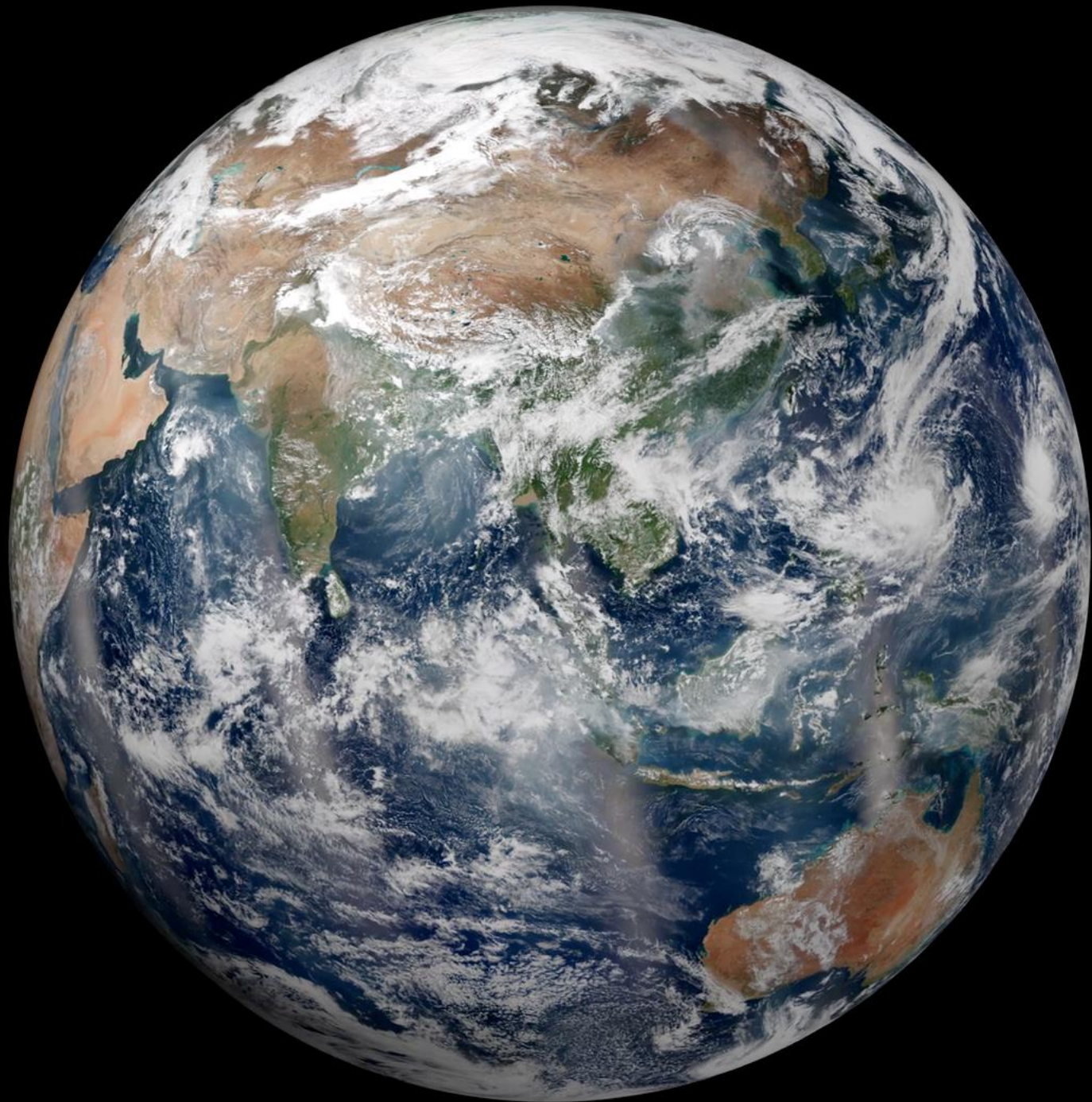


**ADVANCING OUR UNDERSTANDING OF EARTH
SYSTEMS THROUGH
SATELLITE OBSERVATION
PROGRAMS**

Keith Gaddis

NASA Headquarters - Earth Science Division
Applied Sciences and Research and Analysis Programs







Application To Ecological and Biodiversity Monitoring



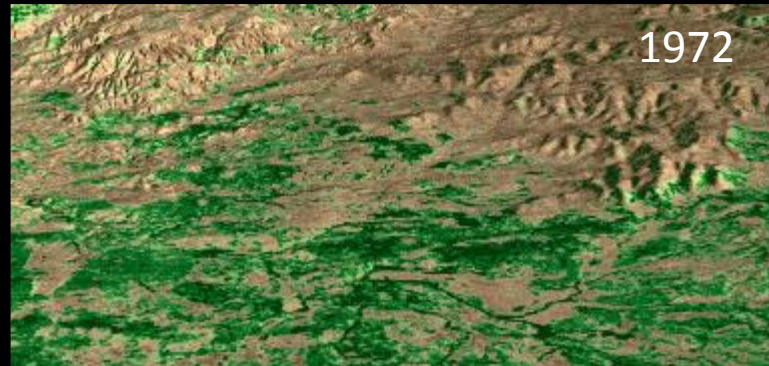
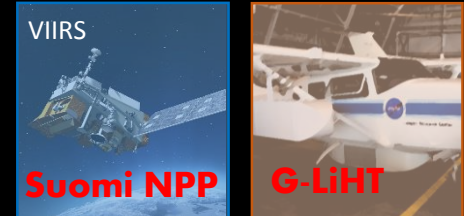
Direct Sensing of Biological Diversity

Land cover

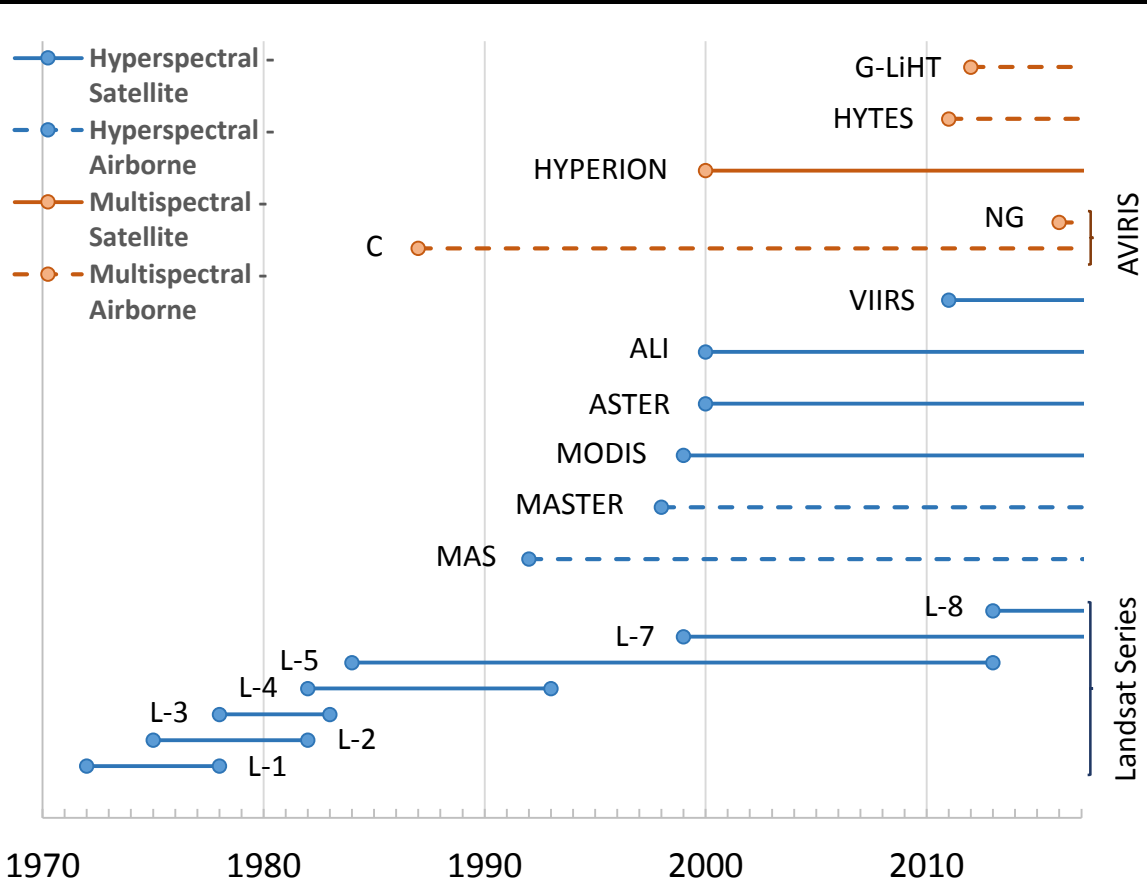
-  Satellite
-  Aircraft
-  Shuttle or ISS

Direct Sensing of Biological Diversity

Land cover

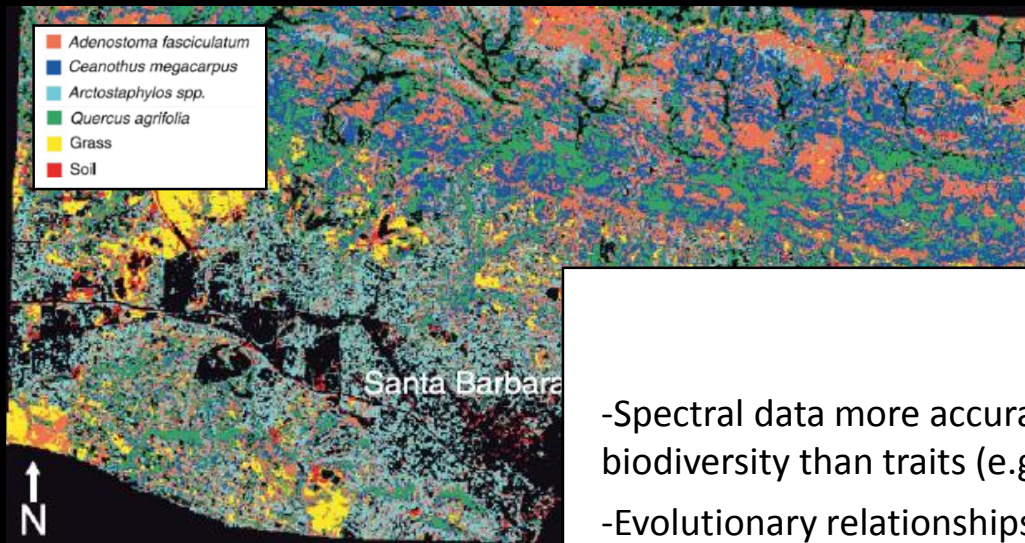


- Satellite
- Aircraft
- Shuttle or ISS

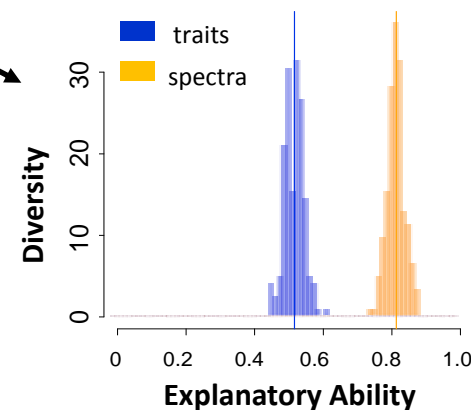


Direct Sensing of Biological Diversity

Species Composition



- Spectral data more accurately predicts biodiversity than traits (e.g. leaf mass area).
- Evolutionary relationships are better predicted than leaf type (e.g. evergreen, deciduous).



Remote Sens. 2016, 8(3), 221; doi:10.3390/rs8030221

Associations of Leaf Spectra with Genetic and Phylogenetic Variation in Oaks: Prospects for Remote Detection of Biodiversity

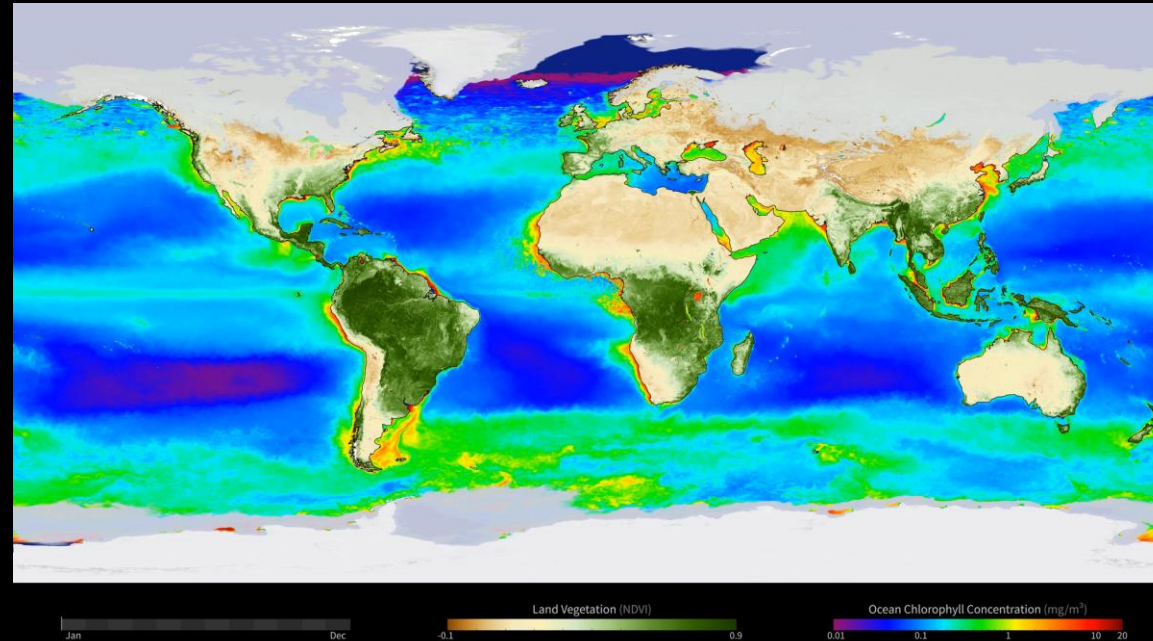
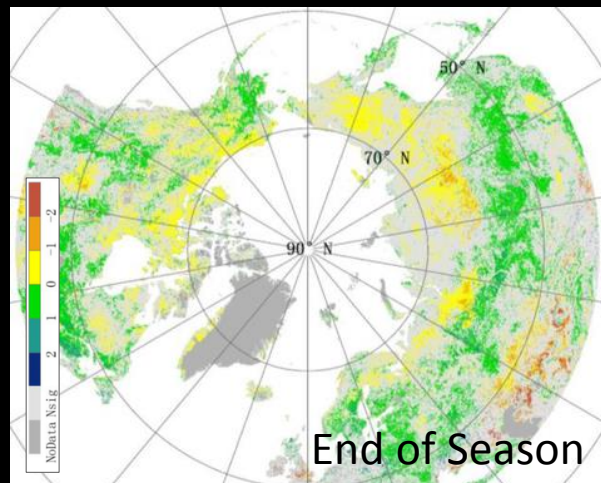
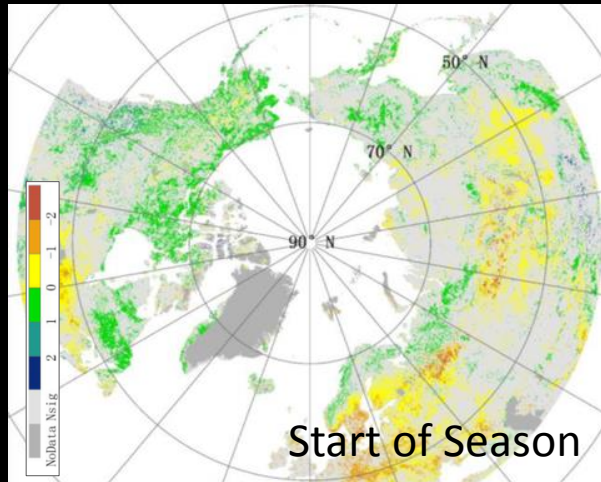
Jeannine Cavender-Bares ^{1,*}, Jose Eduardo Meireles ^{1,*}, John J. Couture ², Matthew A. Kaproth ¹, Clayton C. Kingdon ², Aditya Singh ², Shawn P. Serbin ^{2,3}, Alyson Center ^{1,4}, Esau Zuniga ⁵, George Pilz ⁵ and Philip A. Townsend ²



- Satellite
- Aircraft
- Shuttle or ISS

Indirect Sensing of Biological Diversity

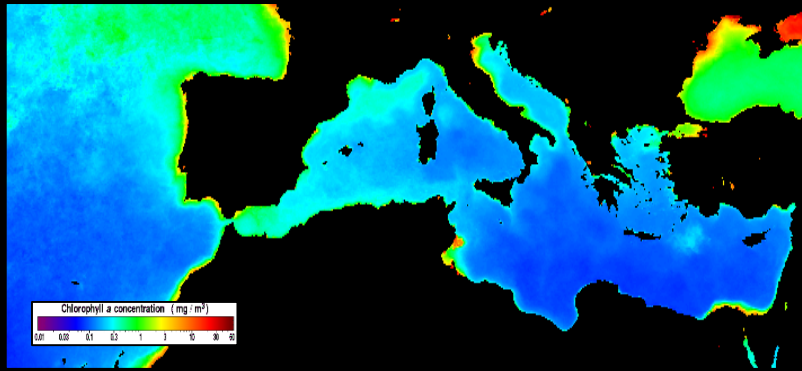
Phenology



- Satellite
- Aircraft
- Shuttle or ISS

Indirect Sensing of Biological Diversity

Ocean Color and Circulation

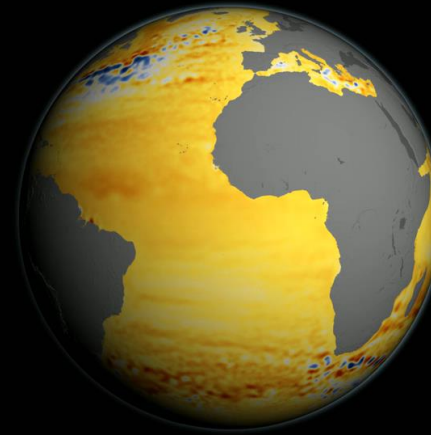
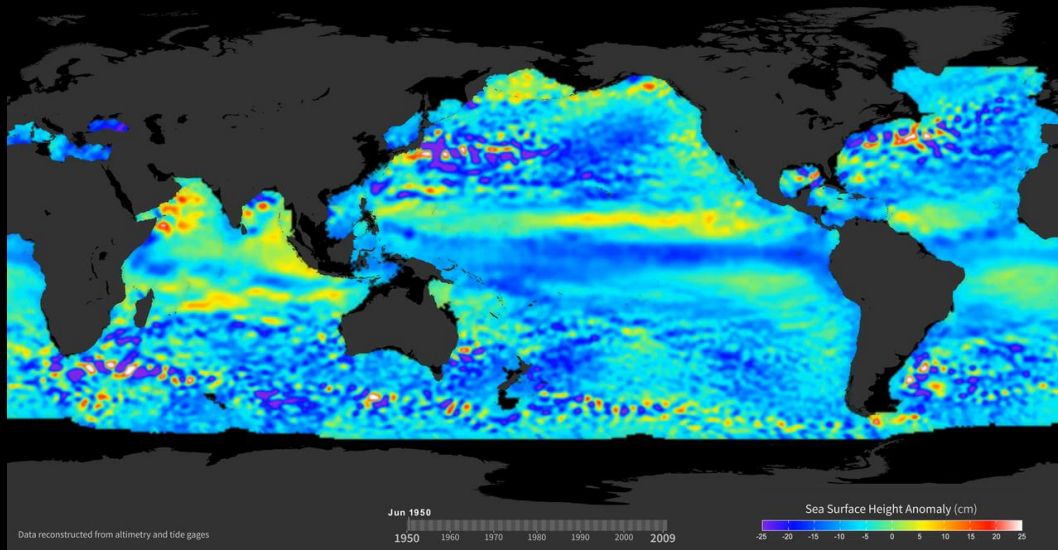


- Satellite
- Aircraft
- Shuttle or ISS

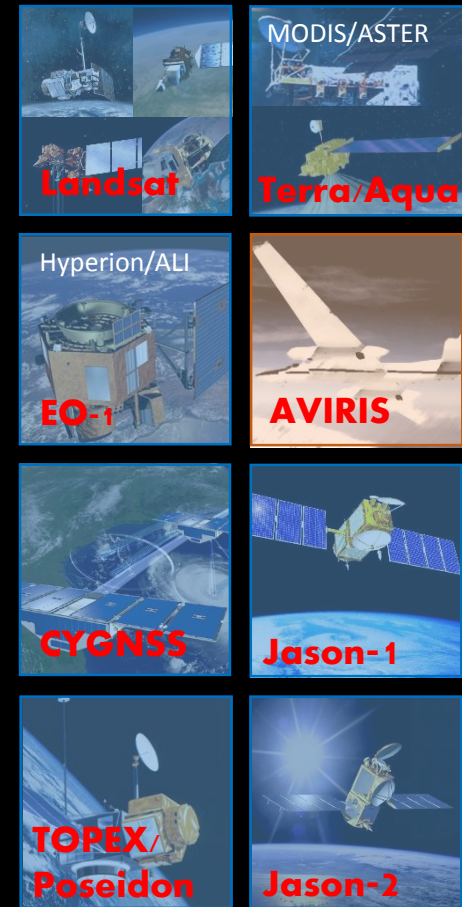
Indirect Sensing of Biological Diversity

Ocean Color and Circulation

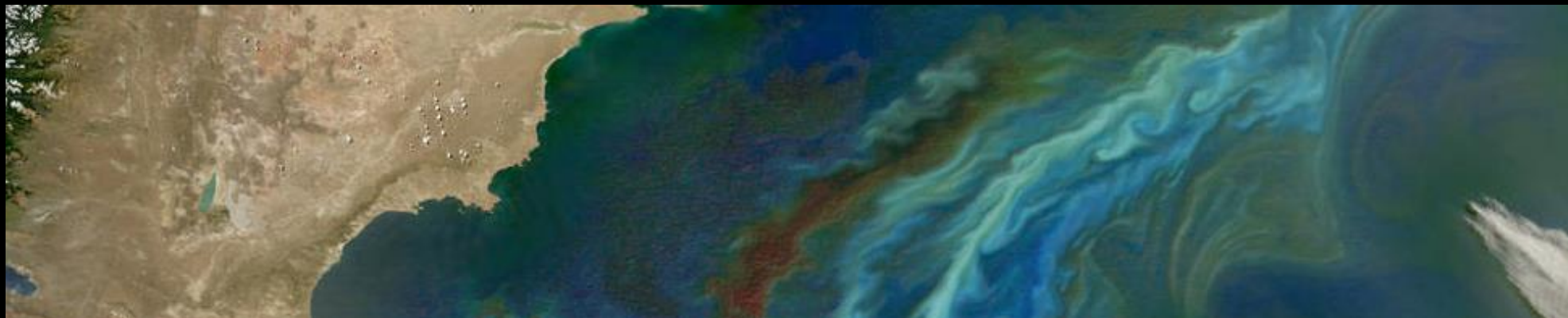
Sea Surface Height Anomalies, 1950-2009



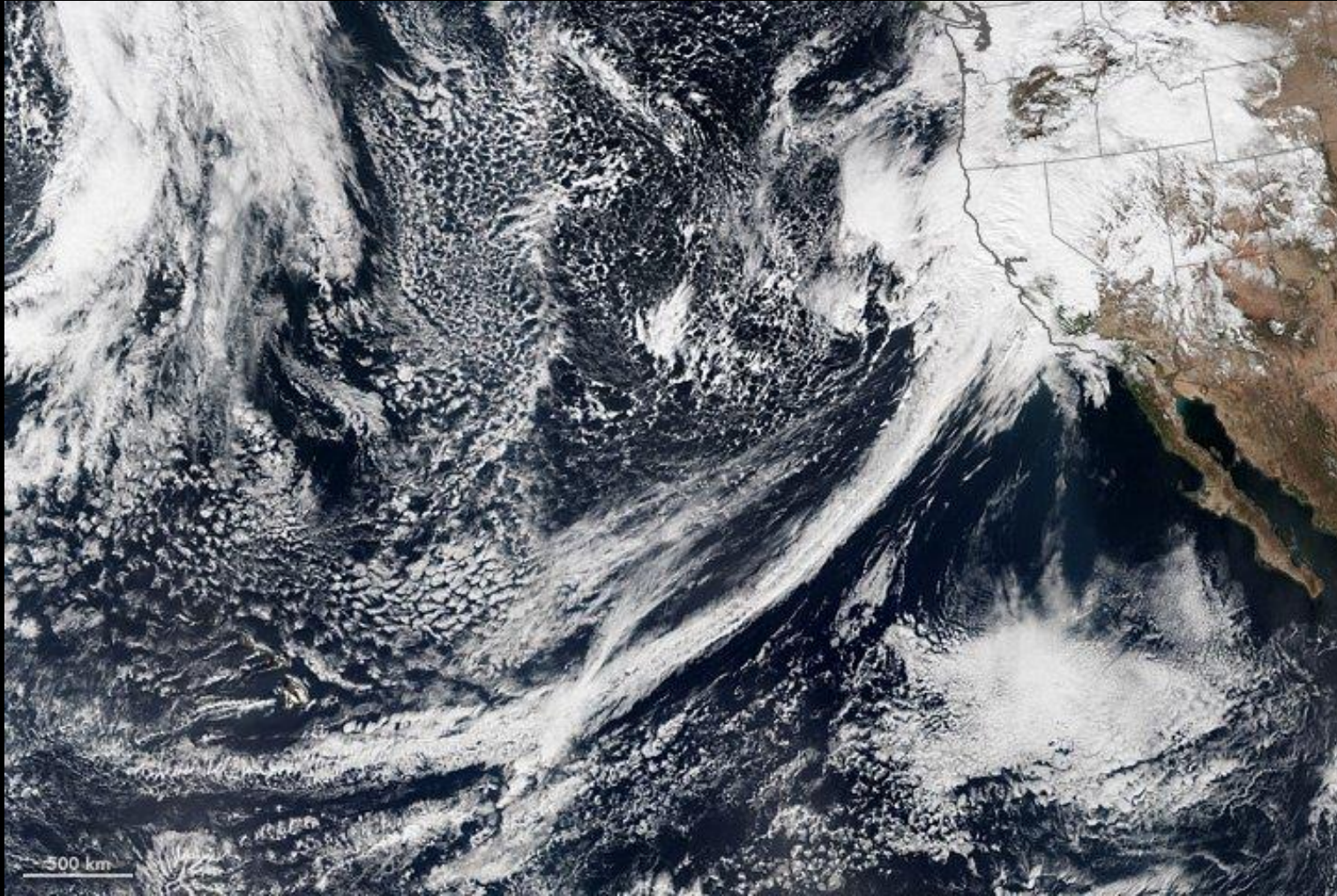
22-year Sea Surface Height Change
-7.0 0 +7.0
(cm)



- Satellite
- Aircraft
- Shuttle or ISS

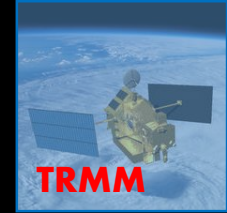
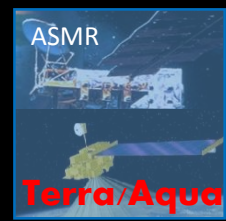
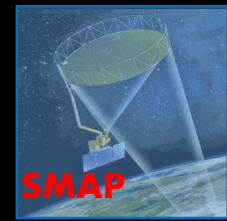
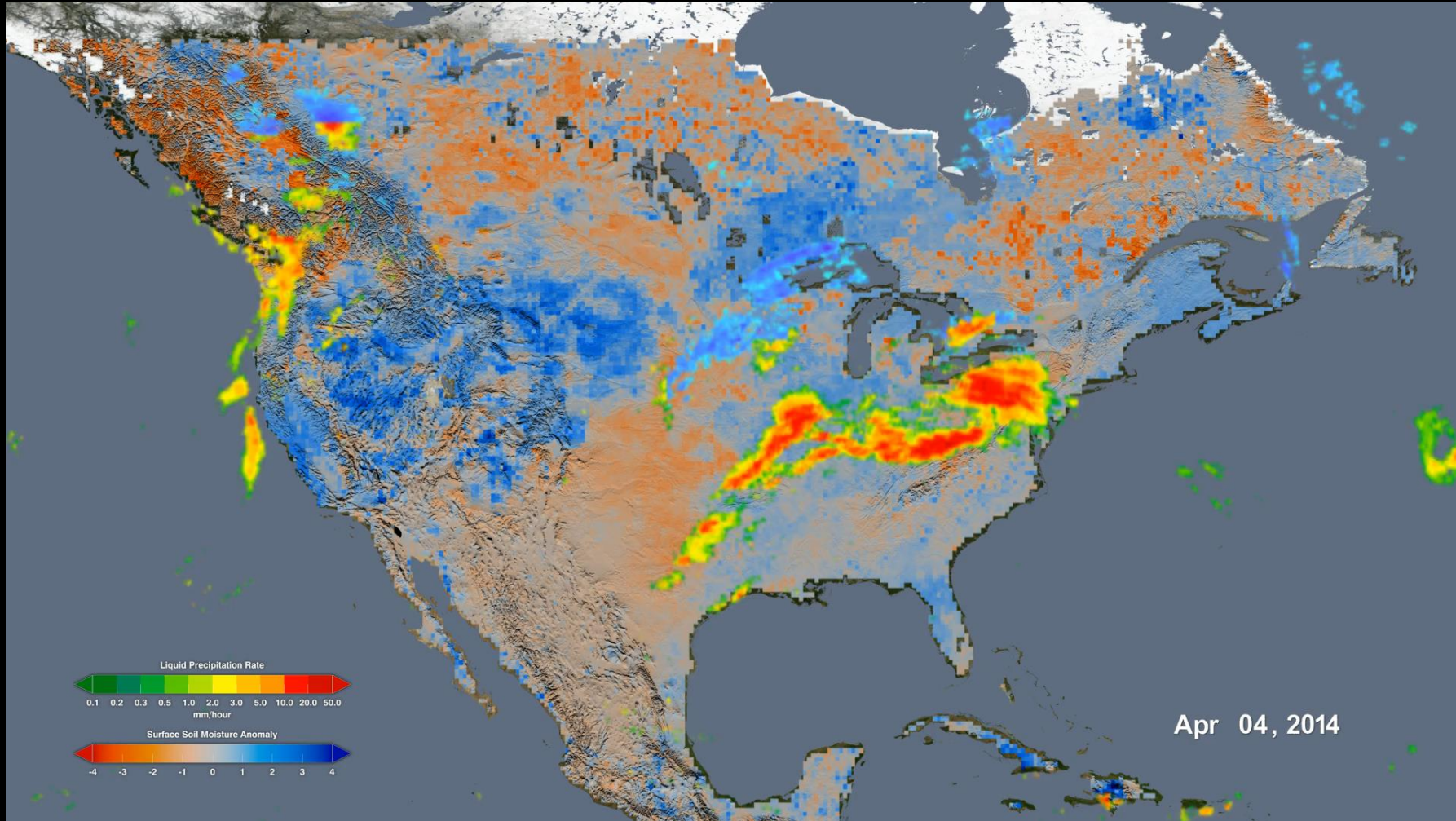


Climate



Climate

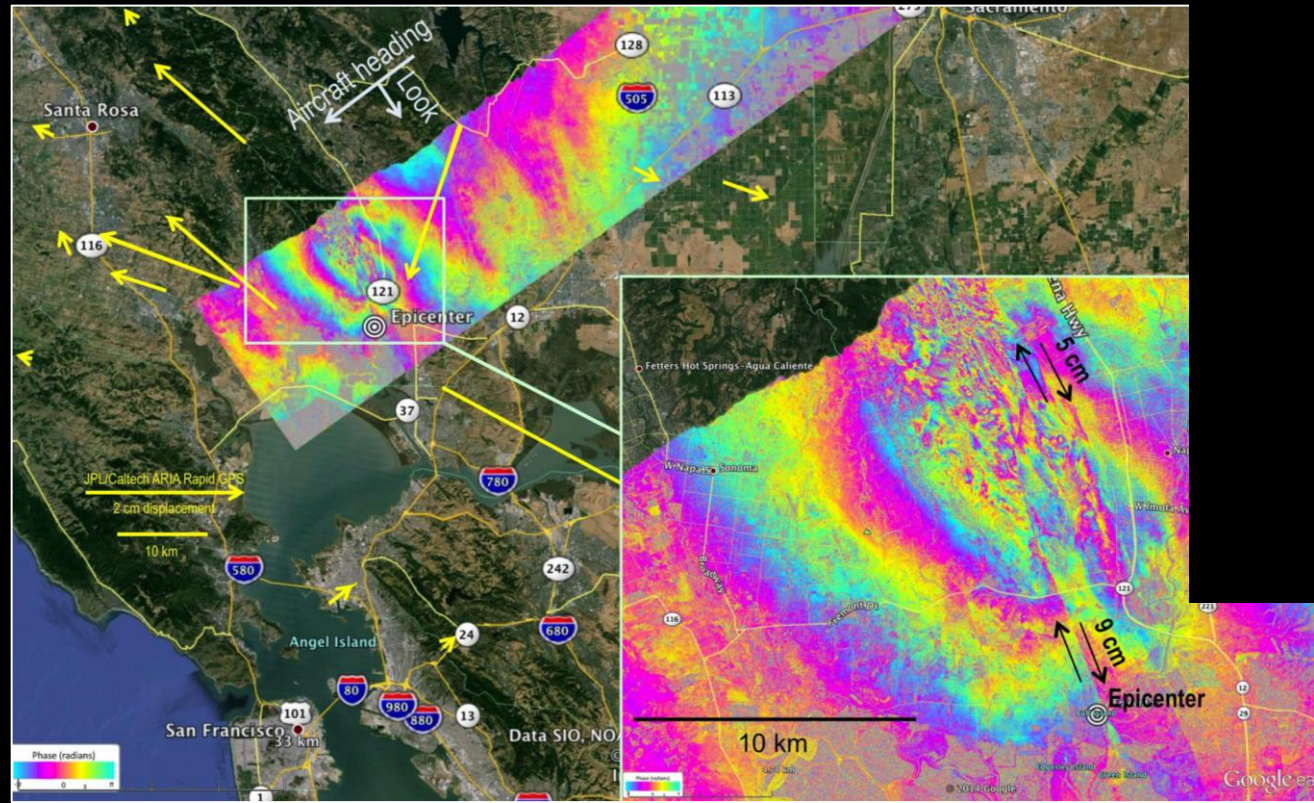
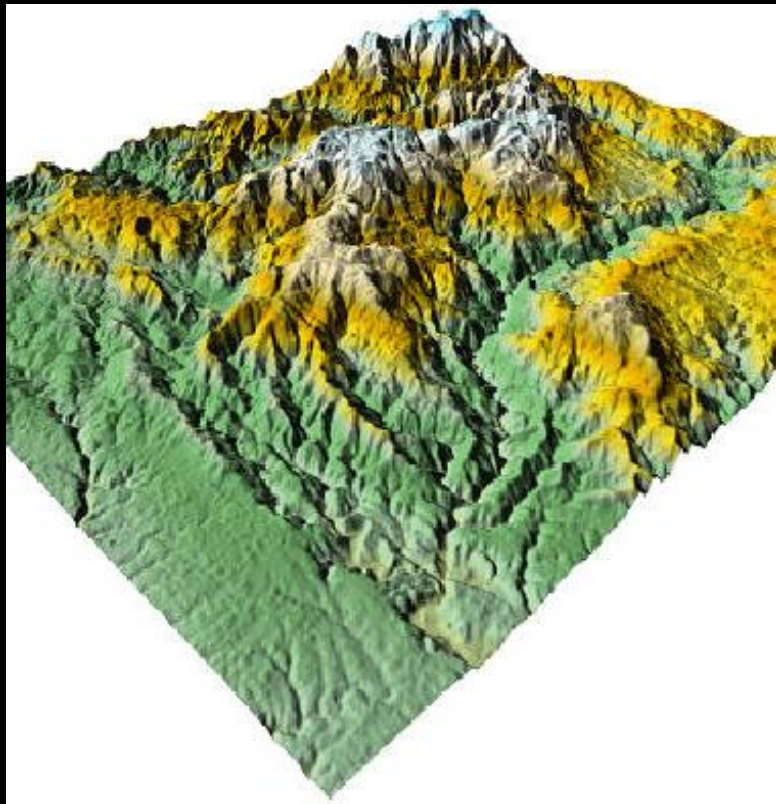
Rainfall and Soil Moisture



- Satellite
- Aircraft
- Shuttle or ISS

Habitat Structure

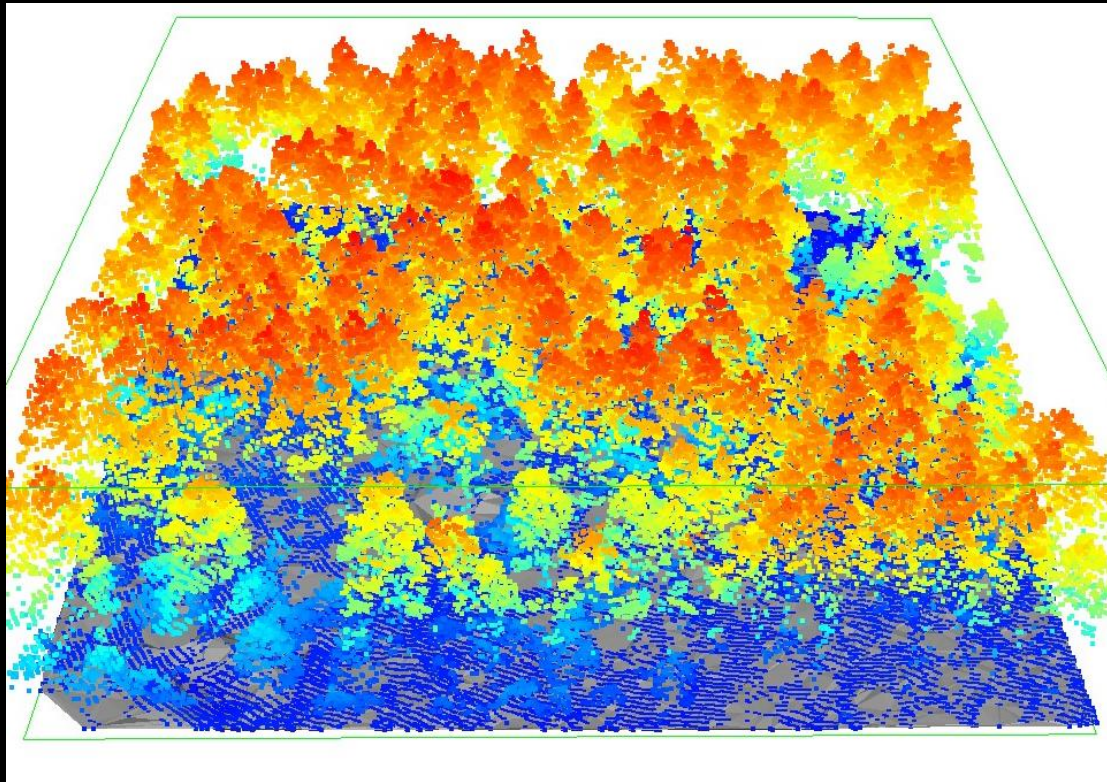
Topography



- Satellite
- Aircraft
- Shuttle or ISS

Habitat Structure

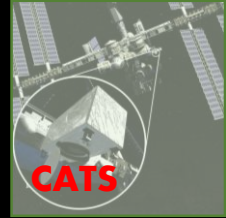
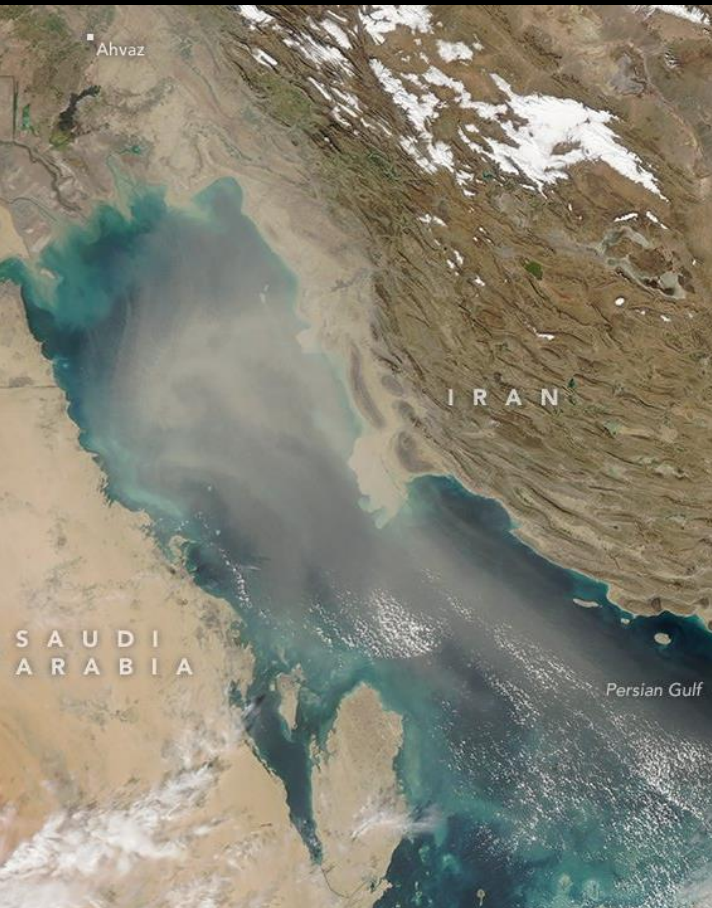
Canopy Structure



- Satellite
- Aircraft
- Shuttle or ISS

Habitat Structure

Aerosols



- Satellite
- Aircraft
- Shuttle or ISS

Habitat Structure

Nightlights and Wildfires

