Basal terraces on melting ice shelves

see also Dutrieux et al., GRL 2014

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A model

[Jenkins 1991-2011]
Observations

- CTD, DO, Tr
- Upward ADCP
- Downward ADCP

Airborne radar

Satellites

Ground radar

Research cruises

Ice Shelf

Pressure freezing point of seawater

-1.9°C

-3.0°C typically

Grounding line

Continental Shelf

- Forward looking altimeter
- Multibeam echo-sounder

Autosub 3
Continental Shelf edge

Meltwater fraction

Temperature

Pine Island

[Jacobs et al., 2011]
A detailed pattern of melt

Surface elevation, SPIRIT 2008

Surface elevation, BAS airborne 2011

basal elevation

Surface ice velocity divergence

[Dutrieux et al., 2013]
Petermann, an 'analogue' in Greenland
**Conclusions:**

Oceanic melting under Pine Island and Petermann glacier ice shelves is critically distributed by the geometry of their ice base:
- near the grounding line,
- along kilometre scale channels.

This matters because ice dynamics is sensitive to melt distribution at large to channel scales...

from Vaughan et al, JGR 2012
How about even finer scale?
How about even finer scale?
How about even finer scale?
How about even finer scale?
Adapted from Millgate et al, 2013
Conclusions

• Oceanic melting under Pine Island glacier ice shelf is critically distributed at kilometre scales,
• Ice-ocean interaction is also largely modulated by finer scale terraces!

→ How are the terraces created?
→ How important are they for the bigger picture?