

# **NASA Update to Unidata**

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**Carbon Cycle & Ecosystems Office  
NASA Goddard Space Flight Center**

**May 14, 2013**



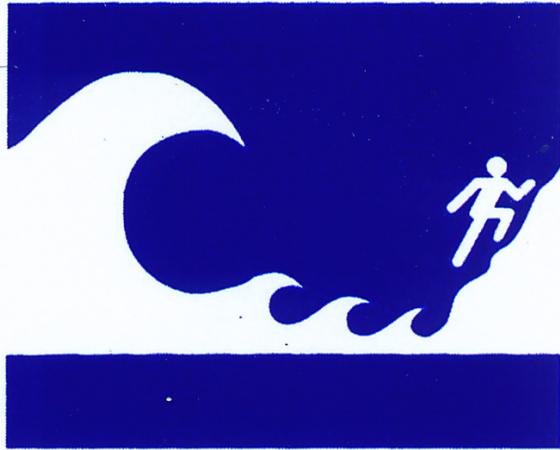
National Aeronautics and Space Administration

## FY 2014 PRESIDENT'S BUDGET REQUEST SUMMARY

Budget Authority (\$ in millions)	Fiscal Year						
	Actual 2012 <sup>1</sup>	Estimate 2013 <sup>2</sup>	Request 2014	Notional			
				2015	2016	2017	2018
<b>NASA FY 2014</b>	<b>17,770.0</b>	<b>17,893.4</b>	<b>17,715.4</b>	<b>17,715.4</b>	<b>17,715.4</b>	<b>17,715.4</b>	<b>17,715.4</b>
<b>Science</b>	<b>5,073.7</b>	<b>5,115.9</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>
Earth Science	1,765.7		1,846.1	1,854.6	1,848.9	1,836.9	1,838.1
Planetary Science	1,501.4		1,217.5	1,214.8	1,225.3	1,254.5	1,253.0
Astrophysics	648.4		642.3	670.0	686.8	692.7	727.1
James Webb Space Telescope	518.6		658.2	645.4	620.0	569.4	534.9
Heliophysics	644.9		653.7	633.1	636.8	664.3	664.6
<b>Subtotal, Science</b>	<b>5,079.0</b>	<b>5,121.1</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>	<b>5,017.8</b>
<b>Less Rescissions</b>	<b>(5.3)</b>	<b>(5.3)</b>					
<b>Aeronautics</b>	<b>569.4</b>	<b>572.9</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>
<b>Subtotal, Aeronautics</b>	<b>569.9</b>	<b>573.4</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>	<b>565.7</b>
<b>Less Rescissions</b>	<b>(0.5)</b>	<b>(0.5)</b>					



**IF YOU FEEL AN EARTHQUAKE, Sequestration MAY FOLLOW.**



# HOW TO ESCAPE

## Sequestration

- 1 Drop, cover, and hold during the earthquake.**
- 2 Move inland and uphill quickly, or use local evacuation route.**
- 3 Wait for official all clear before returning to beach.**

National Tsunami Hazard Mitigation Program (Alaska, California, Hawaii, Oregon, Washington, NOAA, FEMA, USGS)

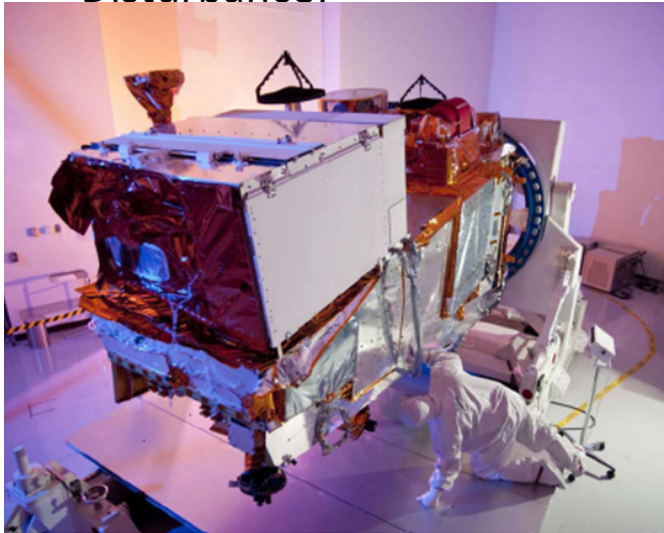






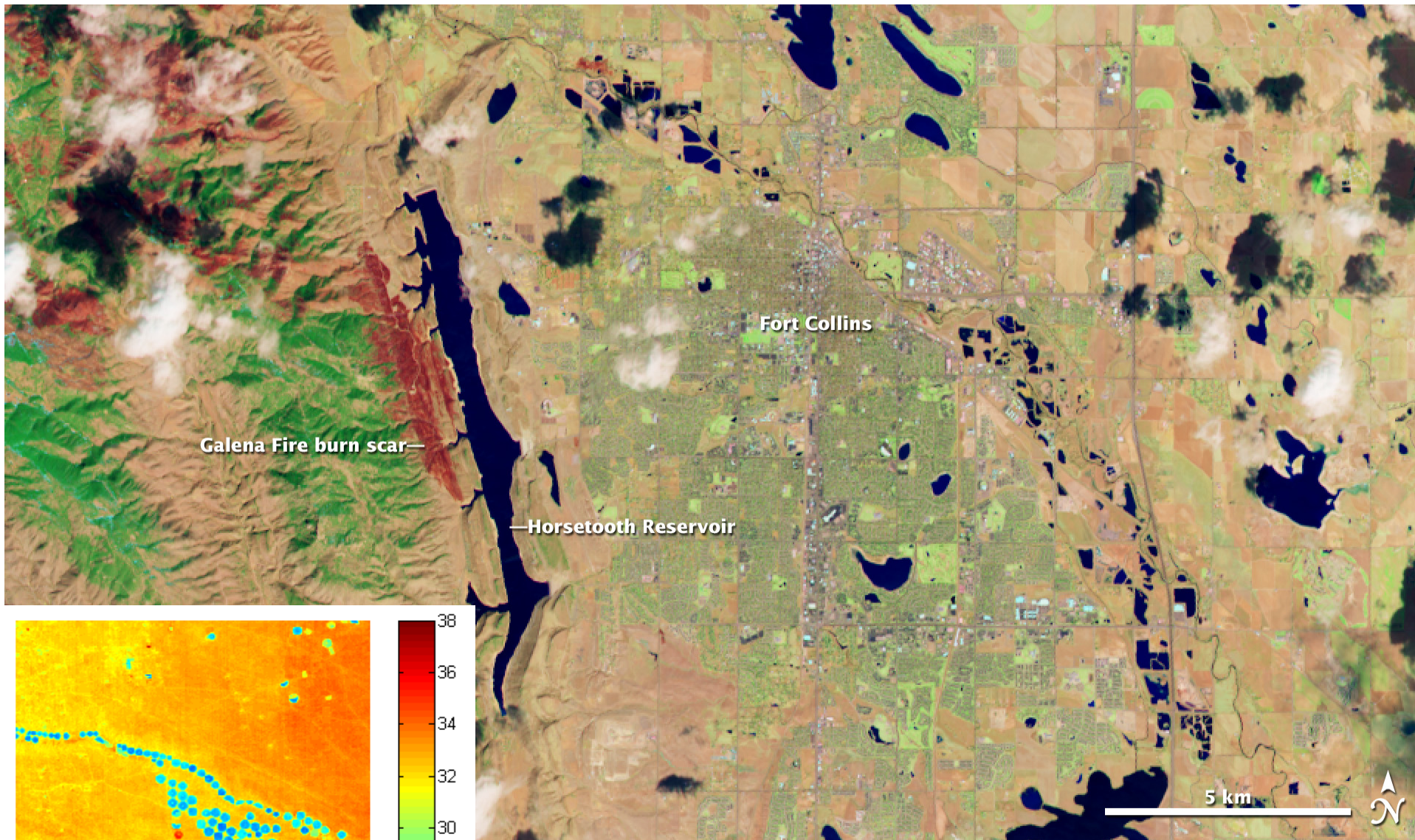
## Visible Infrared Imaging Radiometer Suite (VIIRS)

- MODIS Continuity – Long Term Data Record
- Priority TE Products from VIIRS
  - Active Fires
  - Surface Albedo
  - Land surface temperature
  - Surface type
  - Vegetation index  
(Vegetation Phenology, Land Cover and Change, Disturbance)



Suomi NPP Launched Oct 28 2011  
JPSS-1 planned for launch in 2017





LDCM First Light Image (Ft Collins, CO,  
March 18, 2013)

TIRS 12.0  $\mu\text{m}$  brightness temperature, Saudi  
Arabia Irrigated Crops

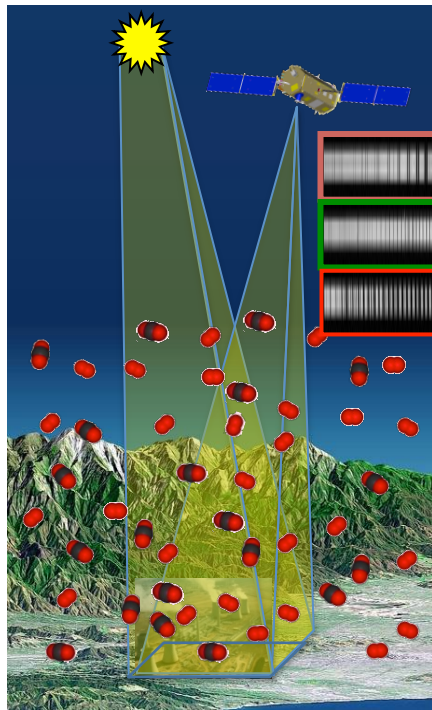


# Orbiting Carbon Observatory (OCO-2)

## Key Science Objectives

- OCO-2 is the first NASA mission designed to make space-based measurements of atmospheric carbon dioxide (CO<sub>2</sub>) with the precision, coverage, and resolution needed to:
  - Quantify CO<sub>2</sub> emissions on the scale of a large U.S. state or average-sized country
  - Find the natural “sinks” that are absorbing over half of the CO<sub>2</sub> emitted by human activities
- To accomplish these objectives, OCO-2 will:

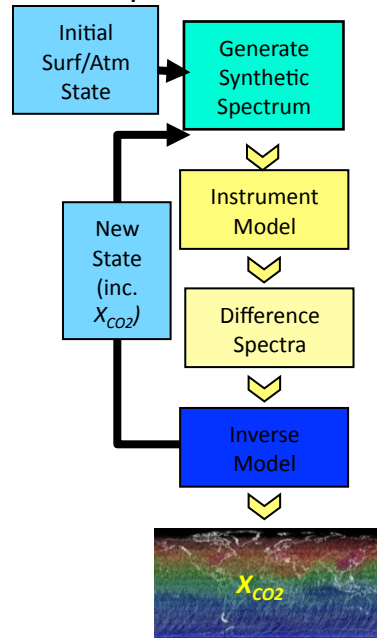
- Record** spectra of CO<sub>2</sub> & O<sub>2</sub> absorption in reflected sunlight



3 km x 3km



- Retrieve** variations in the *column averaged CO<sub>2</sub> dry air mole fraction, X<sub>CO<sub>2</sub></sub>* over the sunlit hemisphere



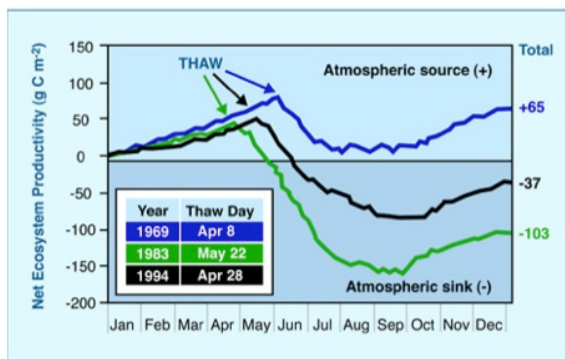
- Validate** measurements to ensure X<sub>CO<sub>2</sub></sub> accuracy of 1 - 2 ppm (0.3 - 0.5%)



# Soil Moisture Active-Passive (SMAP)

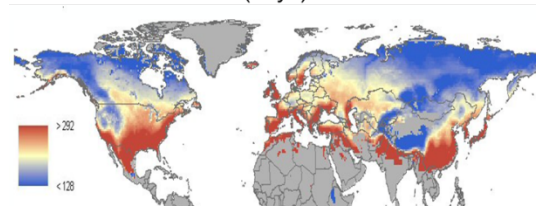
## Key Science Objectives

- **Key SMAP science objectives from the DS:**
  - Improve understanding of processes linking terrestrial water, carbon & energy cycles;
  - Quantify net carbon flux in boreal landscapes
- **Planned SMAP global products relevant to carbon & ecosystems:**
  - Landscape freeze-thaw (FT) state dynamics;
  - Surface & root zone soil moisture (SM) from Model-data assimilation;
  - Net ecosystem CO<sub>2</sub> exchange (NEE), component carbon fluxes (GPP, Reco) & underlying environmental (FT & SM) constraints from satellite data-driven carbon (L4\_C) model outputs;

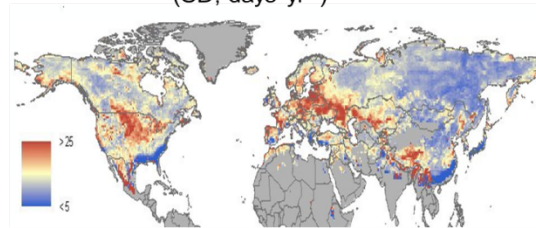


### FT Product Example

Mean Non-frozen Season  
(days)

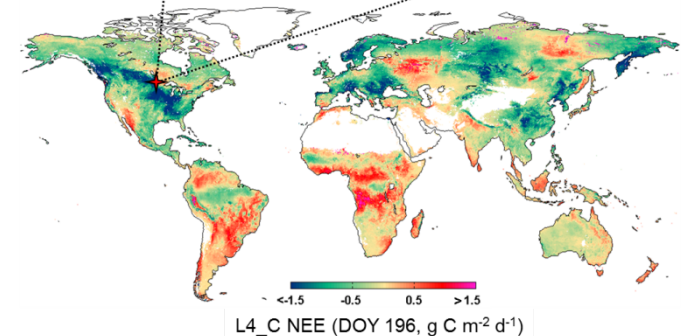
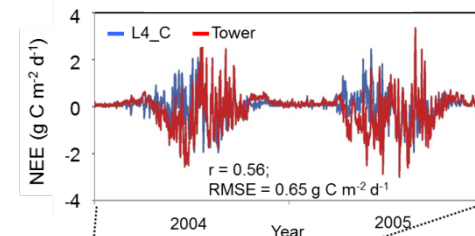


Non-frozen Season Variation  
(SD, days yr<sup>-1</sup>)

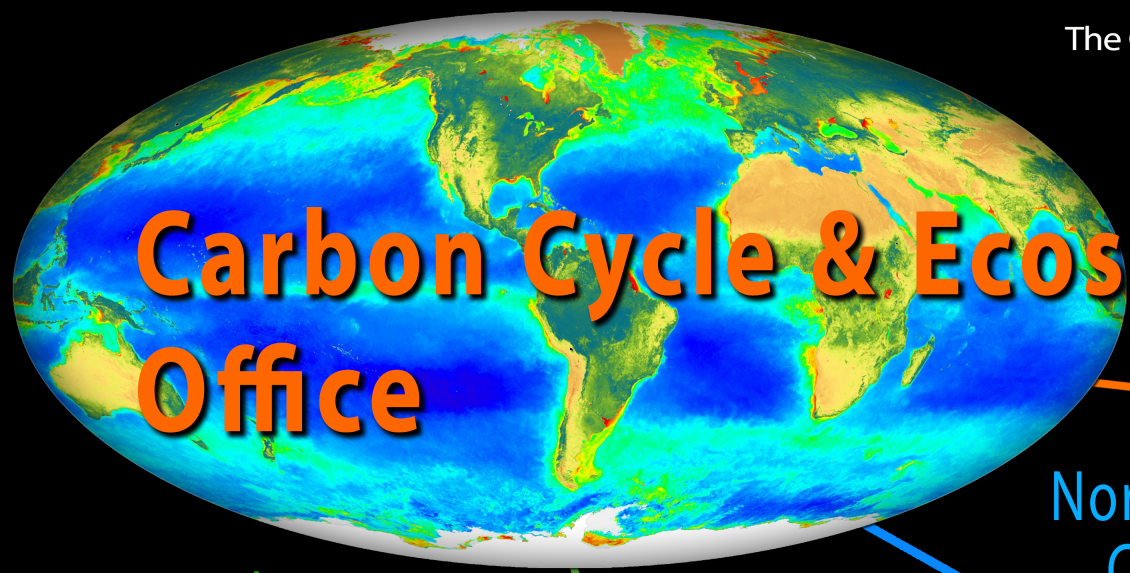


Source: Kim et al. 2012. *Rem. Sens. Environ.* 121.

### L4\_C Product Example







# Carbon Cycle & Ecosystems Office

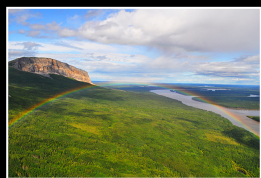
The CC&E Office, funded by NASA, supports the interagency North American Carbon Program (NACP), the NASA-funded carbon cycle and ecosystems research, and the NASA Terrestrial Ecology Program.

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## Terrestrial Ecology Program



NASA's Terrestrial Ecology Program leads in providing remote sensing data, remote sensing data analysis, and modeling. TE has a long history of sponsoring major field campaigns including FIFE, BOREAS, LBA-ECO and ABoVE. [http://cce.nasa.gov/terrestrial\\_ecology](http://cce.nasa.gov/terrestrial_ecology)



**ABoVE**  
The Arctic-Boreal Vulnerability Experiment (ABoVE) is currently in the experiment design phase to be completed early 2014. <http://cce.nasa.gov/above>

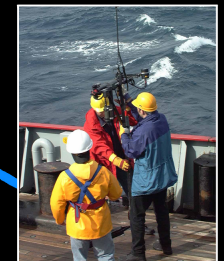
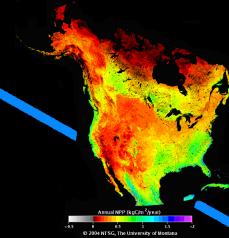
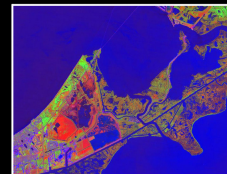
## Carbon Cycle & Ecosystems Research



NASA's CC&E research provides knowledge of the interactions of global biogeochemical cycles and terrestrial and aquatic ecosystems with global environmental change and the implications for Earth's climate, productivity, and natural resources. <http://cce.nasa.gov>

## North American Carbon Program

NACP, a component of the U.S. Global Change Research Program, is designed to quantify continental-scale carbon sources and sinks in North America and adjacent ocean regions. [www.nacarbon.org](http://www.nacarbon.org)





algorithm analysis arctic area assessments atmospheric biomass  
boreal canopy carbon change climate co2  
cover current data derived development disturbance dynamics earth  
ecosystem effects efforts emissions estimates events extreme field  
fire flux forest future global gpp ground growth height imagery imaging  
impacts important improve increase information integrated land  
landsat landscape leaf lidar maps measurements model  
modis moisture monitoring national north northern observations permafrost  
phenology potential present products recent record recovery reflectance regional remote  
resolution response results satellite scales science seasonal  
sensing sensor sites soil spatial state structure study  
surface system temperature temporal terrestrial tree tropical  
uncertainty variability vegetation water wetlands years





How vulnerable and resilient are ecosystems and society to environmental change in Arctic and boreal regions?

- What processes, interactions, and feedbacks control the vulnerability of Arctic and boreal ecosystems and landscapes to structural and functional changes in a changing Earth system?
- How are people at local, regional, national, and global scales being affected by and responding to these changes?
- How do changes to terrestrial processes in the ABR alter inputs to adjacent oceans?
- How do changes to terrestrial processes in ABR alter climate through exchanges of energy, water, gases, and particulate matter between the land surface and troposphere?

ESIP Earth Science Collaboratory case study of data discovery and management for ABoVE using RAMADDA approved and underway.