National Aeronautics and Space Administration

Earth Science and Applications

ISPRS XXII Congress
Earth Observations Forum

Lawrence Friedl
Director, Applied Sciences Program
Earth Science Division · NASA Headquarters

28.August.2012

International Symposium
on Remote Sensing of Environment
ISRSE

Congratulations on 50 Years!

ISRSE at 50

"Since the beginning of remote sensing from space, ISRSE has supported research and applications of Earth science and environmental information. We appreciate the sustained efforts of ISRSE and all its leaders to showcase remote sensing and its value to science and society.

The longevity is an honor to the many people over the half-century and today who design and operate the Earth-observing sensors and satellites, process and deliver the data, and analyze the measurements to benefit all humankind."

Michael H. Freilich, Director
NASA Earth Science

Earth Science by NASA

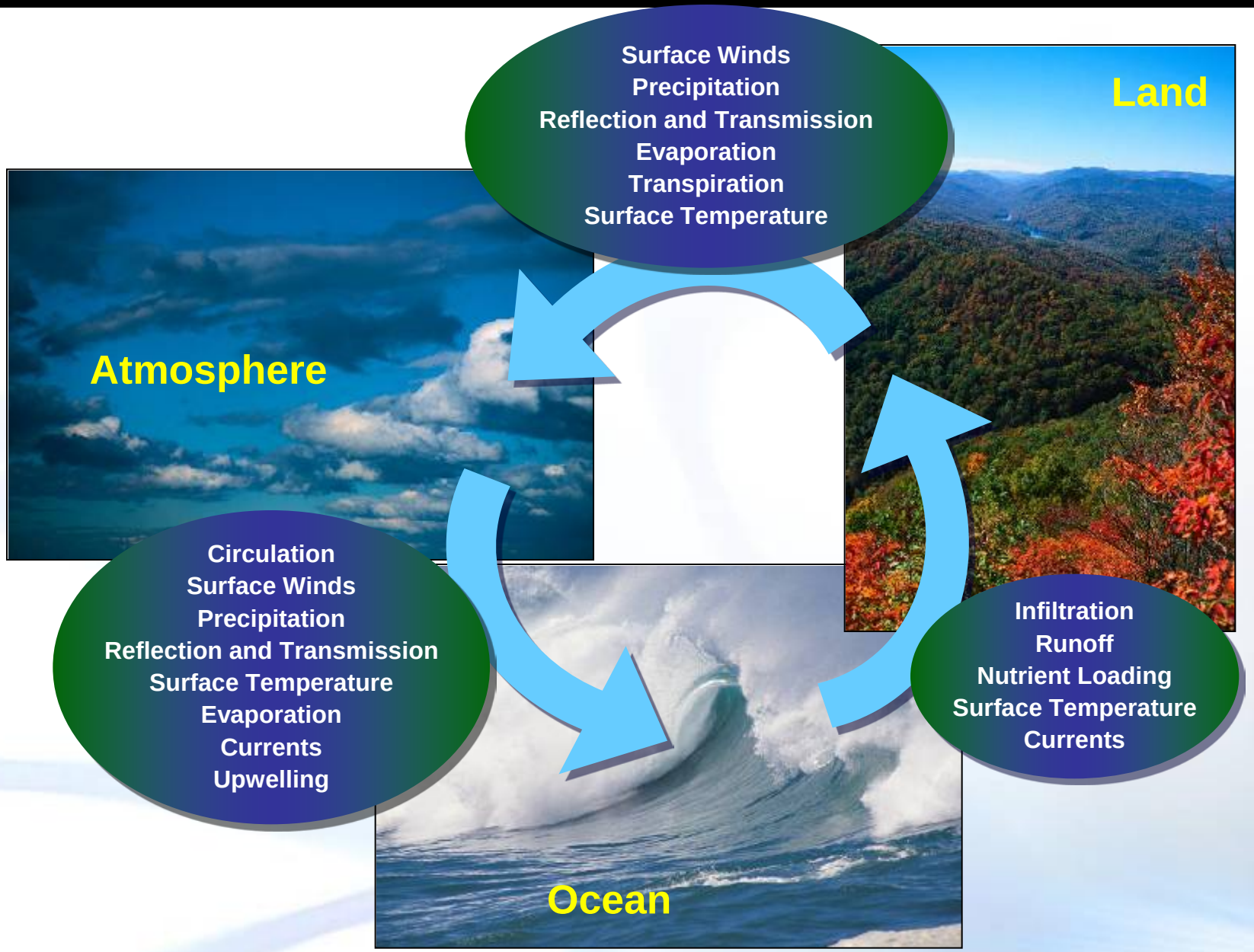
NASA's Earth Science Division supports basic and applied research on the Earth system and its processes. Primary efforts are to characterize, understand, and improve predictions of the Earth system.

- *Satellite Missions*
- *High-Quality Data Products*
- *Research: Analysis, Field Campaigns, Modeling*
- *Applications*
- *Technology*
- *Education & Outreach*

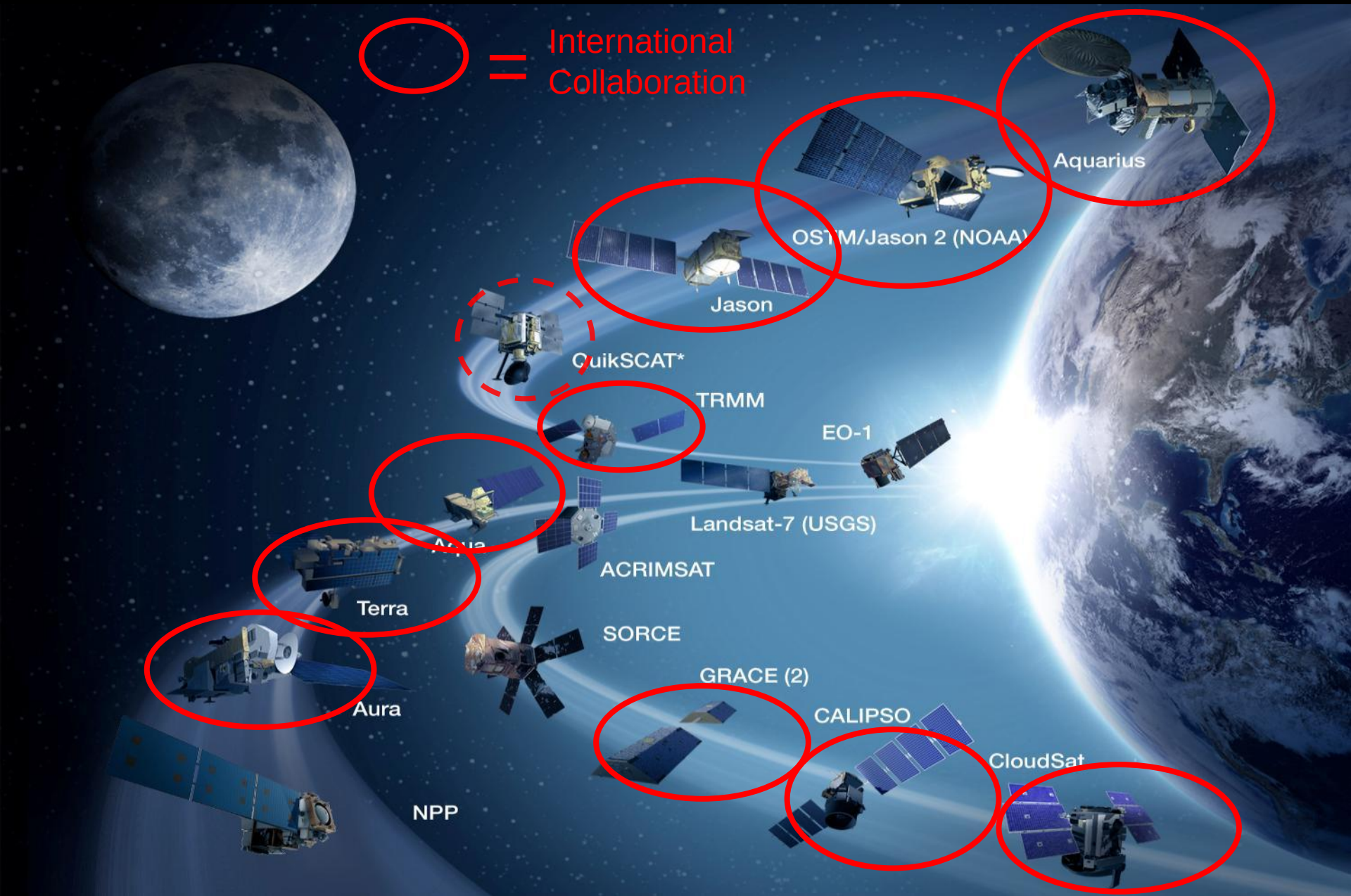
A space program with comprehensive, broad-based scientific research, technology, and applications elements.

A scientific research, technology, and applications program with expertise and access to space.

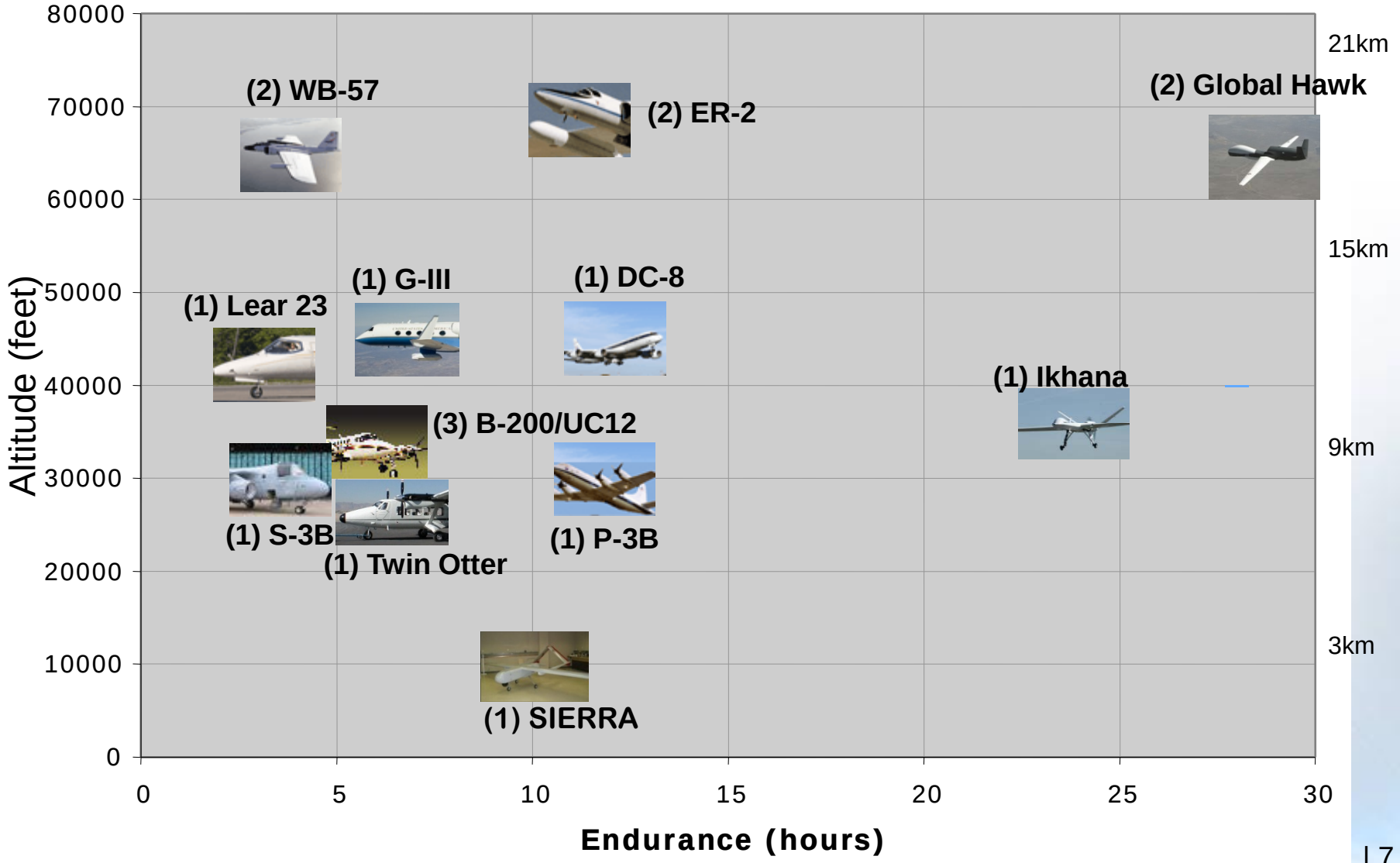
Earth as a Complex Inter-related System



NASA Earth Science Missions



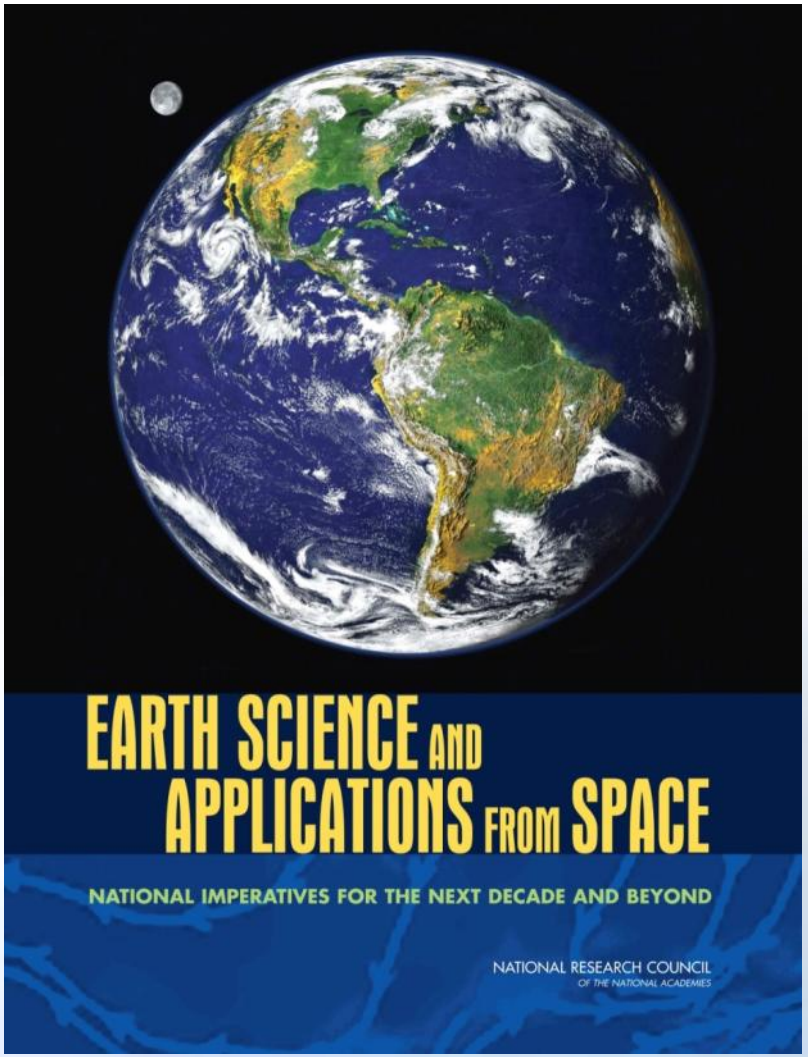
NASA Airborne Science Aircraft



Earth Science & Applications from Space

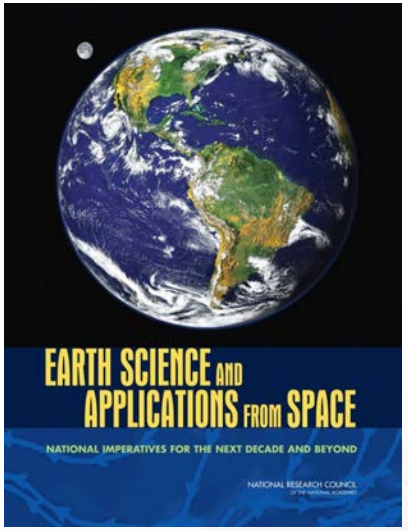
The national strategy outlined here has as its overarching objective a program of scientific discovery and development of applications that will enhance economic competitiveness, protect life and property, and assist in the stewardship of the planet for this and future generations.

Earth Science Decadal Survey
2007



Mid-Term Assessment (2012)

Finding: NASA responded favorably and aggressively to the decadal survey, embracing its overall recommendations for Earth obs., missions, technology investments, and priorities for the underlying science.

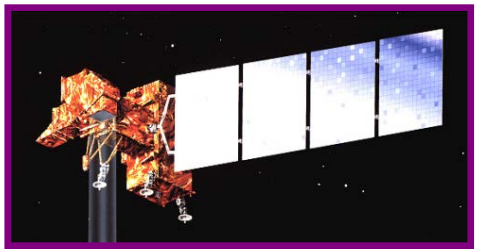


Finding: NASA has made considerable efforts to secure international partnerships to meet its scientific goals and operational requirements.

Recommendation: ESD should implement its missions via a cost-constrained approach.

(these are a subset of the mid-term assessments findings and recommendations)

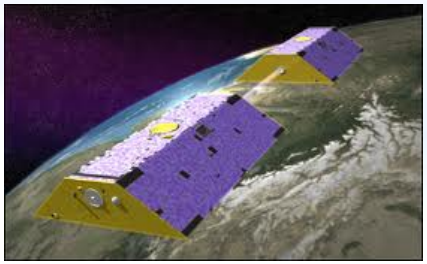
Near-Term Systematic Missions (8/2012)



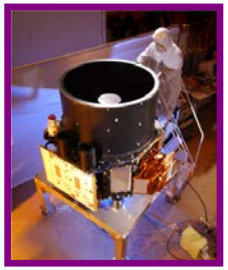
LDCM
2/2013
w/USGS; TIRS

GPM
2/2014
w/ JAXA; Precip

OCO-2
July 2014
Global CO_2



GRACE-FO
2017
w/ GFZ, DLR (Germany)
Gravity, Ice, Ground Water, Climate



ICESat-II
January 2016
Ice Dynamics

SAGE-III on ISS
August 2014
w/HEOMD, ESA
Atmos. Profiles

SMAP
October 2014
w/ CSA
Soil Moist., Frz/Thaw

"Flight-like" Airborne Missions: **ICEBRIDGE** (2009-2017)

Venture Class Activities

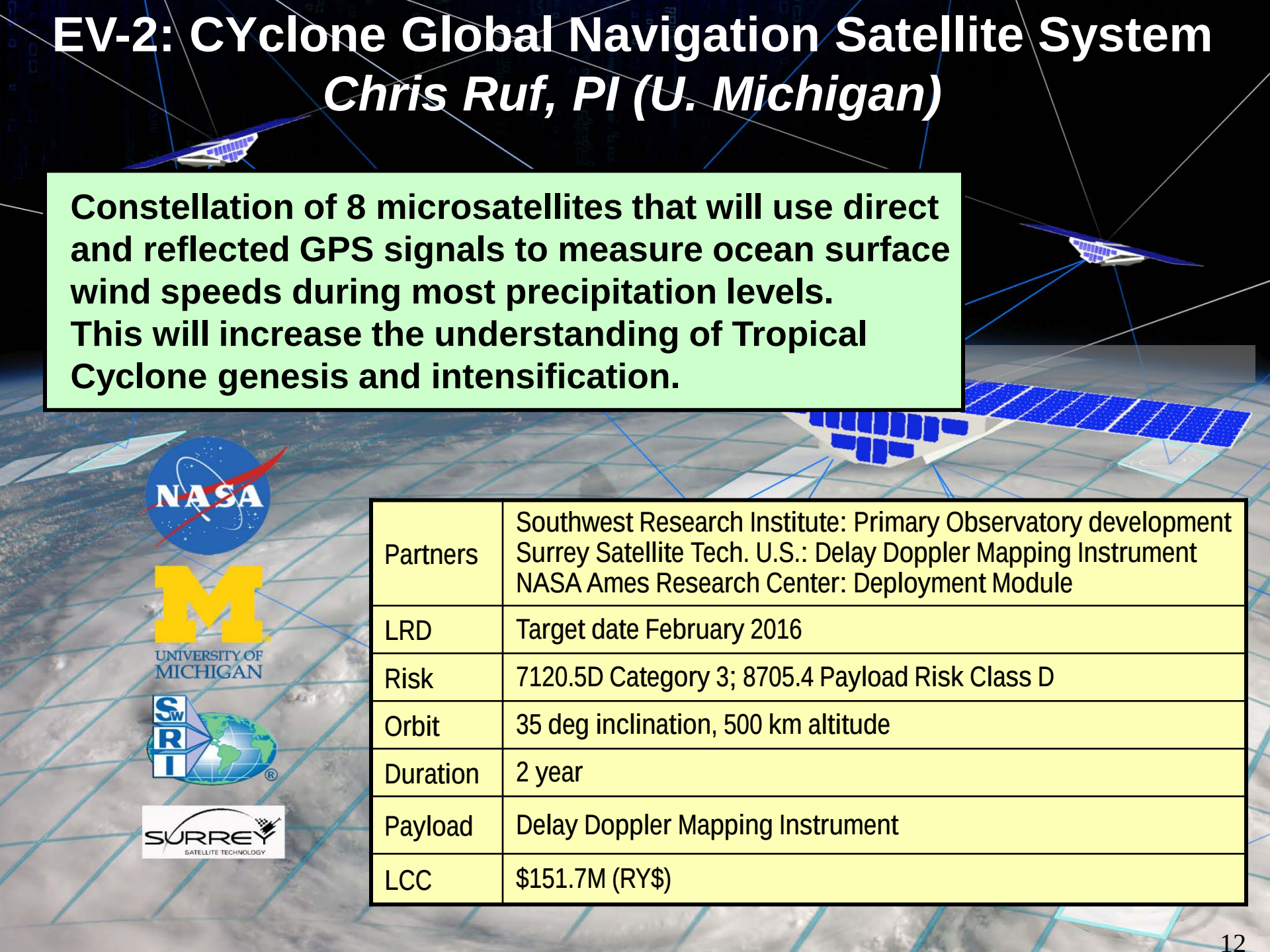
- **Earth Venture 1 (EV-1: Airborne)**
  - 5 investigations selected May, 2010; all initiated
  - Solicitations every 4th year
- **Earth Venture 2 (EV-2: Small, Complete Satellite Missions)**
  - Solicitations every 4th year; $150million
  - 5 years to launch
  - PI-led Missions
- **Earth Venture Instruments (EV-i: Instruments)**
  - Major Instruments for Missions of Opportunity
  - Proposals currently in review; selection expected in 2012
  - Solicitations every year

Earth Venture: Science-based rather than technology demonstration

EV-2: CYclone Global Navigation Satellite System

Chris Ruf, PI (U. Michigan)

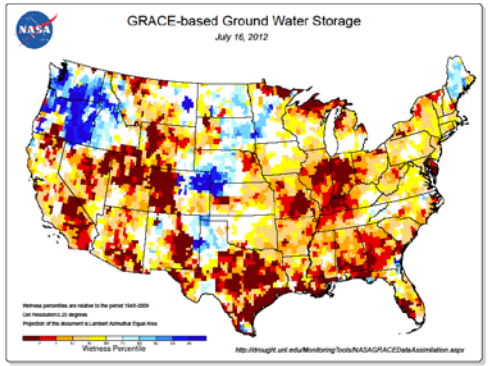
Constellation of 8 microsatellites that will use direct and reflected GPS signals to measure ocean surface wind speeds during most precipitation levels.
This will increase the understanding of Tropical Cyclone genesis and intensification.



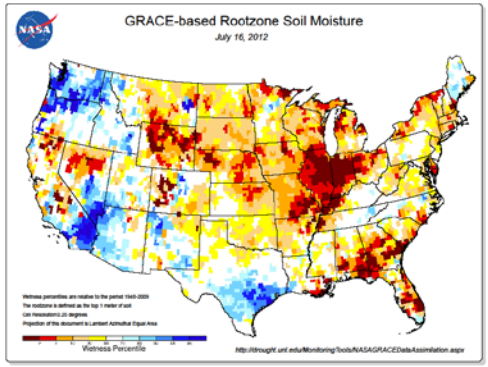
Partners	Southwest Research Institute: Primary Observatory development Surrey Satellite Tech. U.S.: Delay Doppler Mapping Instrument NASA Ames Research Center: Deployment Module
LRD	Target date February 2016
Risk	7120.5D Category 3; 8705.4 Payload Risk Class D
Orbit	35 deg inclination, 500 km altitude
Duration	2 year
Payload	Delay Doppler Mapping Instrument
LCC	$151.7M (RY$)

NASA *GRACE* Products Actively Supporting Official U.S. Drought Assessments

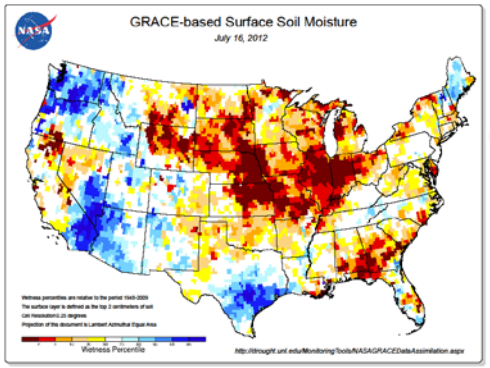
Ground Water Storage

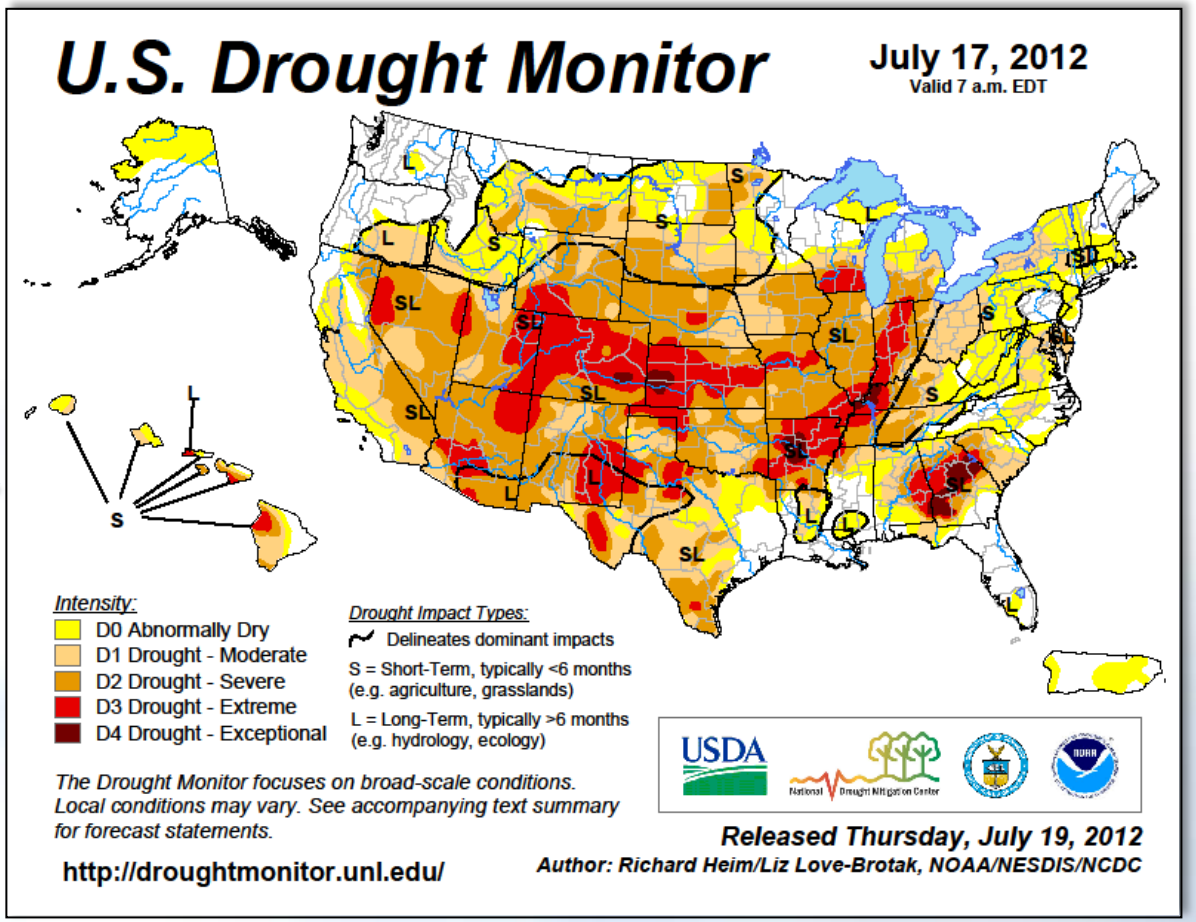


Rootzone Soil Moisture



Surface Soil Moisture





U.S. Government Policy

Private Sector Interaction

Socioeconomic Benefits of Remote Sensing

U.S. Space Policy (2010) excerpts

Facilitate new market opportunities for U.S. commercial space capabilities and services, including commercially viable terrestrial applications that rely on government-provided space systems;

Purchase and use commercial space capabilities and services to the maximum practical extent ...

[Acquire] space launch services and hosted payload arrangements that are reliable, responsive to United States Government needs, and cost-effective

Promote the adoption of policies internationally that facilitate full, open, and timely access to government environmental data;

NASA, NOAA, and USGS shall:
Continue to develop civil applications and information tools based on data collected by Earth observation satellites.

U.S. National Earth Observation strategy

"A time-phased, prioritized national portfolio of Earth observation systems, networks, and platforms to be developed, deployed, maintained, updated, and rebalanced every 3 years over the 10-year planning horizon."

NEO Assessment Working Group:

- National Observing System Portfolio
- Baseline assessment of current portfolio, tiered by relative criticality
  - Both individual SBAs and an overall NEO integrated assessment
- Optimized 10-Year National Observing System Portfolio
  - Recommended portfolio (current, planned, and new capabilities required) tiered by relative criticality over 10-year planning horizon.

    Both individual SBAs and an overall NEO portfolio

Key Issues

- Access to Space
  Medium-Class Launch Vehicles
  Hosted Payloads
- Public-Private Partnerships
  Example: U.S. Water Partnership
- Prizes & Challenges
- Full & Open Data Policy

Remote Sensing & Applications

- Need in remote sensing & Earth observations community to substantiate and quantify the socio-economic benefits
- Need for guidance on socioeconomic analytic techniques and methodologies
- Opportunity to develop case studies and body of literature across different sectors, types of decision making, and applications topics

  Techniques and measures may need to address efficiency, productivity, cost, effectiveness, or other metrics. May vary across topics and the type of decision making activity.

Terminology Transfer in Interdisciplinary Work

Economics & Policy Analysts

- Shadow Price
- Discount Rate
- Contingent Valuation
- Cobb Douglas Function
- Revealed Preference
- Marginal Utility
- Price Elasticity
- Net Present Value

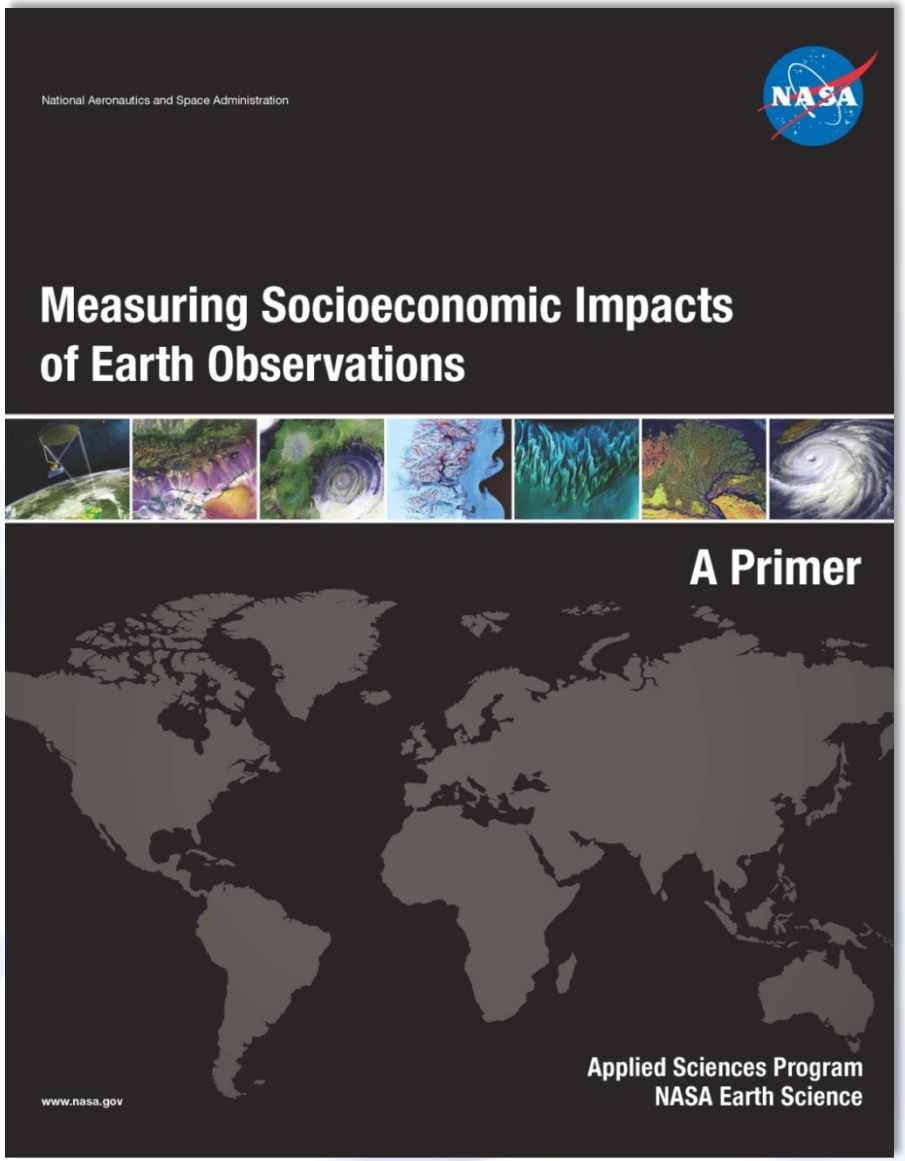
Remote Sensing & Earth Science

- Orthorectification
- Synthetic Aperture
- Normalized Difference Vegetation Index
- Kriging
- Supervised Classification
- Passive Microwave
- OPeNDAP
- Spectroradiometer

Terms shared by both (though meanings may differ)

- Lagrangian function
- Probability density functions
- Markov Processes
- Sensitivity Analysis
- Monte Carlo
- Regression and R-squared

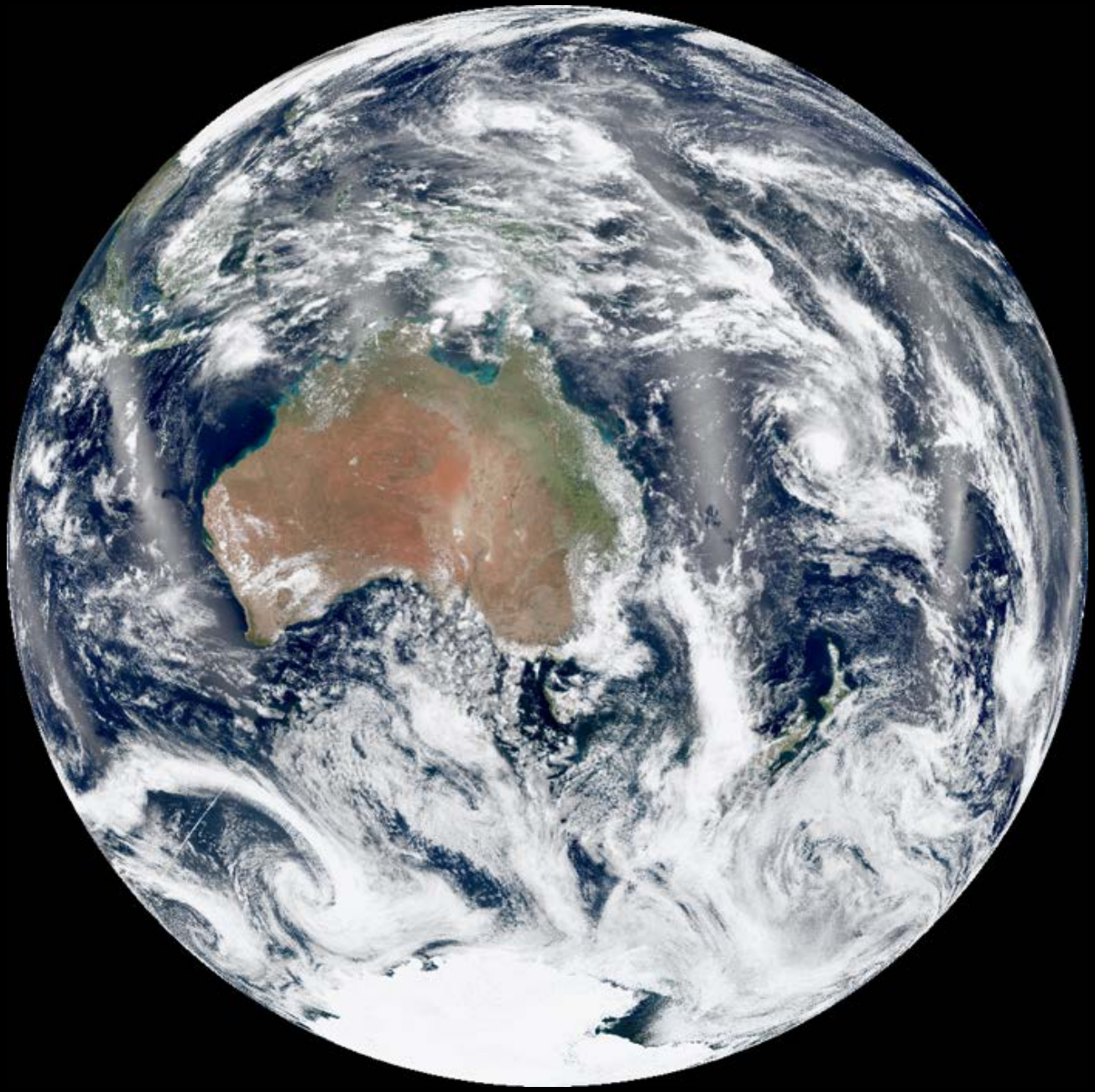
Socioeconomic Impacts: A Primer

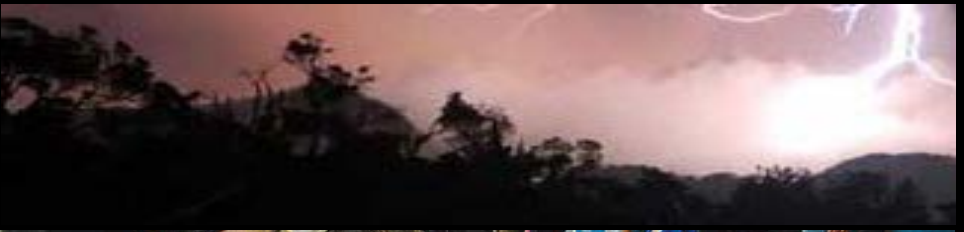


Purpose:

Inform the Earth observations community and project teams about the language, key principles, techniques, and applications of socioeconomic impact analyses.

Autumn 2012





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