and Anandakrishnan (2006), was a grounding line produced from imagery as part of the MODIS Mosaic of Antarctica (MOA; Scambos et al. 2007). These earlier mappings used as a starting point the image representation of the transition from grounded ice to floating ice. MOA provided a consistent, seamless image mapping of the grounding zone with uniform illumination and high radiometric resolution. The MOA grounding

line was mapped by visual interpretation guided by earlier maps.

Repeat laser altimetry across a grounding zone provides another directly measurable location for the grounded-to-floating transition (in addition to InSAR). It also provides additional information about the extent of the zone and response to neap vs. spring tides. Using the MOA grounding line as a start, Fricker et al (2009) and Brunt et al. (2010) determined the grounding zone width at hundreds of ICESat satellite laser altimetry crossing points for the Amery and Ross ice shelves. A comparison between MOA, ICESat and InSAR grounding lines was also provided Figure 7 of Scambos et al. 2007. In the great majority of cases the MOA grounding line lies within the zone of the transition determined by elevation differencing of the tracks, including ice plain and fast ice stream flow regions. There were isolated zones (e.g., southernmost Mercer Ice Stream, and Evans Ice Stream) where the MOA pick followed an incorrect break in slope, and was found to be off by up to 50 km. There were also some regions (Slessor and Foundation ice streams, and Byrd Glacier) where MOA did not report a picked location because of a lack of visual information, as Rignot suggests. But the MOA grounding line provides a generally accurate, nearly continent-wide, assessment to within 1 km (not 10 or 50).

Note that images, and image differencing, have also been successful in extending the mapping of active and inactive sub-glacial lakes from altimetry (Fricker et al., 2008; Bell et al., 2007).

A combined data set of imagery, ICESat track differencing, and InSAR fringe density will lead to the best understanding of grounding zone processes. Images are a quantitative representation of the surface slope, when processed properly. InSAR provides an accurate location of a zone of transition, and repeat laser altimetry quantifies lateral extent and vertical amplitude of the zone well. Moreover, it is clear that changes in ice sheet mass balance and surface elevation mandates that we frequently re-map the grounding zone. Imagery is a quick, comprehensive, and readily accessible means of tracking change, and it will of course continue to be used.

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