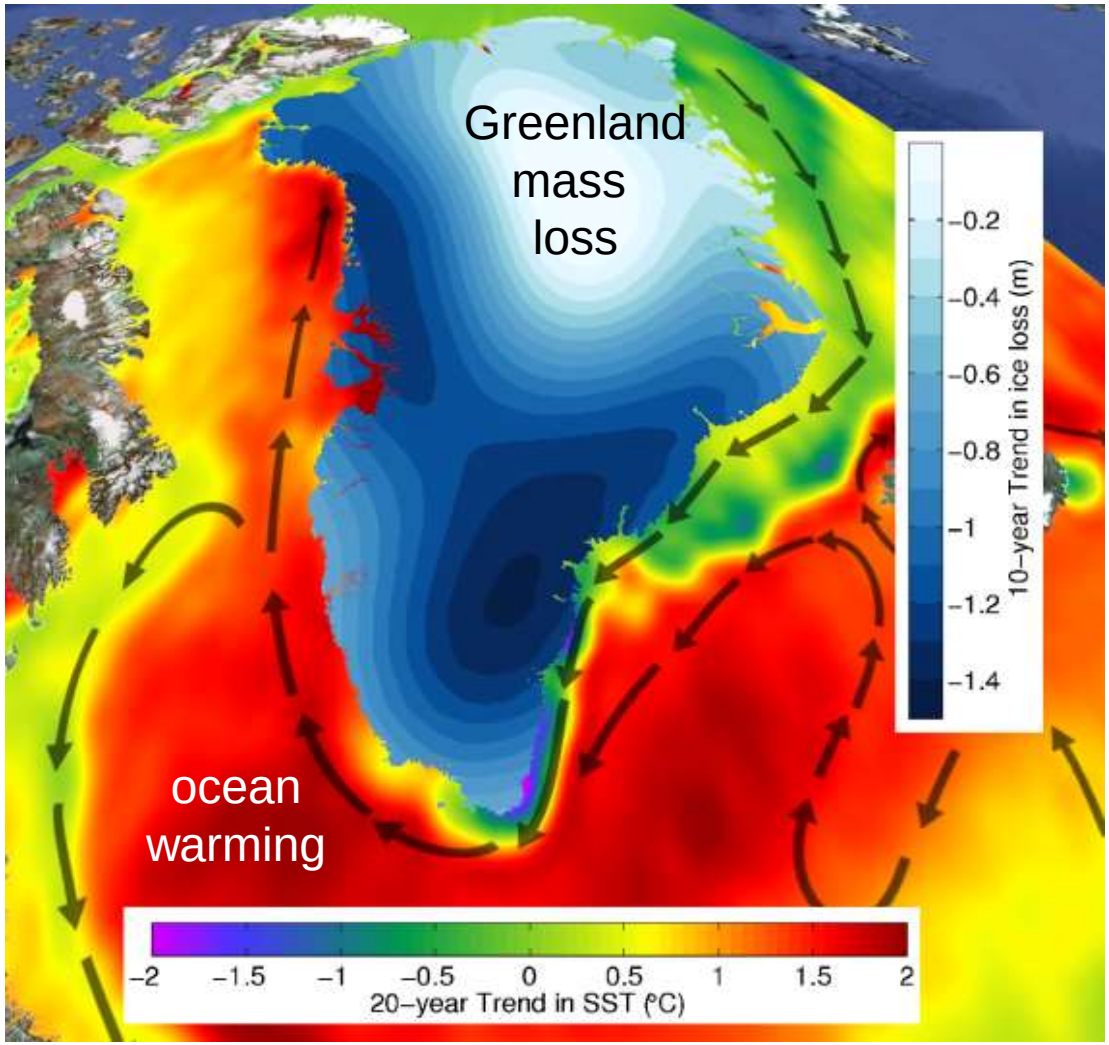
OMG: Oceans Melting Greenland

How much are the Oceans Melting the Greenland Ice Sheet?



Sub-surface warm water melts glaciers that reach the oceans

Ocean Obs: Track spread of warm water

Can we relate these?

Ice Obs: Quantify glacier loss

OMG: Oceans Melting Greenland

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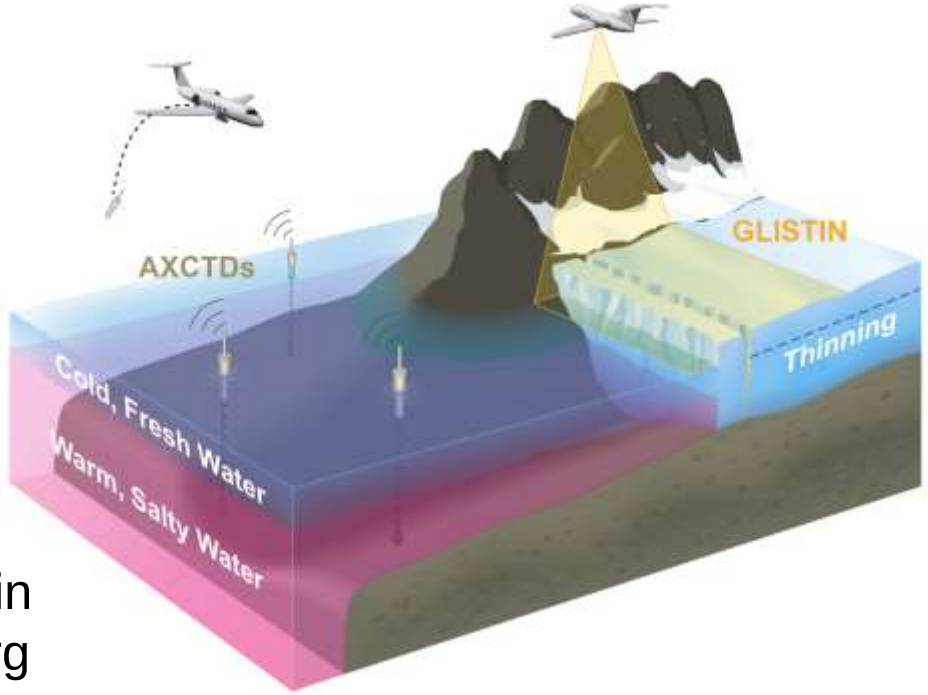
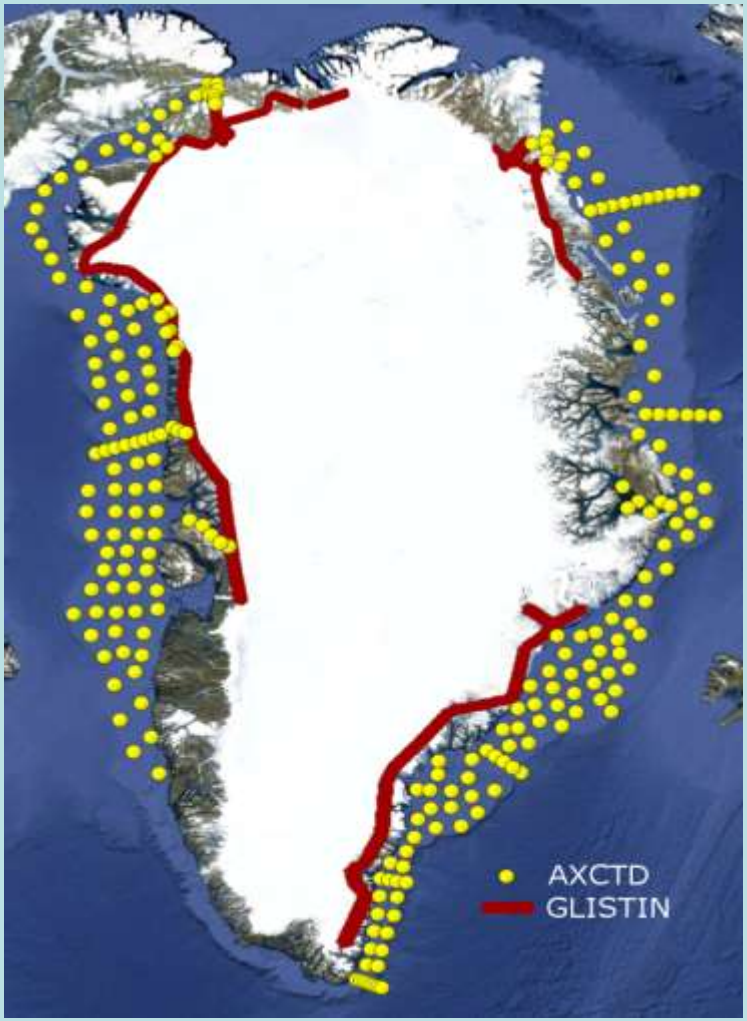


$30 M over 5 years will fund 4 observational campaigns:

Ocean	Ice	Bathy	Bathy
• 5 years • ~250 AXCTDs/yr	• 4 years • GLISTIN radar: 10 km swath at terminus of 90% of all MTG	• One time • Ship survey with multibeam sonar for key, unmapped fjords	• One time • Airborne gravity survey of shelf

OMG Observations

Ocean & Ice



Once per year surveys

Sea Floor

One time surveys

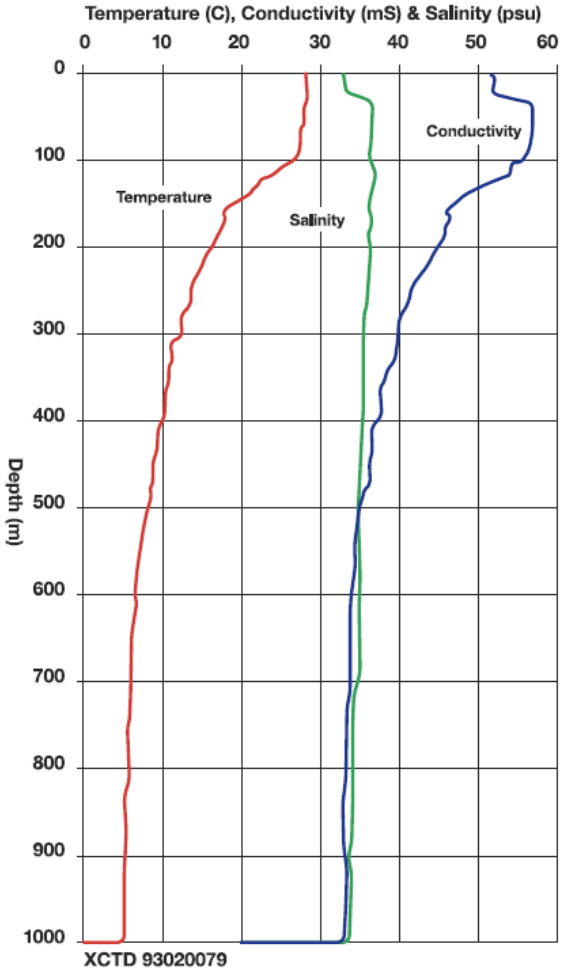
AXCTD probes

Aircraft eXpendable Conductivity Temperature Depth Probe (AXCTD)

- *Air-launched expendable probes*
- *Off-the shelf (decades-long heritage)*
- *1000 m depth range*
- *FM radio transmission of data to aircraft*
- *Approx. 5 kb per profile*
- *Cost: ~$2k per probe.*

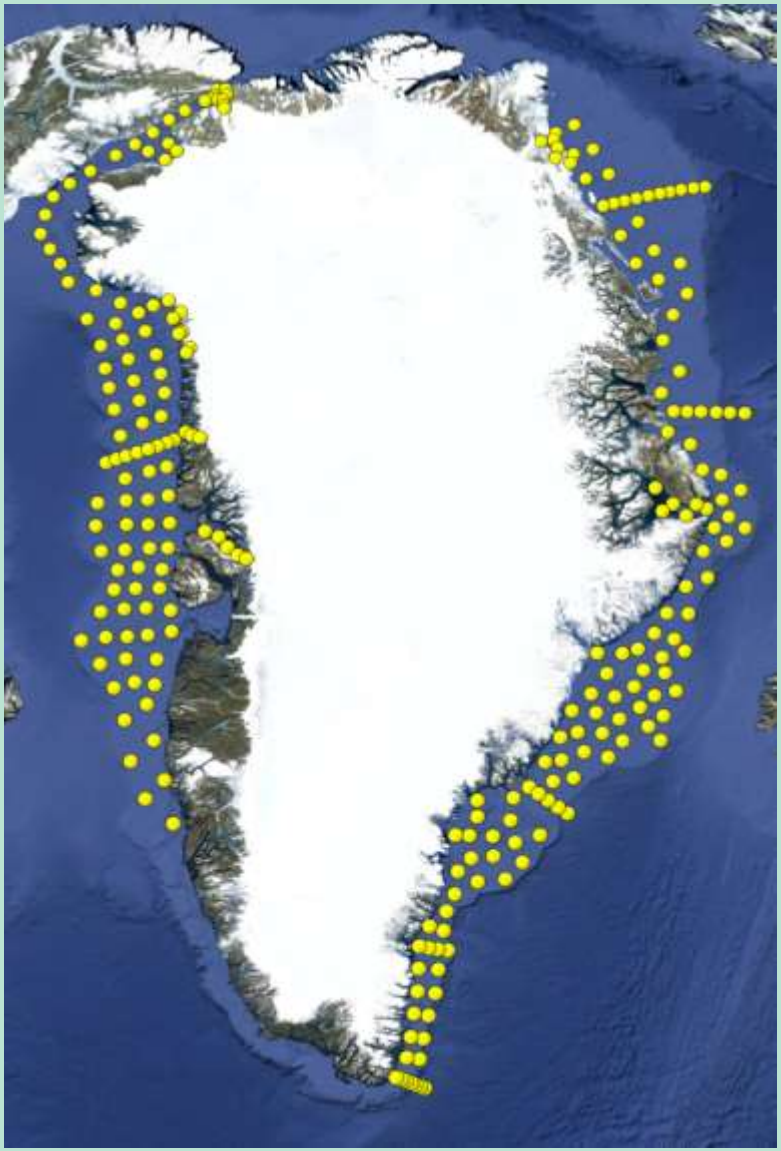
PROBE SPECIFICATIONS

PROBE	PARAMETER	DEPTH	ACCURACY	ACQUISITION SYSTEM
AXCTD	conductivity, temperature	1000 m	-0.035 mS/cm,-0.035°C	MK 12



An AXCTD profile

Science Implementation – Ocean Temp.



Ocean – AXCTD Survey

Scientific need

- Yearly T, S profiles with 50km spacing on shelf with 5m vert. res., 0.1°C, 0.05 psu accuracy

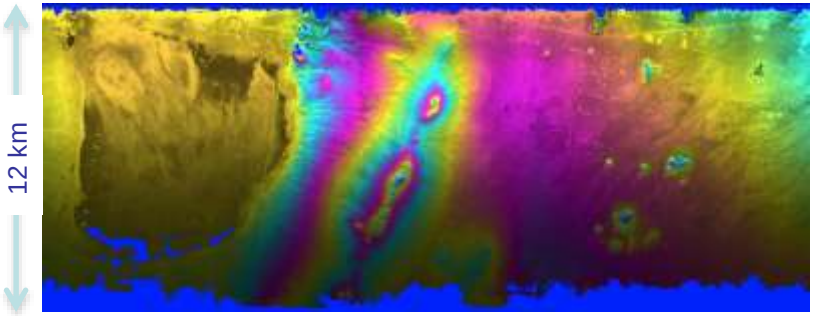
Implementation

- Once per year AXCTD survey in summer near min. sea ice extent
- S3-Viking (*details TBD*)
- *Proposed: P-3, Alt 10,000 ft., 500 km/hr*
- 4 flights (airports: Thule, Nuuk, Kulusuk, Constable)

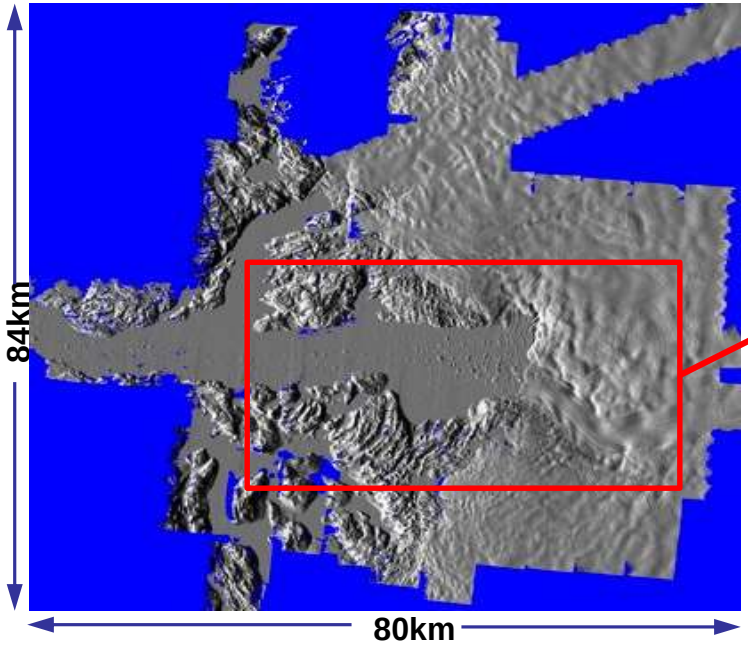
GLISTIN-A
GLacier and Ice Surface Topography Interferometer – Airborne

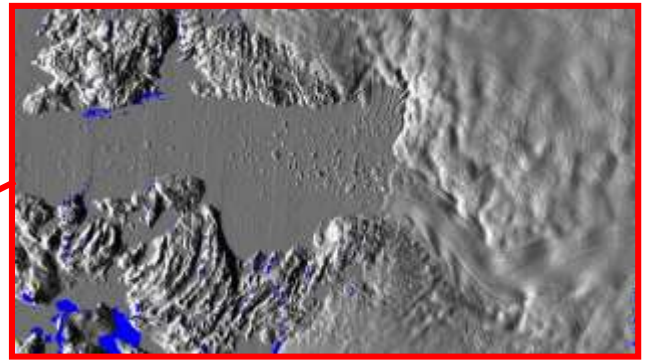
Ka-band antennas on the NASA GIII for single-pass interferometry

- Glacier and Ice Surface Topography Interferometer (GLISTIN) will provide all-weather, high-resolution swath ice surface topography, not available through existing lidar (i.e. ICESAT-2) or radar (CryoSAT) sensors
- GLISTIN-A (airborne) engineering upgrades completed 2012
- **Fully operational and campaign/science ready on GIII with no instrument development required (see data at right)**



Results from GLISTIN-A engineering flight (ping-pong acquisition mode) for Rosamond area collected 8/6/12. The color represents height and one color cycle corresponds to 100m). Results posted at 10m.





Example GLISTIN-A topography mosaic collected as a proof-of concept during NASA International Polar Year activities on 5/5 and 5/6 2009. The height precision is 10cm-1m for a 10m horizontal resolution and 6km swath-width. The upgraded GLISTIN-A system has similar precision with swath in excess of 10km. **Recent campaign to Alaska (4/13) validated performance over ice in an OMG-like scenario (processing in progress).**

Science Implementation – Ice Loss

Ice – GLISTIN Survey

Scientific need

- Yearly elevation within 10km of terminus, for marine term. glaciers with 5-10m vert., 100 m, horiz. res.

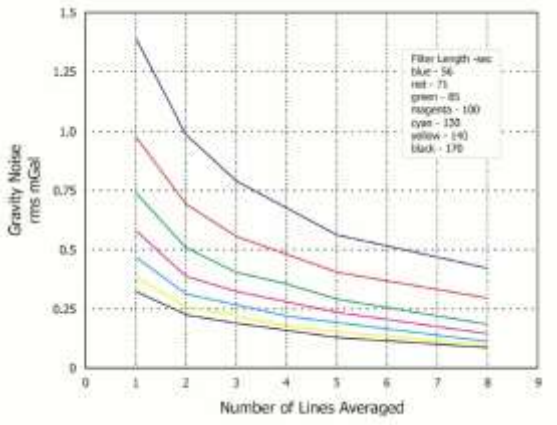
Implementation

- Once per year GLISTIN survey Gulfstream-III, Alt 10,000 ft., 795 km/hr
- 6 flights double coverage (airports: Thule, Kangerlussuaq)

AirGrav – Airborne Gravity

Contractor – SGL

- Provides instrument and data processing
- Will lease, equip and operate aircraft as part of contract



Instrument accuracy vs line density

Science Implementation – AIRGrav

Bathymetry – AIRGrav

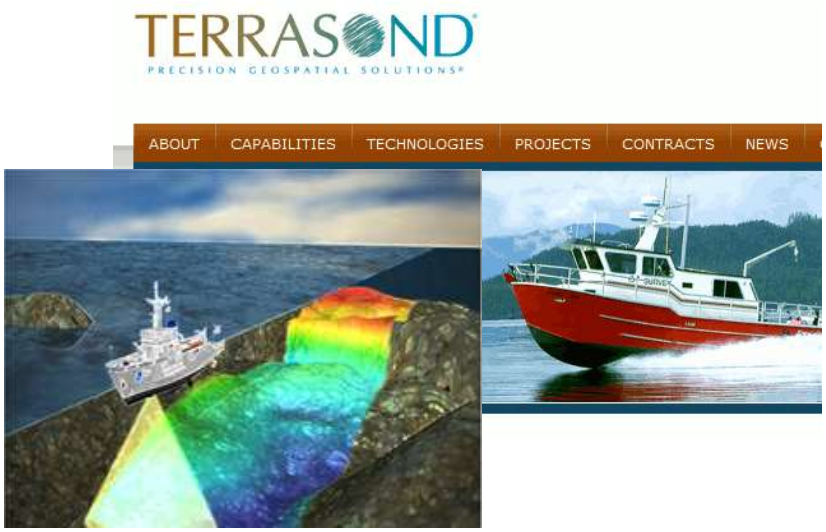
Scientific need

- Bathymetry survey in key regions on shelf with 0.5mGal (100 m vert.) res. 1km horiz. res.

Implementation

- Once time AIRGrav survey
- Contract to SGL (TBD)
- Twin Otter, Alt 1,000 ft., 260 km/hr
- 39 flights (airports: Ilulissat, Kangerlussuaq, Nuuk, Thule, Upernavik, Uummannaq, Ittoqqortoorr (snow), Kulousuk, Narsarsuaq, Nerelerit)

Ship Board Bathymetry



Contractor – Ship Survey

- Terrasond will lease, equip and operate ship
- Data processing services included
- Swath width depends on depth ~few hundred meters
- Vertical accuracy & resolution of a few meters

Science Implementation – Ship Bathymetry

Bathymetry – Ship-based

Scientific need

- Bathymetry in key fjords for geometry & sill depth – 10 m vert., 10 m horiz res., 300 m beam swath

Implementation

- Once time ship-based multibeam sonar survey
- Contract to Terrasond