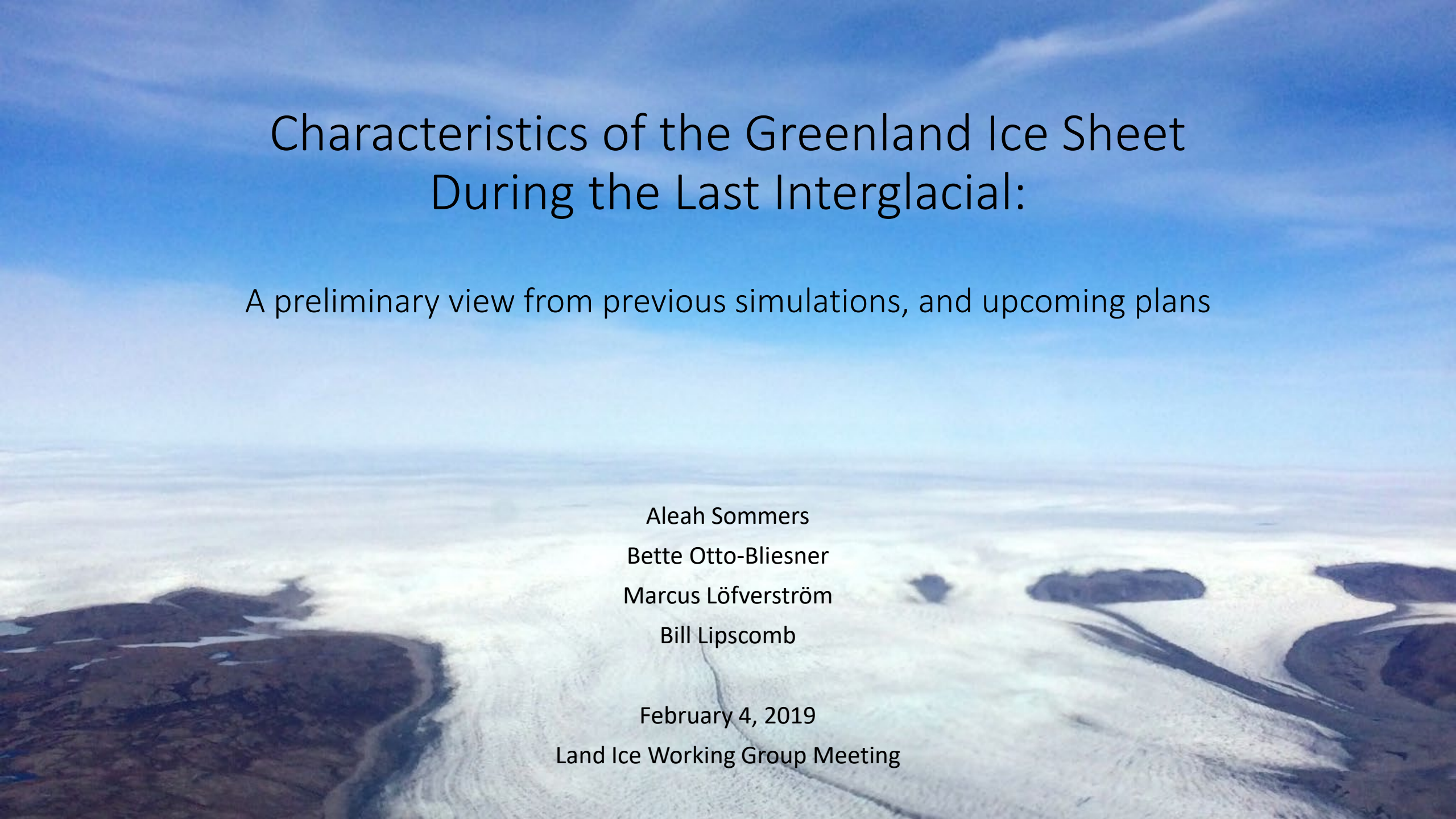

Characteristics of the Greenland Ice Sheet During the Last Interglacial:

A preliminary view from previous simulations, and upcoming plans

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Bette Otto-Bliesner

Marcus Löfverström

Bill Lipscomb

February 4, 2019

Land Ice Working Group Meeting

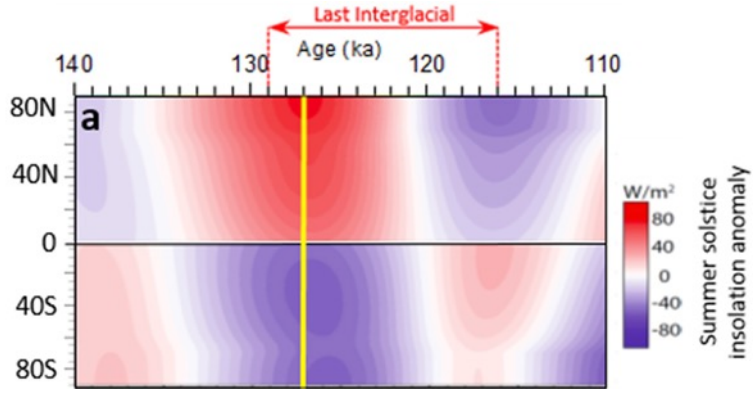
Overview of the Last Interglacial

- ~ 129 – 116 ka
- Global mean temperature warmer than present
- Warmer climate due primarily to orbital configuration

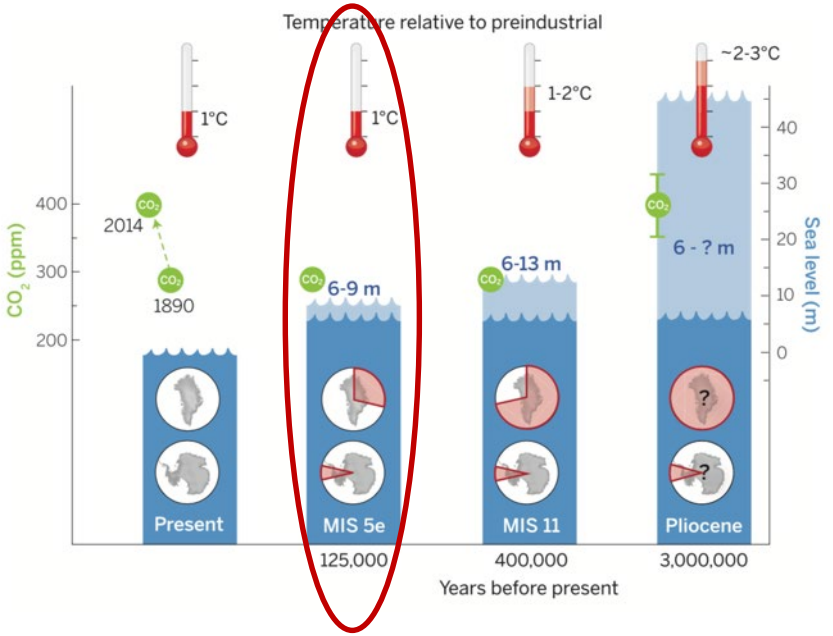
  → High summer insolation anomaly in northern hemisphere

- Global mean sea level several meters higher than present

  → How much due to contribution from Greenland Ice Sheet?



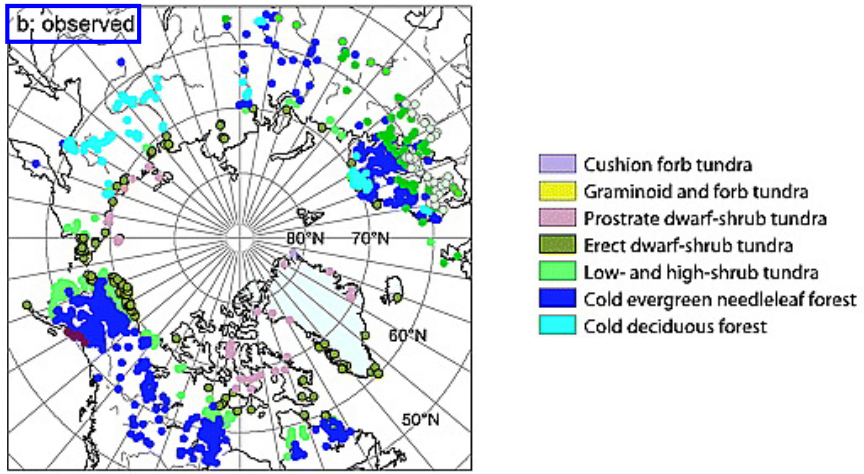
Capron et al., QSR, 2017



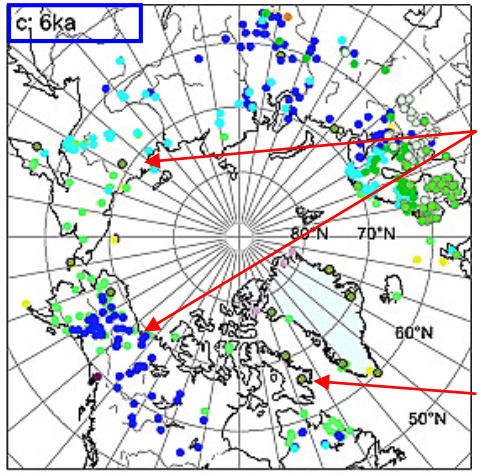
Dutton et al., Science, 2015

A Review of Previous Coupled CESM/CISM Simulations of LIG

1) LIG 127ka orbital forcing [LIG]
   - 2000 CISM yrs, 155 CESM yrs



2) LIG 127ka orbital forcing + (idealized) boreal forests to Arctic Ocean [LIGveg]
   - + 2000 CISM yrs, 80 CESM yrs

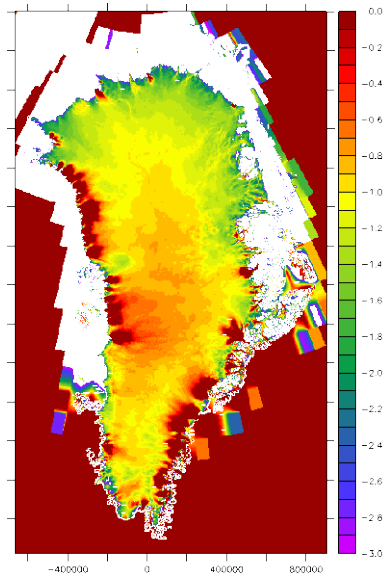
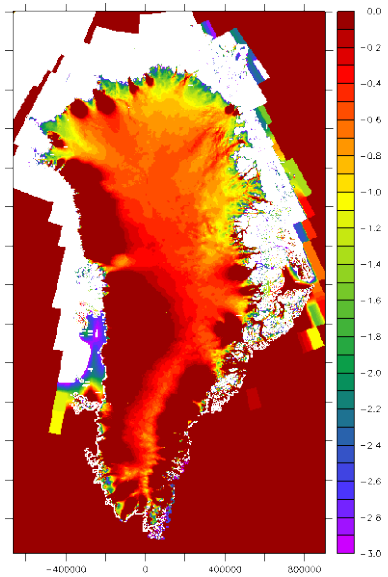
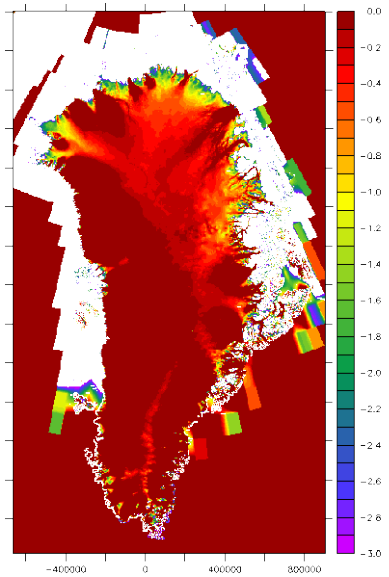
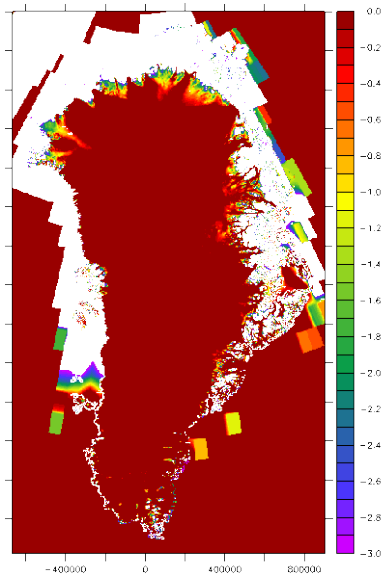
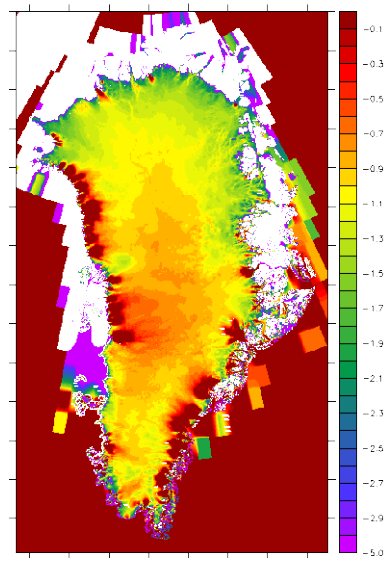
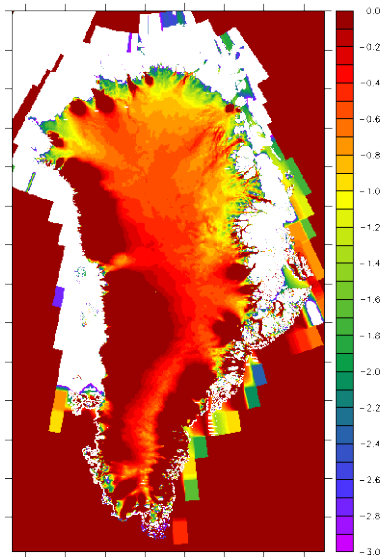
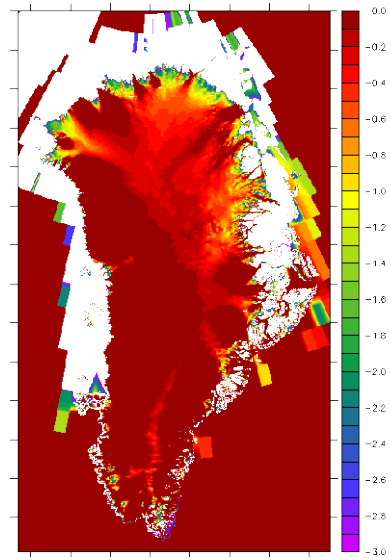
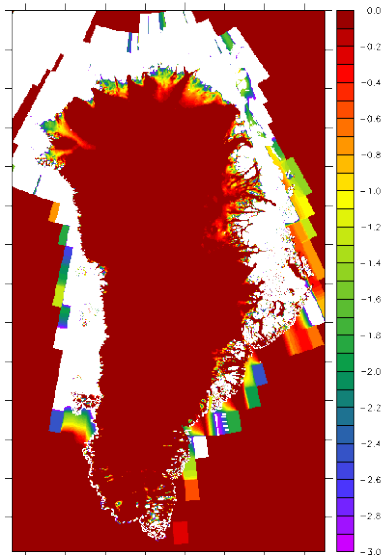


LIG

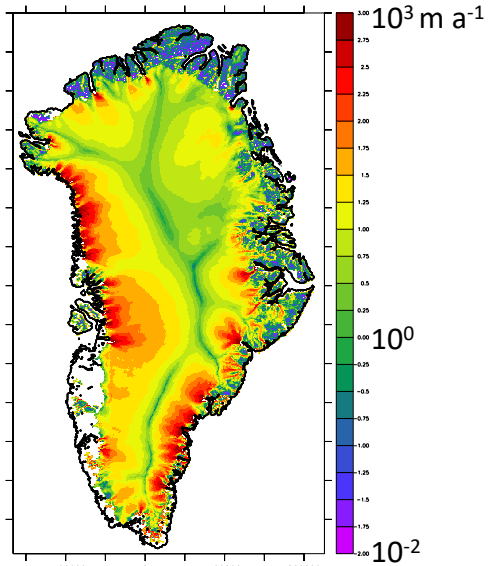
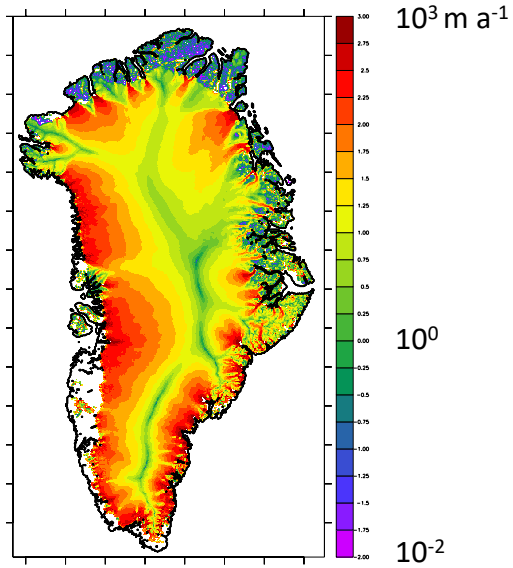
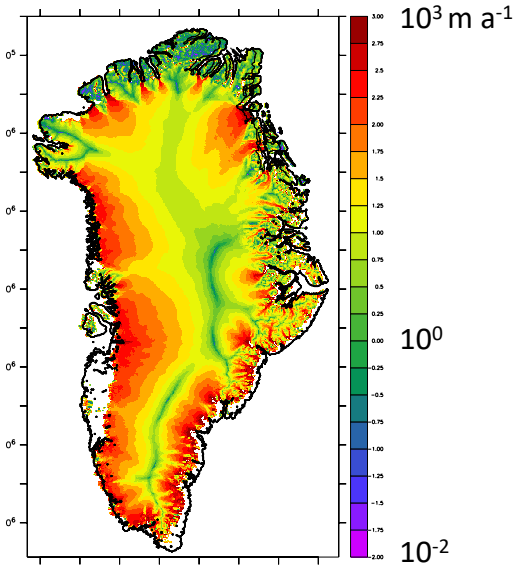
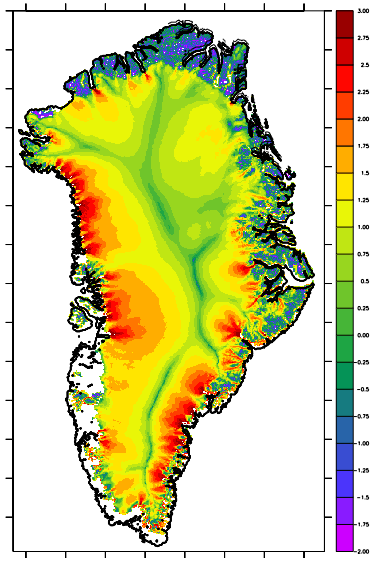
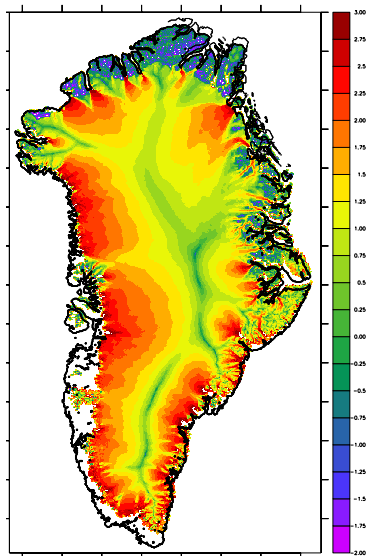
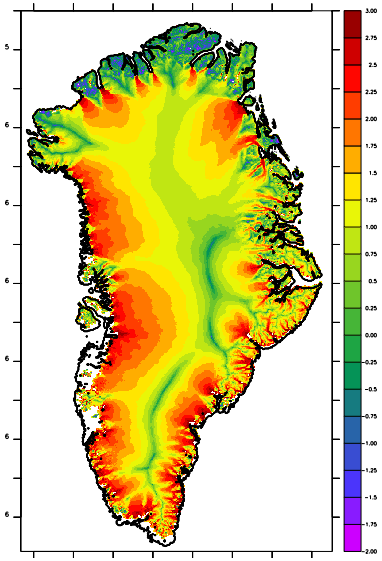
Boreal forest

Low- and high-shrub tundra

Evolution of Basal Thermal State ($T - T_{PMP}$): Cold or thawed…?

	50 a	150 a	250 a	500 a
LIG (orb_127ka)				
Pre-industrial control				

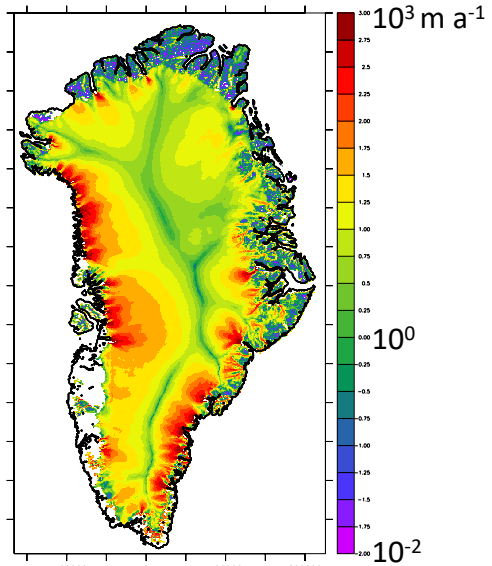
Surface Velocity

	50 a	500 a	2,000 a
LIG (orb_127ka)			
Pre-industrial control			

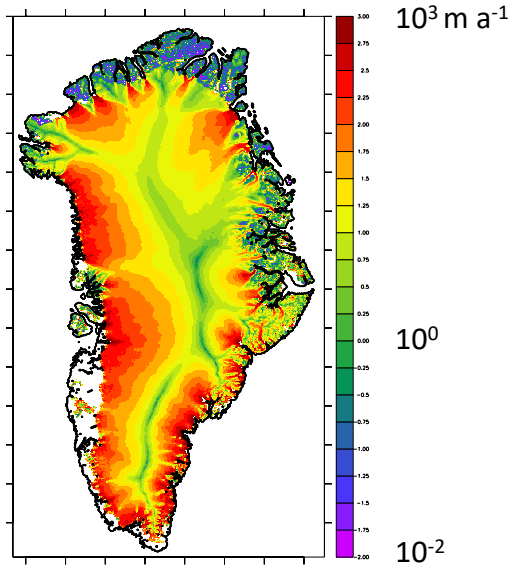
Surface Velocity

LIG (orb_127ka)

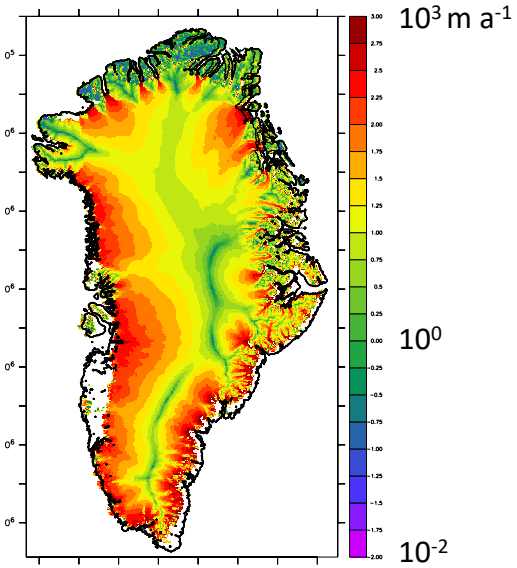
50 a



500 a

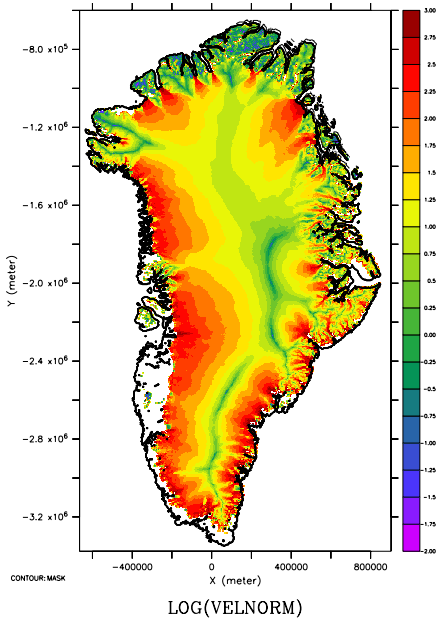


2,000 a



LIGveg

2,050 a



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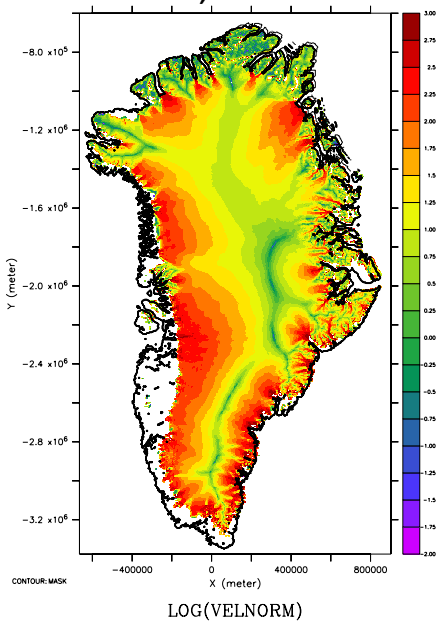

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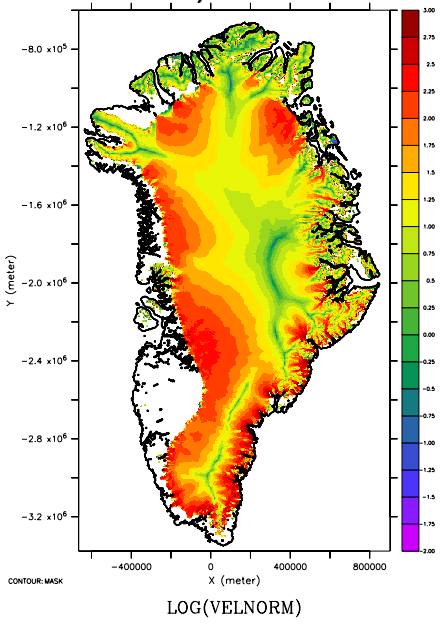
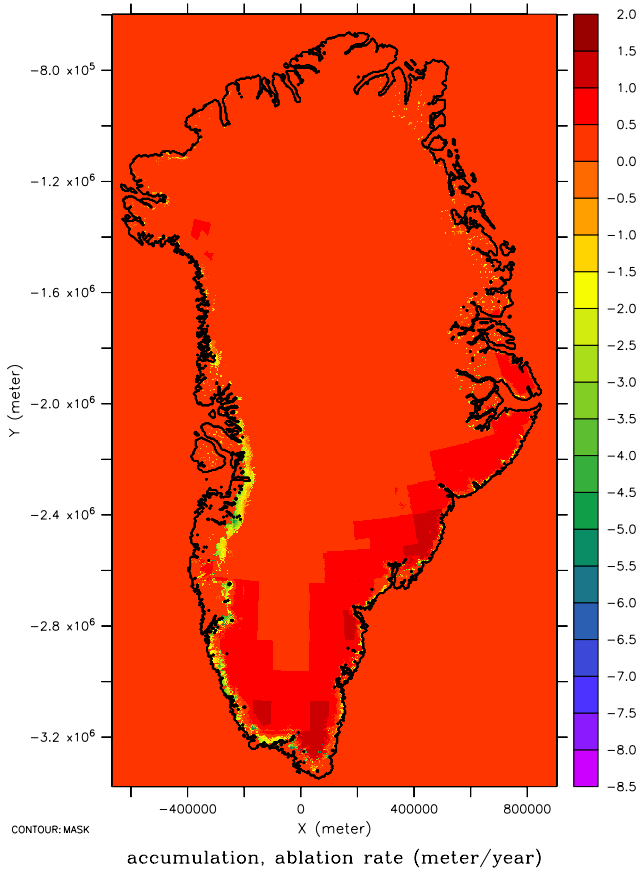


Surface Mass Balance

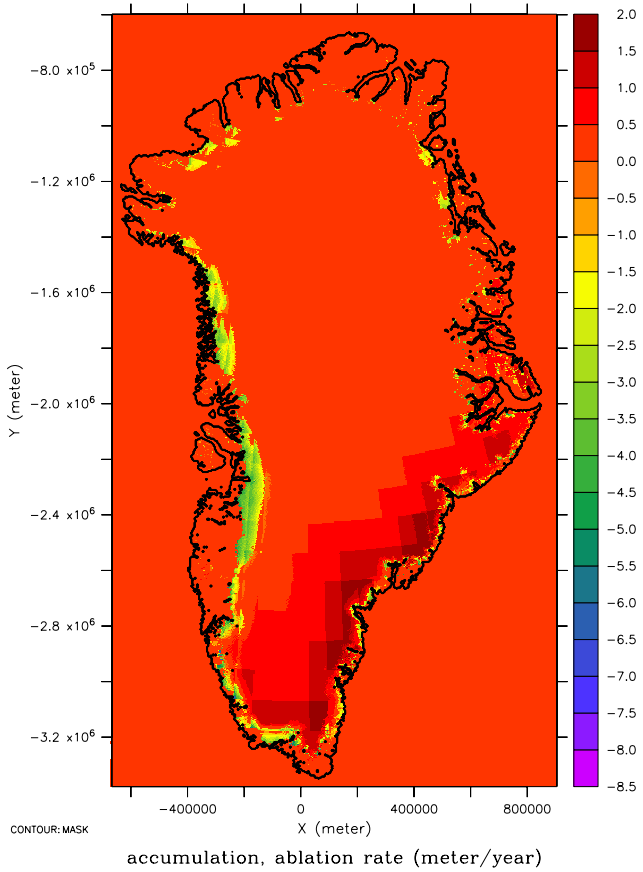
PI Control

2,000 a



LIG

2,000 a



LIGveg

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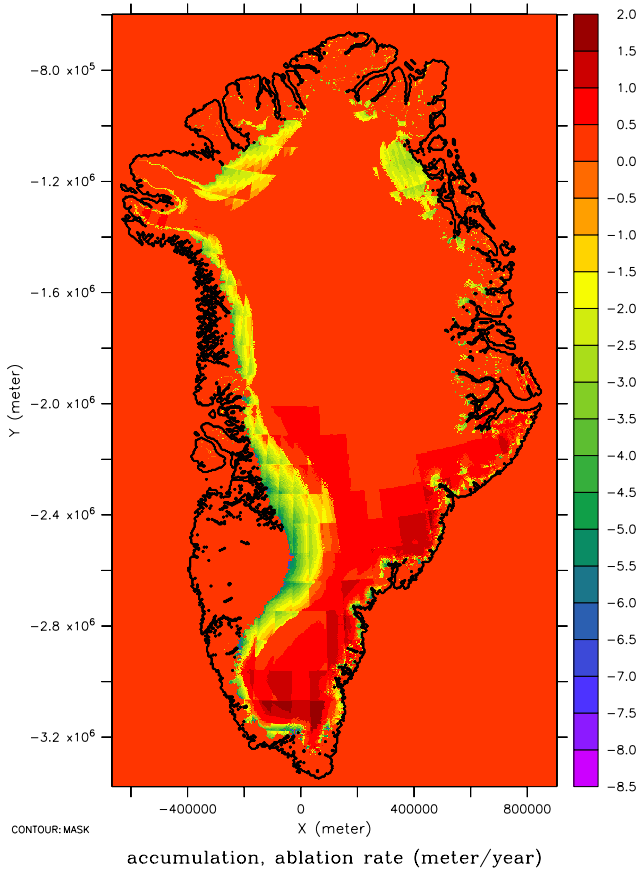
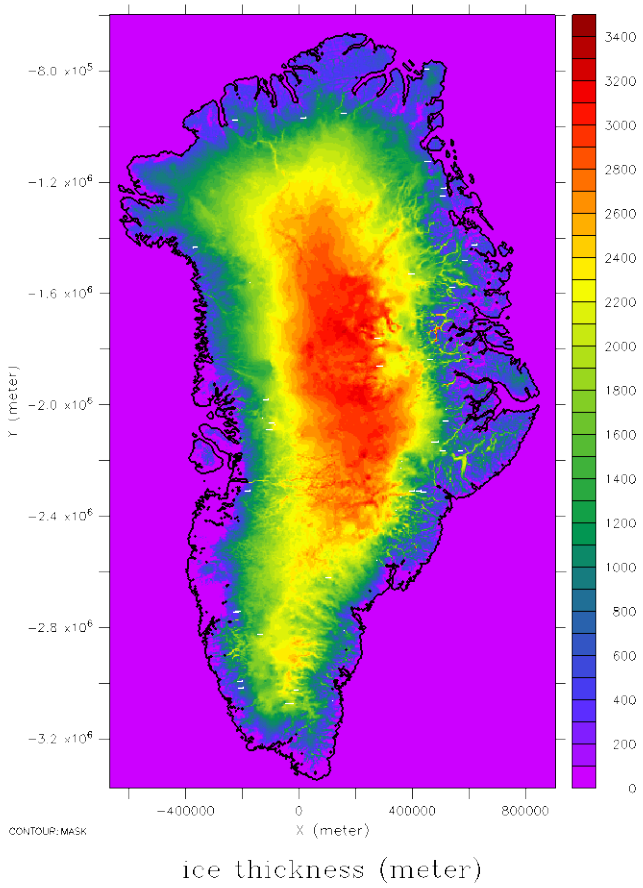


Ice Thickness

PI Control

2,000 a



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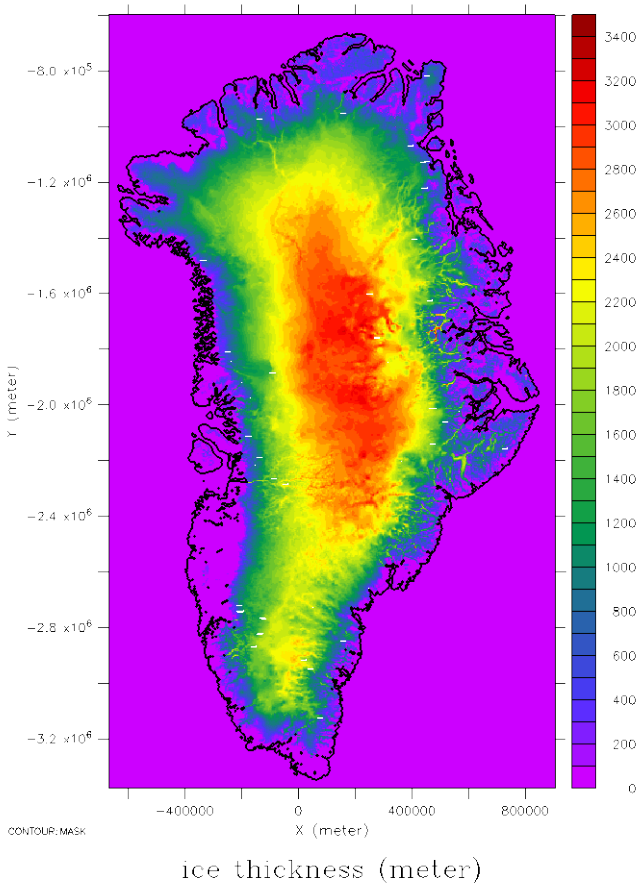

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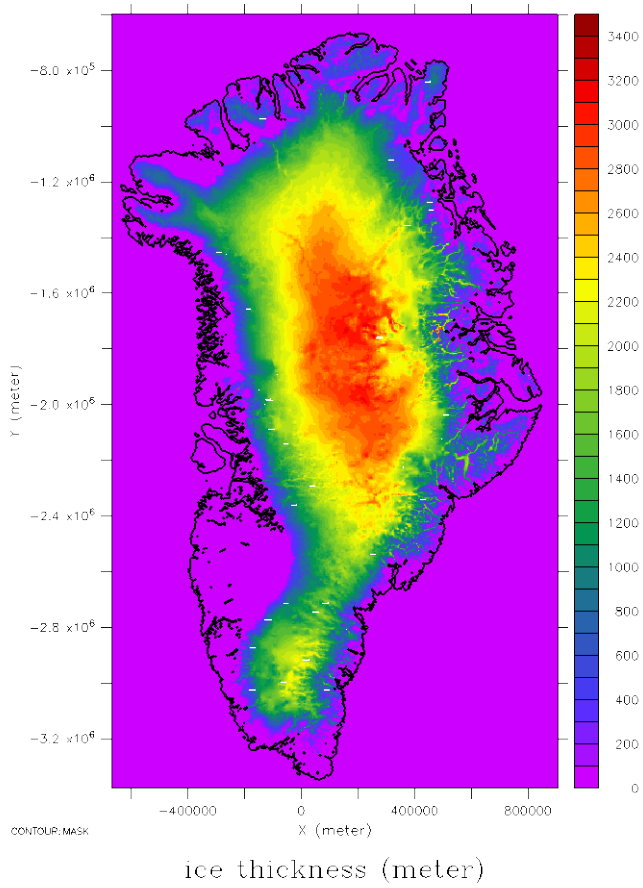

General Summary of Findings from Previous Simulations

- Transition to temperate bed in both pre-industrial control and LIG runs

- 127 ka orbital forcing (LIG run) leads to some thinning and retreat

  ~ 0.6 m sea level equivalent loss of ice compared to present

- With change from tundra to boreal forest in northern latitudes (LIGveg run)

  → dramatic retreat in southwest GrIS, much larger ablation zone

  ~ 1.8 m sea level equivalent loss of ice compared to present

Upcoming Simulation Plans

- New CESM 2.1 simulation with 127 ka orbital forcing
- Stand-alone CISM 2.1 simulations with 127 ka forcing → explore various feedbacks
- Transient 127 – 124 ka coupled CESM/CISM simulations, using ice sheet from JG/BG spin-up and starting from new 127 ka state
- Refine vegetation to be more realistic of LIG in northern latitudes and under retreating ice sheet

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