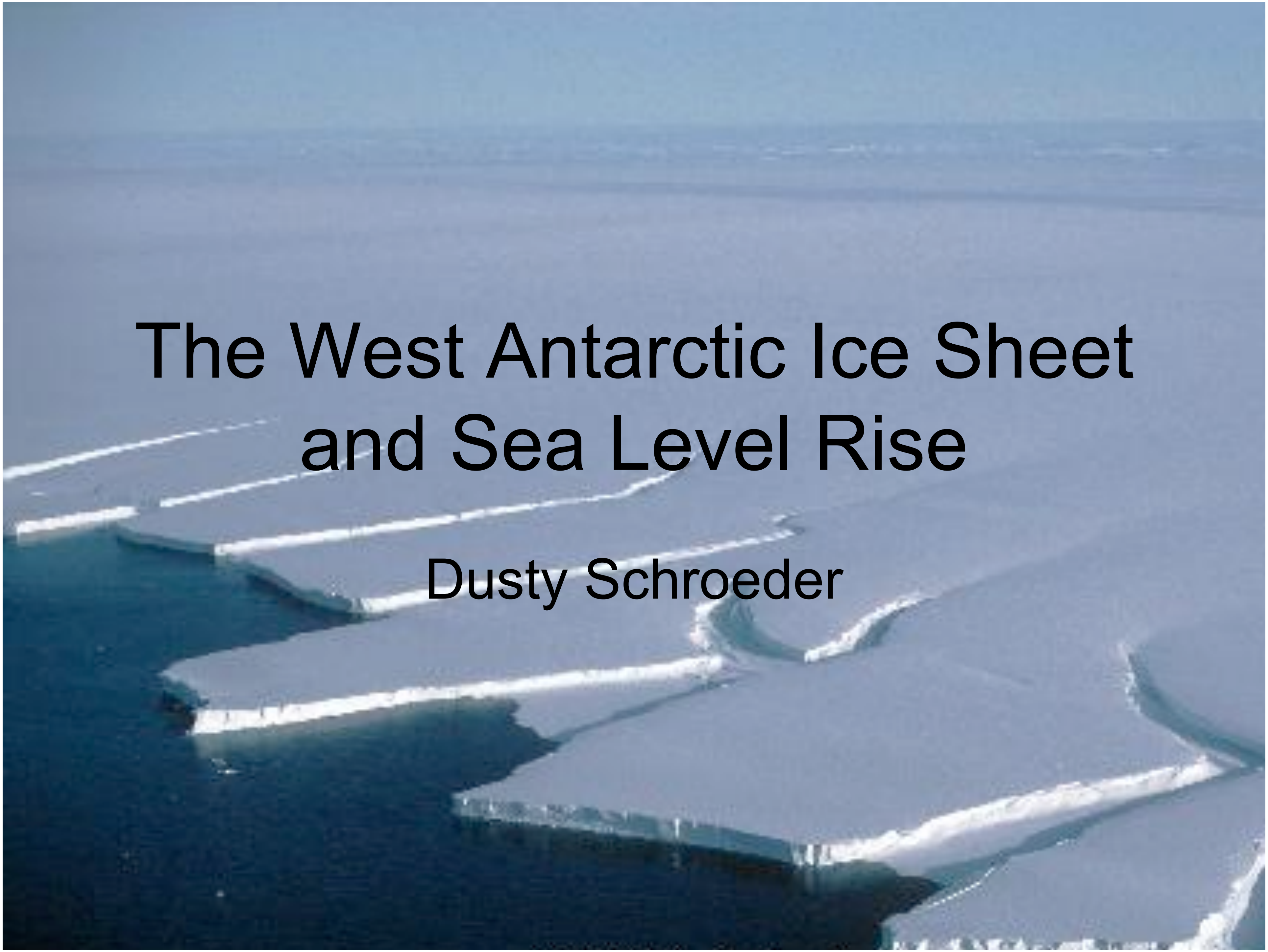
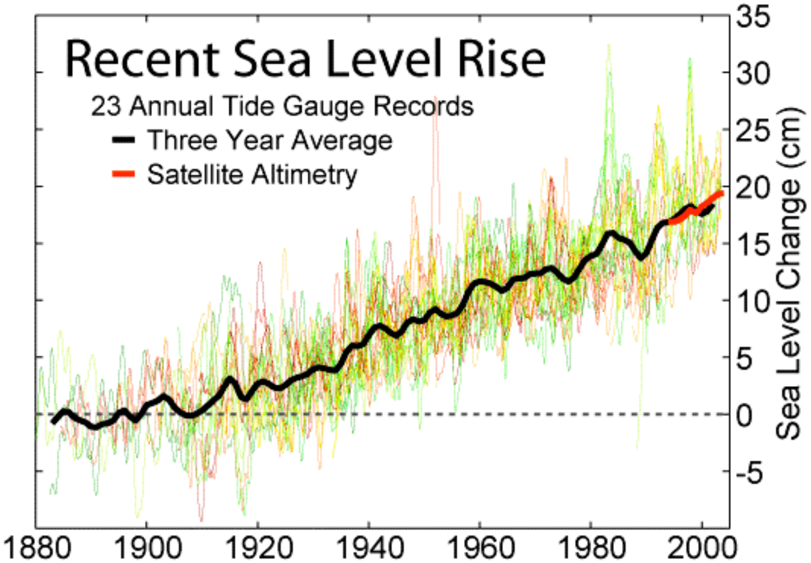
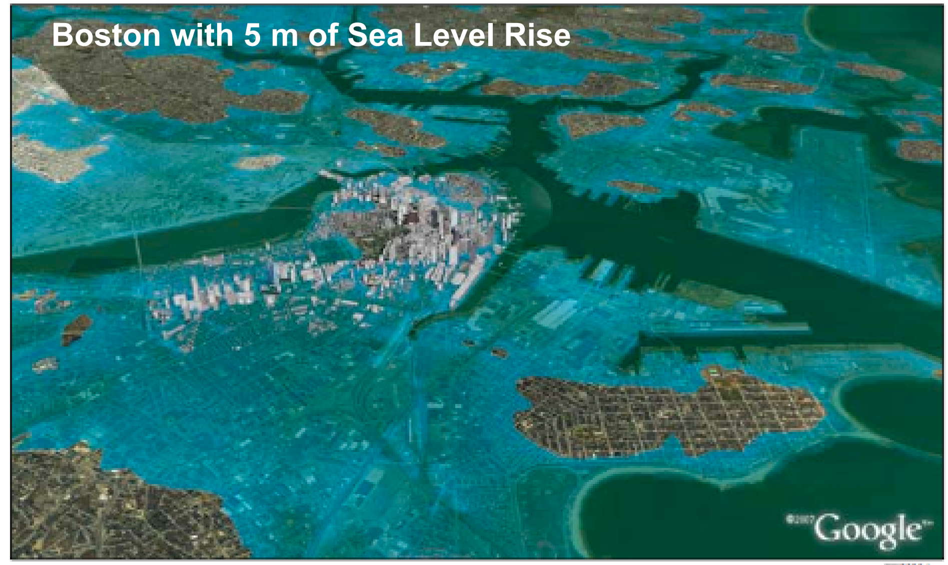

The West Antarctic Ice Sheet
and Sea Level Rise
Dusty Schroeder

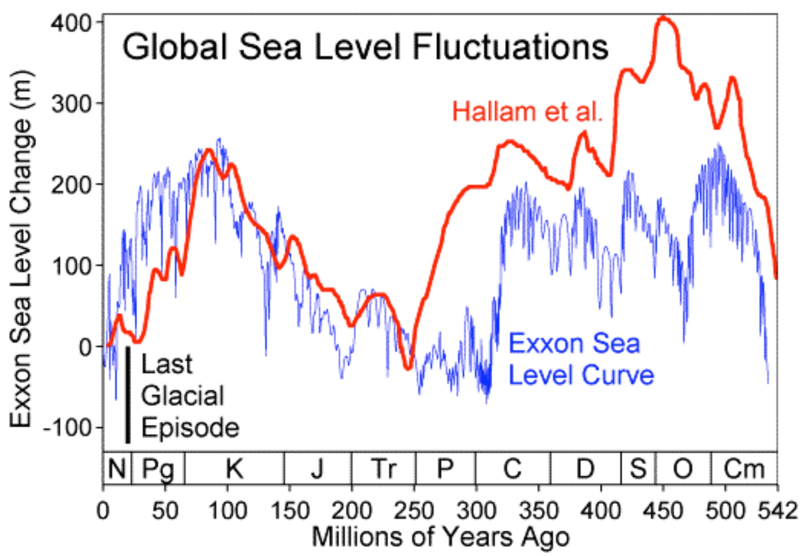
The Cryosphere and Sea Level



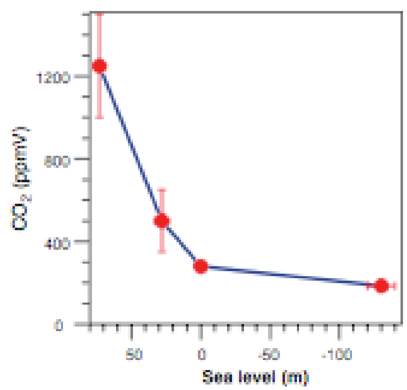
Douglas 1997

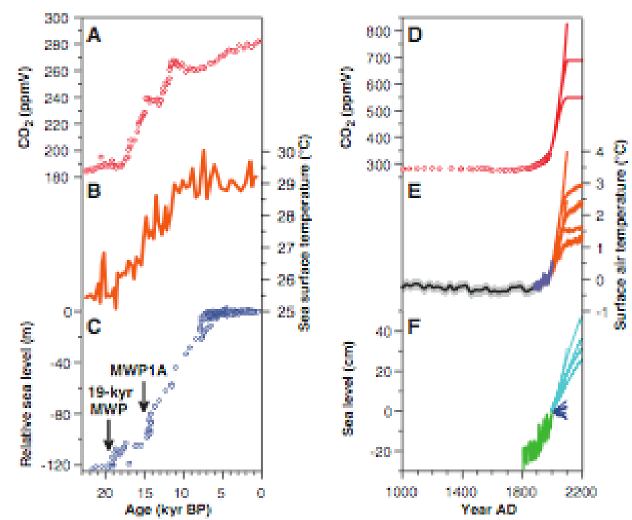


Mazira 2007



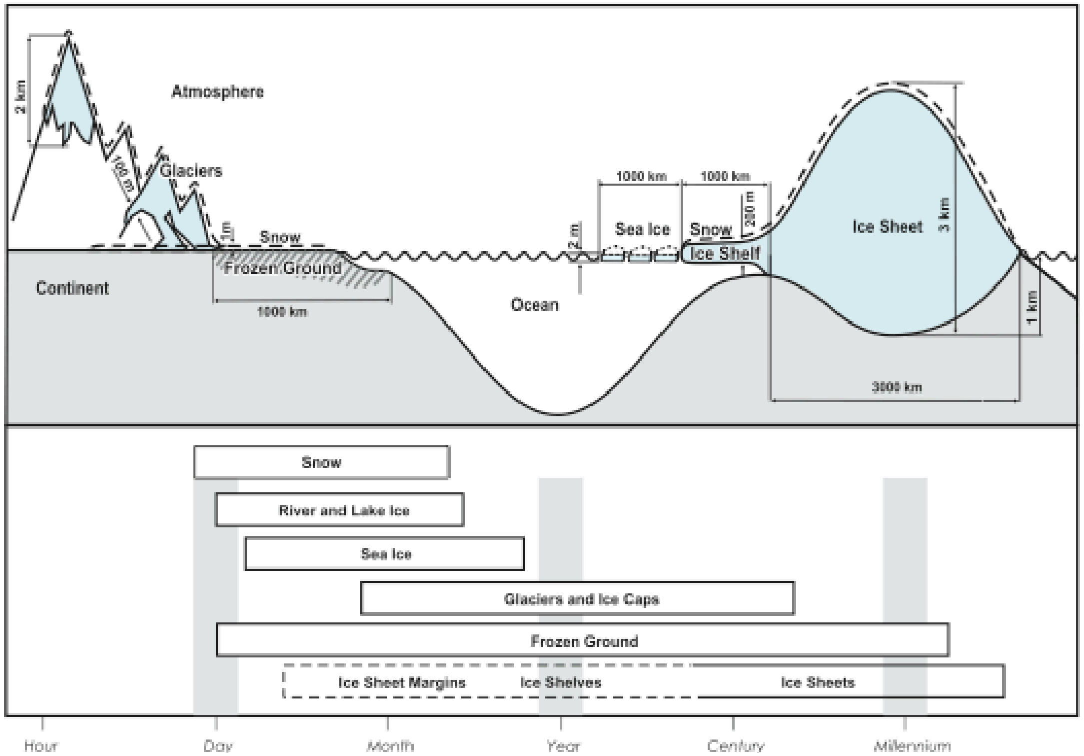
Hellam 1989





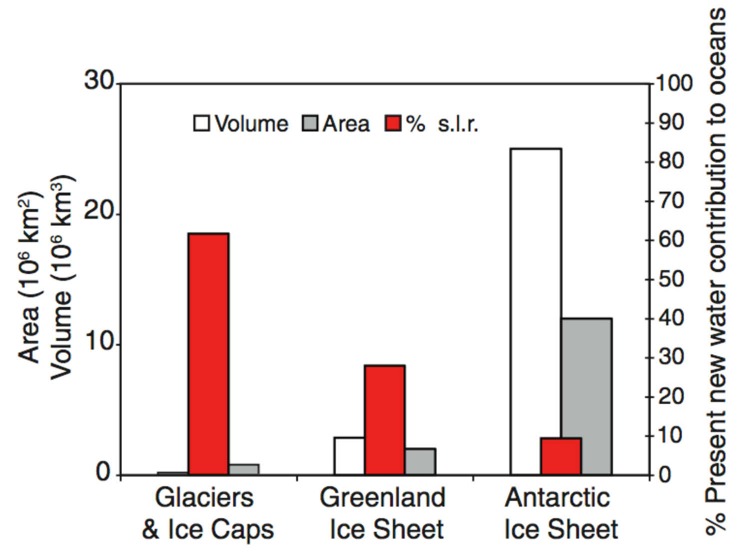
Alley 2008

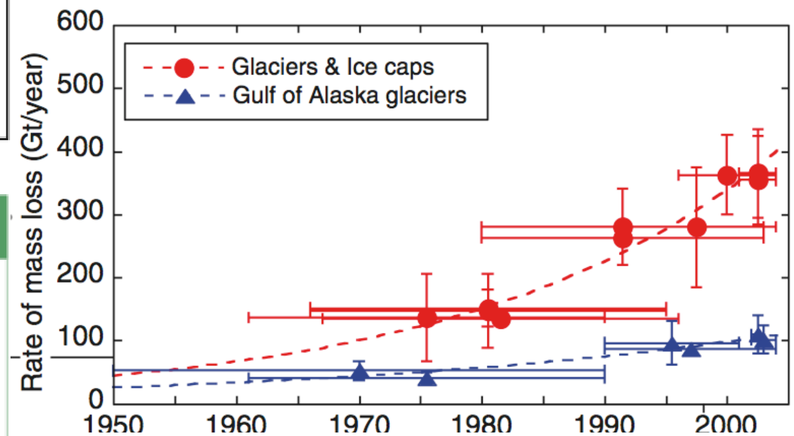
Polar Ice Sheets and Climate Change



Cryospheric Component	Area (10^6 km^2)	Ice Volume (10^6 km^3)	Potential Sea Level Rise (SLE) (m)[g]
Snow on land (NH)	1.9–45.2	0.0005–0.005	0.001–0.01
Sea ice	19–27	0.019–0.025	~0
Glaciers and ice caps			
Smallest estimate[a]	0.51	0.05	0.15
Largest estimate[b]	0.54	0.13	0.37
Ice shelves[c]	1.5	0.7	~0
Ice sheets	14.0	27.6	63.9
Greenland[d]	1.7	2.9	7.3
Antarctica[c]	12.3	24.7	56.6
Seasonally frozen ground (NH)[e]	5.9–48.1	0.006–0.065	~0
Permafrost (NH)[f]	22.8	0.011–0.037	0.03–0.10

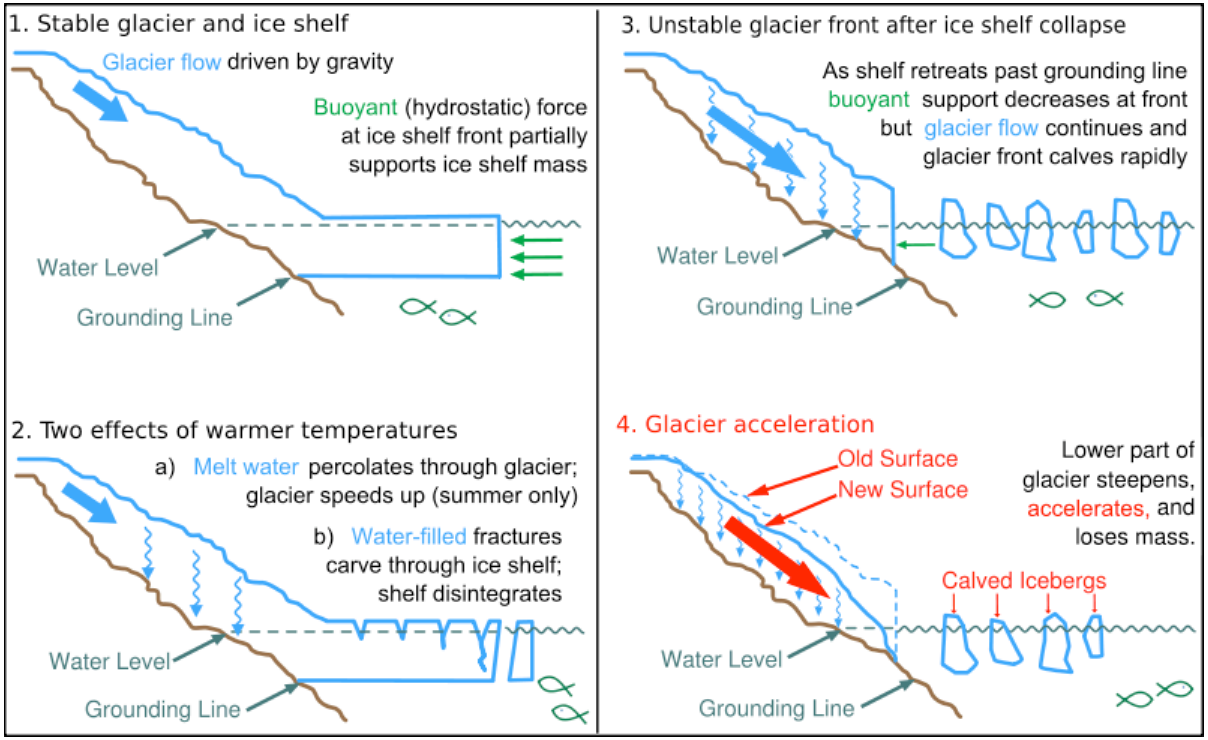
IPCC 2007



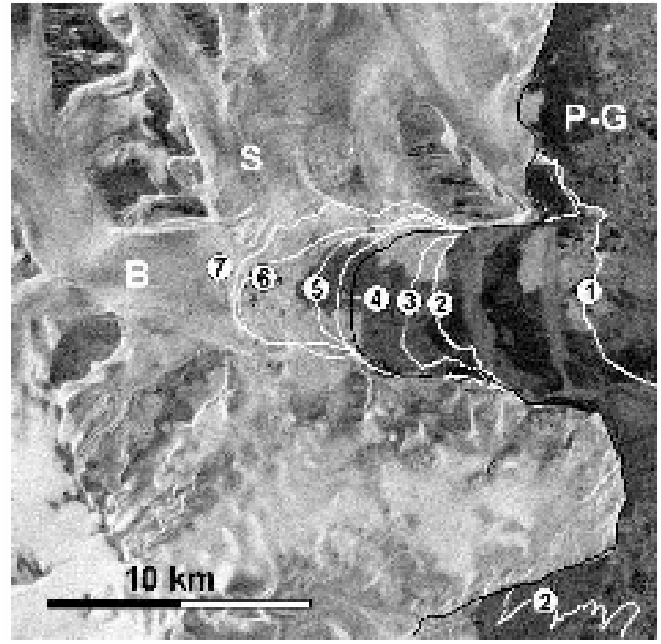


Meier 2007

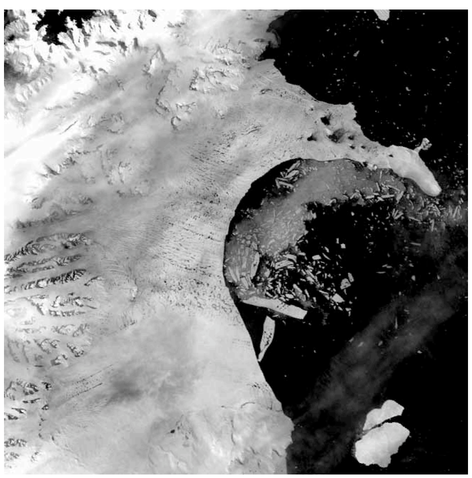
Marine Ice Sheets and Abrupt Change



Scambos 2008

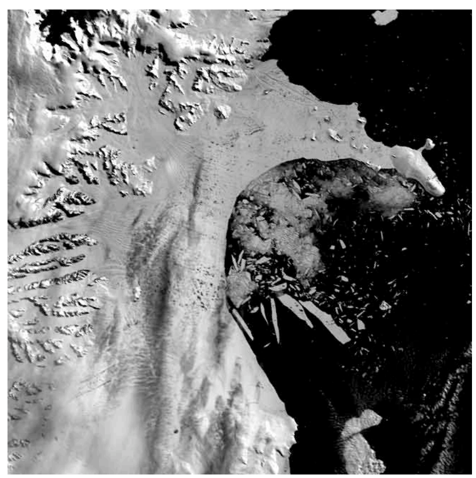


Rott 2002

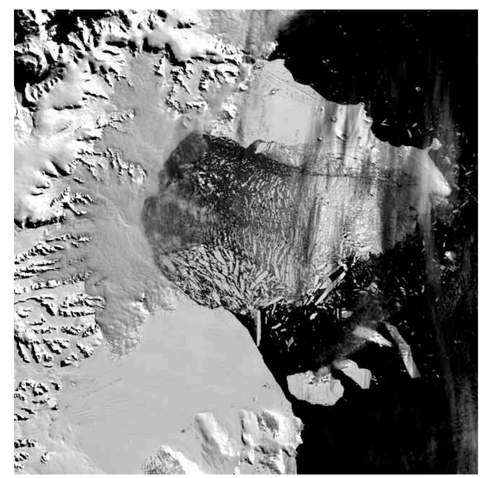


NSIDC

1 Week

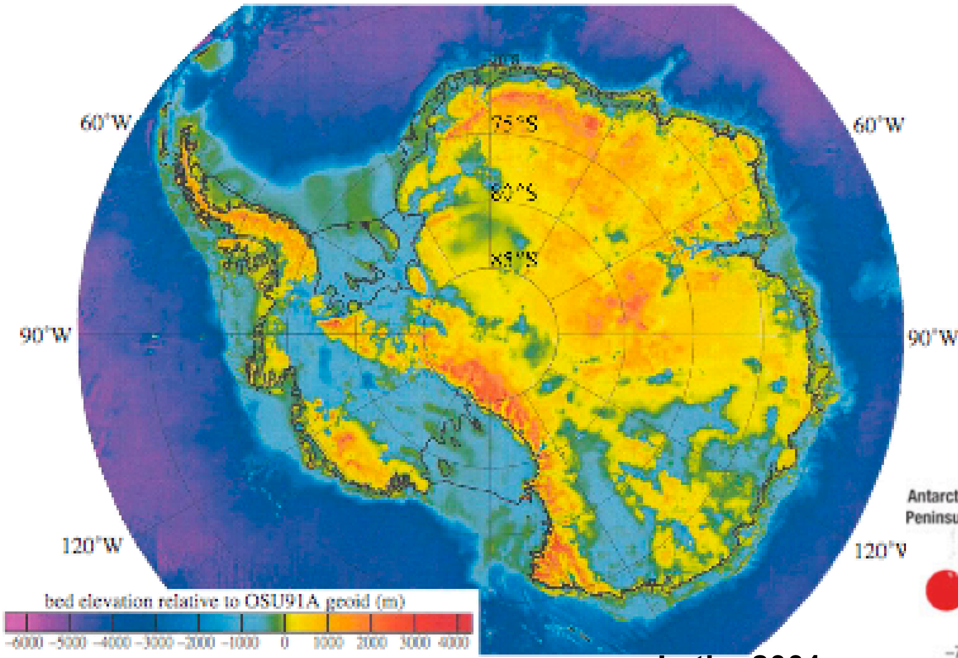


1 Week



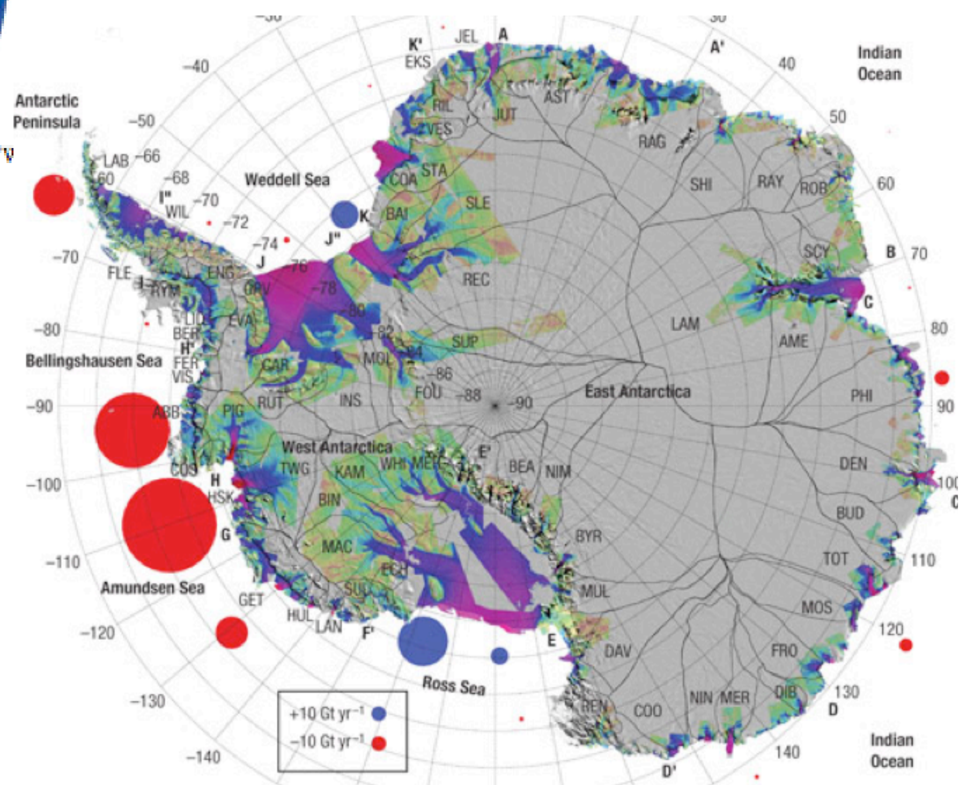
The Antarctic Ice Sheet

Bed Elevation



Lythe 2001

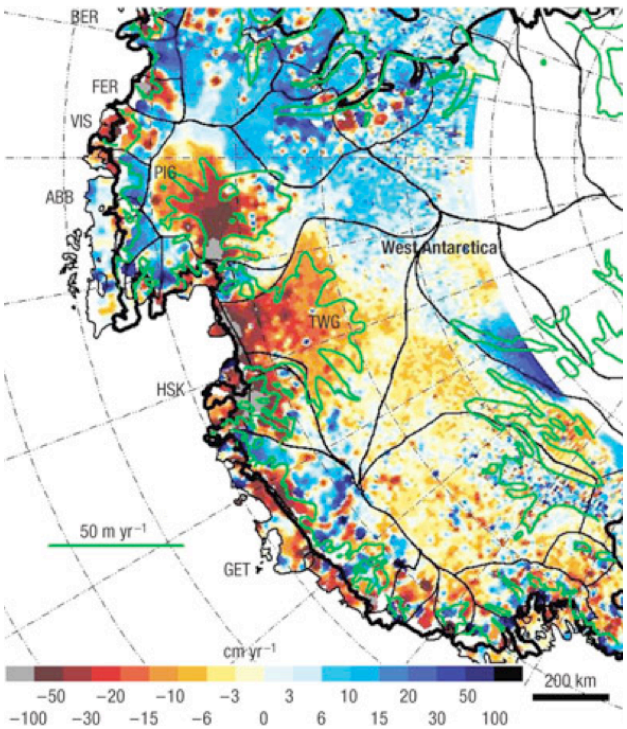
Mass Balance



Rignot 2008

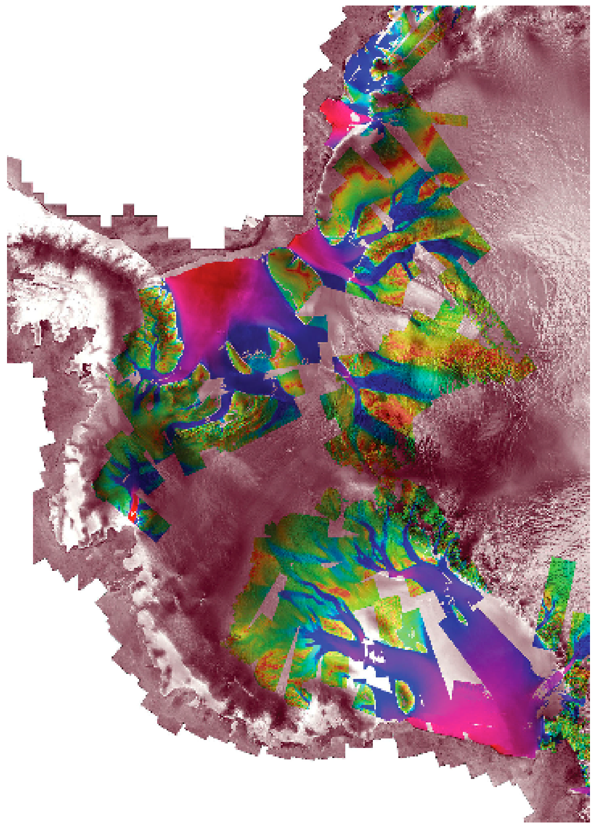
The West Antarctic Ice Sheet

Surface Elevation Change



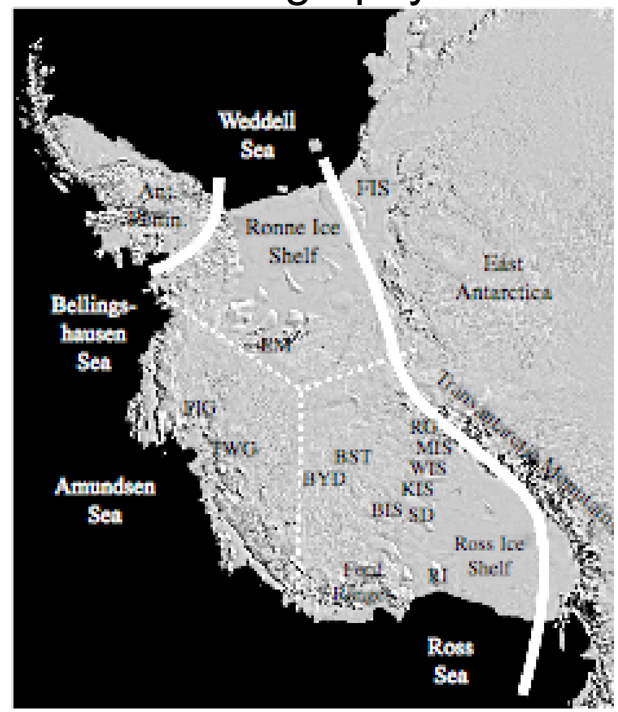
Rignot 2008

Surface Velocity



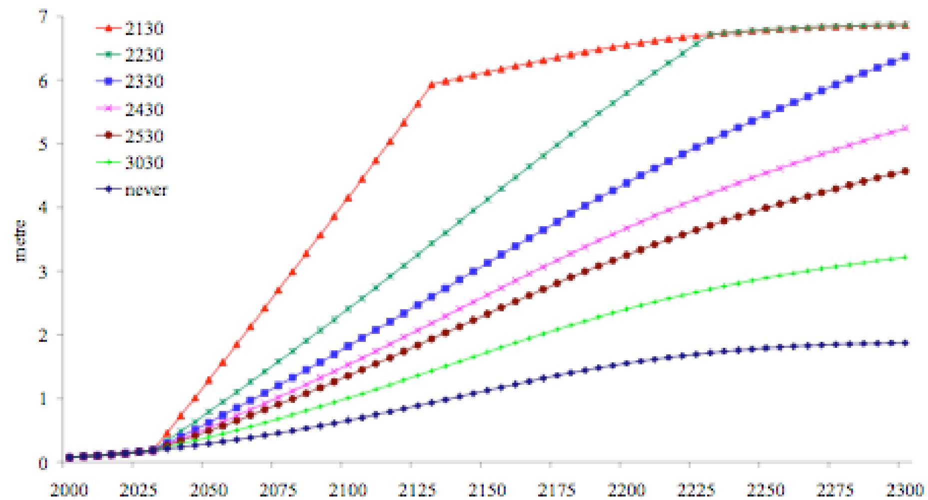
Rignot 2008

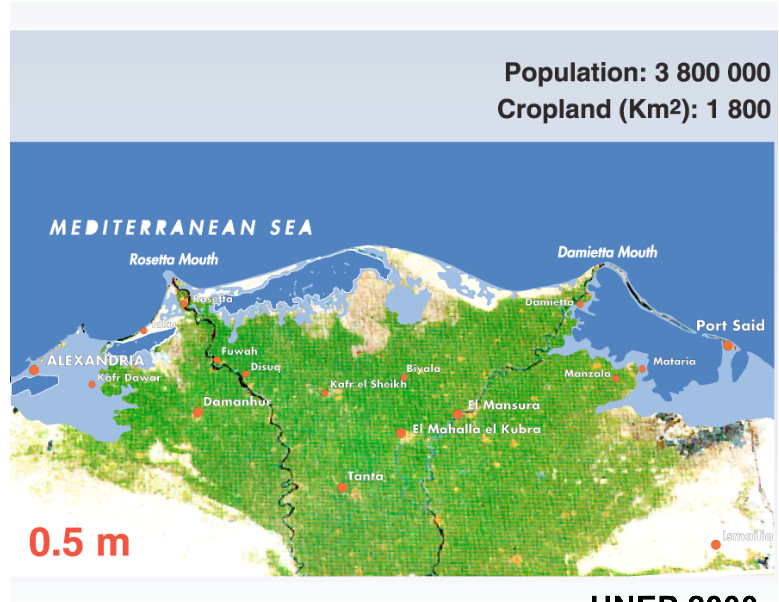
Geography



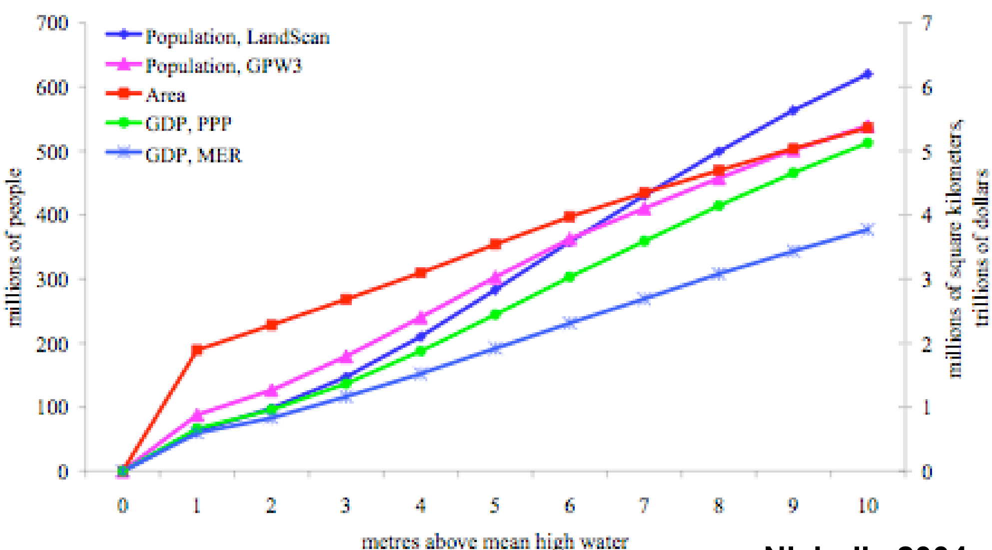
Bindschadler 2006

Impact of WAIS Collapse





UNEP 2000



Nicholls 2004

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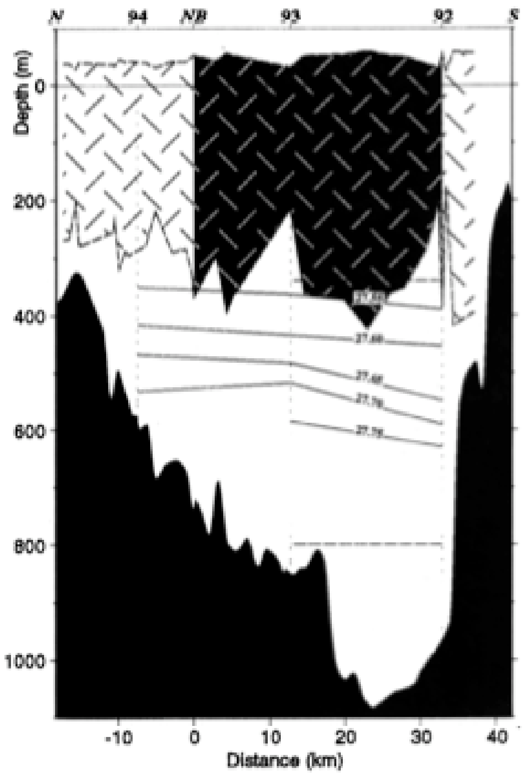
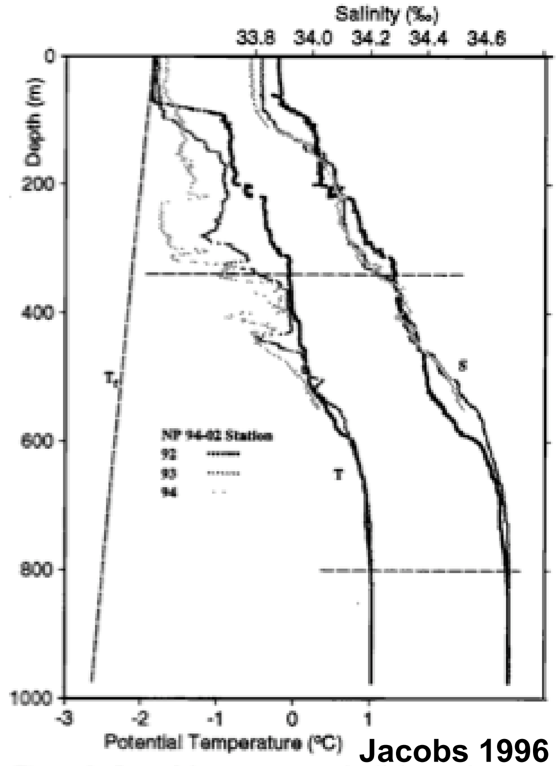
GALVESTON, TEXAS - 1.5-meter sea level rise
Population: 57,247 Data Source: NOAA NGDC

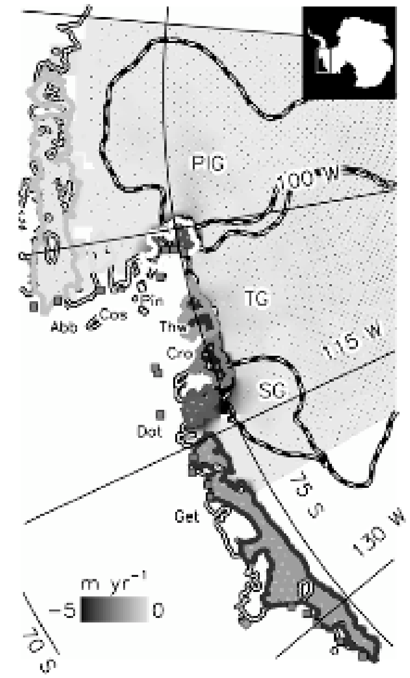
Mazira 2007

Oceans and Ice Sheet Forcing





Jacobs 1996

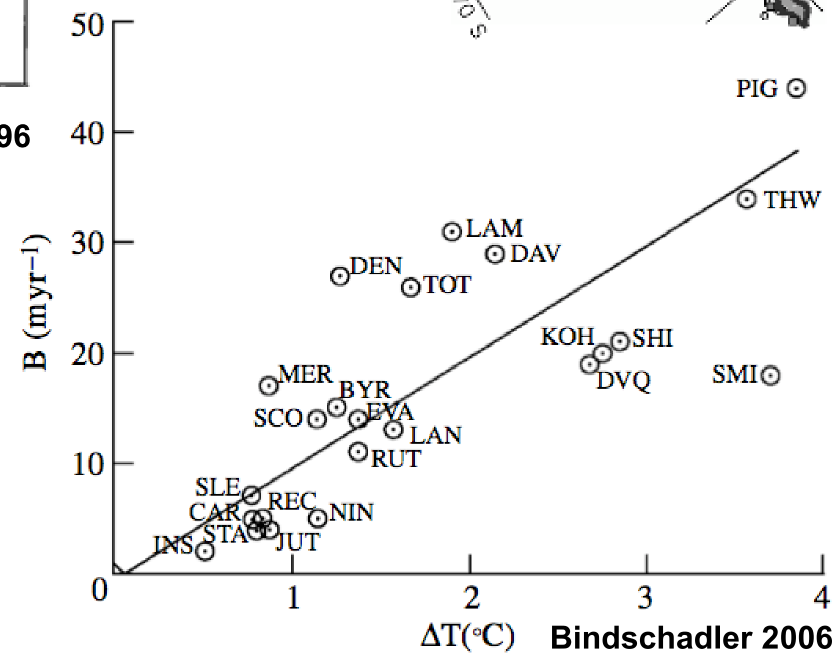


Shepard 2004

Ice Shelf	Area (km²)	Ice thickness[a] (m)	Elevation rate (cm year⁻¹)	Thinning rate (m year⁻¹)
Abbot	30,827	419	−6 ± 4	0.6 ± 0.4
Cosgrove	2,553	729	−8 ± 3	0.7 ± 0.4
Pine Island	2,365	657	−42 ± 4	3.9 ± 0.5
Thwaites	1,687	698	−59 ± 7	5.5 ± 0.7
Crosson	3,843	776	−49 ± 4	4.5 ± 0.5
Dotson	3,433	469	−36 ± 2	3.3 ± 0.4
Getz	31,186	899	−17 ± 6	1.6 ± 0.6

[a]Derived from the empirical relationship of [*Vaughan et al.*, 1995].

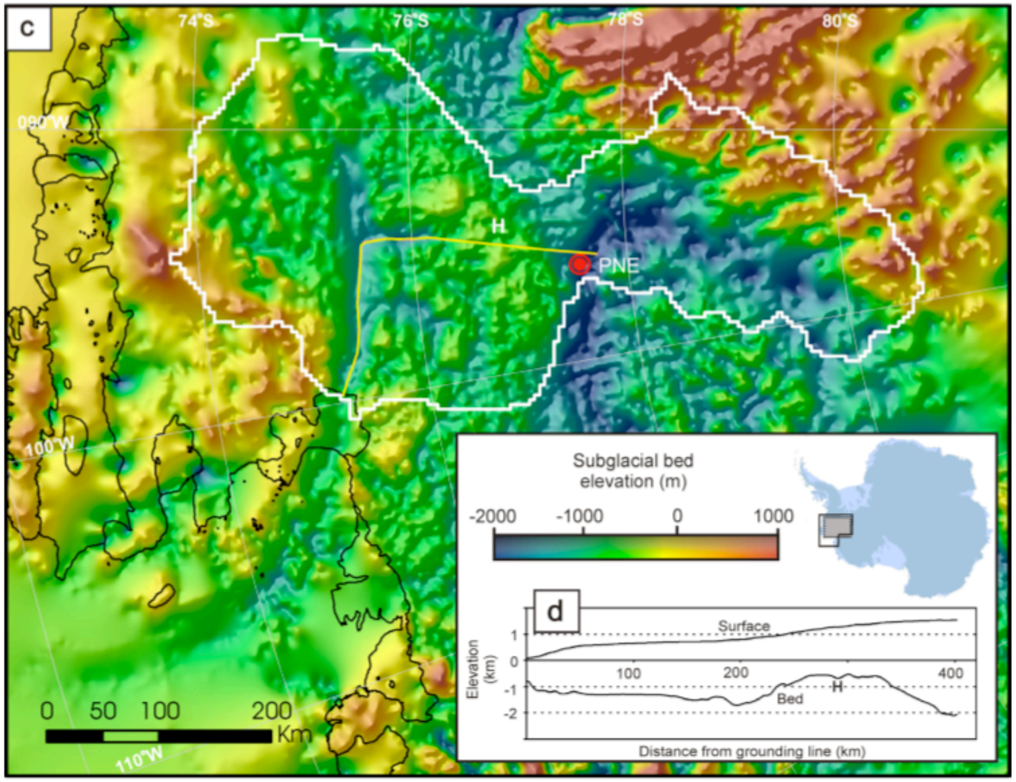
Shepard 2004



Bindschadler 2006

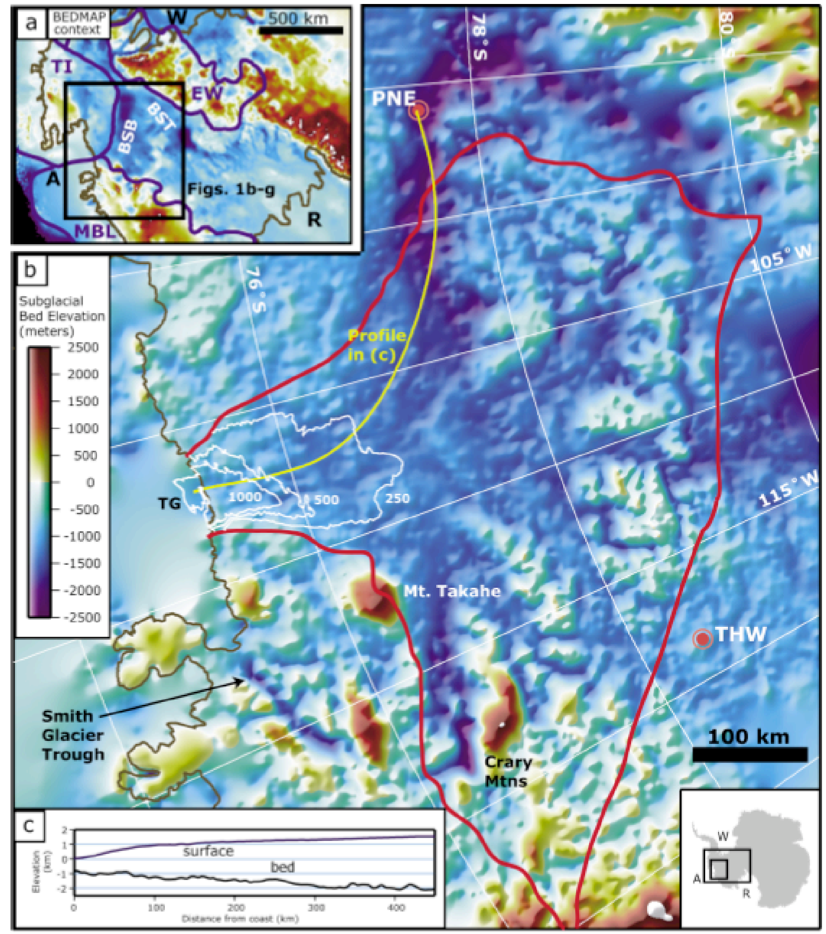
Morphology and Ice Sheet Response

Pine Island Glacier



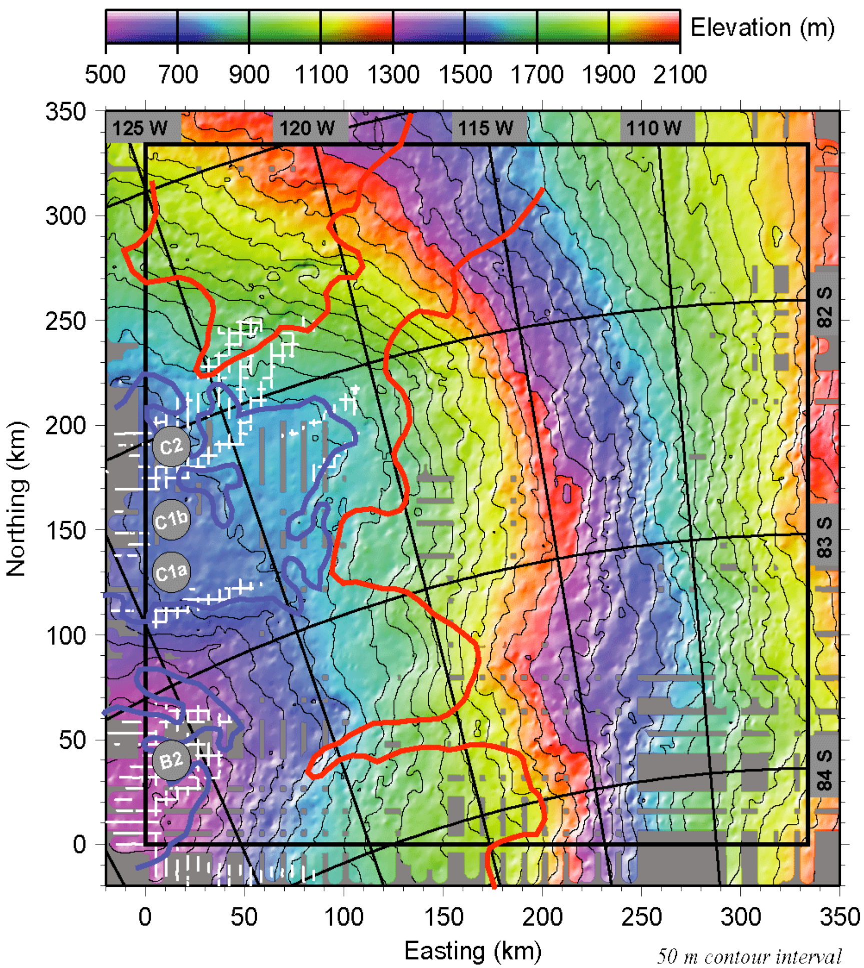
Vaugn 2006

Thwaites Glacier

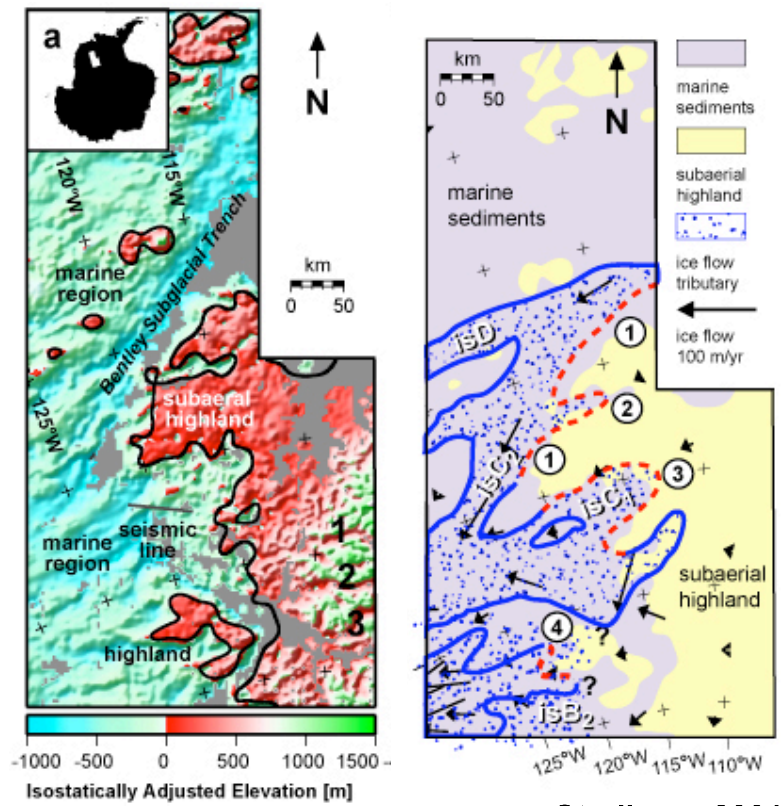


Holt 2006

Sediment and Ice Sheet Response



Blankenship 2001



Studinger 2001

Hydrology and Ice Sheet Response

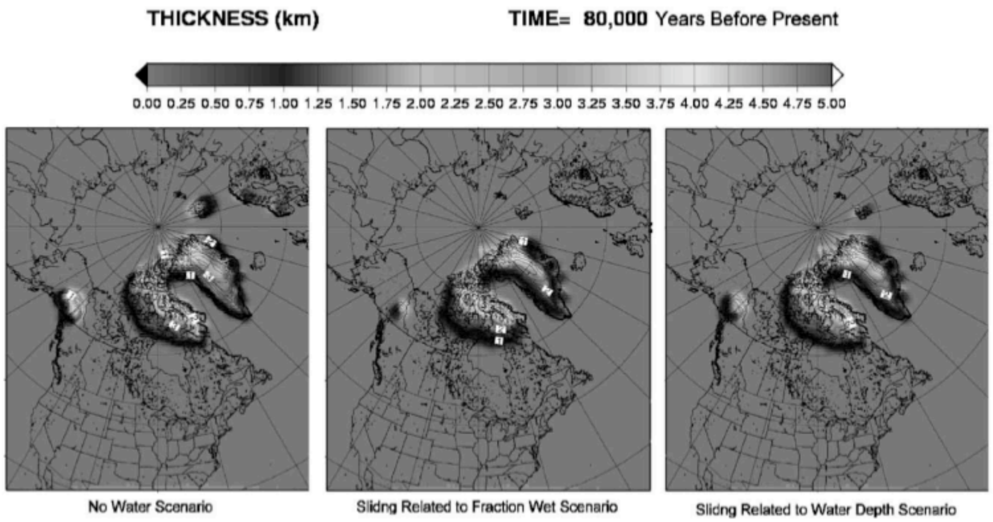


Fig. 2. Ice sheet thickness for three different sliding models. Inception phase of glaciation.

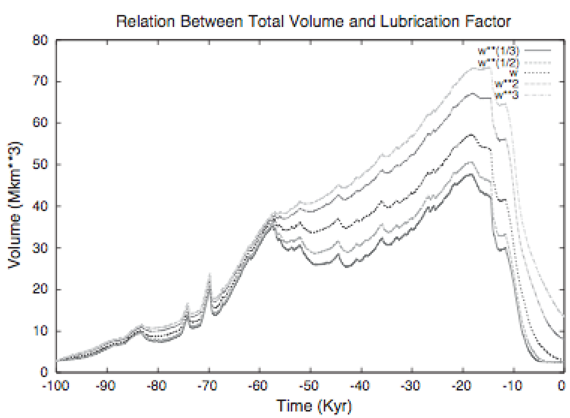


Fig. 13. Sensitivity of total volume to sliding law exponent.

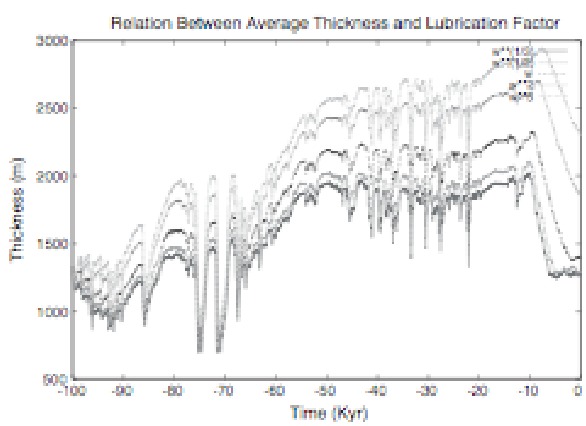
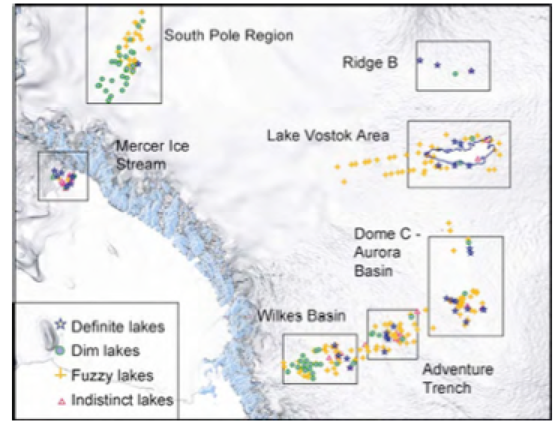
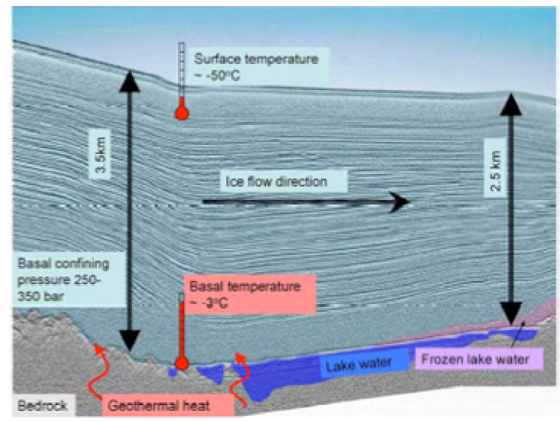
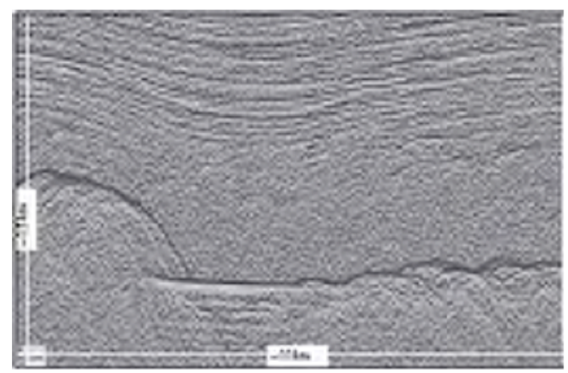


Fig. 12. Sensitivity of average thickness to sliding law exponent.

Johnson 2002



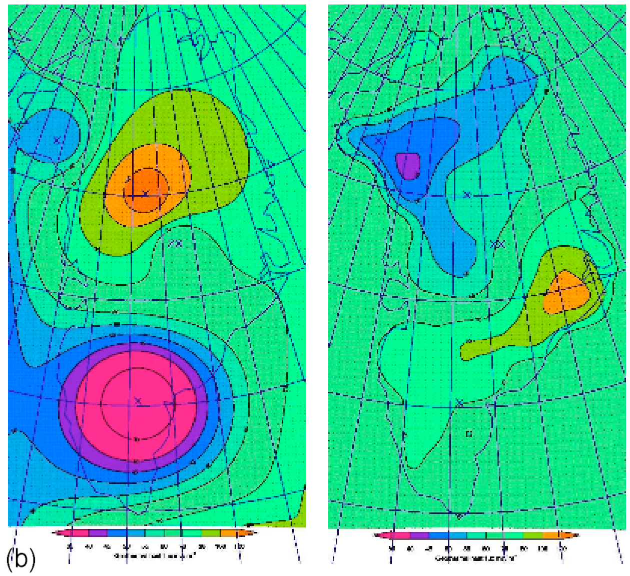




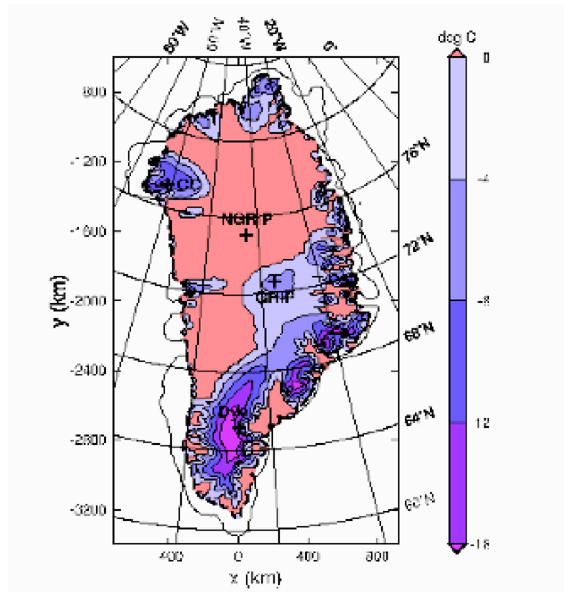
Carter 2008

Geothermal Flux and Ice Sheet Response

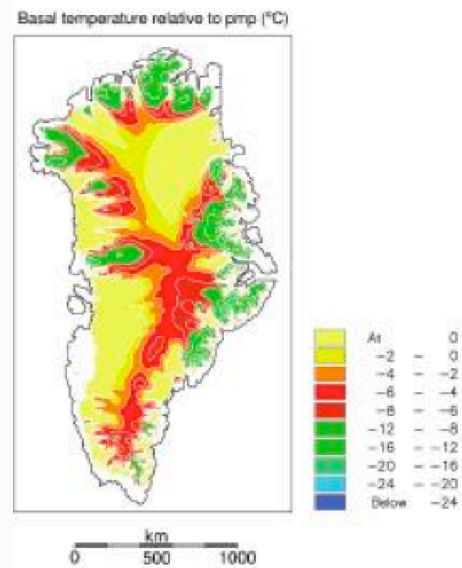
Model Fit Satellite Mag



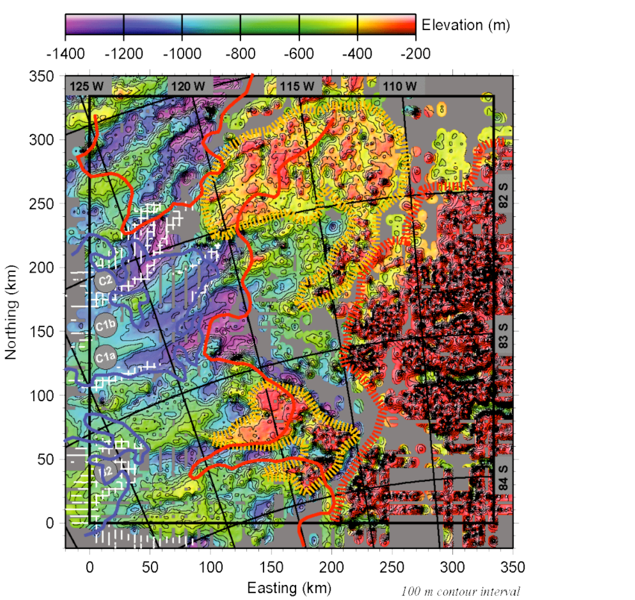
Fit Result

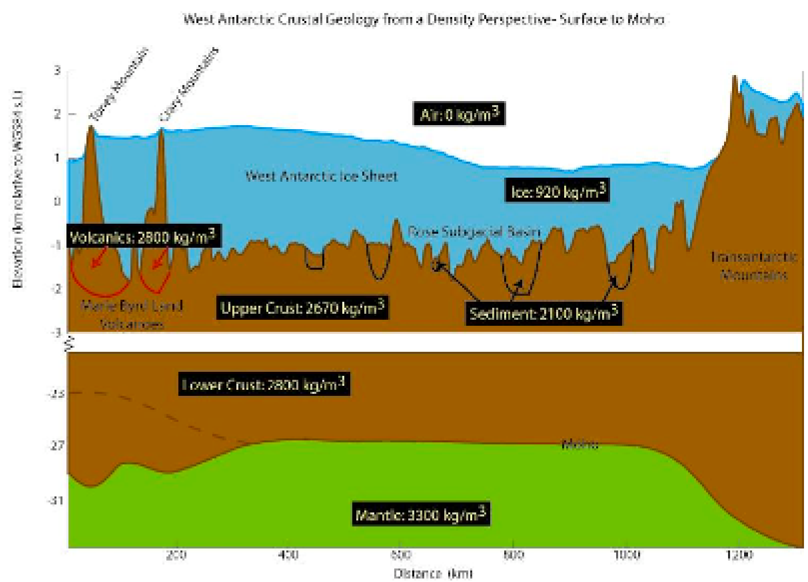


Uniform Result



Greve 2005





Blankenship 2001

Diehl 2008

Challenges in Modeling the Ice Sheet

1) Poor(or Missing) Key Physical Processes:
   - Ice Sheet/Ocean Interaction
   - Grounding Line Migration
   - Production and Flow of Basal Water
   - Ice Stream Dynamics and Basal Processes
   - Iceberg Calving
   - Higher Order Physics

2) Conflicting Predictions for Ice Sheet Stability

3) Non-uniform Boundary Condition Data

4) No Systematic Analysis Model/Data Uncertainty

Oppenheimer 2007, Vaugn 2007, Van Der Veen 1985