

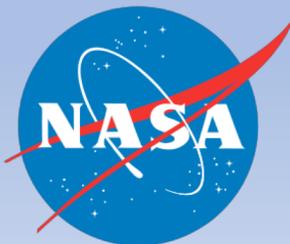
Cuvettes and Flux Towers in the Sky

David Schimel

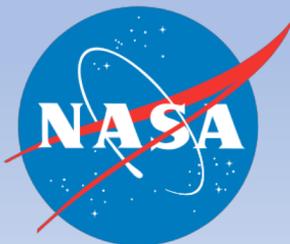
Jet Propulsion Lab

California Institute of Technology

Pasadena CA 91109



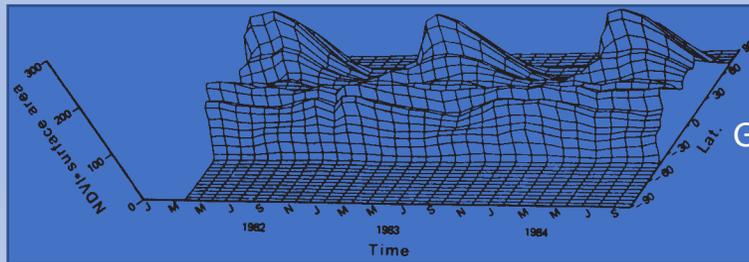
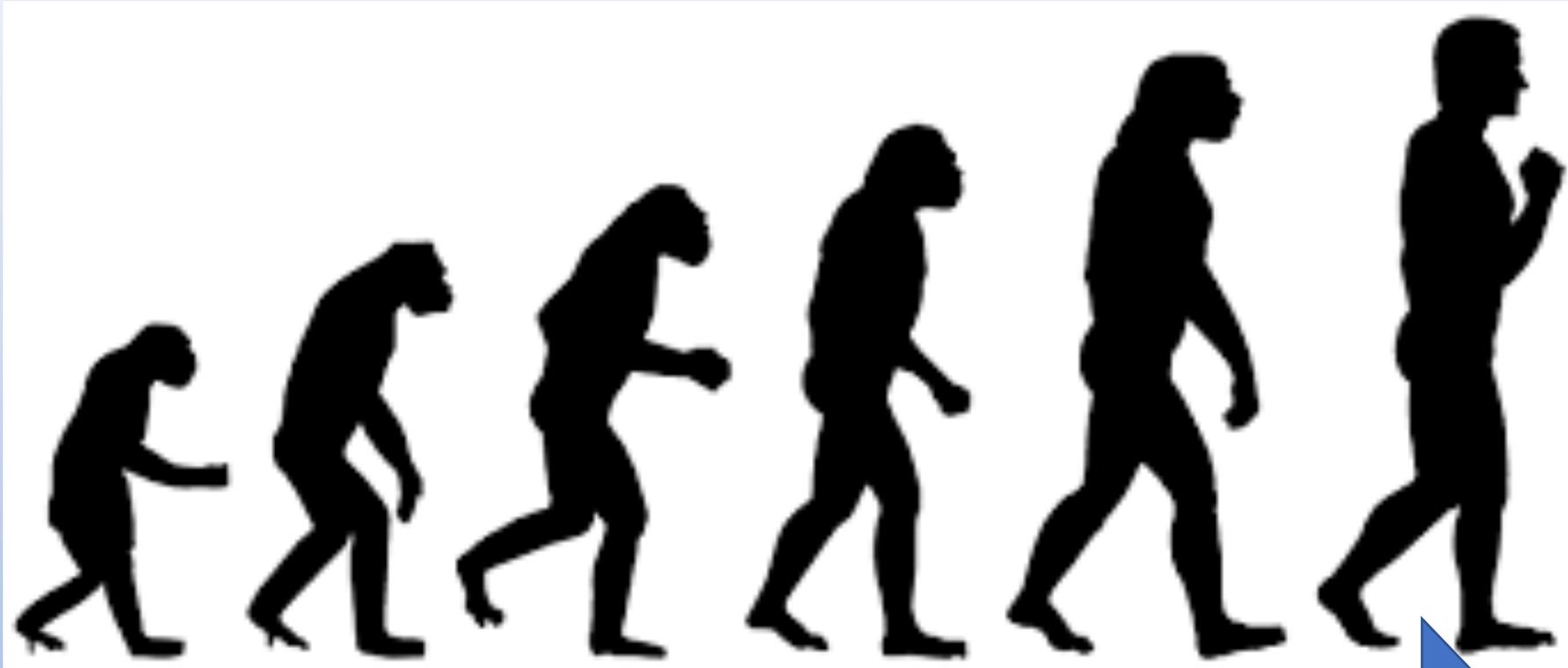
Vandenberg, 2 July 2014



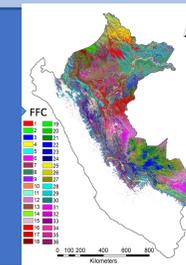
The Blue Marble



The evolution of global ecology

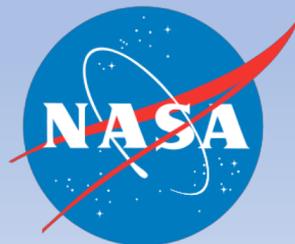
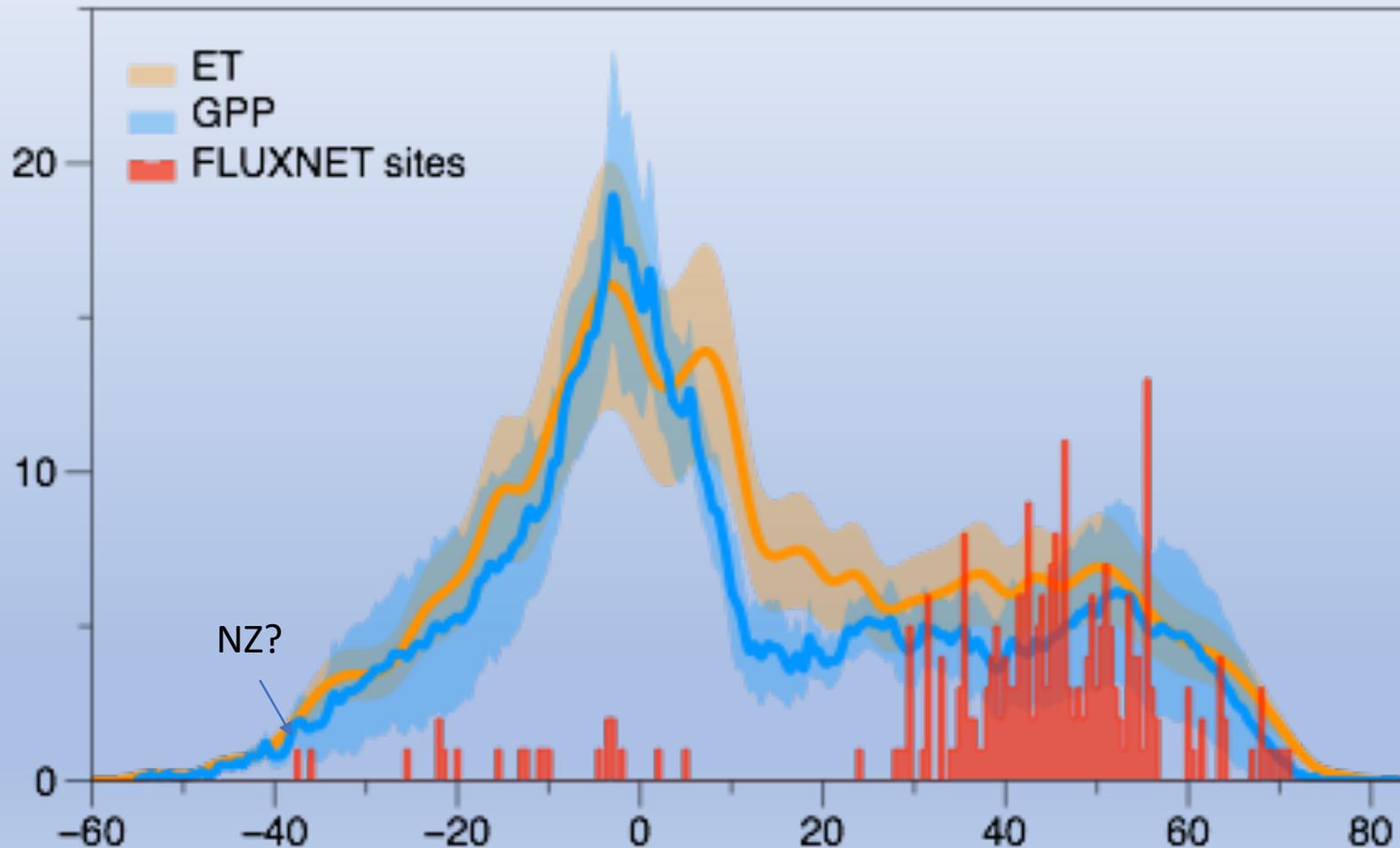


Green slime -> Plant Functional Diversity

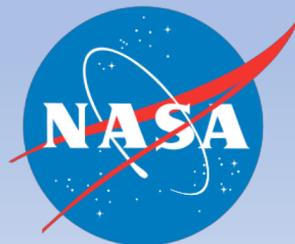
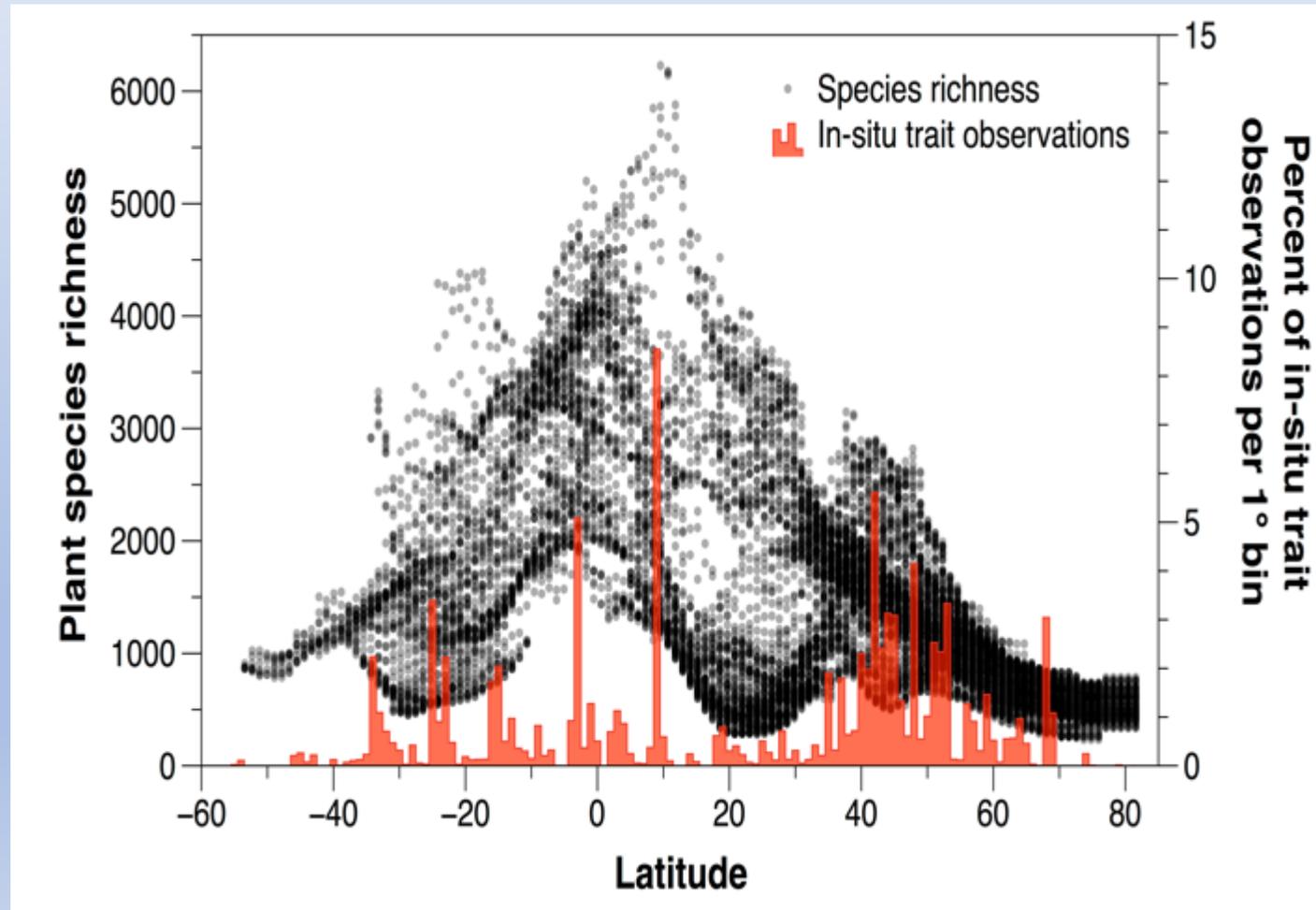


The Data Gap:

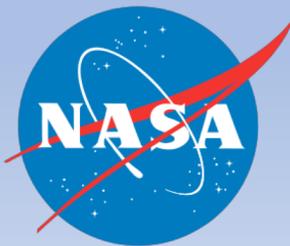
We don't observe our blue marble very well:
Global sampling of evapotranspiration and plant productivity



Biodiversity data shows the same sampling biases as do biomass and carbon/water flux



Ecologists in the Sky

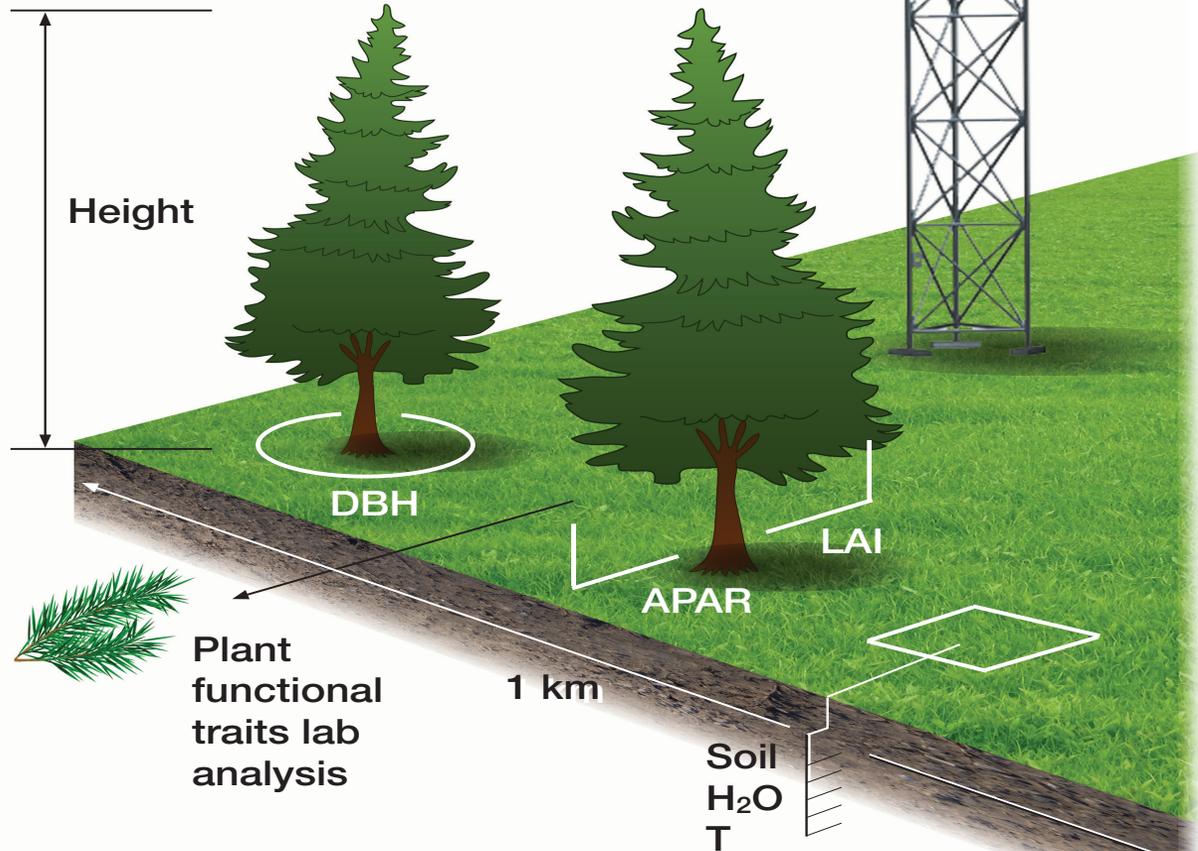


IN SITU

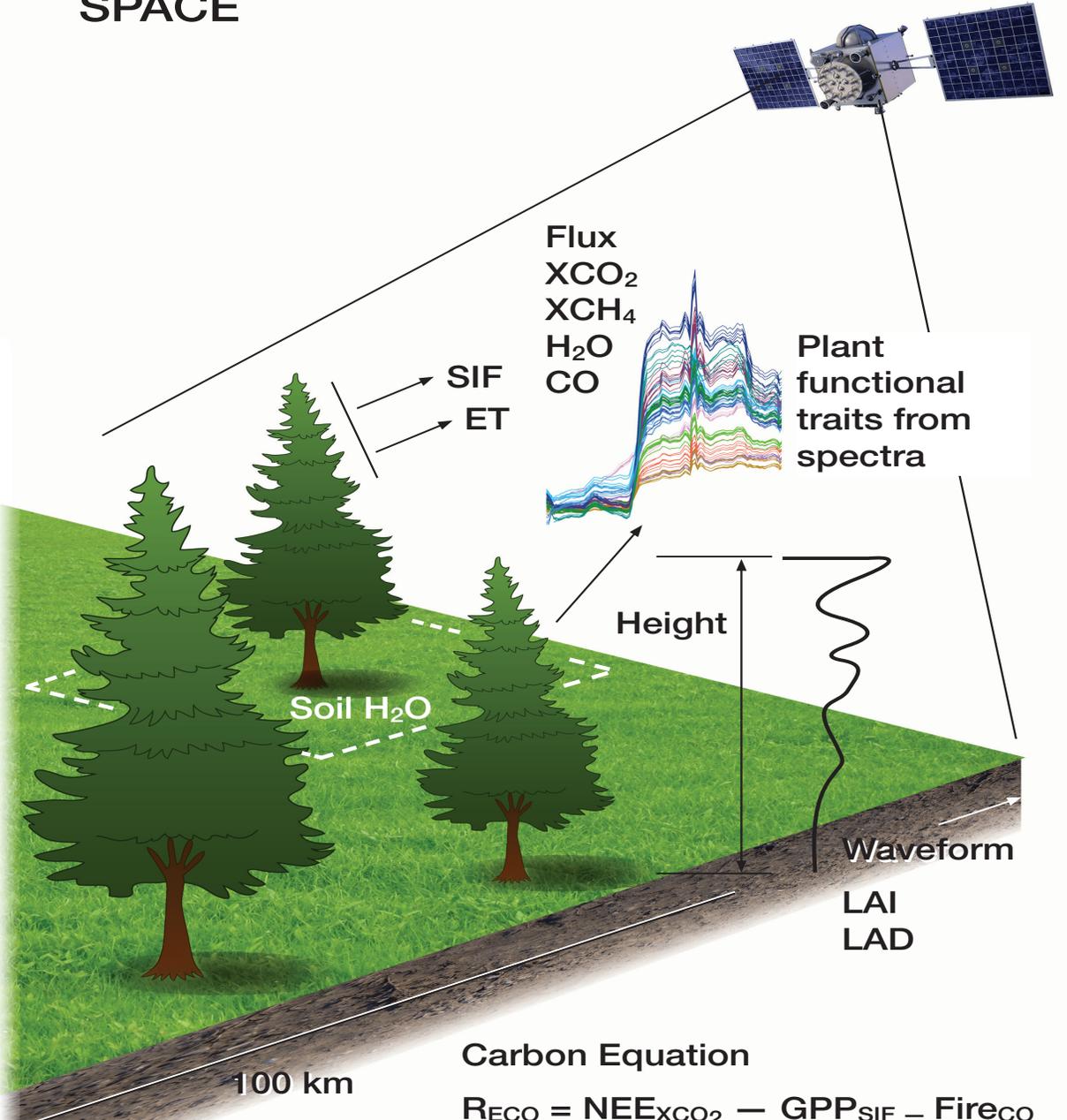
Carbon Equation

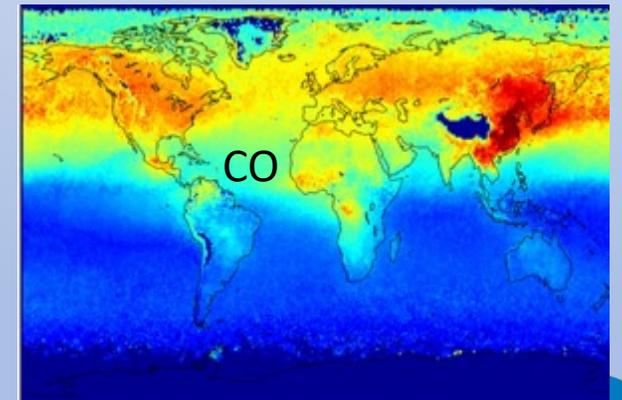
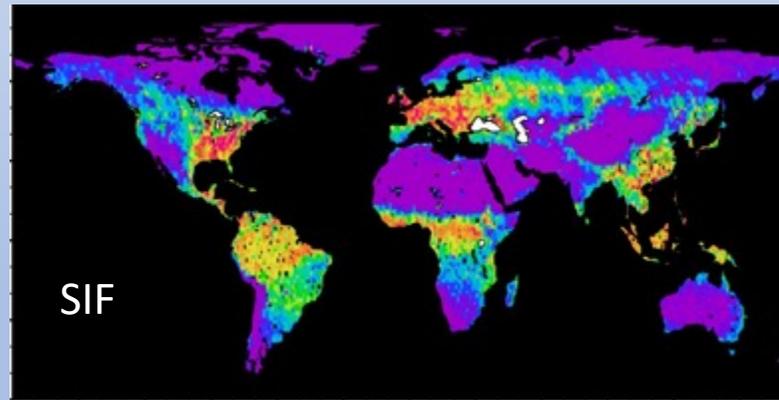
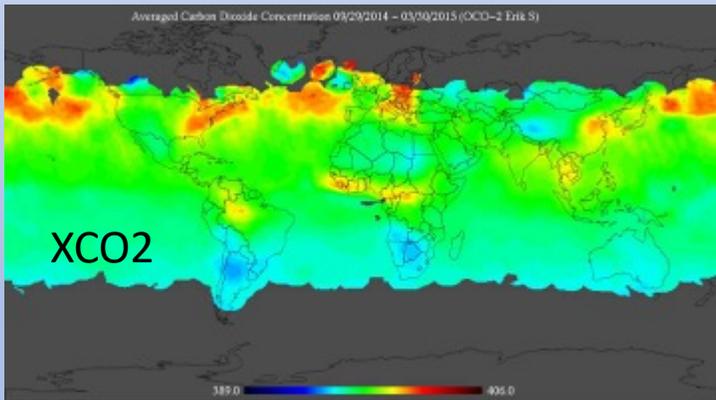
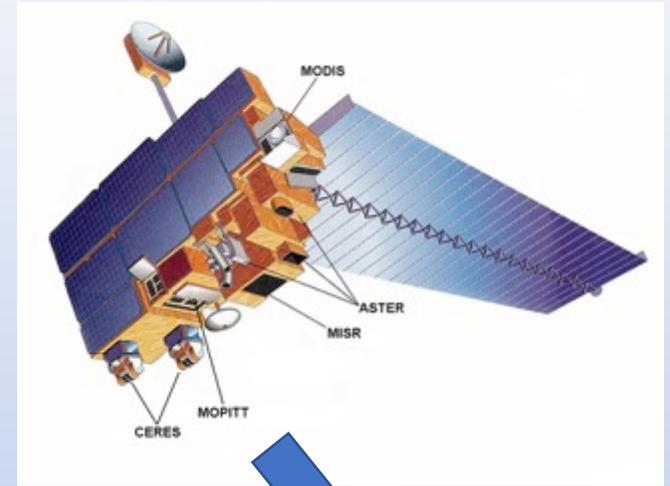
$$GPP = NEE_{EC} - R_{ECO} \text{ (night)}$$

Flux
H₂O
CO₂
CH₄
PAR

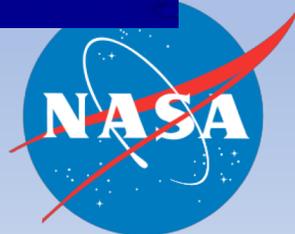


SPACE

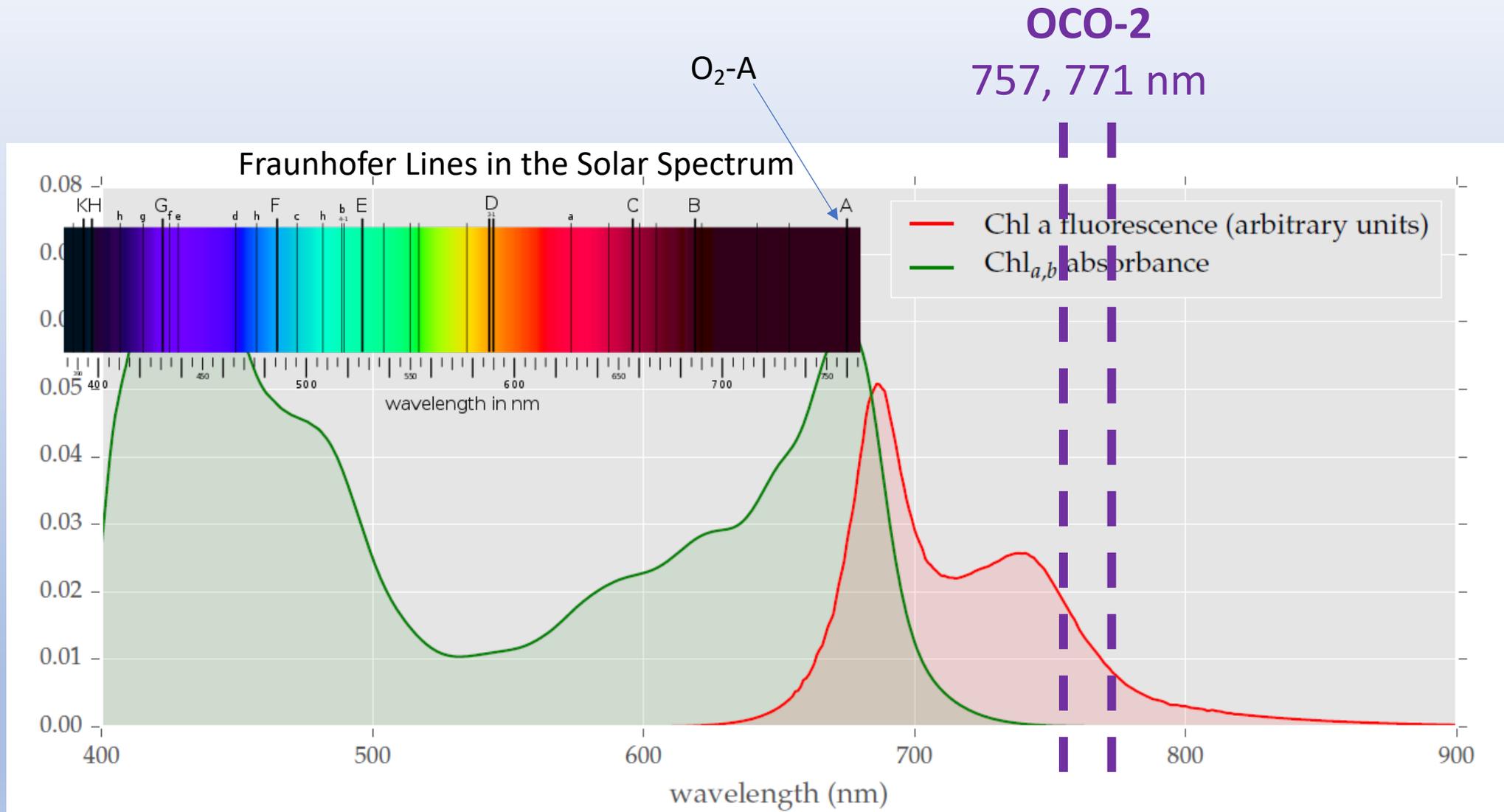




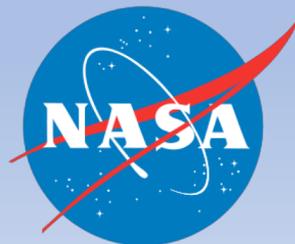
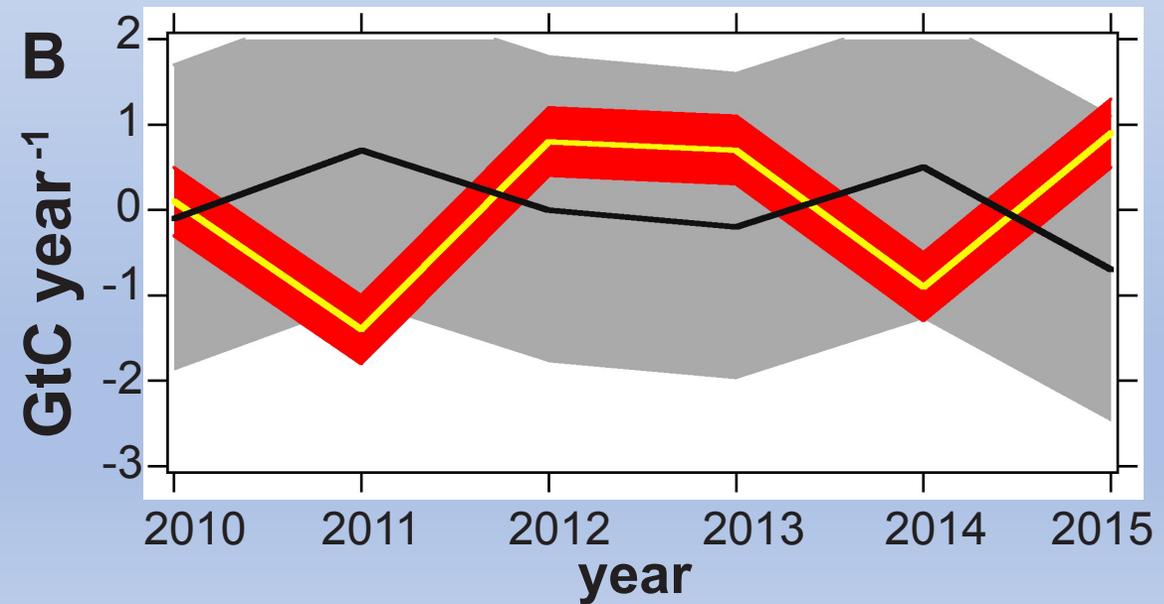
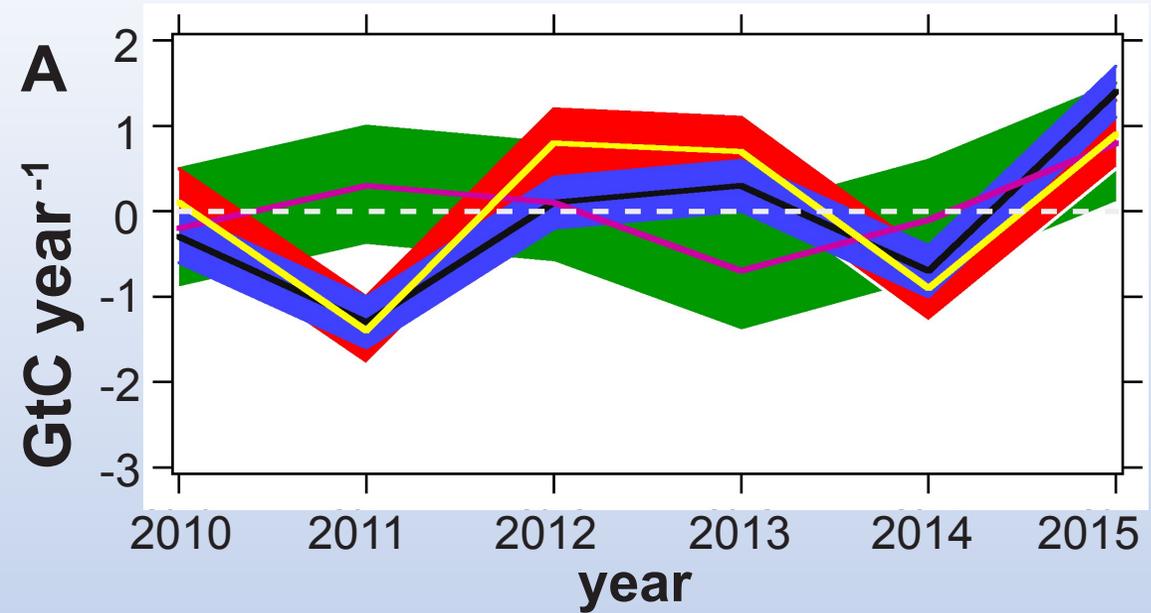
Flux towers in the sky



Spectroscopy of SIF.

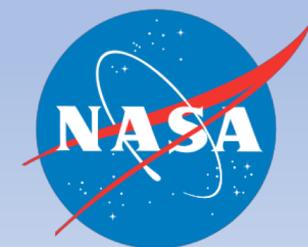
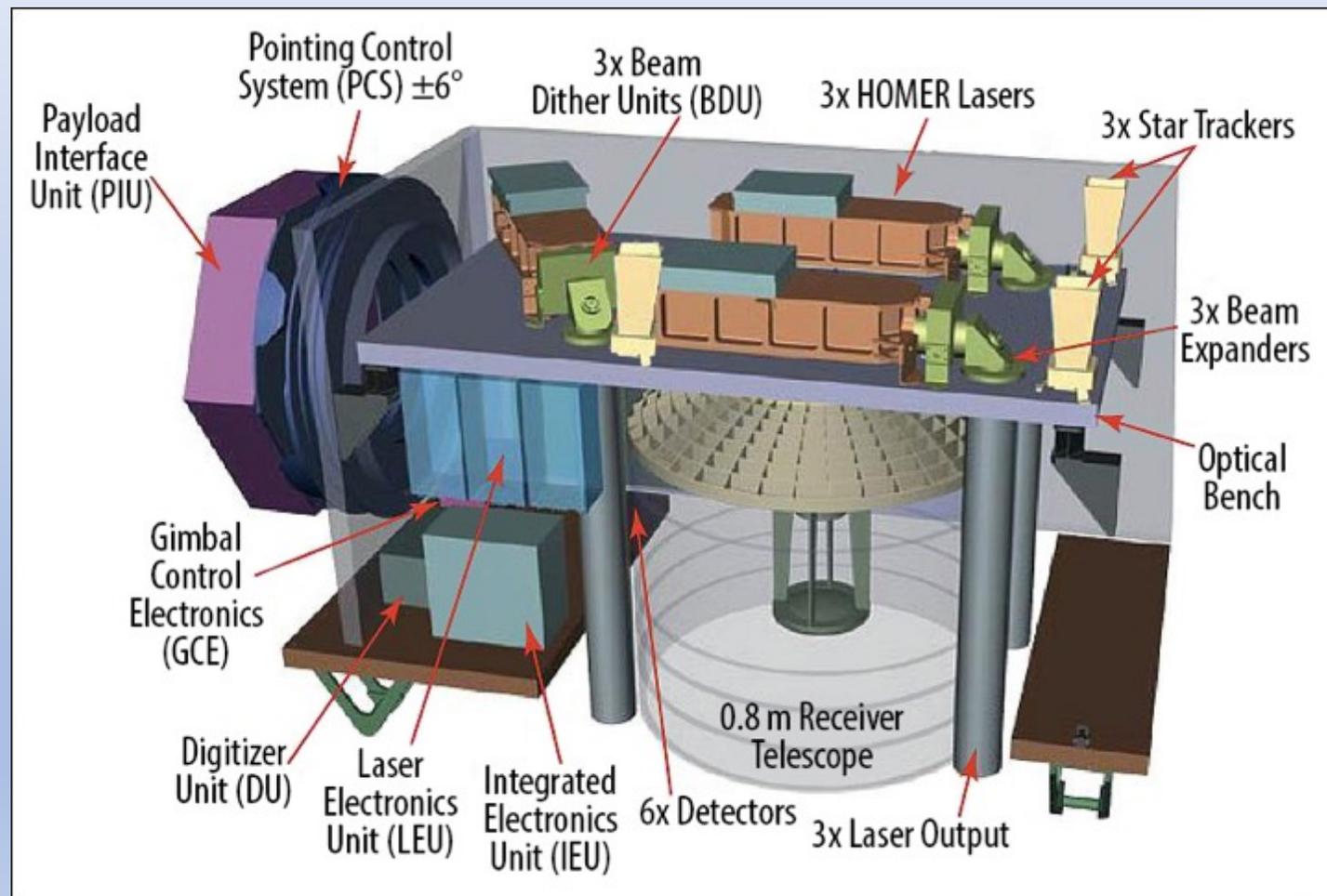


A longer record:
The tropics explain
the growth rate of
CO₂ but GPP does
not.

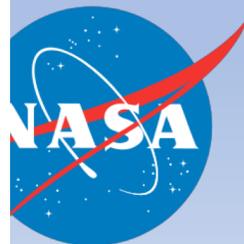
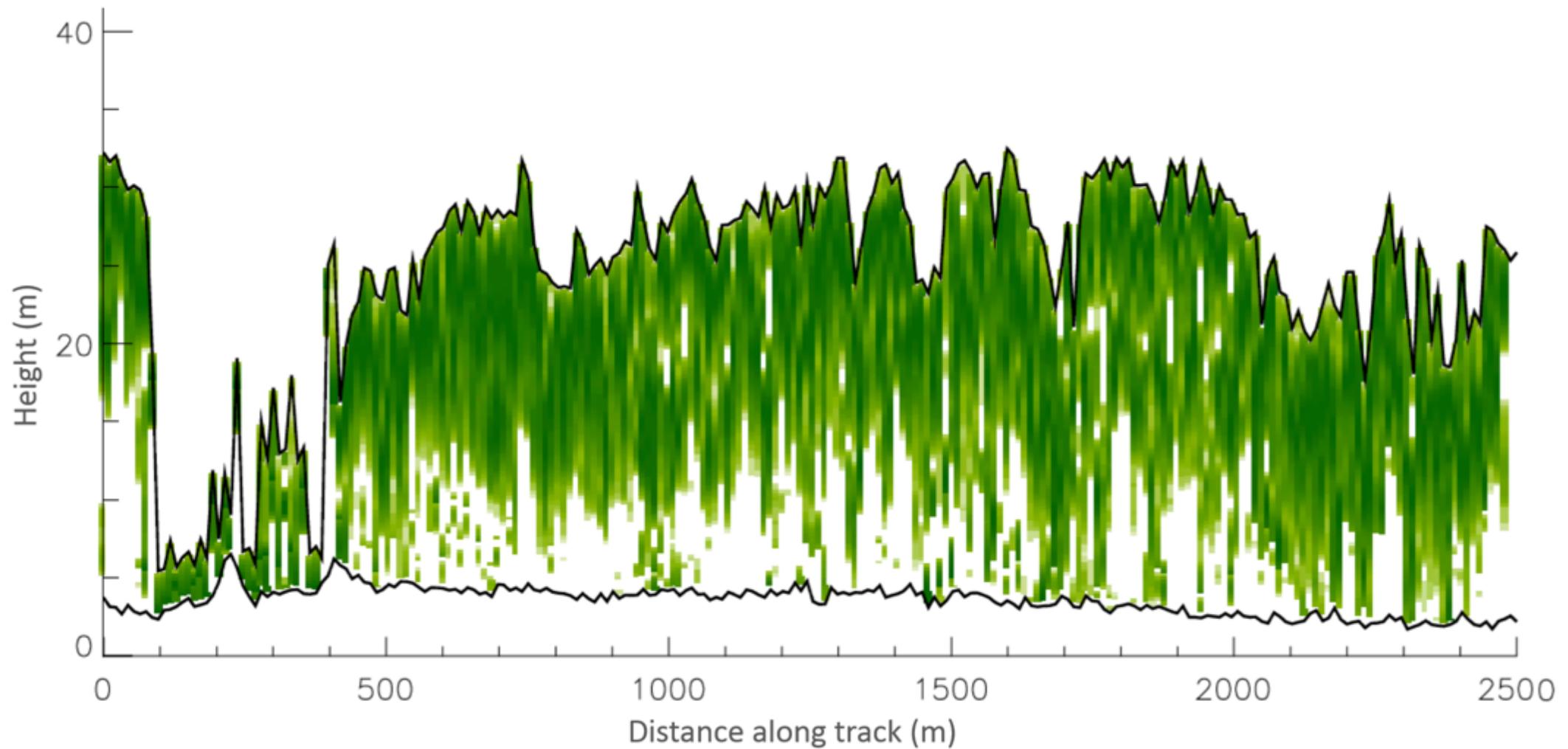


GEDI: November 2018

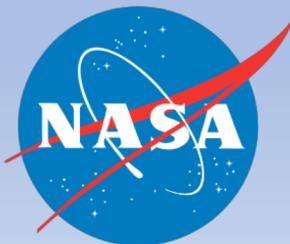
Biomass from Space

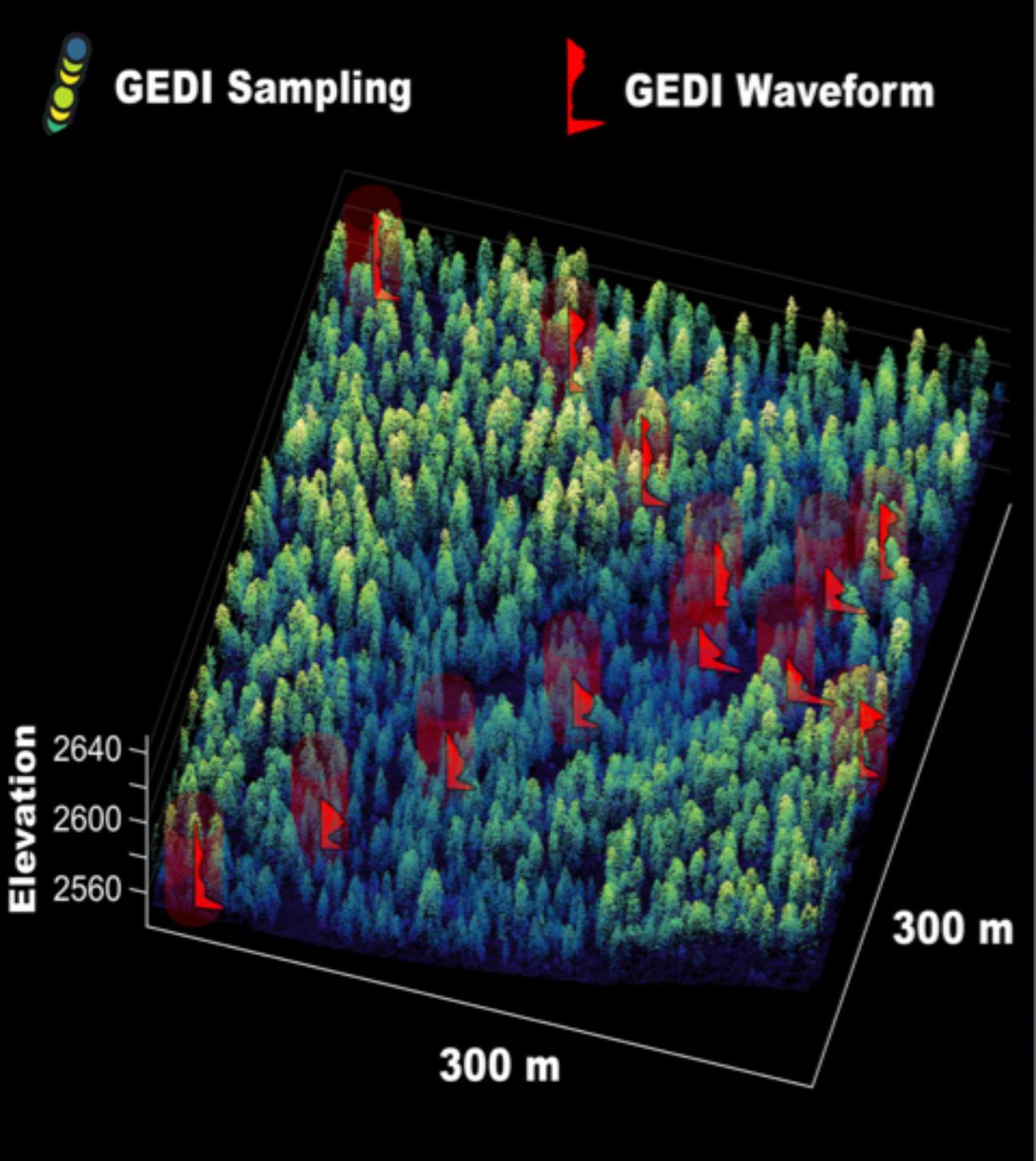
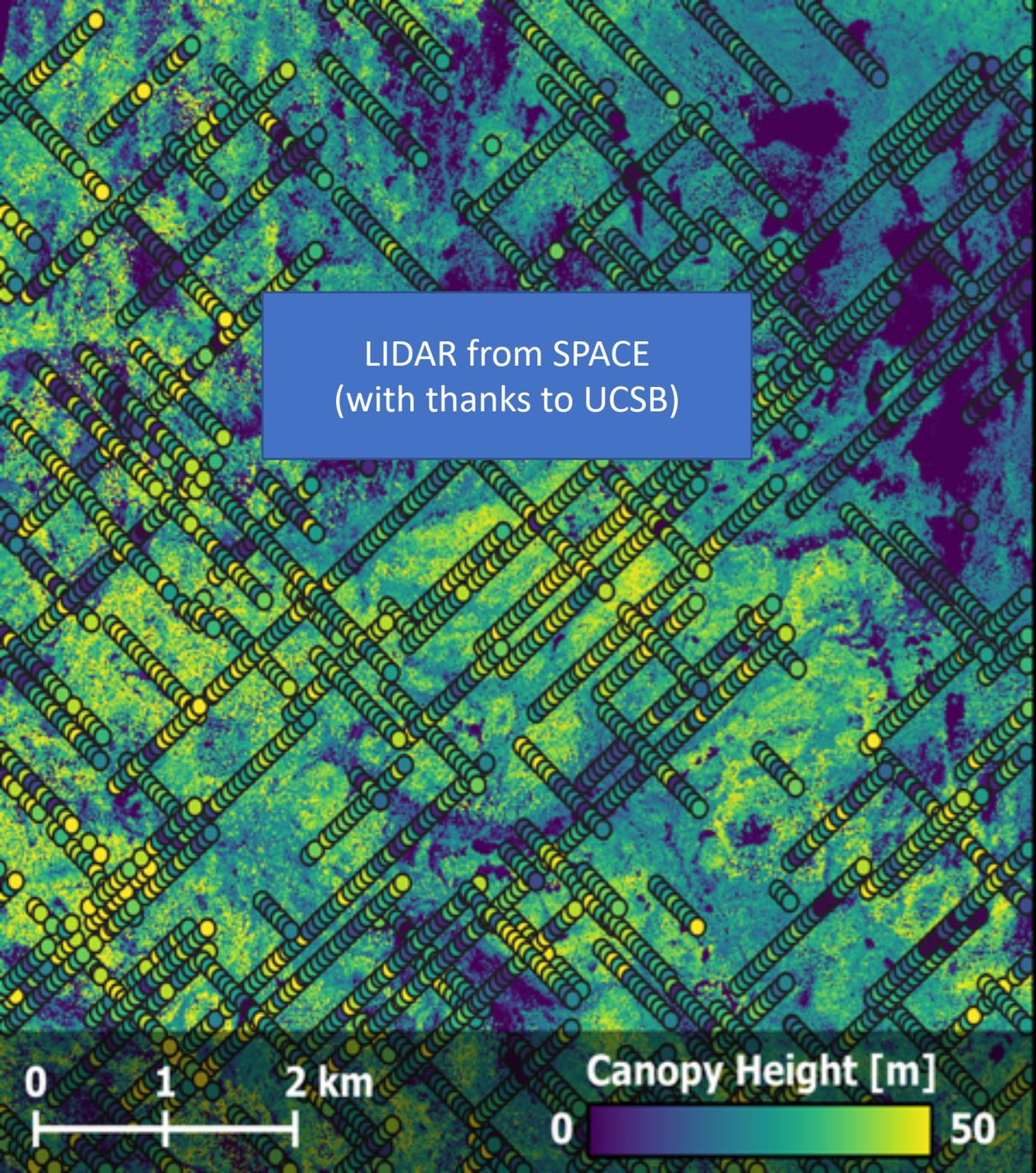


GEDI Data



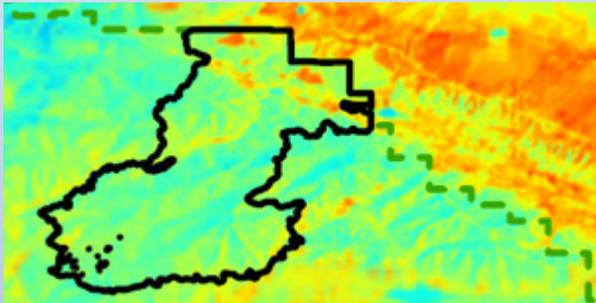
Zooming in on California





Thermal observationsL: Powerhouse Fire Imagery--2013

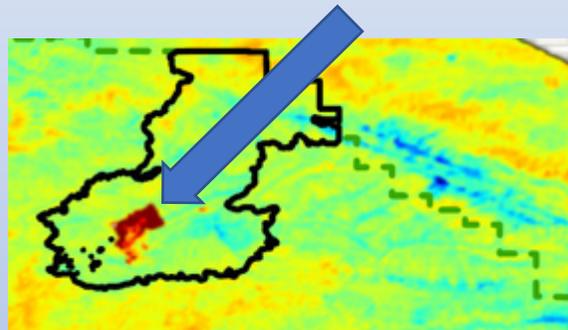
Cool surface temperatures from transpiring vegetation



Fire area is similar to surrounds

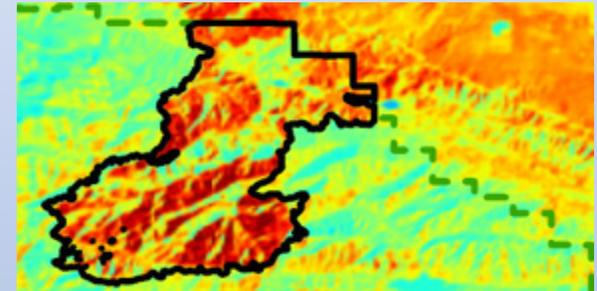
May 22 2013

Active burning, recorded in the infrared

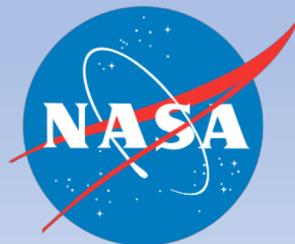


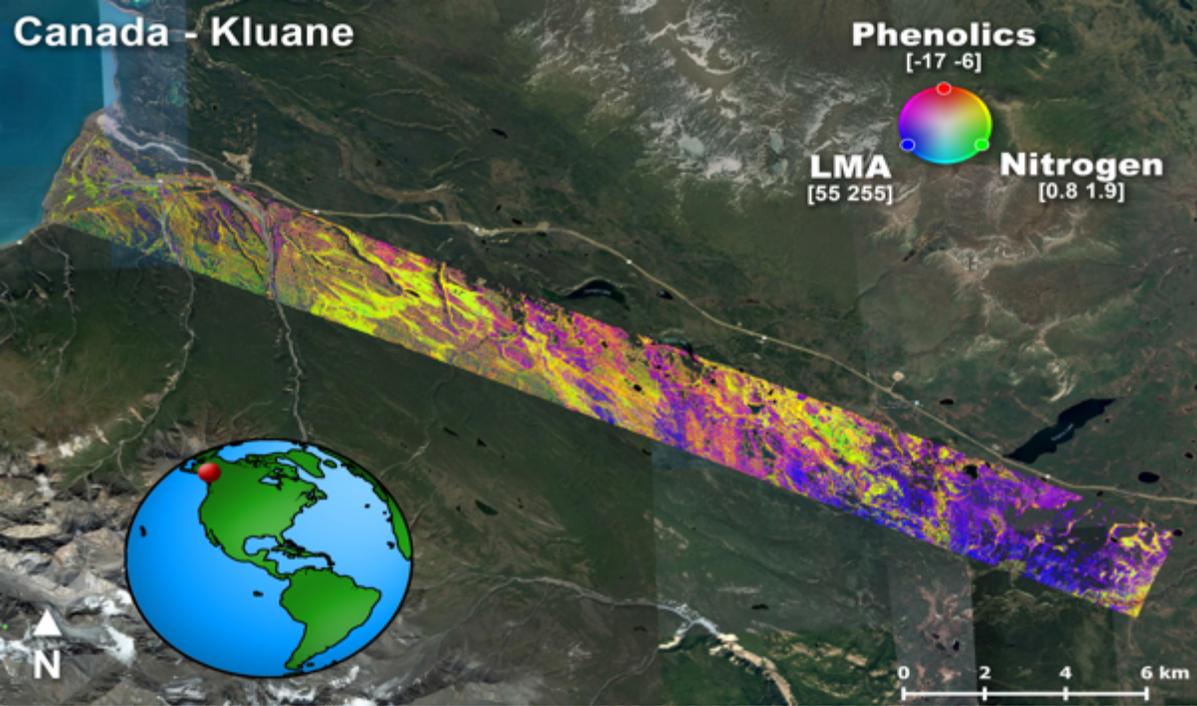
June 1, 2013

Hot surface, not cooled by active vegetation

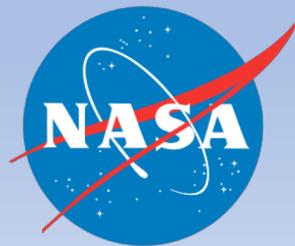
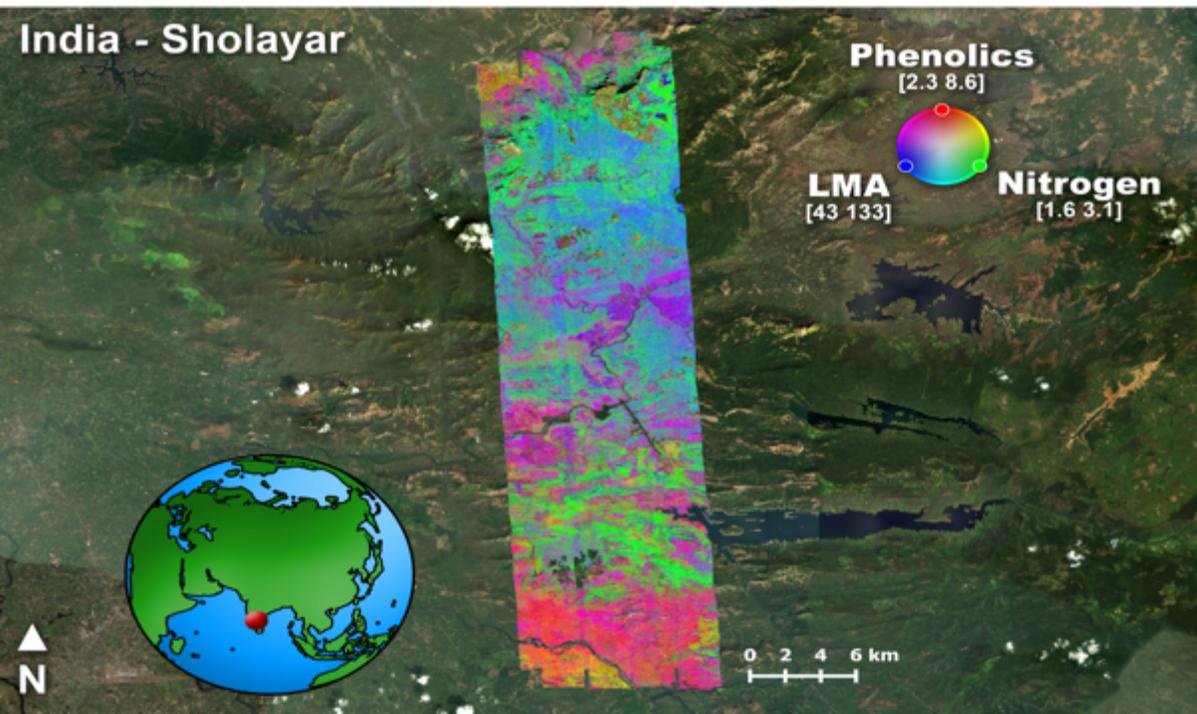


September 24, 2013

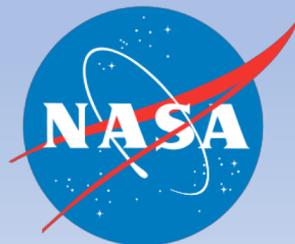
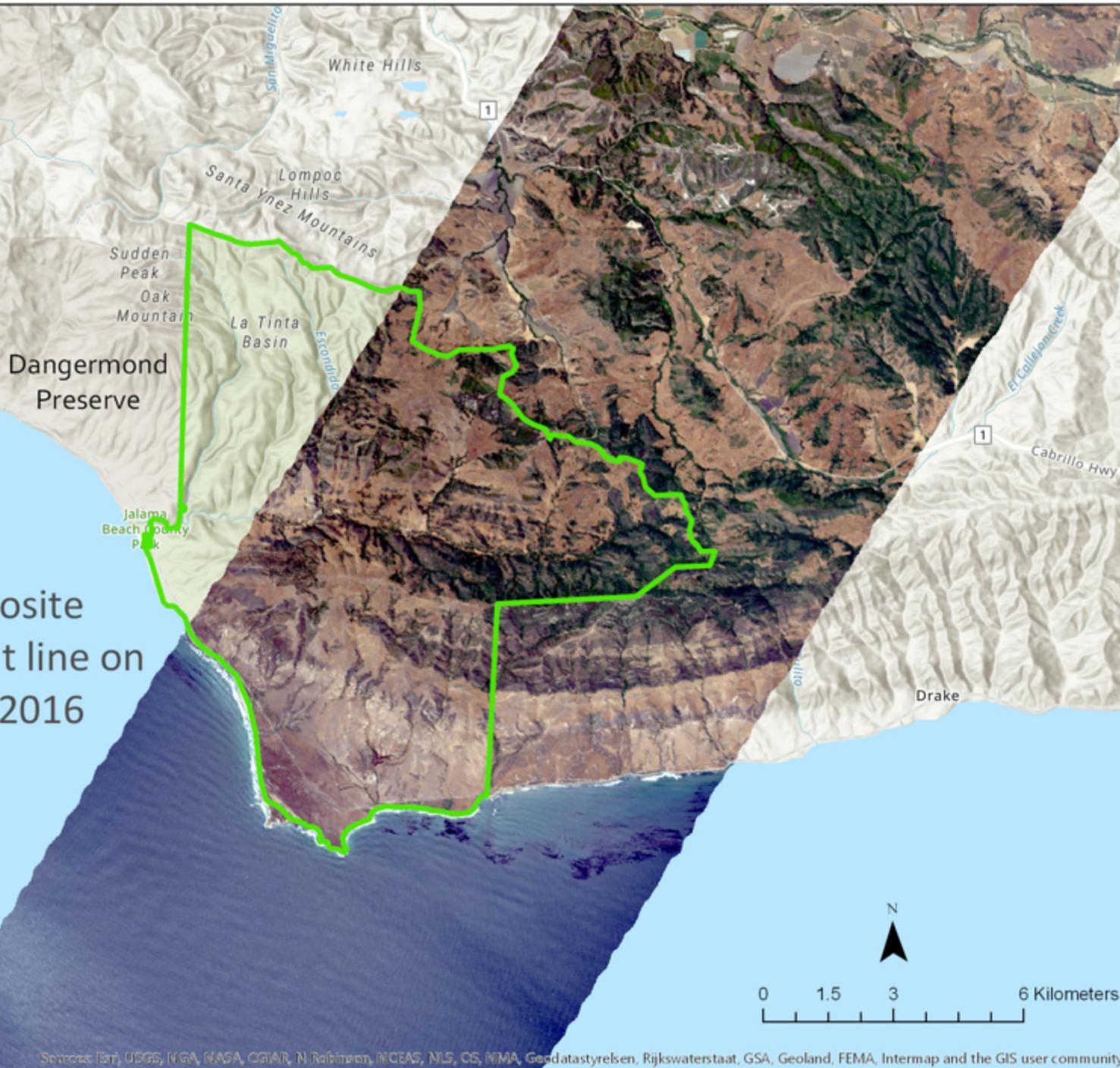




What we can
measure!



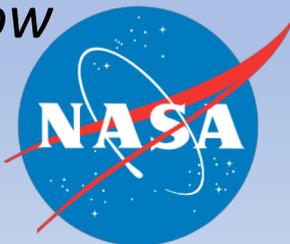
Where we were!



Surface Biology and Geology: a Designated Mission: 2024

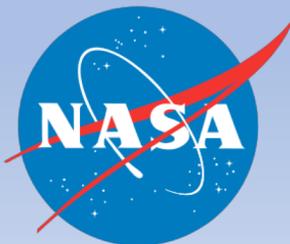


What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space

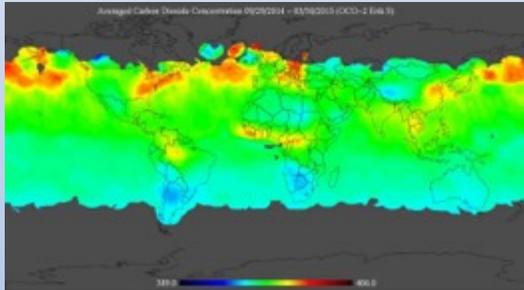
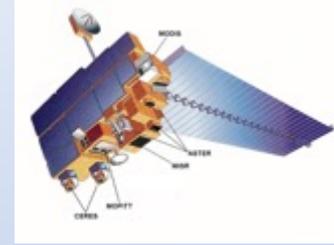


The golden age of global ecology

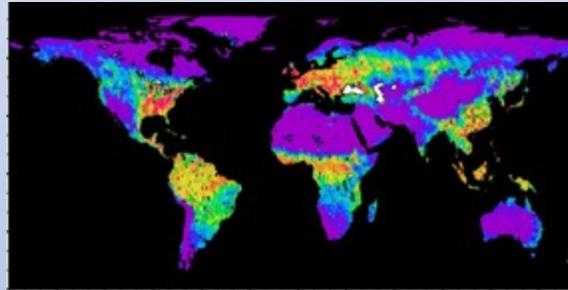
- New missions, on orbit, soon to launch and planned!
- Tools for big data abound.
- A big challenge: ecological data unmoored from taxonomic identity.
- Quantitative ecologists, perhaps the best prepared generation for this type of data ever.
- At key sites, we can both relate new remote (aircraft, drone and space) measurements to the *in situ* and also concentrate our efforts on ecology that can't be measured from space, soils, animals, microorganisms as well as conduct experiments.
- Even global ecologists start with inspiration and for some, it's the blue marble but for most it's closer to home!



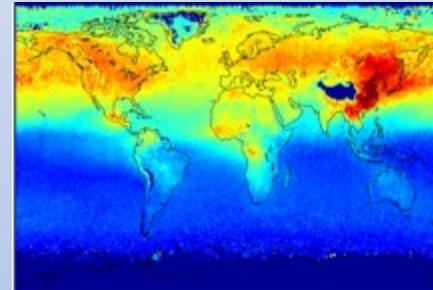
Carbon Arithmetic



-



-



=

Respiration

NBP from XCO2

-

GPP from SIF

-

Fire from CO.

=

R_{eco}

