

IPY: Flow Dynamics of Two Amundsen Sea Glaciers: Thwaites and Pine Island

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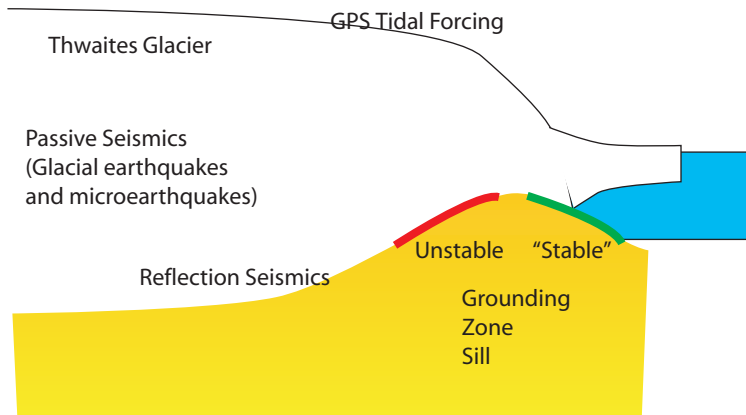
International Polar Year RFP, May 2006

- **IPY Guideline:** Our proposal
- **Ice Sheet History and Dynamics:** Dynamics of Thwaites and Pine Island, two glaciers with large, recent changes.
- **International:** significant collaboration with BAS.
- **“...engage the public”:** audio and video podcasts starring me *and* many folks from WAIS.

Science Justification: Characterize the Basal Boundary of Amundsen Sea Part of WAIS

- Marine ice sheets are inherently unstable (*Weertman, 1974; Thomas and Bentley, 1978, Schoof, 2006*)
- Glaciers terminating on the seaward side of a sill are conditionally stable...
- Glaciers terminating on the landward side of a sill are unconditionally unstable...
- ...Thwaites Glacier has a 50km sill.
- What are the properties of that sill; how quickly could Thwaites retreat; how far back could Thwaites retreat?

Marine Ice Sheet & Thwaites/PI Cartoon



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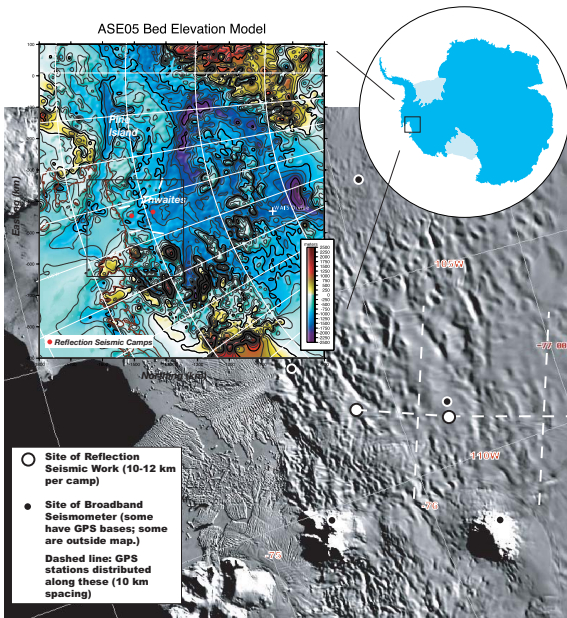
- The basal boundary is critical in developing predictive models.
- We propose: **reflection seismic imaging**, **GPS flow**, and **passive seismics** experiments.
- We propose: these data flow into ice-sheet modeling of ocean-terminating glaciers (tuned to Thwaites and Pine Island).

Thwaites and Pine Island: Terry's Weak Underbelly

- Small ice shelves buttress them.
- Ready access to warm ocean waters.
- Overdeepened basins.
- Thawed, relatively smooth beds.
- Except for possibly frozen to grounding zone sill.

AGASEA Project

ASE05 Bed Elevation Model



Proposed Work: Characterize The Bed

- Bed of Thwaites matters:
 - Siple Coast ice streams *so well* lubricated, side drag very important.
 - Large outlet glaciers (including Rutford) are “narrow” and deep: sides very important.
 - **Thwaites bed might dominate.**
- Shallow sill matters: bed may be frozen, and stability of Thwaites depends on which side of sill it grounds on.

Proposed Work: Seismics

- Best way to characterize bed details: **high resolution reflection seismic imaging**.
- Profiles on sill (if possible) and in the main glacier body.
- AM Smith will carry out work on Pine Island, PSU will carry out work on Thwaites.
- Compare/contrast two glaciers... (and share resources as appropriate)

- Best way to characterize bed average properties: **GPS response to tidal forcing**.
- Tides impose forces that are seen well upstream: infer average bed properties from these data.
- **Passive Seismics** Glacial earthquakes can be detected at great distances.
- Microearthquake arrays can monitor large parts of the bed.

Proposed Work: Modeling

- Combined flow model of Pollard, includes shelf and sheet flow.
- Tests of increased ocean-warming-induced ice shelf melt.
- Our field data will allow for better constraints of model outputs.

- Pod- and vod-casting: audio and video content in near real time.
- Bill Carlsen (Science Ed. expert) & Cynthia Berger (Science reporter for NPR affiliate)
- Dissemination on web and Weather Channel.
- Weekly “episodes” that trace an arc through polar science:
 - Coring & paleoclimate
 - Geophysics
 - Geology
 - Oceanography
 - Modeling
- End with off-Antarctic trip: sea level impacts on low-latitude people (Florida & Madras, India)