



The Water and Ecosystems group at JPL

NASA Hydrosphere meeting
Sept 1-3, 2026
Washington, DC



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JPL is a Nonprofit Organization

The California Institute of Technology (Caltech) is a nonprofit organization, and as an operating division of Caltech, JPL is as well



[Credit: Caltech]



General Counsel
(Caltech)
J. Lum
S. Atlee

**Office of Associate Lab
Director for Flight Projects
& Mission Success**
K. Patel
H. Eisen

1000

D. Gallagher, Director

L. Livesay, Deputy Director
L. Haber, Chief of Staff
J. Lunine, Chief Scientist
R. Cook, ALDSI
J. Kelly, CFO

**Office of Safety & Mission
Assurance (SMA TA)**

Ethics Office

Ombuds Office

**2000
Financial & Business
Operations**

J. Kelly
J. Ibrahim

Program Analysis
and Evaluation

Financial Planning
and Analysis

Accounting
and Contracts

Project Business
Management

Acquisition

**3000
Engineering & Science**

S. Goodman
M. Gross

Science,
Implementation,
and Operations

Communications
and Instruments

Autonomous
Systems and
Advanced Software

Mechanical and
Control Systems

**4000
Flight Projects**

K. Patel
J. Evans

Office of Project Eng
and Management (ETA)

Telecom Programs
and Oversight

National Programs
Implementation

Planetary Flight
Projects

Astronomy and Helio
Flight Projects

Earth Flight Projects

Earth Systematic
Program

**5000
Strategy & Formulation**

R. Cook
G. Goode

Strategic Planning
and Integration

JPL Capabilities
and Products

National Programs

Space Science
Development

Exploration Systems

Communications,
Legislative Affairs,
and Academic
Engagement

Mars Exploration
Program Office

Exoplanet Program
Office

**6000
Lab Operations**

B. Corcoran
J. Ciernan Price

Enterprise IT Services

Cybersecurity
Governance,
Engineering and
Operations

Enterprise Information
Management

Facilities and Logistics
Operations

Protective Services

Human Resources

**7000
Lab Administration**

L. Haber
H. Herman

Director's Office
Administration

Financial and Business
Operations
Administration

Engineering and
Science Administration

Flight Projects
Administration

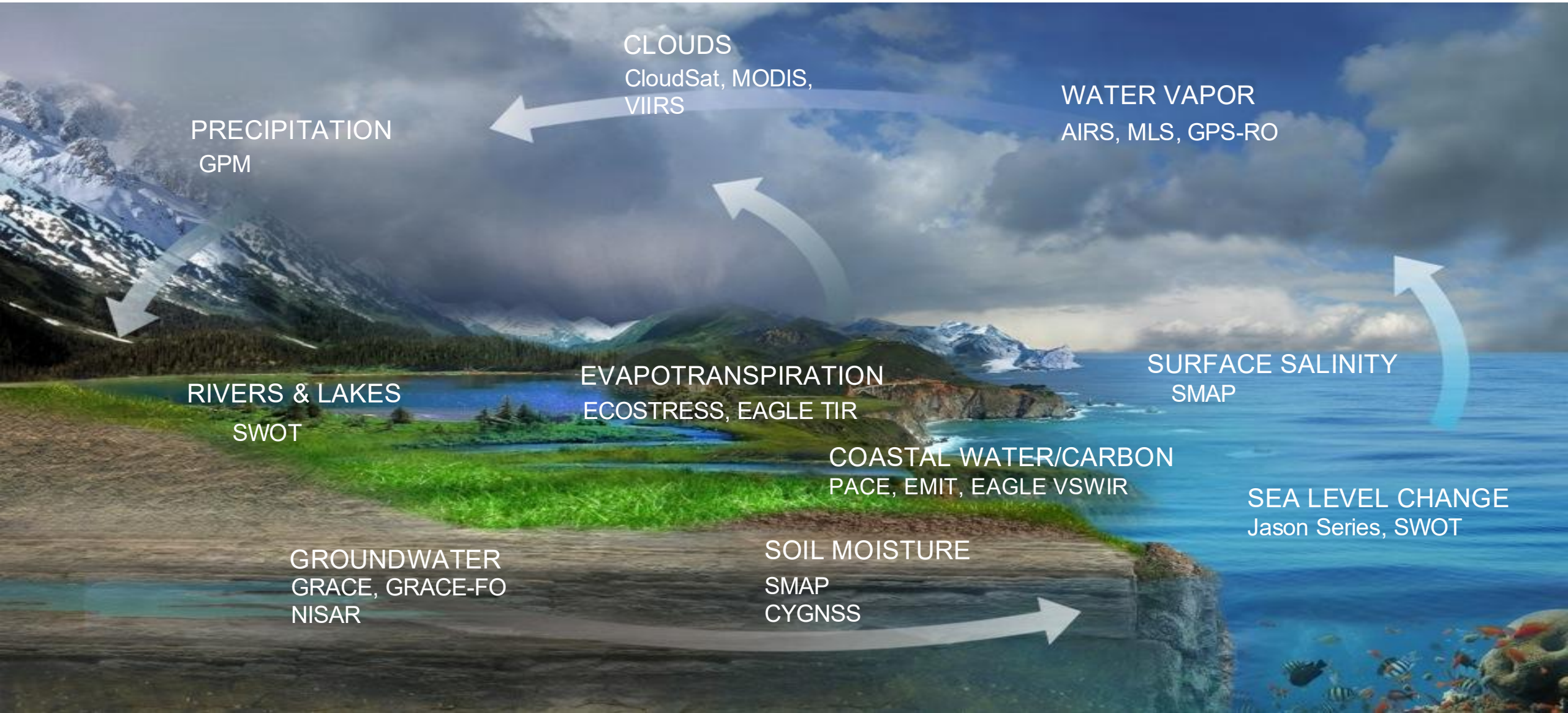
Strategy and
Formulation
Administration

Lab Operations
Administration

A “GOLDEN AGE” OF WATER CYCLE AND FRESHWATER AVAILABILITY OBSERVATIONS

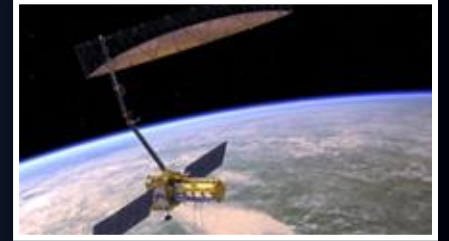
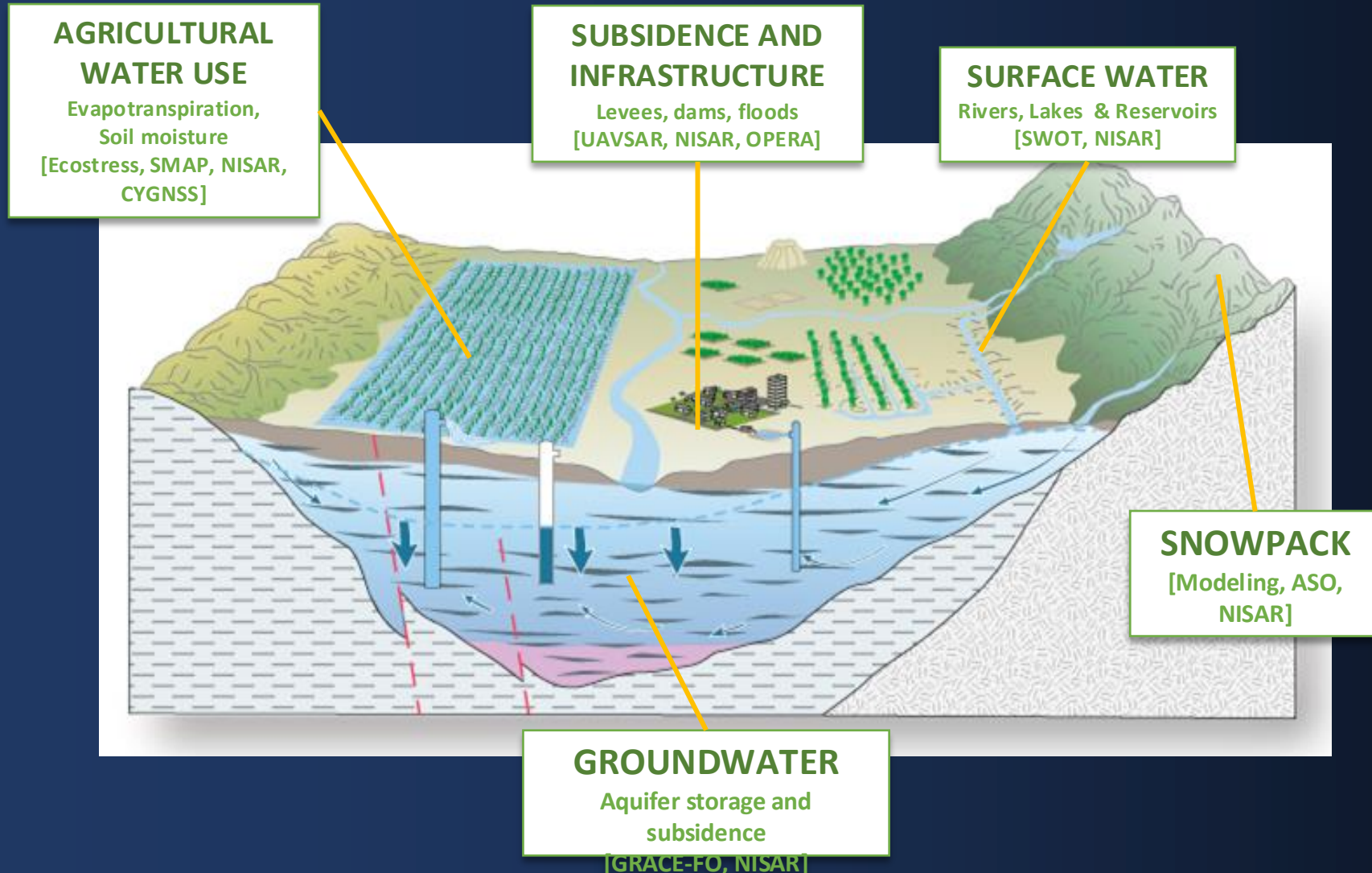
NASA has now provided at least one measurement of every major component of the water cycle

**Next step: integrated value*



Water Information from space to ground

Water Availability, Physical Hydrology and Water Quality



Group Introduction & Charter: Water and Ecosystems

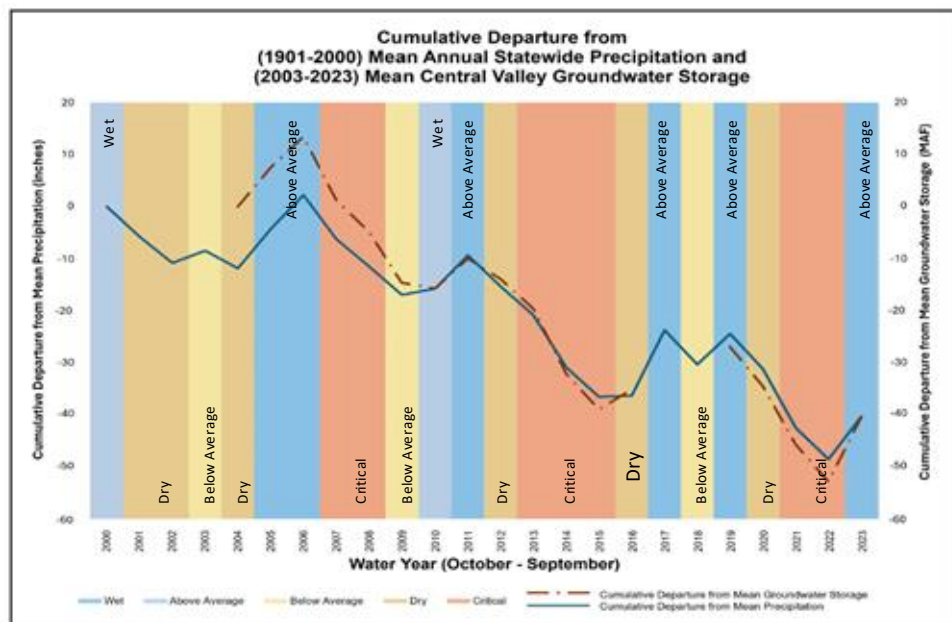
1. **Scientific Discovery.** We combine spaceborne, airborne, and *in situ* observations with scientific theory to shed new light on Earth's geophysical and biogeochemical processes.
1. **Applications.** We link advances in understanding of the water cycle to practical Earth science applications to support sustainable water and natural resources management and maximize societal benefit.
1. **Mission Support.** Collaborate with the teams managing and operating existing and upcoming NASA missions (also known as “flight projects”).
1. **Mission Formulation.** We plan for the future of Earth spaceborne observations by evaluating scientific challenges in light of available technology to help motivate new missions.



JT Reager (group supervisor)



Highlight: GRACE-FO used by California's Dep. of Water Resources (DWR) for better Groundwater Management



*NASA GRACE/GRACE-FO data provided by personal communication from J.T. Reager at NASA Jet Propulsion Laboratory)



Current Focus:

- Group supervisor, 321E;
- Deputy Project Scientist, GRACE-FO;
- Water-cycle research and community coordination

Key History:

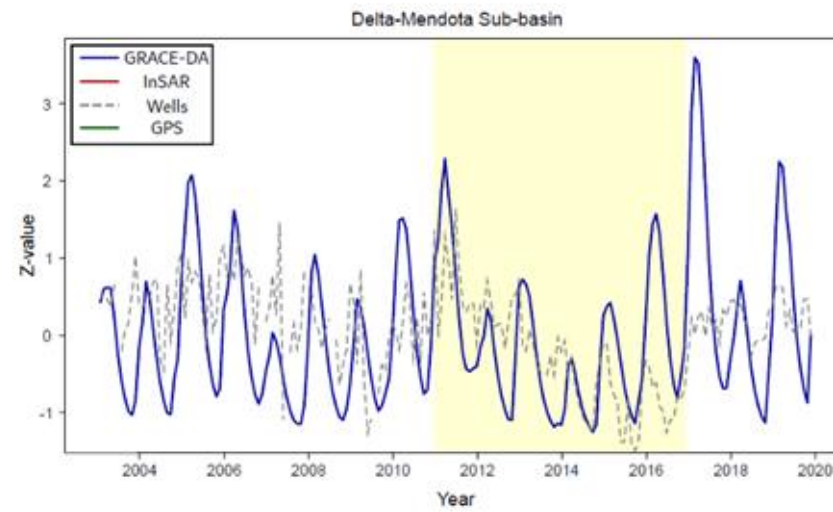
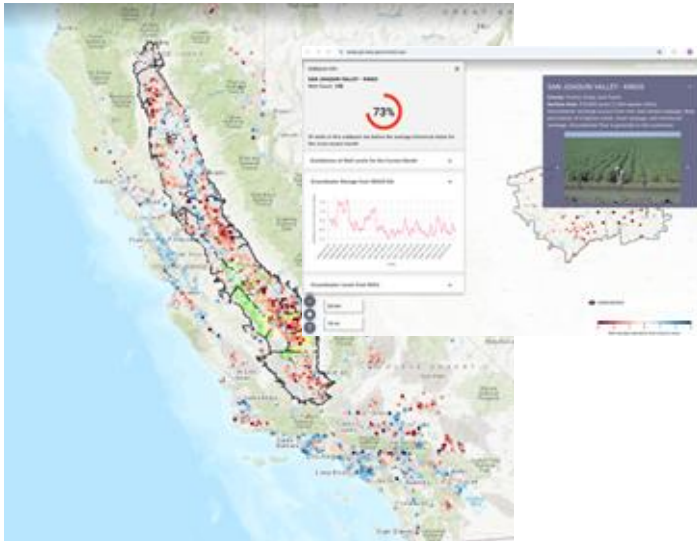
- ~12+ years at JPL (GRACE science team, water cycle, water resources, hydrologic extremes);
- Experience across research, missions, applications and programs

- CA's DWR will include GRACE(-FO) data on a semi-annual basis for '*insight for the regional changes in groundwater*', and '*to help inform science-backed management decisions.*'
- Key strategy to managing CA's essential water resources is to divert surface water surplus in wet years (e.g., 2023) towards groundwater recharge.
- GRACE(-FO) observations address this crucial need '*for sustainable groundwater management practices to ensure water resiliency amidst ongoing climate challenges [...]*'.

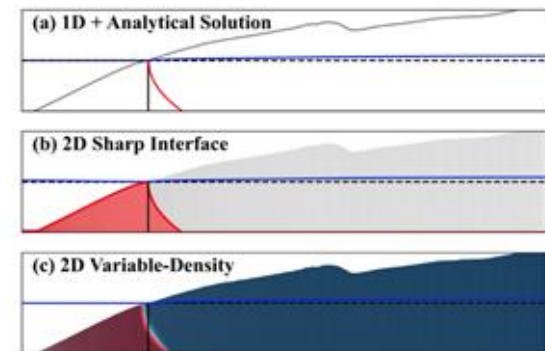
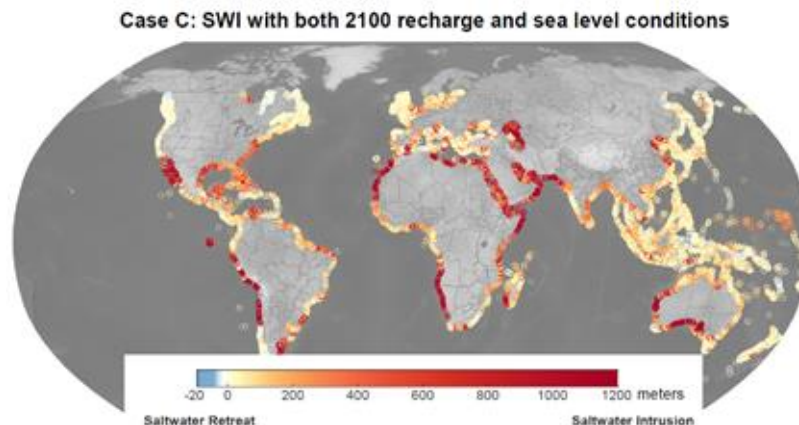
Kyra Adams (scientist)



Highlight 1: co-developed VIRGO (Visualization of In-situ and Remotely-Sensed Groundwater Observations) for end-users to explore groundwater changes using GRACE and well data. First to explore suitability for GRACE-DA products at sub-basin scale hydrology



Highlight 2: Global saltwater intrusion projections driven by recharge changes and sea level rise calculated for DoW, with uncertainties driven by model & parameter choice



Current Focus:

- Coastal hydrology, sea level rise impacts, and groundwater modeling
- Groundwater monitoring from space

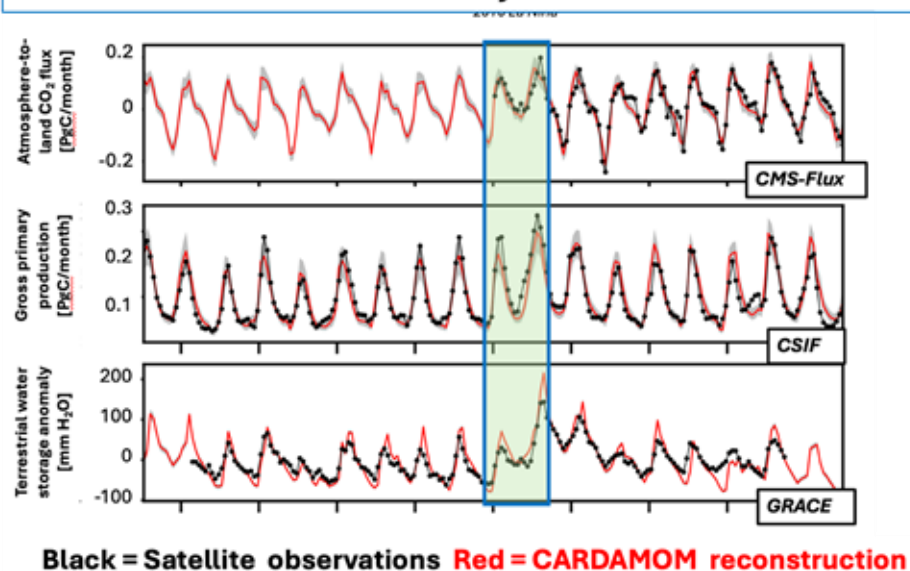
Key History:

- Technical Lead for Dept. of War SERDP projects (saltwater intrusion, VLM)
- Developed VIRGO water resources tool for state of CA
- Past term as Assistant Section Manager for Earth Science
- NASA Coastal Resilience science team

Anthony Bloom (scientist)

Highlight 1. CARDAMOM land model-data integration framework

CARDAMOM's observation-informed mechanistic reconstruction enables advances in water and ecosystem science



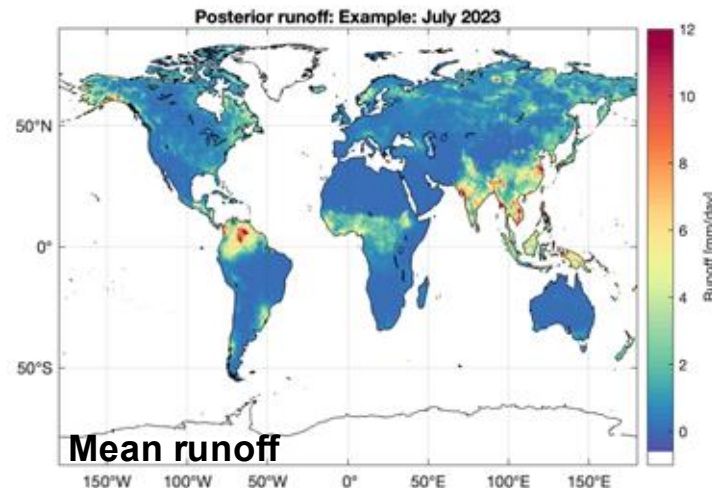
Current Focus:

- Land and river hydro-biogeochemical modeling and model-data integration

Key History:

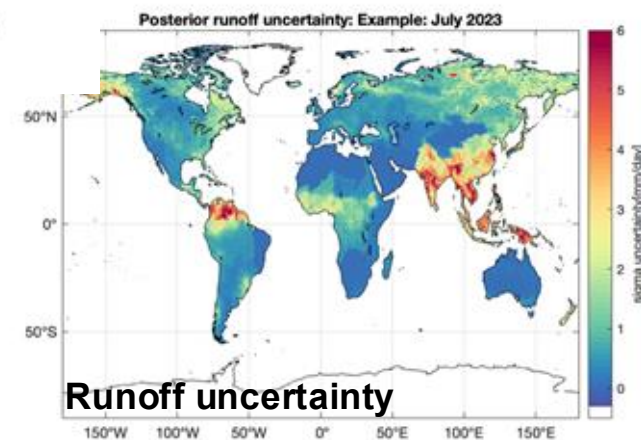
- CARDAMOM & WetCHARTs process development and Bayesian integration of water and carbon datasets,
- 7+ years PI experience across ROSES and RTD efforts

Highlight 2. SWOT-derived runoff mapping



Fresh-off-the-press

First SWOT-derived surface and subsurface runoff maps from CARDAMOM-RAPID framework



Matt Bonnema (scientist)



Highlight:

Geophysical Research Letters

RESEARCH LETTER

10.1029/2022GL098987

Key Points:

- Smaller water bodies show significantly more global surface area variability than larger water bodies
- Reservoirs show more surface area variability than lakes of similar sizes
- Global intermittently inundated surface water body area is ~20% of its average, and small water bodies made up the most significant portion

Supporting Information:

Supporting Information may be found in the online version of this article.

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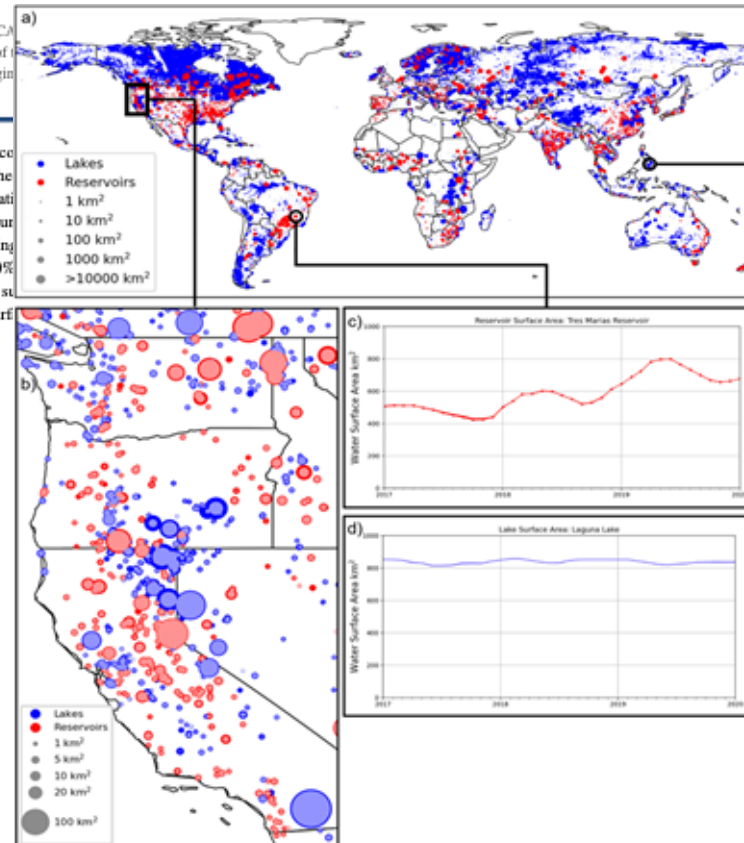


The Global Surface Area Variations of Lakes and Reservoirs as Seen From Satellite Remote Sensing

Matthew Bonnema¹, Cédric H. David¹, Renato Prata de Moraes Frasson¹, Catalina Oaida¹, and Sang-Ho Yun^{1,3,4}

¹Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA; ²Nanyang Technological University, Singapore, Singapore; ³Asian School of Engineering, Singapore, Singapore; ⁴School of Electrical and Electronic Engineering, Singapore, Singapore

Abstract Natural lakes and artificial reservoirs are important components for freshwater, food, and energy. Relatively little is known about the area globally. For the first time, this study presents the global variability of water bodies larger than 1 km². Using radar remote sensing, we found only 2% of total surface area over a 3 year period. When considering that transition between land and water, these variations equaled 20% largely driven by variations of smaller water bodies. Additionally, surface area is more variable than the surface area of lakes of similar size. The large surface area have a previously underappreciated impact on the Earth System.



Current Focus:

- SWOT Mission Application Lead (MAL),
- OPERA project science team

Key History:

- Early Career Investigator Program,
- CYGNSS water surface detection

Dana Chadwick (scientist)

Highlight:

VSWIR-PLANTS: Plant Traits and Spectral database



Focus:

- EMIT (MAL, DART, Critical Minerals).
- MAL for EAGLE-VSWIR.
- Deputy Science Definition Team Lead, PANGEA
- VSWIR-PLANTS Lead
- AVIRIS Airborne Australia Lead.
- NASA ESD Rep for Industry Advisory Board

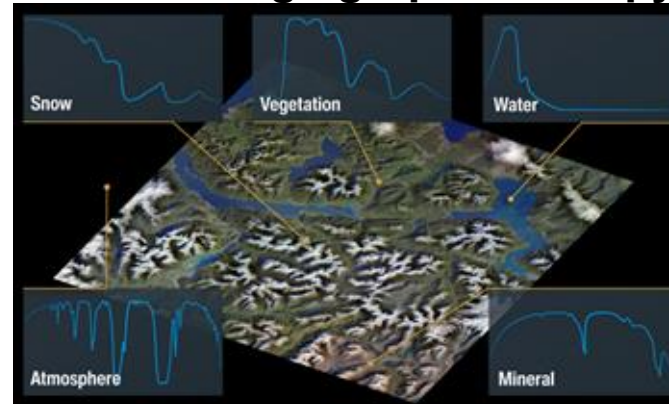
Key History:

- SBG VSWIR Terrestrial Vegetation Lead;
- Stakeholder Engagement Lead, US GHGC

Mission Applications Approach



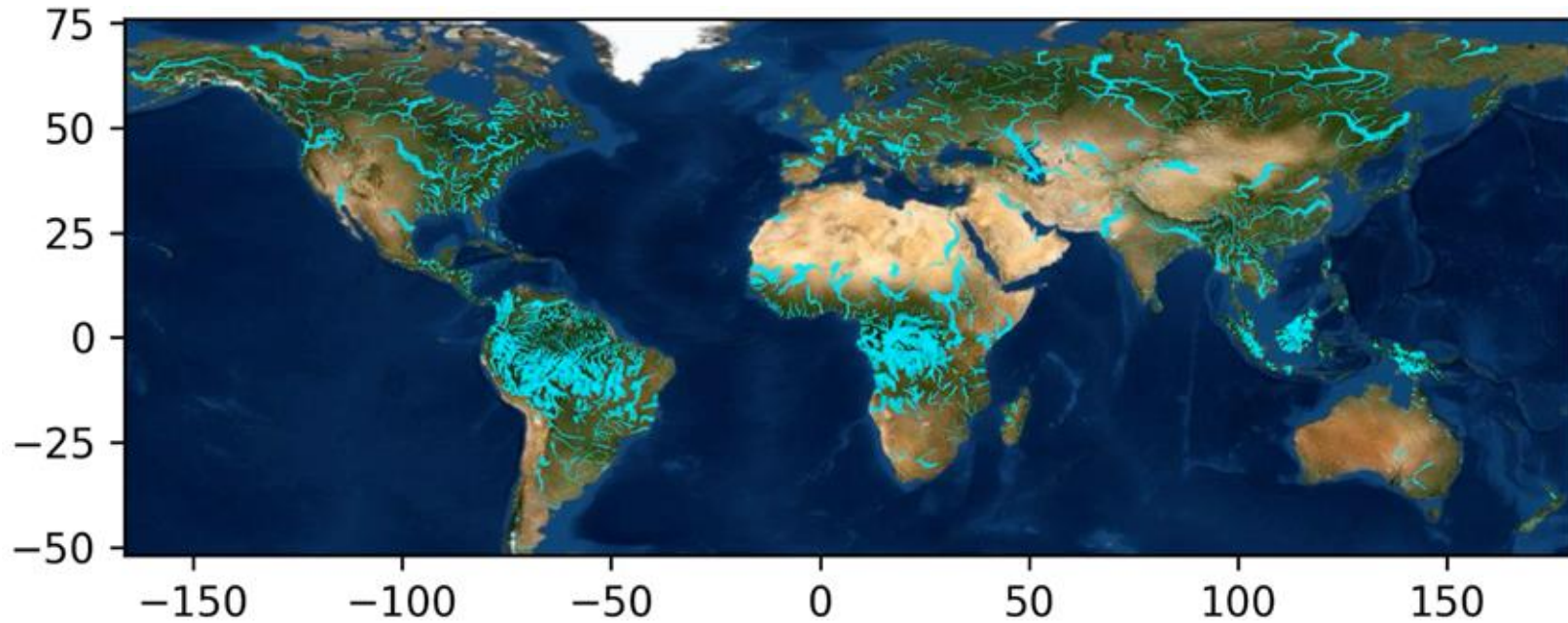
VSWIR Imaging Spectroscopy



Cédric David (scientist)



Highlight: River “maps without gaps” with RAPID + SWOT DA



RAPID evaluates water stores and fluxes in rivers, lakes, and reservoirs, which are the most accessible, renewable, and sustainable source of freshwater, as well as the most devastating cause of disasters

Focus:

- SWOT science team member
- River View Earth Science to Action project lead
- Open Source team member
- Developer of the RAPID river routing model

Key History:

- Former Group Supervisor
- Former NASA Open Science Champion
- Principal Investigator on 6 selected ROSES projects, Co-Investigator on 10.
- Principal Investigator on 2 JPL Strategic Initiatives
- 12+ years at JPL

Brandi Downs (technologist)

Highlight:

NISAR time series composite showing temporal change across **Blackwater National Wildlife Refuge** and tributaries of **eastern Chesapeake Bay**. All data acquired in 2026.



Current Focus:

- NISAR Project Science Team
- IGS Central Bureau
- PO.DAAC Applied Science Team

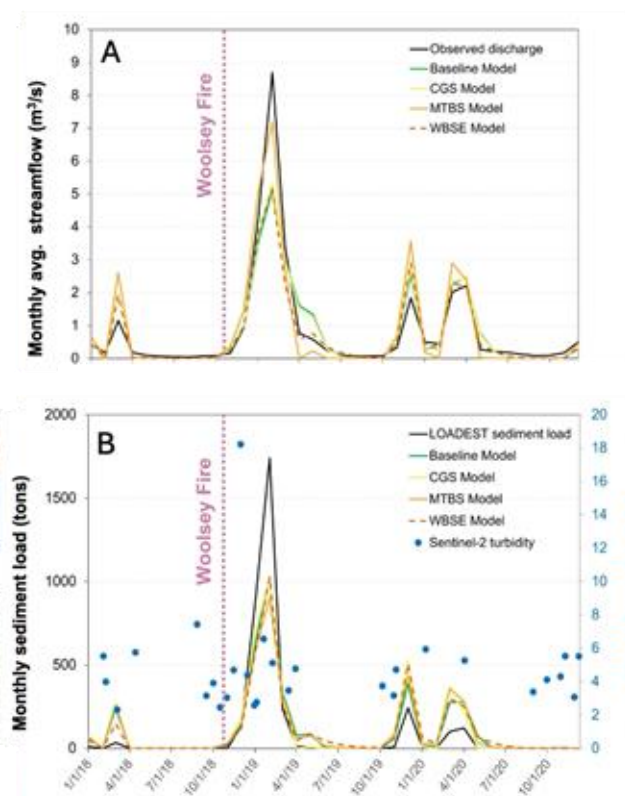
Key History:

- Chief Editor, NISAR Science Users' Handbook Second Edition
- PI, CYGNSS for Action Phase-1 Study

Mandy Lopez (technologist)



Highlight: *Fire-to-Coast Hydrology: Linking Wildfire, Streamflow, and Coastal Water Quality*



Malibu Creek watershed effects

field measurements and model simulations

Runoff and sediment loads elevated relative to pre- and post-fire but within range of similar non-fire water years

“First flush” runoff shifts earlier in time post-fire → fire-impacted erosion susceptibility lingers

Coastal effects

Coastal **turbidity** doubles
measured from space

Total **coliform** 9x higher
Enterococcus 53x higher
field measurements

Current Focus:

- Coastal water quality remote sensing
- Wildfire impacts on watersheds
- Imaging spectroscopy trace gas plumes

Key History:

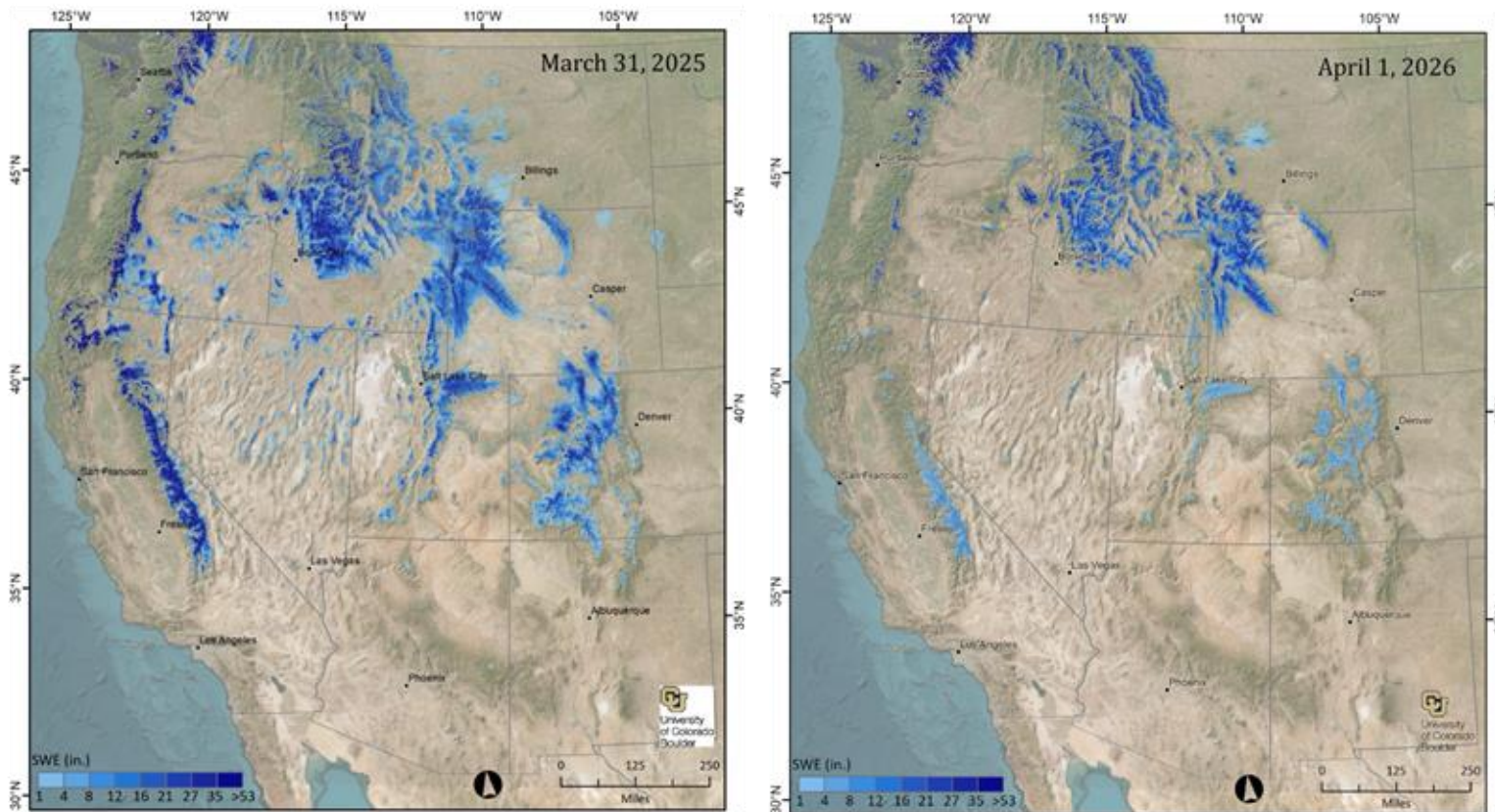
- Hydrological modeling
- Marine biogeochemistry
- Isotope geochemistry

- Lopez et al. (2026) *AGU Water Resources Research* In review.
- Lopez et al. (2025) *AGU Earth and Space Science* 12, e2024EA003843.
- Cira et al. (2022) *Scientific Reports*, 12(1), p.2428.

Noah Molotch (affiliate scientist)

Highlight:

SWE Fusion: 2026 Western US Snow Drought



Current Focus:

- Snow modeling
- Reanalysis and Data assimilation
- Operation snow product delivery to state and federal agencies

Key history:

- Snow community leadership
- UC Boulder faculty

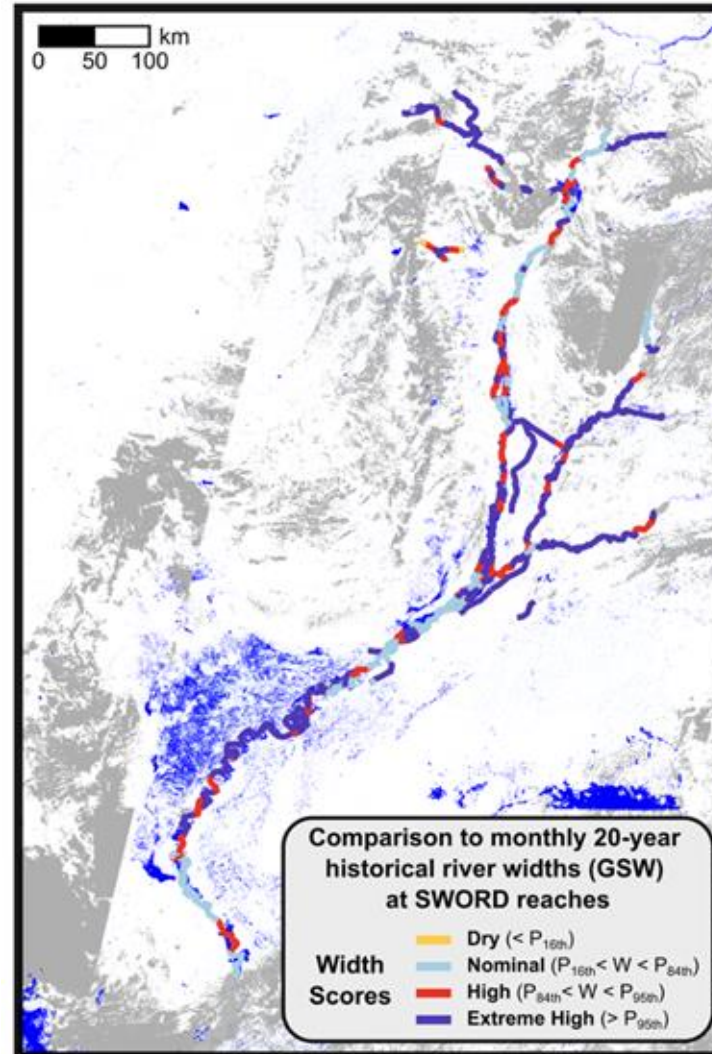
Renato Prata de Moraes Frasson (scientist)



Highlight:

Transforming Remote Sensing data into actionable information:

- Collaboration with Engineer Research and Development Center (ERDC) and the National Geospatial Intelligence Agency (NGA)
- Globally applicable water diagnostics system
- Anomaly detection and severity estimation
- Fully reliant on spaceborne observations
- Combines strengths from Optical and Radar platforms
- High cadence, with potential for estimates every 2 to 3 days.



Current Focus:

- Multi-sensor remote sensing of surface waters
- Discharge estimation and uncertainty quantification
- OPERA Project science team
- Water Resources Program and Western Water Action Office

Key History:

- SWOT Algorithm Team (River Products)
- SWOT Science Team (River Discharge)
- 6+ years at JPL

Madeleine Pascolini-Campbell (scientist)



Highlight:

- Pascolini-Campbell, M., Bohn, N., Lou, Y., An, K., Rolla, J., Peacock, A., Chen, R., Miner, K., Frankenberg, C. and F. Seidel, ***Synergies between Imaging Spectroscopy and SAR for assessing pre- and post-fire fuel conditions.***
- Pascolini-Campbell, +30 co-authors. ***Gaps, opportunities and future technology needs for wildfire science and applications for the next Decadal Survey***
- E Tajfar, Pascolini-Campbell, M., Hakuba, M., Reager, J.T., David, C., and Landerer, F. ***Higher Terrestrial Water Storage Capacity Sustains Evapotranspiration and Latent Cooling During Drought in Mississippi River Sub-Basins***, Water Resources Research

Current Focus:

- NASA FireSense Implementation Team Center Lead & PI for 2 funded wildfire projects
- TIR Evapotranspiration Algorithm Developer and Implementation
- Wildfire Hazard and Recovery Modeling
- Science Applications Lead for ECOSTRESS

Other water folks at JPL



Christine Lee

- Assistant Section Manager
- ECOSTRESS Project Science Team Member (applications)
- PI (coastal and water resources projects), JIFRESSE Assistant Director
- Ex-Group Supervisor; NASA Associate PM for Water Resources; Project Scientist (pre-project) California Climate Information System



Xiaolan Xu

- Senior Member, IEEE
- Microwave remote sensing forward modeling,
- Retrieval algorithm development,
- SMAP science team
- Snow and Signals of opportunity



Shadi Oveisgharan

- Radar Remote Sensing
- Modeling scattering waves in snow/forests/soil,
- SAR/InSAR,
- Radar design, data fusion, requirement definition/evaluation, sensitivity/error analysis



Mary Morris

- Surface water detection using Microwave radiometry and GNSS-R.
- (CYGNSS) science team,
- SMAP science team



Simon Yueh

- SMAP Project Scientist
- Previously: Aquarius Project Scientist, Radar Science and Engineering Section Manager



Niklas Bohn

- Expert in atmosphere and snow radiative transfer and physics-based forward models.
- uncertainty quantification from spaceborne imaging spectroscopy measurements,



Marc Simard

- coastal zones, wetlands, and forested landscapes
- Mangroves
- Hydrodynamic using SAR, altimetry
- PI of Delta-X mission, STV hydrology lead



Zhen Liu

- Plate boundary deformation using GNSS and InSAR
- Estimating seismic hazard from tectonics and understanding earthquake dynamics
- Satellite remote sensing of groundwater and subsidence



Thank you for your attention

email: john.reager@jpl.nasa.gov



Jet Propulsion Laboratory
California Institute of Technology