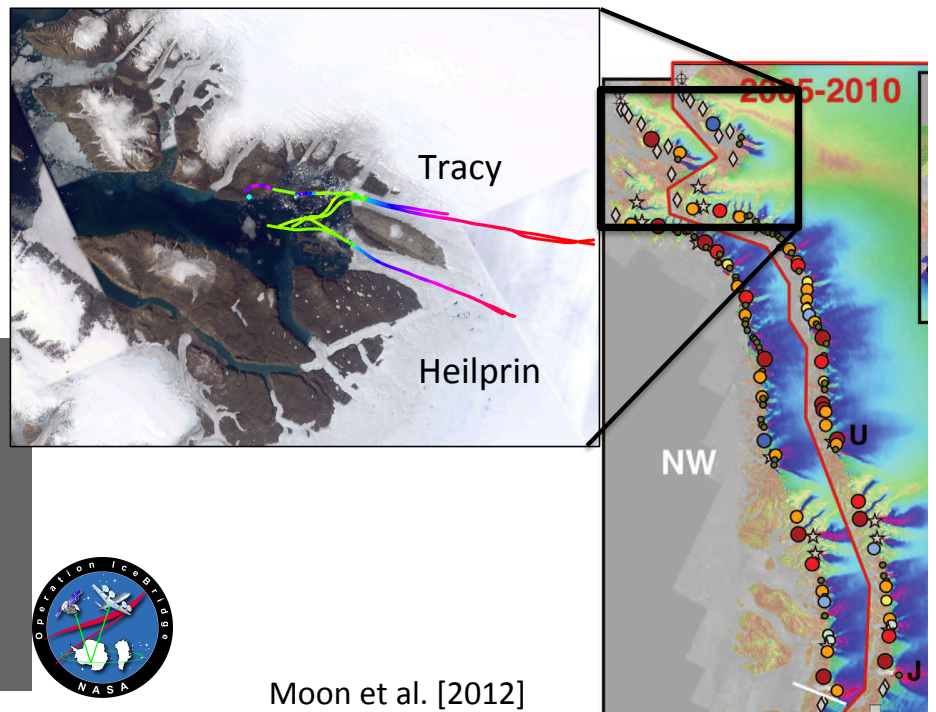


# Fjord Bathymetry Controls on Basal Melt and Glacial Retreat in Greenland

“Can gravity-based fjord bathymetry explain the spatial variability in glacier behavior”



**David Porter**

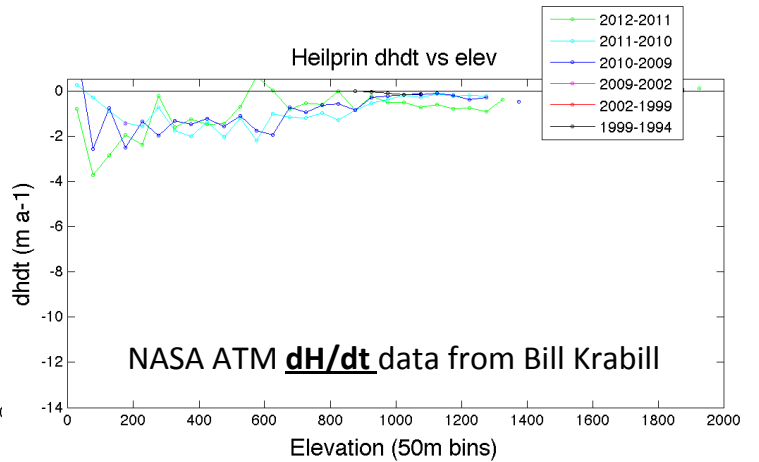
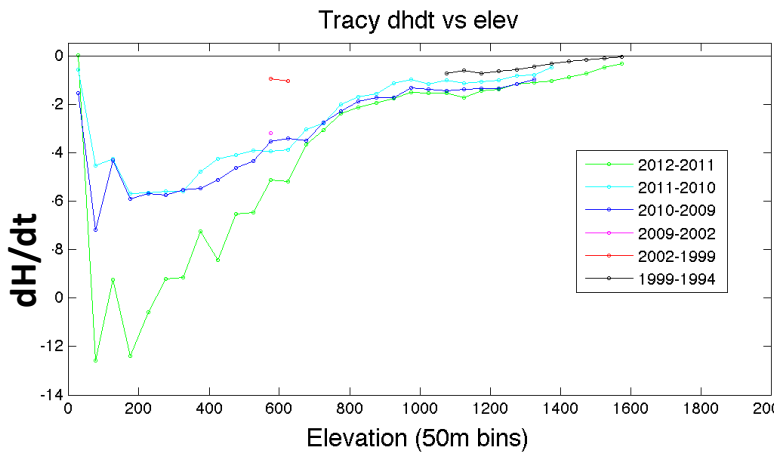
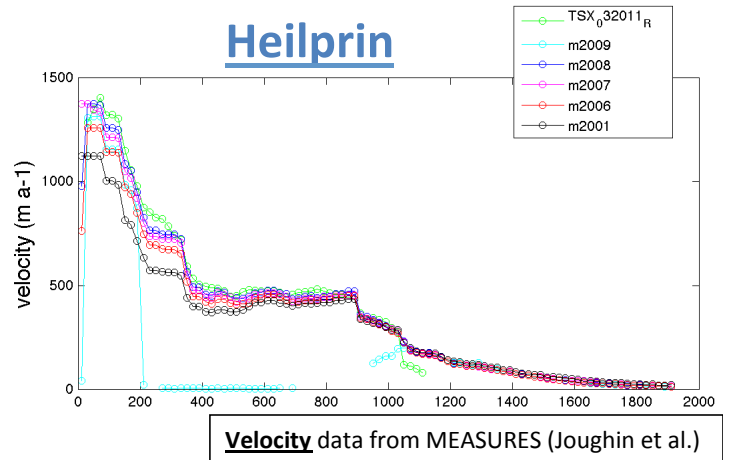
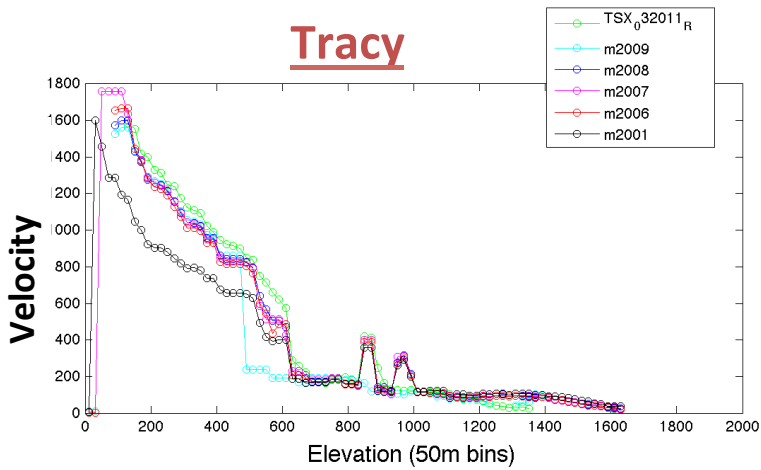
Kirsteen Tinto, Alex Boghosian, James Cochran, Robin Bell

Lamont-Doherty Earth Observatory  
Columbia University, NY



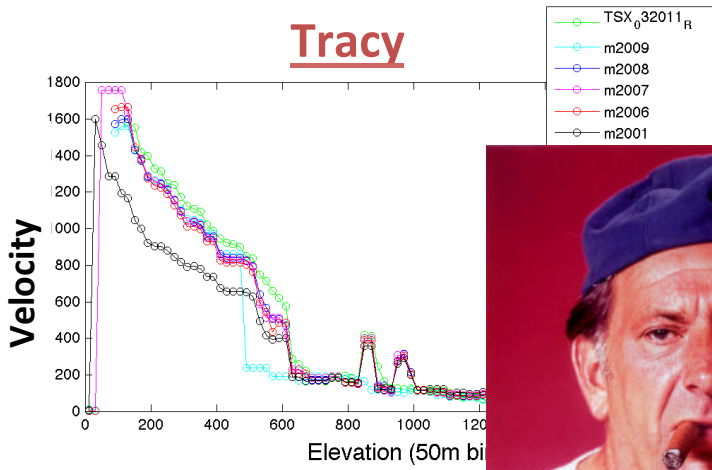
Moon et al. [2012]

# Thinning and speed-up

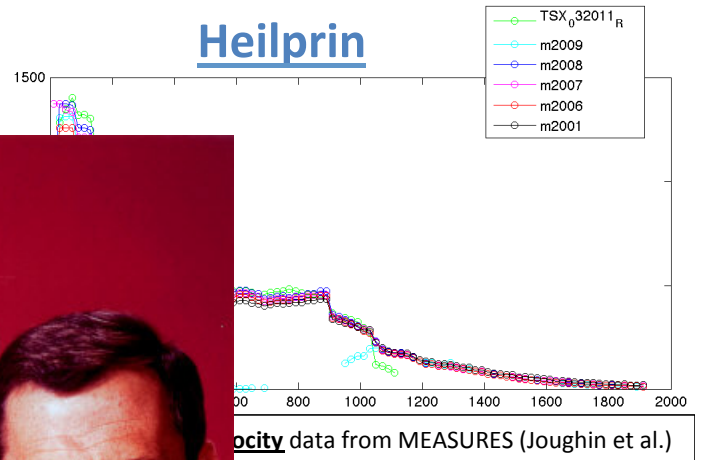


# Thinning and speed-up

**Tracy**

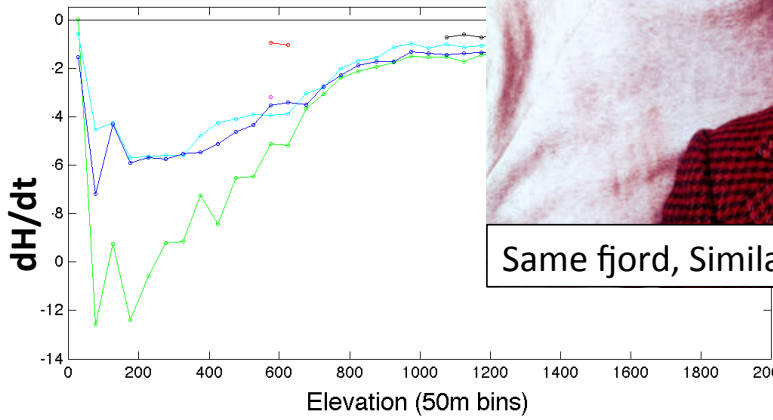


**Heilprin**

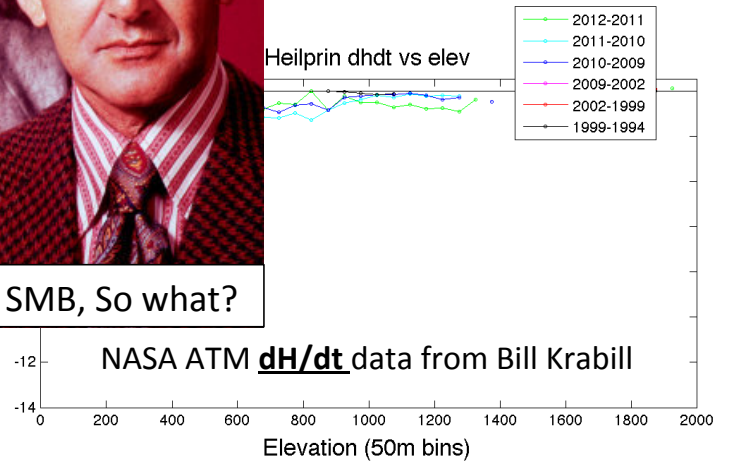


Same fjord, Similar SMB, So what?

Tracy dhdt vs e



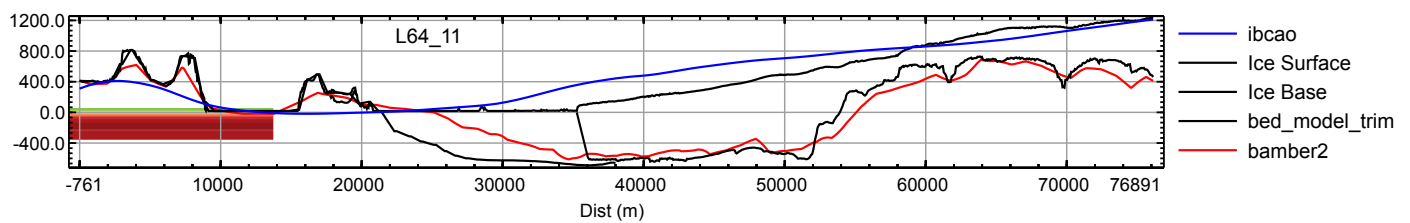
Heilprin dhdt vs elev



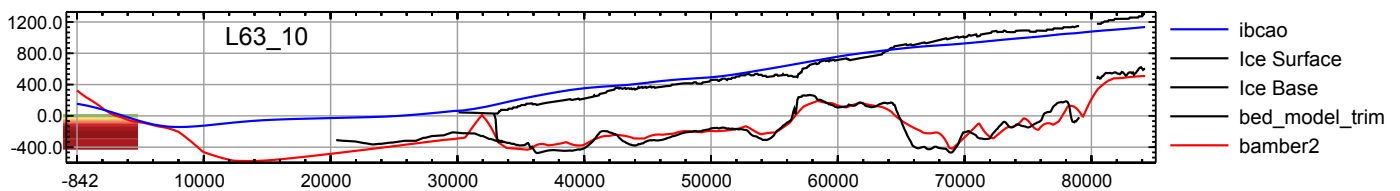
NASA ATM **dH/dt** data from Bill Krabill

# Bathymetry – Deeper Grounding Line

## Tracy – 610m depth



## Heilprin – 350m depth



- Reverse Bed Slope?
- Adjusting to new equilibrium?

# Increased Mass Loss

“Frontal Ablation” – Motyka, 12:08 PM



	GL depth	M	smb	U	Ocean forcing	Calving*	Basal Melt*
Tracy	610 m	-1.6 Gt/yr	0.345 Gt/yr	3.7 Gt/yr	-1.77 Gt/yr	0.48	-1.29
Heilprin	350 m	-0.53 Gt/yr	0.91 Gt/yr	2.2 Gt/yr	-0.73 Gt/yr	0.15	-0.59

Following Stearns (Ann. Glaciology, 2011)

- New gravity-derived fjord bathymetries should improve ocean and ice models
- See evidence for increased ocean melt in Tracy over Heilprin, likely due to a deeper grounding line with more ice in contact with warm water.