



AEROKATS

Advancing Earth Research Observations with Kites/Terrestrial Sensors



Geoff Bland, Andy Henry, Brian Campbell

8-21-17



PARI

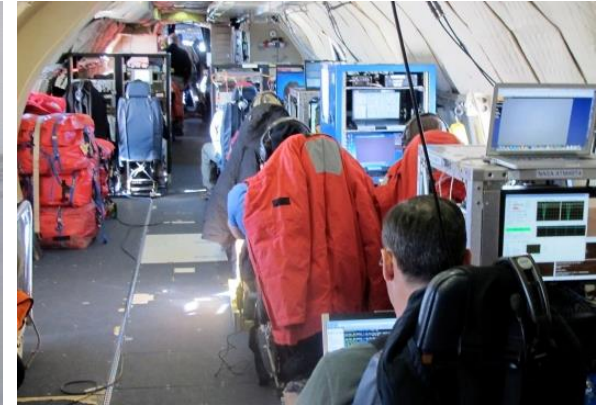
NASA Earth Science

Capturing The Global View from Space



NASA Airborne Science Program

A Detailed Perspective

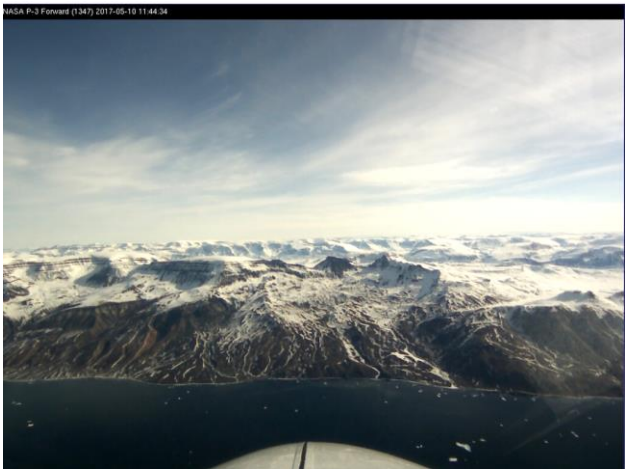
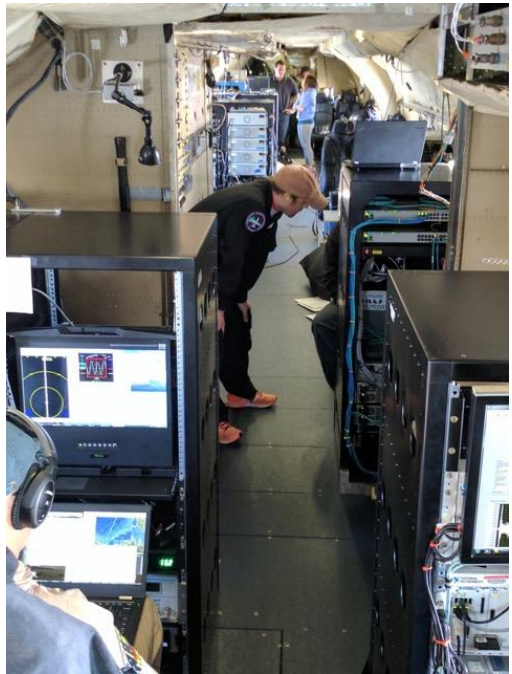


Operation Ice Bridge

Airborne Topographic Mapping (ATM)

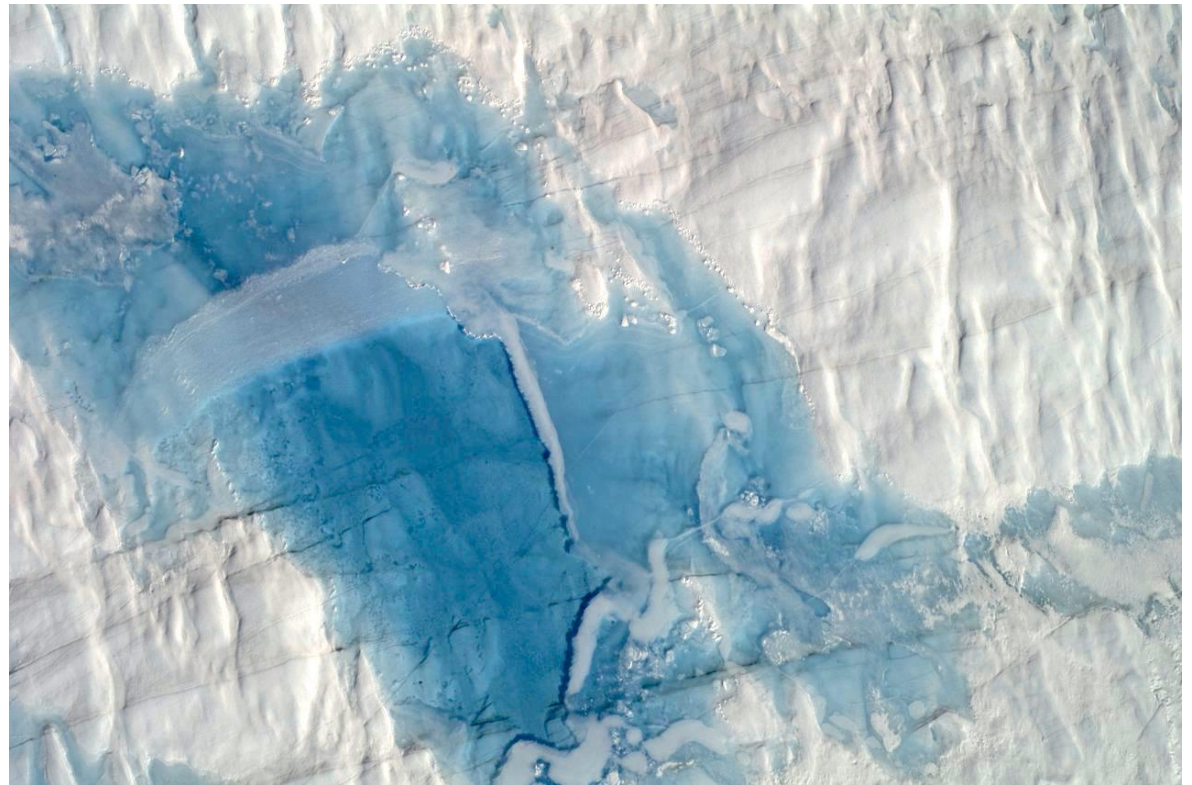


Images Courtesy of 2017 *Operation Ice Bridge*/NASA ATM Team



Images Courtesy of 2017 *Operation Ice Bridge*/NASA ATM Team





Images Courtesy of 2017 *Operation Ice Bridge*/NASA ATM Team

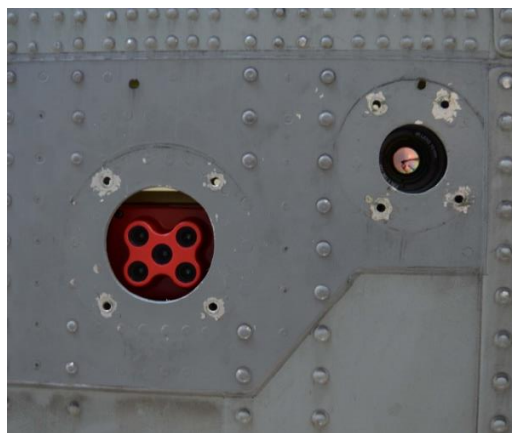
Surface Imaging System (SIS)

for CARbon Atmosphere Flux Experiment (CARAFE, Kawa, et al)

C-23 (N430NA), September 2016, May 2017



Nikon DSLR (D7000) color camera
Flir Thermal Imager (AS325sc) with computer
Micasense multiband camera



S/S Color & Thermal Infrared Images

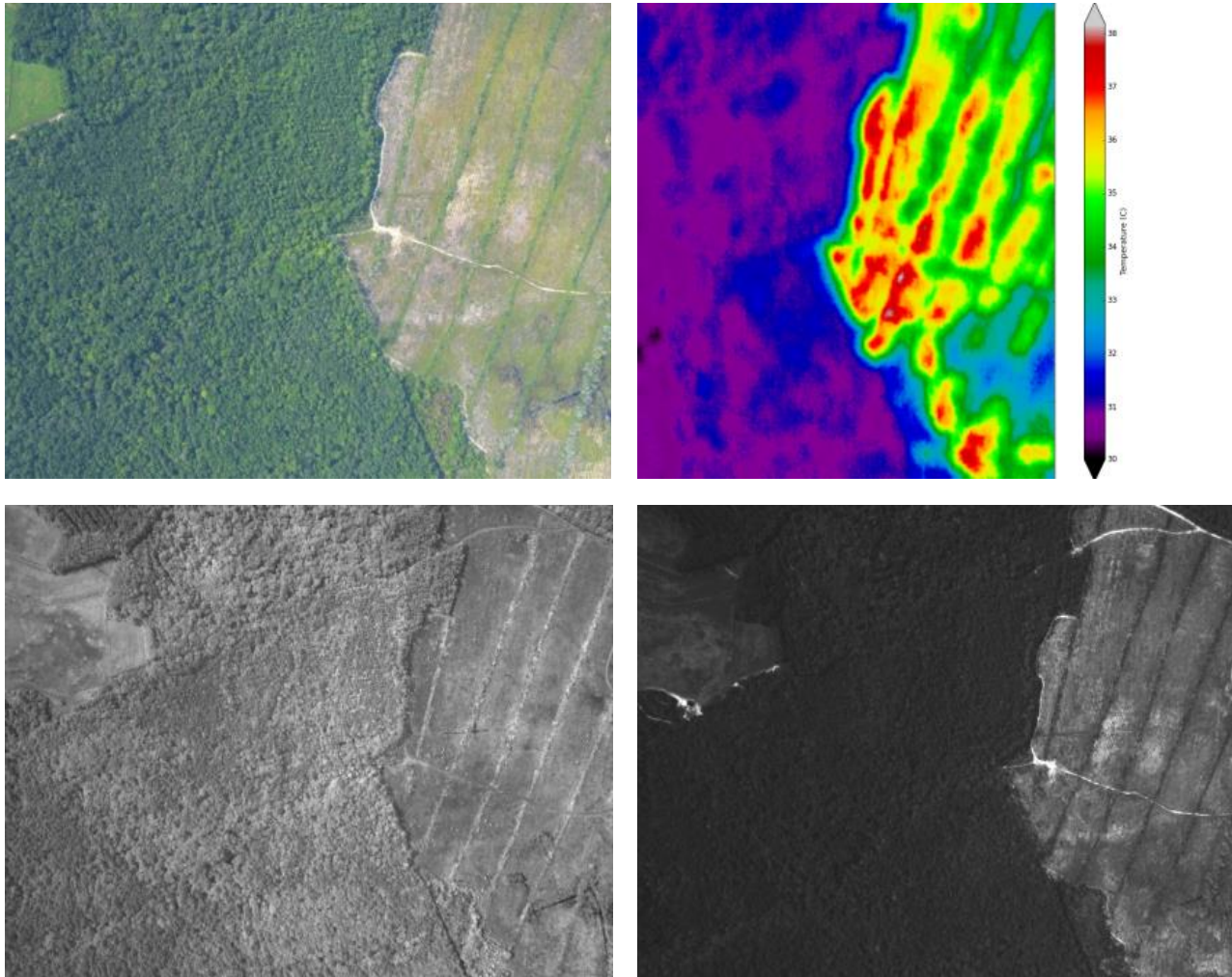


Images Courtesy of NASA ATM Team

Surface Imaging System (SIS)

CARAFE 3-Camera System Example

Color, Thermal Infrared, Multispectral (Red, Near-Infrared shown)



Images Courtesy of NASA ATM Team

Vanilla Aircraft VA001 Multispectral Composite

LandSat False color
technique to
enhance
chlorophyll

Near IR band= red
Red band=green
Green band =blue

MicaSense
(adjusted)*

Near IR (4) =red
Red band (3) =green
Green band (2)= blue

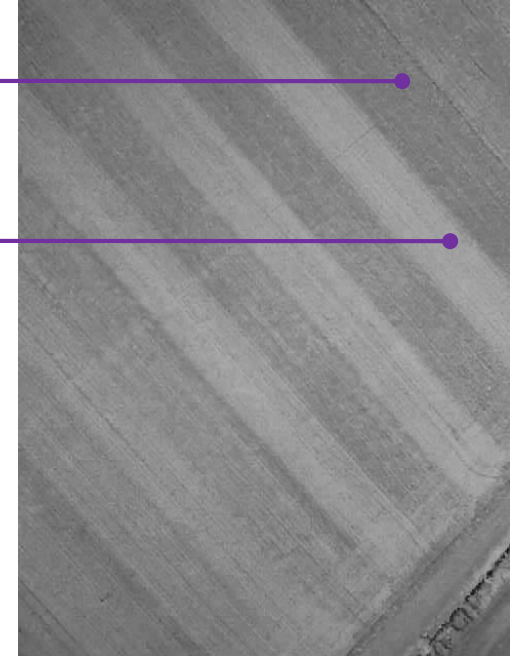
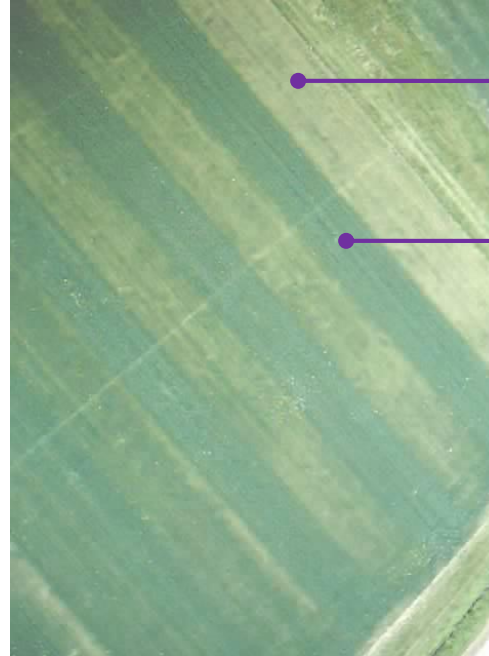
*Not identical bands
to LandSat and color
balance adjusted
for visual match to
LandSat images



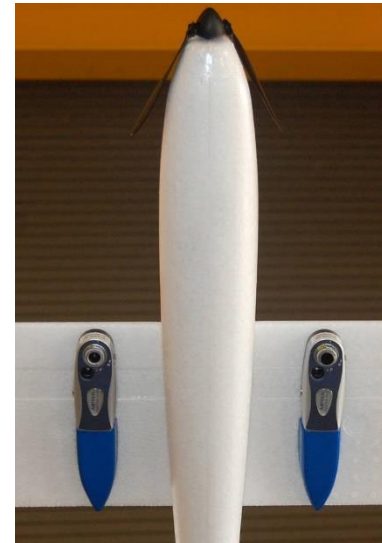
Images Courtesy of NASA ATM Team; Vanilla Aircraft, LLC



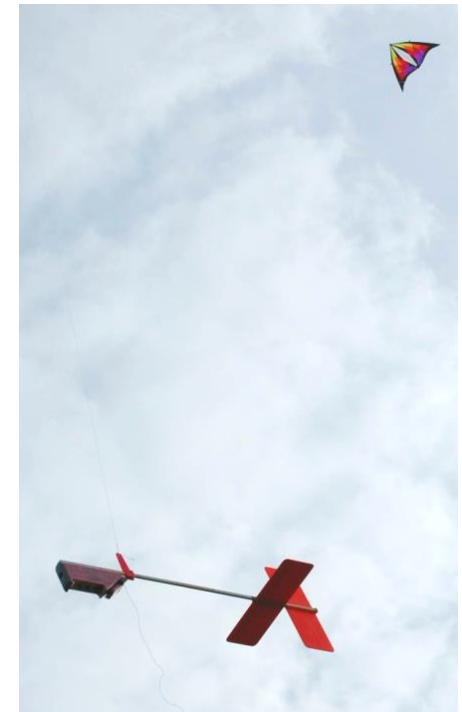
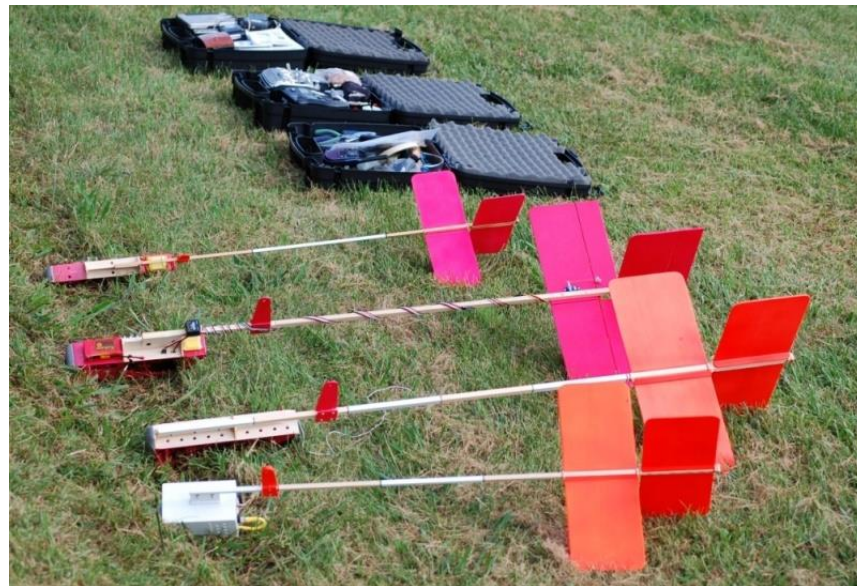
TwinCam



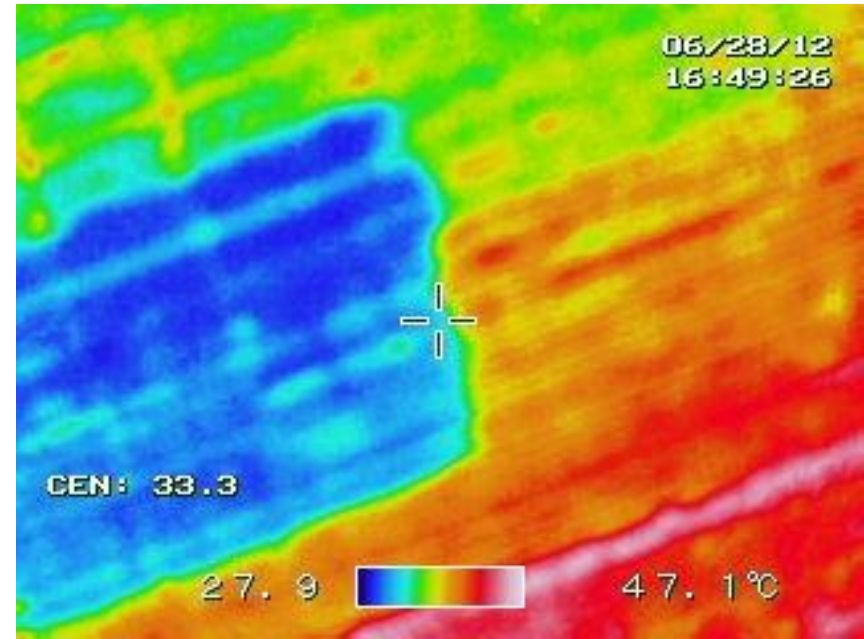
- Low-Cost Video Cameras: Color and Near-Infrared for Normalized Difference Vegetative Index (NDVI)
- With UMES Natural Sciences & Engineering and Aviation Sciences Departments



1912 Picavet Alternative - The Aeropod



UMES/Boseman Field - Thermal Imager

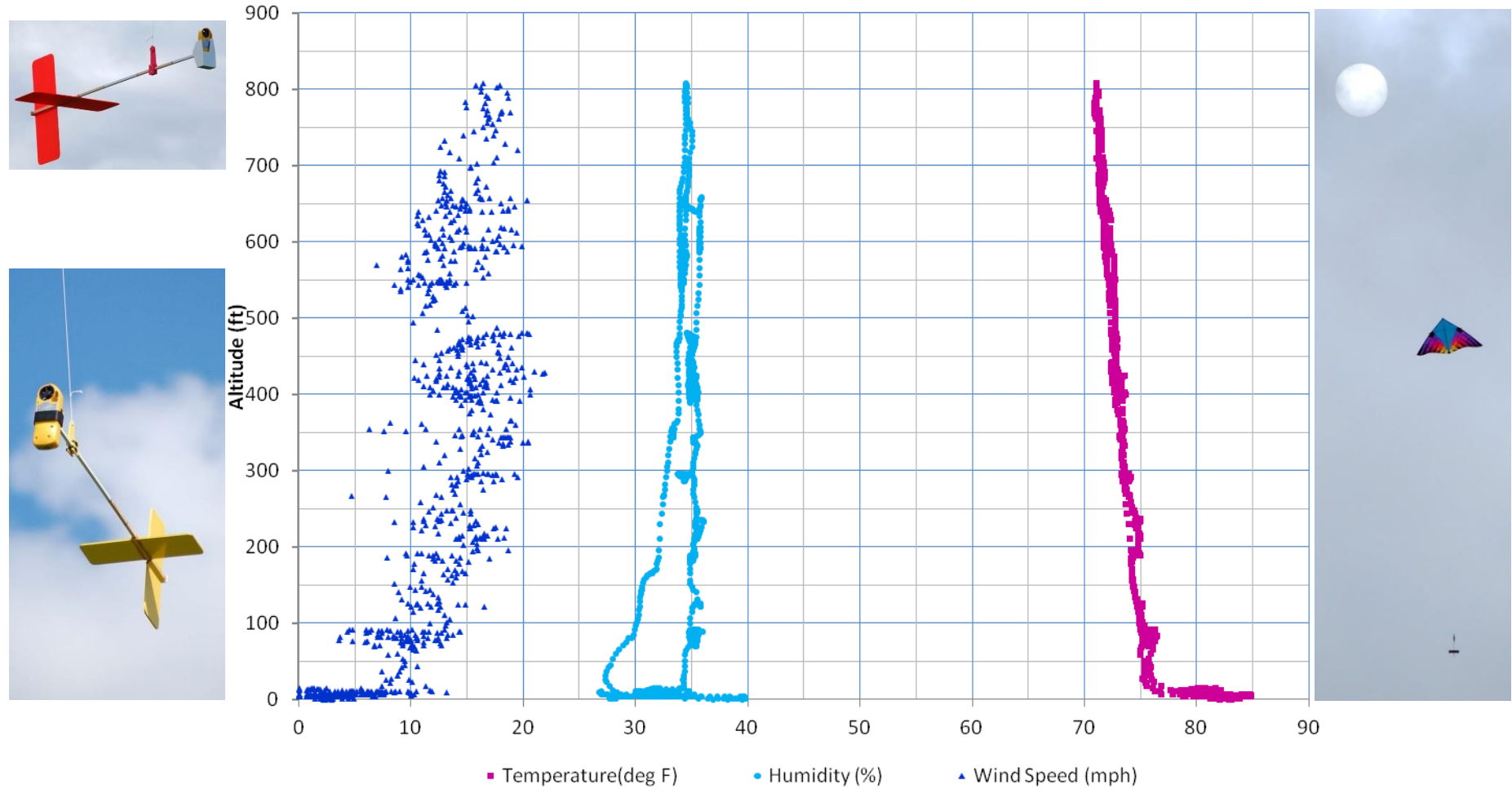


MultiPod



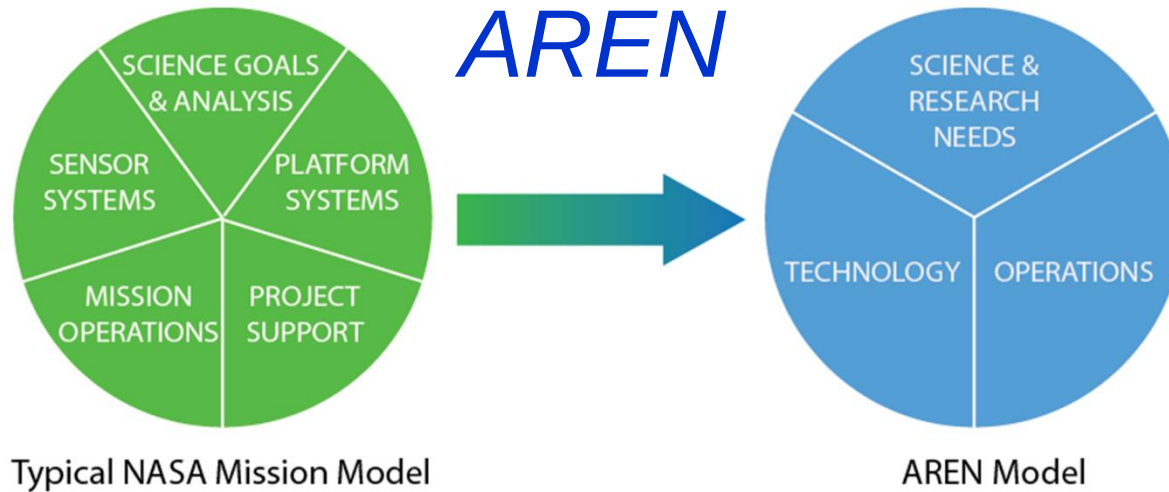
Profiler

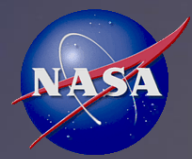
Boundary Layer Studies



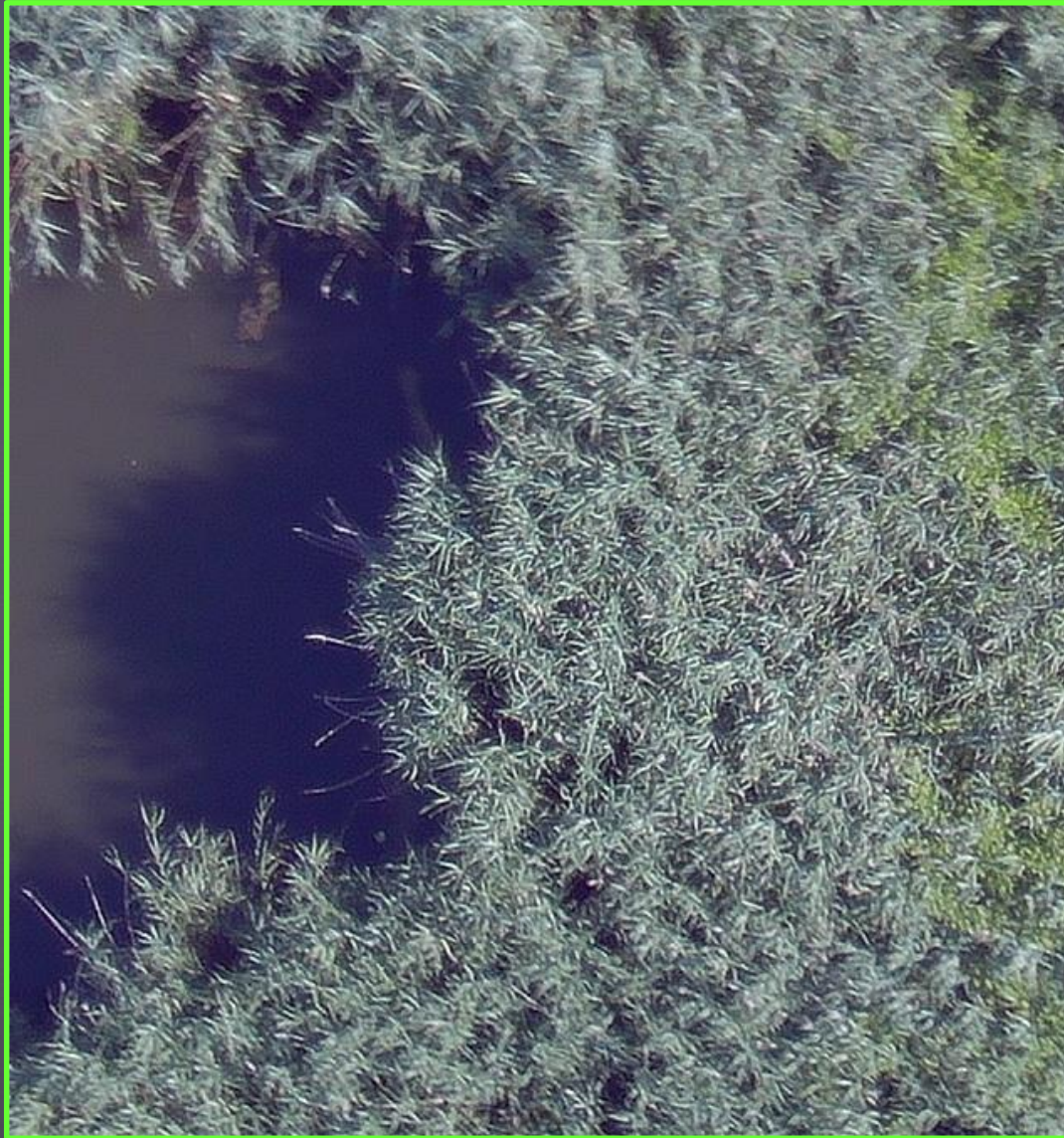


AEROKATS and ROVER Education Network





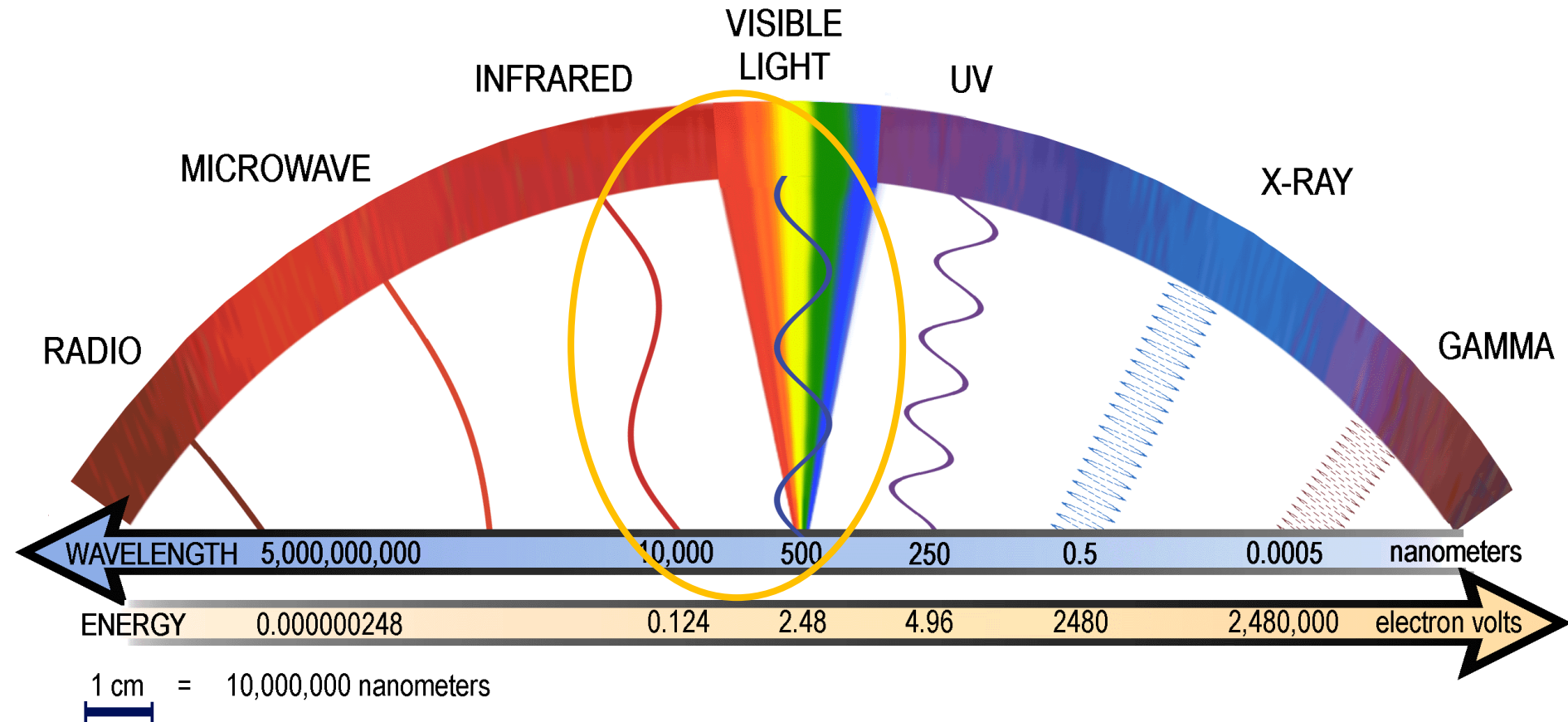
AEROKATS



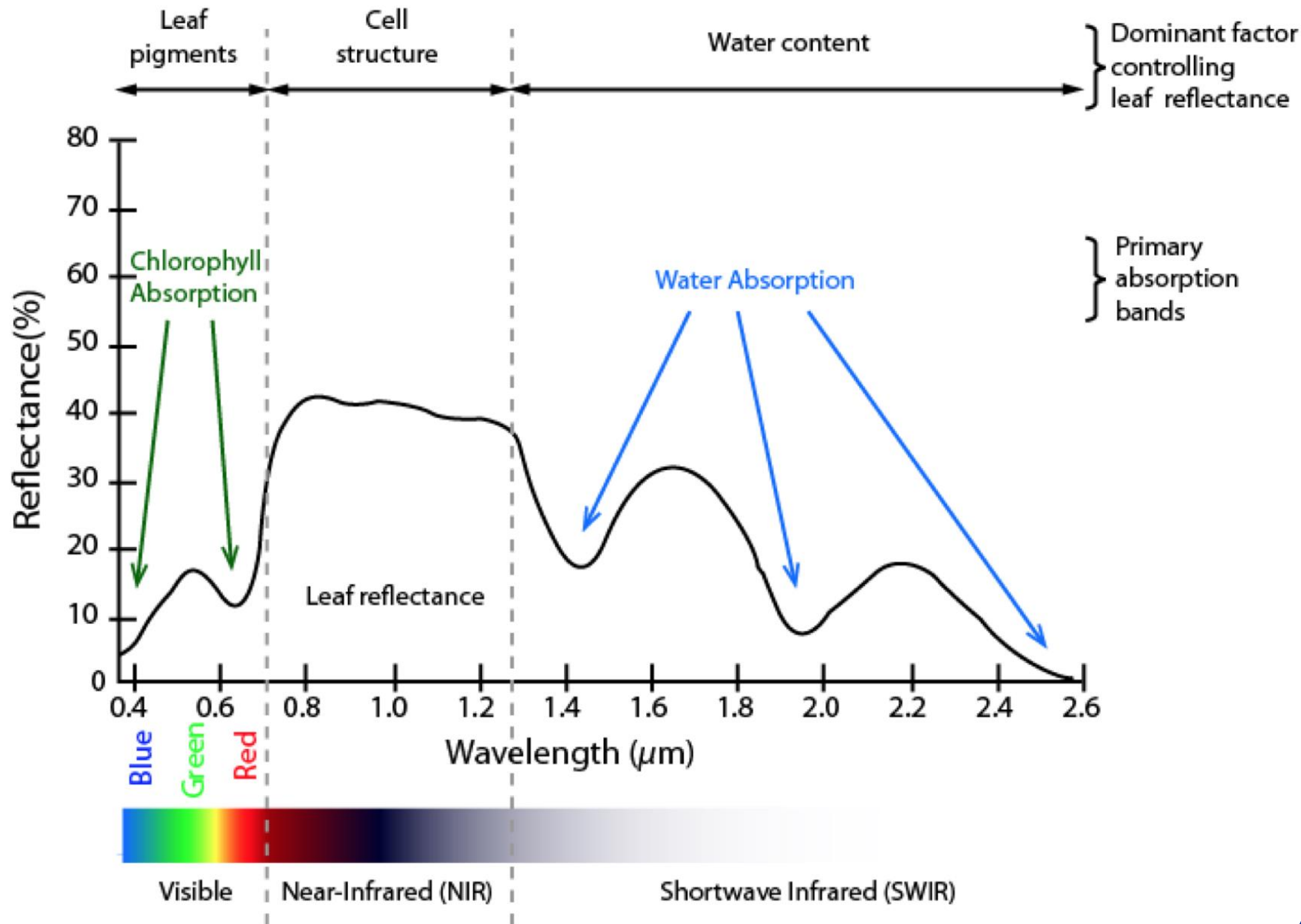
MonoCam



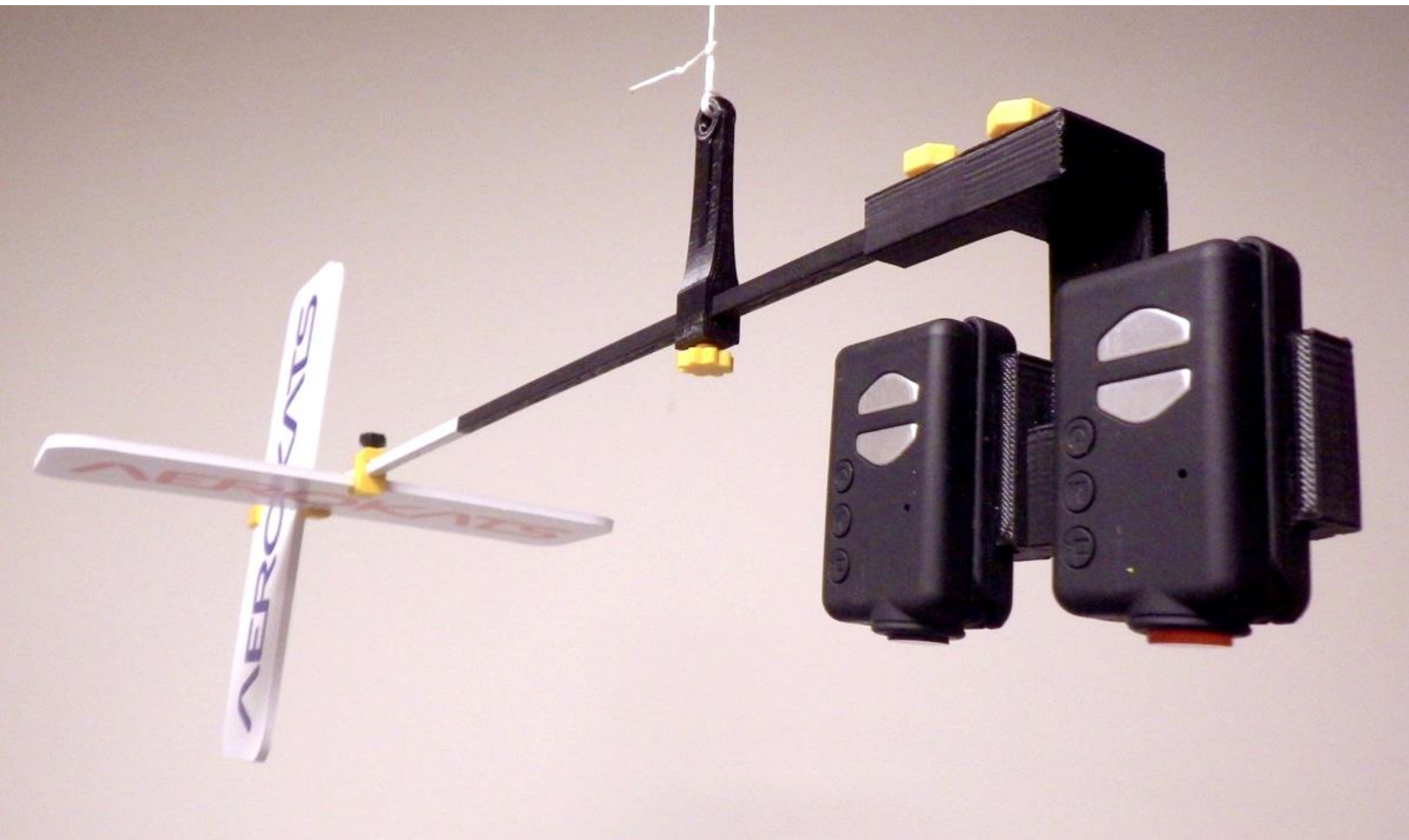
Electromagnetic Spectrum



Spectral characteristics of healthy green vegetation



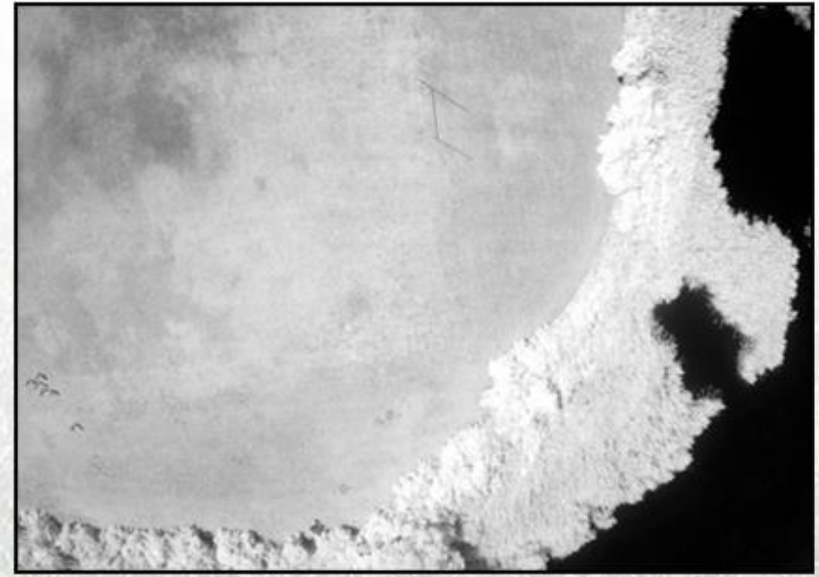
TwinCam



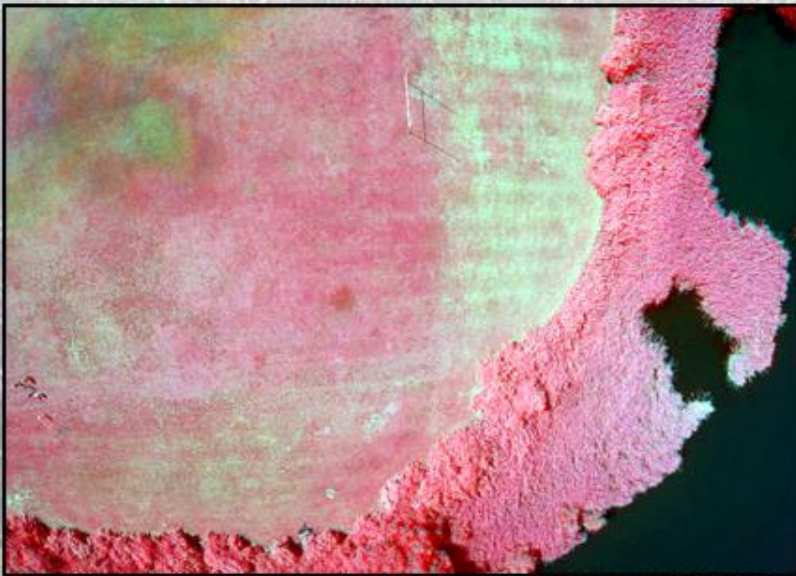
Twin Cam Image Processing - Classification Example



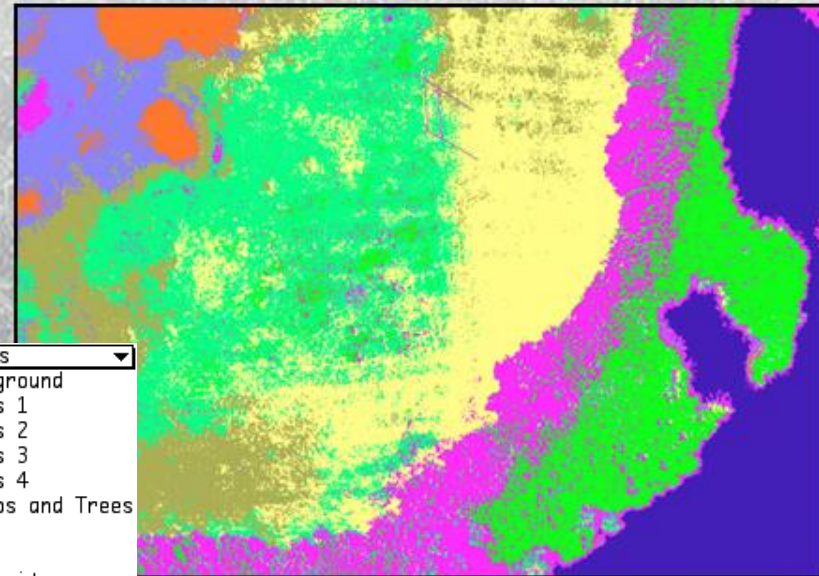
Visible (RGB)



Near Infrared (N)



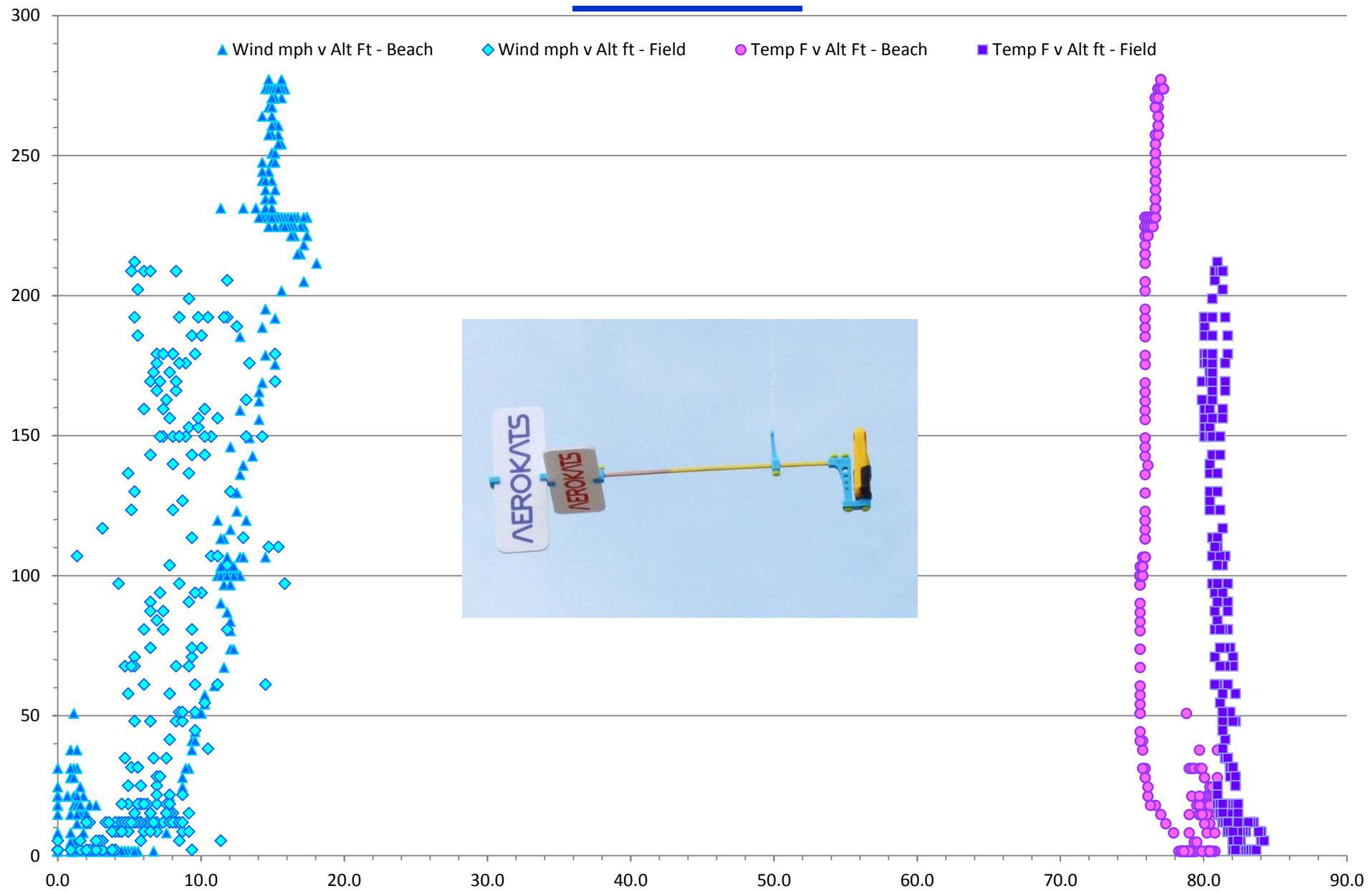
Composite (NRG)



Classified

- Classes
- background
 - Grass 1
 - Grass 2
 - Grass 3
 - Grass 4
 - Shrubs and Trees
 - Phragmites
 - Grass 5
 - Water

Profiler



VEREX

Volcanic Retrievals Emissions Experiment

Pieri, et al – Feb. 12, 2017



VEREX

Volcanic Retrievals Emissions Experiment



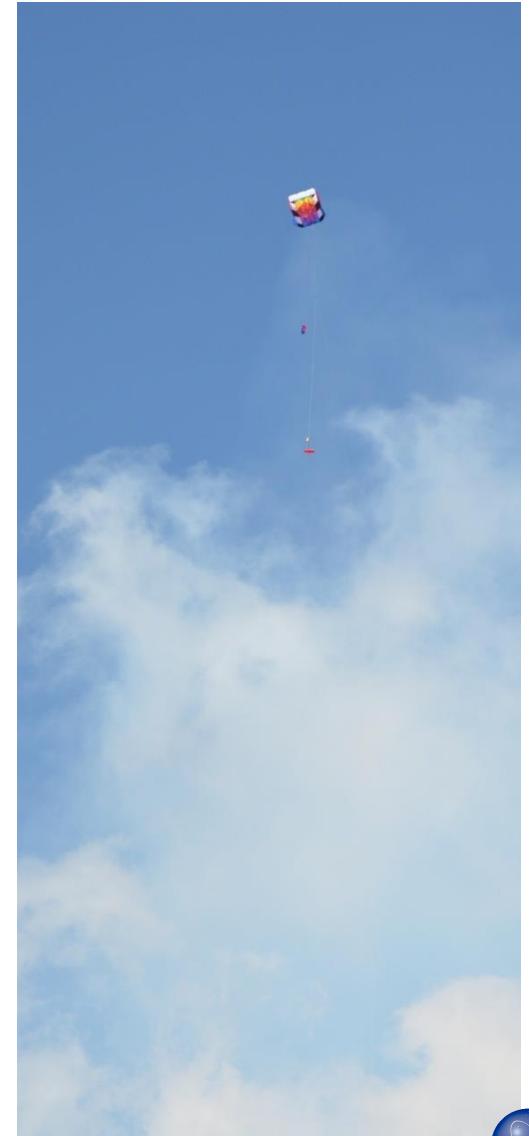
VEREX

Volcanic Retrievals Emissions Experiment



VEREX

Volcanic Retrievals Emissions Experiment



VEREX

Volcanic Retrievals Emissions Experiment



MicroSpectrometer on MSC Barge

w/ Jeff Sumey, et al – California Univ. of Pennsylvania



Schmidt Ocean Institute R/V *Falcor*

Images Captured by S. Uz, et al/NASA



GLOBE

Global Learning and Observations to Benefit the Environment

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IN THE PALM OF YOUR HAND**

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observer.globe.gov



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**EARTH
RIGHT NOW**

What is the GLOBE Program?

- The *Global Learning and Observations to Benefit the Environment (GLOBE)* Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment. Announced by the U.S. Government on Earth Day in 1994, GLOBE launched its worldwide implementation in 1995.
- ***Vision:*** A worldwide community of students, teachers, scientists, and citizens working together to better understand, sustain, and improve Earth's environment at local, regional, and global scales.
- ***Mission:*** To promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery.
- www.globe.gov

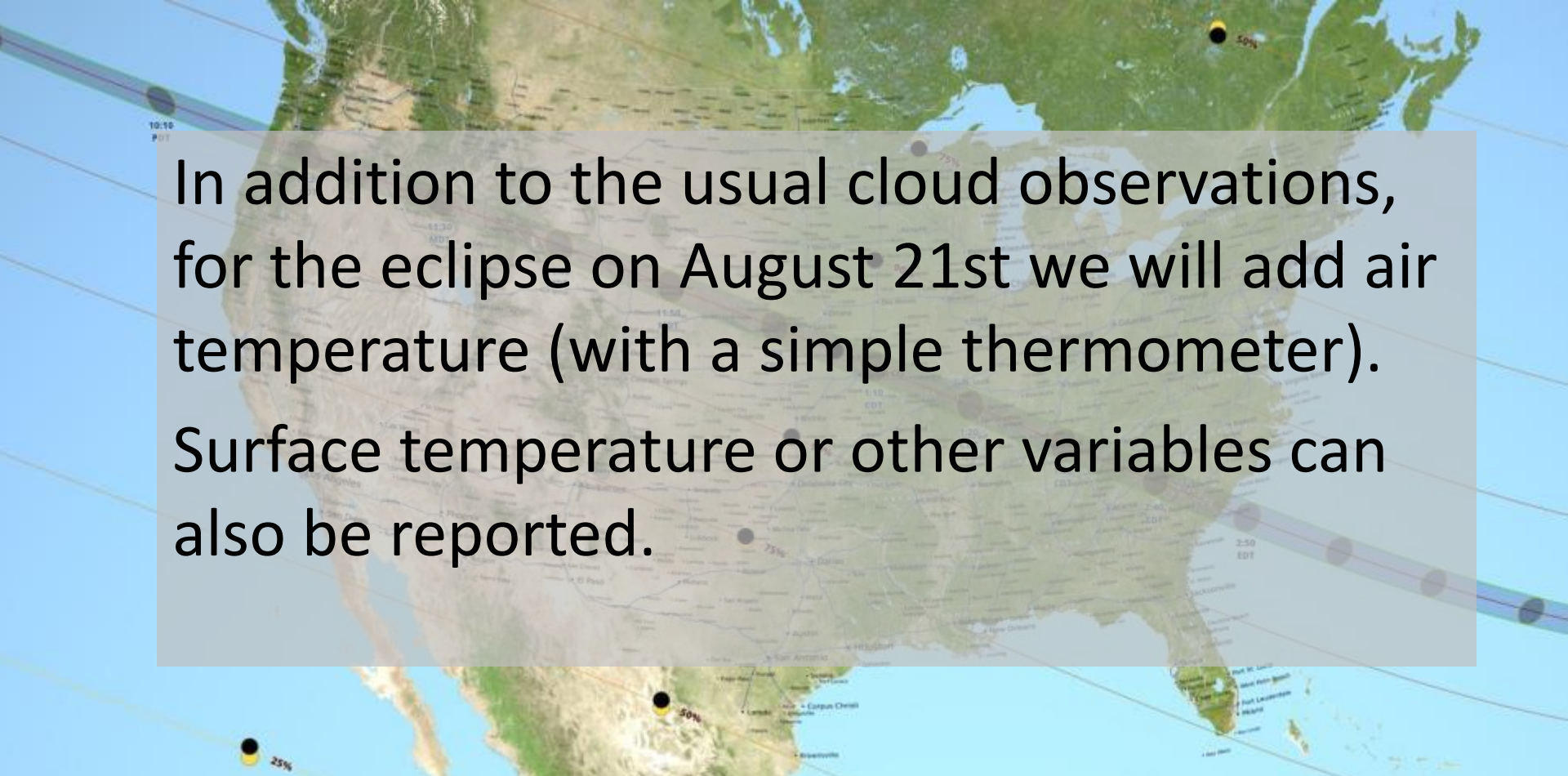
How Cool is the Eclipse?

Explore the Sun Earth Connection with GLOBE Observer

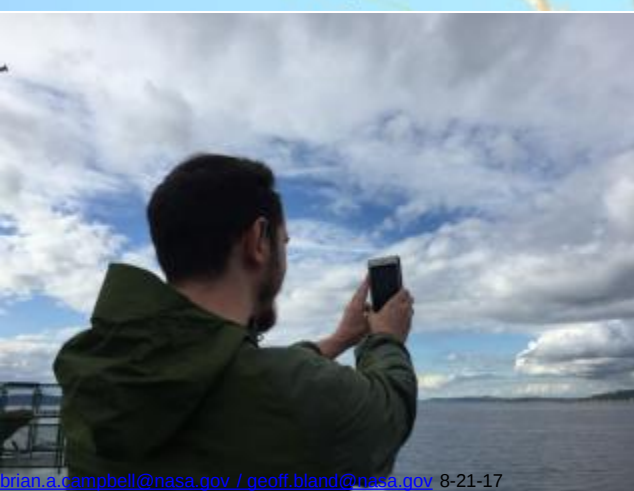
The Earth is solar-powered. What happens to clouds when the sun's light is blocked, even temporarily? If you measure air and surface temperature, how cool is the eclipse?

Help us answer these questions and others by collecting citizen science data during the Total Solar Eclipse on August 21, 2017.

- Observe how the eclipse changes atmospheric conditions near you.
- Contribute to a citizen science database used by scientists and students to study the effects of eclipses on the atmosphere.
- Provide comparison data even if you are not in the path of totality.



In addition to the usual cloud observations, for the eclipse on August 21st we will add air temperature (with a simple thermometer). Surface temperature or other variables can also be reported.





Choose your protocol:



Visit the GLOBE Website



Read further information, about how to make observations, including details about how to observe the eclipse safely.

Adjust your settings, including the type of thermometer you have, reporting in degrees (Celsius or Fahrenheit) and whether or not you want measurement alarms.

Settings

Please confirm your thermometer type:

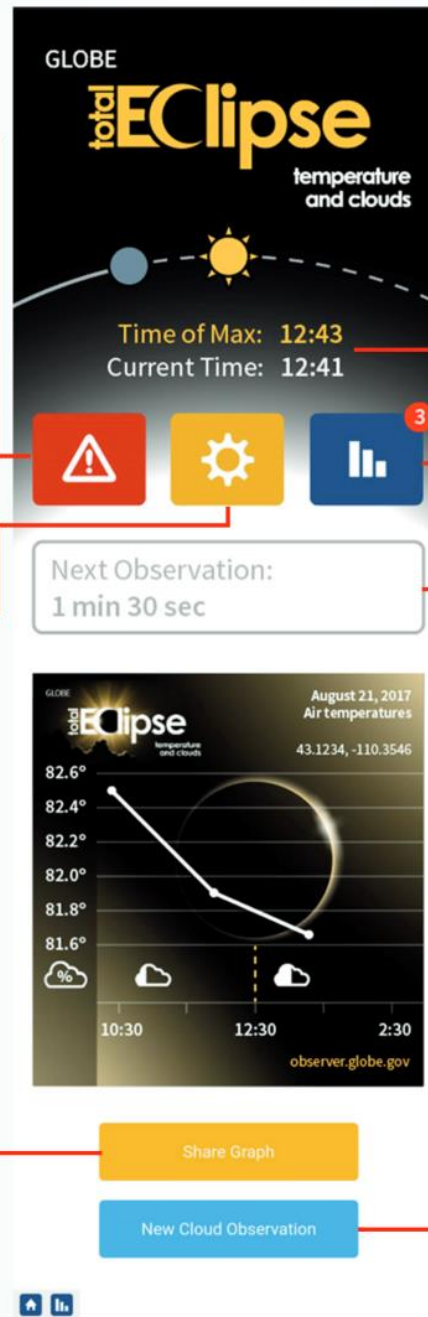
Type of Thermometer: ▼

C **F**

Measurement Alarm: On

Location: 39.0009, -76.9146

You can share your graph on social media to let others know you made eclipse observations and contributed to citizen science with GLOBE and NASA!



See the current time, as well as when the time of maximum eclipse will occur based on your location.

View, edit, or delete previous measurements.

See how long until your next observation. If you have turned on the Measurement Alarm, you will also get a notification. When it is time to enter data, click to get a scroll bar to report the current temperature

Enter Data Now! ▼

Done

74.8
74.7
74.6
74.5
74.4
74.3

As you make temperature measurements, the app will periodically remind you to also observe the clouds, but you can make additional observations anytime, then return to the eclipse page.

For more information, visit: observer.globe.gov/eclipse2017



For citizen scientists



GLOBE Observer / Science / Total Eclipse 2017 /

How Cool is the Eclipse?

The Earth is solar-powered. So what happens when the Sun's light is blocked, even temporarily? If you measure air and surface temperature, how cool is the eclipse?

Help us answer these questions and others by collecting citizen science data using the GLOBE Observer app during the Total Solar Eclipse on August 21st, 2017.

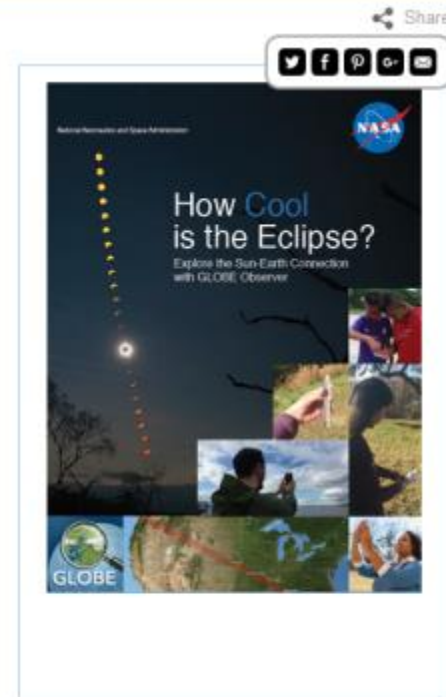
- Observe how the eclipse changes atmospheric conditions near you
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- Provide comparison data even if you are not in the path of totality

How should I make observations during the eclipse?

First and foremost, make sure you are being safe when you are observing the eclipse. Looking directly at the Sun is unsafe except during the brief total phase of a solar eclipse ("totality"), when the moon entirely blocks the Sun's bright face, which will happen only within the narrow path of totality. For more details about how to observe safely, including the appropriate type of eclipse glasses and filters to use, visit the [NASA Eclipse 2017 webpage](#).



Also, a total solar eclipse is an amazing experience, apart from the interesting science involved. Especially for first-time eclipse observers, we recommend you put down your phone or camera during the precious few minutes of totality itself and just enjoy the experience. The data collection procedures below take that into account, and ask you to make observations and measurements before and after



<https://observer.globe.gov/eclipse2017>

