AirSWOT Alaska Summary

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Science Questions

1. How do complex systems of Arctic floodplain lakes interact with changing main-stem water levels in the associated river?

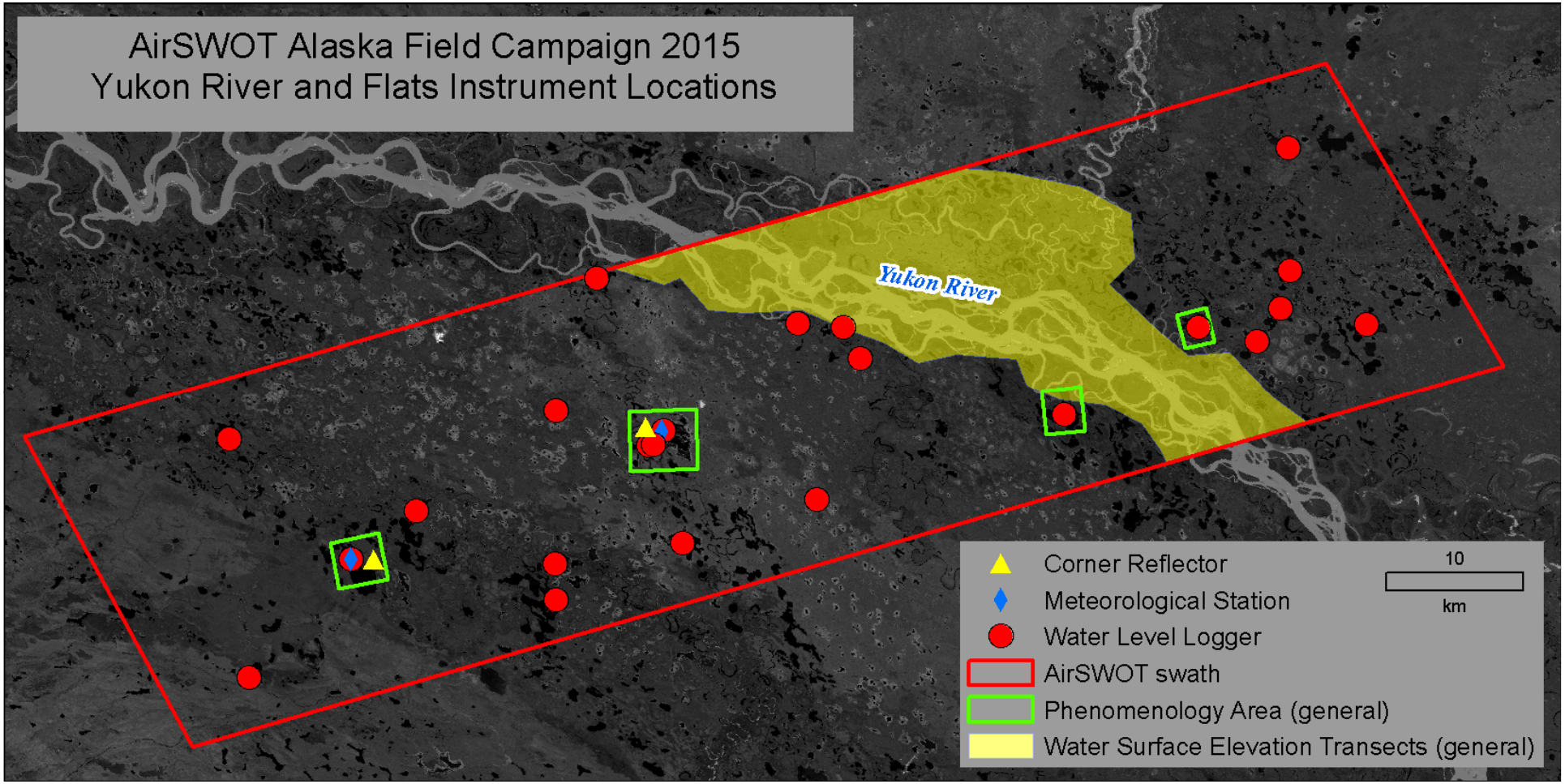
2. How does water flow through complex braided river systems? how do slopes and water surface elevations change with increasing discharge? How well are these flow pattern represented in state-of-the-art hydrodynamic models?

Technical Questions

1. How well can AirSWOT/SWOT distinguish inundation under different conditions such as surface roughness, emergent vegetation, and adjacency to wet sediment?

2. Can SWOT/AirSWOT accurately measure elevations and height changes in different river planforms, lakes of various sizes, and wetlands with different vegetation characteristics?

Yukon Flats Field Site



Credit: Lincoln Pitcher, UCLA

Data collected:

Water surface elevations on 20 lakes, 2 rivers

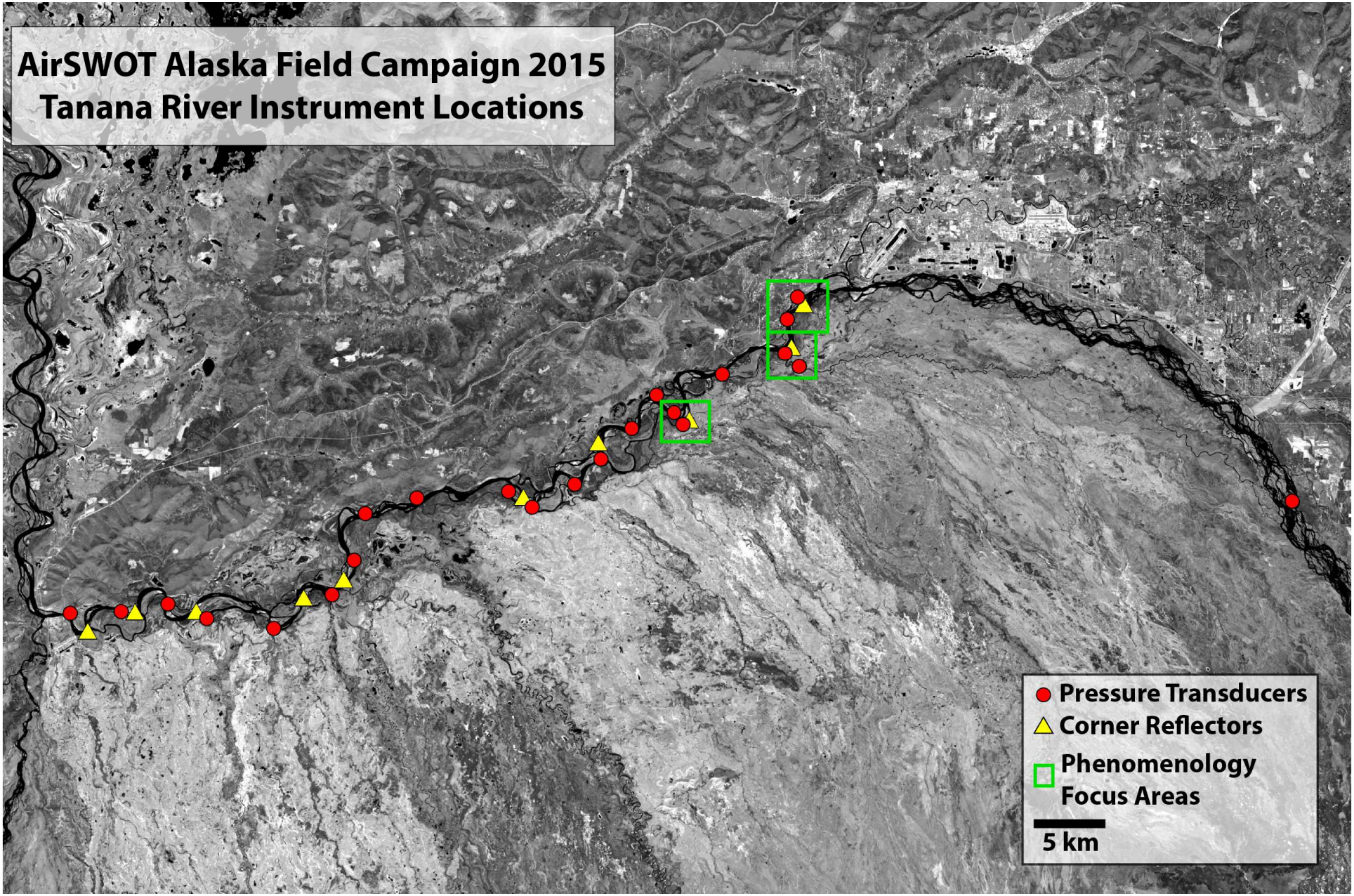
Meteorological data near 2 lakes

Vegetation height and density

Lake boundaries with precision GPS

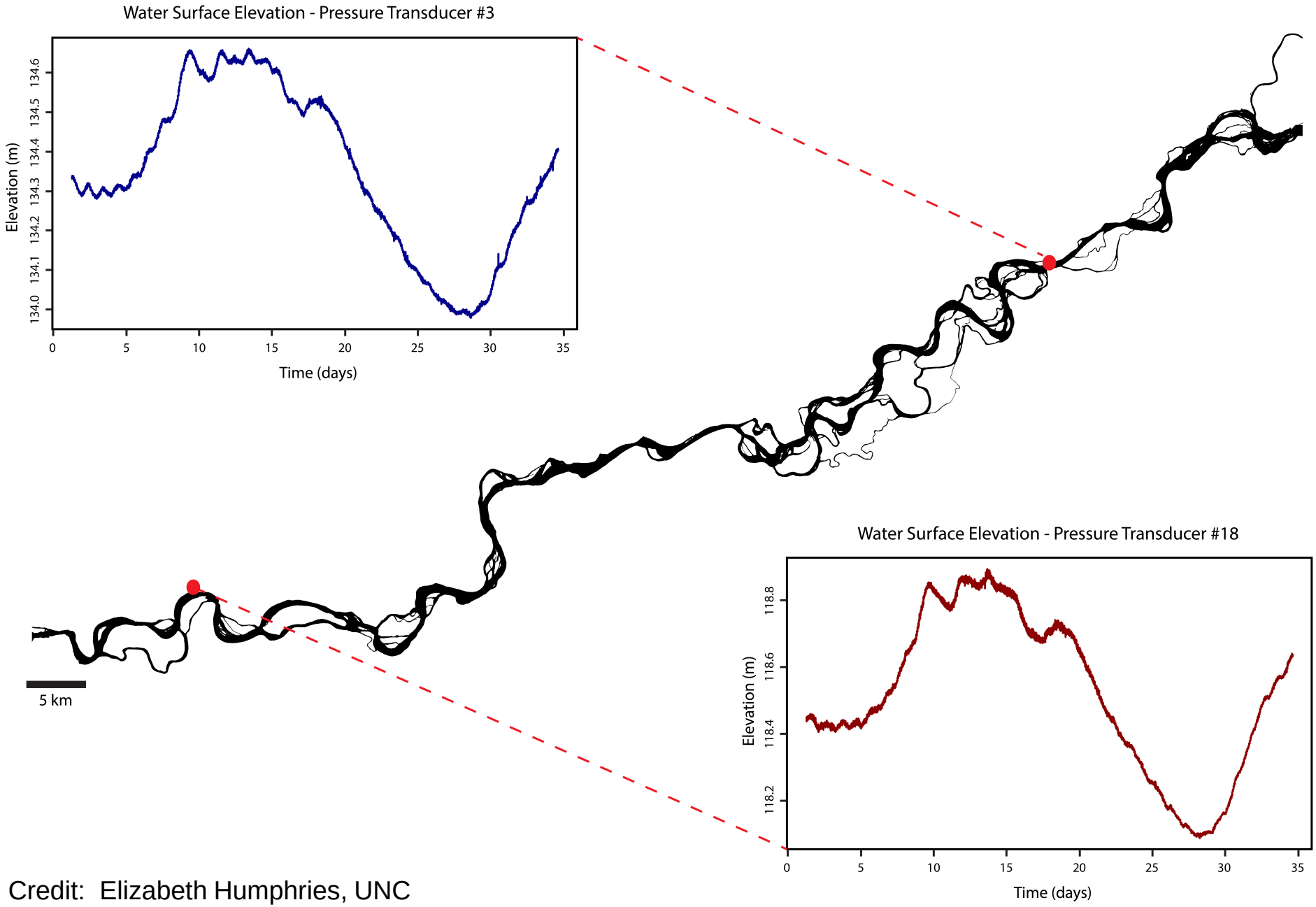
Continuous water surface elevations, depths on Yukon River on 3 different dates.

Tanana River Field Site



Credit: Elizabeth Humphries, UNC

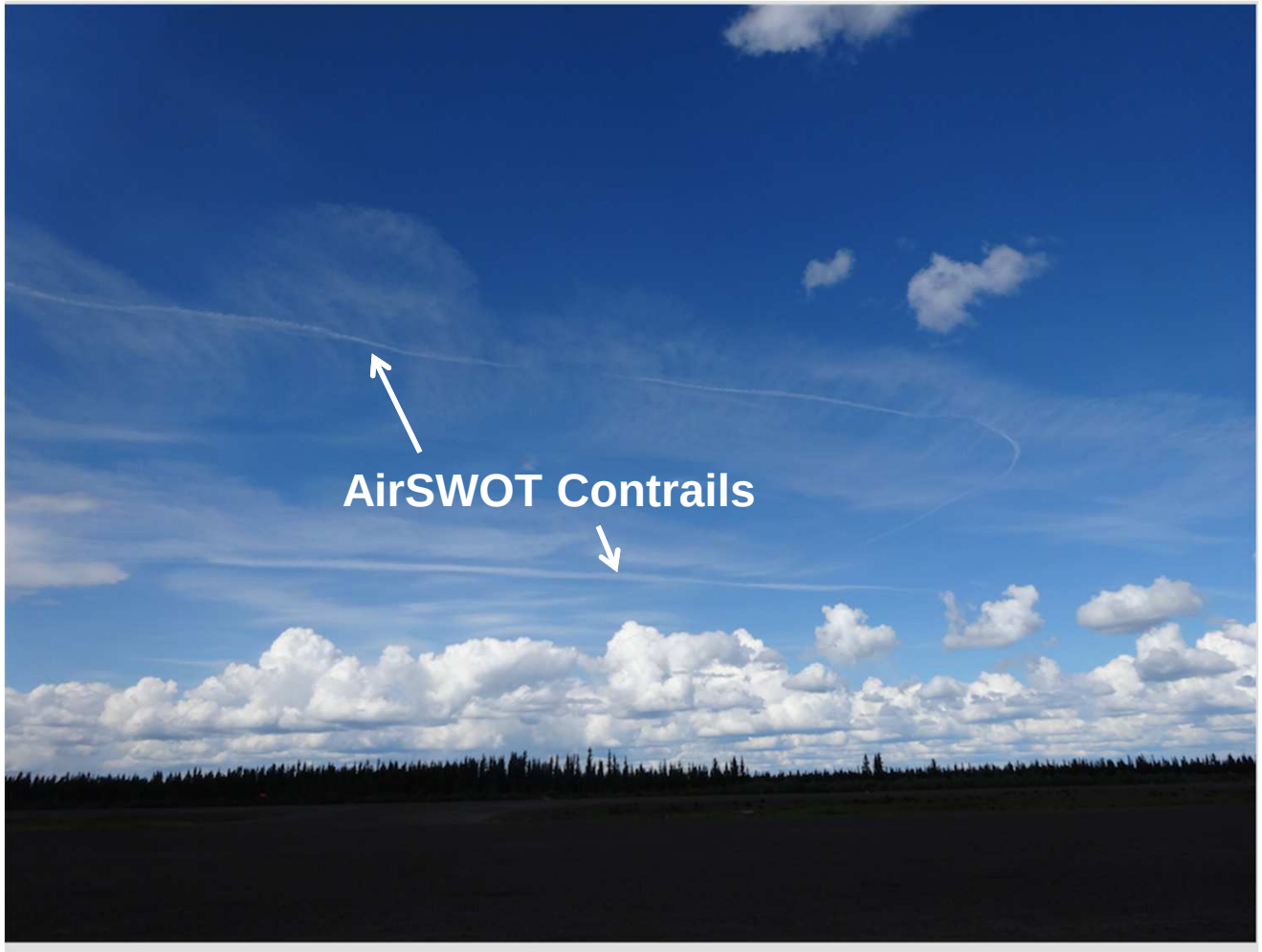
Tanana River Water Level Changes



Credit: Elizabeth Humphries, UNC

AirSWOT Data Collections

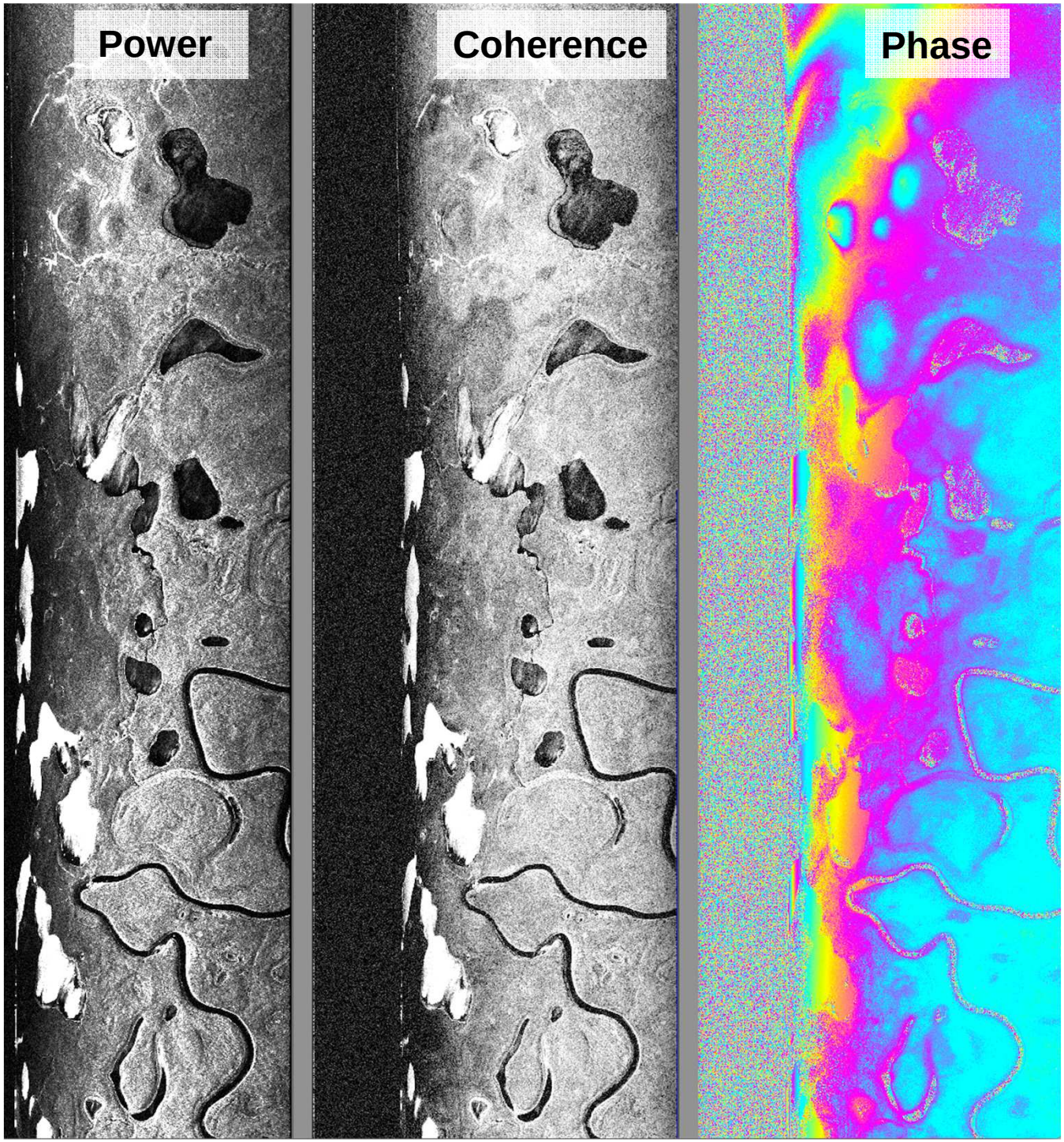
- Arrived in Alaska May 31
- Problems with autopilot (and weather) resulted in only 2 days of data collection in first week (June 2, 4).
- Problems were solved in Week 2, and data was collected as follows:
  - Yukon Flats: June 2, 4, 7, 8, 10, 12, 15, 22
  - Tanana River: June 2, 7, 9, 13, 14, 16, 17, 18, 20, 22
- Radar data was successfully collected on all days, though SWOT-liked data was not collected on June 2, 4 due to procedural error



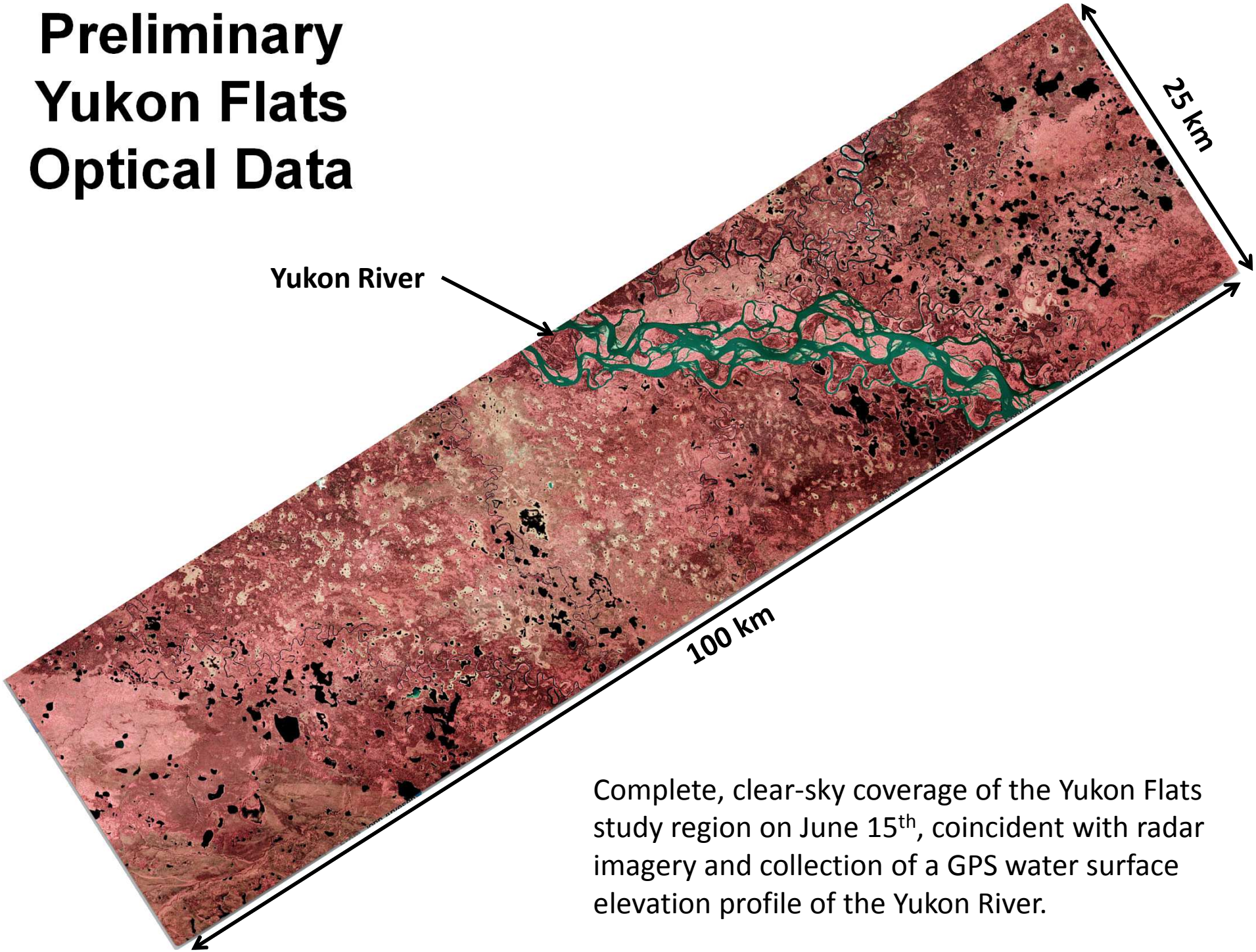
- Optical data is available . Good-quality optical data with spatial resolution of ~1m was collected at least once (and often repeatedly) over all study areas.

Preliminary Radar Data

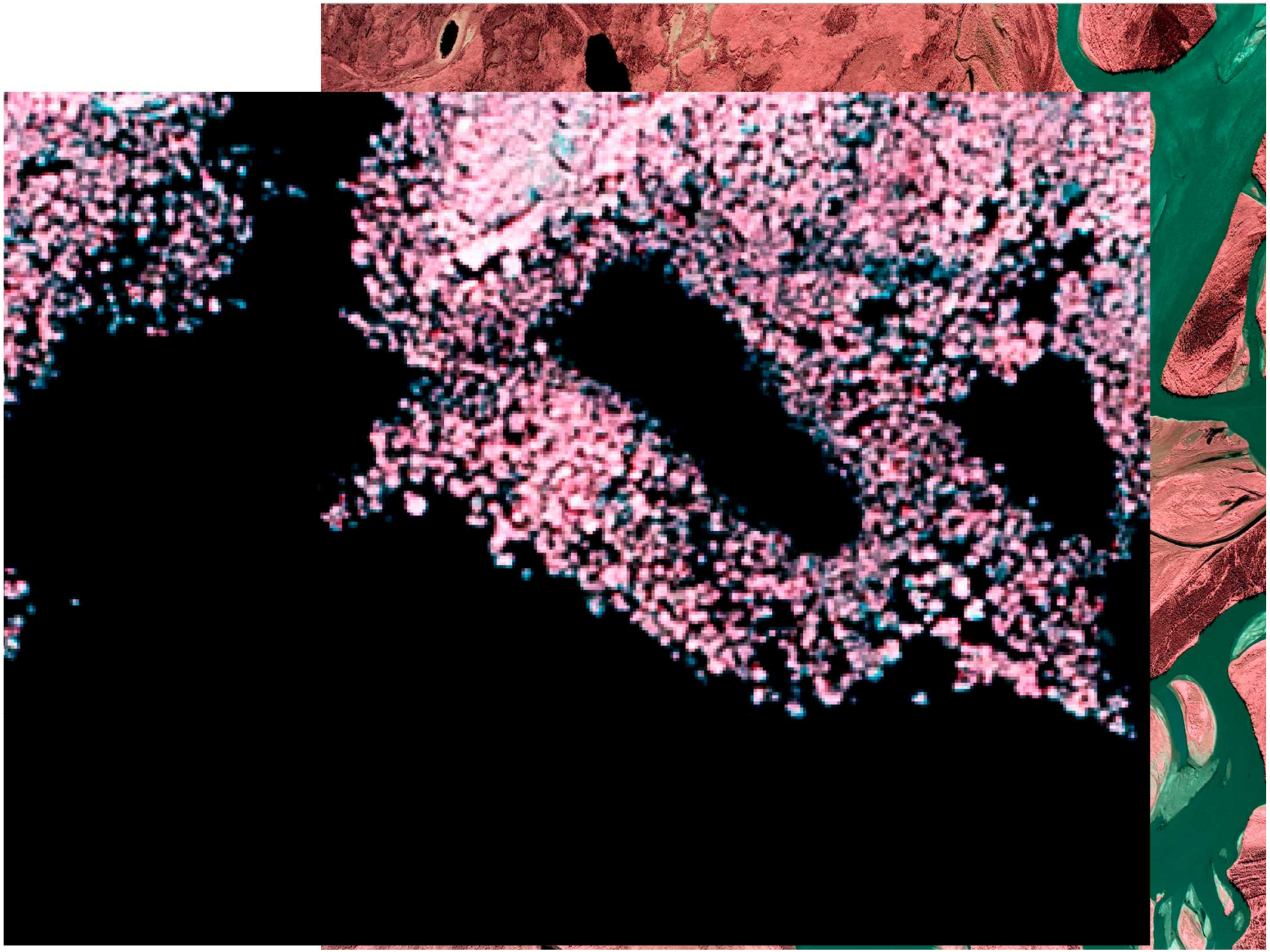
- Near nadir (SWOT-like) data has high power, coherence over water, low over vegetation.
- Higher incidence angles yield darker returns over water as surfaces become more specular.
- Wind conditions appear to substantially influence returns from different portions of the same lake.



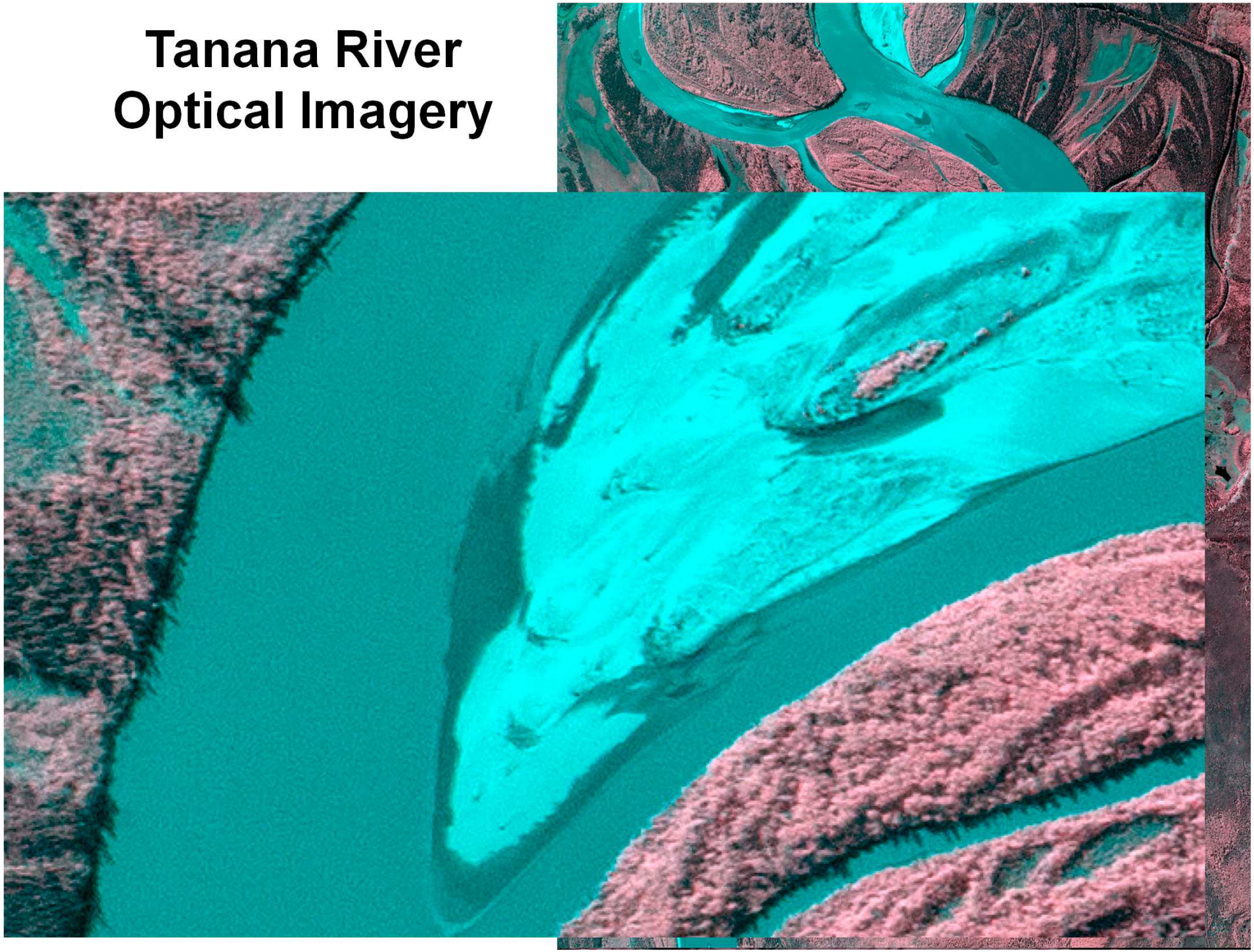
Preliminary Yukon Flats Optical Data



Complete, clear-sky coverage of the Yukon Flats study region on June 15th, coincident with radar imagery and collection of a GPS water surface elevation profile of the Yukon River.



Tanana River
Optical Imagery



Conclusions

1. Despite a few bumps, a large amounts of AirSWOT data was successfully collected over a diverse array of targets.

2. A substantial amount of field calibration, validation, and science data was collected in concert.

3. Initial examination of AirSWOT and field data suggests that it is of high quality and will be useful for addressing the campaign goals.

4. Substantial effort needs to go into processing both the field data and the airborne data in order to achieve science and technical goals.

Thanks to all of the Participants

UNC: Tamlin Pavelsky (PI), Elizabeth Humphries (PhD Student), Christine Lion (Postdoc), George Allen (PhD Student)

UCLA: Larry Smith (Co-I), Lincoln Pitcher (PhD Student)

Remote Sensing Solutions: Delwyn Moller (Co-I)

Ohio State: Michael Durand (Collaborator)

U. Bristol: Paul Bates (Collaborator)

IRD: Stephane Calmant (Collaborator)

U. Washington: David Butman (Collaborator)

JPL: Greg Sadowy, Mauricio Sanchez Barbetty, Mark Haynes, Nathan Brummel

NASA Armstrong: KingAir B200 pilots and mechanics

Yukon Flats National Wildlife Refuge: Mark Bertram (Logistics Support)

Stephane and Elizabeth Surveying the Heights of SWOT Experiments Yet to Come

Yukon Flats Science

1. **What controls temporal variations in water level (and water storage) in large river-dominated wetlands like the Yukon Flats?**
    1. AirSWOT will provide variations in water surface elevations for hundreds of lakes throughout the study area.
    2. Optical and radar imagery will yield information on surface water connectivity.
    3. A priori datasets from the USGS will provide information on permafrost extent.

2. **How are carbon chemistry, hydrologic dynamics, and hydrologic connectivity of lakes linked?**
    1. Water level and connectivity information from AirSWOT
    2. Carbon chemistry measurements made on the ground at 18 lakes in study area include:
        1. CO_2 and CH_4 fluxes between lake and atmosphere
        2. Dissolved CO_2 and CH_4, Lignin concentrations
        3. Stable and radio isotopes of carbon, oxygen and hydrogen isotopes in water
        4. Optical properties of the water (UV absorption and fluorescence)

Tanana River Science

1. **What level of hydrodynamic model complexity is required to accurately simulate variations in water surface elevation, slope, discharge complex multichannel rivers?**
    1. Multiple LisFlood FP models of the Tanana River study reach ranging from full 2-D simulations at 10 m grid spacing to 1-D simulations using a simplified river centerline.
    2. Comparison against AirSWOT-derived and *in situ* heights, slopes, discharge measurements.