

National Aeronautics and
Space Administration

Hydrosphere Investigator
Meeting

Earth System Science Research

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September 1, 2026

A large, circular graphic representing the Earth system. It features concentric rings of different colors and textures: a blue outer ring, a green ring, a brown ring, and a white ring. In the center is a blue globe. A satellite is shown in the upper left, and a white aircraft is in the lower right. The text "NASA Earth" is written in large white letters across the center.

NASA Earth

Increasing the Speed of Earth Science

NASA's Earth Science Division is accelerating functions and simplifying processes with the goal of increasing speed of science and scale of impact.

This includes:

- Speed to orbit
- Speed to science and scientific discovery
- Speed and scale of impact of science
- Driving interdisciplinary science to go after the most complex questions



NASA's End-to-End Earth System Science Capability

Technology



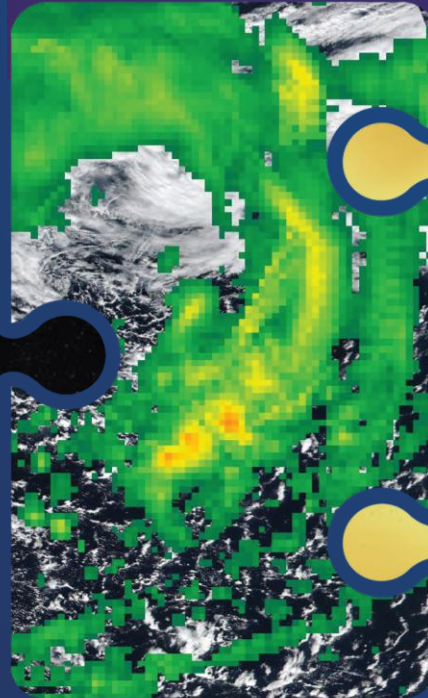
10 new technology infusions/year

Flight



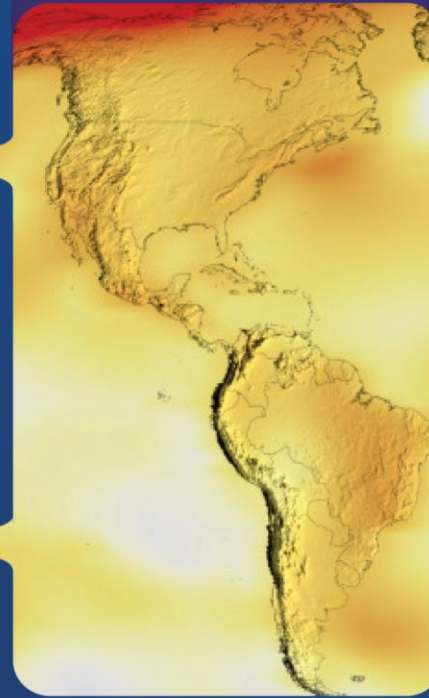
**10 launches in the next 3 years;
3 new private partnerships**

Data



**Ingest 180 TB/Day,
Serve ~800 TB/Day,
>28M users**

Research



Transforming mission data to discoveries that advance American competitiveness

Earth Action



Addressing national needs in Agriculture, Energy, Disasters, Wildfires, Water, & more

Our Goal

Advance scientific breakthroughs to better understand Earth and advance models that capture the intricacies of the Earth system.

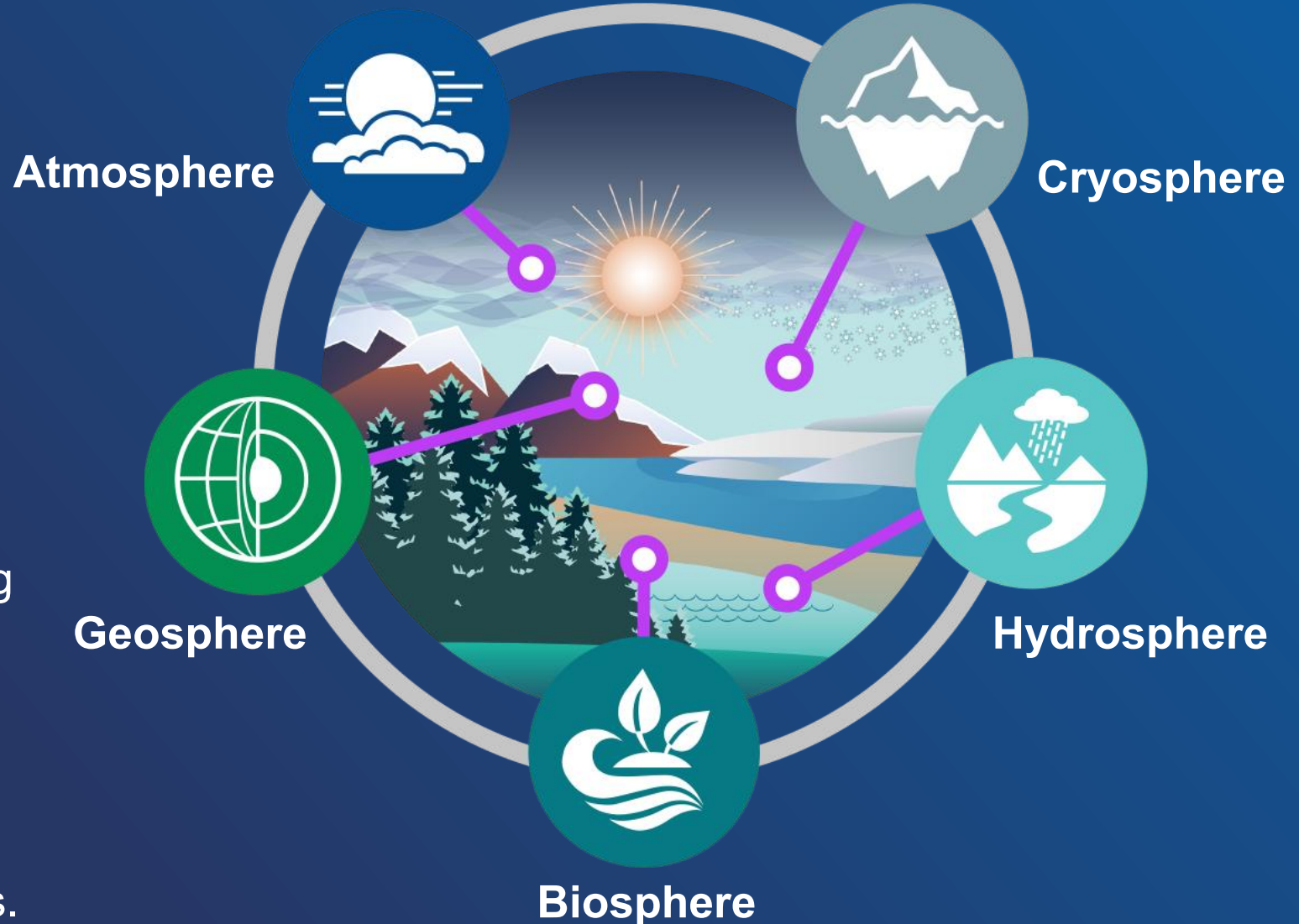
- Focus on things that only NASA can do
- Sustain our community as a premier knowledge incubator
- Understand Earth's complex and interconnected systems
- Strengthen the linkage between discovery and impact of science



Transforming Data to Discoveries

Science Spheres: Like parts of the human body, Earth's "spheres" interact with one another in complex ways. To understand Earth as an integrated system, we measure key Earth processes across different places and times of year.

Research advances scientific understanding of Earth's interconnected systems by integrating NASA's satellite, airborne, surface, and partner datasets; developing predictive models and data analysis tools; and disseminating peer-reviewed discoveries, tools, and insights to improve societal outcomes.



Enabling Capabilities

Foundational cross-cutting activities, opportunities, technologies, systems, or processes that benefit all Earth Science Division elements and Science Spheres.



**Airborne
Science
Program**



**Early
Career
Research**



**Ground
Networks,
Calibration
Labs, and
Crowdsourcing**



**Earth
Modeling
Nexus**

*Previously known
as Integrated
Earth System
Modeling*



**Precision
GNSS**

*Previously
known as the
Space Geodesy
Program*



The ESD Airborne Science Program is Modernizing and Recapitalizing a Diverse Fleet to Support World-Class Airborne Science Well into the Future







Early Career Research Program

Discovery · Participation · Community · Action

Empowering the next generation of Earth science researchers to create a workforce that enables solutions to benefit society, respond to changes in the Earth's system, and to support the Earth Science to Action Strategy.

#NASAEarthECR



FIES2A

First Immersion in Earth Science to Action



SARP

Student Airborne Research Project



FINESST

Future Investigators in NASA Earth and Space Sciences and Technology



ECIP

Early Career Investigator Program in Earth Science



NASA HQ Earth Science Division

Earth System Science Research Program (ESSRP)

Associate Director for Research | Barry Lefer
Deputy Associate Director for Research | Michelle Hawkins

SCIENCE SPHERES

Atmosphere	Biosphere	Cryosphere & Geosphere	Hydrosphere	Enabling Capabilities	
Ken Jucks Upper Atmosphere Research	Kelsey Bisson* Biological Diversity	Robert Emberson* Earth Surface & Interior	David Considine^ Energy & Water Cycle	David Considine^ Computing	Derek Rutovic Airborne Science Program
Emma Knowland Tropospheric Composition	Laura Lorenzoni Ocean Biology & Biogeochemistry	Denis Felikson* Cryospheric Science & Geospheric Science	Craig Ferguson Terrestrial Hydrology	Cynthia Hall* Early Career Research	John Sullivan^ Ground Networks & Calibration Labs
Will McCarty^ Atmospheric Physics	Ryan Pavlick Terrestrial Ecology	Thorsten Markus Cryospheric Science	Jessica Hausman* Ocean Physics	Argie Kavvada Integrated Earth System Modeling	Lucia Tsaoussi^ Precision GNSS
Ed Nowotnick^ Radiation Science	Krishna Vadrevu**^ Land-Cover and Land-Use Change	Lucia Tsaoussi^ Geodesy	Will McCarty^ Precipitation Science	Yáitza Luna-Cruz Early Career Research	Krishna Vadrevu**^ Crowdsourcing
Justin Stachnik**^ Atmospheric Physics	Amanda Whitehurst^ Terrestrial Ecology		Justin Stachnik**^ Precipitation Science	Ed Nowotnick^ Airborne Science Program	Amanda Whitehurst^ Crowdsourcing
John Sullivan^ Atmospheric Composition			Nadya Vinogradova Shiffer Ocean Physics		
Embeds Amber Emory (ESTO) Joel Scott (ESDS) John Haynes (EA)	Embeds Teresa Kauffman (ESTO) Jessica Burnett (ESDS) Keith Gaddis (EA)	Embeds Parminder Ghuman (ESTO) Jessica Burnett (ESDS) Ali Giese–Cryo (EA) Shanna McClain–Geo (EA)	Embeds Laura Rogers (ESTO) Joel Scott (ESDS) Erin Urquhart (EA)		

ESSRP FY26 Metrics



1,167 active ESD Research grants*



37% competed funding, 63% directed funding



19 airborne campaigns across seven countries, 1,100+ flight hours



179 FINESST-funded graduate students**



32 NPP-funded post-docs across four centers***

*Airborne metrics as of August 26,
all other metrics as of August 1*

Earth System Science Research

The world's premier catalyst for understanding Earth as a unified and dynamic system, empowering humanity through transformative insights into Earth system science.



Science Spheres



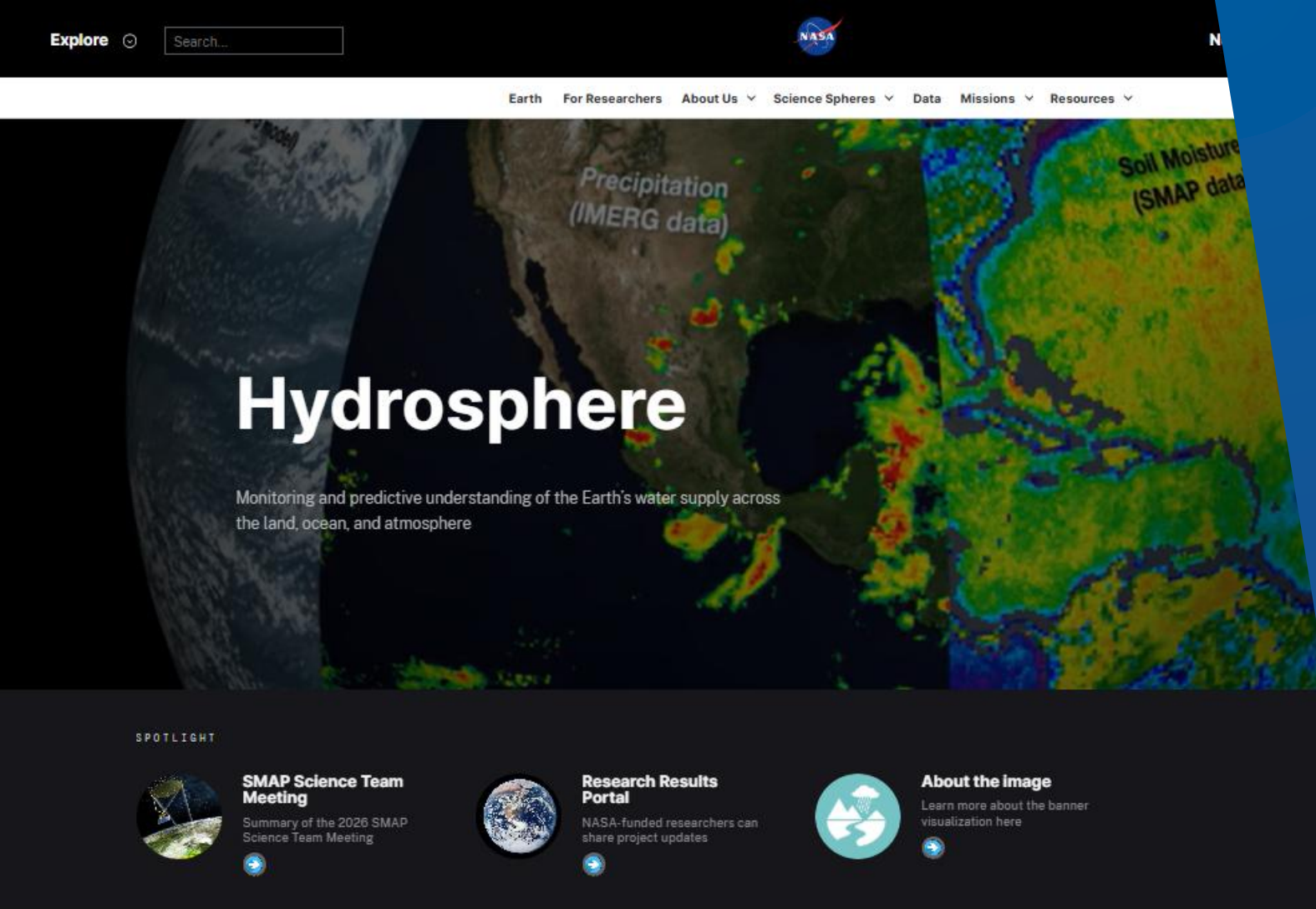
Enabling Capabilities



**Research
Opportunities**



Scan the QR code or go to:
science.nasa.gov/earth-science/research/



Scan the QR code or go to:
<https://science.nasa.gov/earth-science/research/hydrosphere/>

Featured News	↓	Research Highlight
Research Drivers	↓	Funded Research Opportunities
Research Areas	↓	Research Data
Missions and Campaigns	↓	Events
Collaborations	↓	Contacts

Reducing Submission Burden and Reviewer Workload While Increasing Productivity and Efficiency

Changes implemented in recent ROSES calls:

1. ESD Research releasing an element for each Sphere instead of each program
2. Implementing a two-step process or mandatory NOI
3. Reducing proposal length (10-12 pages)
4. Utilizing pre-panel reviews for proposal triage

Implementing some or all of these measures has reduced review time (proposal submittal to selection decision) from six months to under three months.



Open & Planned ROSES-25 Opportunities

[Link to ROSES-25
Table of Solicited
Research Programs](#)



Title	Element	Deadline	Program Officer(s)
Rapid Response and Novel Research in Earth Science (RRNES)	A.4	No Due Date	Krishna Vadrevu
Atmosphere	A.14	August 20 (Mandatory NOIs) October 20 (Proposals)	Atmosphere Team
Biosphere	A.15	September 4 (Step-1s) November 6 (Step-2s)	Biosphere Team
<i>Cryosphere</i>	<i>A.X</i>	<i>TBD</i>	<i>Cryosphere Team</i>
<i>Geosphere</i>	<i>A.X</i>	<i>TBD</i>	<i>Geosphere Team</i>
<i>Hydrosphere</i>	<i>A.X</i>	<i>TBD</i>	<i>Hydrosphere Team</i>

Planned ROSES-26 Elements

Elements subject to change



Earth System Science

- Atmosphere
- Biosphere
- Cryosphere
- Geosphere
- Hydrosphere
- Professional Engineering and Scientist Exchange Program (PESEP-Earth)



Other Research-Related Opportunities

- Future Investigators in NASA Earth and Space Science and Technology (FINESST)
- Multisource Integrated Observatory (MIO)
- Rapid Response and Novel Research in Earth Science (RRNES)
- Supporting High-Impact Opportunities for Uniting Teams (SHOUT)





1215

PROPOSALS
REVIEWED

33

PANELS

483

PANELISTS

124

EXTERNAL
REVIEWERS

ESD Research by the Numbers: FY 2026

(as of August 27)



NASA Earth Science Research Results Portal



esdresearch.nasa.gov

WHOI-NASA Summer School in Sea-Level Science



Meetings and Events

NURTURE '26 News Story on CBC Newfoundland & Labrador



Ashley Brauweiler shows how a NASA project in Labrador will help predict weather

Here & Now



Campaign Highlights

Article

Wide-swath altimetry maps bank shapes and storage changes in global rivers

<https://doi.org/10.1038/s41586-026-10218-y>

Received: 6 August 2025

Accepted: 30 January 2026

Published online: 4 March 2026

Open access

Check for updates

A. Corbelaud^{1,2,3,4}, J. Wade^{1,5}, C. H. David^{1,2}, M. Durand², R. P. M. Frasson¹, T. Pavelsky³ & H. Oubanas⁴

Rivers are Earth's most renewable and accessible freshwater resource¹, yet global estimates of the magnitude and variability in river water storage have remained few and inconsistent^{2–5}. Previous estimates of variability have relied either on sparse and asynchronous remote-sensing observations^{6,7} or on hydrological models constrained

SCIENCE ADVANCES | RESEARCH ARTICLE

ATMOSPHERIC SCIENCE

Decoding global precipitation processes and particle evolution using unsupervised learning

Fraser King^{1,4,†}, Claire Pettersen¹, Brenda Dolan², Julia Shates³, Derek Posselt³

High-quality hydrometeor microphysical observations are essential for accurate precipitation estimates and for evaluating weather and climate models. However, analyzing these properties is challenging due to their high variability, complex interactions, and large data volumes. In this study, we examine more than 1.5 million minute-scale rain and snow particle attributes and collocated meteorological variables from seven global measurement sites over 9 years. Applying Uniform Manifold Approximation and Projection (UMAP) for nonlinear dimensionality

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Water Resources Research*

RESEARCH ARTICLE

10.1029/2025WR041521

Key Points:

- Vegetation responds more strongly to precipitation across space than time, adding uncertainty in ecosystem projections under climate change
- The space-time discrepancy is largely due to differences in seasonal water variability, rooting depth, and soil properties
- Vegetation sensitivity to soil moisture converges across CONUS drylands, underscoring soil hydrology's role in ecosystem response

Supporting Information:

Supporting Information may be found in

Soil Moisture Buffers the Impact of Precipitation Variability on Ecosystem Productivity

Huiqi Wang^{1,2}, Maoya Bassiouni², Yanghui Kang³, Sami W. Rifai⁴, Laureano A. Gherardi², Anna Ukkola⁵, and Trevor F. Keenan^{2,6}

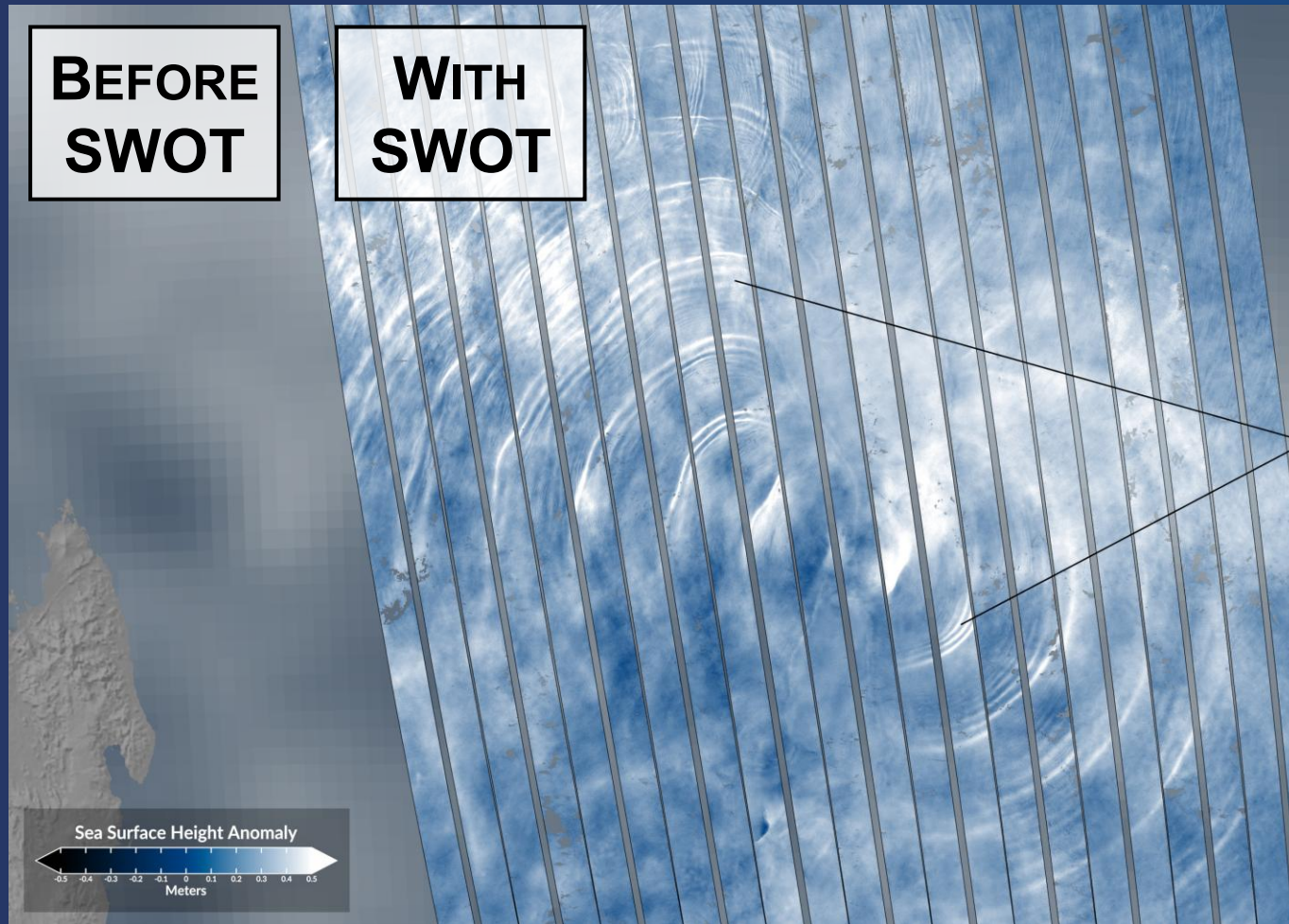
¹Department of Civil and Environmental Engineering, University of California, Berkeley, CA, USA, ²Department of Environmental Science, Policy and Management, UC Berkeley, Berkeley, CA, USA, ³Department of Biological Systems Engineering, Virginia Tech, Blacksburg, VA, USA, ⁴School of Biological Sciences, Adelaide University, Adelaide, SA, Australia, ⁵Climate Change Research Centre, The University of New South Wales, Kensington, NSW, Australia, ⁶Earth and Environmental Sciences Area, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Abstract Water availability governs ecosystem productivity, yet estimates of vegetation sensitivity to water can differ greatly depending on whether the sensitivity is examined spatially or temporally. In particular, the spatial sensitivity is often reported to be much stronger than temporal sensitivities, leading to highly uncertain projections of ecosystem responses to future climate change when using space-for-time substitution. The large

Introducing biases in simulated... of centimeters in snow water... the timing of peak streamflow... times that incorporate humidity... as wet-bulb-temperature-based... skill, they do not generalize... particularly in areas with high-... (10, 19). These challenges under-

Research Results and Scientific Developments

SWOT Sees Beneath the Surface: Resolving Ocean Internal Gravity Waves



Surface expression revealed by SWOT in the Indian Ocean. The blurry background is how we used to see these internal tides with conventional altimeters; now we see the radiating internal waves. *Credit: NASA Scientific Visualization Studio.*



Internal tides dissipate half of Earth's lunar tidal energy, shaping ocean mixing, heat distribution, and even the Moon's orbit. *Credit: NASA Scientific Visualization Studio.*

Improved Global Soil Moisture Monitoring with SMAP-NISAR

X. Xu *et al.*, "A Semiempirical Modeling for Soil Moisture Retrieval Using High-Resolution SAR Data," in *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 19, pp. 13599-13618, 2026, doi: 10.1109/JSTARS.2026.368211

Science Transition from SMAP radiometer-only

40 [km] →

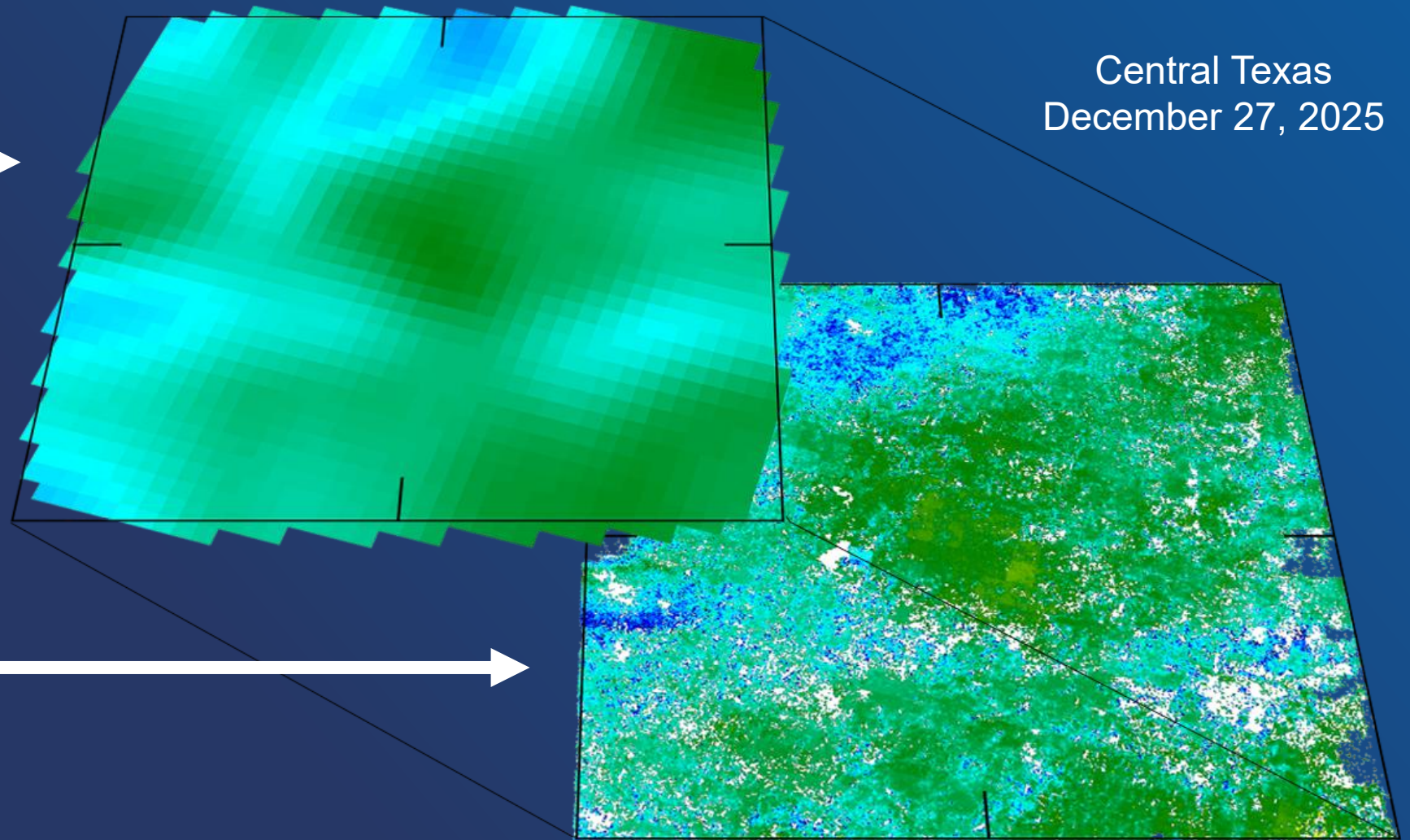
SMAP radiometer-only
use-cases:

- Land-atmosphere feedbacks
- Drought monitoring
- Global ecology

Science Transition to SMAP-NISAR 100 [m]

Newly captured applications
with SMAP-NISAR:

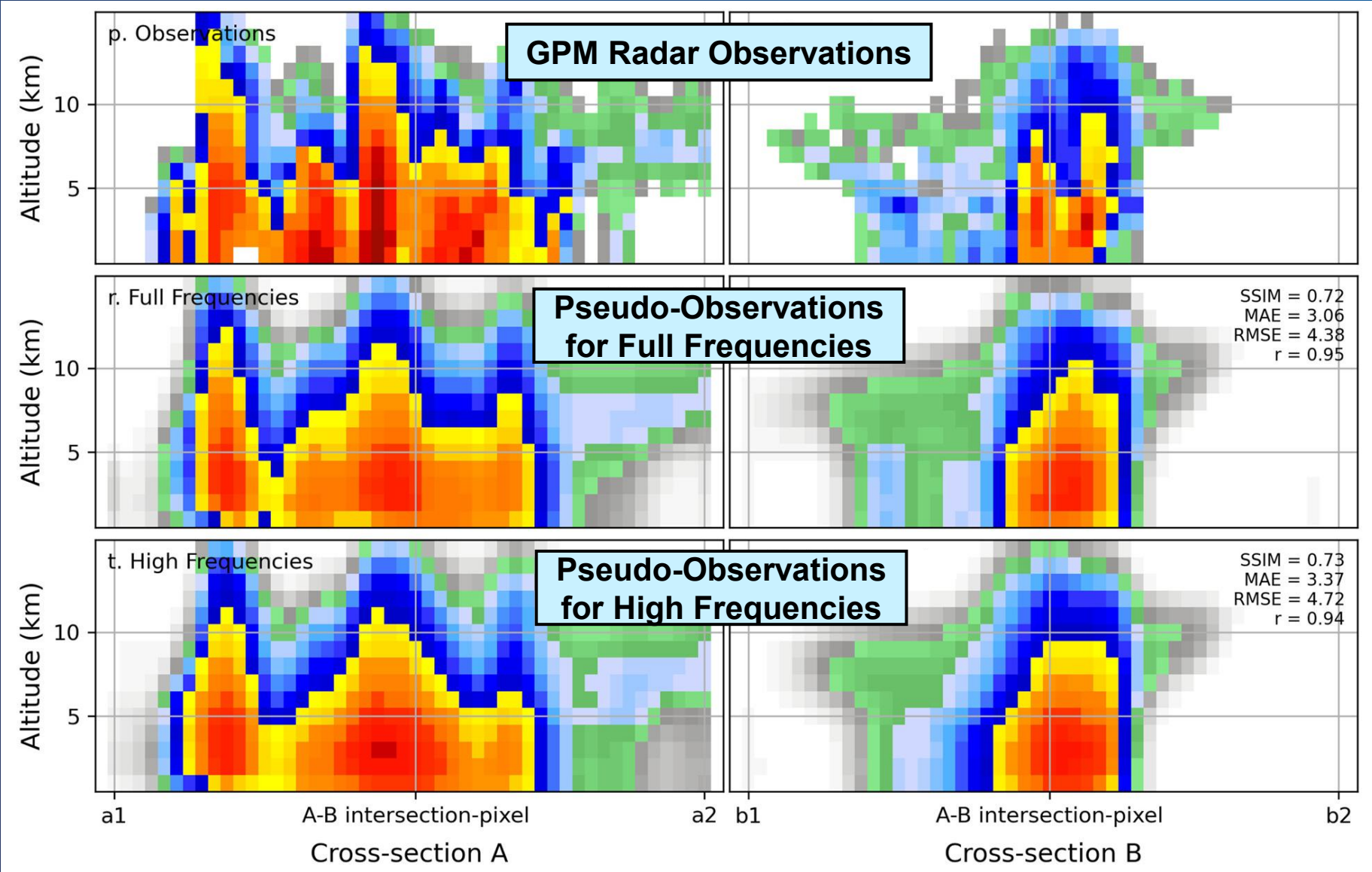
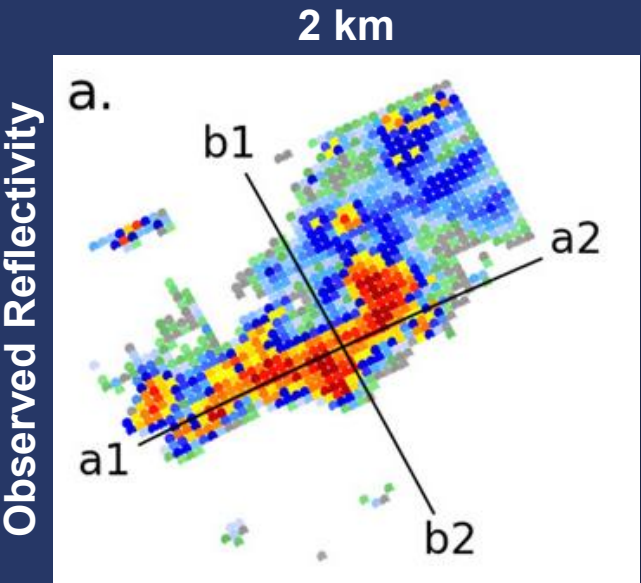
- Field-scale agriculture
- Floodplain runoff
- Landslide hazard
- Wildfires risk



From Xialoan Xu (JPL)

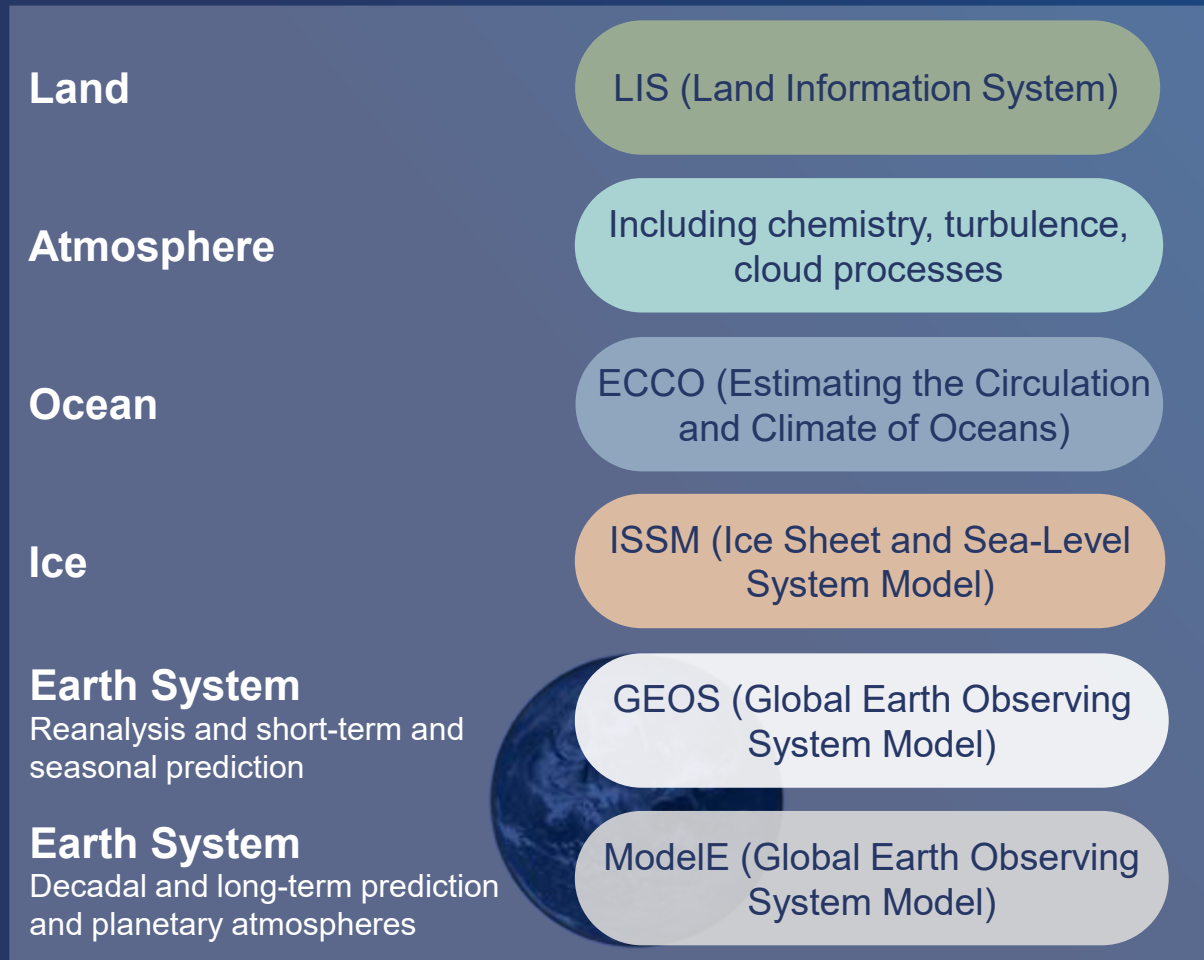
3D Vertical Precipitation Structure Derived from 2D Passive Microwave Observations

Morvais, F., & Liu, C. (2026). Pseudo-radar reflectivity by applying U-net models to global passive microwave brightness temperatures. *Journal of Geophysical Research: Atmospheres*, 131, e2026JD046570.
<https://doi.org/10.1029/2026JD046570>

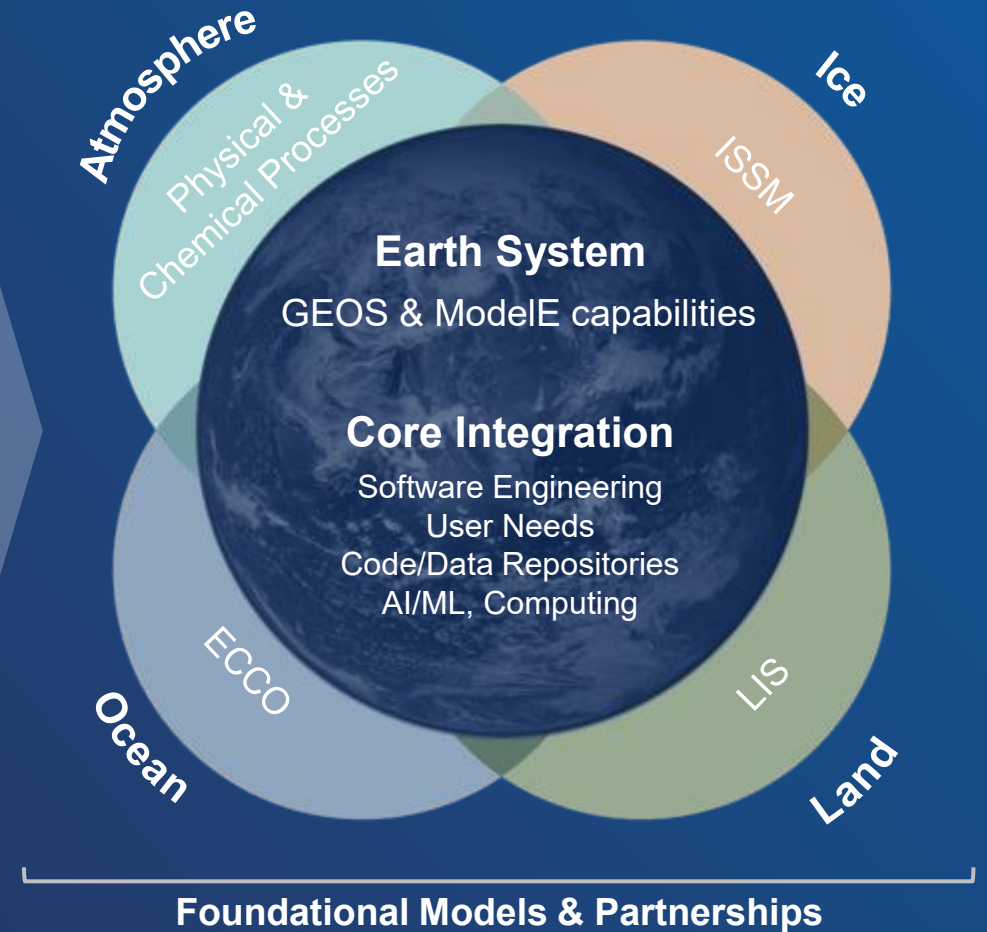


Earth Modeling Nexus (formerly IESM): From Independent to Integrated

Independent Models Today



Integration via Earth Modeling Nexus



NASA CSDA Commercial Data Portfolio

Broadening access to diverse, complementary Earth observation capabilities

National Aeronautics and
Space Administration



OPTICAL/ MULTISPECTRAL

AIRBUS



BLACK SKY
SATELLOGIC



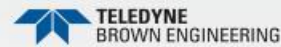
SATLANTIS
Vantor



HYPERSPECTRAL (VNIR-SWIR)



pixxel



KUVA SPACE



SAR

AIRBUS



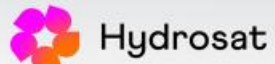
ICEYE



GNSS (RO/R)



THERMAL INFRARED



PRECIPITATION/ MICROWAVE



ATMOSPHERIC/ GHG



DEM/ ELEVATION

AIRBUS



DIVERSE

Broad set of commercial
partners and capabilities



COMPLEMENTARY

Complements NASA's
Earth observations



RESPONSIVE

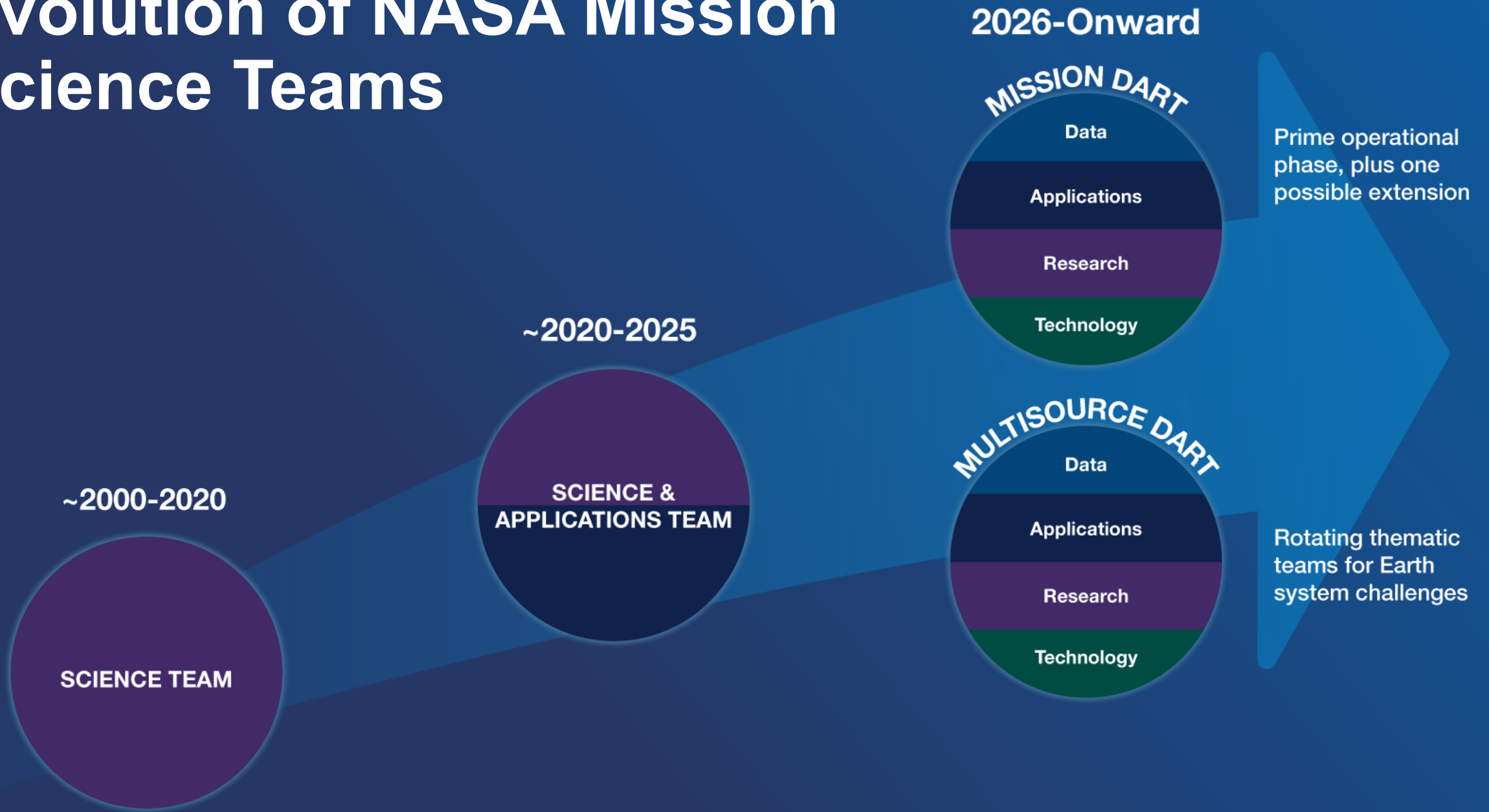
Rapid access to data for
timely decision making



ACCESSIBLE

Structured delivery framework
broadens U.S. government access.

Evolution of NASA Mission Science Teams





Questions?



NASA Earth

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