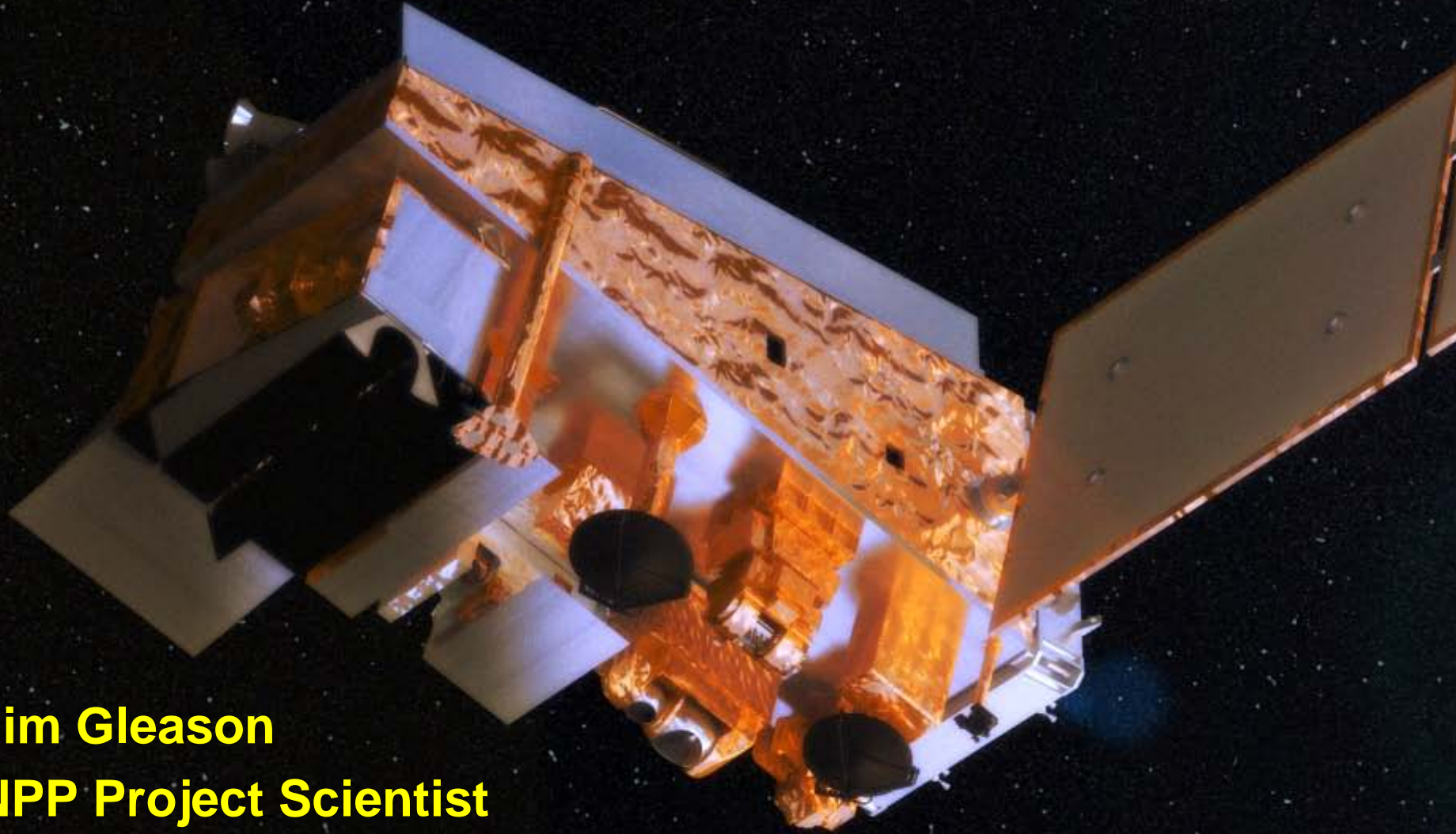


NPOESS Preparatory Project (NPP)



Jim Gleason
NPP Project Scientist

npp.gsfc.nasa.gov



NPP Mission: Make Environmental Observations



Provide Data for Weather Forecast Models

**Short term Environmental Observations
(Events)**

**Long term Environmental Observations
(Climate Change Detection)**

**Fly the P-POD system and Deploy CubeSats
Educational Launch of Nanosatellite (ELaNa)**

NPP with 5 instruments

13.2 ft long
8.5 ft wide
4,500 lbs

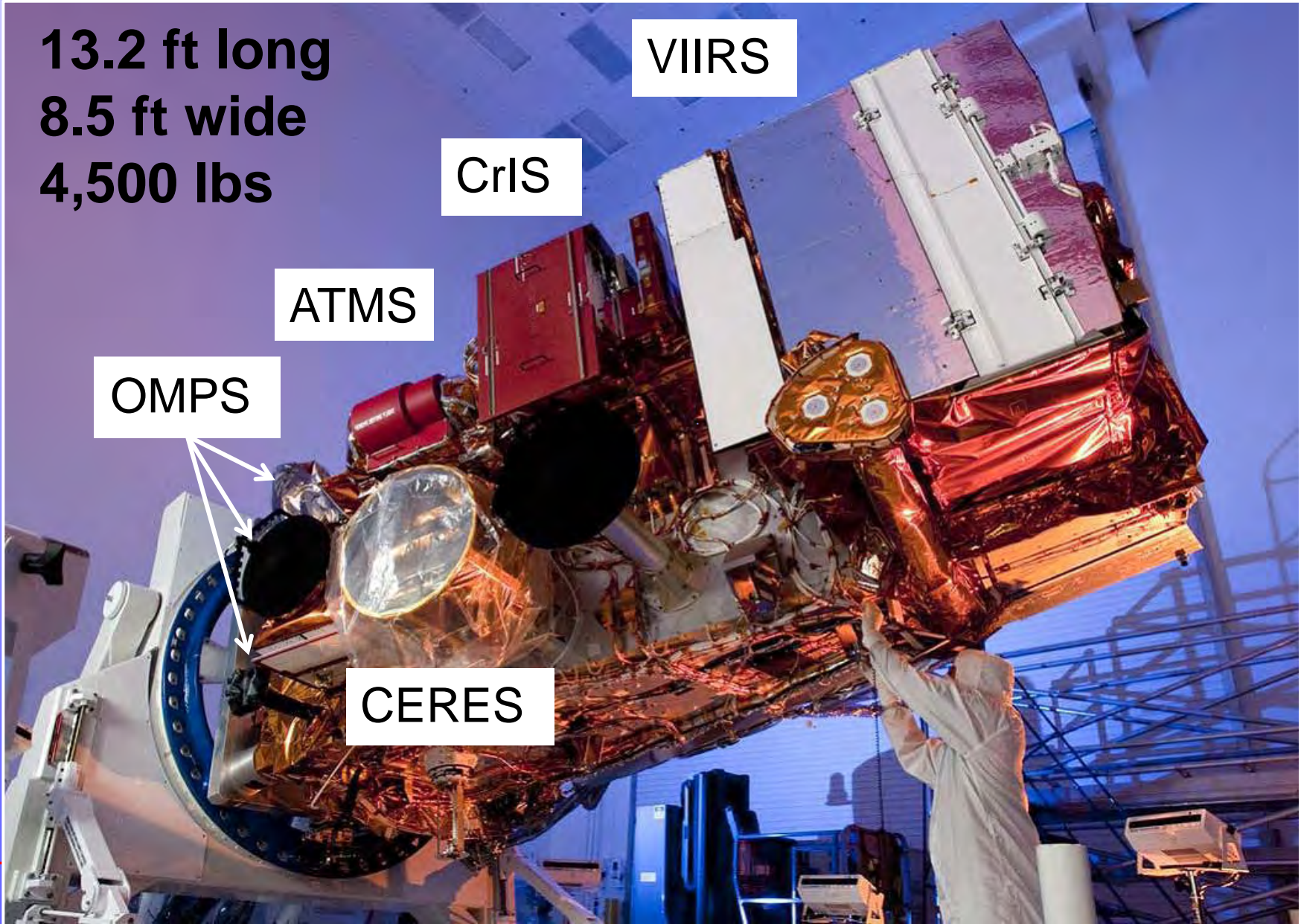
VIIRS

CrIS

ATMS

OMPS

CERES



Dynamics
October - November 2010



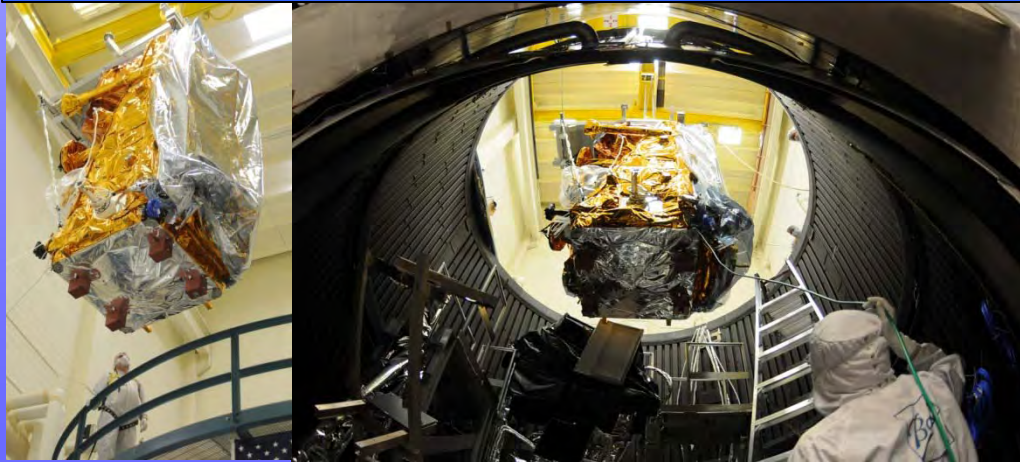
EMI/EMC
December 2010 – January 2011



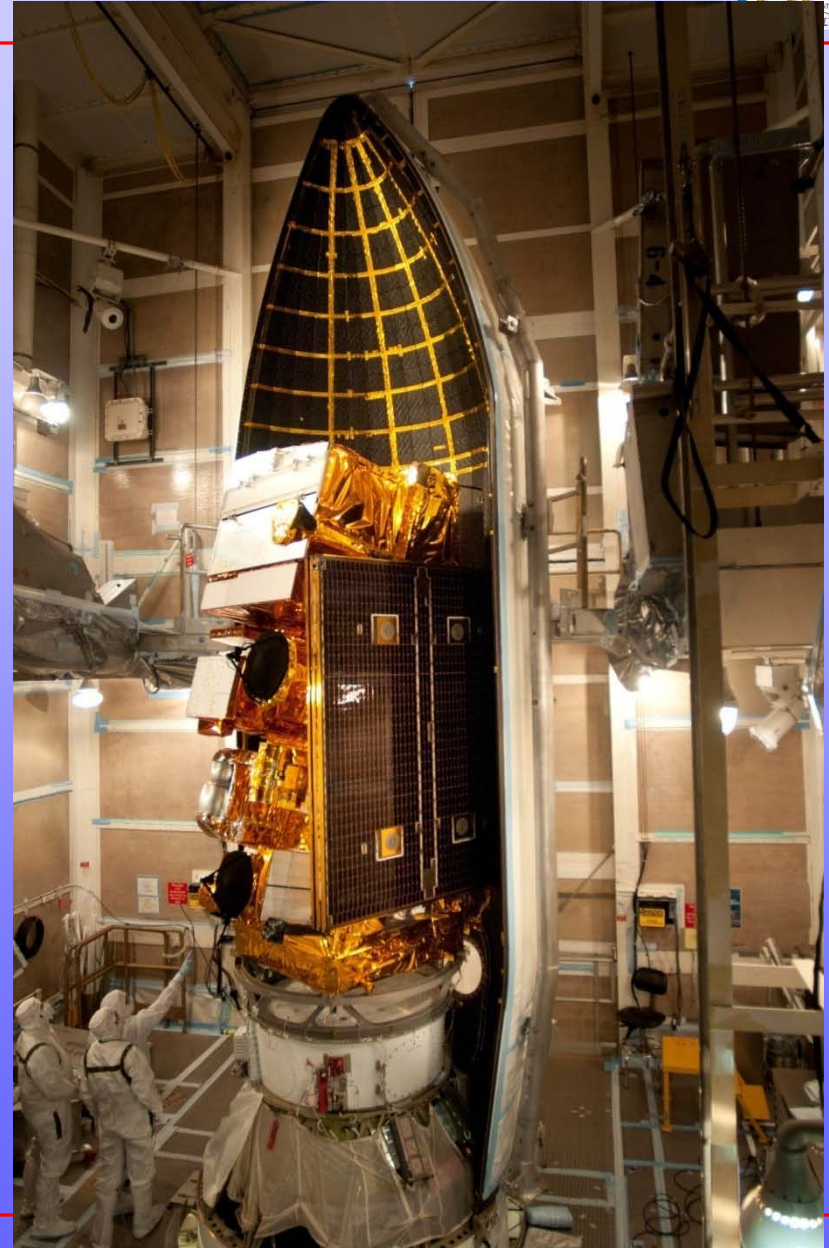
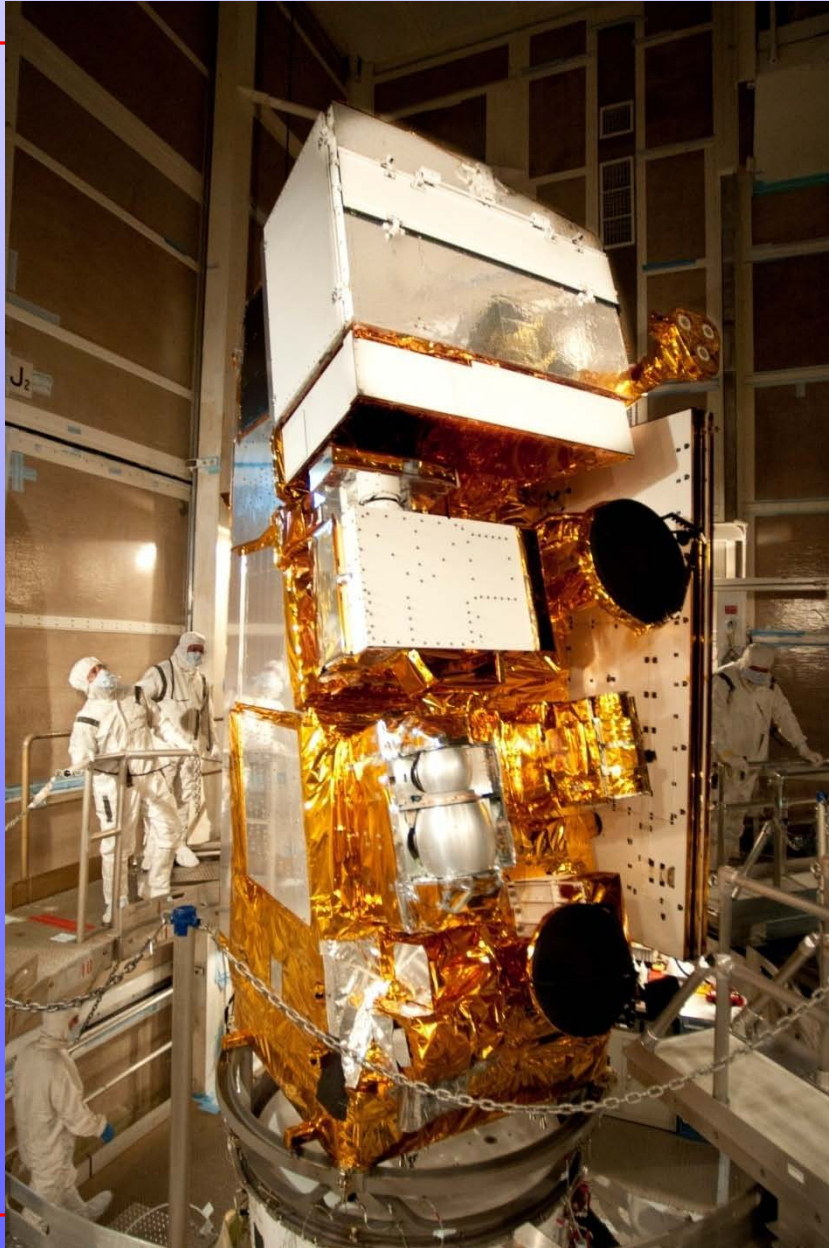
Solar Array Pop & Catch
Pre/Post Dynamics & Post
TVAC



Satellite TVAC March - April 2011



NPP: Final Assembly



P-PODs/CubeSats Overview

- The Poly Picosatellite Orbital Deployer (P-POD) was developed by California Polytechnic State University (CalPoly)
- The P-POD utilizes a tubular design and can hold up to 34cm x 10cm x 10cm of hardware
- P-POD (empty) is ~2.75 kg
- Typical CubeSats are ~1 – 1.33 kg each
- The P-POD has successfully flown on five different launch vehicles
- Four P-PODs have released CubeSats on orbit



P-PODs



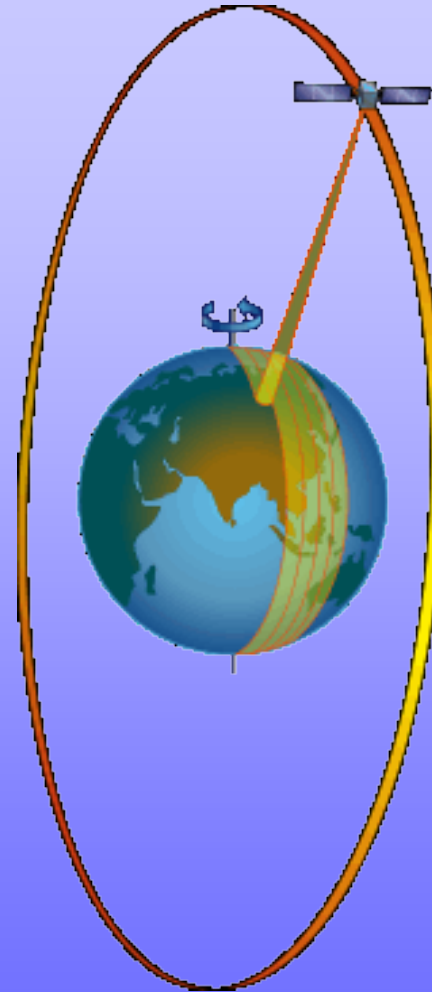
**The Dynamic Ionosphere
Cubesat Experiment (DICE)
Utah State University
Space Dynamics Lab**

NPP is in Polar orbit

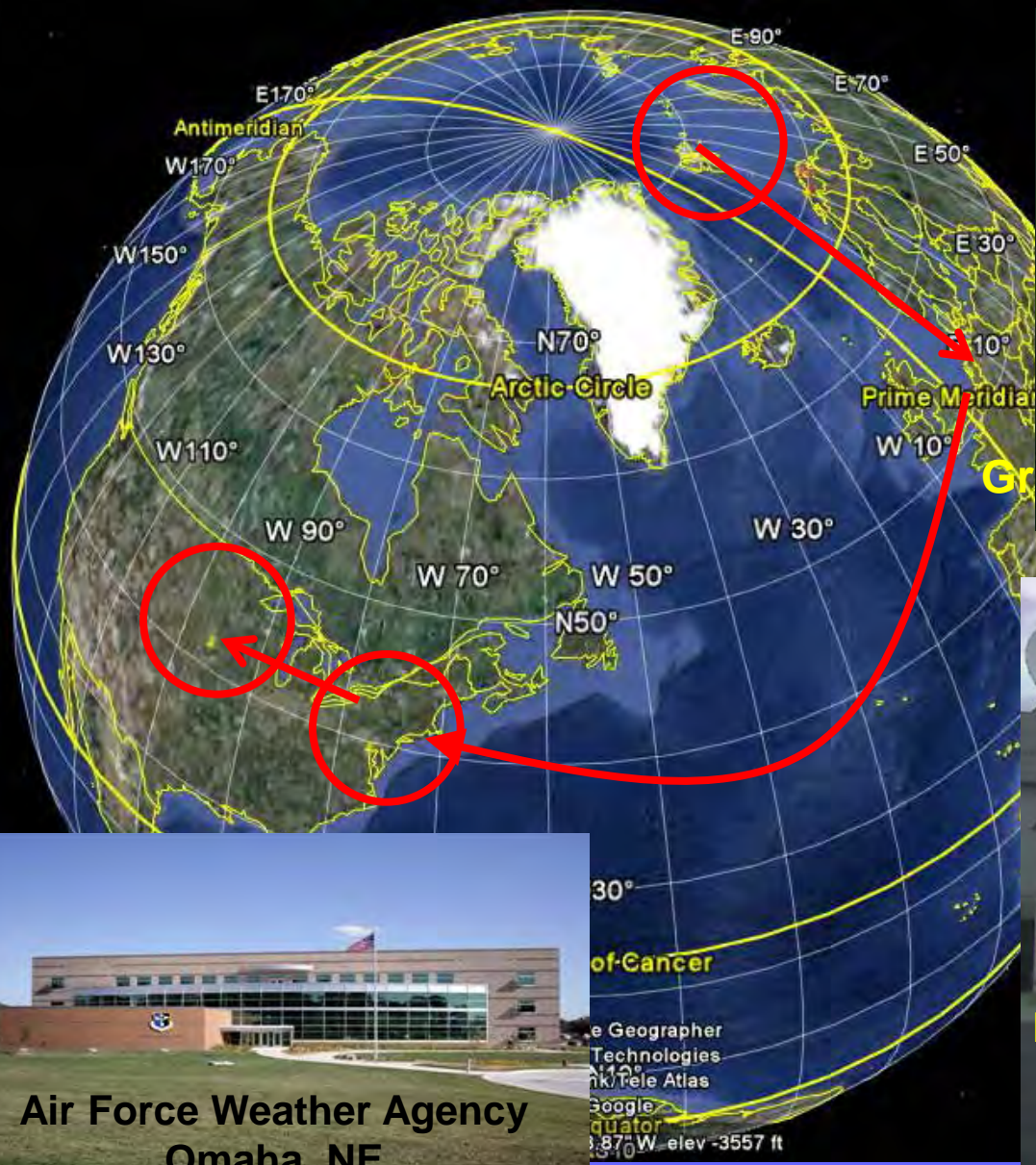
NPP is sun-synchronous.

Observes at the same
local time everyday

NPP will pass over GSFC
about 1:40 pm everyday



NPP Data: From Orbit to Svalbard to NOAA & AFWA



Ground Station, Svalbard Norway



NOAA Satellite Operations Facility (NSOF) Suitland, MD



Air Force Weather Agency Omaha, NE



NPP Mission

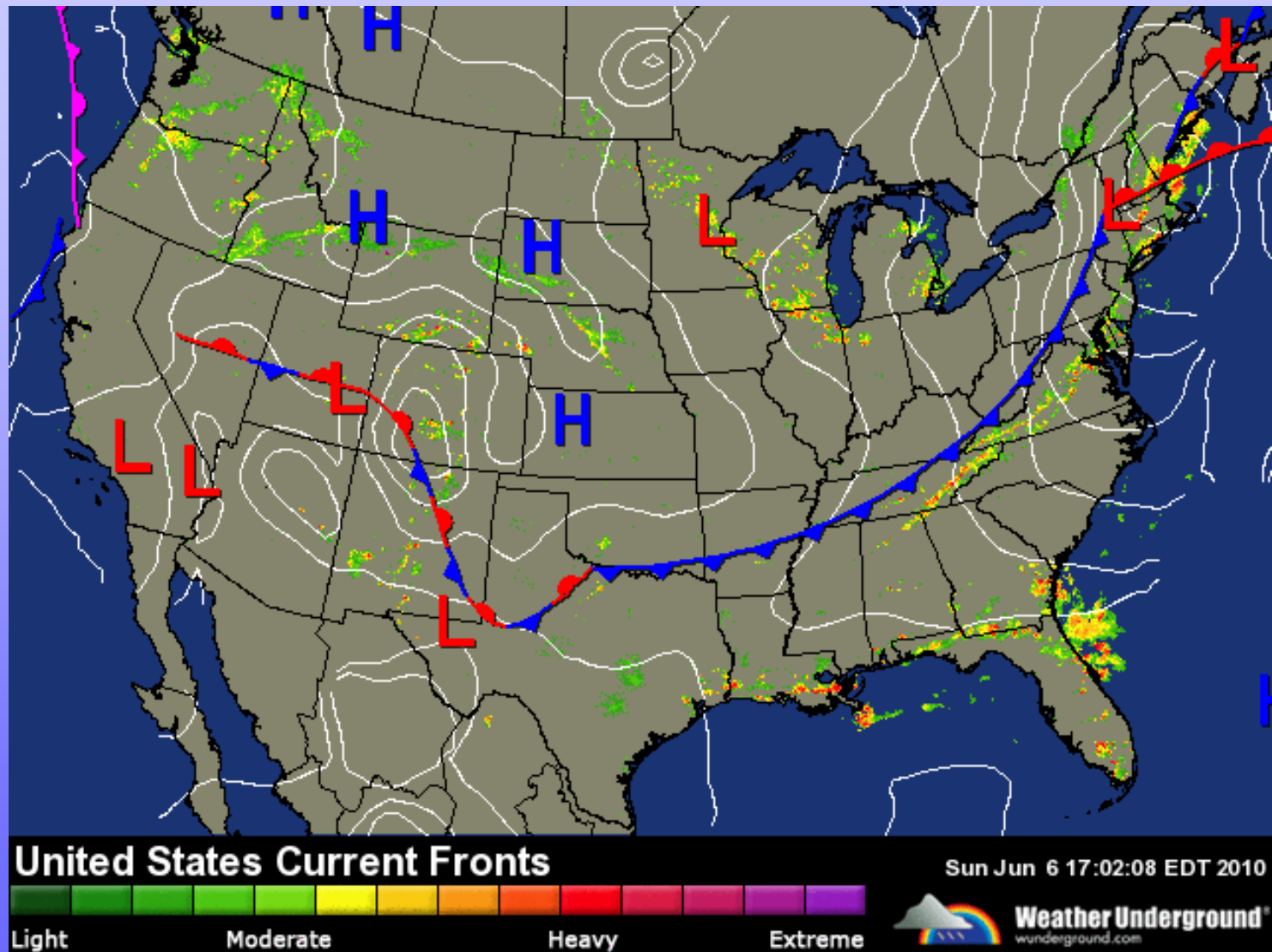


Provide Data for Weather Forecast Models

Short term Environmental Observations
(Events)

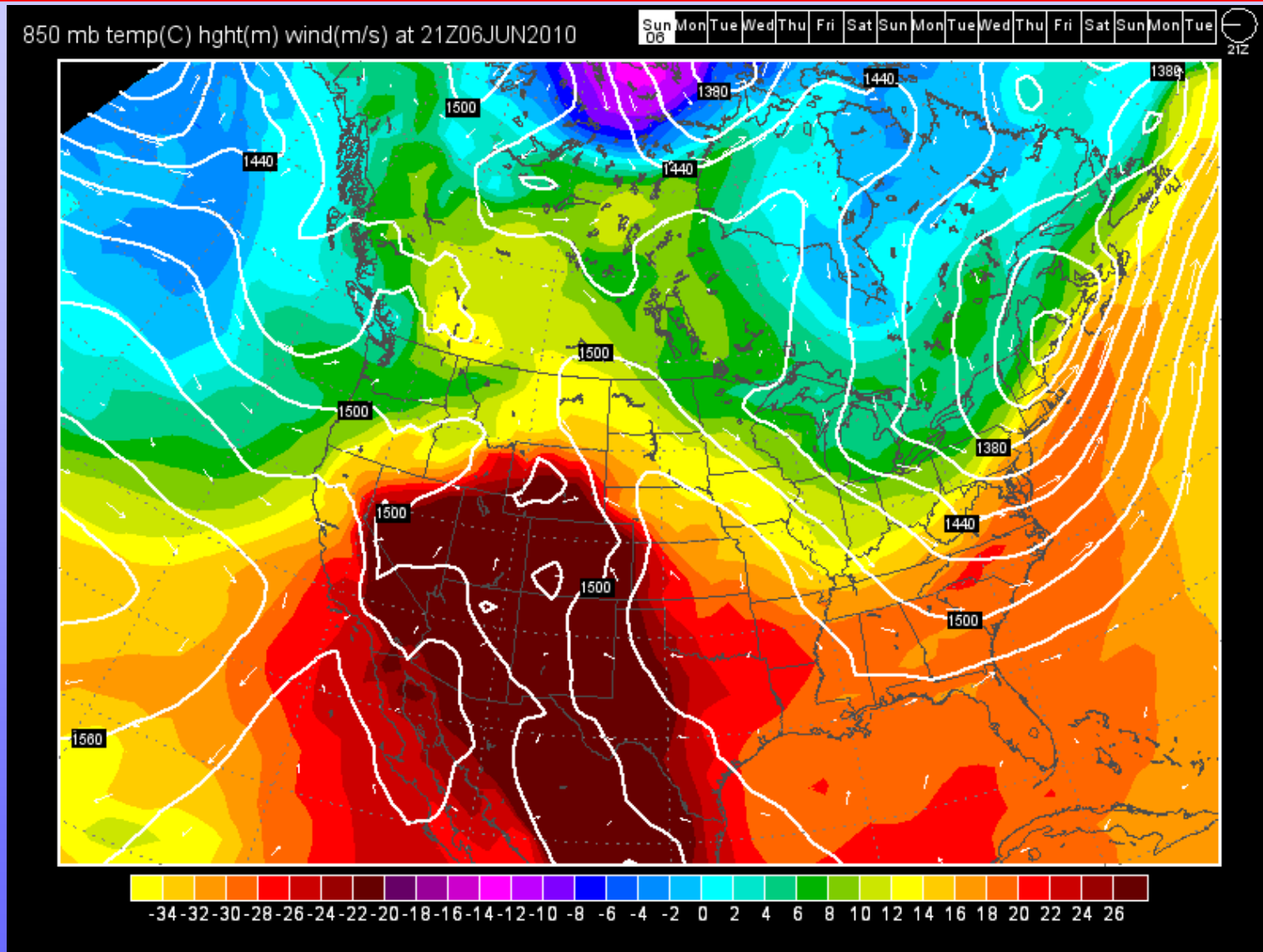
Long term Environmental Observations
(Climate Change Detection)

Weather Maps



Frontal Map with Radar June 6, 2010

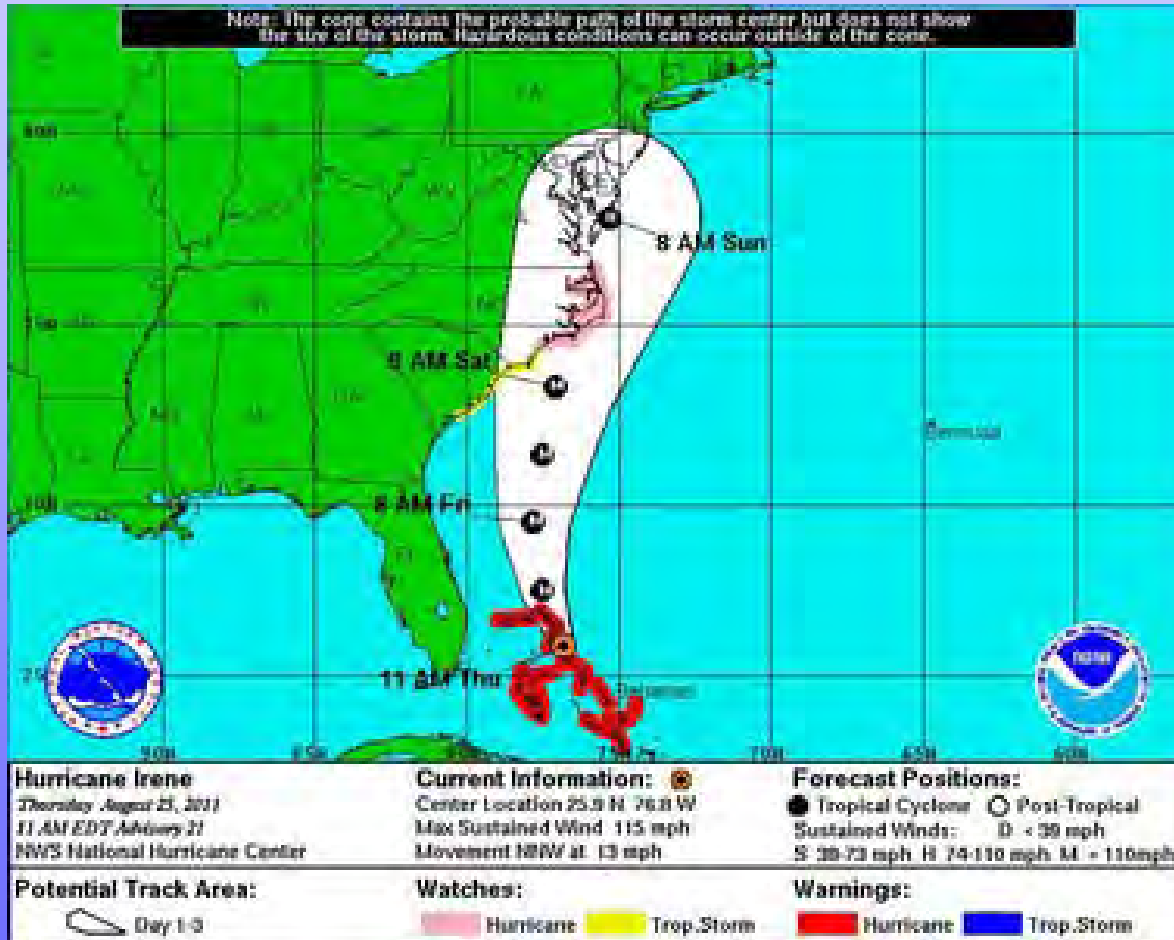
Weather Model and Forecast



Temperature at 850mb (5000ft) June 6 2010

Hurricane Track Forecast

3-Day Forecast Track for Hurricane Irene Aug 2011



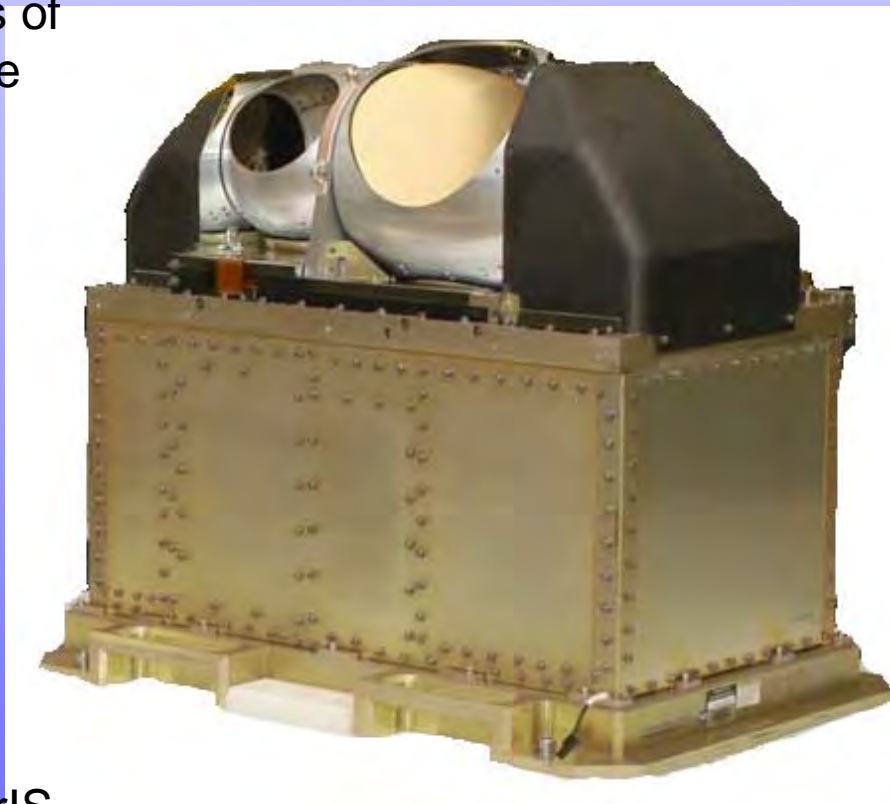
Track forecast error
 1960s-1980s:
 400 miles/3days

For 2008:
 200 miles/3 days
 Lt 100 miles/2days

“A forecast for five days from now is as accurate as forecasts for three days away were a decade ago” Bill Read NOAA/NHC

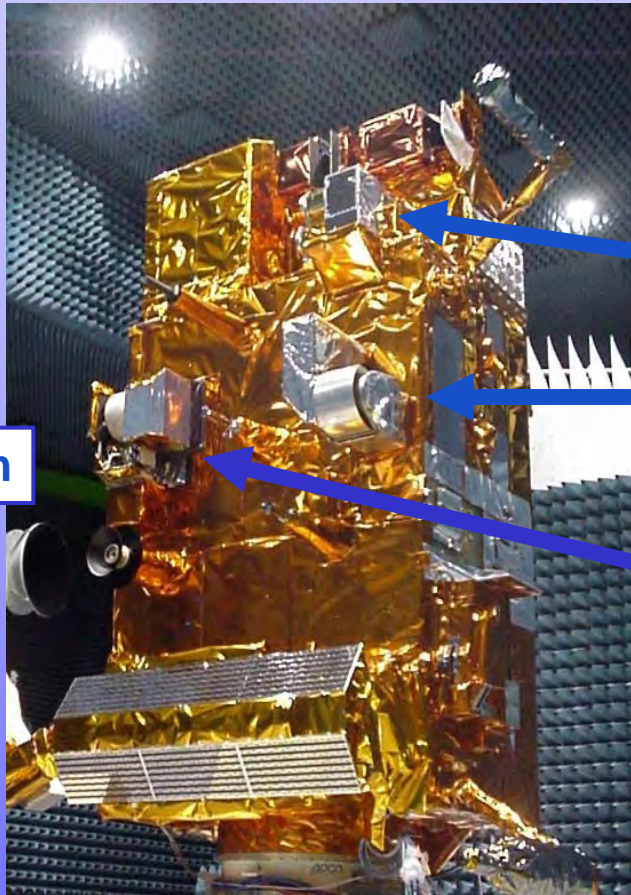
Description

- **Purpose:** In conjunction with CrIS, global observations of temperature and moisture profiles at high temporal resolution (~ daily).
- **Predecessor Instruments:**
AMSU A1 / A2, MHS
- **Approach:**
Scanning passive microwave radiometer
(22 channels
(23GHz - 183GHz))
- **Swath width:** 2300 km
- **Co-registration:** with CrIS



AMSU-A1 + AMSU-A2 + MHS = ATMS

First METOP in Test



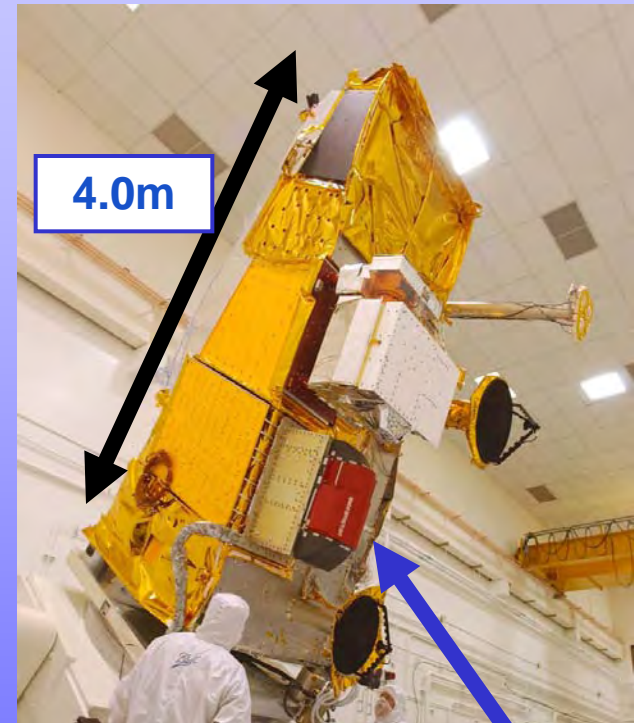
6.3m

AMSU-A1
55kg

AMSU-A2
50 kg

MHS
66 kg

NPP



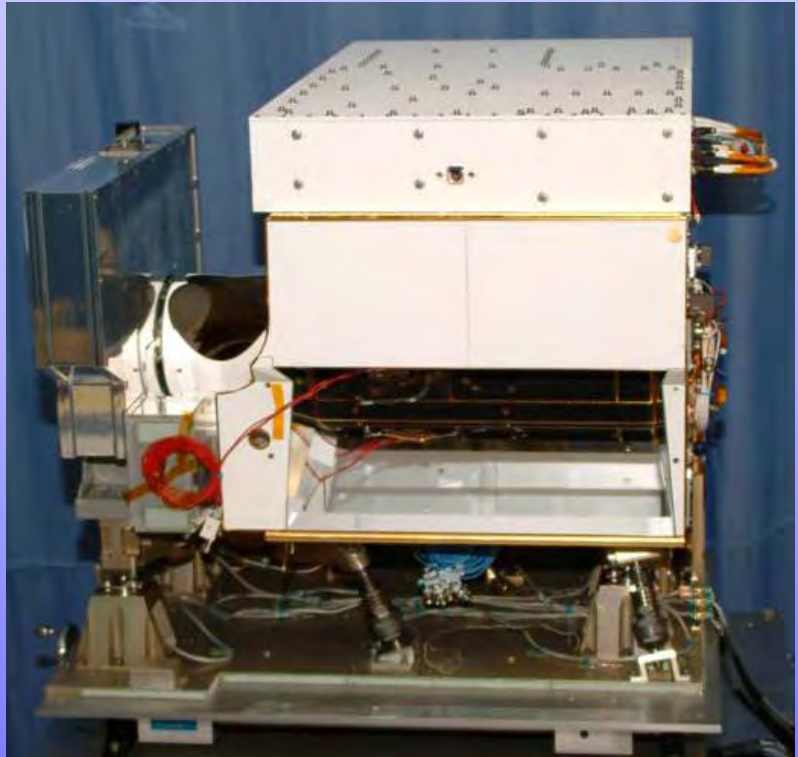
4.0m

ATMS
75 kg

CrIS Overview

ITT, Fort Wayne, IN

- The Cross-track Infrared Sounder (CrIS) is a key sensor
 - Fourier Transform Spectrometer providing high resolution IR spectra:



Band	Wavelength Range (cm-1)	Wavelength Range (mm)	Sampling (cm-1)	No. Chan.
SWIR	2155-2550	4.64-3.92	2.5	159
MWIR	1210-1750	8.26-5.71	1.25	433
LWIR	650-1095	15.38-9.14	0.625	713

- Fields of Regard each 3 x 3 FOVs
- Photovoltaic Detectors in all 3 bands
- 4-Stage Passive Detector Cooler
- 14 km nadir spatial resolution
- 2200 km swath width
- On-board internal calibration target
- Science pioneer: AIRS on EOS Aqua, IASI on METOP-A
- Supplier: ITT Industries
- Key subcontractors:
 - ABB Bomem, Interferometer, ICT
 - DRS, detectors
 - AER, EDR algorithm

	Spec
Mass, kg	165
Average Power, W	135
Average Data Rate, Mbps	1.5



NPP Mission



Provide Data for Weather Forecast Models

**Short term Environmental Observations
(Events)**

Long term Environmental Observations
(Climate Change Detection)

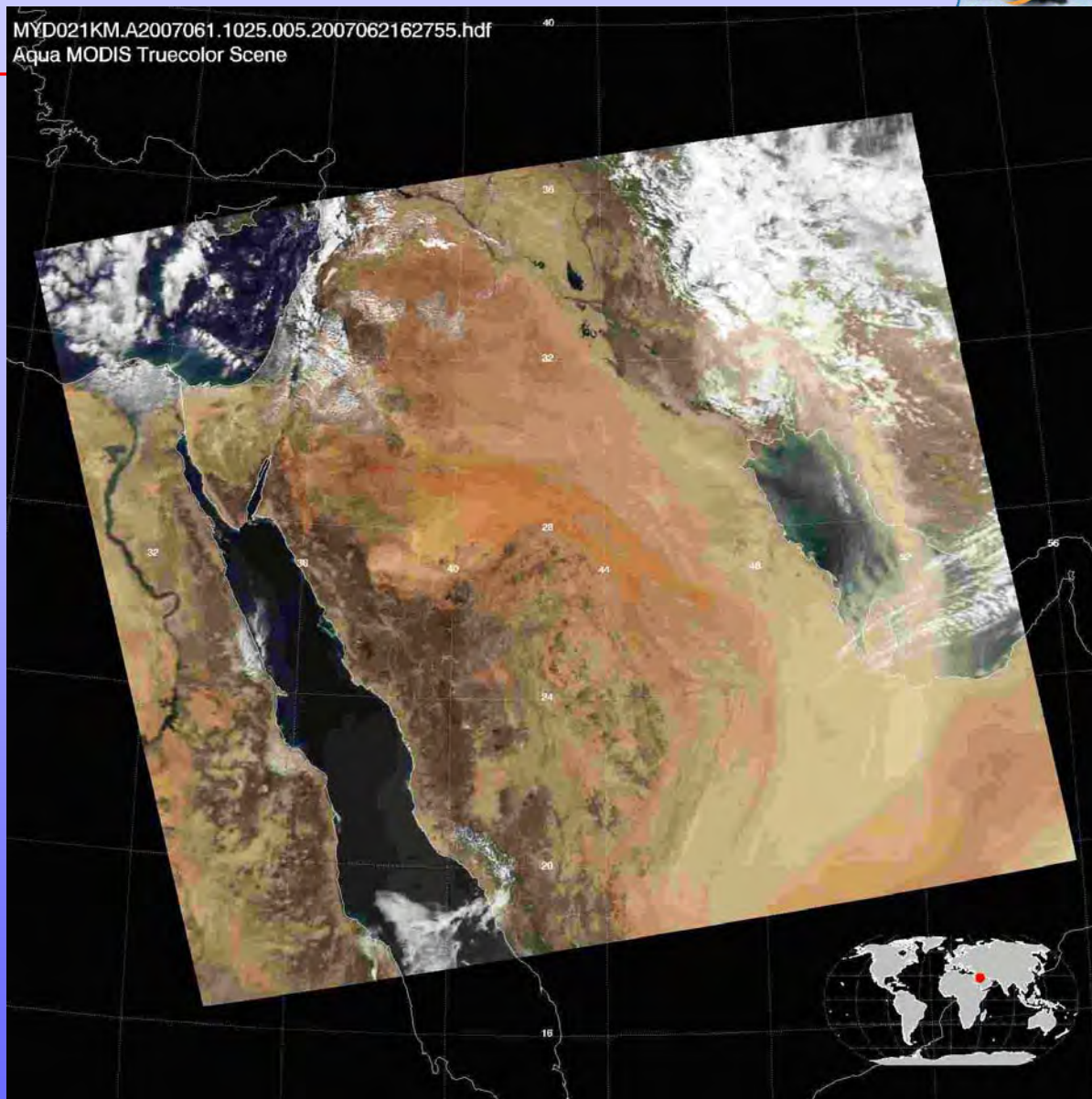


Deepwater Horizon Oil Slick

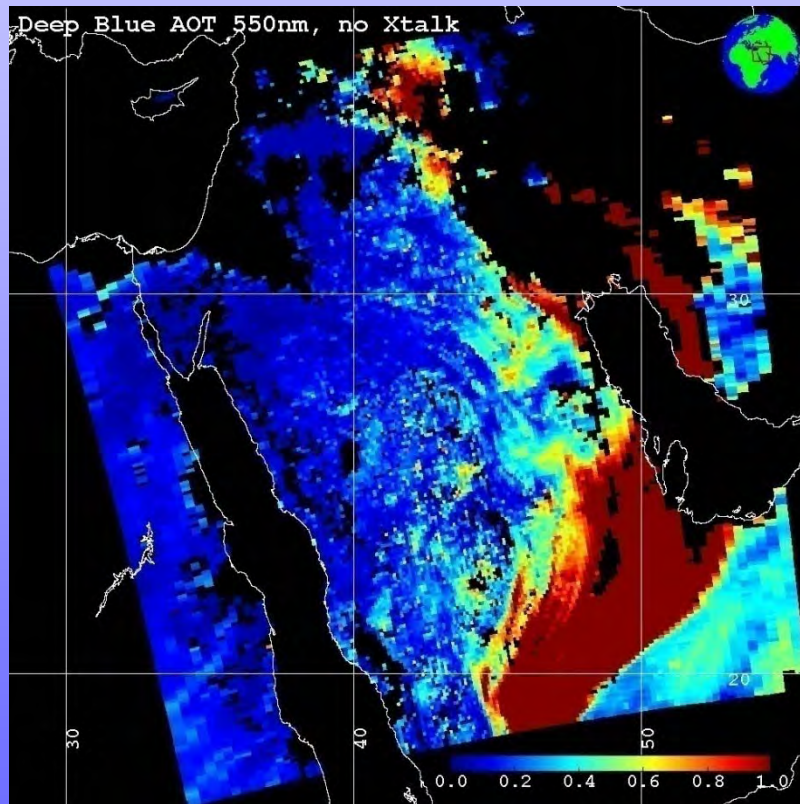
April 29, 2010



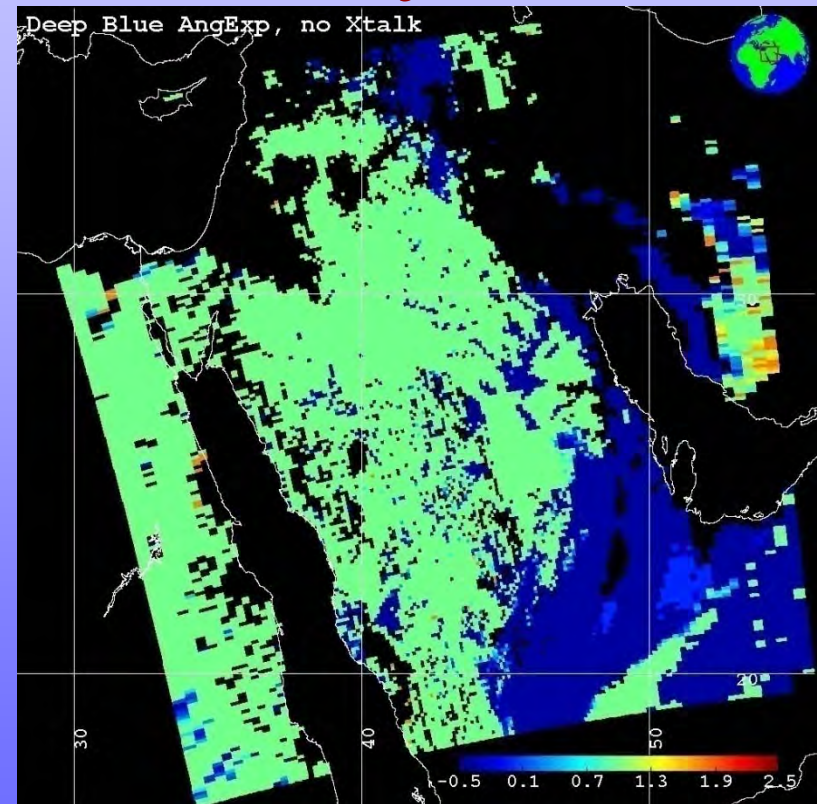
Heavy Dust Plumes over Iraq & Persian Gulf Scene



Aerosol Optical Thickness Aerosols over Land

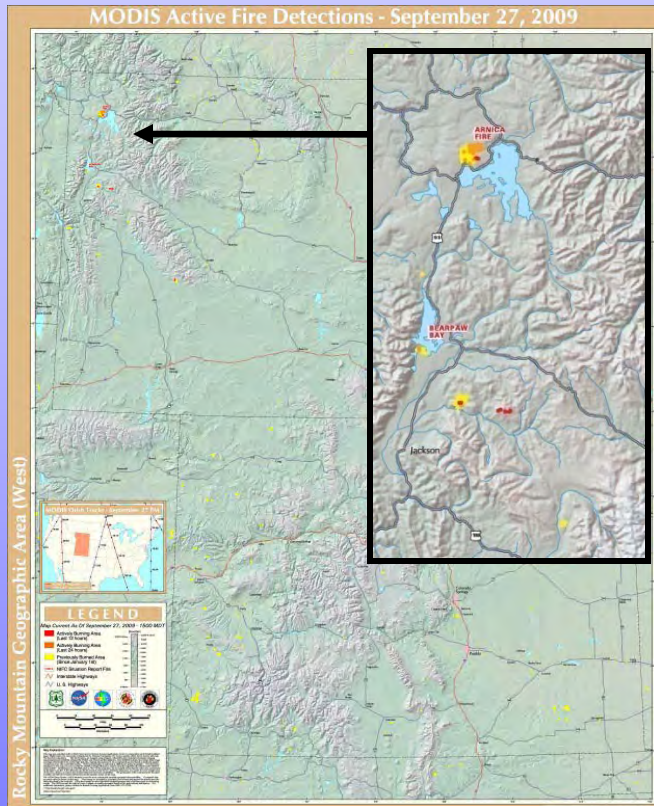


Angstrom Exponent Size Information



Forest Fire Management

USDA Forest Service MODIS Active Fire Mapping Program



Yellowstone Fire September 27, 2009

The MODIS Active Fire Mapping Program provides a near real-time geospatial overview of the current wildland fire situation at regional and national scales. Locations of current fires and the extent of previous fire activity are ascertained using satellite imagery acquired by the MODIS sensor.. This information is utilized by fire managers to assess the current fire situation and serves as a decision support tool in strategic decisions regarding fire suppression resource allocation.

Visible Infrared Imaging Radiometer Suite Raytheon SAS El Segundo, Ca

Description

- Purpose: Global observations of land, ocean, & atmosphere parameters at high temporal resolution (~ daily)
- Predecessor Instruments: AVHRR, OLS, MODIS, SeaWiFS
- Approach: Multi-spectral scanning radiometer (22 bands between 0.4 μm and 12 μm) 12-bit quantization
- Swath width: 3000 km

Spatial Resolution

16 bands at 750m

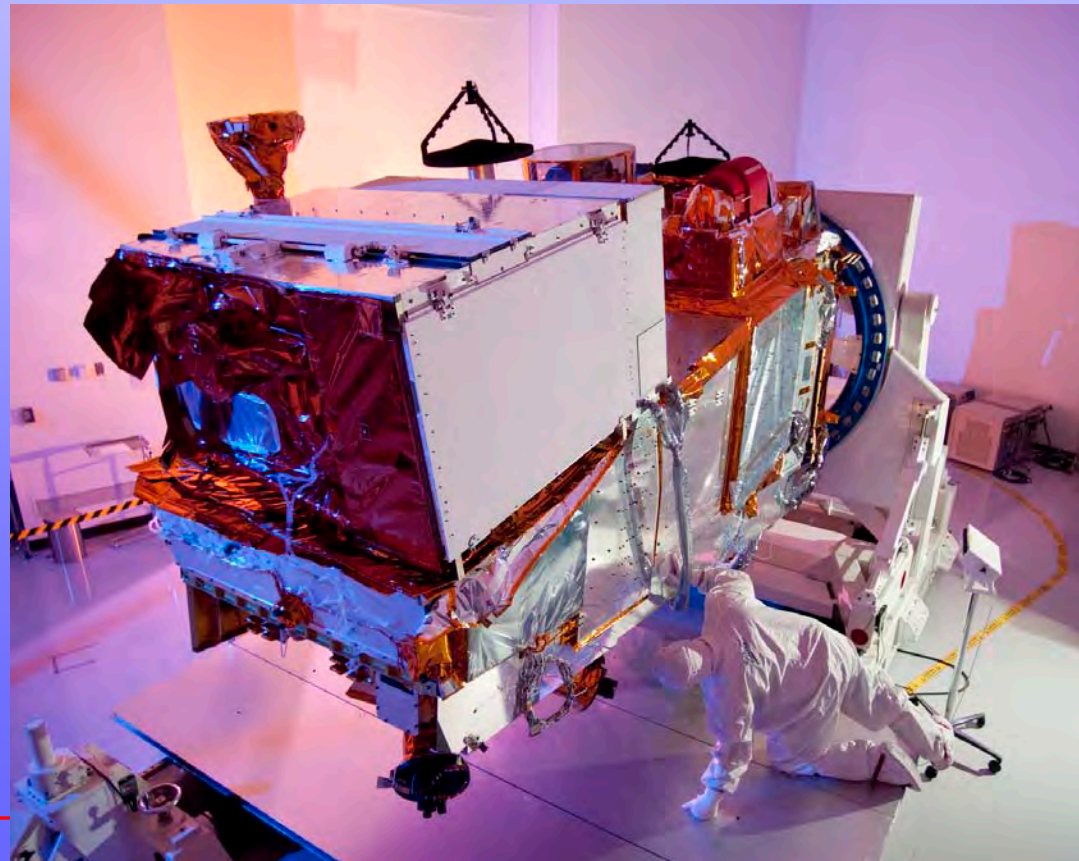
5 bands at 325m

DNB

20 Data Products

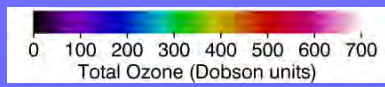
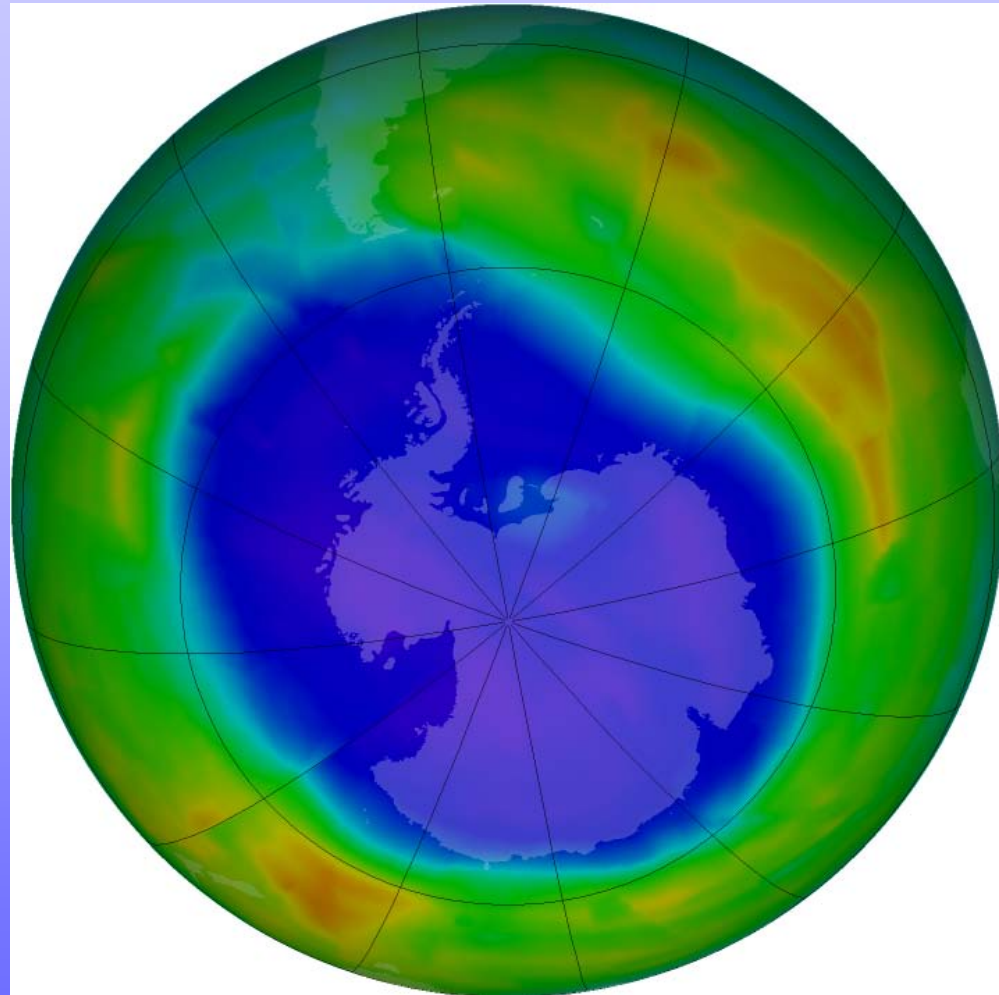
Land, Ocean, Atmosphere

VIIRS on NPP



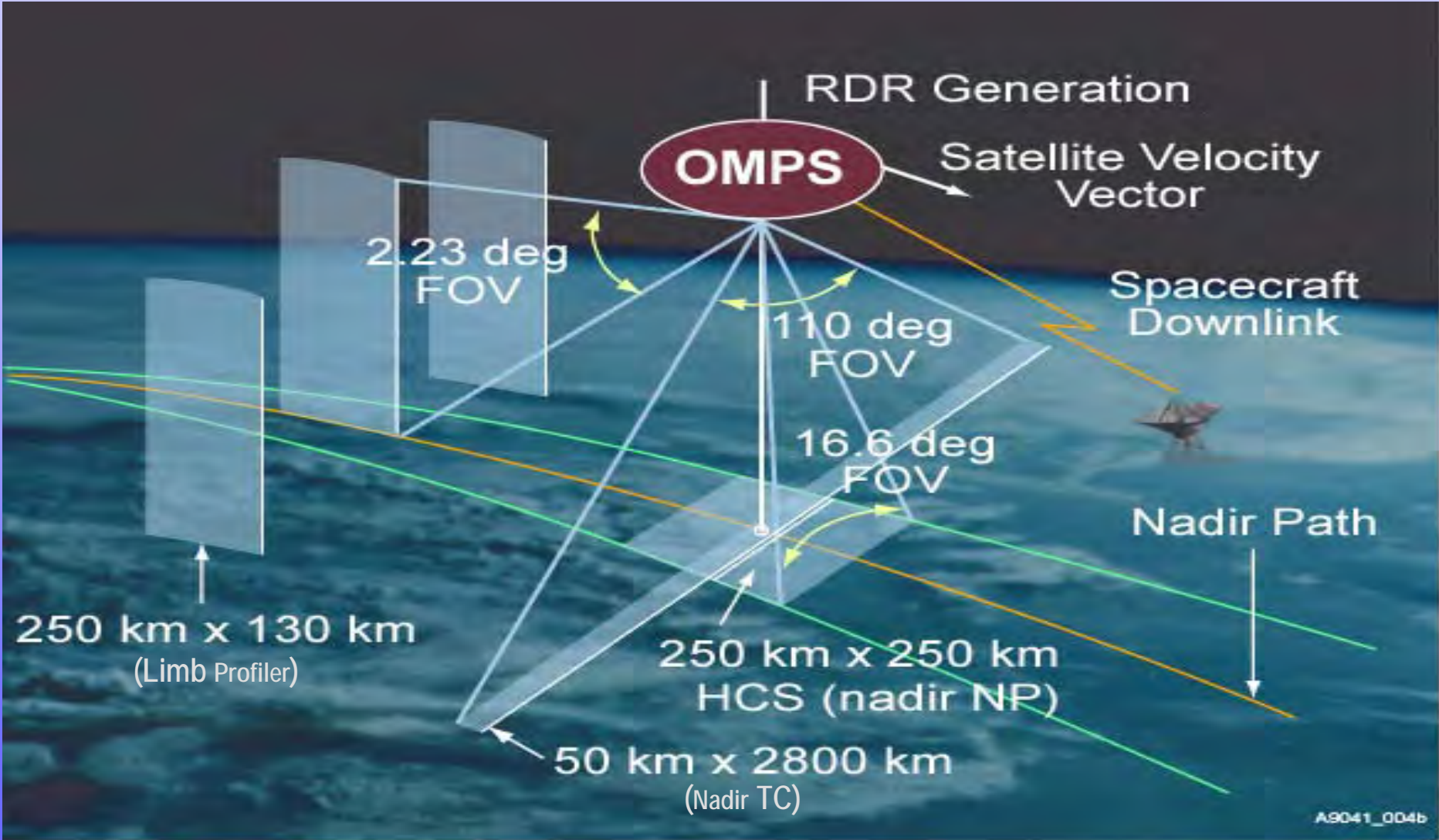
Ozone Hole

September 12, 2011



Area: 26 million km²
Area of North America
25 million km²

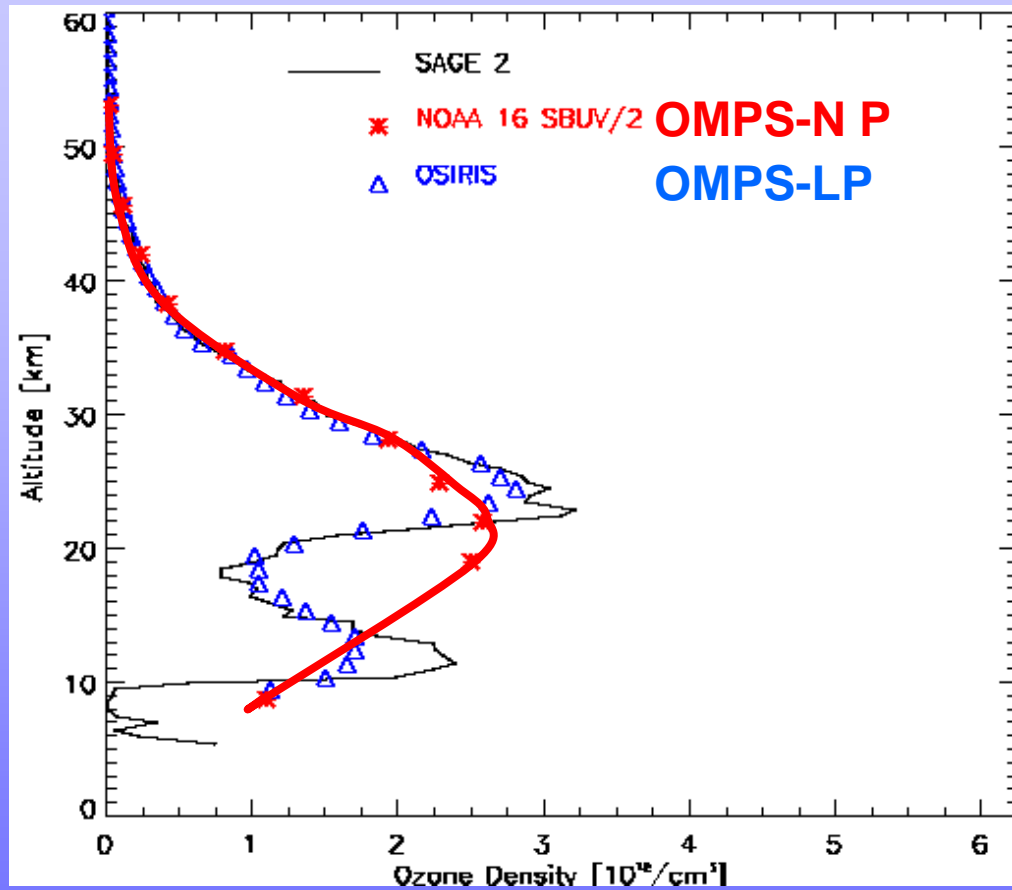
What does OMPS see?



Ozone Profile and OMPS Limb



Ozone Profile Comparison 10/10/2002





NPP Mission



Provide Data for Weather Forecast Models

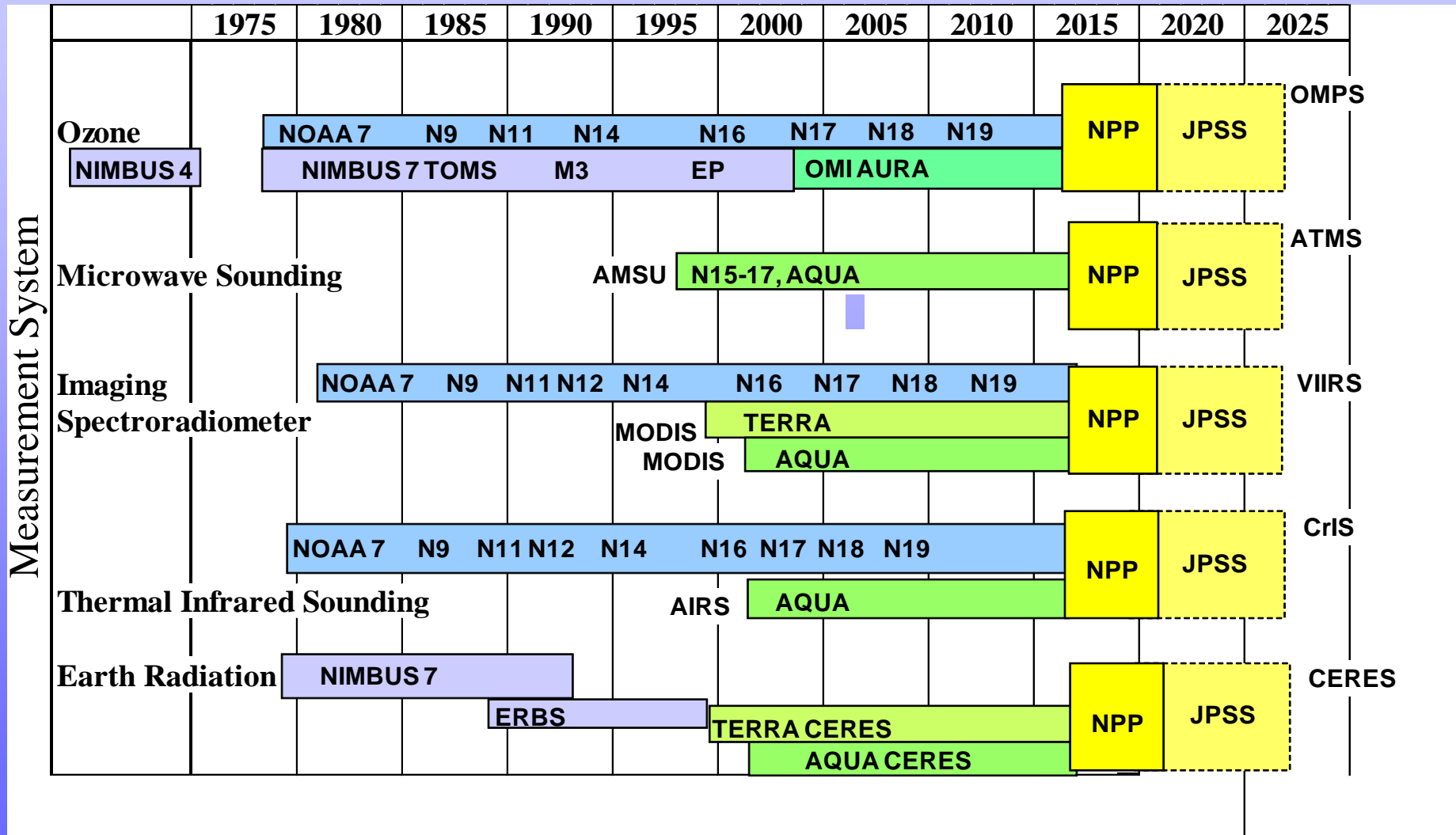
Short term Environmental Observations
(Events)

Long term Environmental Observations
(Climate Change Detection)

NPP Continues Data Time Series



Year

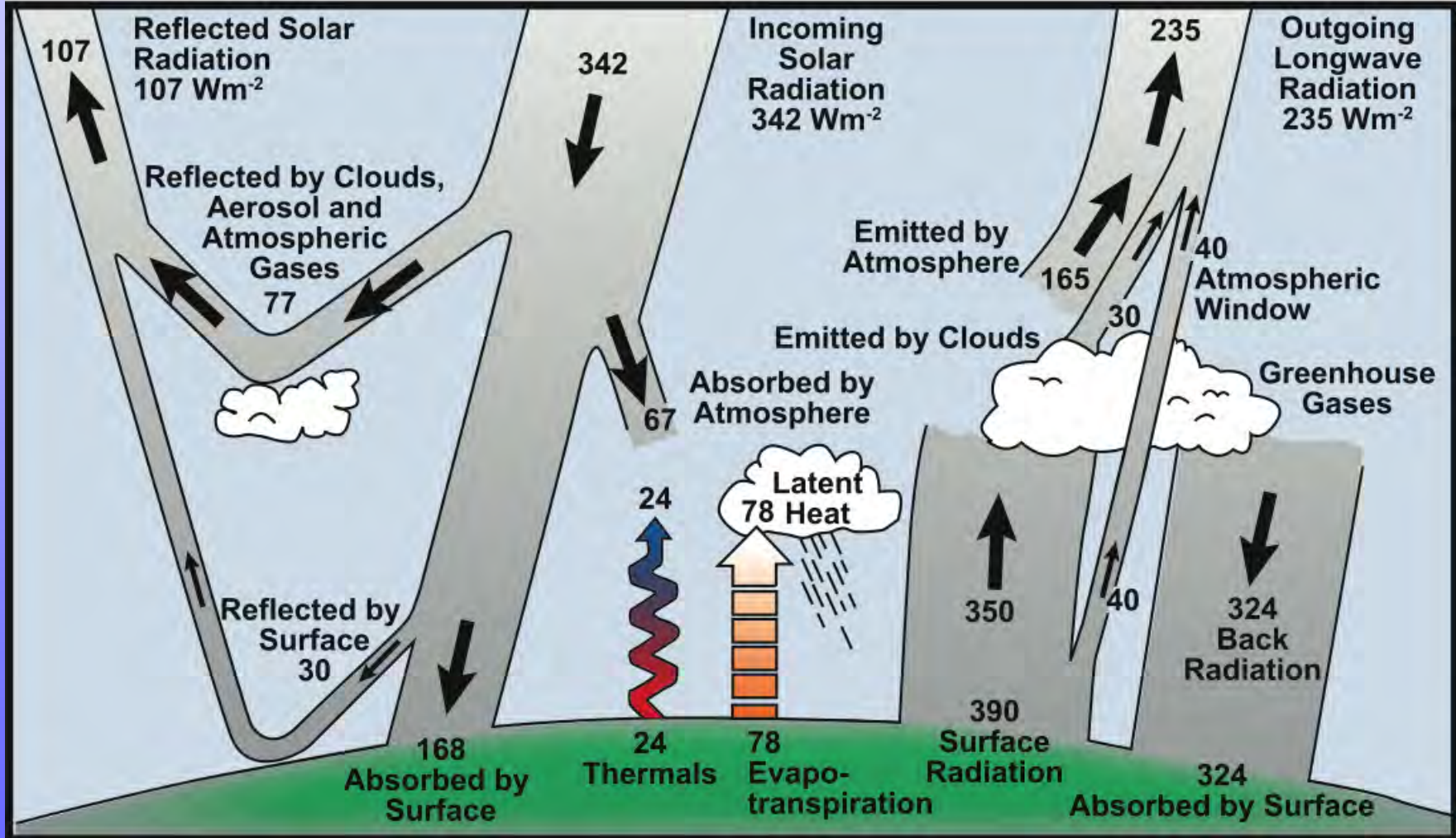


NPP Mission: Long-term Observations of Earth's Energy Balance.

CERES Shortwave

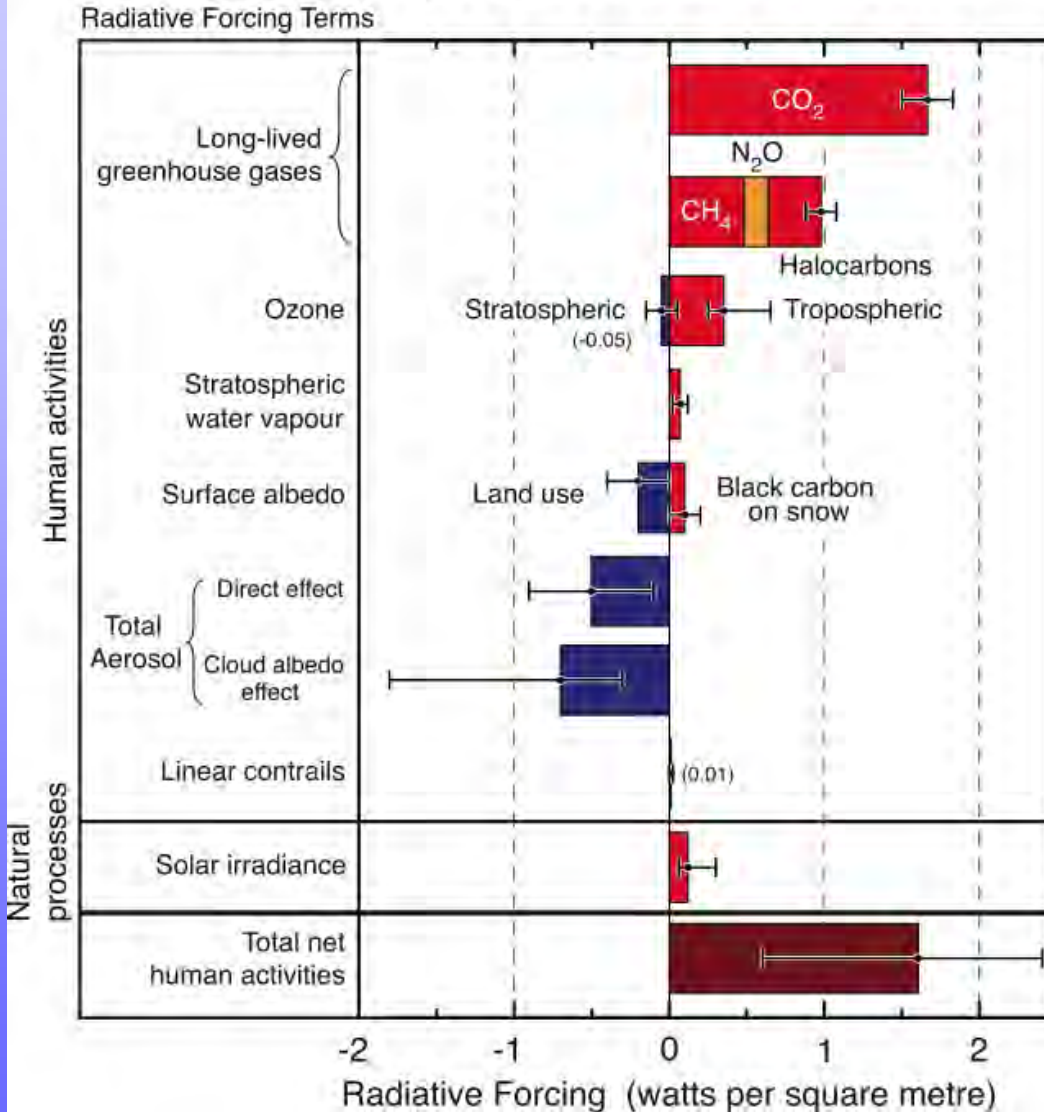
TSIS

CERES Longwave



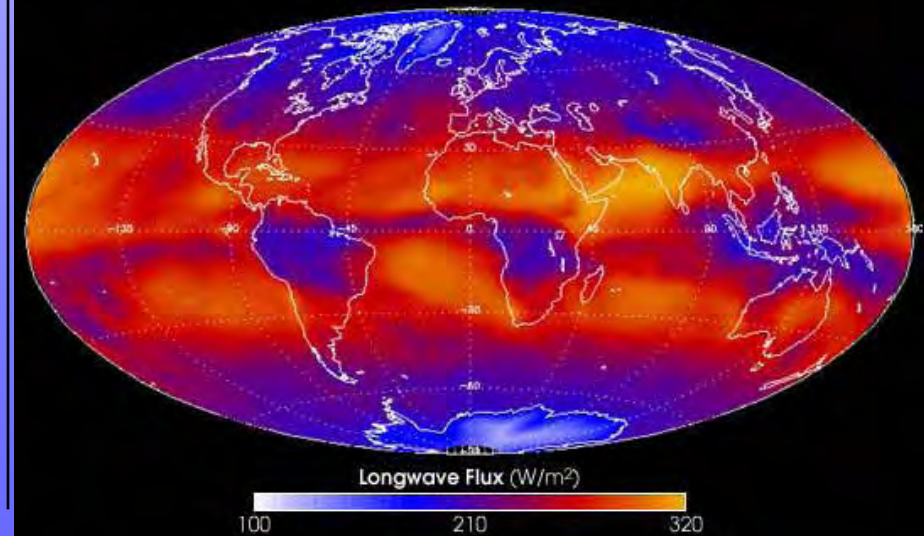
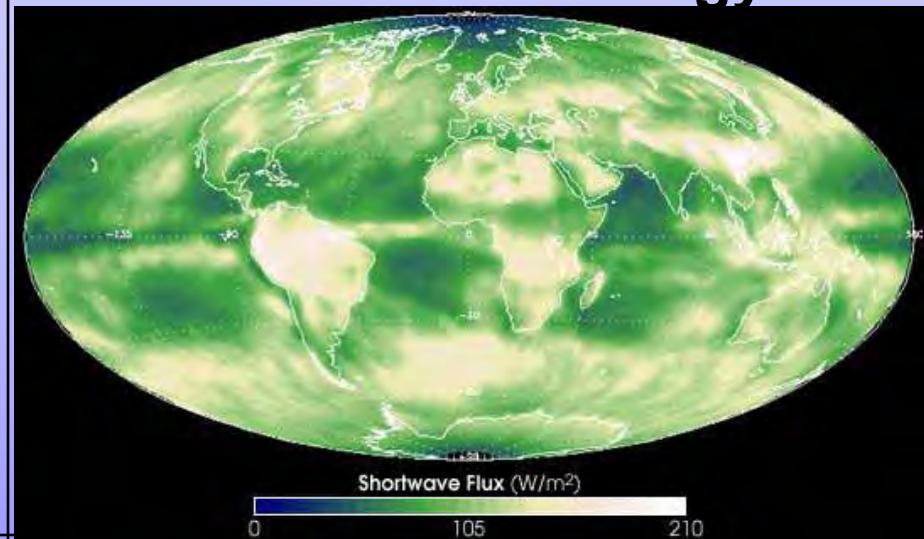
IPCC Radiative Forcing

Radiative forcing of climate between 1750 and 2005





Reflected Solar Energy



CERES scanning radiometer measuring three spectral bands at TOA

- Total (0.3 to $>50 \mu m$)
- Shortwave (0.3 to $5.0 \mu m$)
- Longwave Bandpass (8 to $12 \mu m$)

Operations, Data Processing, Products, and Science are a continuation of experience developed on

- TRMM (1), EOS Terra (2), EOS Aqua (2)

Emitted Thermal Energy

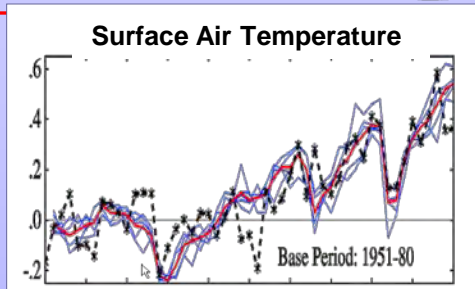
Satellites: POES → EOS → **NPP** → JPSS

How is the global Earth system changing?

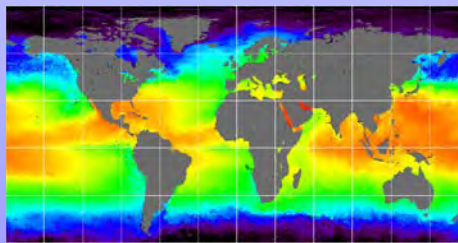
- atmospheric temperature and moisture profiles
- variability in ocean color and temperature
- vegetation productivity patterns

How does the Earth System respond to natural and human-induced changes?

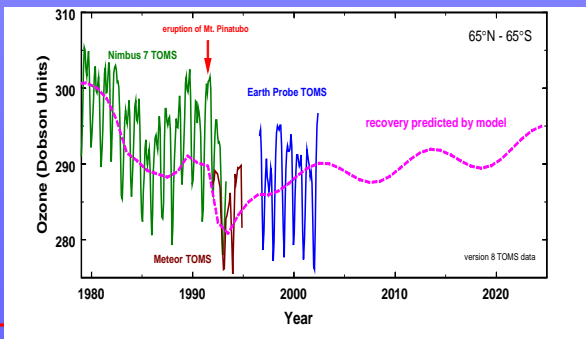
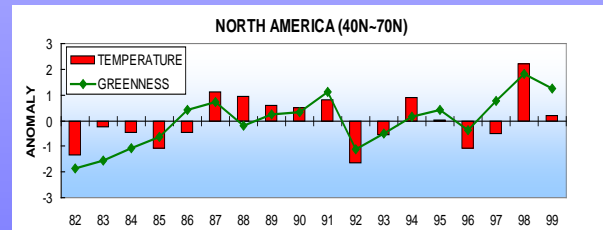
- vegetation responses to climate
- ozone layer recovery
- clouds and aerosols



Atmospheric Sounding



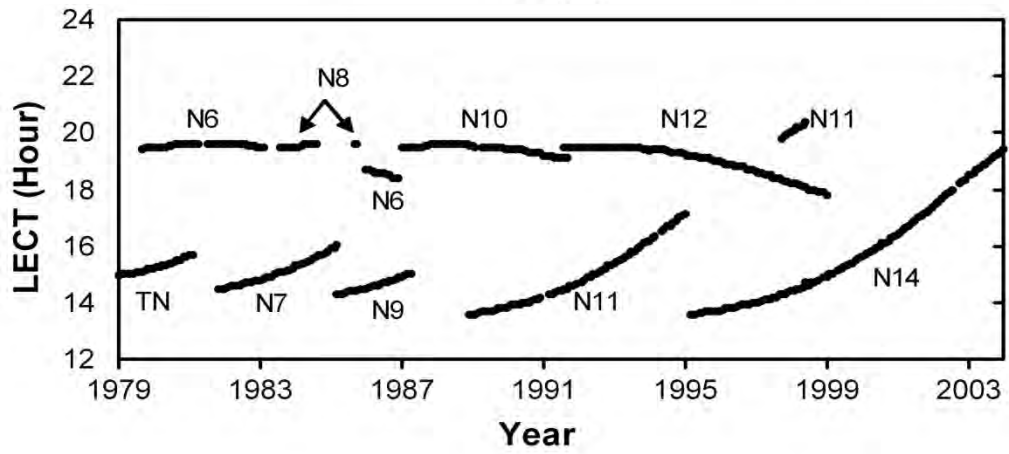
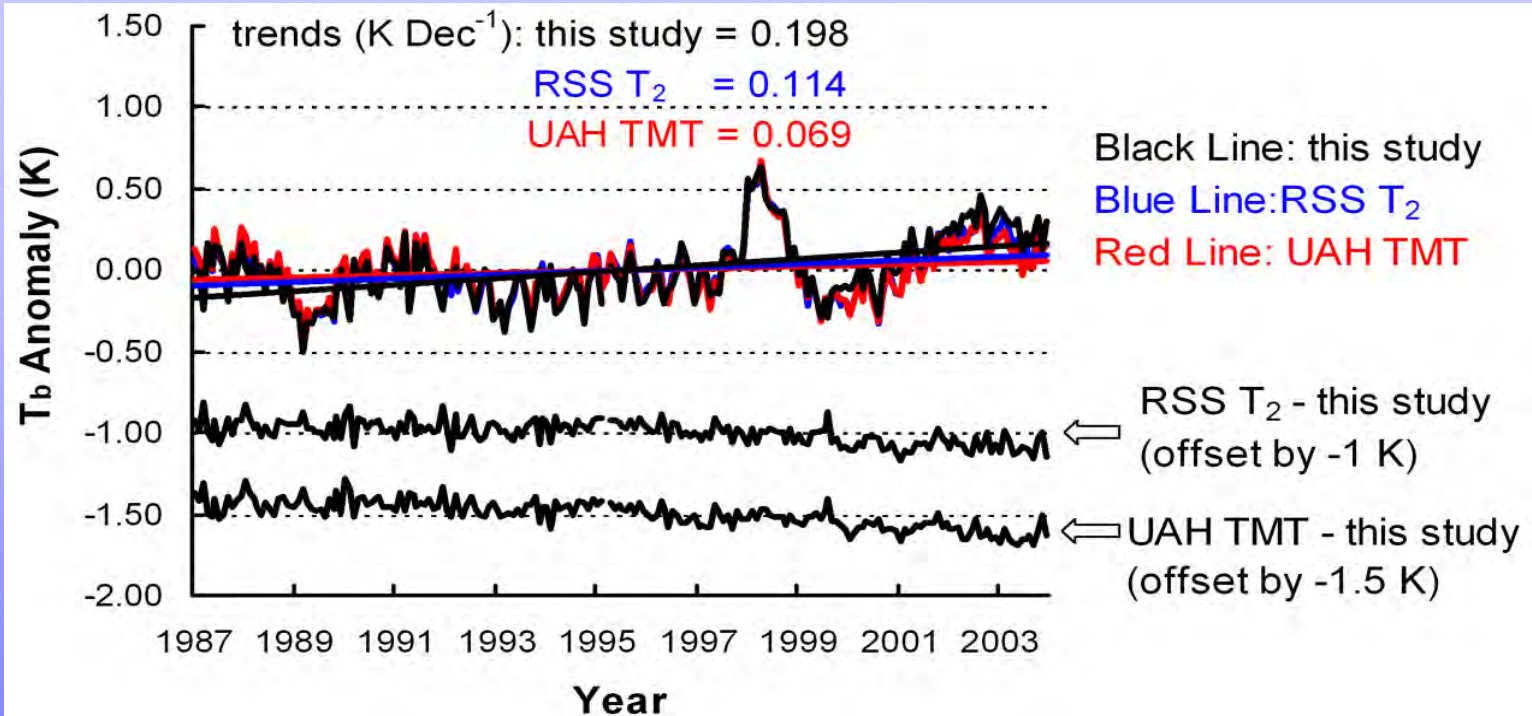
Multispectral Imaging / Surface Biophysical Properties



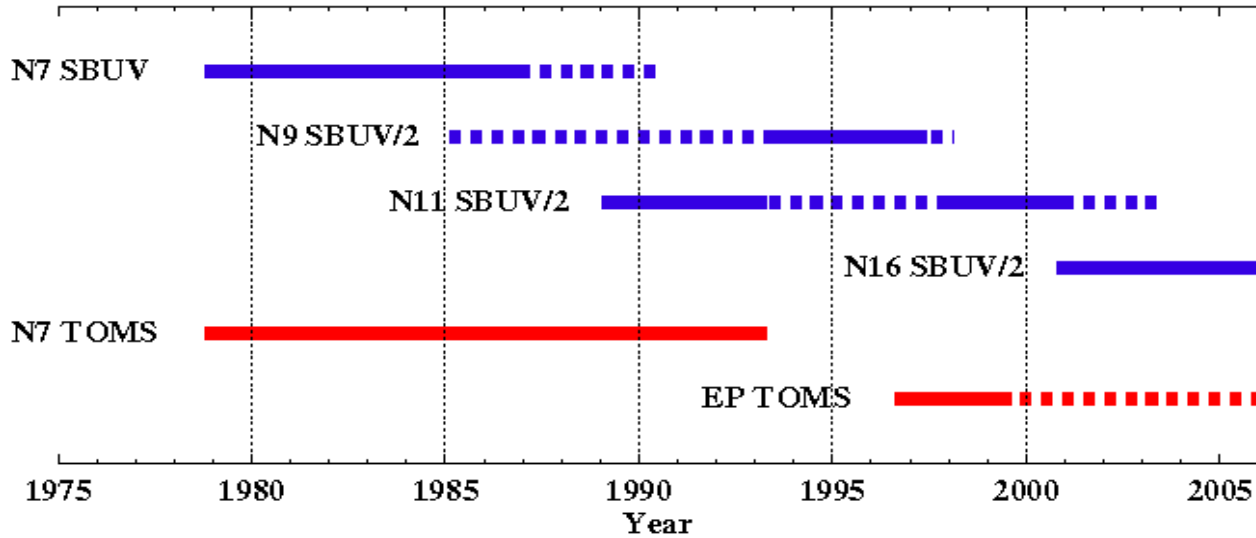
Total Ozone Monitoring

MSU Tropospheric Temperature Trends

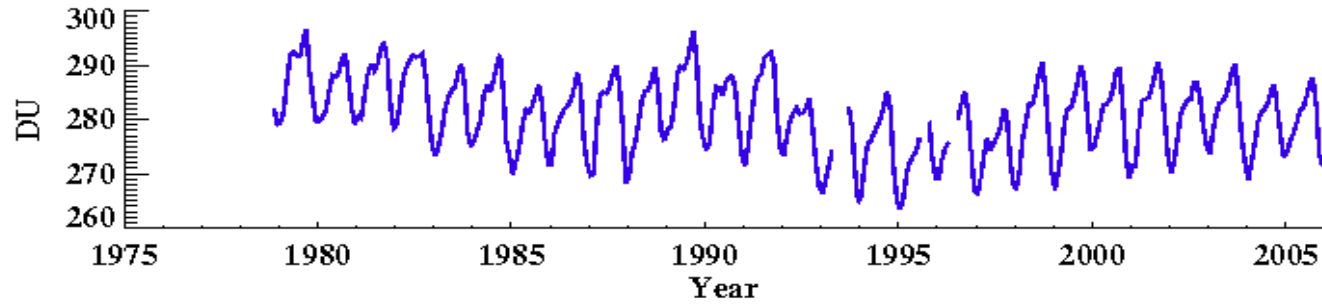
Zou et al., JGR-Atm, 111 (D19): D19114 OCT 14 2006



Instrument Data used to create Merged Ozone Dataset



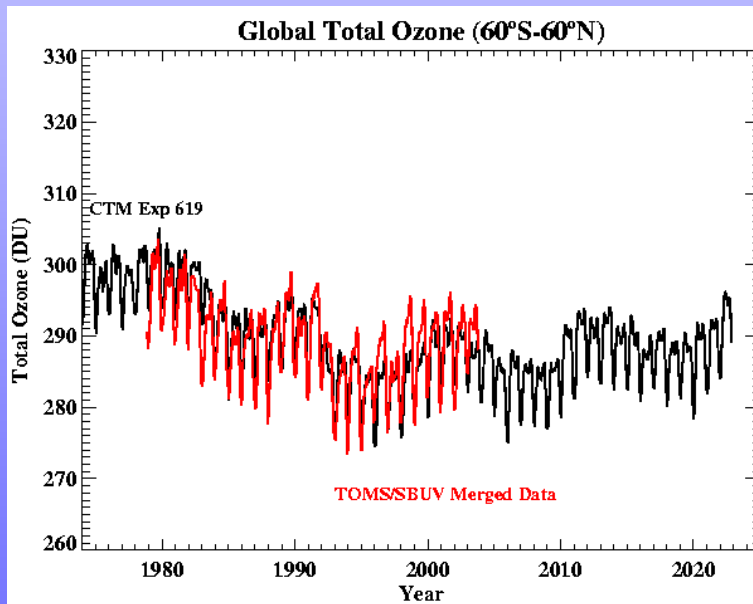
50°S - 50°N MOD Time Series



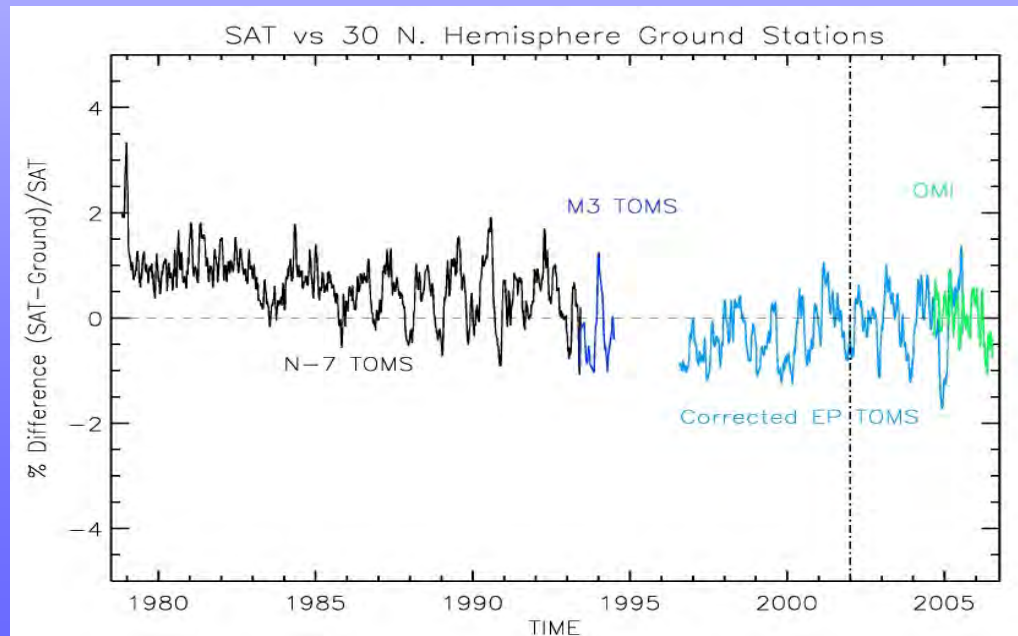
Climate Science Questions

Can we use past performance to predict the future?

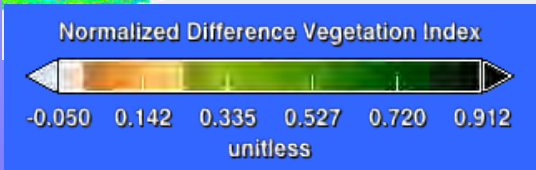
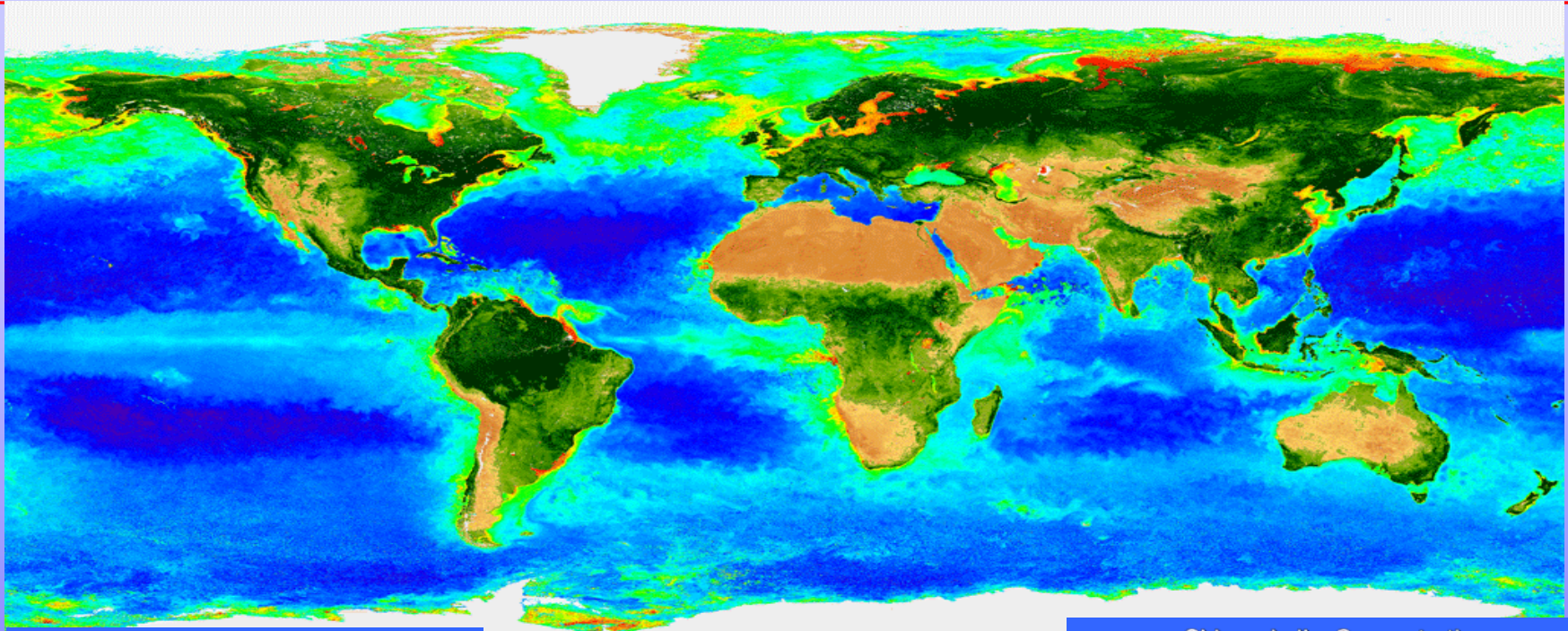
Does the model data reproduce the satellite observations?



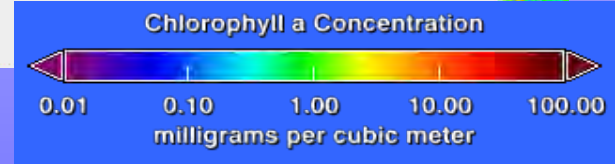
How much confidence do we have in the observations?



Carbon Cycle Questions



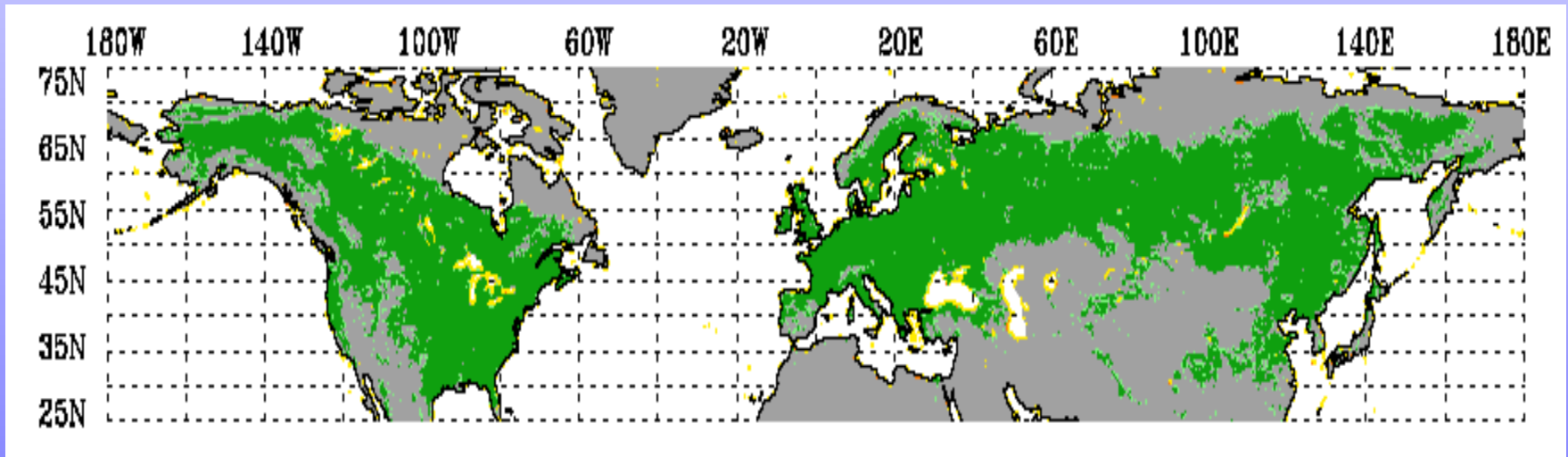
SeaWiFS July 2003



Where are the carbon sources and sinks?
Are source/sinks changing?
Is the biosphere changing?

Study Region

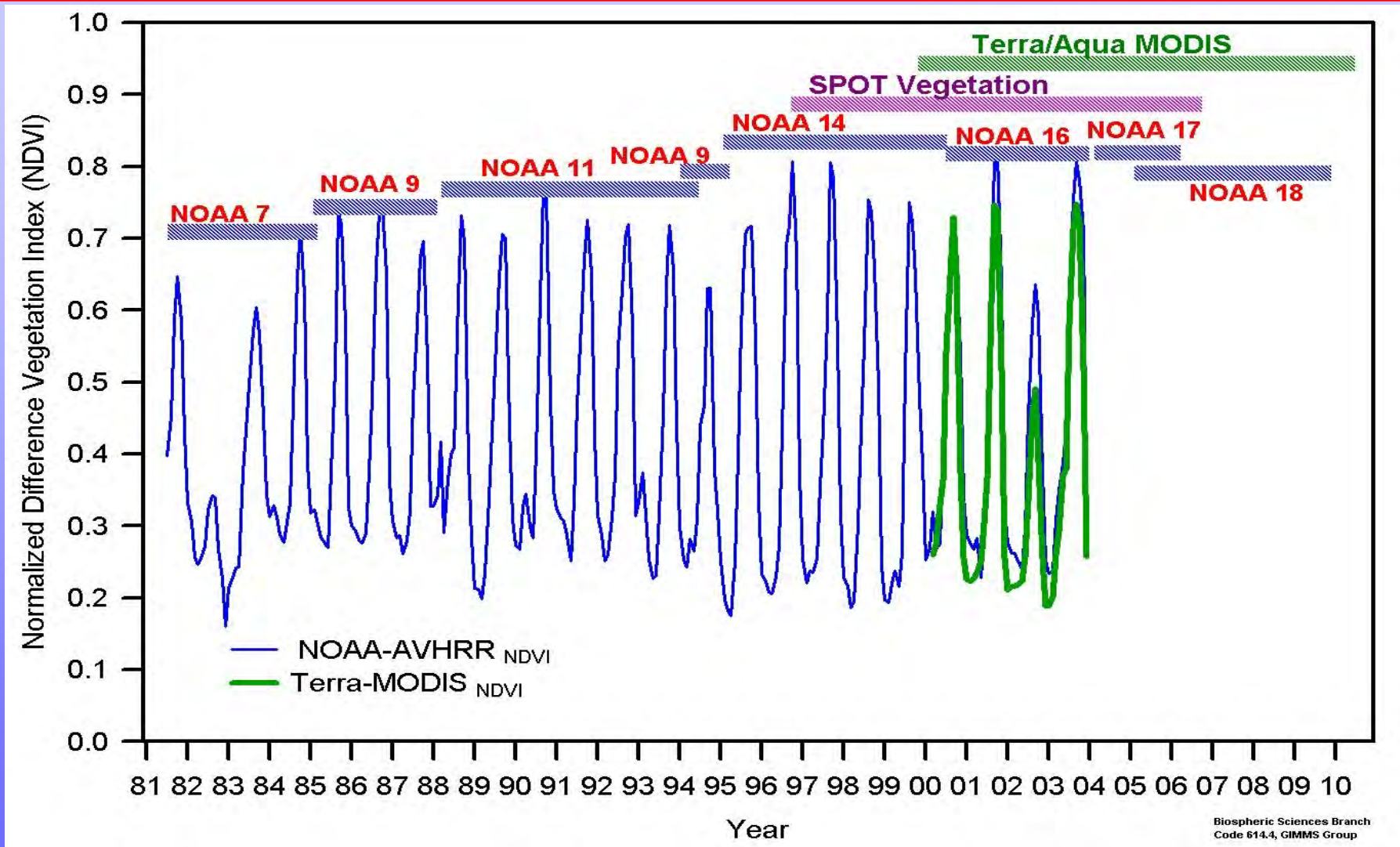
- Vegetated pixels between 30°N-70°N



Objectives

1. minimize the effect of Solar Zenith Angle
2. reduce background effects (snow, barren and sparsely vegetated areas)
3. use data from the same pixels in the entire analysis.

Multi satellite NDVI time series



Biospheric Sciences Branch
Code 614.4, GIMMS Group

NDVI data set and the satellites that are used.

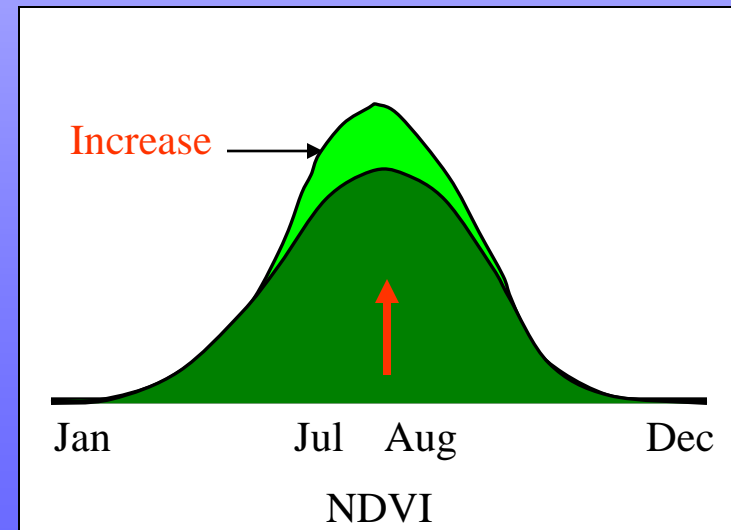
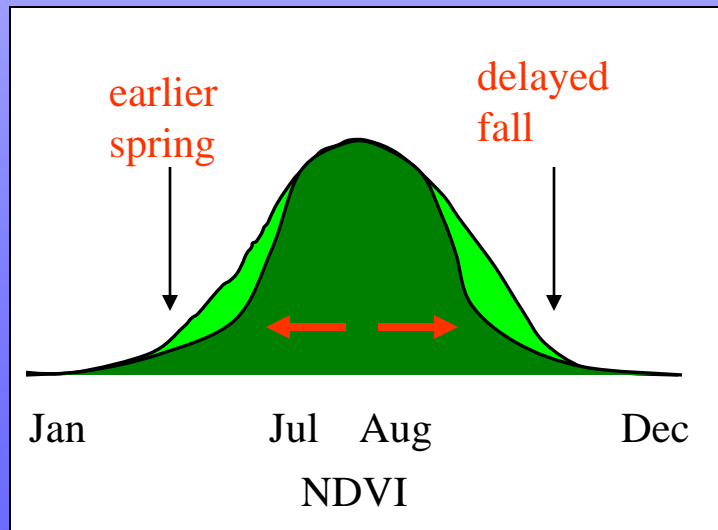
- Changes in vegetation activity can be characterized through

1. changes in growing season

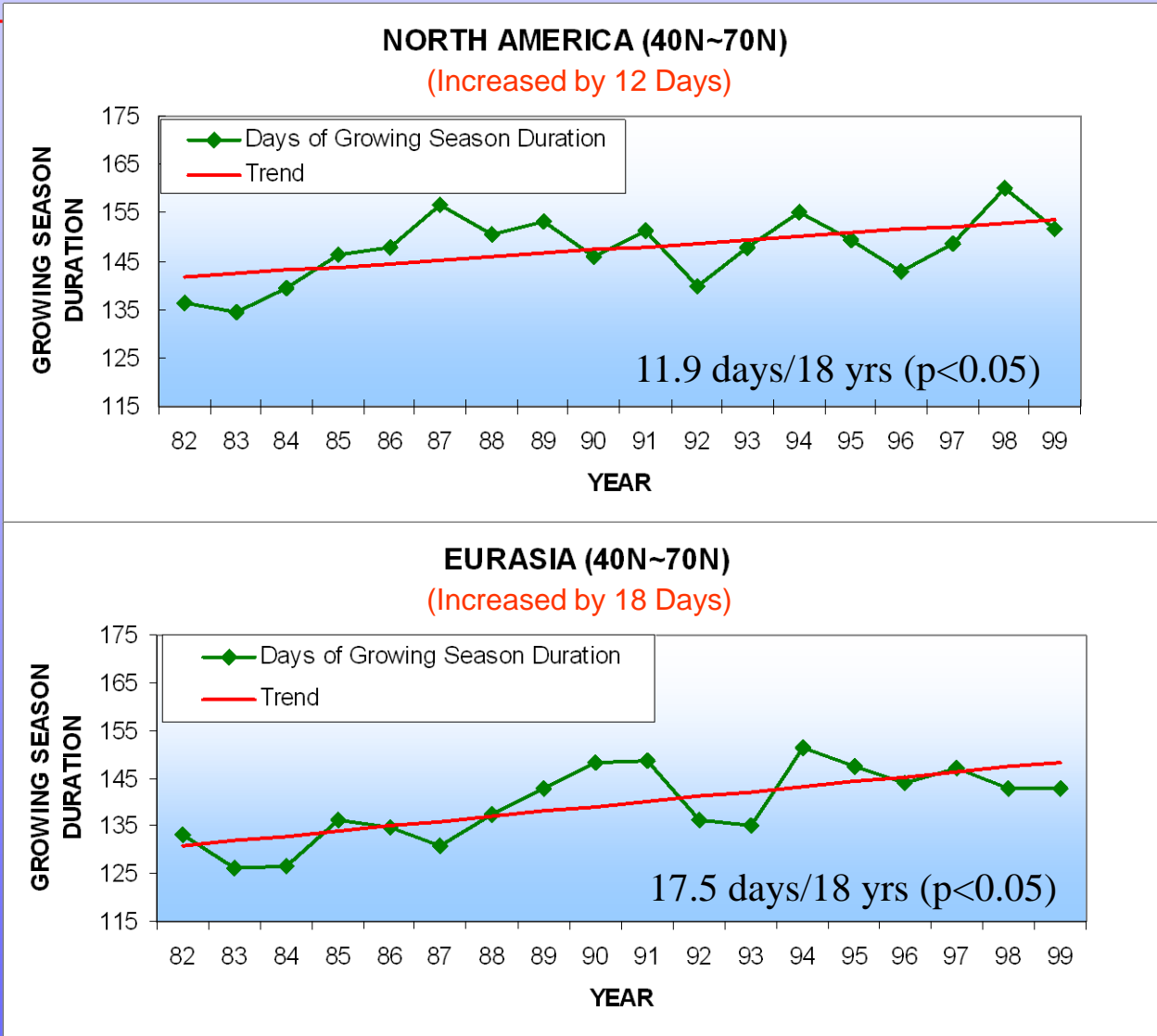
2. changes in seasonal NDVI magnitude

Increases in growing season

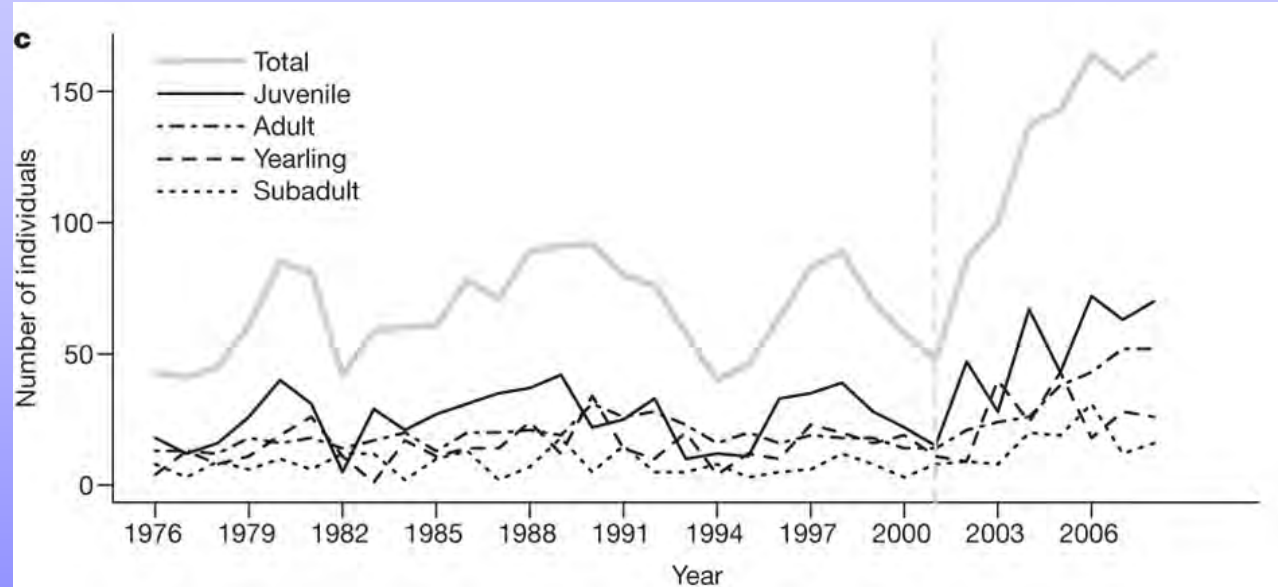
Increases in NDVI magnitude



Longer Growing Seasons

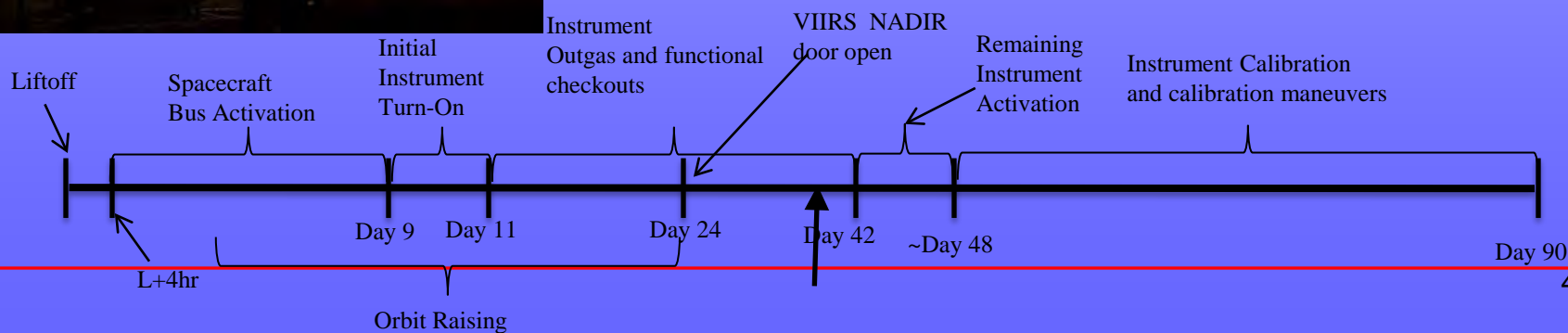


Longer Earlier Growing Season results in: More, Fatter Marmots in Colorado



Nature :
Coupled dynamics of body mass and population growth in response to environmental change

NPP Launch: Oct 28, 2011



NPP Status: Schedule & Results

First Science Data Packets – subject to change

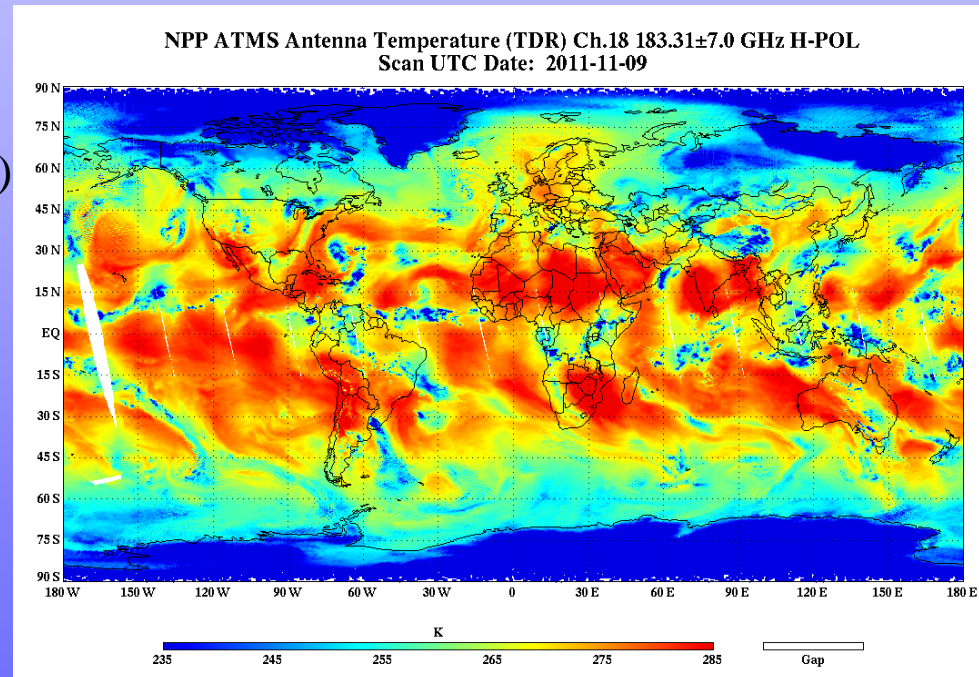
- ☑ ATMS - 11/8 (full science data)
- ☑ VIIRS - 11/8 (no valid science data)
- ☑ CERES - 11/9 (no valid science data)
- ☑ OMPS - 11/10 (no valid science data)
- CrIS - 12/12 (full science data)

NPP Press Release Image
ATMS Channel 18
183 GHz

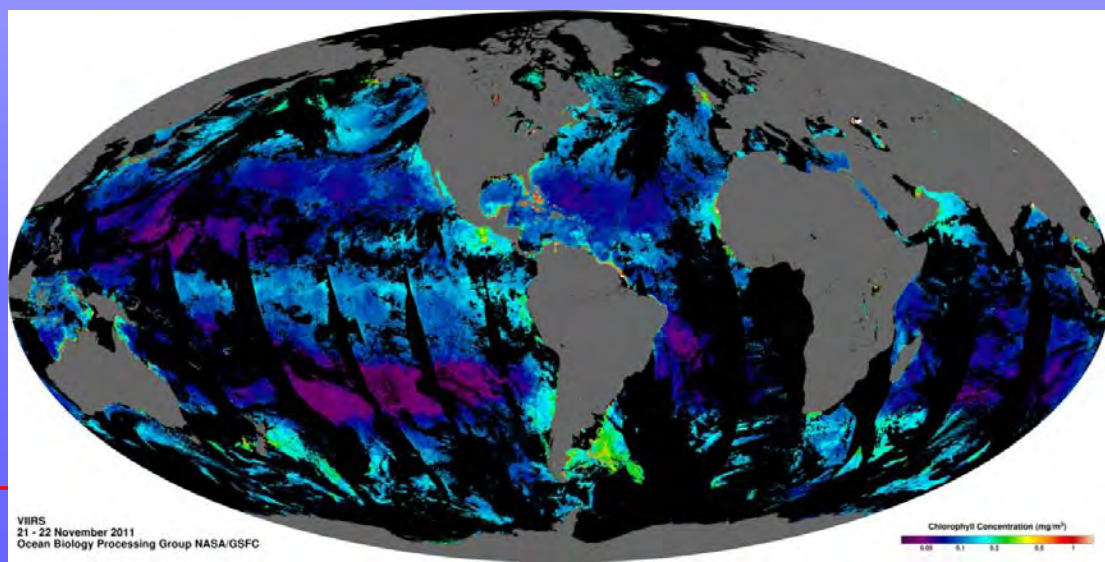
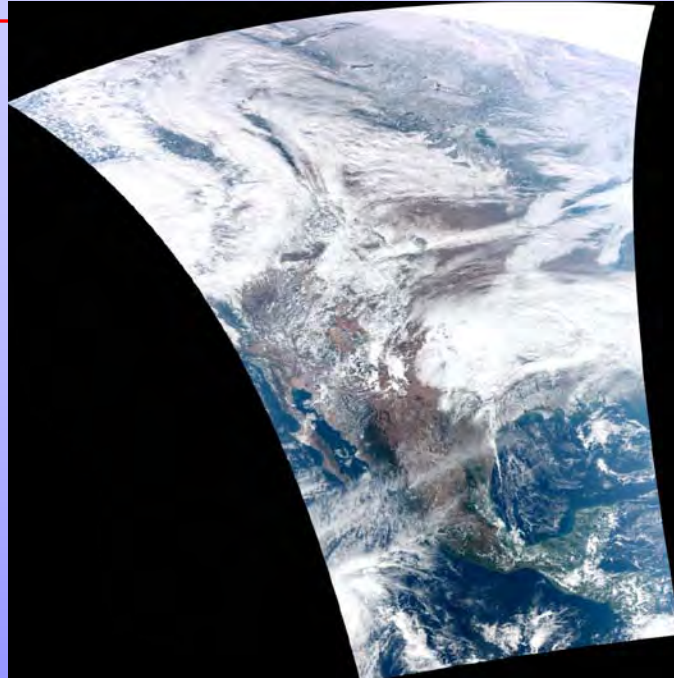
First Valid Science Data – subject to change

- ☑ ATMS - 11/8/2011 (full science data)
- ☑ VIIRS - 11/21 (vis data only)

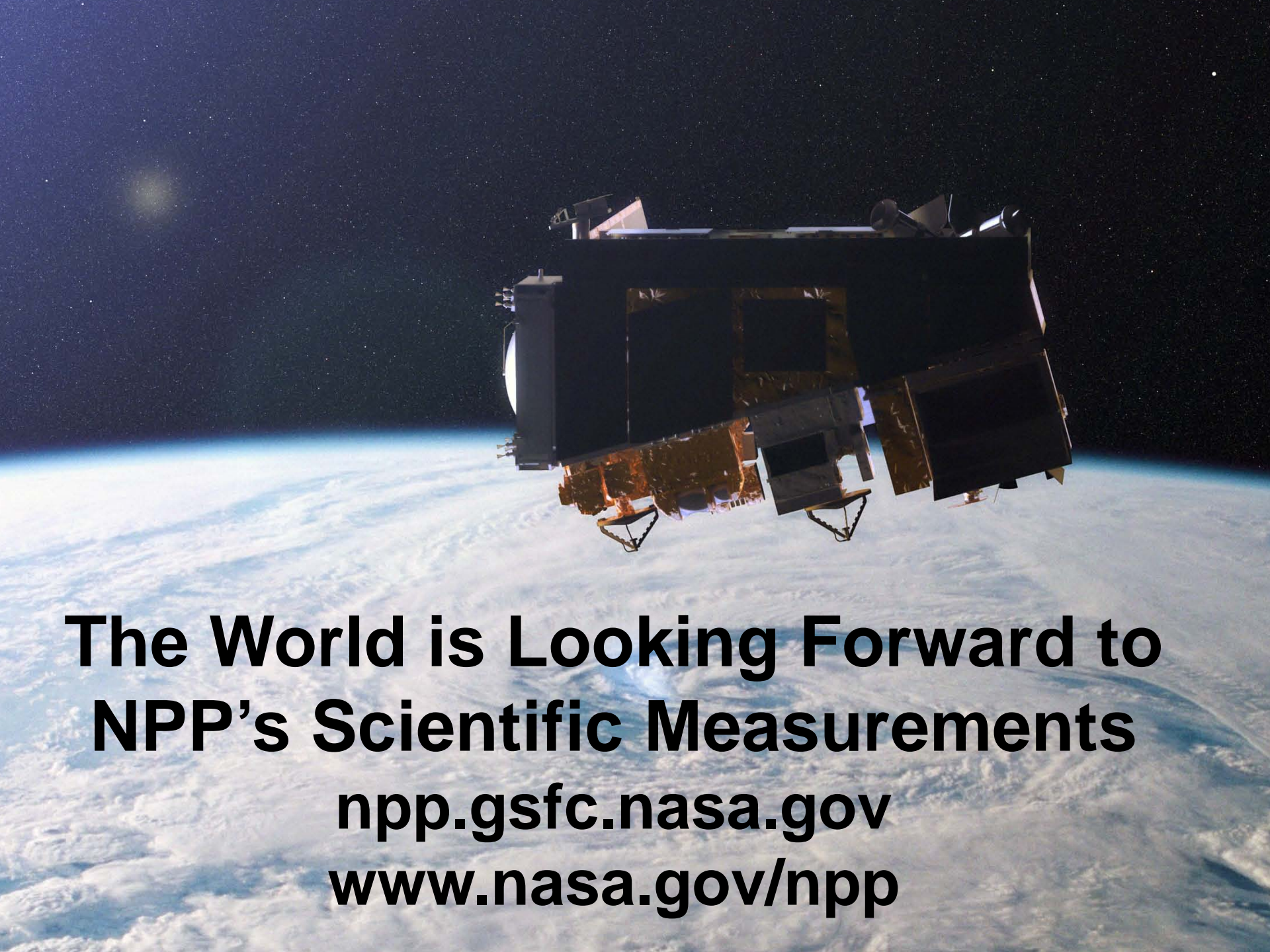
VIIRS - 12/10 (full vis/ir science data)
CERES - 12/11 (full science data)
OMPS - 12/11 (full science data)
CrIS - 12/12 (full science data)



NPP Status: VIIRS Early Visible Results



VIIRS
First Ocean
Color
Chlorophyll



The World is Looking Forward to NPP's Scientific Measurements

npp.gsfc.nasa.gov

www.nasa.gov/npp