AGU24

Washington, D.C. | 9–13 December 2024

Get your AGU24 started early by taking part in a pre-conference workshop!

These hands-on, in-person workshops take place on Sunday, 8 December and are a great way to start off your week of learning, networking, and communicating at AGU24. Workshops vary in length from a few hours to a full day and are available for an additional cost.

Check out the pre-conference workshop options below, and make sure to add them during the registration process. Workshops can be added at a later date, but space is limited so we encourage you to add them during registration.

<u>AGU24: Pre-Conference Workshops</u>

All workshops are in-person only

Introducing the Community Earth System Model (CESM) via an Interactive Hands-On Tutorial (PREWS1)

Date: Sunday, 8 December 2024

Time: 8:30 – 12:00 EDT

Organizer: Isla Simpson, National Center for Atmospheric Research

Description: CESM is a state-of-the-art Earth System Model that can be used for prediction and understanding of a wide variety of aspects of the earth system. It is freely available for use by the climate research community, making it an ideal tool for Earth system research and education. The capabilities within CESM range from idealized models of the atmosphere to comprehensive coupled simulations for leading edge research in climate science.

This workshop will provide an introduction to the capabilities within CESM2 and provide attendees with the basic building blocks to start their research with it. This will be achieved through a hands-on interactive tutorial on running CESM, using the Amazon Web Services (AWS) Cloud. Participants will learn how to set up default

configurations, modify these default configurations to suit their needs and will be introduced to source code modifications through tutorial exercises. By the end of this workshop, attendee's should have the necessary background knowledge to start using CESM for their research. We welcome participants at all career stages who are looking for an introduction to running CESM.

Jupyter Notebooks for Accessing, Analyzing & Visualizing Ocean Data (PREWS2)

Date: Sunday, 8 December 2024

Time: 8:30 – 12:00 EDT

Organizer: Dwight Owens, Ocean Networks Canada, University of Victoria

Description: In today's dynamic digital world, Application Programming Interfaces (APIs) play a vital role in seamless data sharing, process automation and application integration. This workshop will equip you with essential knowledge and skills to utilize an API connected to the Ocean Networks Canada (ONC) data archive. Using Jupyter notebooks, you will retrieve and visualize data. You will also run a simple machine learning algorithm to analyze a data set pulled down from that archive.

The workshop includes an introduction to ONC's Oceans 3.0 data management and archival system and its accompanying API based on the OpenAPI specification. We will work through several task-based scenarios based on actual interesting events and phenomena observed in the data archive, accessing and plotting them with Python. Additionally, you will learn how to cite data using this system.

Students, researchers, and early/mid-career professionals who are keen on staying at the forefront of data-driven discoveries are invited to participate. This workshop is geared to beginner and intermediate proficiency levels. Basic programming experience is expected; python experience is beneficial but not required.

Participation requirements include access to the internet with 50 Mbps download speeds or higher, an up-to-date browser (Firefox, Chrome, or Edge) and a minimum of 8GB RAM machine with the recent operating system, either Windows or Mac.

Python for Satellite Remote Sensing: Analysis and Visualization for Earth Scientists (PREWS3)

Date: Sunday, 8 December 2024

Time: 8:30 – 12:00 EDT

Organizer: Rebekah Esmaili, NOAA

Description: In this workshop, participants will get a crash course on using Python to analyze satellite data. We will cover how to read satellite data formats like NetCDF and HDF, perform basic analysis, and create visualizations of satellite data. This session will be beneficial for both experienced programmers who want to learn Python and those just getting started with scientific programming. Examples will include datasets from the NOAA GOES-R and JPSS programs and other current sensors, but the presented tools and techniques are transferable to other satellite datasets. No prior Python experience is required, but some coding familiarity is recommended. Additional details can be found on the course website (http://www.rebekahesmaili.com/workshop).

Harnessing the Power of NASA Open Digital Repositories for Earth and Space Research (PREWS4)

Date: Sunday, 8 December 2024

Time: 8:30 – 12:00 EDT

Organizer: Brit Myers, ScienceBetter Consulting

Description: Join us for a 3-hour practical skills development workshop titled "Harnessing the Power of NASA Open Digital Repositories for Earth and Space Research," designed to equip researchers with the skills and knowledge to leverage new NASA digital resources for open science. In alignment with the conference theme of "What's Next for Science," this session focuses on making Earth and space data more accessible, interoperable, and impactful while promoting scientific collaborations across disciplines and geographic boundaries.

Participants will explore NASA's open digital repositories, including the NASA Science Explorer (NASA SciX), the Planetary Data System, and the NASA Science Discovery Engine. These platforms provide access to extensive datasets in astrophysics, earth science, heliophysics, planetary science, biological sciences, and physical sciences. Through hands-on demonstrations and guided exercises, attendees will learn how to navigate these resources effectively for information discovery and data integration.

Our workshop emphasizes the interconnectedness of information repositories, showcasing their potential to foster interdisciplinary research and address complex global challenges. By engaging with diverse repositories and datasets, participants will obtain tools to assist them in bridging gaps between disciplines and geographic regions, leading to innovative projects and discoveries that push the boundaries of scientific knowledge.

Central to the workshop is the focus on integrating open science workflows into research practices. Participants will gain practical insights into incorporating diverse datasets into their projects, promoting transparency, reproducibility, and collaboration within the scientific community. Through tutorials, demonstrations, and discussions, attendees will learn best practices for information archiving, sharing, and attribution, ensuring proper credit and promoting wider recognition for creators.

This workshop provides a platform for researchers at all levels to enhance their information discovery skills and develop a deeper understanding of NASA's open digital repositories. By fostering a culture of openness and collaboration, we aim to inspire researchers to make meaningful contributions to the advancement of Earth and space sciences.

Whether you're an established researcher or just beginning your scientific journey, this workshop offers valuable insights and practical skills to navigate NASA's open digital repositories with confidence. Join us as we harness the power of these resources to shape the future of Earth and space research.

Open Data Curation and Image Analysis in Digital Rocks Portal (PREWS5)

Date: Sunday, 8 December 2024

Time: 8:30 – 12:00 EDT

Organizer: Masa Prodanovic, University of Texas at Austin

Description: Computed tomography (CT), micro-computed tomography (μCT), and focused ion beam scanning electron microscopy (FIB-SEM), are now applied routinely to acquire three-dimensional images that reveal the structure of geologic materials. 3D imaging has allowed many porous media processes to be observed and simulated in detail, providing key insights into the mechanisms that directly impact their behaviors at larger scales.

This workshop will instruct researchers in how to curate 3D image data in the re-designed open data repository Digital Rocks Portal (https://www.digitalrocksportal.org/) as well as perform image analysis for characterizing digitized porous materials and for creating simulation inputs. Curation will involve identifying and documenting the image material properties according to descriptive standards as well as documenting the image quality. Analyses The analysis portion will include hands-on practice using Jupyter Notebook workflows that can be run on a personal laptop or used as part of the suite of open source applications available in the Digital Rocks Portal. Researchers will get practical experience in analysis/visualization of 2D and 3D images, quantifying properties such as porosity, tortuosity, Minkowski functionals, and estimating data heterogeneity as well as their associated uncertainty. This requires a combination of advanced image analysis algorithms, scientific visualization and computation. This workshop is sponsored in part by NSF GEO OSE grant #2324786. We gratefully acknowledge the high performing computing systems that will be provided by the Texas Advanced Computing Center available through the Digital Rocks Portal.

Software Use and Requirements: The workshop will be a combination of presentations, literature overview and hands-on exercises for at least one third of the class time. Attendees will be expected to bring their laptops for hands-on exercises. Visualization and image analysis software used in class include Python 3 programming environment (Anaconda distribution) for advanced exercises and we will clearly communicate installation instructions prior to the workshop. All the open-source code used in the workshop will be shared via GitHub.. We do not assume working/programming knowledge for any of these software packages beyond basic familiarity with programming basics in Python (or similar language); all further guidance will be provided during class.

NASA Proposal Writing Workshop (PREWS6)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Christina Richey, NASA Jet Propulsion Laboratory

Description: The success of scientists depends upon their ability to obtain funding. One of the largest challenges is to create strong proposals. Using Research Opportunities in Space and Earth Sciences (ROSES) from NASA as a template, this workshop will focus on teaching the audience key points to communicating science

through successful proposal writing. As a result of this session, participants will be able to understand the proposal writing, reviewing, and selection process for federally funded research. This will also help those who have previously submitted proposals improve their performance. How to understand one's values and maintain those throughout this process will also be focused on. Story tellers will add unique and important lessons learned to the session.

Physics-Informed Machine Learning for Solving Partial Differential Equations (PREWS7)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Md Lal Mamud, Pacific Northwest National Laboratory

Description: Physics-Informed Machine Learning (PIML) has emerged as a novel technique to solve complex partial differential equations (PDEs) associated with fluid flow, contamination transport, heat transfer, wave propagation, and various other phenomena. By seamlessly integrating PDEs, boundary conditions, and available data into a unified loss function, PIML offers a versatile framework capable of addressing ordinary and partial differential equations across domains of any dimension, regardless of regular or irregular geometries. Notably, PIML excels in solving challenging PDEs characterized by nonlinearities, convection dominance, or shocks, areas where traditional methods may encounter difficulties. Leveraging modern optimization techniques and auto-differentiation, PIML embodies a state-of-the-art approach to efficiently and accurately solving intricate PDE problems.

This workshop is designed to provide participants with comprehensive insights into solving PDEs describing fluid flow, contamination transport, heat transfer, wave propagation, and other phenomena using PIML. Through a combination of brief presentations, demonstrations of PDE solving, and hands-on experiences with PIML, attendees will gain practical skills and in-depth understanding of this cutting-edge methodology. Participants will have the opportunity to engage directly with PIML techniques, enhancing their proficiency in applying them to real-world problems. Prior to the workshop, participants will receive course materials developed in the Python programming language, ensuring they are well-prepared to maximize their learning experience.

Overall, this workshop aims to equip participants with the knowledge and skills necessary to leverage PIML effectively in their research endeavors, enabling them to unlock new insights and advance their respective fields.

Science to Action: Practical Skills for Scientists to Participate in and Support Nonviolent Grassroots Activism (PREWS8)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Rose Z Abramoff, Wintergreen Earth Science

Description: For decades, scientists have been sounding the alarm about the climate and ecological crisis. Each successive report has delivered alarming findings, yet these warnings have been met with political inertia and an insufficient international response. Consequently, the disastrous effects of human activity on land, water, and atmosphere persist, surpassing the Earth's system boundaries and posing existential threats to both nature and humanity [1,2]. At the same time, an impassioned climate movement has emerged, led primarily by young activists and most-affected people demanding immediate climate action [3]. Inspired by this movement, scientists and academics are increasingly taking on roles that directly address the imbalance of power that prevents meaningful climate action [4,5,6]. In collaboration with historically marginalized communities and activists, scientists can engage in a variety of tactics to apply pressure on those in power to take action.

This workshop is for those researchers who wish to gain practical skills in grassroots organizing. Lessons learned in this workshop can be applied to supporting intersectional movements but will focus primarily on climate justice and harnessing the particular leverage held by academics and Earth scientists. Learning goals include understanding basic principles of grassroots organizing, including ways to build collective power and resolve conflict. Morning talks will cover overarching principles and best practices, with examples from specific social movements and campaigns, while the afternoon's nonviolent direct-action training will cover practical aspects of grassroots movement organizing. Participants will learn about common action designs, legal support, and how to interact with law enforcement, bystanders, and the media. After a break, participants will end the workshop by practicing nonviolent action and support roles in roleplay scenarios and summarizing lessons learned.

References [1] IPCC AR6 SYR 2023 [2] Rockström et al. 2023 Nature [3] Shuman et al. 2021 JPSP [4] Artico et al. 2023 Front Sustain [5] Capstick et al. 2022 Nat. Clim. Chang. [6] Gardner et al. 2021 Front Sustain

----

Mastering Geospatial Visualizations with GMT/PyGMT (PREWS9)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Wei Ji Leong, Development Seed

Description: This workshop aims to provide a detailed technical demonstration of GMT/PyGMT's capabilities in creating maps and visualizations of geospatial, geophysical, and planetary data across a wide range of applications. PyGMT, a Python library built on top of the Generic Mapping Tools (GMT), offers an intuitive and accessible interface for generating high-quality figures suitable for publication. Suitable for both beginner and advanced Python users, this workshop will cover advanced techniques for manipulating geospatial and geophysical data, widely utilized in the Earth, Ocean and Planetary Science communities, providing participants with the necessary skills to extract meaningful insights and effectively communicate their findings through clear and informative maps and visualizations. By exploring GMT/PyGMT's functionalities, participants will have the opportunity to learn how to create customized maps and data visualizations tailored to the specific needs of their research areas.

Communicating a Deeper Understanding of our Earth and Beyond (PREWS10)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Jessica L Swann, Arizona State University

Description: This workshop is tailored for early career scientists eager to enhance their science communication skills. In today's climate of dwindling trust in the scientific community, it's crucial for emerging scientists to connect with broader audiences effectively. Through this workshop, participants will delve into strategies and techniques curated by science communication experts, aimed at crafting inclusive and engaging scientific messages.

Attendees will explore various methods to inclusive communication, such as developing relatable introductions, aligning messages with audience interests, demystifying technical jargon, and using metaphor to simplify complex concepts. They'll engage in hands-on activities that exemplify these skills, empowering them to confidently convey their research findings and methodologies to diverse audiences.

Perfect for individuals enthusiastic about enhancing their science communication skills, this workshop offers a platform to connect with like-minded scientists passionate about sharing their work with the world. Additionally, participants will gain insights into NASA's SciAct projects, with opportunities for involvement and potential funding for related initiatives.

Thanks to funding from the NASA Science Activation program, facilitated by the NASA SMD Community of Practice for Education project, this workshop promises to equip early career scientists with the tools they need to bridge the gap between science and society.

Large-scale Geospatial Data Analysis and Visualization in R (PREWS11)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Debasish Mishra, Texas A&M University College Station

Description: Analysis of large-scale geospatial data (regional- to global-scale at high spatial and temporal resolution) can be computationally expensive and time-consuming, especially when working with multiple formats and sources of data. R provides a powerful computational alternative to popular Geographic Information System (GIS) software to organize, analyze, and visualize geospatial data. R enjoys a vast collection of open-source libraries for GIS-type operations and proven statistical analysis and data visualization capabilities. Taking examples from global satellite data in gridded/ raster format, we will demonstrate several geospatial operations like projections, resampling, spatial extraction, cropping, masking, etc., using rasters, shapefiles, and spatial data frames. For a seamless analysis across different datatypes and platforms, conversion from/to different data formats like data frames, matrices, raster, and structured data like NetCDF will be discussed. Advanced topics will include working with multilayer raster/ raster time series, layer-

wise operations on multilayer raster, and cell-wise operations on raster time series by implementing user-defined functions.

Out-of-the-box multicore parallel application of user-defined functions for block-, layer-, and cell-wise parallel operations will be demonstrated on large-scale datasets.

How to Write an Open Science & Data Management Plan Workshop (PREWS12)

Date: Sunday, 8 December 2024

Time: 8:30 – 17:00 EDT

Organizer: Paul M Bremner, NASA Marshall Space Flight Center

Description: NASA's funding solicitations (e.g. ROSES) now require Open Science and Data management plans (OSDMP) as part of the submission process. These plans describe how the scientific information produced will be managed and made openly available. This workshop will walk you through what these plans are and how to write them. We will cover the details of describing your data products, how to make it citable, and how to make it more findable. Details of data file formats to use, how or where data can be archived, and how software written can be archived, preserved, and made publicly available. Rather than "another checkbox to be ticked", these plans will help you get your data into the hands of other researchers leading to more citations and impact for your work.

This training will include specific guidance on how to provide data products in the published literature and what can and cannot be hosted in the Journals. For larger datasets we will describe our recommendations for using domain-specific and generalist repositories, including the benefits and pitfalls of each repository type. We will describe workflows for finding and citing data from such repositories. This training will also cover Journal policies for software archiving and citation, as well as how to plan for sharing computational notebooks. We will also describe the Journals' approach to open access and supported models of publication provided to authors.

This workshop is being presented by NASA's Transform to Open Science (TOPS) and NASA's Open-Source Science Initiative (OSSI).

Introduction to Radiocarbon: Theory and Best Practices for Ocean and Earth Sciences (PREWS13)

Date: Sunday, 8 December 2024

Time: 13:30 – 16:30 EDT

Organizer: Susan Q Lang, Woods Hole Oceanographic Institution

Description: Radiocarbon is a key tool in ocean and earth sciences, functioning as both a clock and a tracer of the magnitude and rate of carbon exchange between global reservoirs. This workshop, hosted by members of the National Ocean Sciences Accelerator Mass Spectrometry facility (NOSAMS), will cover both theoretical and practical considerations of radiocarbon in research. Specific topics will include radiocarbon theory, sample preparation, accelerator mass spectrometry instrumentation, and marine and terrestrial radiocarbon applications. Participants will learn the basics of radiocarbon analyses, best practices for collecting, preparing, and processing samples, and receive hands-on experience with data reduction.

An Introduction to Cloud-Based Geospatial Analysis with Earth Engine and Geemap (PREWS14)

Date: Sunday, 8 December 2024

Time: 13:30 – 16:30 EDT

Organizer: Qiusheng Wu, University of Tennessee

Description: The Earth is constantly changing, which creates significant challenges for the environment and human society. To tackle these challenges on a global scale, the Earth science community relies heavily on geospatial datasets that are collected through various means, such as satellite, aerial, and mobile sensors. However, the explosive growth of geospatial datasets over the past few decades has overwhelmed the Earth science community's capacity for storage, analysis, and visualization. Fortunately, the advent of cloud-computing platforms (e.g., Google Earth Engine) has made it possible to access, manipulate, and analyze large volumes of geospatial data on-the-fly. In recent years, Earth Engine has become increasingly popular in the geospatial community and has enabled numerous Earth science applications at local, regional, and global scales.

The geemap Python package is built upon the Earth Engine Python API and open-source mapping libraries. It allows Earth Engine users to interactively manipulate, analyze, and visualize geospatial big data in a Jupyter environment. Since its creation in April 2020, geemap has received over 3,188 GitHub stars and is being used by

over 1,100 projects on GitHub. More than 130 Jupyter notebook examples and an open-access book are available for learning geemap.

This tutorial consists of seven 30-minute sessions and three 10-minute breaks. During each hands-on session, the attendees will walk through Jupyter notebook examples on Google Colab with the instructors. At the end of each session, they will complete a hands-on exercise to apply the knowledge they have learned. The topics that will be covered in this tutorial include: (1) Introduction to Earth Engine and geemap; (2) Using Earth Engine data; (3) Visualizing Earth Engine data; (4) Analyzing Earth Engine data; (5) Exporting Earth Engine data; (6) Creating satellite timelapse animations; and (7) Developing and deploying interactive Earth Engine web apps.

This tutorial is intended for scientific programmers, data scientists, geospatial analysts, and concerned citizens of Earth. Attendees should have a basic understanding of Python and the Jupyter ecosystem. Familiarity with Earth science and geospatial datasets is not necessary, but it will be helpful. For more information about Earth Engine and geemap, visit https://earthengine.google.com and https://geemap.org.

Advancing Earth Observation Through Geospatial Machine Learning With TorchGeo (PREWS15)

Date: Sunday, 8 December 2024

Time: 13:30 – 16:30 EDT

Organizer: Adam Stewart, Technical University of Munich

Description: Machine learning-based approaches to geospatial data analytics are becoming increasingly common. However, existing Geographic Information System (GIS) applications lack support for modern deep learning methods, and deep learning libraries lack support for handling geospatial data. The lack of models pre-trained on multispectral imagery severely hinders the ability to perform transfer learning on applications with small-labeled datasets, something very common in the geosciences. The multidisciplinary field of Earth observation (EO) and machine learning (ML) requires a collaborative effort, bringing together researchers from both domains to work in synergy. To facilitate this collaboration and lower the barrier of entry for researchers in both ML and EO, we developed the TorchGeo library.

TorchGeo is an open-source PyTorch domain library designed to make it simple for ML experts to work with geospatial data and for remote sensing experts to explore

ML solutions. It abstracts away the complexities of reading, reprojecting, and resampling data, allowing researchers to instead focus on the science. It provides over 80 built-in datasets for uncurated raster data (e.g., Sentinel, Landsat) and segmentation masks (e.g., NLCD, CDL), datasets built for self-supervised learning (e.g., SeCo, SSL4EO), and curated task-specific benchmark datasets (e.g., EuroSAT, BigEarthNet). It also comes with over 40 models pre-trained on your favorite satellites.

Working With The International Soil Radiocarbon Database (ISRaD) (PREWS16)

Date: Sunday, 8 December 2024

Time: 13:30 – 16:30 EDT

Organizer: Sophie F von Fromm, Dartmouth College

Description: Are you working with soil radiocarbon data? Do you want to? Then this workshop is for you. The International Soil Radiocarbon Database (ISRaD) is an open community repository for soil radiocarbon data. The goals of ISRaD are to i) improve the use of radiocarbon as a constraint for understanding the soil carbon cycle, ii) to provide a place for researchers to contribute their soil radiocarbon data once published, and iii) to produce tools to make the repository useful for the scientific community. In this workshop you will learn how to get engaged with ISRaD, how to access and analyze ISRaD data in R, and how to enter your own radiocarbon data to contribute to open data and open science. We will provide a short overview of ISRaD and what we have achieved over the last years, and then we will have a hands-on workshop using the R package 'ISRaD' and how to enter your own data into the database. This will be a great opportunity to connect and engage with the soil radiocarbon community and to discuss what's next for soil radiocarbon.

Advancing Open Science: Greenhouse Gas Emission Data Analysis using the US Greenhouse Gas Center's Jupyter Hub (PREWS17)

Date: Sunday, 8 December 2024

Time: 13:30 – 16:30 EDT

Organizer: Deborah K Smith, University of Alabama in Huntsville

Description: This half-day workshop will provide hands-on practice to efficiently use the U.S. Greenhouse Gas Center (US GHG Center) key datasets, open-source tools, and computing resources for exploring, visualizing, analyzing, and communicating science.

The US GHG Center portal was created to provide curated, trusted greenhouse gas data and information in a user interface, QGIS or cloud computing environment to make it easier to access, use and understand from one centralized location regardless of data producer or data location. The GHG Center provides cloud optimized access to a growing set of federal and non-federal data. The contents reflect transparency in both data and methods, to address different end user needs and to bring together actionable information from multiple sources.

Workshop activities will encompass exploration of several science questions and activities using the US GHG Center services and tools. Participants will learn from GHG specialists about the latest science or policies for a given region or location. Attendees will produce trends over time, visually compare data from selected times, utilize code notebooks to compare datasets and develop figures and comparison charts as well as summarize and share results. Example python code will be provided so that users can gain practice at using and adapting the open code and focus more on the activity than on building new code given time limitations.

The workshop is best designed for science researchers, educators, and students with some technical experience who are seeking practice with utilizing open code, open-source tools and have a desire to better understand greenhouse gas datasets for research and communication.   Some experience in python and knowledge of open-source tools and practices is advised. The science behind the data-driven activities will be shared as part of the workshop. Code notebooks will be provided that will be adapted and applied to specific scenarios. Preparation materials will be available prior to the workshop to maximize participant success.