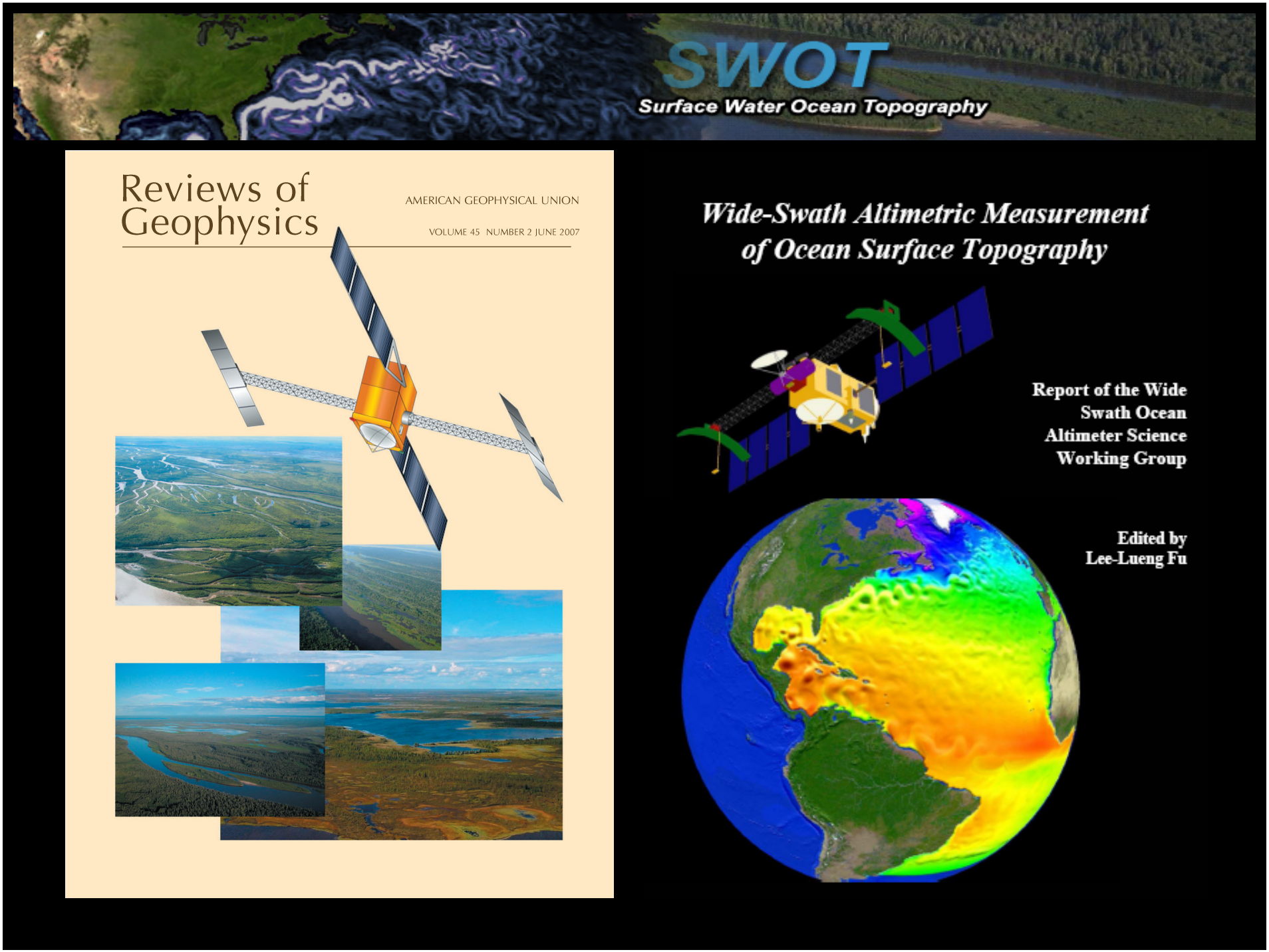
SWOT and the NASA Airborne Science Program

Ernesto Rodríguez

January 13, 2011



oceanography.

SWOT
Surface Water Ocean Topography

1. The Problem

In-situ cannot measure this

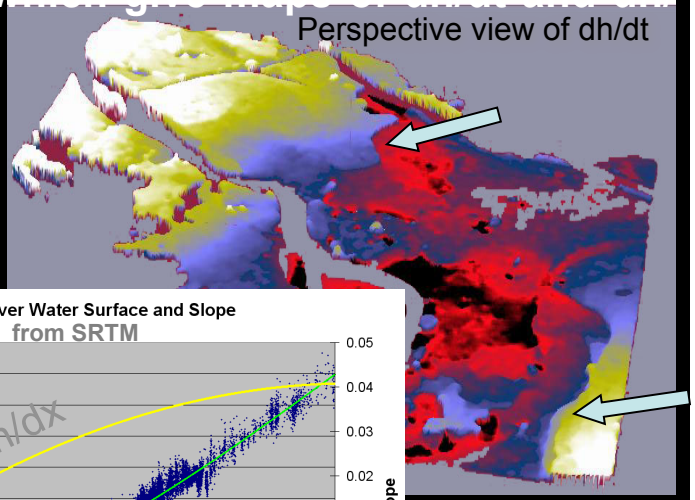
Ohio R.

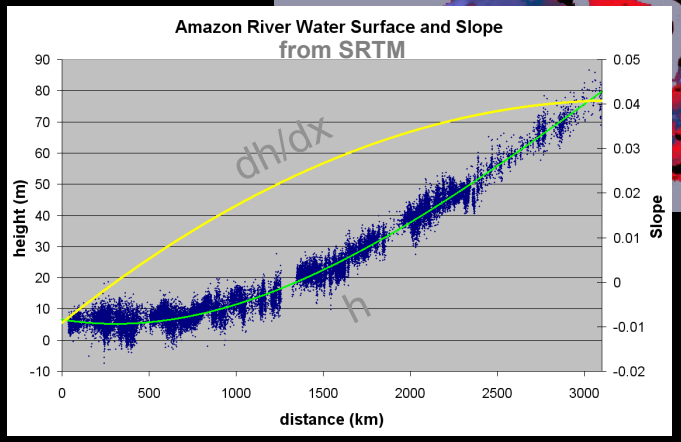
2. The Question

What is the spatial and temporal variability of freshwater stored in the world's terrestrial water bodies?

3. Measurements Required

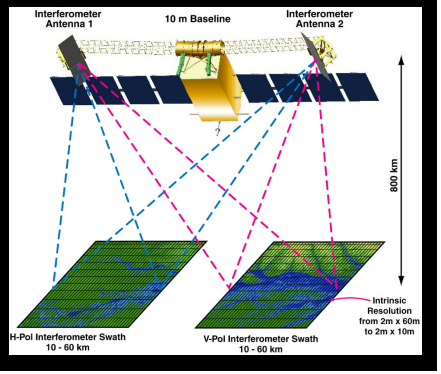
maps of h, which give maps of dh/dt and dh/dx





4. The Solution

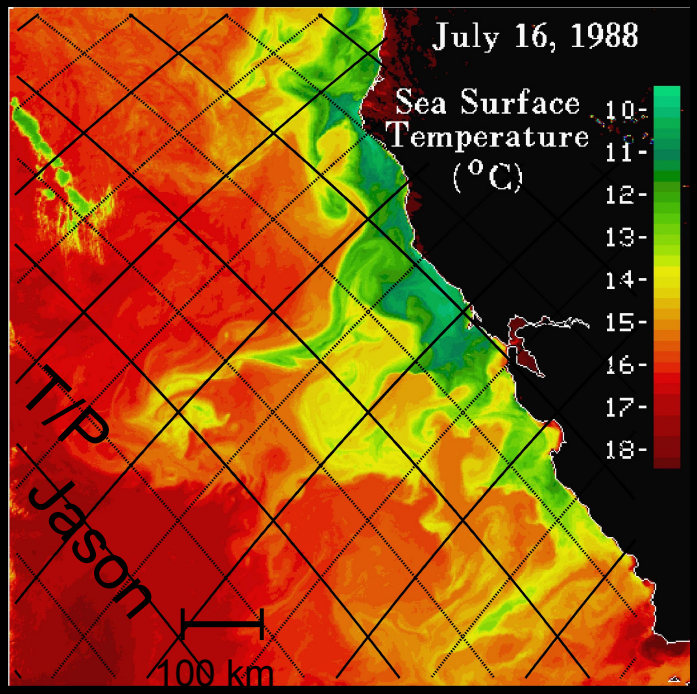
KaRIN: Ka-band Radar Interferometer. SRTM, WSOA heritage. Maps of h globally and ~weekly.



SWOT

Surface Water Ocean Topography

1. The Problem Altimeters miss considerable ocean area.

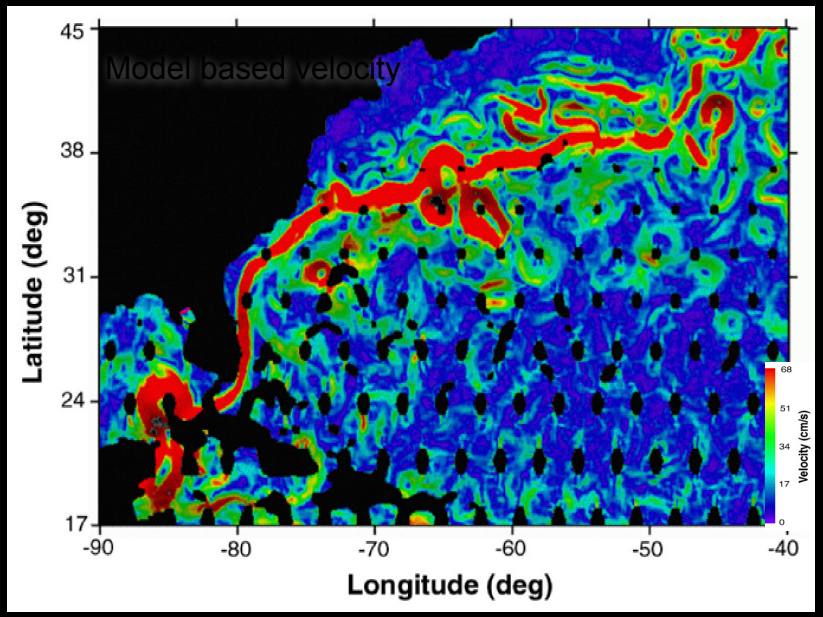


2. The Question

What are the energy dissipation, ocean circulation, and climate implications from oceanic eddies which contain 90% of the kinetic energy, but are ~10 km scale in cross-stream direction, e.g. Gulf Stream, Kuroshio.

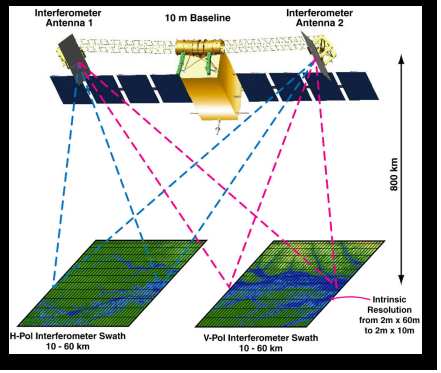
3. Measurements Required

Maps of h, which give maps of dh/dt and dh/dx allowing derivation of velocity, vorticity, and stress tensor.



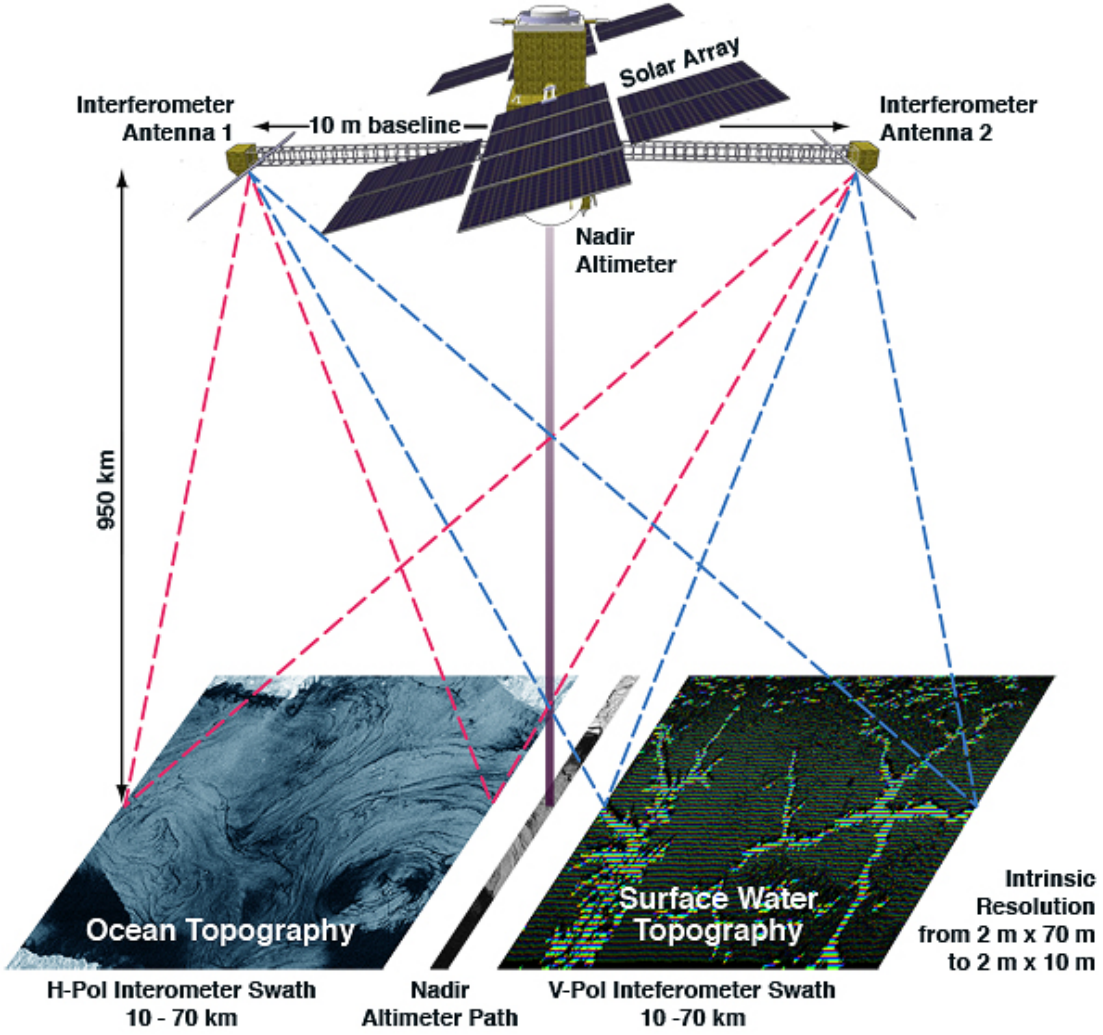
4. The Solution

KaRIN: Ka-band Radar Interferometer. SRTM, WSOA heritage. Maps of h globally and ~weekly.



SWOT

SWOT Key Instrument Capabilities

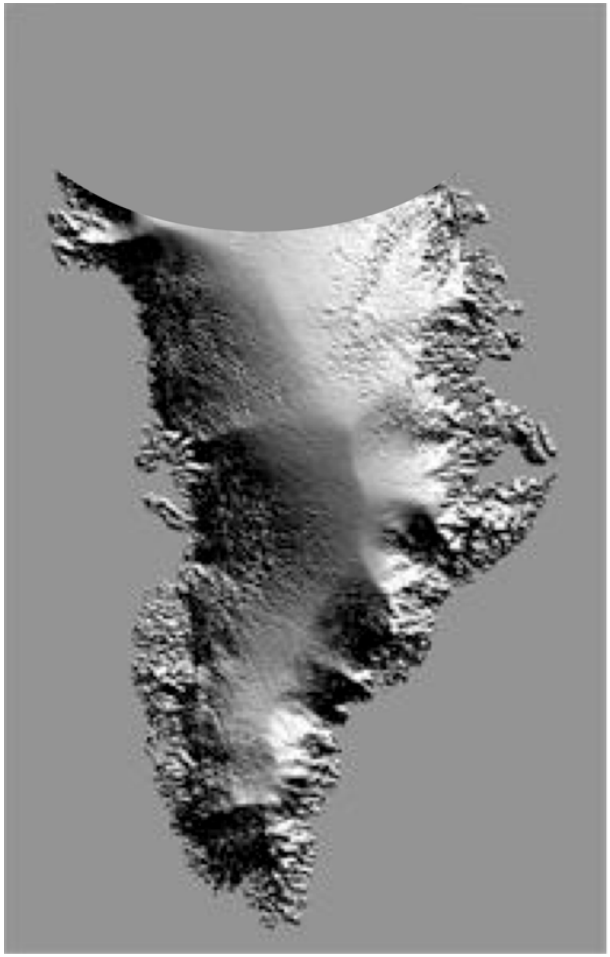


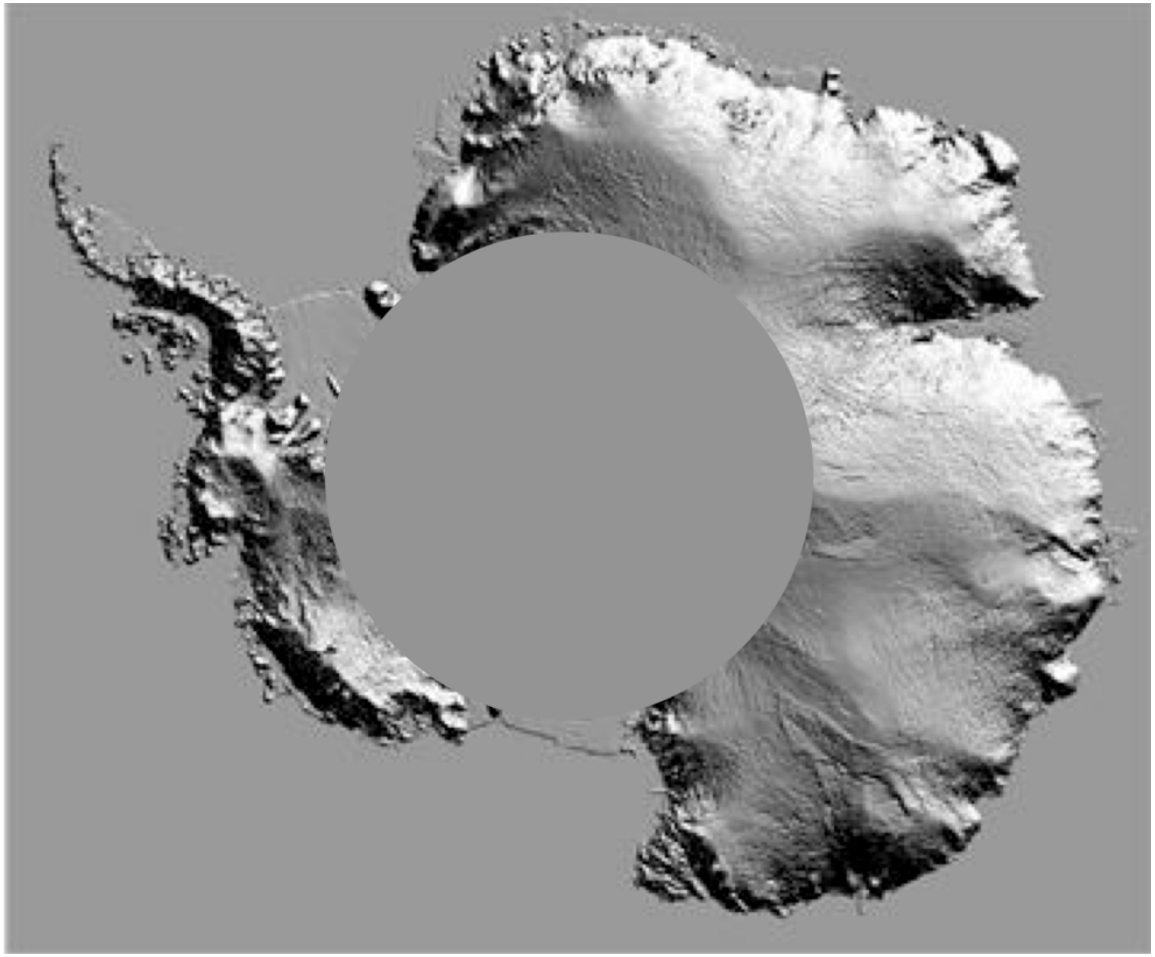
- Ka-band SAR interferometric system with 2 swaths, 60 km each
- Intrinsic spatial resolution: 5m along-track, 10m-70m across-track
- Additional instruments:
  - conventional Ku/C Jason-class altimeter for nadir coverage
  - Nadir Ka-band SAR altimeter
  - AMR-class radiometer (with possible high frequency band augmentation) to correct for wet-tropospheric delay (does not work over ice)
  - Instrument precision: ~1cm at 1km averages. Precision scales with area.
  - Accuracy lover ice imited by wet tropospheric delay, roll knowledge, and propagation of ocean calibration into ice.

SWOT Synergistic Science

- In addition to the hydrology and oceanography primary areas of interest, SWOT, additional synergistic science has been identified:
  - Sea ice thickness and extent using freeboard and imaging (US lead: R. Kwok)
  - Ice sheet topography for smoother areas (there may be layover problems in outlet glaciers) (US lead: W. Abdalati)
  - Ocean bathymetry and gravity

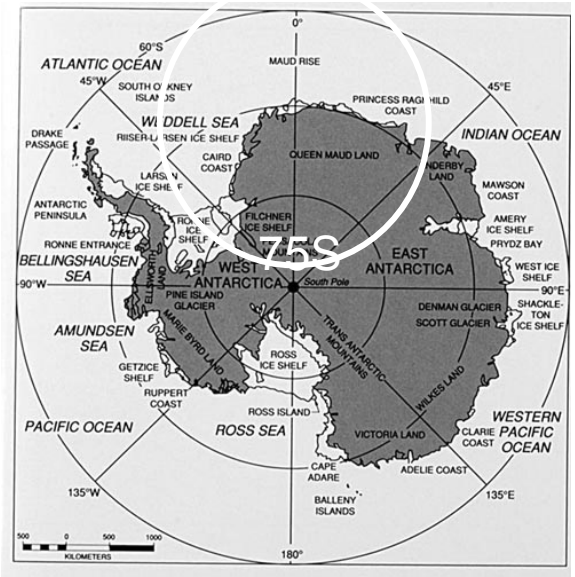
SWOT and Ice Sheets

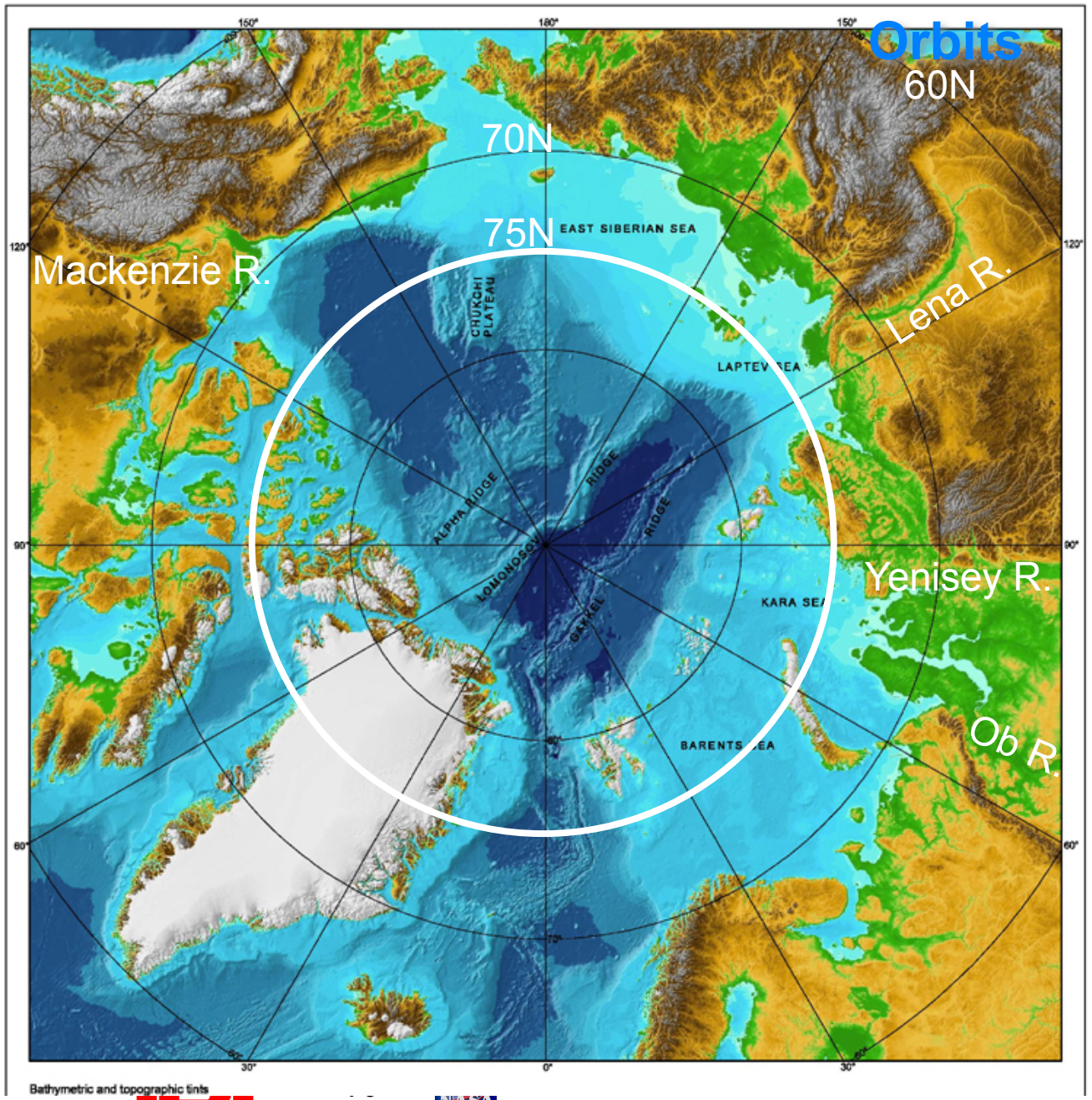




SWOT

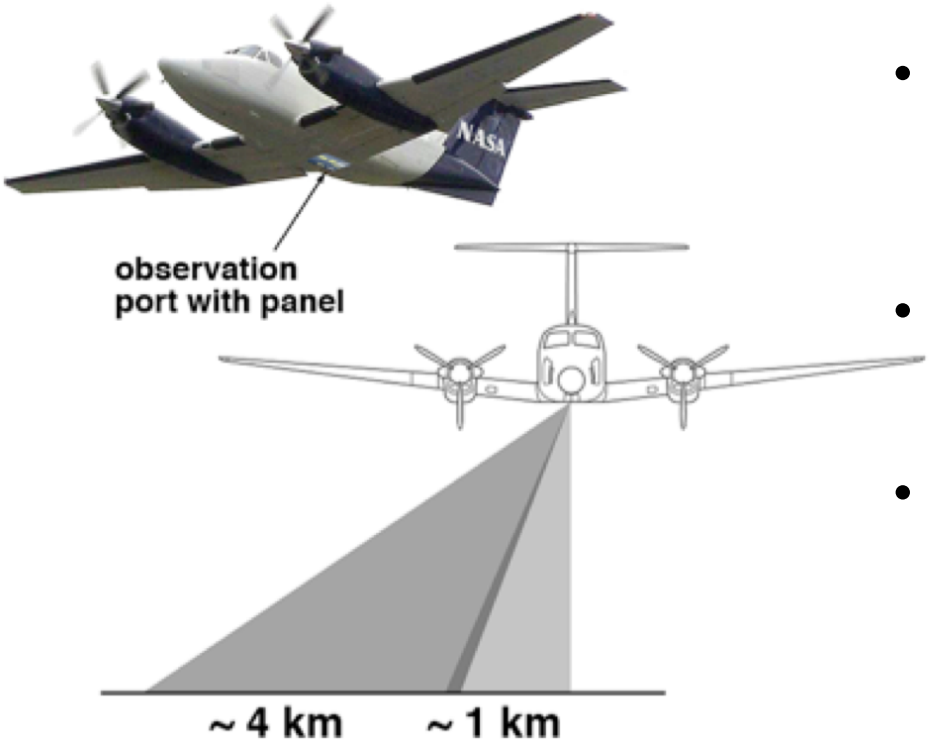
- Orbit inclination: 78deg





- SWOT is part of the NASA mission plan, scheduled for a launch in 2019
- SWOT is a collaborative mission between NASA and CNES
- CNES/France have already allocated substantial financial resources to SWOT
- A mission concept review is planned for early spring 2012
- Currently in pre-phase A/phase A

AirSWOT



- AirSWOT is a funded airborne simulator for the SWOT mission
- AirSWOT is able to achieve SWOT like performance over a 5km swath using a 2-swath Ka-band radar interferometer
- AirSWOT is currently being built and will be demonstrated in 2012
- There is currently a proposal that has been submitted to NASA for the deployment of AirSWOT to Greenland in 2012 (proposal status: unknown)

AirSWOT Greenland Proposal

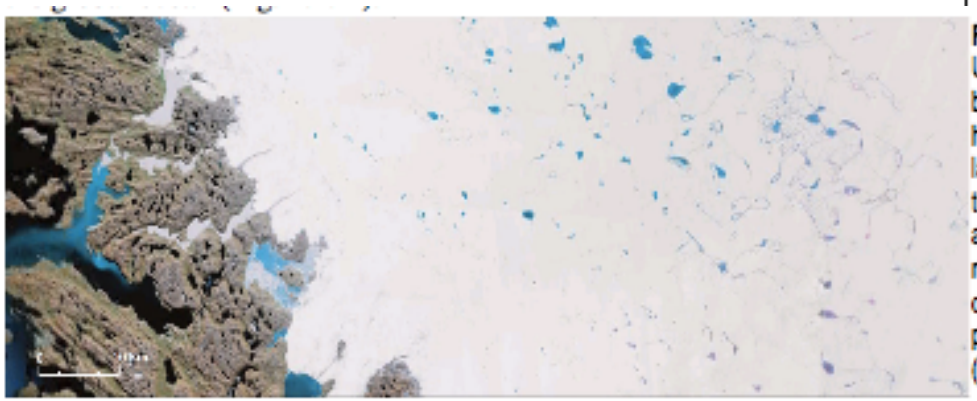


Figure 1.1.-1: Understanding linkages between the supraglacial hydrology of meltwater lakes and channels on the ice sheet surface, and terrestrial lakes, rivers and coastal waters downstream is this proposal's scientific goal (image: GoogleEarth™)

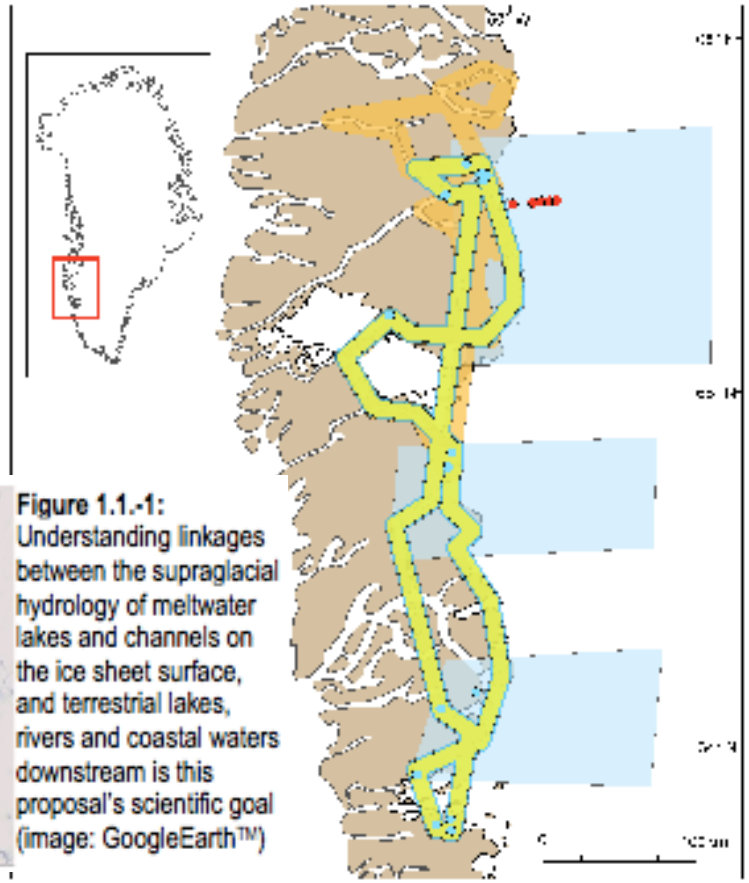


Figure 1.2.2-1: Proposed Ikhana and SIERRA UAS coverage of the ice sheet, proglacial zone, and major rivers; and in situ data sites