Changes in Pine Island Glacier from Time Series of ICESat GLAS Data

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The importance of changes in Pine Island Glacier and their relationship to the stability of the WAIS may not need any introduction in this community. The center of this presentation are the analysis of laser altimeter data collected over Pine Island Glacier, discussion of mathematical approaches to interpolation, roughness analysis and simulation at several scales, and geophysical conclusions. We use Geoscience Laser Altimeter System (GLAS) data collected during the ICESat Mission (2003-2009) and Airborne Topographic Mapper (ATM) data collected since 2002 (in recent years, as part of Operation IceBridge).

(1) *Interpolation:* Using all data collected over Pine Island Glacier, its catchment area and its ice shelf, time series of elevation maps and elevation-change maps are derived. This part of the analysis includes separation of geophysical signals and artifacts that may affect laser-data values. (2) *Surface roughness:* Features of the ice surface, such as flow bands and crevasses fields, influence the received laser signal (error source), but on the other hand may serve as an additional source of geophysical information. The second part of the talk presents results derived from roughness analysis. (3) *Scale-dependent simulation:* Results of roughness properties at highest resolution and large-scale elevation models are integrated into a scale-dependent elevation model, which is generated using an approach to conditional simulation that allows inclusion of realistic (data-derived) spatial properties at every scale. This may serve as input in scale-dependent modeling as well as geophysical interpretation

Discussion: In previous work, we have reported that the spatial distribution of surface lowering in Pine Island Glacier suggests an attribution of the changes to an internally forced process in the glacier. Thinning rates increased since 2003, which indicates an increase in the magnitude of changes in Pine Island Glacier. We discuss indications of processes that initiate from changes in the ice shelf versus processes that start internally in the glacier.