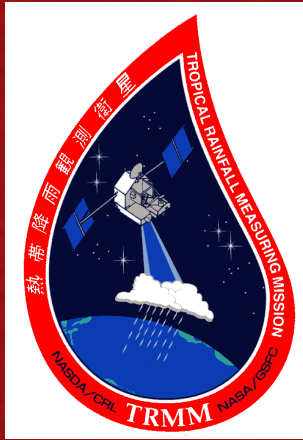
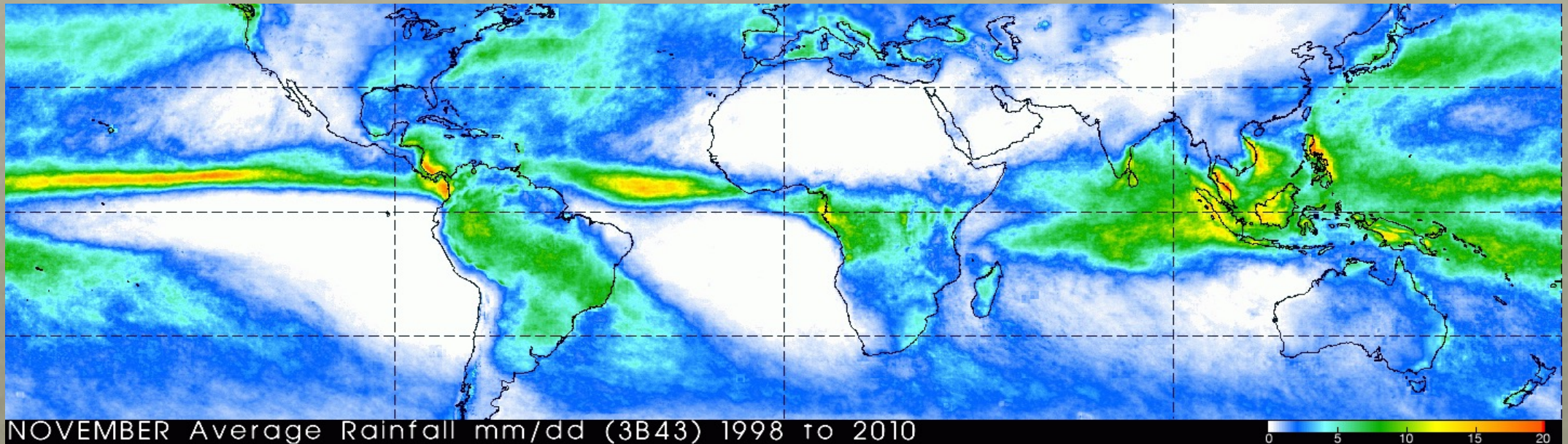




TRMM ACCOMPLISHMENTS

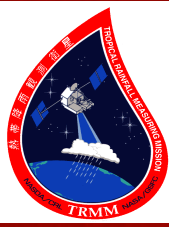


Dr. Scott Braun (scott.a.braun@nasa.gov)
TRMM Project Scientist (2008-2015)
NASA Goddard Space Flight Center





TRMM PAYLOAD



Joint NASA/JAXA mission launched in Nov. 1997

Instrument Payload:

- TRMM Microwave Imager (TMI)
- Precipitation Radar (PR) [Japan]
- Lightning Imaging Sensor (LIS)
- Visible IR Scanner (VIRS)
- Clouds and Earth's Radiant Energy System (CERES)

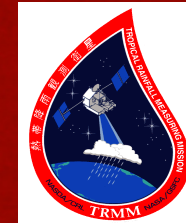


Original TRMM Goal: To produce rainfall estimates on 5x5° grids on monthly time scales

Accomplishment: High-quality rainfall estimates on 0.25x0.25° grids at 3-hourly time scales



TRMM RAINFALL CLIMATOLOGY

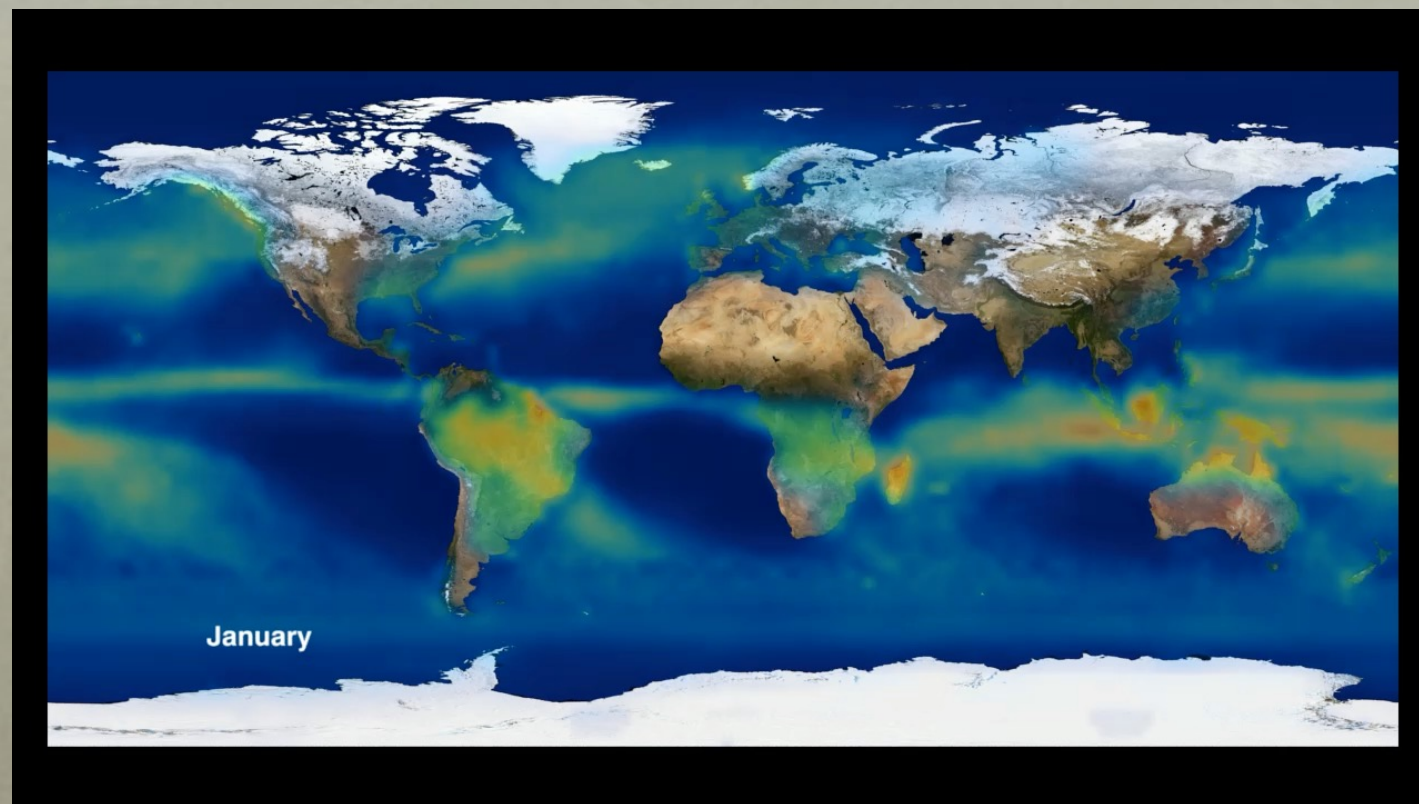


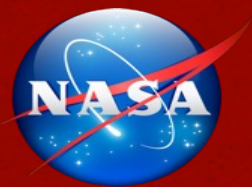
Benchmark 17+ year climatology

Unique monitoring of interannual rainfall variations related to ENSO

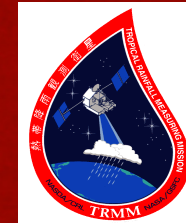
Comprehensive estimates of how rainfall is directly related to latent heat release (LHR)

Global Precipitation by Month





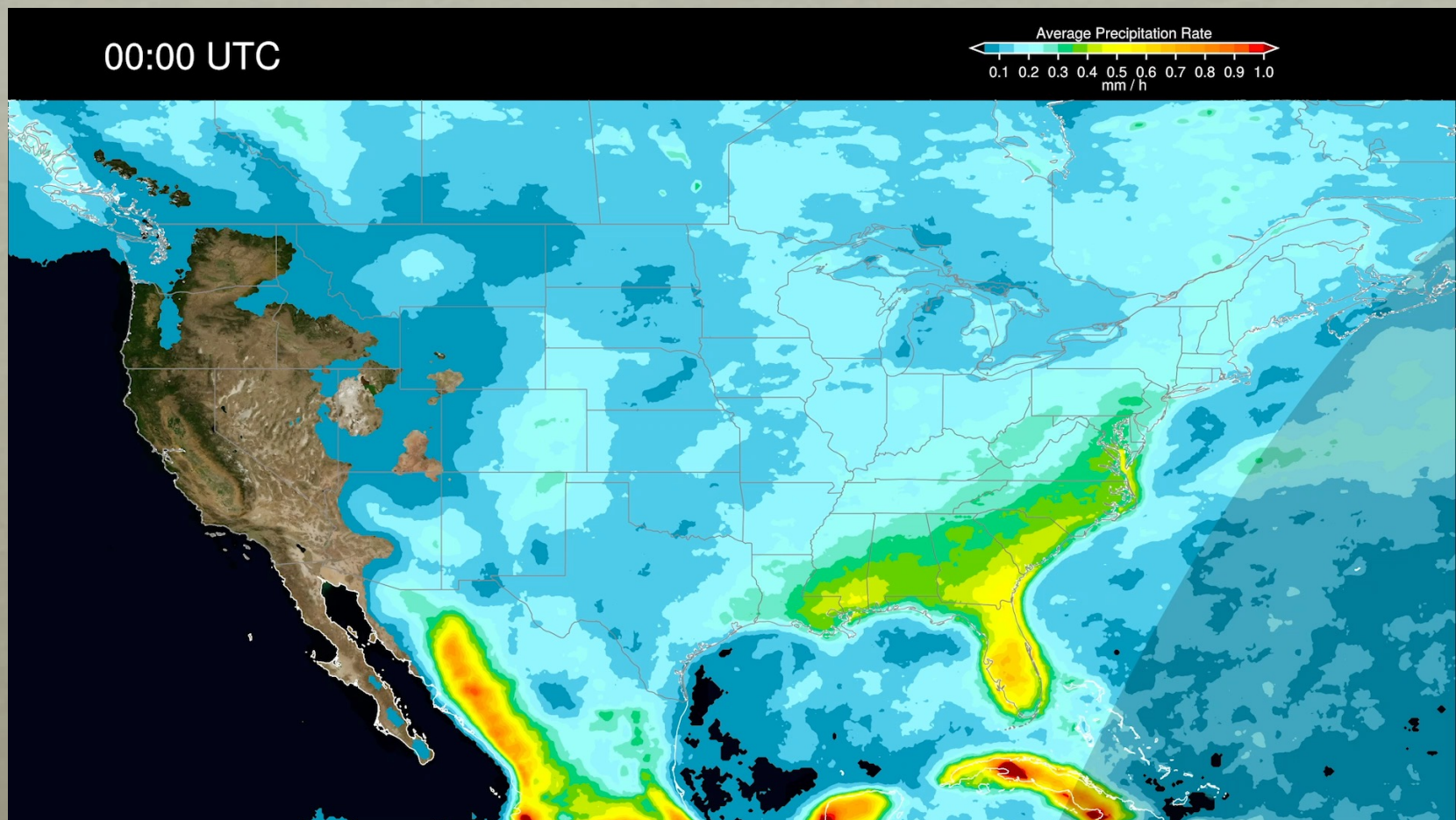
TRMM RAINFALL: DIURNAL CYCLE



Low inclination (35°),
precessing orbit allows
sampling of all local hours
over several weeks

Quantification of diurnal
cycle of precipitation
tropics wide

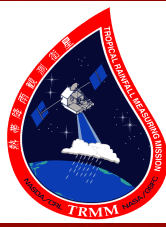
Has also allowed focus on
global, regional, and local
scales



Precipitation shifted in time to common hour of day

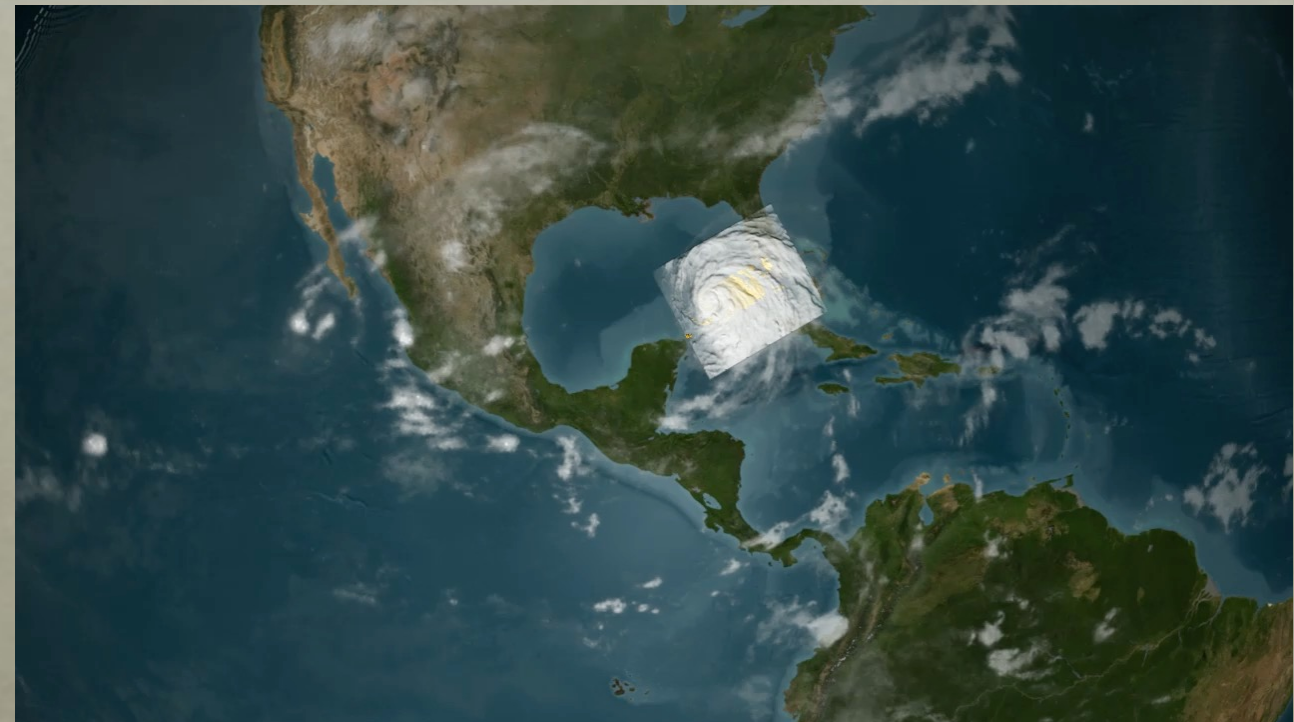


TROPICAL CYCLONE SCIENCE



- ~500-600 Center fixes per year
- Rainfall climatologies in hurricanes
 - Radial distribution
 - Vertical wind shear and motion induced asymmetries
 - Eyewall and rainband vertical structure and lightning
 - Precipitation feature database characteristics
- Improved SST estimates in storm wakes

TRMM VIRS and PR Radar For Hurricane Ike (2010)



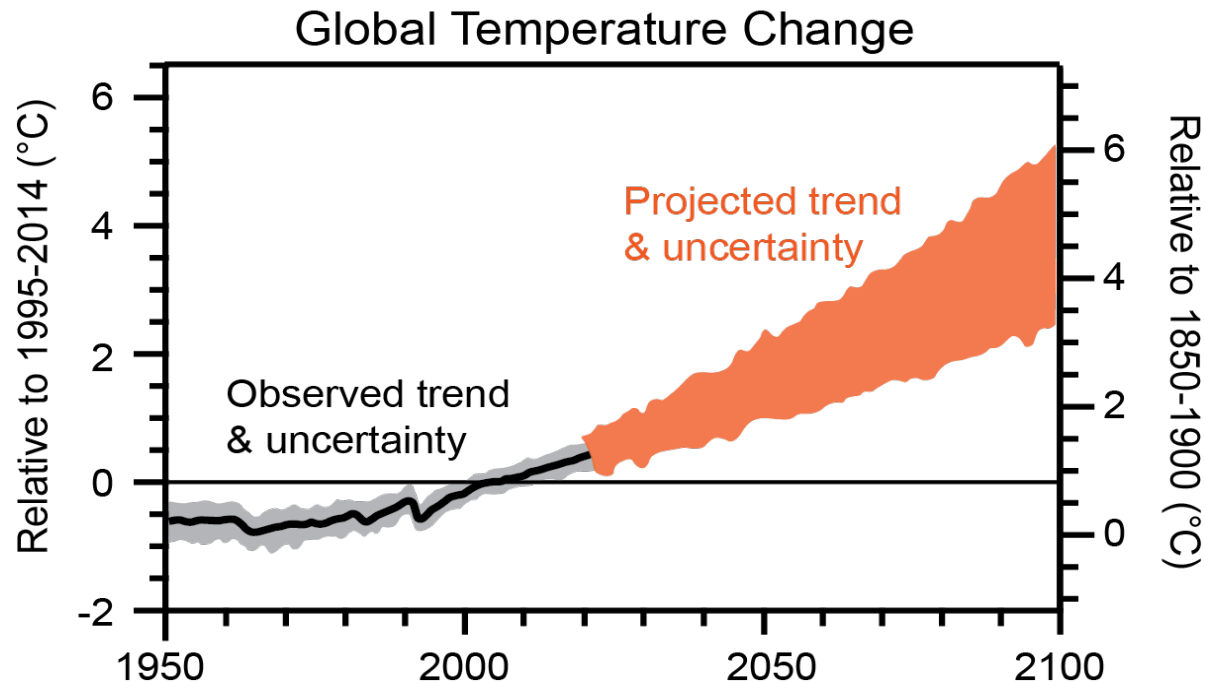
The Atmosphere Observing System (AOS)

- AOS is a new NASA mission that will deliver transformative space-based, airborne, and ground-based observations fundamental to understanding coupled aerosol-cloud-precipitation processes that profoundly impact weather, climate, and air quality

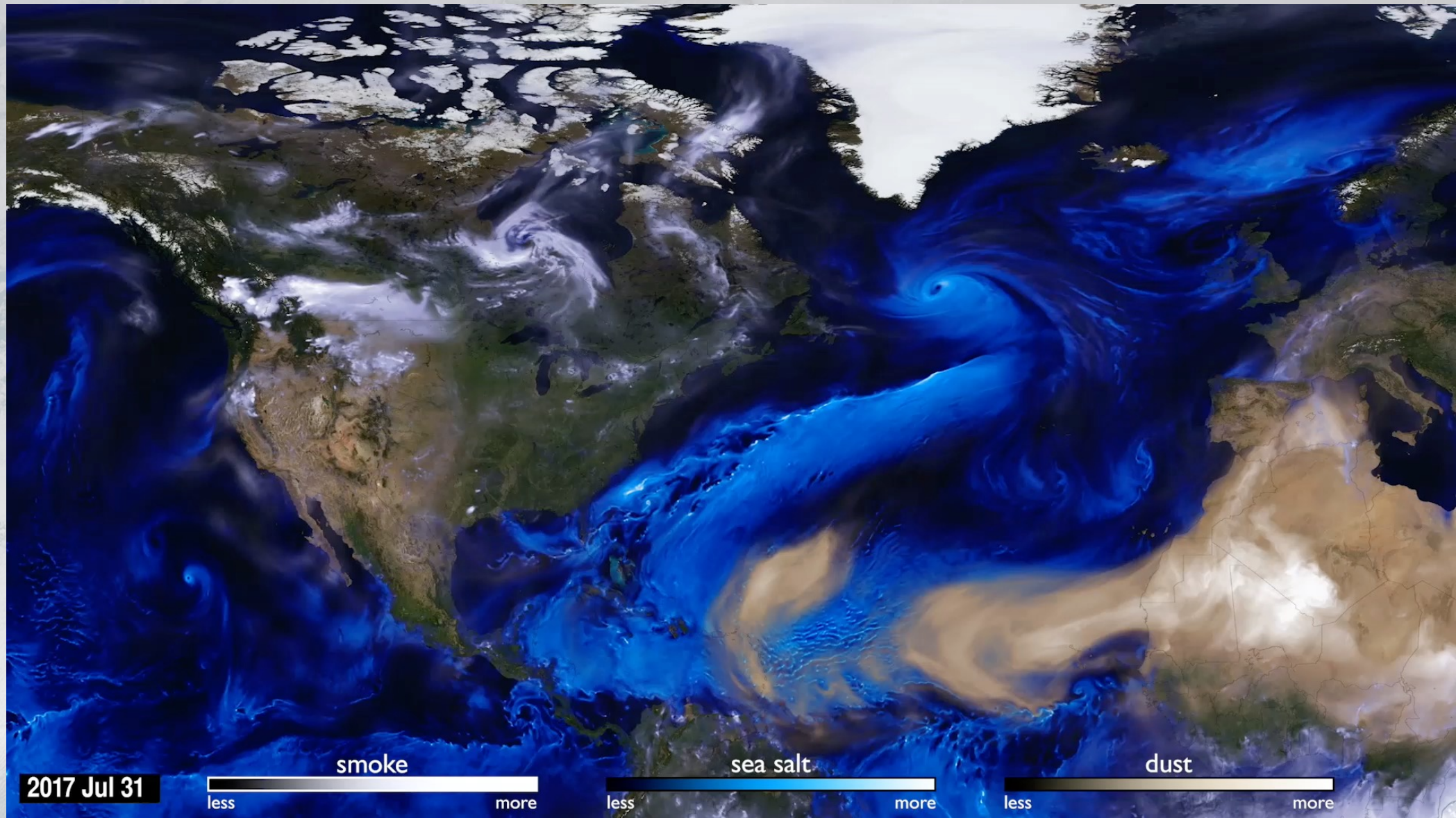


Why AOS?

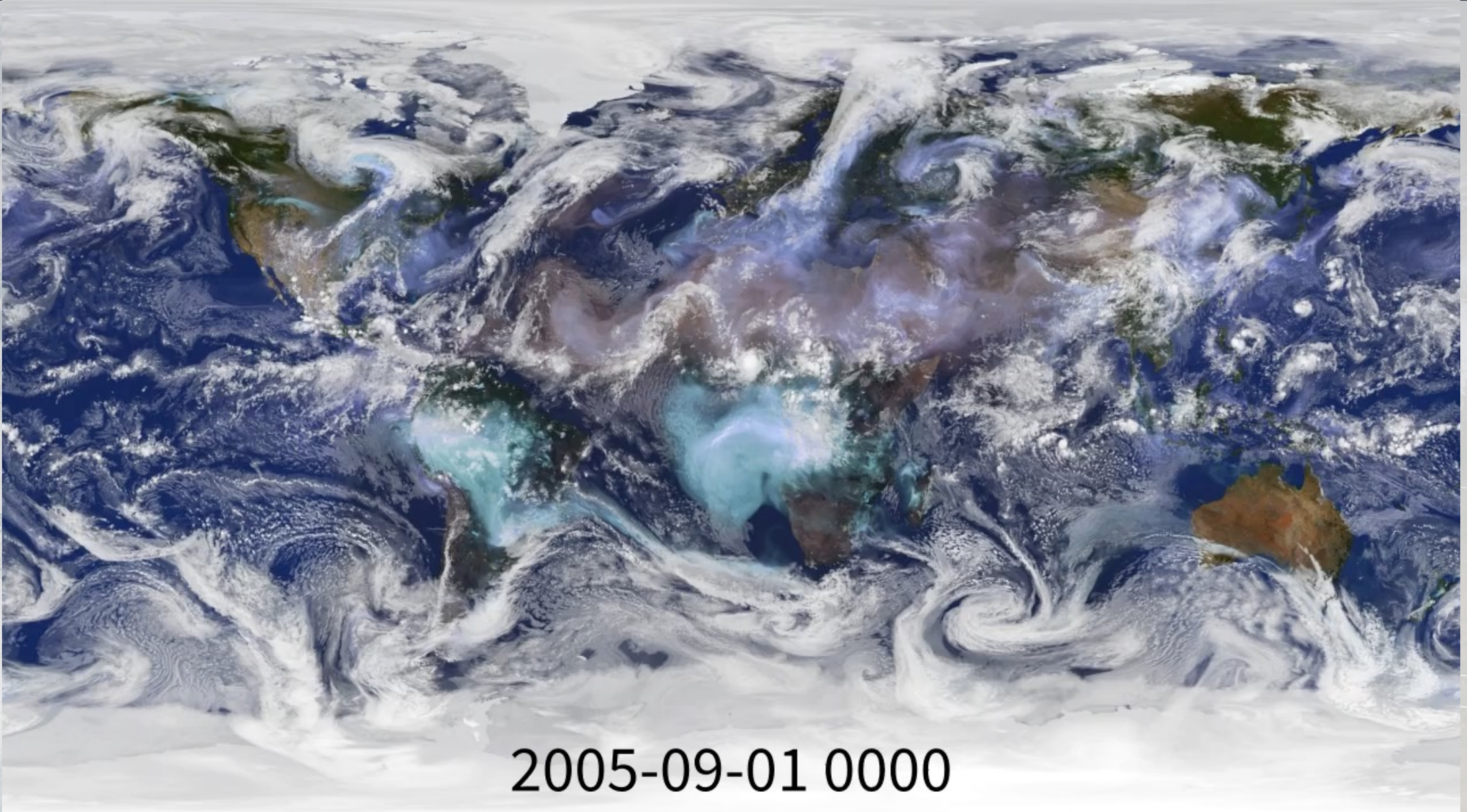
- Science themes: Climate sensitivity, convective storms, aerosols
- Aerosols and their interactions with clouds are key drivers of climate sensitivity
- Aerosols impact air quality, human health, aviation
- Nearly 7-fold increase in \$Billion disasters over the last 40 years



Aerosol Distributions and Processes



Aerosols and Clouds Coexist



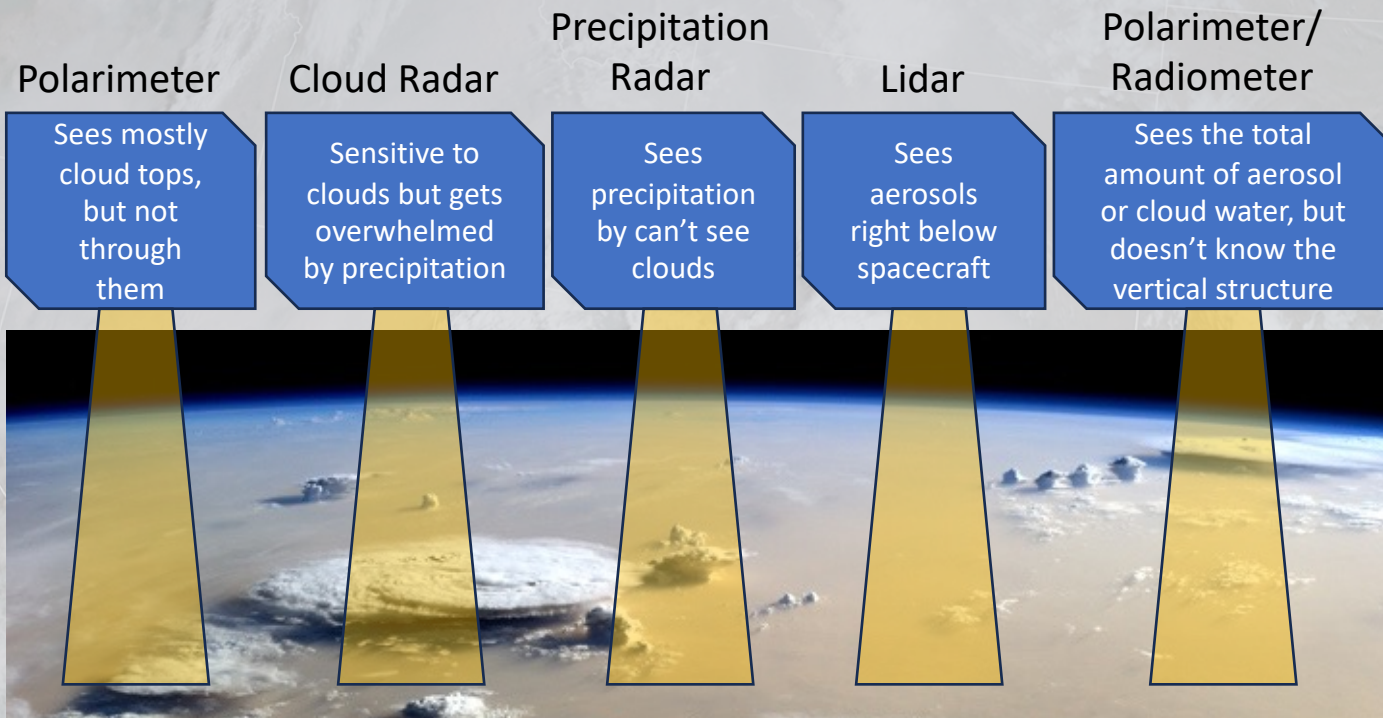
2005-09-01 0000

Measurement Synergy Is Critical To AOS

Image from NOAA & CIRA/Colorado State Univ.

1-minute imagery

07-06-2022 13:00:56 UTC

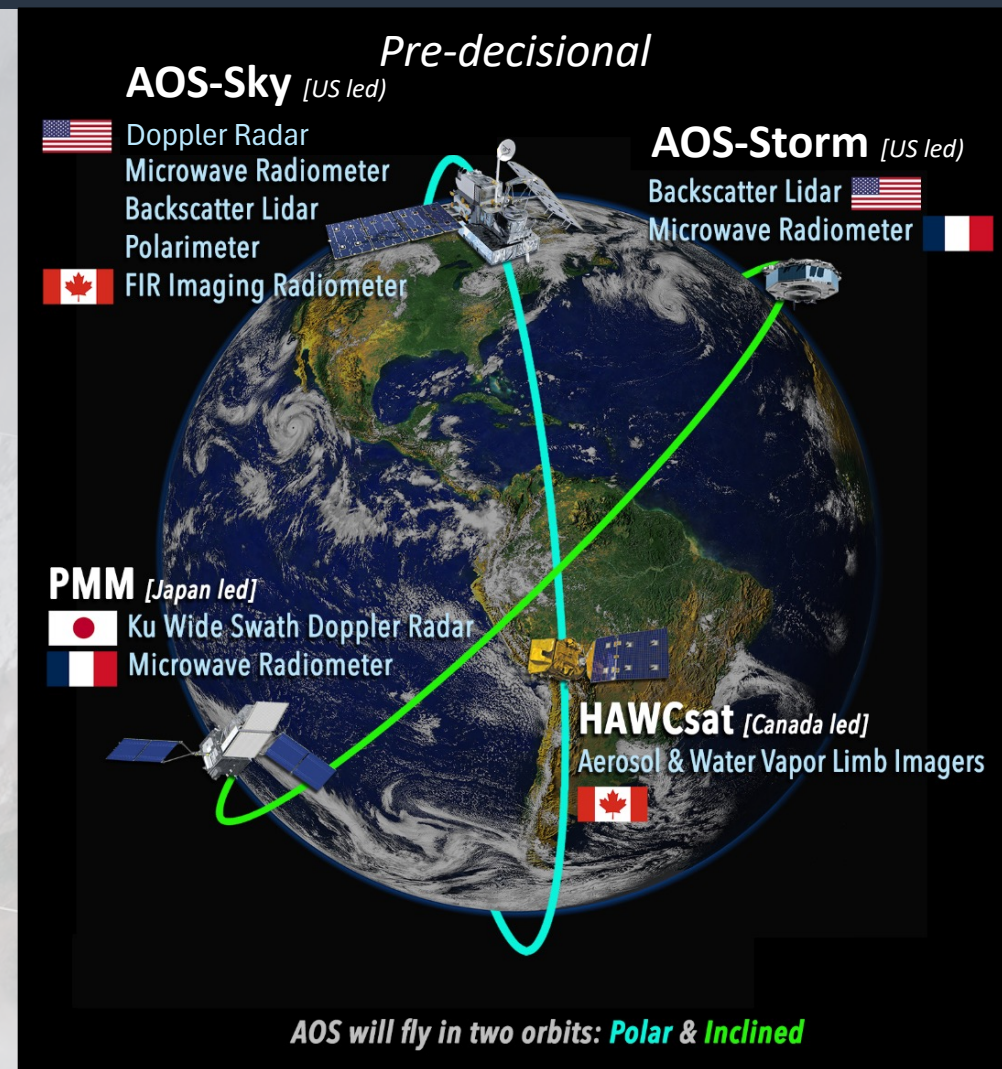


Coincident in time and space measurements needed because convective clouds occur on spatial scales of ~ 0.5 -5 km, temporal scales of minutes

The AOS Mission

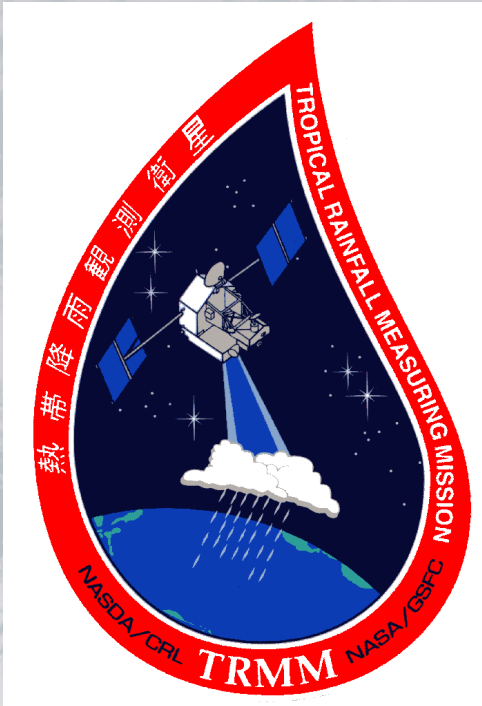


- Four satellites, 11 instruments, 3 international partners
- Delivers globally distributed measurements over a range of temporal scales
- AOS-Sky provide measurements central to understanding aerosol-cloud interactions for climate and aerosol studies
- Generous contributions from Japan and France enable observations of convective storms over varying times of day combined with NASA cloud/aerosol measurements



Graphic reflects initial architecture concept directed at KDP-A. Additional direction was provided to study architecture changes, which are still on-going.

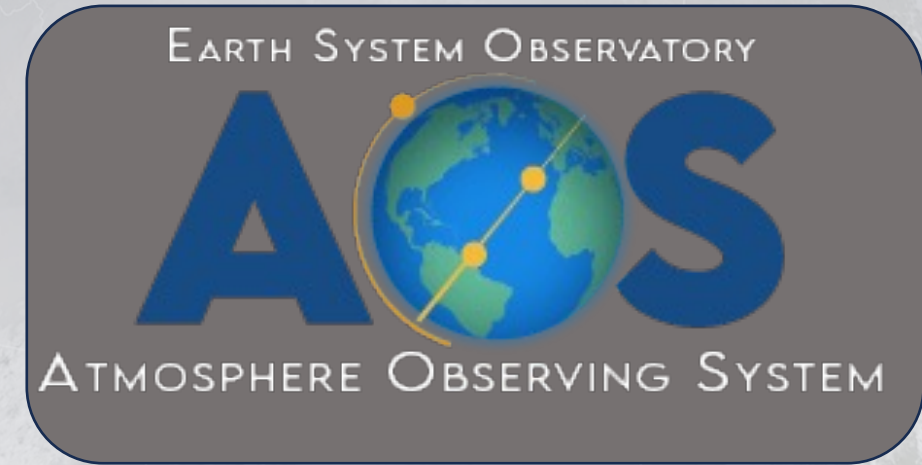
Summary



- First precipitation radar in space
- Coupled precipitation, clouds, and lightning data
- Focus on the tropics
- 17 year lifetime



- More accurate dual-frequency radar
- Additional microwave channels, improved resolution
- Extension to mid latitudes
- Formal constellation
- Real-time data
- Potential 16+ year record



- Single frequency Doppler radars
- Coupled aerosol-cloud-precipitation measurements
- With TRMM & GPM, potential for 35+ years of precipitation measurement