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Analysis and Model Comparison of Internal Layers in Pine Island Glacier, West Antarctica from Radio Echo Sounding Data

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In the southern summer 2004/2005 the British Antarctic Survey and the University of Texas carried out a radio echo sounding survey of the Pine Island Glacier (PIG) in West Antarctica retrieving bed topography as well as layers of high reflectivity in the interior of the glacier. In this study we present the results from an extensive analysis of the internal layering as well as a comparison between the observed internal layers and layers generated with a 3D ice flow model (Hindmarsh et al. 2009).

The Pine Island glacier is one of the largest glaciers in West Antarctica and drains approximately 175,000 km2 of the West Antarctic Ice Sheet (Vaughan et al. 2006). During the last 35 years the glacier has experienced well-documented changes in flux and ice thickness (Rignot 2006), but it is unknown whether the changes are caused by deglaciation as a response to climate change or simply natural fluctuations (Vaughan et al. 2006).

Studies of other glaciers (e.g. Siegert et al. 2005 and Rippin et al. 2006) have found a correlation between the degree of disruption of the internal layering and the changes in ice flow velocity of the glacier. To a large extent this correlation also holds true for the layering in PIG in agreement with the fact that the glacier is topographically constrained and therefore unlikely to have undergone significant changes in flow pattern.

In order to investigate in more detail the changes PIG has undergone in the past, the internal layering is compared to that generated from a 3D flow model assuming steady state conditions. We find that the goodness of the fit varies not only with different surface velocity but also with the direction of the flightline compared to the ice flow.

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