

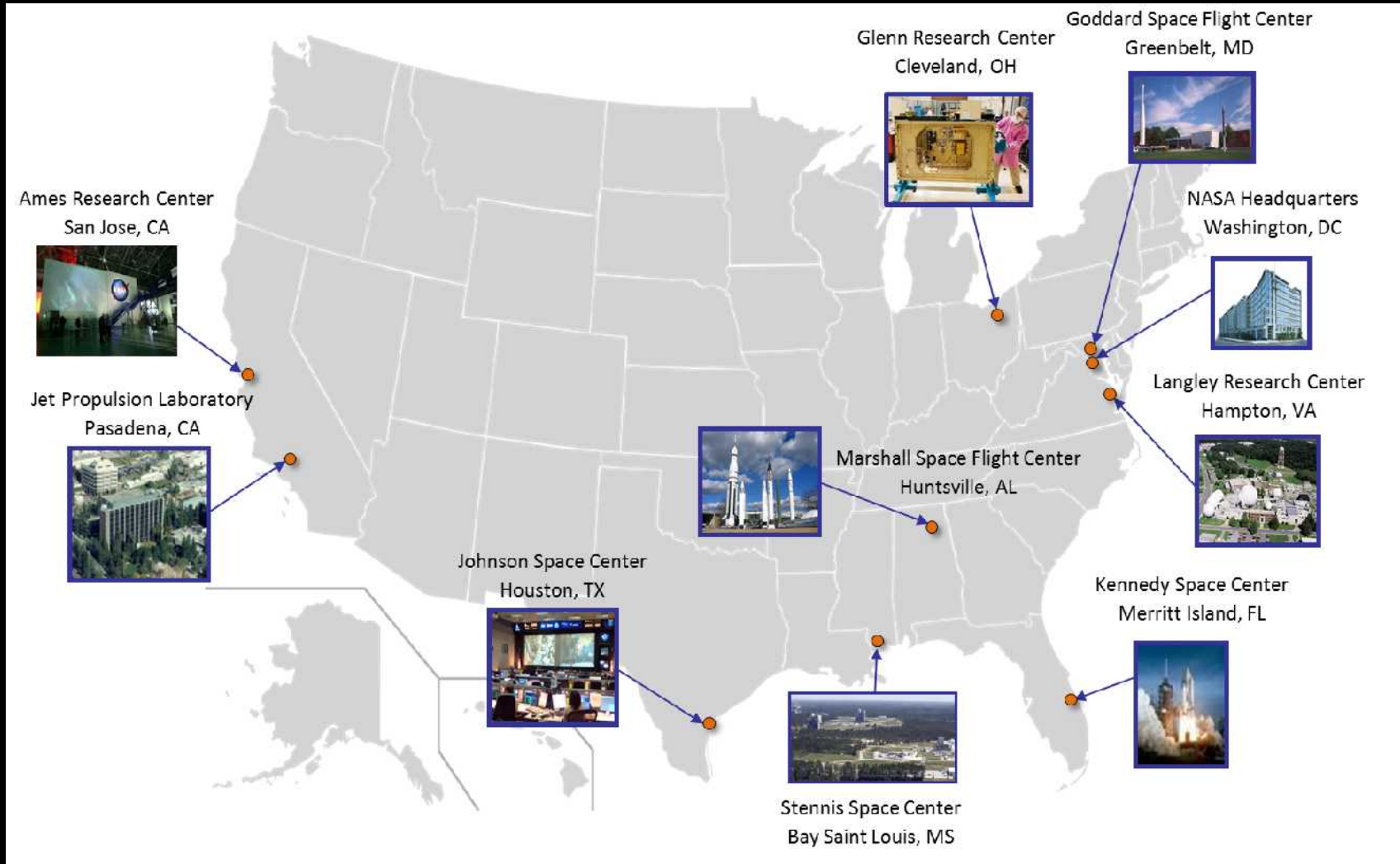


CLIMATE SCIENCE AND PROJECT MANAGEMENT

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NASA



EARTH MISSIONS



SOLAR MISSIONS



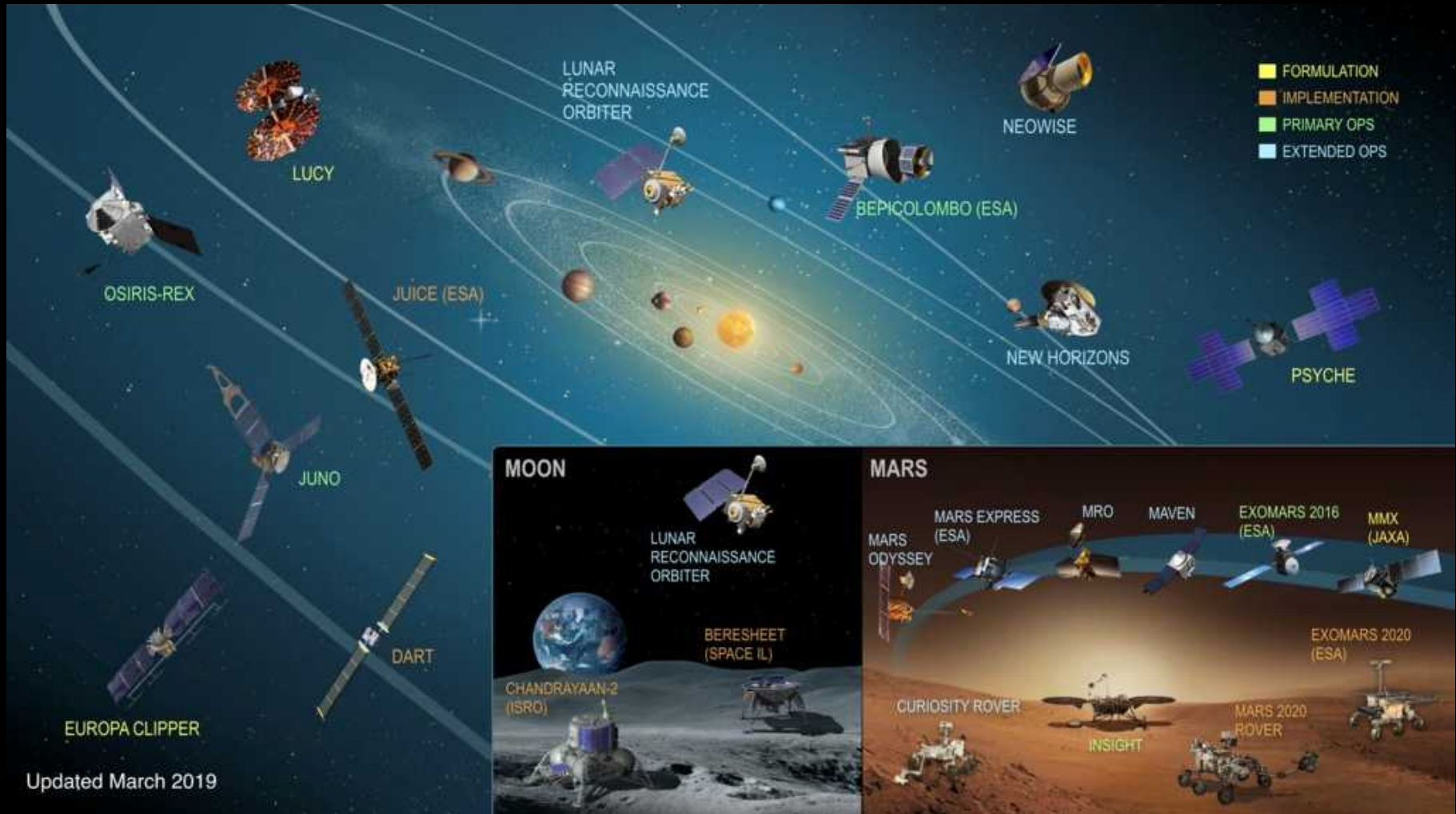
Heliophysics System Observatory

- 18 Operating Missions with 24 Spacecraft
- 4 Missions in Development
- 1 Mission in Formulation



Revised February 20, 2019

PLANETARY MISSIONS



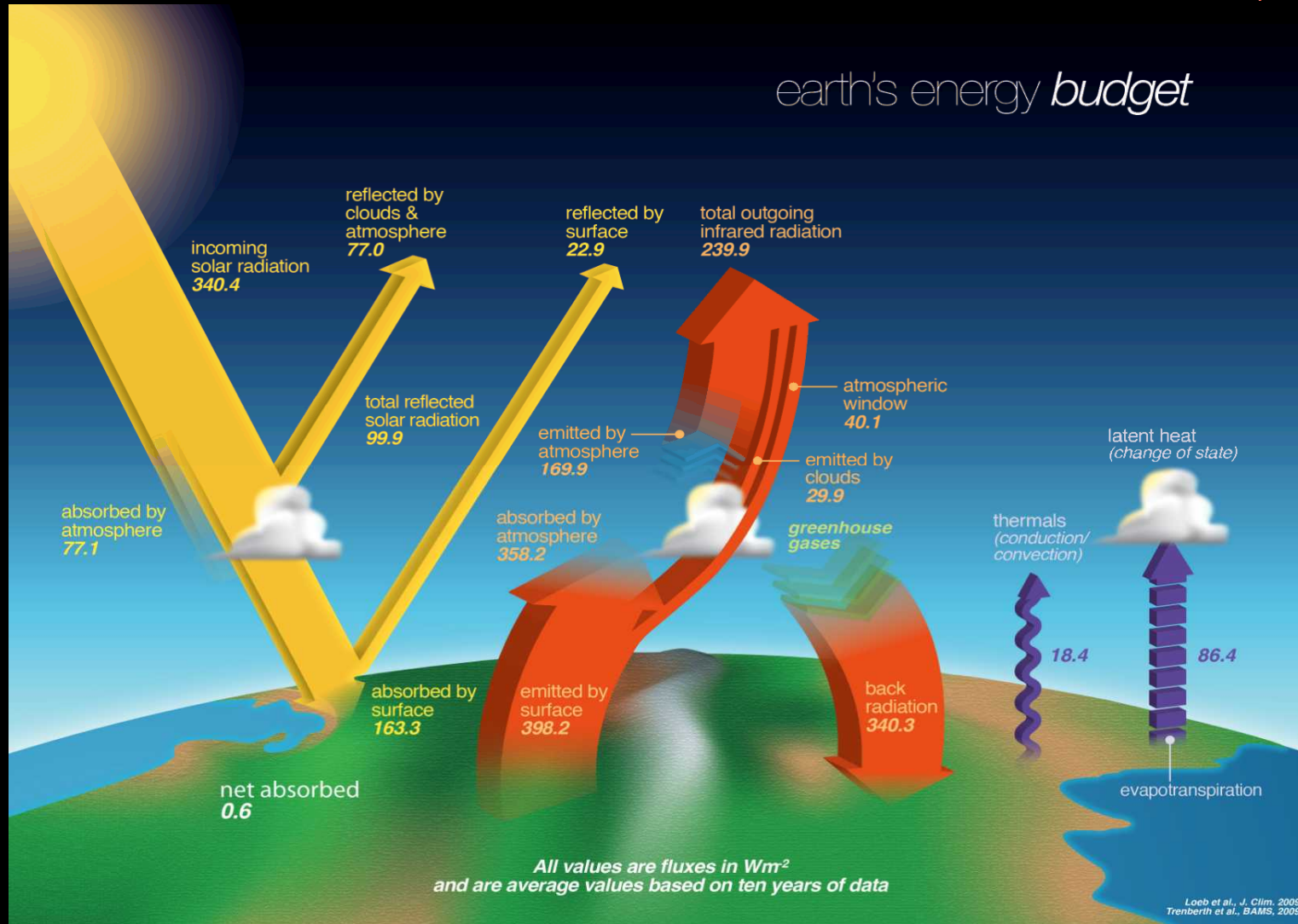
Updated March 2019

CLIMATE MEASUREMENTS

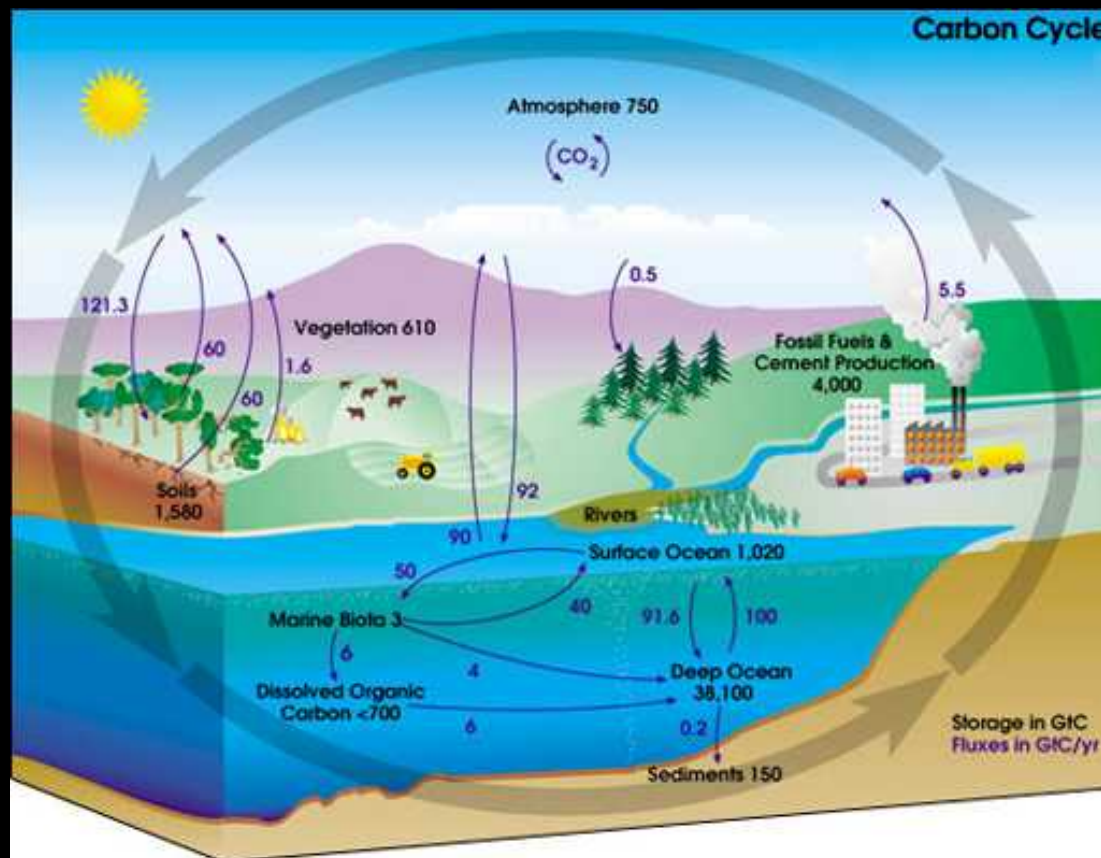


- Temperature (sea surface temperature, air temperature)
- Atmospheric reflectivity, surface reflectivity (snow/ice reflects more than rocks and dirt)
- Chemical species (ozone, black carbon, smoke, carbon dioxide, methane, etc.)
- Water (rainfall, sea level, ice melting, etc.)
- Land use change (industrial, farming, forest, etc. and the changes between)
- Many more

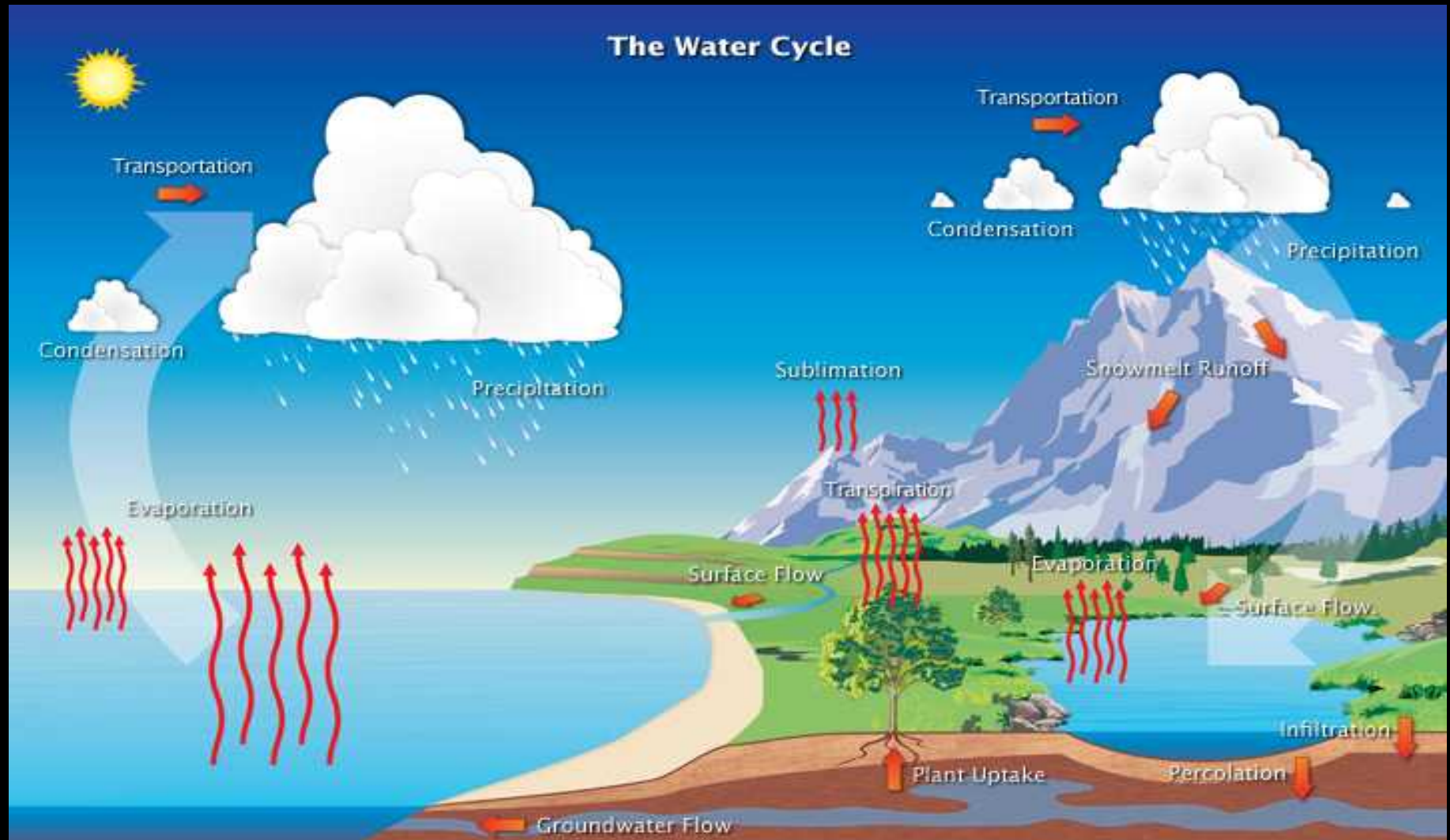
RADIATION BUDGET



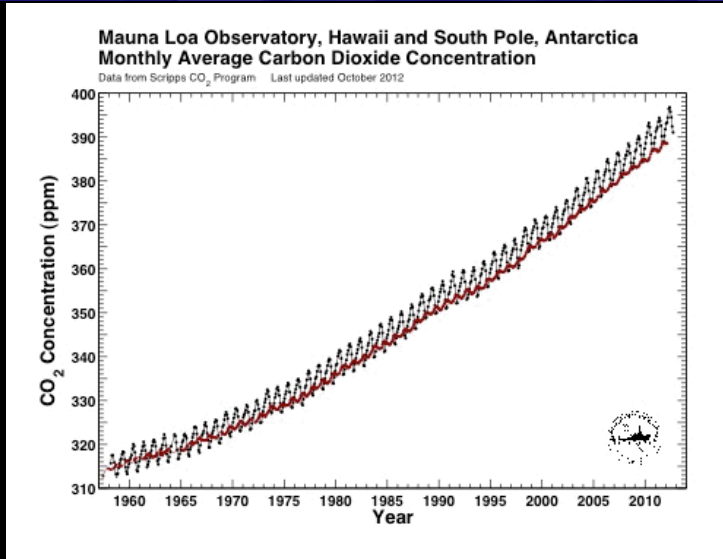
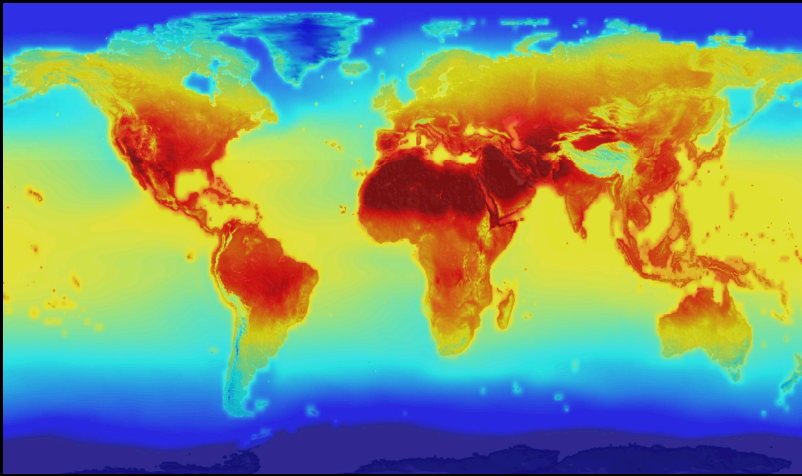
CARBON CYCLE



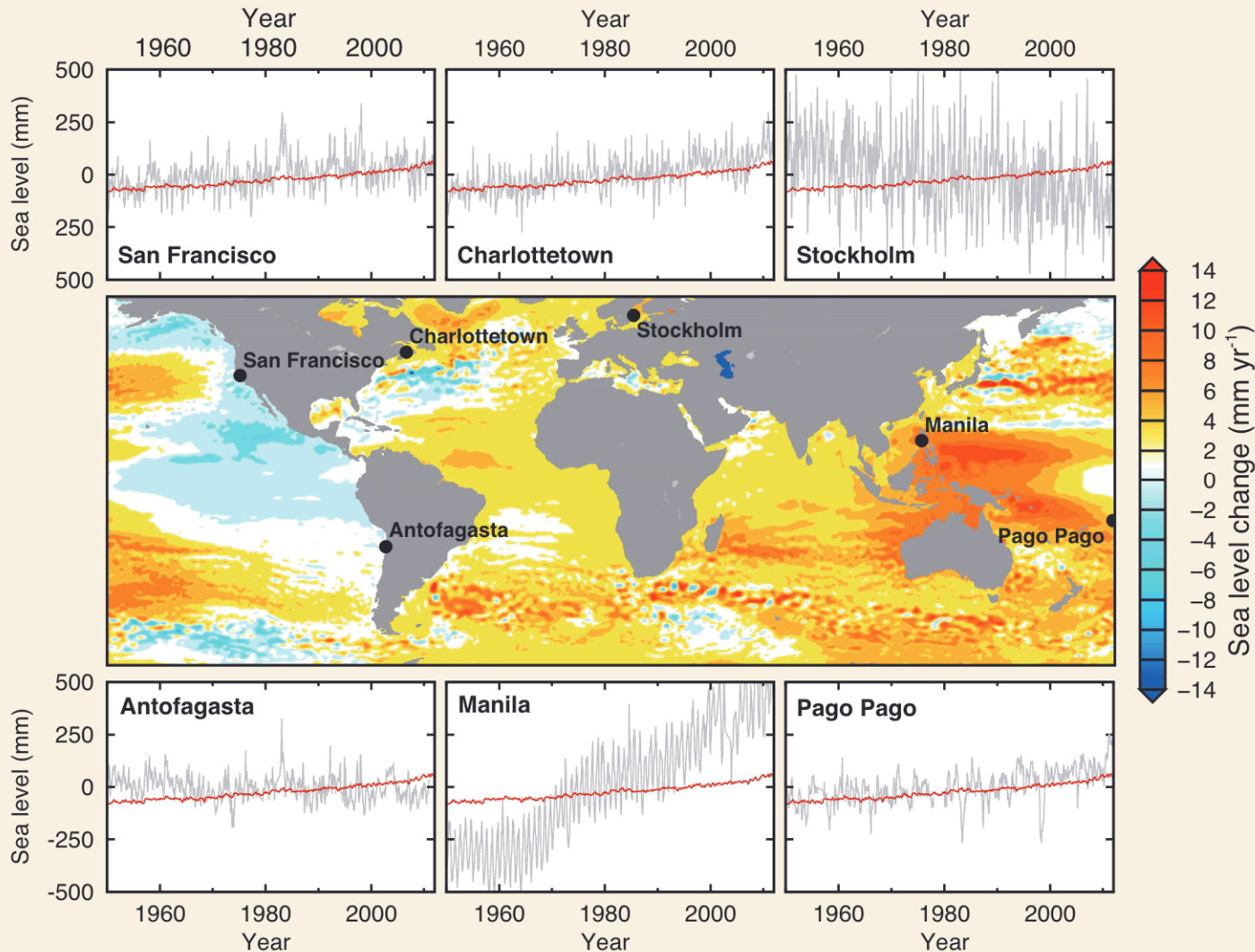
WATER CYCLE



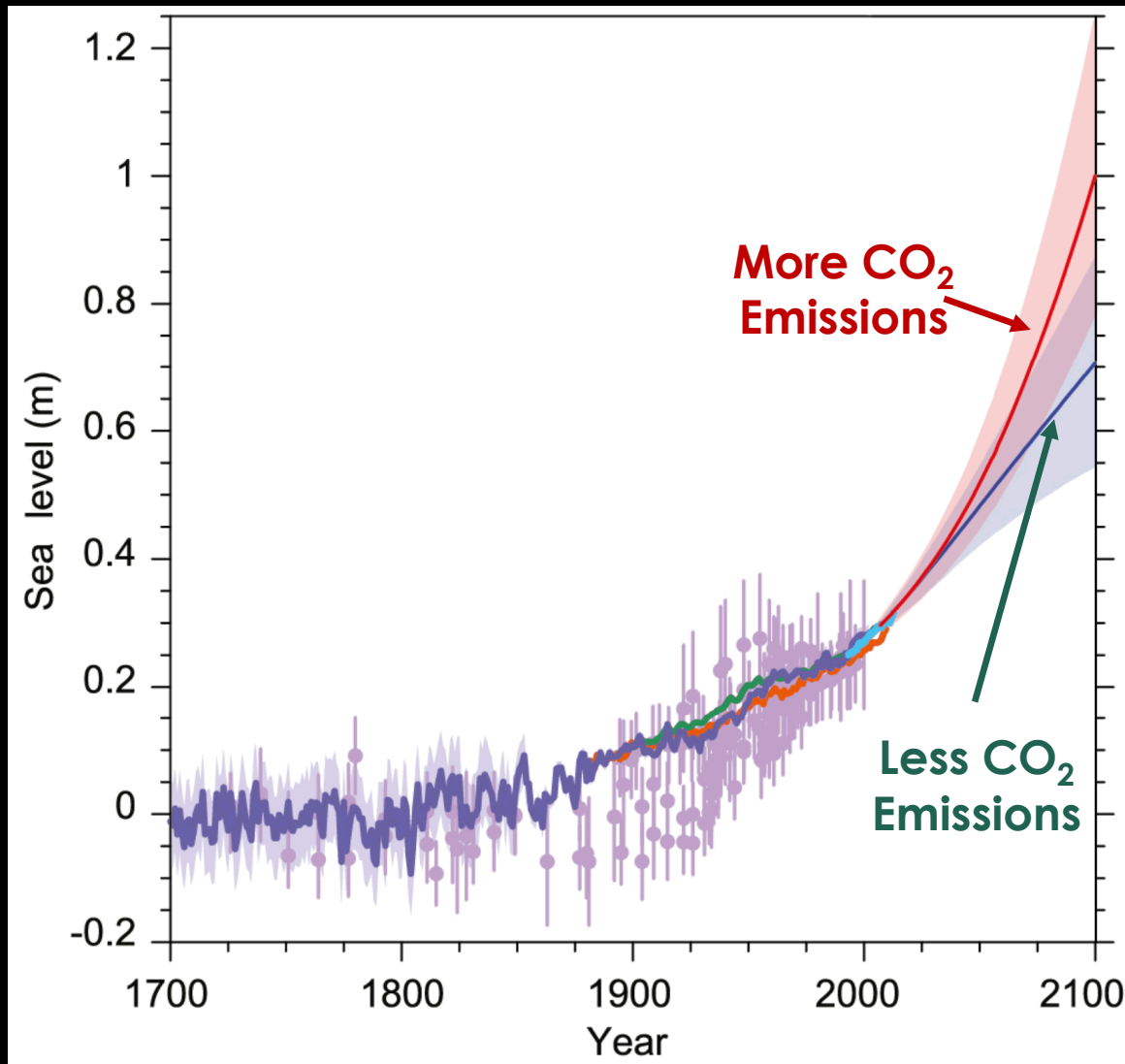
CLIMATE CHANGE



SEA LEVEL RISE 1993-2012



FUTURE SEA LEVEL RISE



- Sea level rise proportional to increase in greenhouse gas emissions
- Models disagree on timing of specific events (ice sheet collapse, currents shifting)
- Some argue IPCC values are conservative



HOW DO WE DO THAT?

- Design experiment
- Collect data
- Analyze data
- Draw conclusions



HIGH PERFORMANCE COMPUTING TRENDS

- Power per volume is increasing while cost is decreasing
- iPhone 4 has equal processing power to Cray 2
 - World's fastest computer in mid 1980s
- Cost per GFLOP, today's \$\$
 - 1984: \$42,000,000
 - 1997: \$42,000
 - 2007: \$52
 - 2017: \$0.03
- NASA Ames has 2 supercomputers on the top 500 list (31 and 37)
<https://www.top500.org>



 Cray 2 Supercomputer
NASA Langley Research Center 3/23/1989 Image # EL-2001-00428



ATMOSPHERIC SCIENCE DATA CENTER

- 50 projects, 800 archived data sets
 - Radiation, clouds, aerosols, and atmospheric composition



ATMOSPHERIC SCIENCE DATA CENTER

All NASA data is free and open, organized into “levels”

- | | |
|----------|--|
| Level 0 | Reconstructed, unprocessed instrument and payload data at full resolution, with any and all communications artifacts |
| Level 1A | Reconstructed, unprocessed instrument data at full resolution including radiometric and geometric calibration |
| Level 1B | Level 1A data that have been processed to sensor units |
| Level 2 | Derived geophysical variables at the same resolution and location as Level 1 source data. |
| Level 3 | Variables mapped on uniform space-time grid scales, usually with some completeness and consistency. |
| Level 4 | Model output or results from analyses of lower-level data (e.g., variables derived from multiple measurements). |



NASA PROJECT MANAGEMENT

- Office of the Chief Engineer governs
 - 7120.5E – Space Flight
 - 145p document
 - Revision E published 2012
 - Accumulation of rules and processes over time
 - 7120.8 – Research and Technology
 - 89p document
 - Revision A published 2018
 - New to NASA

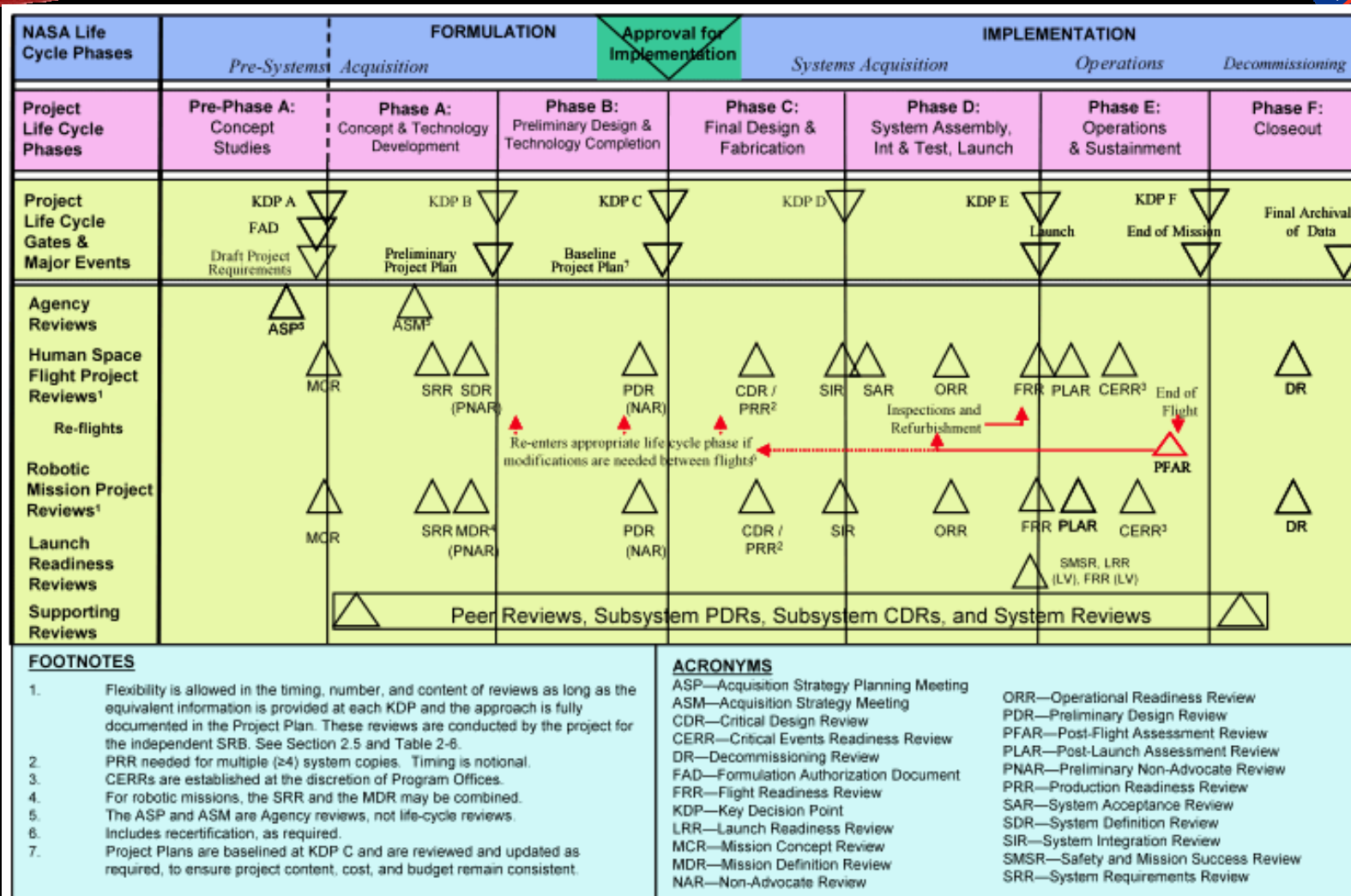


Figure 5-2 – The NASA Project Life Cycle



NASA PM STRUCTURE

- Project Manager, Principal investigator, Chief Engineer
 - Project Scientist, Instrument Scientist
 - Subsystem Lead
 - Discipline expert



HOW TO BECOME A PM?

- Discipline experts become subsystem leads
- Subsystem leads become system leads
- System leads become chief engineers or “project” roles
- Project managers usually come prior group
- USAJOBS is the only way to become a civil servant
 - Job title changes typically done via USAJOBS as well

SUMMARY



- NASA is operating a variety of instruments making a variety of measurements for a variety of reasons
- Better measurements make future predictions more accurate
- All future climate projections are dependent on what the world emits or does not emit
- Analysis is performed utilizing a variety of tools and techniques
- NASA PM helps NASA's big projects

QUESTIONS?

