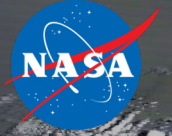


National Aeronautics and  
Space Administration



# EXPLORE SCIENCE

**Open Source Science for Earth  
System Observatory Mission  
Data Processing Study  
-Workshop #2-**

Tuesday, 1 March 2022



# Welcome

Thank you all for joining the Open Source Science for ESO Mission  
Data Processing Study **Workshop #2**.

Your time and commitment to the Open Science Data Initiative is greatly  
appreciated!

Workshop #1 (October 19-20, 2021) Report has been published, and is available for  
download at <https://trs.jpl.nasa.gov/handle/2014/53042>

# Virtual Platform

- ❖ This workshop is being hosted and supported by our partners at Earth Science Information Partners (ESIP)
- ❖ The workshop is being recorded and all proceedings will be available publicly on the workshop's website.
- ❖ Please enter your full first and last name as your display (screen) name. Please do not use initials or nicknames.
- ❖ If you experience technical issues during the workshop, please contact [staff@esipfed.org](mailto:staff@esipfed.org).

❖ The link for the meeting will be the same each day and is found here:  
<https://esipfed-org.zoom.us/j/88110478543?pwd=NFpPdmV0NVE5VVhUOXpwUGFjSWU3UT09>

❖ We request that you **not share** this link, but instead encourage colleagues to attend by registering (link below):  
[https://docs.google.com/forms/d/1b3of2JzJg8GMXLoMhlyh0imWhOoiyZ5u1ikbTuuMD7o/viewform?edit\\_requested=true](https://docs.google.com/forms/d/1b3of2JzJg8GMXLoMhlyh0imWhOoiyZ5u1ikbTuuMD7o/viewform?edit_requested=true)

zoom

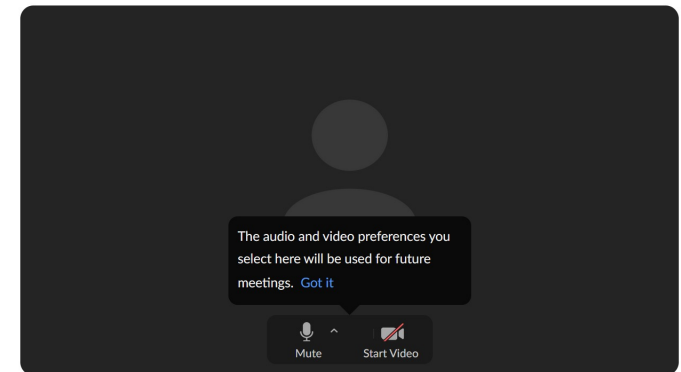
Join Meeting

Your Name

Remember my name for future meetings

By clicking "Join", you agree to our [Terms of Services](#) and [Privacy Statement](#)

Join



# Meeting Logistics

- ❖ Workshop Emcees: Sara L., Karen Y., Chelle G., Andy B., Luke D., Andy M.
- ❖ Speakers will receive a warning when you near the end of your allotted time.
- ❖ Designated Question & Answer sessions (aka Fishbowl Discussion) after each session. Please direct any comments and questions through the ZOOM chat function and [Slido platform](#). We are prioritizing questions from members of the Study Architecture Working Group. However, everyone is allowed to ask questions in the chat. If time does not permit to have them addressed during the session, responses will be provided in the meeting notes.
- ❖ Scheduled breaks throughout
- ❖ Breakout Groups:
  - System development approaches & challenges*
  - System operations approaches & challenges*
  - Open-sourced science approaches & challenges*
  - Data analysis needs for Mission Data Processing System (MDPS)*
  - Open source software approaches & challenges*
  - MDPS Architectures now and the future*
- ❖ Workshop proceedings (including notes) will be made public on the study website.

### ESDS Program

- Earth Science Data Systems Program
- Program Components
- IMPACT
- Competitive Programs
- Commercial Smallsat Data Acquisition Program
- Harmonized Landsat Sentinel-2 (HLS)
- Multi-Mission Algorithm and Analysis Platform (MAAP)
- ESDS Geographic Information Systems Team (EGIST)
- Enabling Earth Science in the Cloud
- Open Science
- Artificial Intelligence/Machine Learning
- Continuous Evolution
- ESDS Highlights
- Adding New Data to EOSDIS
- Open Data, Services and Software Policies

## Open Source Science for the Earth System Observatory Mission Science Data Processing Study Workshops



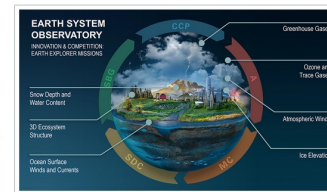
NASA is formulating the Earth System Observatory (ESO), a set of Earth-focused missions to provide key information to guide efforts related to monitoring climate change, mitigating disasters, fighting forest fires, and improving real-time agricultural processes. With this integrated approach, Kevin Murphy (Chief Science Data Officer, Science Mission Directorate, and Program Manager, Earth Science Data Systems [ESDS] Program) has set forth a challenge to the mission processing community to:

**NEW!** Register now for the Open Source Science for Earth Science Observatory Mission Science Data Workshop 2: State-of-the-Art in Mission Data Processing Systems

*Identify and assess potential architectures that can meet the ESO mission science processing objectives, enable data system efficiencies, promote open science principles, and seek opportunities that support Earth system science.*

A mission data processing system is the set of algorithms, software, compute infrastructure, operational procedures, documentation, and teams that automatically process raw instrument data through to science-quality data products. This includes the software tools that support the development of the processing algorithms and the validation and analysis of the processed data.

Open science is a foundational objective of NASA's Science Mission Directorate (SMD) and is defined as "a collaborative culture enabled by technology that empowers the open sharing of data, information, and knowledge within the scientific community and the wider public to accelerate scientific research and understanding" (Ramachandran, R., Bugbee, K. & Murphy, K.J. From Open Data to Open Science. *Earth and Space Science*, 8(5), doi:10.1029/2020EA001562). On October 14, SMD will report out on open science and activities at NASA's Open Source Science for Data Processing and Archives Workshop.



Day 1:  
Tuesday  
March 1st,  
2022  
(1 - 5 PM  
EST)

Time ET	PST	Talk Duration	Title	Speaker	Organization
12:00 PM	9:00 AM	0:15:00	Welcome and Study Overview	Andy Mitchell and Andy Bingham	GSFC/JPL
12:15 PM	9:15 AM	0:05:00	Logistics	Sara Lubkin and Karen Yuen	GSFC/JPL
12:20 PM	9:20 AM	0:05:00	Opening Remarks	Kevin Murphy	NASA
12:25 PM	9:25 AM	0:10:00	Open Source Science / SPD-41	Katie Baynes	NASA
12:35 PM	9:35 AM	0:05:00	<b>Session 1 introduction: Science collaboration approaches</b>	Chelle Gentemann	Farallon Institute
12:40 PM	9:40 AM	0:12:00	NISAR	Naiara Pinto	JPL
12:52 PM	9:52 AM	0:12:00	AI and Big Data	Willow Coleman	Harvey Mudd College
1:04 PM	10:04 AM	0:12:00	Big Data Community Algorithms	Morteza Karimzadeh	University of Colorado
1:16 PM	10:16 AM	0:12:00	Cloud Computing Platforms for Processing Geospatial Big Data: Current Status and Challenges	Qiusheng Wu	University of Tennessee, Knoxville
1:28 PM	10:28 AM	0:12:00	Project Jupyter - Lessons and Principles from a Community-Driven Open Source Pproject	Fernando Perez	University of California, Berkeley
1:40 PM	10:40 AM	0:20:00	Fishbowl Discussion	Q&A led by the SAWG	
2:00 PM	11:00 AM	0:10:00	Break		

Continued  
**Day 1:**  
**Tuesday**  
**March 1st,**  
**2022**  
**(1 - 5 PM**  
**EST)**

Time ET	PST	Talk Duration	Title	Speaker	Organization
2:10 PM	11:10 AM	0:05:00	<b>Session 2 introduction: NASA Earth Systematic Mission Processing Architectures</b>	Andy Mitchell	GSFC
2:15 PM	11:15 AM	0:15:00	Terra MODIS	Robert Wolfe	GSFC
2:30 PM	11:30 AM	0:15:00	CLAREO	Chris Currey	LaRC
2:45 PM	11:45 AM	0:15:00	ICESat-2	Tom Neumann	GSFC
3:00 PM	12:00 PM	0:15:00	PACE	Sean Bailey and Bryan Franz	GSFC
3:15 PM	12:15 PM	0:15:00	SWOT	Oh-Ig Kwoun	JPL
3:30 PM	12:30 PM	0:15:00	Fishbowl Discussion	Q&A led by the SAWG	
3:45 PM	12:45 PM	0:10:00	Break		
3:55 PM	12:55 PM	0:15:00	Break Room Topics & Logistics		
4:10 PM	1:10 PM	0:30:00	Breakout Rooms: Topics TBA		
4:40 PM	1:40 PM	0:30:00	Report out from Breakout rooms		
5:10 PM	2:10 PM		END		

<b>Date</b>	<b>Time ET</b>	<b>PST</b>	<b>Title</b>
Wednesday 2 <sup>nd</sup> of March	12:05 PM	9:05 AM	Session 3 : <b><i>NASA Earth System Science Pathfinder mission processing architectures</i></b>
	1:50 PM	10:50 AM	Session 4 : <b><i>Non-NASA Earth science mission processing architectures</i></b>
Thursday 3 <sup>rd</sup> of March	1:30 PM	10:30 AM	Session 5 : <b><i>Non-Earth science mission processing architectures</i></b>
	2:45 PM	11:45 AM	Session 6 : <b><i>System interfaces and standards</i></b>
Friday 4 <sup>th</sup> of March	12:05 PM	9:05 AM	Session 7 : <b><i>Other Big Data processing system architectures</i></b>



# Code of Conduct

## Expected Behavior

- All participants are treated with respect and consideration, valuing a diversity of views and opinions.
- Be considerate, respectful, and collaborative.  
Communicate openly with respect for others, critiquing ideas rather than individuals.
- Avoid personal attacks directed toward other participants.  
Be mindful of your surroundings and of your fellow participants. Alert staff if you notice a dangerous situation or someone in distress.
- Respect the rules and policies of the meeting venue.

## Unacceptable Behavior

- Harassment, intimidation, or discrimination in any form will not be tolerated.
- Physical or verbal abuse of any participant.
- Examples of unacceptable behavior include, but are not limited to, verbal comments related to gender, sexual orientation, disability, physical appearance, body size, race, religion, national origin, inappropriate use of nudity and/or sexual images in public spaces or in presentations, or threatening or stalking any participant.
- Disruption of panel discussions and lightning talks.

# Code of Conduct Continued

## Expected Behavior

- Anyone requested to stop unacceptable behavior is expected to comply immediately. Staff may take any action deemed necessary and appropriate, including immediate removal from the meeting without warning.

## Reporting Unacceptable Behavior

- If you are the subject of unacceptable behavior or have witnessed any such behavior, please immediately notify a staff member.
- Notification should be done by contacting a staff person on site or by emailing your concern to [andrew.e.mitchell@nasa.gov](mailto:andrew.e.mitchell@nasa.gov).
- Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety is advised to contact 911.



**Jet Propulsion Laboratory**  
California Institute of Technology

# Open Sourced Science for Earth System Observatory (ESO) Mission Science Data Processing Study

## Goal of Workshop #2

March 1-4, 2022

Andrew Bingham (JPL)

Andrew Mitchell (GSFC)

This document has been reviewed and determined not to  
contain export controlled technical data.



# NASA's Earth System Observatory (ESO)



- Four missions:
  - Atmosphere Observatory System (AOS)
  - Mass Change (MC)
  - Surface Biology and Geology (SBG)
  - Surface Deformation and Change (SDC).
- Working in tandem to create a holistic view of Earth.
- In pre-Phase A -> preparing for Mission Concept Review (MCR) this year (except SDC).
- Window of opportunity to take a fresh look at how mission science data processing systems are architected.

# Study Goal

Identify and assess potential architectures that

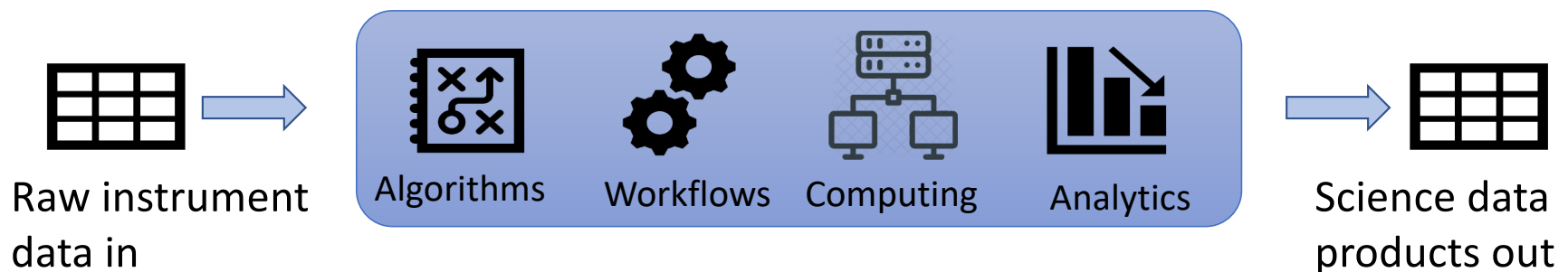
- meet the ESO mission science data processing objectives,
- promote open science principles,
- enable data system efficiencies,
- support earth system science and applications.

Aligns with the challenge set by NASA to create a single observatory that combines data from the ESO missions to understand the earth as a system and accelerate our ability to apply this understanding.

# Definition of a Mission Science Processing System

The set of algorithms, software, compute infrastructure, operational procedures, and documentation to automatically process raw instrument data through to science quality data products.

This includes the software tools that support the development of the processing algorithms and validation and analysis of the processed data.



# Study Participants

## Steering Team

- Andrew Bingham, JPL
- Andrew Mitchell, GSFC
- Chelle Gentemann, Farallon Institute
- Luke Dahl, JPL

## System Engineering Support

- Sara Lubkin, GSFC
- Karen Yuen, JPL

## System Architecture Working Group (SAWG)

- Co-Chairs
  - Elias Sayfi (JPL)
  - Natasha Stavros (U. Colorado)
- ESO Mission Representatives
  - Hook Hua (SBG & NISAR/SDC)
  - Curt Tilmes (AOS)
  - Bernie Bienstock (MC)
- Community Representatives
  - Qing Yue (Algorithm developer)(JPL)
  - Wenying Su (Science applications)(LaRC)
  - Andy Michaelis (Open source developer)(ARC)
  - Lesley Ott (Numerical modeler)(GSFC)
- Large Scale Processing Systems Representatives
  - Evelyn Ho (GSFC)
  - Chris Engebretson (USGS)
  - Adrian Parker (NOAA)
  - Sean Harkin (MSFC)

# Study Approach

## **Workshop #1: October 19-20, 2021**

Receive input from NASA Program Offices and ESO Missions on requirements, constraints, recommendations, and opportunities for science data processing. Report available on Study Website.

## **Workshop #2: March 1-4, 2022**

Understand the current state of mission and science data processing and obtain community input.

## **Architecture Study: April – July, 2022**

Analyze the architectural options and identify an optimal solution for the ESO missions.

## **Workshop #3: August, 2022**

Report out on the study and make a recommendation to Kevin Murphy, SMD Chief Scientific Data Officer.



# Workshop #2 Goals

- Understand the current state of mission science data processing:
  - NASA Earth missions (flagship and PI-led missions)
  - NASA Astrophysics missions
  - Other federal agency and international missions.
- Understand opportunities for collaboration with systems that interface with and enable mission processing systems.
- Learn from other big-data processing systems
  - Based on input received through a “Requestion For Information” solicitation
- Gain community insights and recommendation

Deliverable: Report of findings