Arctic-Boreal Vulnerability Experiment

The Arctic-Boreal Vulnerability Experiment (ABoVE) Airborne Campaign Planning

14th International Circumpolar Remote Sensing Symposium
Homer, AK
13 September 2016

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ARCTIC BOREAL VULNERABILITY EXPERIMENT

Arctic-Boreal Vulnerability Experiment

ABoVE is a large-scale NASA-led study of environmental change in arctic & boreal regions and the implications for ecological systems and society

Our overarching Science Question is

How vulnerable or resilient are ecosystems and society to environmental change in the arctic and boreal region of western North America?

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ABoVE development (where we are now)

Selection of 21 core science teams for Phase 1 (Aug 2015)

- 1st Science Team meeting (held Oct 2015)
- 2nd Science Team meeting (held Jan 2016)
- 3rd ST meeting w. POLAR Canada (May 2016 in Yellowknife)
- Implementation plan is being finalized

Current Science Team includes

- 40 funded projects
- 231 investigators & collaborators from 103 organizations

NASA Terrestrial Ecology AO for ABoVE Airborne Science

- Proposals submitted August 1st
- $3.5M (not including foundational airborne measurements)

Current Science Team Membership

	Investigators	Organizations
Principal Investigators	34	21
Funded Investigators	100	58
Collaborators	131	55
Total	231	103

Organizations Represented

	U.S.	Canada	Europe	Japan	Total
University	43	10	3		56
National Agencies/Labs	17	6	4	1	27
State/Provincial/Territorial	2	8			10
Private	4	2			7
Native/Aboriginal Organizations	2	1			3
Total	68	27	7	1	103

Key Partners: Next-Generation Ecosystem Experiment (NGEE Arctic)

Oak Ridge National Laboratory
Brookhaven National Laboratory
Los Alamos National Laboratory
Lawrence Berkeley National Laboratory
University of Alaska Fairbanks

- Objective is better representation of permafrost in ESMs
- Field sites in Barrow AK (phase 1) & on the Seward Peninsula (phase 2)
- ABoVE will facilitate remote sensing, scaling & integration

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Key Partners: Polar Knowledge Canada (PKC)

Canadian High Arctic Research Station (CHARS)

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ROSES 2016 A.4 Terrestrial Ecology

Arctic-Boreal Vulnerability Experiment

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NSPIRES NASA Solicitation and Proposal Integrated Review and Evaluation System

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|NSPIRES Time: May 08, 2016 11:36PM EDT

NASA Research
- Solicitations

View Solicitations
- Future
- Open
- Closed/Past Selected

Science Mission Directorate

NASA Research Announcement

Terrestrial Ecology

Solicitation: NNH16ZDA001N-TE

Dates

Release	Feb 19, 2016
TE16 NOIs Due	May 16, 2016
TE16 Proposals Due	Aug 01, 2016

Announcement Documents
- Table 2, list of program elements in due date order as amended and clarified (.HTML)
- Table 3, list of program elements in Appendix order as amended and clarified (.HTML)
- ROSES-2016 Summary of Solicitation as amended (.PDF)
- FULL ROSES-2016 as amended and clarified (.PDF)
- A.1 Earth Science Research Program Overview (.PDF)
- A.4 Terrestrial Ecology as amended and clarified (.PDF)

Program Element Information
- Research Opportunities in Space and Earth Sciences 2016 (ROSES–2016)

NASA Terrestrial Ecology Program solicits research proposals for use of airborne remote sensing data during the ABoVE Airborne Campaign

Seeks research on using airborne data in key ABoVE research areas
- Impacts of variations in permafrost on ecosystems
- Characterize the type, structure, and function of vegetation, especially in relationship to disturbance
- Understanding of the drivers and impacts of variations in surface hydrology

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ABoVE Airborne Intensives

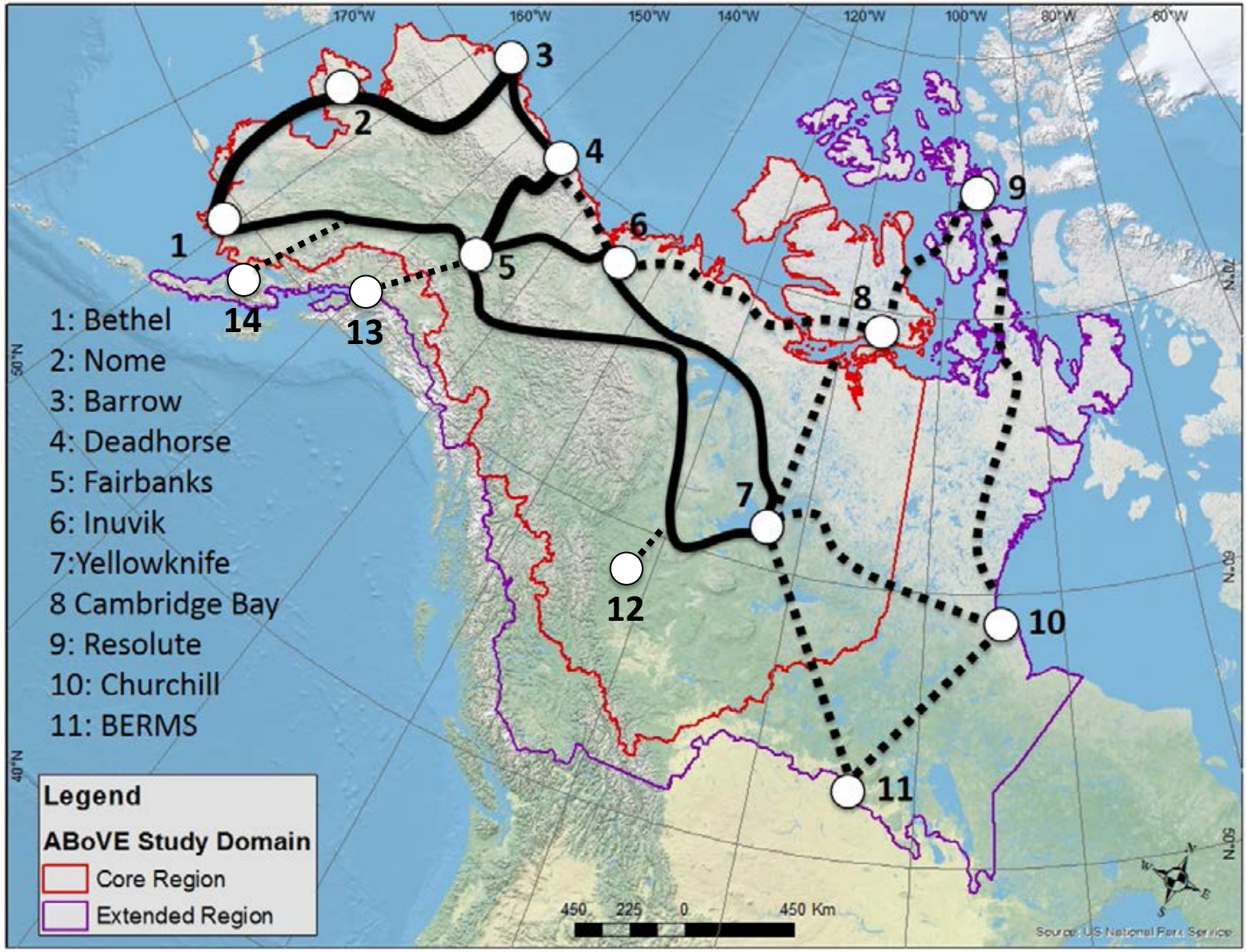
ABoVE airborne intensives are scheduled for 2017 & 2019

Goals:

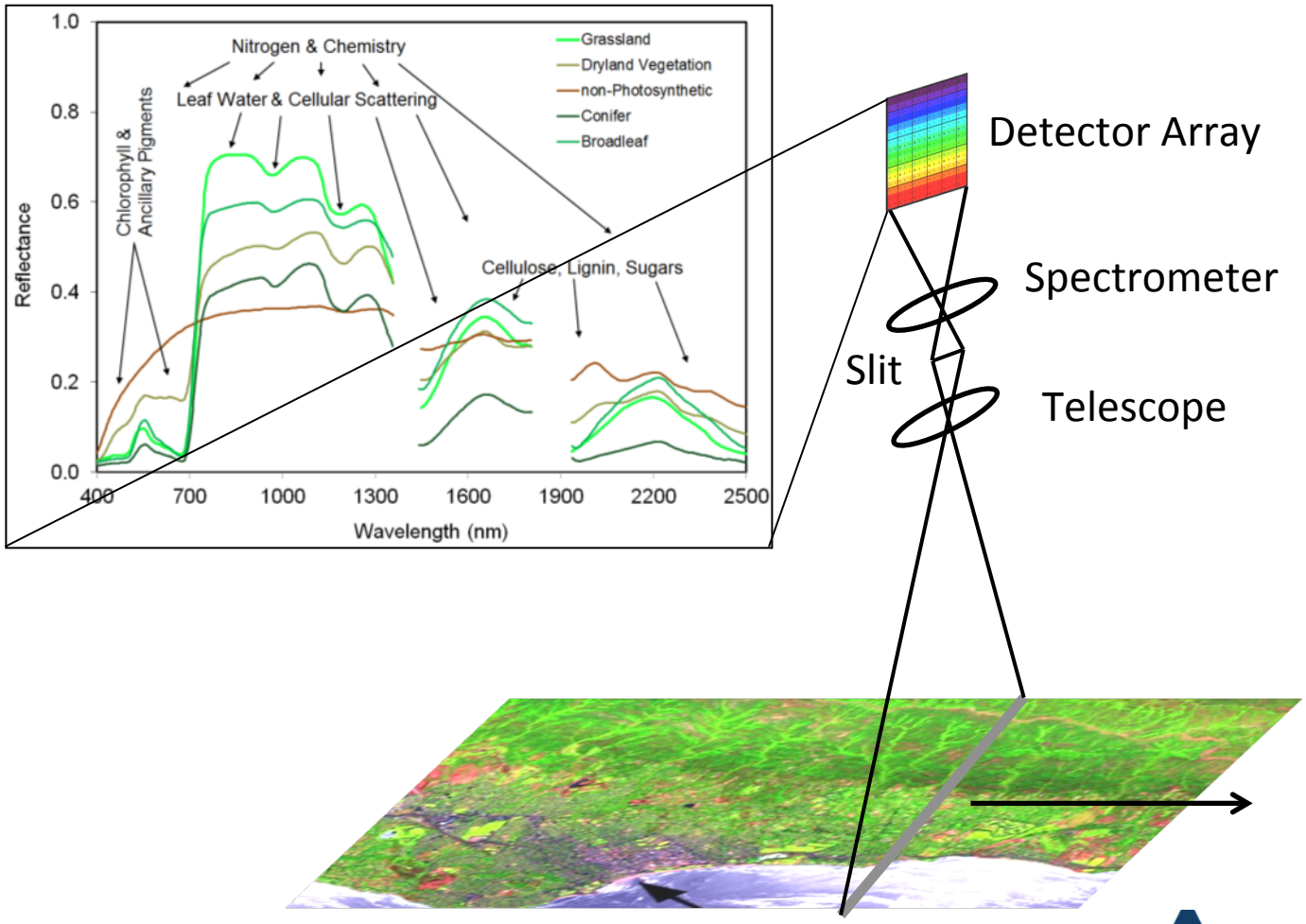
- **Provide domain-wide context to unify site-level process studies**
- **Link to satellite remote sensing**
- **Demonstrate new remote sensing technologies and multi-sensor data products**

Arctic-Boreal Vulnerability Experiment

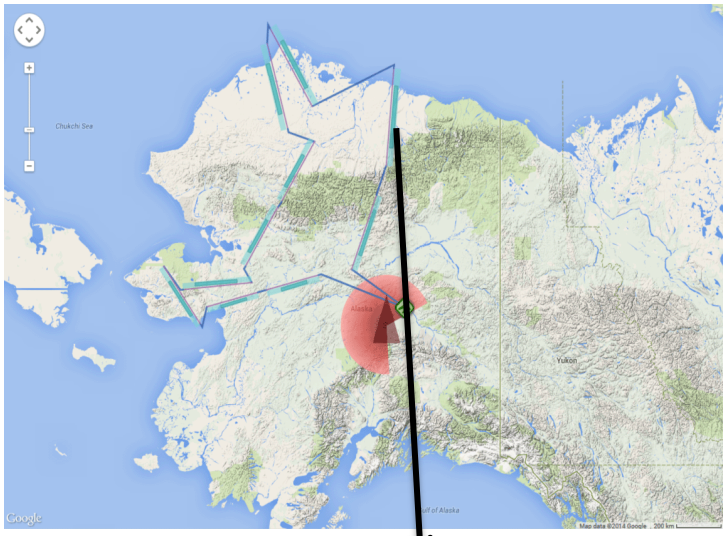
ABoVE Foundational Flight Lines

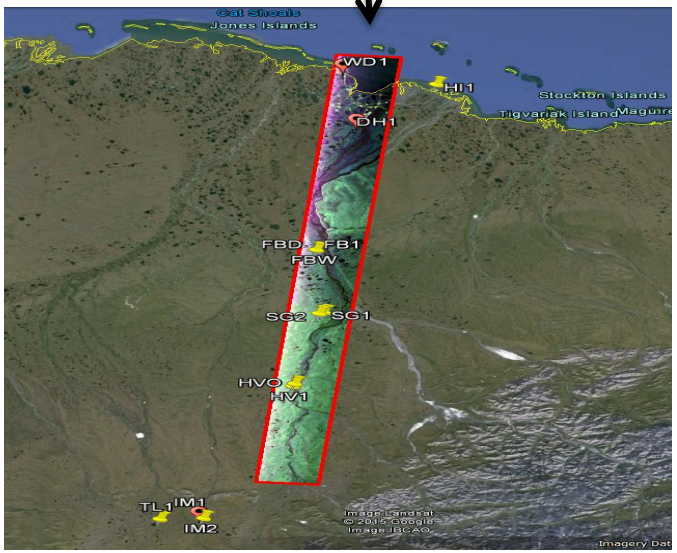


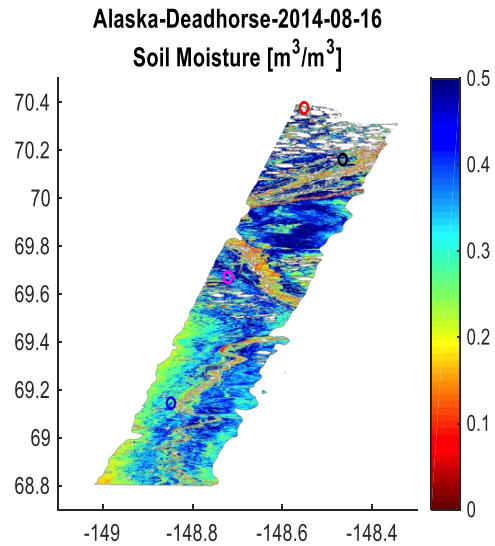
The BOREAS Legacy: AVIRIS-NG VSWIR Imaging Spectroscopy for Carbon Cycle and Ecosystem Science

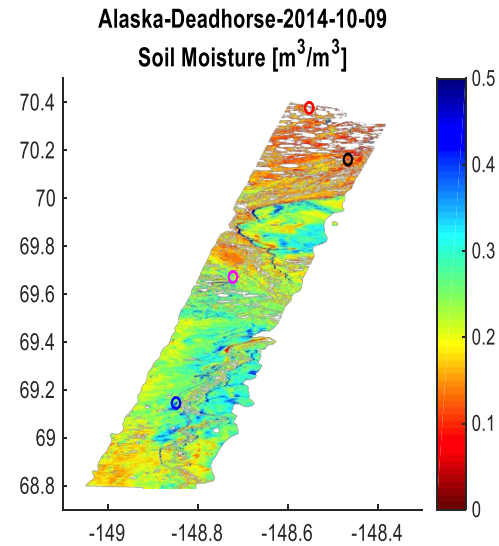


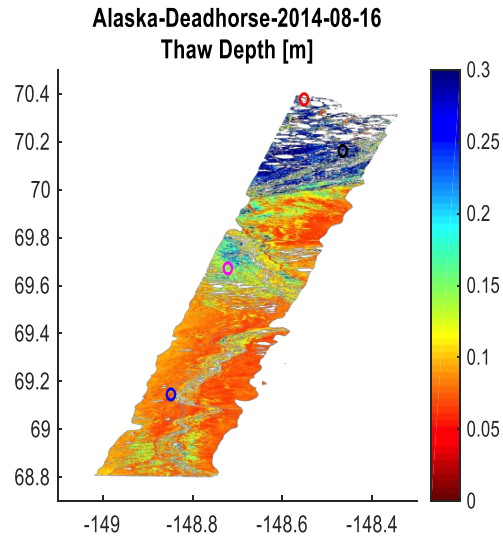
UAVSAR & AirMOSS: Thaw Depth and Soil Moisture

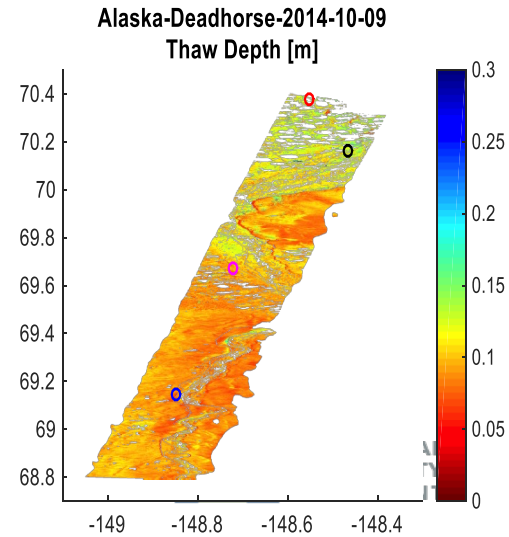




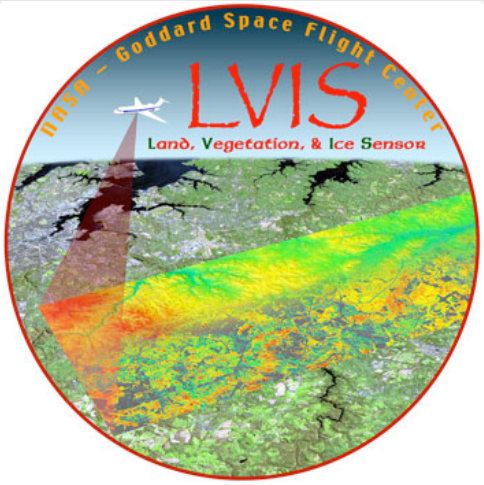


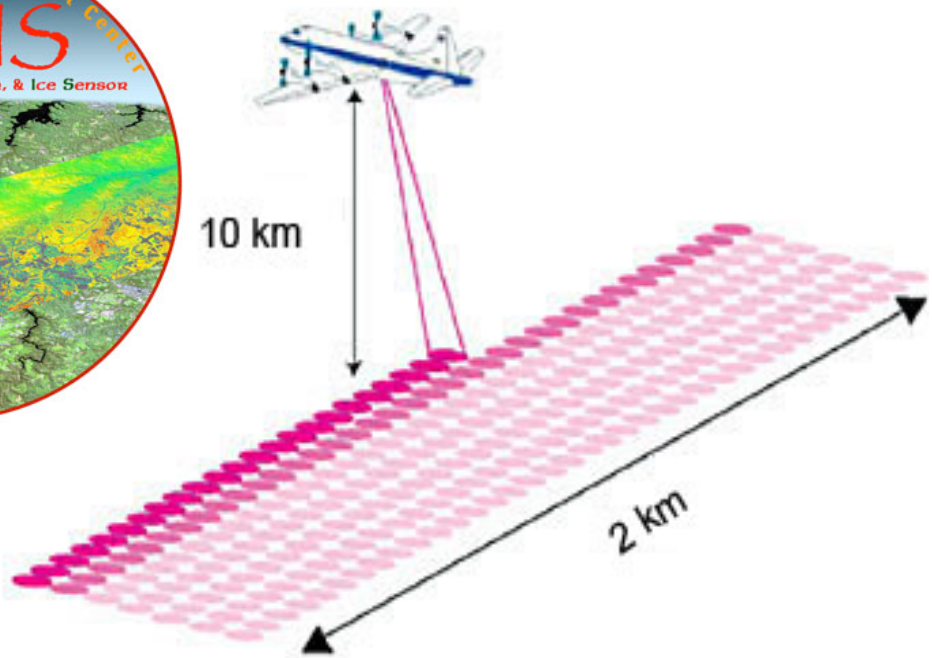


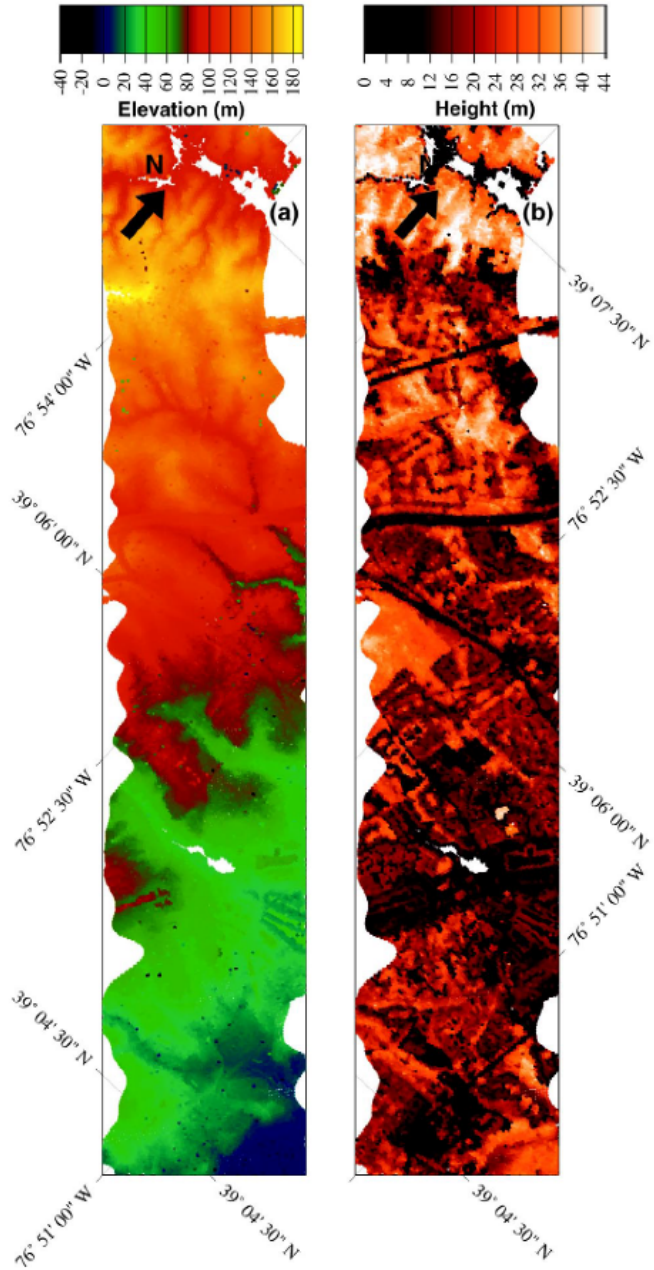




FOUNDATIONAL Measurement Payload



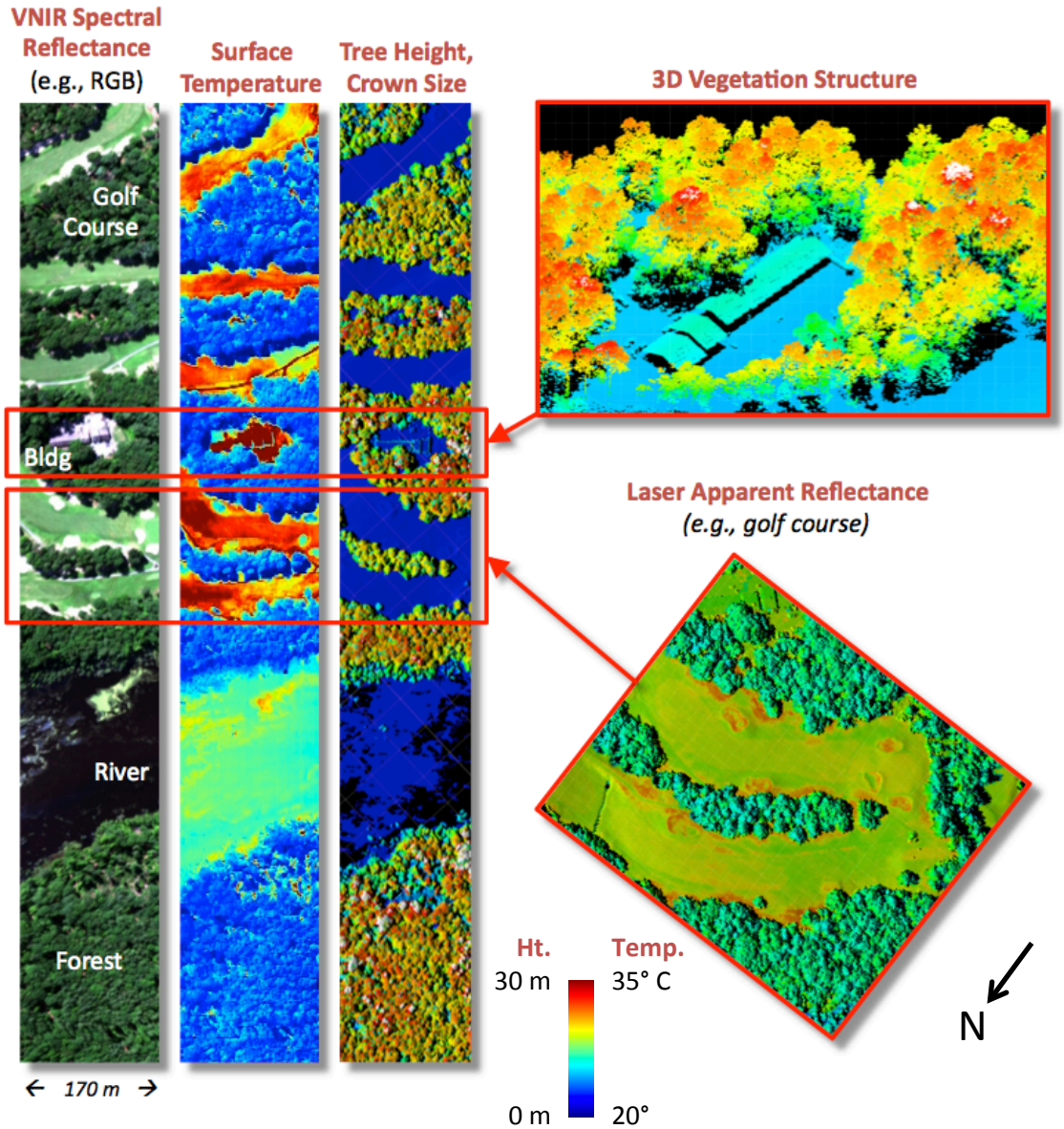




Waveform LIDAR
IFOV spatial resolution ~ 7 m
Cross-track resolution ~2000 m

Potential FOCUSED Measurement Payload

G-LiHT: Goddard's Lidar, Hyperspectral, and Thermal airborne imager



INSTRUMENT SPECIFICATIONS

Scanning lidar (Riegl VQ-480)

Swath width*/FOV	387 m (60°)
Footprint diameter	10 cm (0.3 mrad)
Maximum ranging distance	350 m
Sampling density at surface†	6 pulses m^{-2}
Max. returns per pulse	8

Irradiance spectrometer (Ocean Optics USB-4000)

FOV	hemispheric (180°)
Raw sampling resolution	1.5 nm
Acquisition rate	1 Hz

Imaging spectrometer (Headwall Hyperspec)

Swath width*/FOV	310 m (50°)
Cross track pixels	1,004
Spectral range	420 to 920 nm
Raw/Binned sampling resolution	1.5/4.5 nm
Spectral resolution (FWHM)	8 to 15 nm
Acquisition rate	50 Hz

Thermal camera (Xenics Gobi-384)

Swath width*/FOV	173 m (30°)
Imaging array size	384 × 288
Spectral range	8 to 14 µm
Sensitivity (NETD)	>50 mK at 30°C
Acquisition rate	25 Hz

GPS-INS (Oxford RT-4041 w/*Omnistar G2)*

Position accuracy	10 cm
Roll/pitch/yaw accuracy	0.03°/0.03°/0.10°

** At nominal altitude of 335 m (1100 ft) AGL*
† At laser pulse repetition frequency of 300 kHz

Potential FOCUSED Measurement Payload

Riegl Q1560 3D Scanning lidar
1064 nm, canopy penetration
1 m spatial resolution

CASI-1500 Imaging Spectrometer
0.35-1.05 μm
2 m spatial resolution

- < 24 hour turnaround of products
- Quantification of snow volume, SWE, albedo, etc
- Same payload also provides key terrestrial ecosystem properties from lidar & hyperspectral imagery

Potential FOCUSED Measurement Payload

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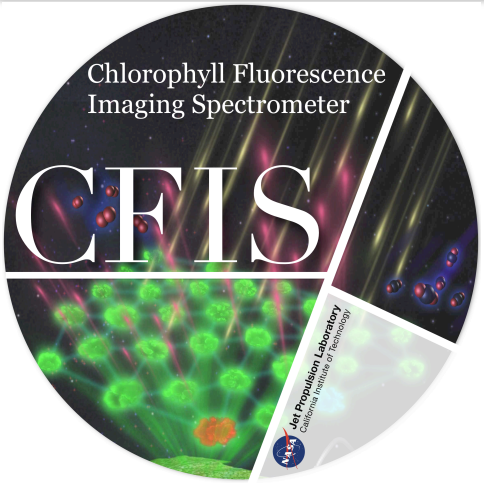

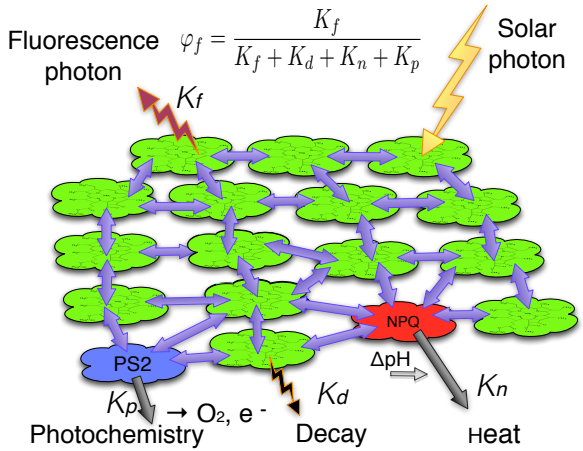

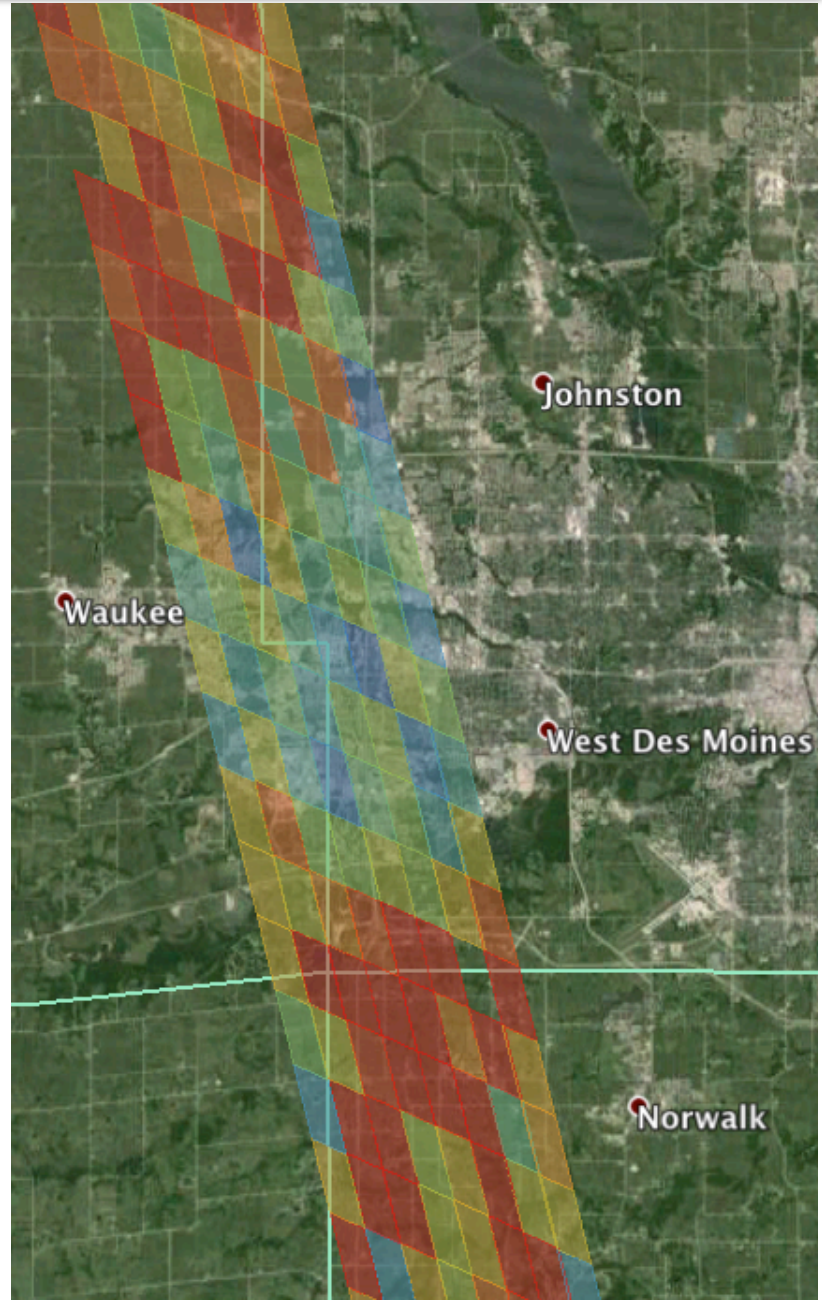

Solar Induced chlorophyll Fluorescence (SIF) is a direct by-product of photosynthesis

SIF provides a unique dynamic proxy for gross primary production GPP