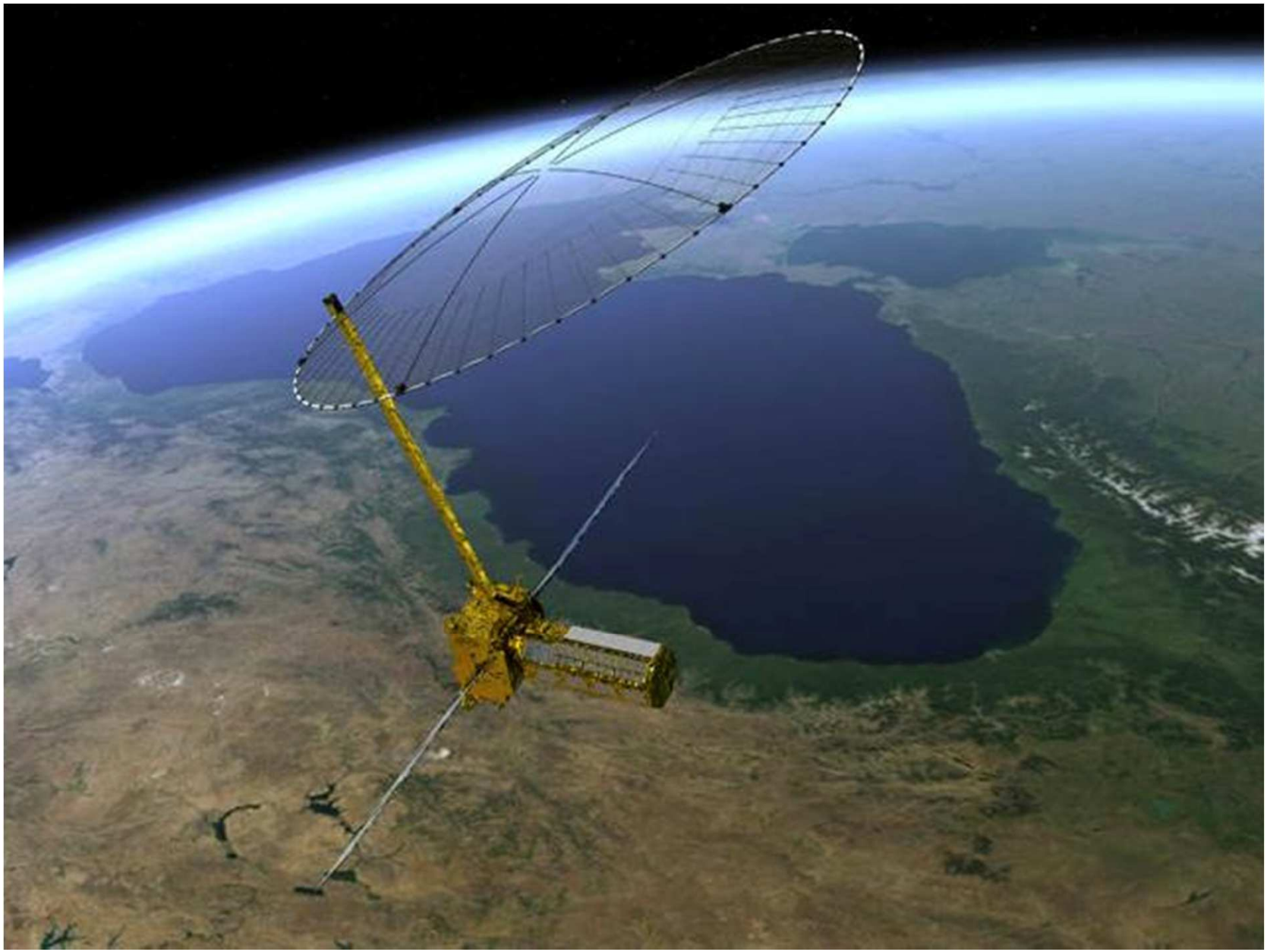
NISAR: NASA-ISRO Synthetic Aperture Radar



Tamlin Pavelsky, June 2, 2017

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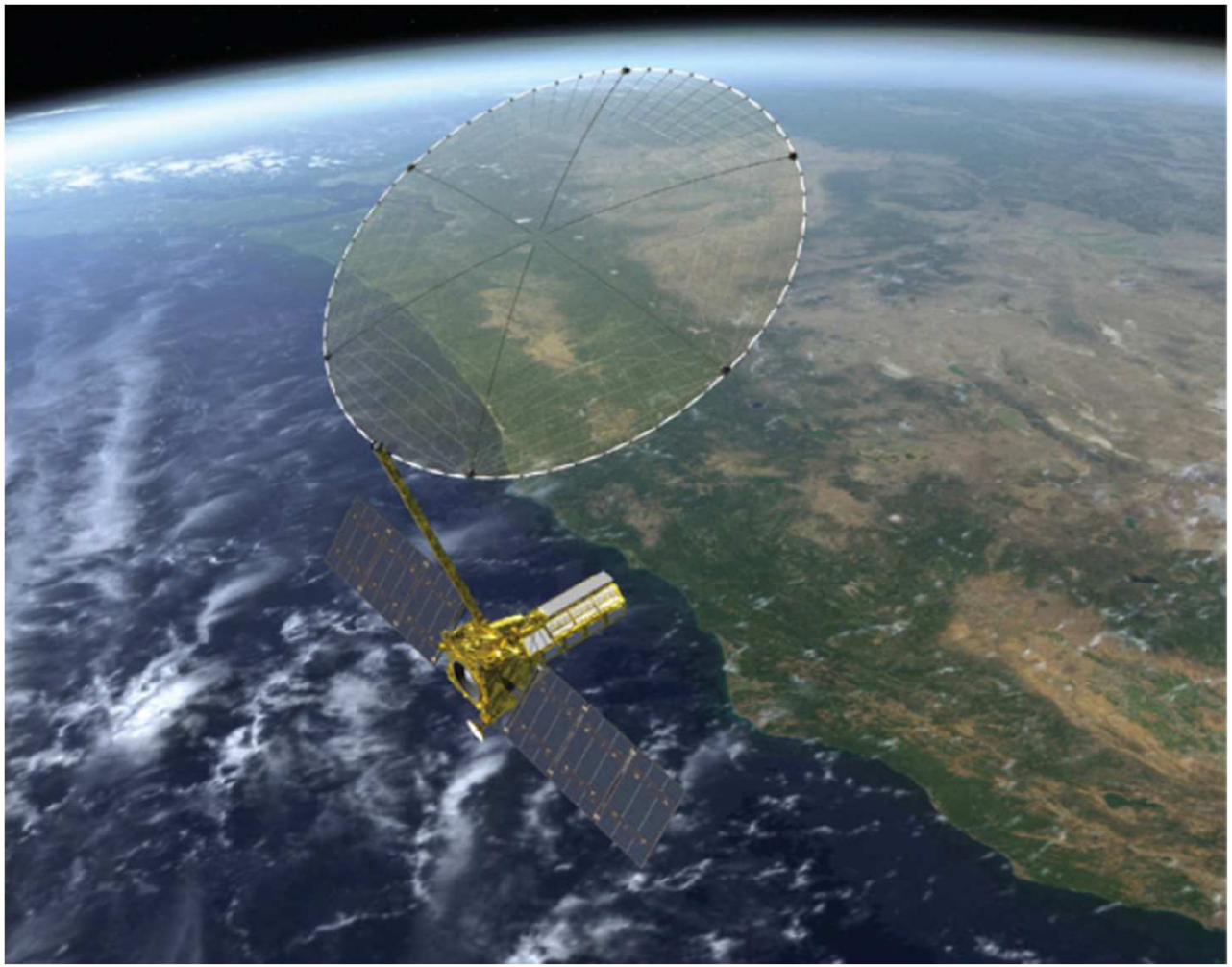


Goals: measure variations in topography, fault motion, vegetation characteristics, and wetland extent globally.

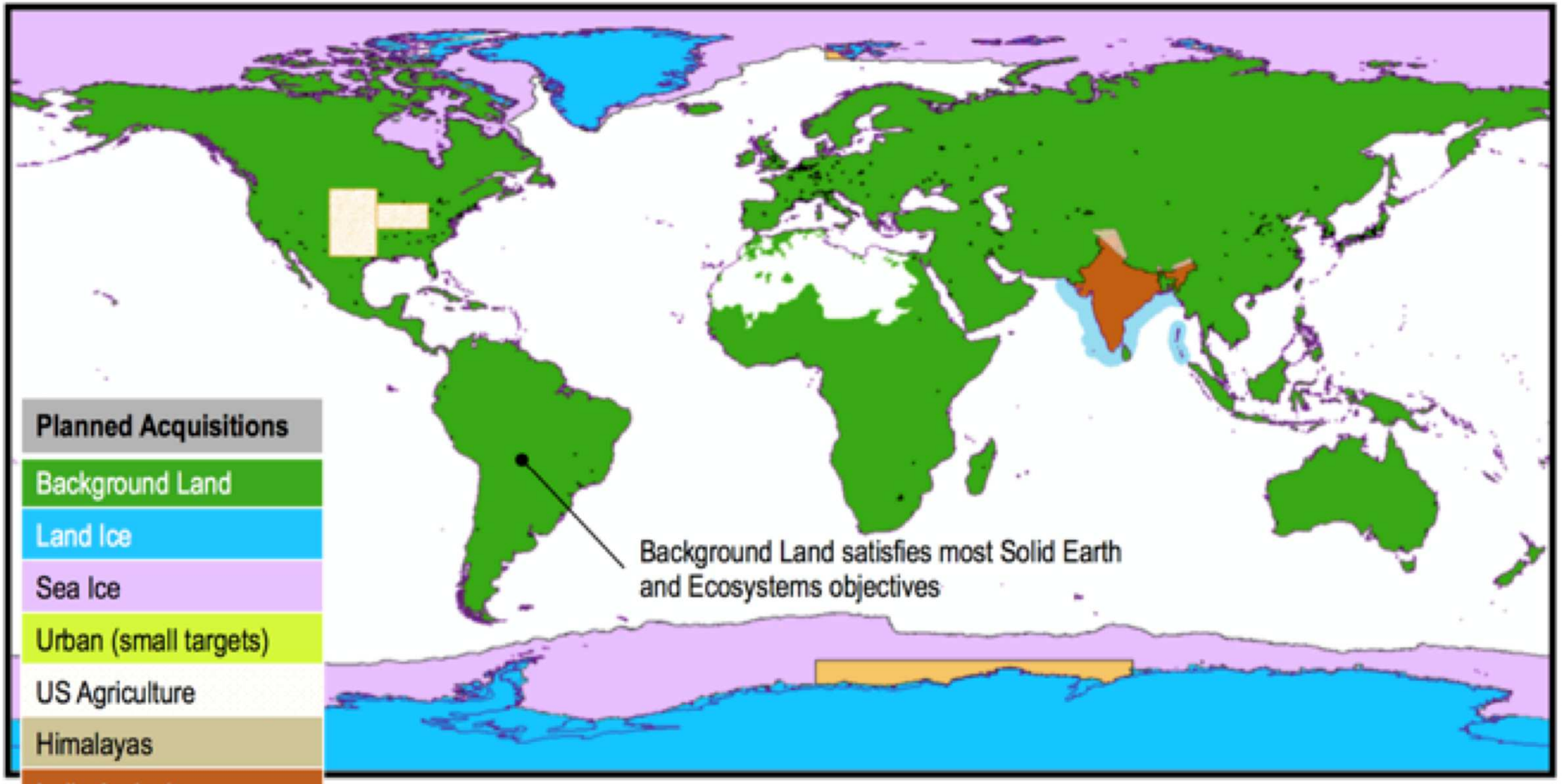
Launch Date: 2020

Instruments: L-band radar (24 cm) by NASA, S-band radar (12 cm) by ISRO.

Native resolution (L band): ~6 m x 8 m to 12 m x 8 m

12 day repeat orbit

Multiple SAR Modes for Multiple Different Targets



- Each colored region represents a single radar mode chosen to satisfy multiple science objectives over that area
- Avoids mode contention that would interrupt time series

Primary NISAR Science Goals

NISAR will:

- determine the contribution of Earth's biomass to the global carbon budget and characterize ecosystem disturbance and impacts on biodiversity.
- measure surface deformation to determine the likelihood of earthquakes, volcanic eruptions, and landslides, and monitor groundwater, hydrocarbon, and sequestered CO2 reservoirs.
- determine how climate and ice masses interrelate and raise sea level and will measure changes in sea ice, snow extent, permafrost, and surface melting.
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Measuring the Cryosphere with NISAR

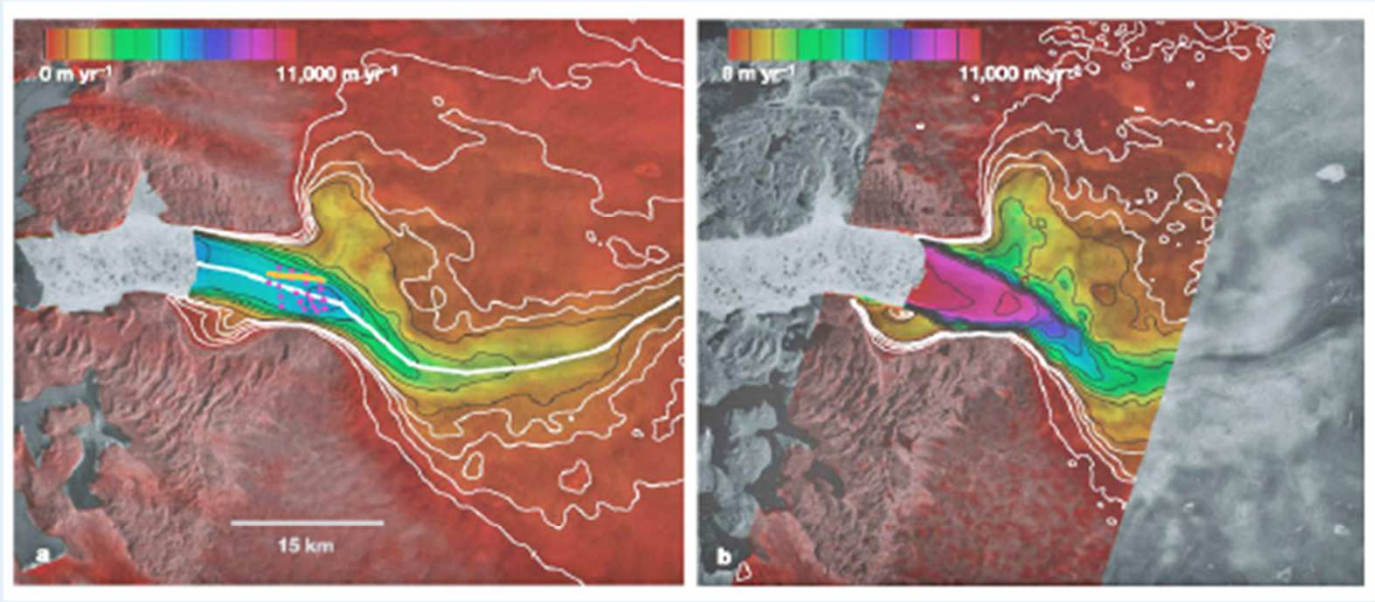
NISAR can be used to measure active layer thickness in permafrost, sea ice, glacier velocities, and melt onset (among other variables).

All of these variables (with the possible exception of sea ice) are potentially related to lake water storage, nutrient dynamics, or other physical chacteristics.

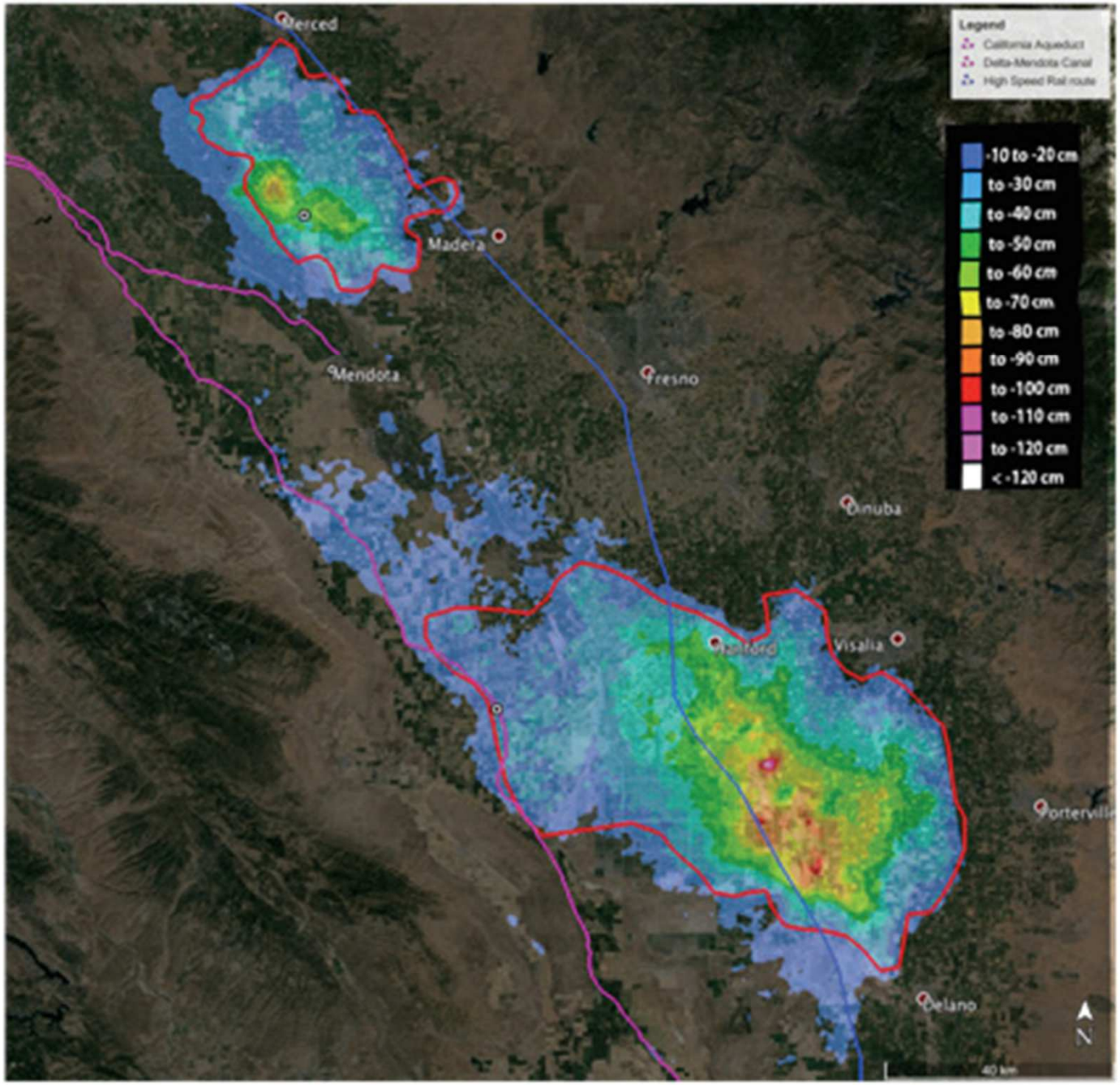
Mapping Ice Sheet Flow

Radar measurements from the Canadian RADARSAT mission show the rapid speed up of Jakobshavn Isbræ in Greenland between February 1992 and October 2000. Over the last decade, glaciers in Greenland have sped up on average by more than 30 percent. NISAR would allow monitoring of ice sheets in Antarctica and Greenland as well as glaciers throughout the world.

The images are from Ian Joughin, Waleed Abdalati, and Mark Fahnestock, "Large Fluctuations in Speed on Greenland's Jakobshavn Isbrae Glacier," Nature 432: pp. 608–610.

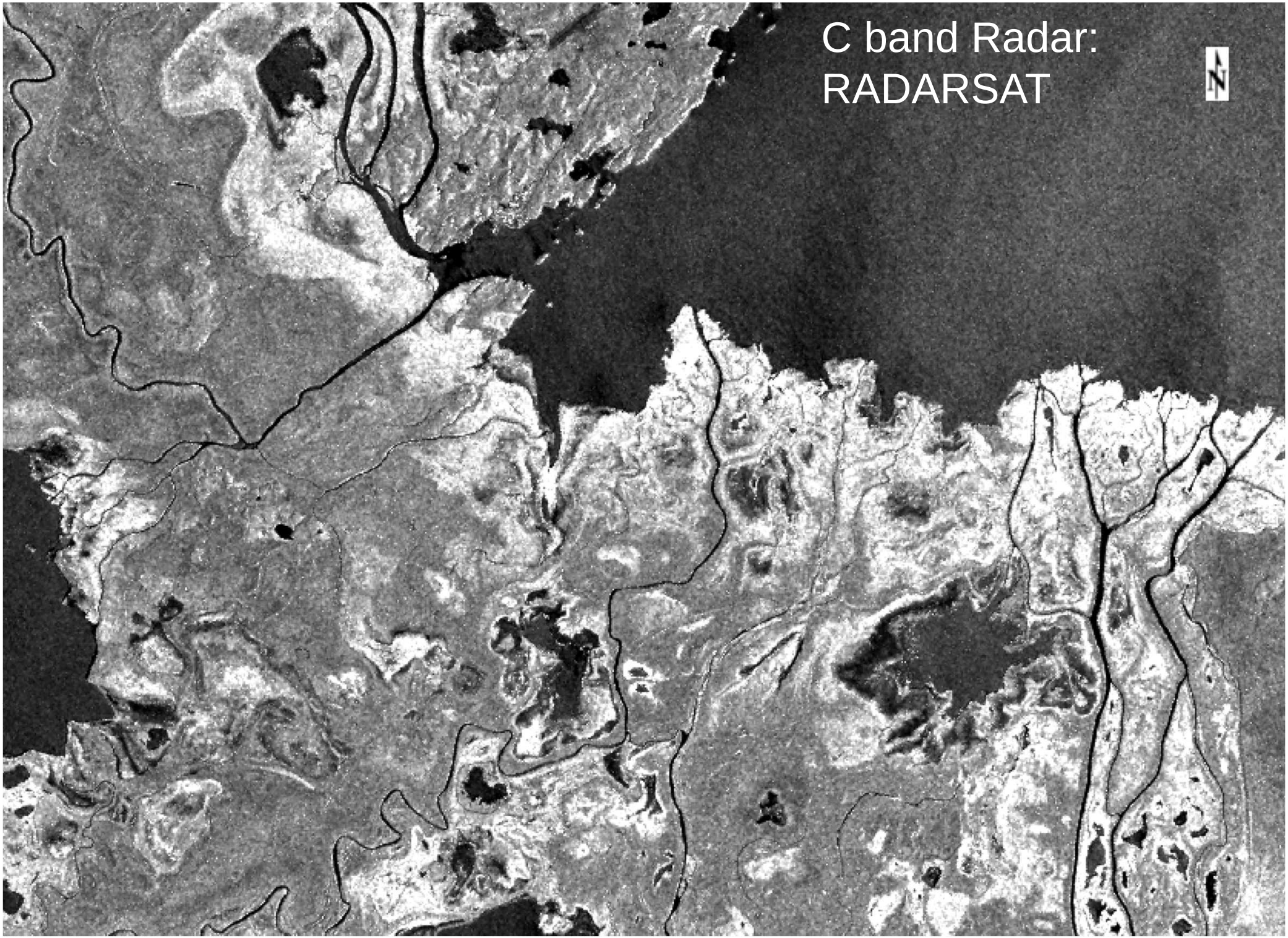


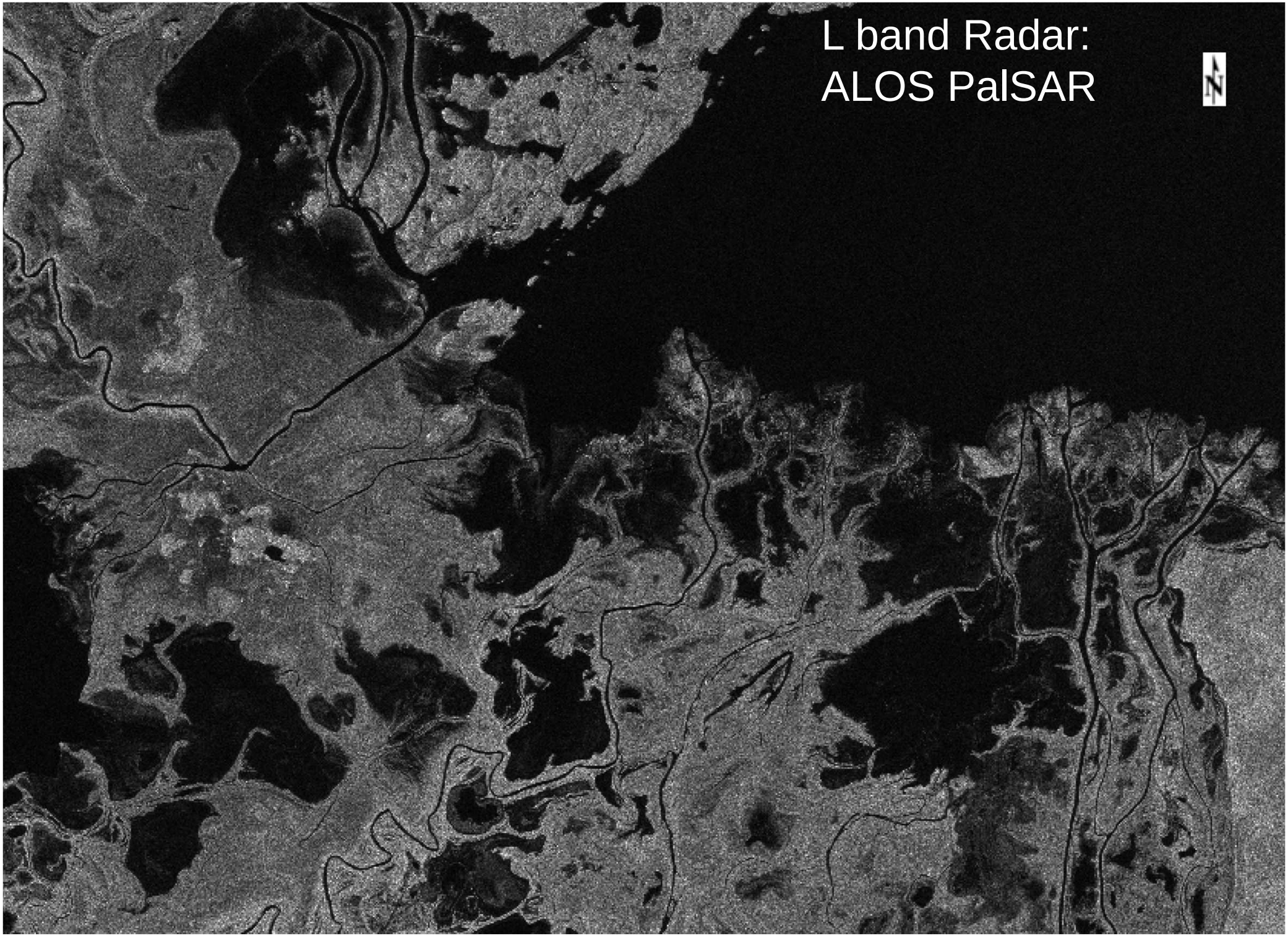
The economic impact of sea level rise on the US will exceed $20B.

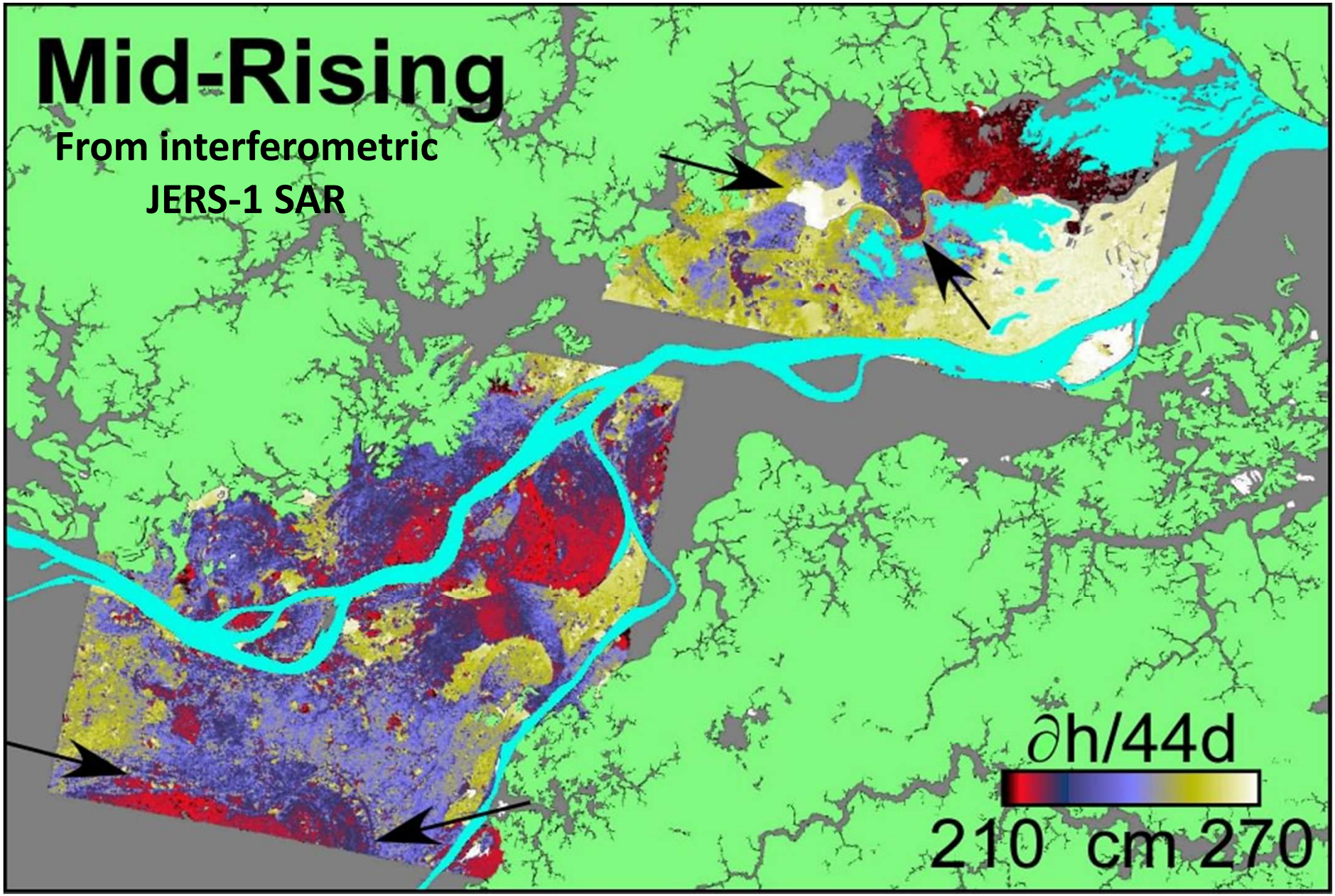


NISAR will contribute to measures of subsidence related to groundwater withdrawal, which can affect lakes through surface water-groundwater interactions.

Total subsidence in the San Joaquin Valley, California, from 2007 to 2011 measured by InSAR.


C band Radar:
RADARSAT


L band Radar:
ALOS PalSAR



In densely forested environments, L-band (and other wavelength) SARs can be used to measure water surface elevation using double bounce.

Alsdorf et al., *GRL*, 2007

Opportunities for Synergy: SWOT & NISAR

By combining water surface elevation measurements by SWOT over open water with NISAR measurements in vegetated areas, we can potentially seamlessly measure storage change across complex lake/river/wetland landscapes.