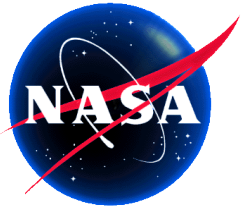
K&C Phase 4 – Status report

Near simultaneous observations of inundation by ALOS-2 and Sentinel

and utilization of the SRTM 30 m DEM to improve the radiometric terrain correction of ALOS-2 data and derived products

Bruce Chapman, Sean Buckley
JPL-Caltech

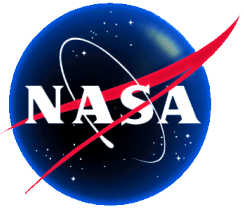


Science Team meeting #23
Hatoyama, Japan, January 18-20, 2017

Project outline and objectives

- Report on the release of each component of the 30 m SRTM DEM.
- A slope difference map between DEMs
- Analysis of 14 day repeat for characterizing inundation.

The radiometric terrain correction is useful for enabling the utilization of image mosaics and other image products, and therefore supports the underlying 4 K&C thematic drivers.



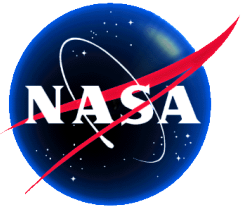
The 30 m SRTM DEM has been released and is freely available at the USGS earthexplorer website.

https://lta.cr.usgs.gov/SRTM1Arc

A NASA Measures product is working on the "NASADEM", an improved version of the SRTM DEM which will be based on a reprocessing of the SRTM data and better void filling.

This task is lead by Sean Buckley of JPL

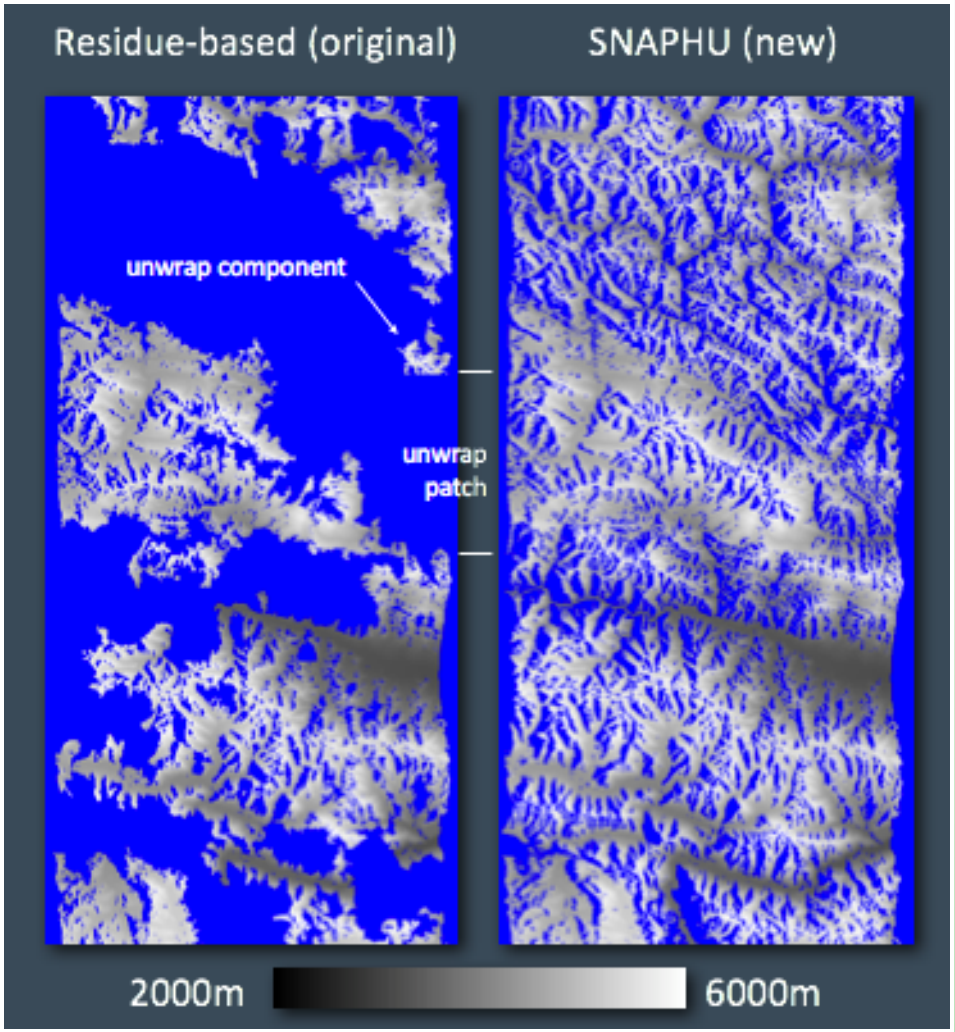
Buckley et al, "NASADEM initial production processing results: SRTM reprocessing with improvements", AGU, December, 2016



NASADEM

- **Improved phase unwrapping**
  - ➪ **Use SNAPHU algorithm when void coverage exceeds threshold**
  - ➪ **Refined low-res height database**
  - ➪ **multi-burst (MB) merge unwrapping strategy**

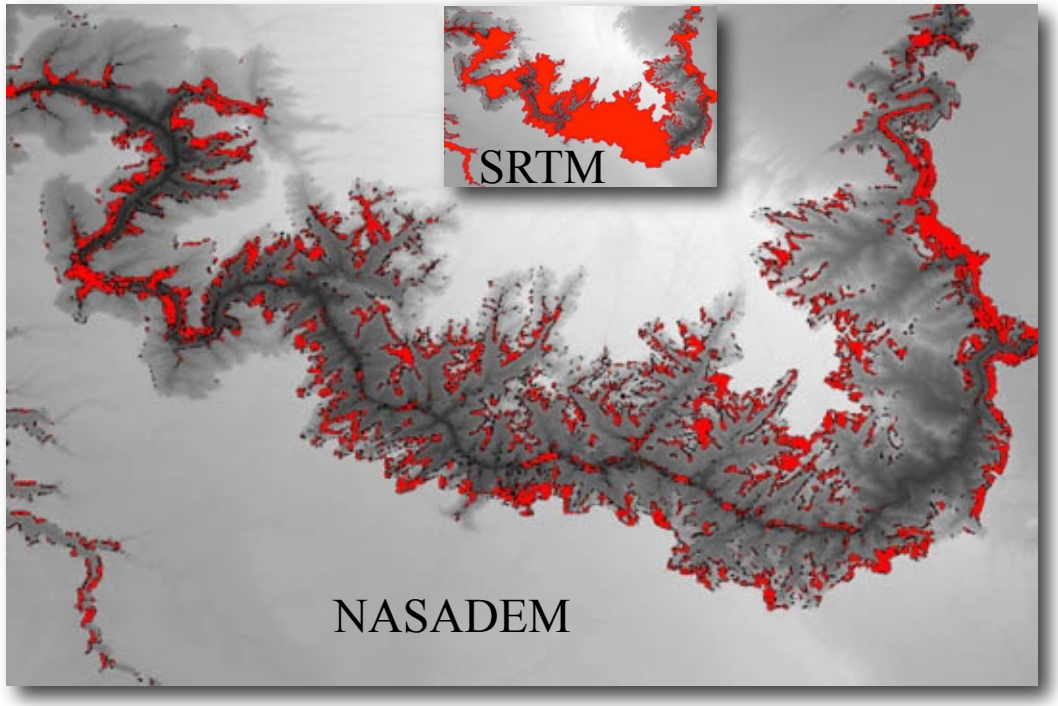
- ➢ **54% of strip data not unwrapped in SRTM is unwrapped in NASADEM**
- ➢ **97% of strip data is now unwrapped for NASADEM as compared with 94% for SRTM**



Void (blue) reduction in Himalayas strip DEMs for 80-km subswath

NASADEM

- **DEM Merging**
  - **Remaining SRTM cell voids filled with:**
    1. **Primary: PRISM DEM**
    2. **Secondary: ASTER Global DEM**
  - **Refined merging techniques developed for MEaSUREs 2006 project**
    1. **Use Delta Surface Fill to rubbersheet data across void for seamless merger**
    2. **More accurate than cut-&-paste patch**

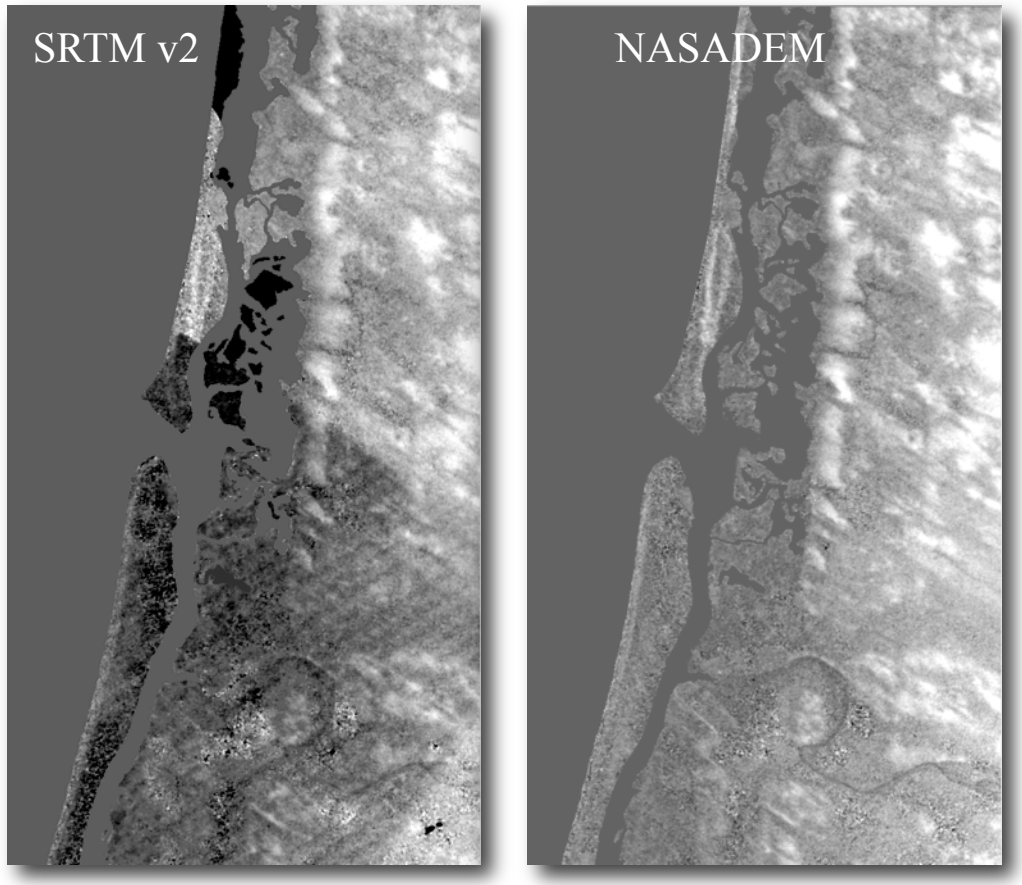


Void reduction in Grand Canyon. Heights in brightness & voids in red. Image width ~75 km.

NASADEM

- **Height Ripple Error Correction**
  - **Elevation artifacts in SRTM strip DEMs**
    1. Due to uncompensated mast motion most pronounced after Shuttle roll adjustment maneuvers
    2. Ripples of a few meters in size with along-track spatial scales of tens of kilometers
  - **Developed height ripple error correction**

	RMSE (M)	Bias (m)
Before HREC	6.1	0.8
After HREC	5.3	0.03



West coast of Baja California, Mexico (quad N25W113). Height is brightness. Lagoon area with ocean to the left.

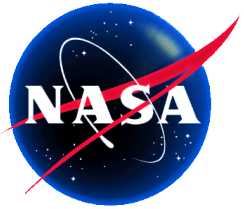
NASADEM

- **NASADEM products to be freely available:**
  - Void-filled merged DEM
    - Data source for each pixel
  - Topo Slope/Aspect
  - SRTM-only DEM
  - SRTM height precision estimate
  - Radar image/image time/incidence angles
  - Merged radar image
    - Data source for each pixel
  - Correlation
  - Icesat single-shot data
    - Used for control/assessment
  - Vegetation bias map

C-band radar image mosaic of overlapping SRTM swaths - Southern California

C-band (Sentinel 1 A/B) versus L-band (ALOS-2) observations for inundated areas

- ALOS-2 and Sentinel 1 both provide routine coverage over inundated regions.
- If they occur at the same time, we can examine their relative sensitivity to inundation at various flood stages for many different types of inundated wetlands.
- ALOS-2 is typically HH and HV, while Sentinel 1 is typically VV and VH.



ALOS

K&C Initiative

An international science collaboration led by JAXA

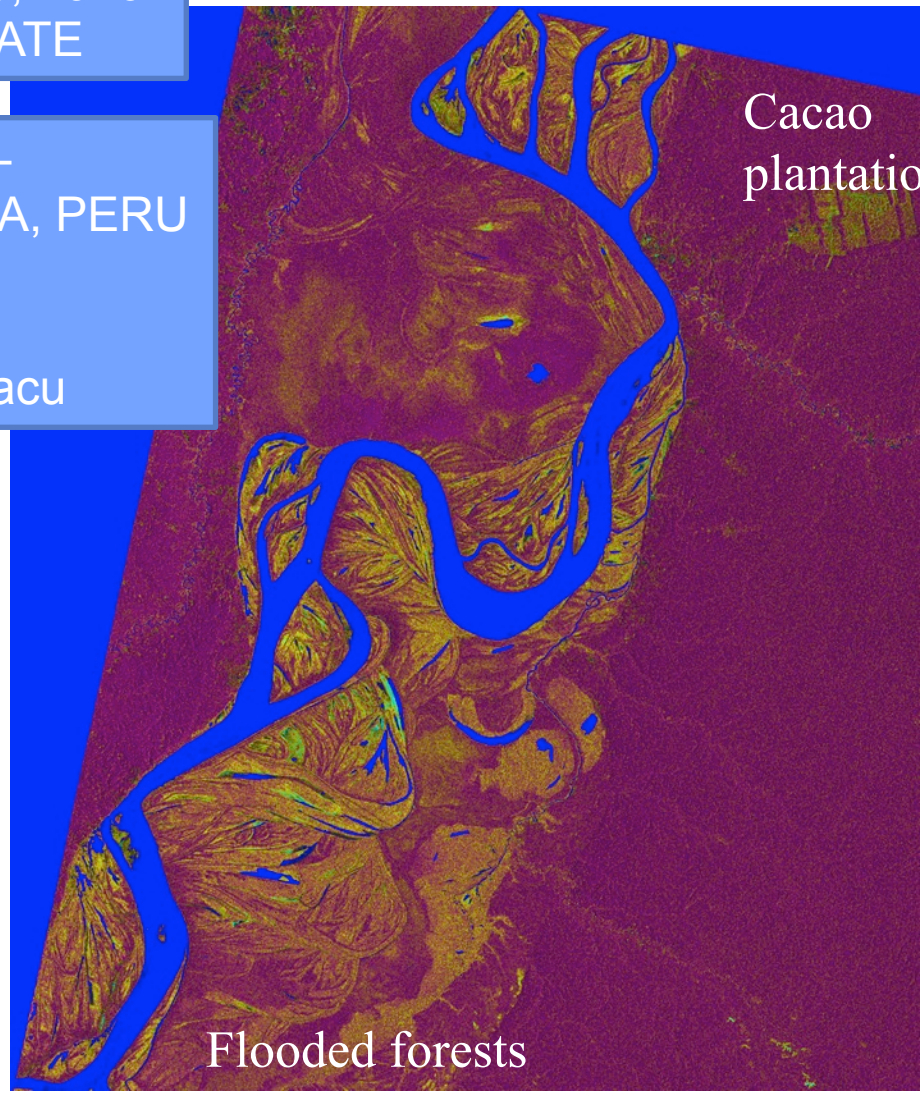
March 26, 2016
SAME DATE

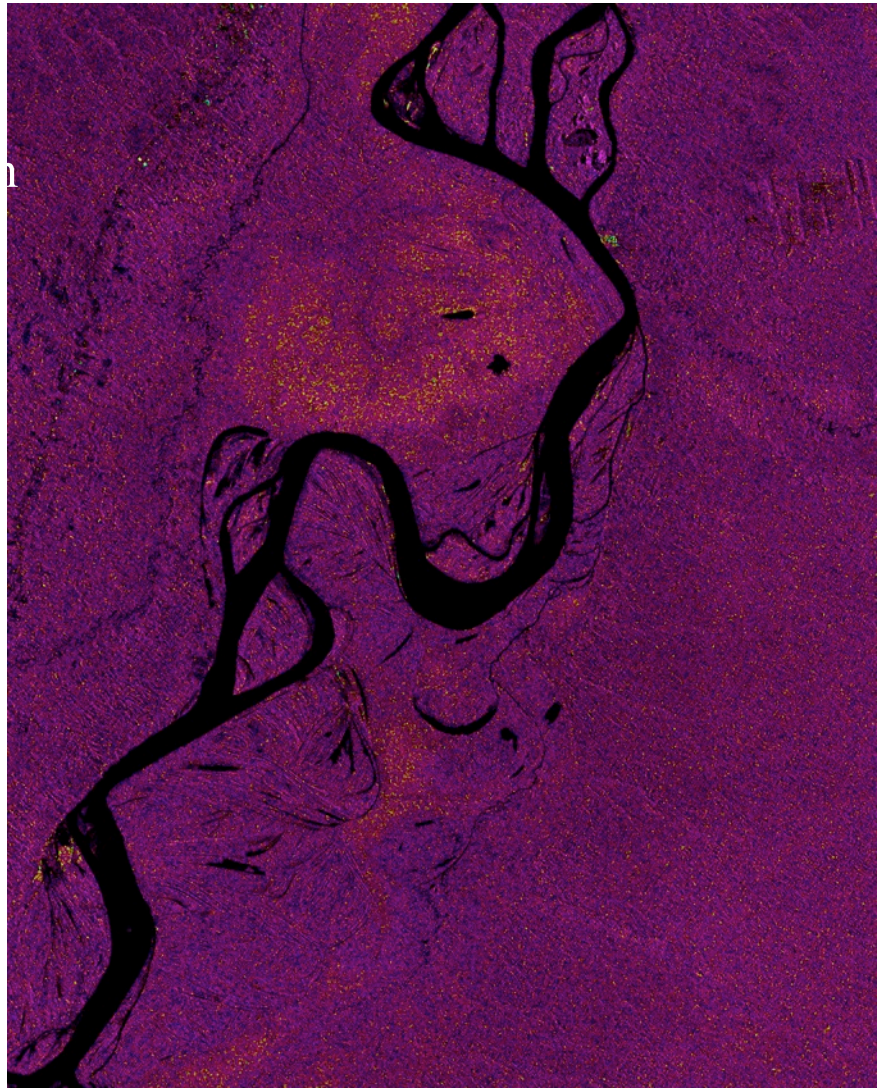
PACAYA-SAMERIA, PERU

Near Tamshiyacu

L-band HH + HH/HV color

C-band VV + VV/VH color

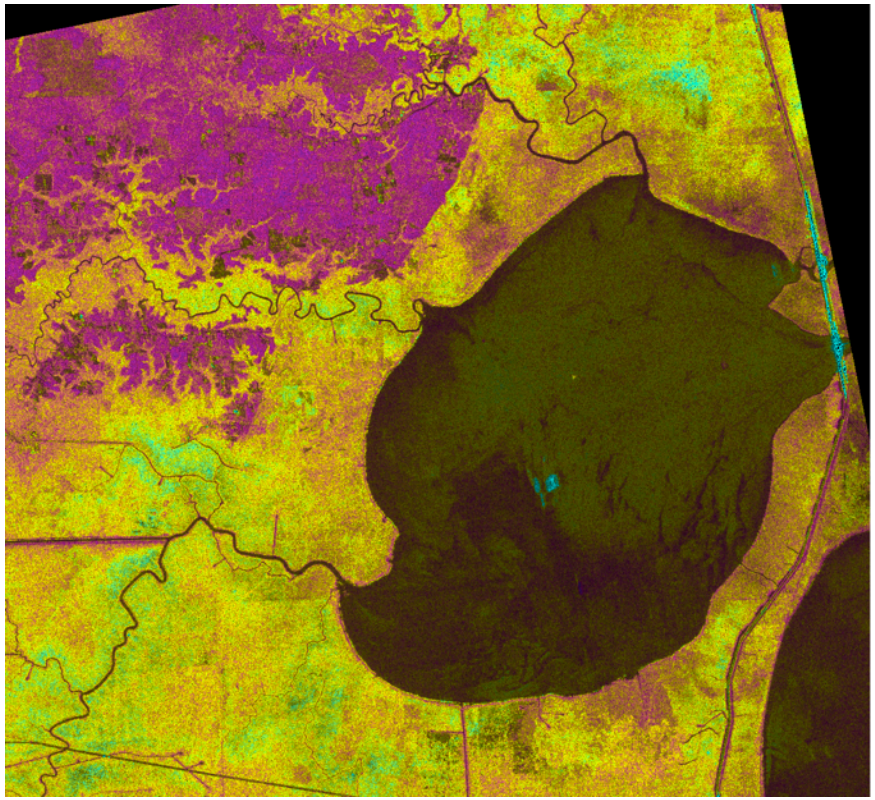




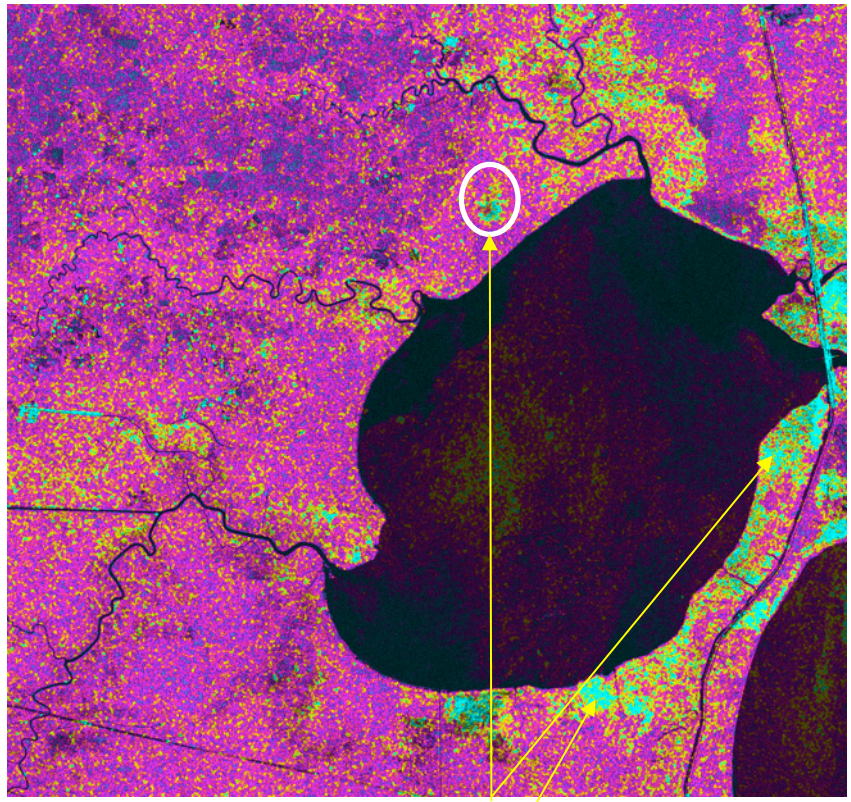
22Aug, 2016 (ALOS2)
19Aug, 2016 (Sentinel 1)

Lake Maurepas, Louisiana

L-band HH + HH/HV color

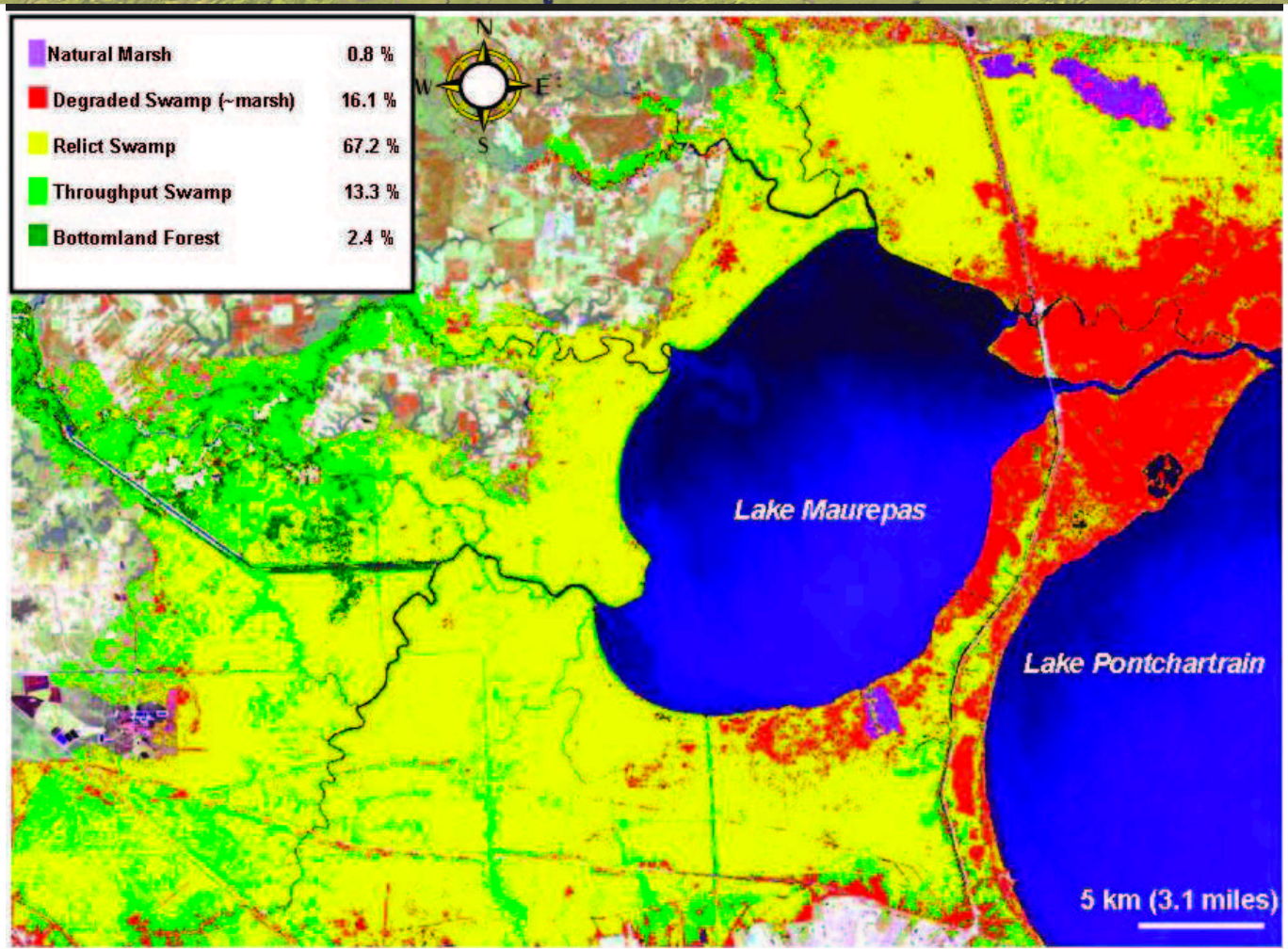


C-band VV + VV/VH color



flooded cypress tupelo swamp

Degraded swamp



From Louisiana wildlife federation website:
http://www.lawildlifefed.org/content.cfm?new=474&id=177

06Jul, 2016 (ALOS2)
07Jul, 2016 (Sentinel 1)

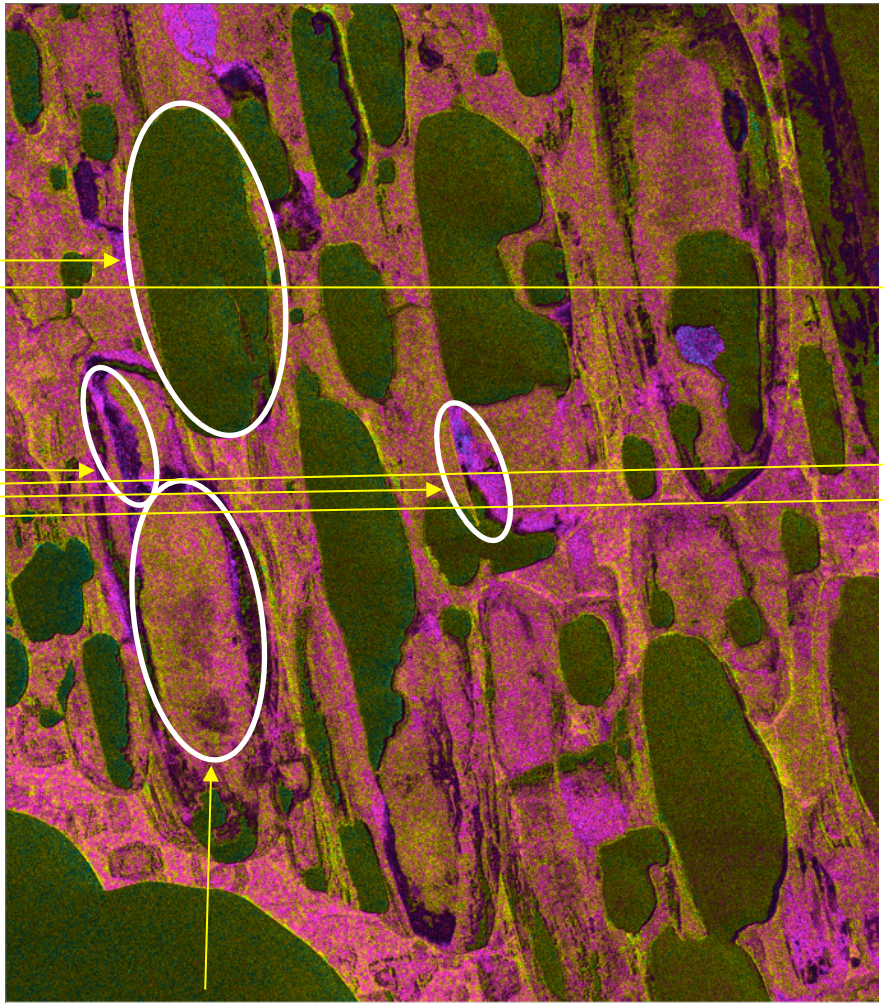
L-band HV + HH/HV color

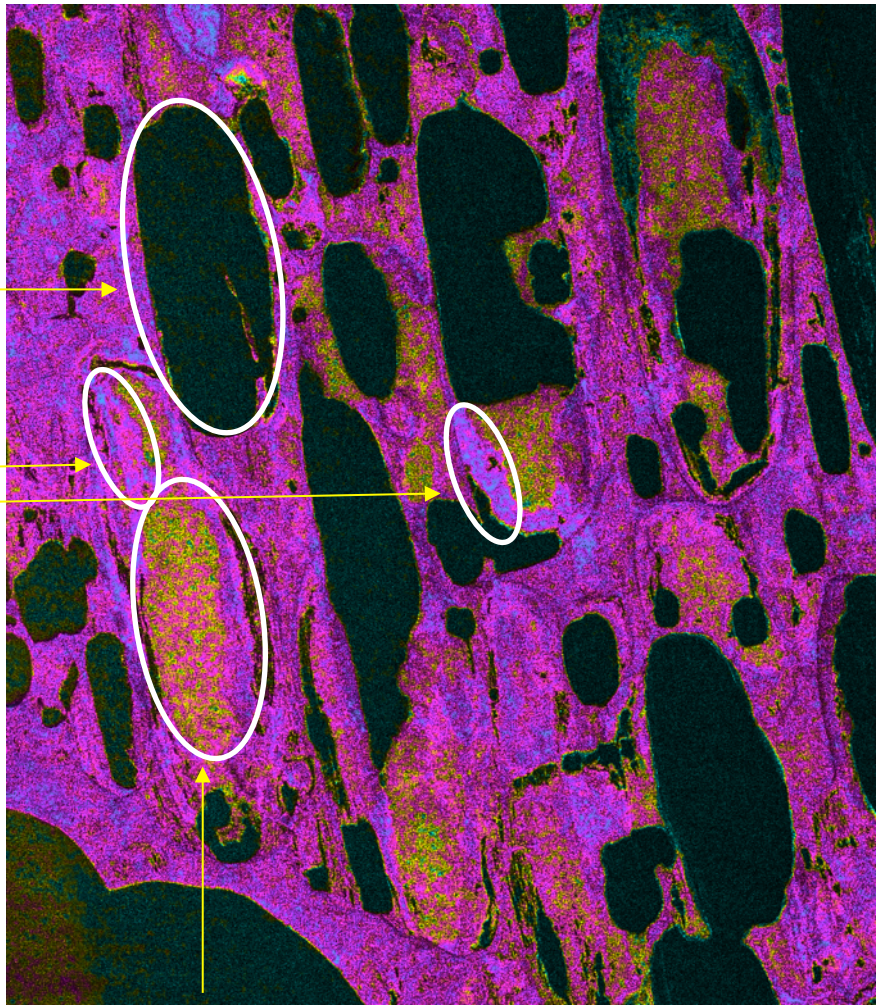
C-band VH + VV/VH color

Teshekpuk Lake, Alaska

Open water

ice





Flooded ? Or just vegetation is different?

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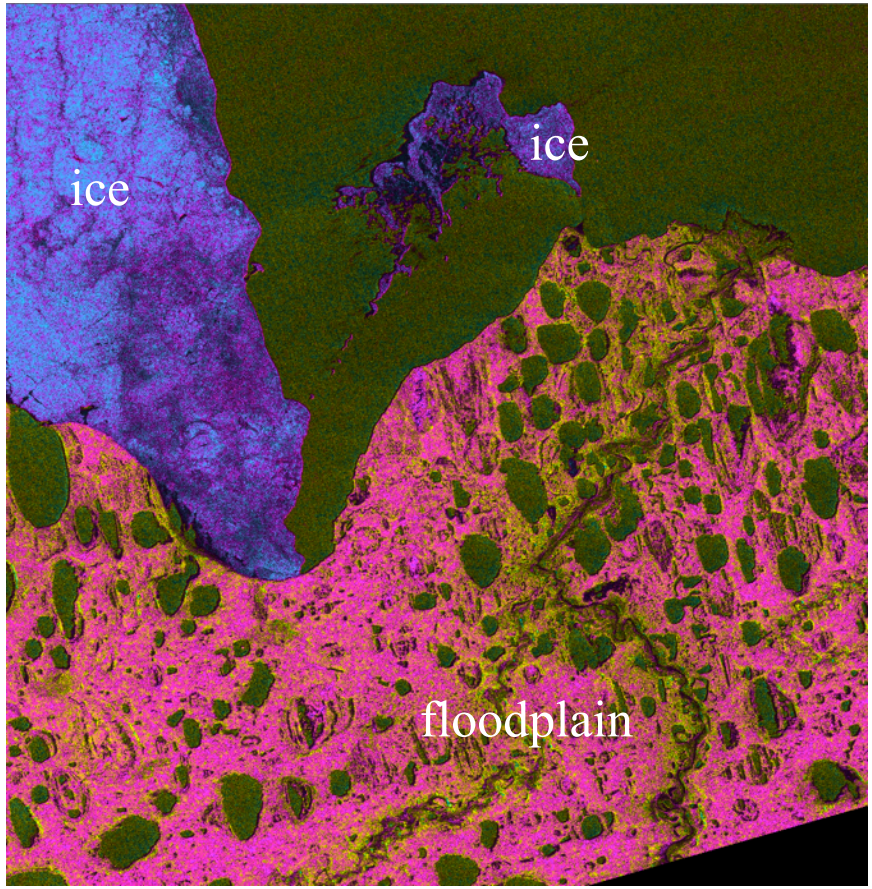
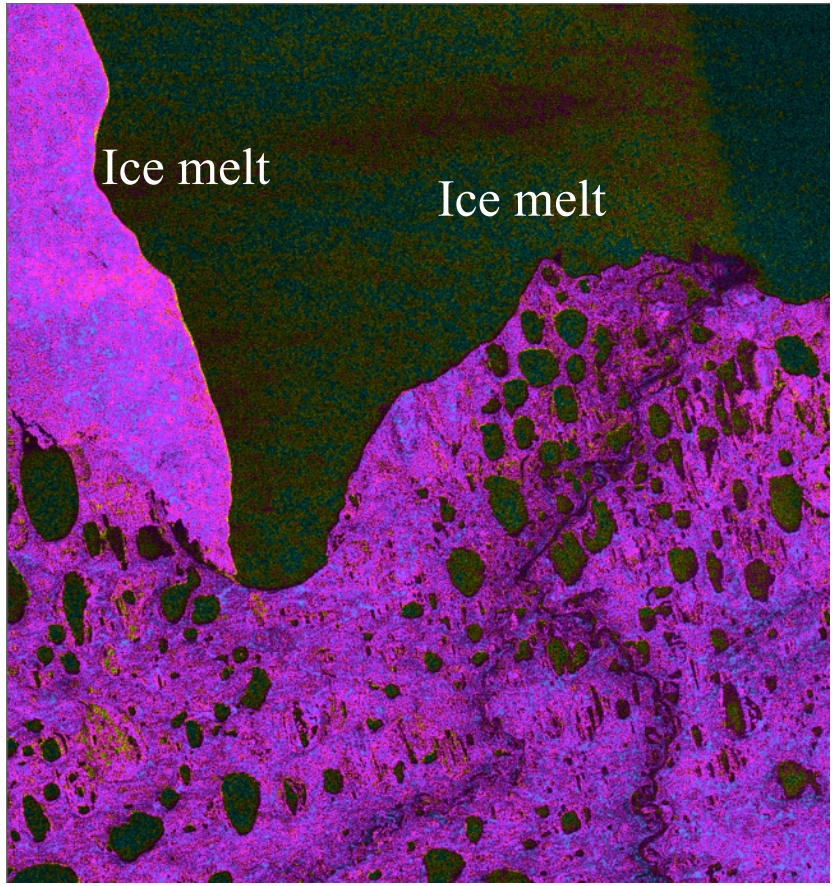
06Jul, 2016 (ALOS2)
07Jul, 2016 (Sentinel 1)

Teshekpuk Lake, Alaska

L-band HV + HH/HV color



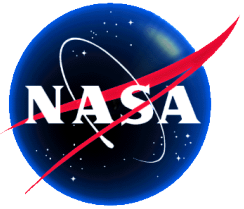
C-band VH + VV/VH color



1 day later than ALOS

Project milestones

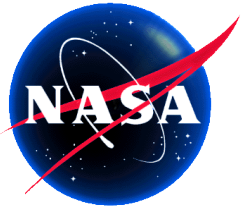
- Late 2015 – release of SRTM 30 m DEM
- End of 2017 – release of 30 m NASADEM
- Comparison of 30 m SRTM/90 m DEM/30 m NASA DEM – March 2018.
- Analysis of 14 day repeat for characterizing inundation – March 2018.



Deliverables

Describe the planned output of your project.

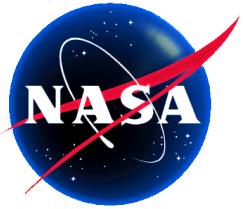
- Report on 30 m DEM
- Report on 14 day repeat for characterizing inundation



PALSAR/PALSAR-2 data access

Have requested and received ALOS-2 palsar data over various wetlands.

Will be downloading additional data comparing image time sequences between ALOS-2 and sentinel 1 data, for which there are sufficient resources.



Thank you

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