



# Unidata Reimagined

NSF Unidata Strategic Plan  
2024

# What is NSF Unidata?

NSF Unidata is a community cyberinfrastructure facility for the Earth Systems Sciences (ESS), established in 1984 by U.S. universities with sponsorship from the National Science Foundation (NSF). The NSF Unidata Program Center (UPC), the program office for NSF Unidata and the hub for activities related to NSF Unidata's mission, is managed by the University Corporation for Atmospheric Research (UCAR), a consortium currently comprising 127 North American colleges and universities providing science in service to society.

NSF Unidata exists to engage and serve researchers and educators who are advancing the frontiers of ESS; we hope to support their efforts by creating opportunities for community members from many backgrounds and disciplines to share data, knowledge, methods, and expertise. As part of this effort, we strive to provide well-integrated data services and tools that address the entire ESS data lifecycle, from locating and retrieving useful data, through the process of analyzing and visualizing data either locally or remotely, to curating and sharing the results.

In the nearly 40 years of our program's existence, NSF Unidata's primary areas of activity have evolved from delivering observational meteorological data to universities to broad-based support for access to all types of environmental data, along with tools to manage, analyze, and visualize that data. Along the way, we've realized that in order to be a useful part of the effort to understand the science of the Earth and its myriad Systems, we must engage closely with the community of researchers, educators, and students to understand their needs and provide effective solutions. As a result, we re-state our long-held view of our role in the community in this way:

## **Our Vision**

*NSF Unidata acts as a community hub for data, tools, knowledge, and people to advance Earth System Science*

## **Our Mission**

*To transform the Earth System Science community, research, and education by providing innovative data services, tools, and expertise*

## About this Plan

NSF Unidata undertakes strategic planning every five years to renew the program's vision, mission, goals, and strategies. This strategic plan was written with and for our community.

To develop strategic goals guided by the NSF Unidata ESS community's current and anticipated needs, NSF Unidata gathered and synthesized extensive input and feedback over the course of eight months. Throughout all phases of the strategic planning process, we consulted with our governing committees, NSF Unidata Program Center staff, and with additional focus groups. We sought to identify the "grand challenges" facing the ESS community and assessed the internal obstacles and opportunities that will affect our work with the community as we go forward. As the development and drafting of our strategic plan proceeded, we incorporated multiple rounds of feedback resulting in the development of vision, four strategic goals, and fourteen associated strategies. Our strategic plan, summarized in the graphic below, is closely aligned with both the UCAR and NSF strategic plans, and will provide a framework for guiding NSF Unidata activities over the next five years. We thank everyone that contributed to this process.

# Unidata Strategic Plan

## Our Goals

### Provide Data and Tools

Ensure fair and equal access to Earth Systems Science data and tools

### Reduce Barriers to Participation

Grow the Earth Systems Science community by reducing barriers to participation

### Foster Community Action

Foster community action to improve Earth Systems Science teaching and research

### Innovate on Technology

Guide the Earth Systems Science community toward innovative technical solutions

## Our Strategies

Provide performant, high quality data storage, access, and visualization

Provide core infrastructure and software

Streamline projects and workflows

Build capacity and access to cloud infrastructure

Provide FAIR\* and open data, tools, and services

Promote and integrate accessibility, fairness, and ethical principles

Provide fair and equal access to high quality learning and research resources and services

Broaden and support community by active engagement, outreach, and advocacy

Foster next generation workflows and career skills

Act as a community hub

Marshal and build strategic partnerships and liaise on behalf of the community

Support community readiness and adoption of new techniques and approaches to solve Earth System Science problems

Work collaboratively to create and share data, tools, resources, and knowledge

Identify trends and bring together cutting edge solutions suitable to advance capabilities

Support development and utilization of sustainable modern workflows, tools, infrastructure, and resources

Harness community expertise and encourage collaborative contributions in development and use of modern and novel workflows

# Challenges and Opportunities Facing NSF Unidata's Community

NSF Unidata serves a broad community of researchers, educators, and students in the ESS domain. In crafting our strategic plan, we have identified the following themes and trends as areas where NSF Unidata can effectively contribute to the broad success of our community's endeavors.

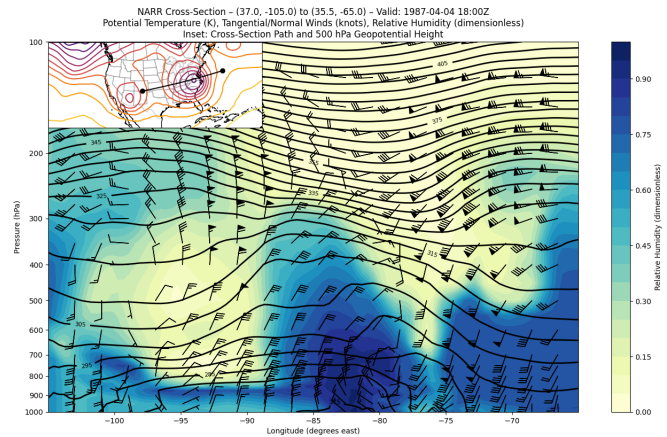
- **Convergent Earth System Science:** Understanding the Earth as a complex, adaptive system requires a view that crosses traditional science domain boundaries. NSF Unidata will play a role in bringing science domains together through easy access to many types of environmental data.
- **Open Science:** Bringing scientists together is easier when there are fewer roadblocks. NSF Unidata supports a rich ecosystem of freely-available and unrestricted data, software tools, and analytical platforms.
- **FAIR and Ethical Principles:** To minimize barriers, NSF Unidata works toward making data Findable, Accessible, Interoperable, and Reusable (FAIR). But these ideas alone are not enough — we believe that data must be collected and used in ways that support human values and societal concerns.
- **Broadening Participation:** A wide range of perspectives and insights are needed to understand complex ESS systems. NSF Unidata will play a role in bringing new participants from a range of organizations — including Minority Serving Institutions, Emerging Research Institutions, and other populations that have challenges accessing scientific research — into the community by working to remove barriers and expand access to data and tools.
- **Rapidly Changing Technology:** The technological landscape in which Earth Systems scientists operate is changing more quickly than ever, as computing environments that have been in use for years or decades are supplanted by cloud-based systems and machine learning tools. NSF Unidata strives to act as a guide to our community, bringing attention to useful workflows that take advantage of modern technology.
- **Growing Data Volumes:** As the amount of environmental data continues to expand, new approaches to access and use will be necessary. NSF Unidata's long experience in delivering data to community members' computing resources is augmented by our more recent work to enable data-proximate and scalable computing solutions.
- **STEM Workforce Development:** Managing technological change is especially difficult for educators who have limited resources for developing and implementing new educational materials. NSF Unidata will play a role by providing ready-to-use asynchronous learning materials alongside synchronous training for both students and educators.

# Our Contributions to the Community

The NSF Unidata Program is not itself a scientific research organization, so we must be intentional about what actions we can undertake to advance ESS research and education. Between guidance from the National Science Foundation and the expressed wishes of our community as represented by our governing committees, we have identified the following areas where we will continue to provide useful service in furtherance of our mission.

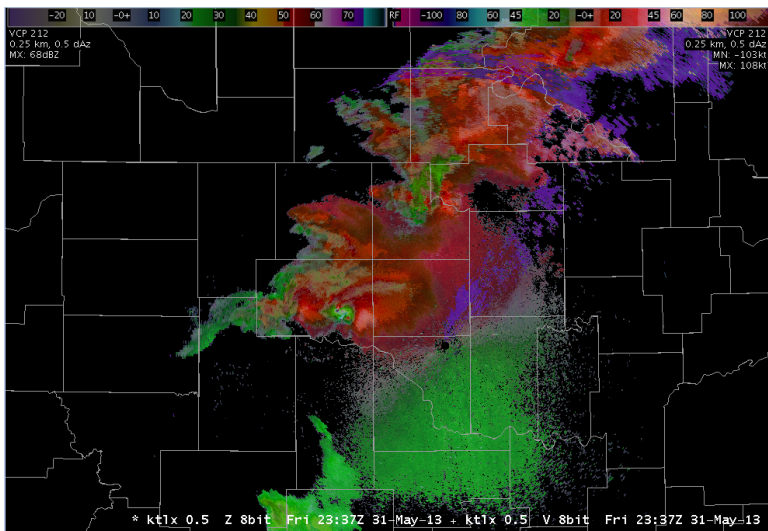
## Provide Data and Tools

Making sure our community has access to the data it needs to pursue scientific enquiry is central to NSF Unidata's reason for being. But access to data is only part of the picture: we also want to make sure that community members have the software tools they need to be able to manage, analyze, and visualize that data.



## Strategic Goal

Ensure fair and equal access to ESS data and tools



## Approaches to Achieve this Goal

- Provide performant, high quality data storage, access, and visualization
- Provide core infrastructure and software to support data access
- Create streamlined workflows for data analysis and visualization
- Build community capacity to access and use of cloud-computing infrastructure
- Make access to data, tools, and services FAIR and open

# Reduce Barriers to Participation

Helping to create a broad-based and vibrant community of ESS researchers, educators, and students means including participants from communities involved in different disciplines and varying levels of available resources. Enabling accessibility, community, engagement, and representation of a broad range of people will maximize



innovation as we work together to advance ESS. We will build NSF Unidata's participant base by making it easier to learn about our services, take advantage of what we offer, and share data, knowledge, and tools with others in the community.

## Strategic Goal

Grow the ESS community by reducing barriers to participation

## Approaches to Achieve this Goal

- Promote and integrate accessibility, equality, and ethical principles
- Create and deliver tools that are easy to use, understand, and incorporate into research and learning workflows
- Actively engage with communities with limited access to scientific research to build partnerships and strong community relationships
- Provide equal access to high quality learning and research resources and services
- Broaden and support community by active engagement, outreach, and advocacy
- Foster next-generation workflows and career skills for all communities

# Foster Community Action

While independent projects will always be a part of the scientific ecosystem, we believe that the ESS community benefits greatly from collaborative effort. NSF Unidata will play a central role in community activities, by acting as a catalyst, an honest-broker, and a community representative when working with providers of data and services.

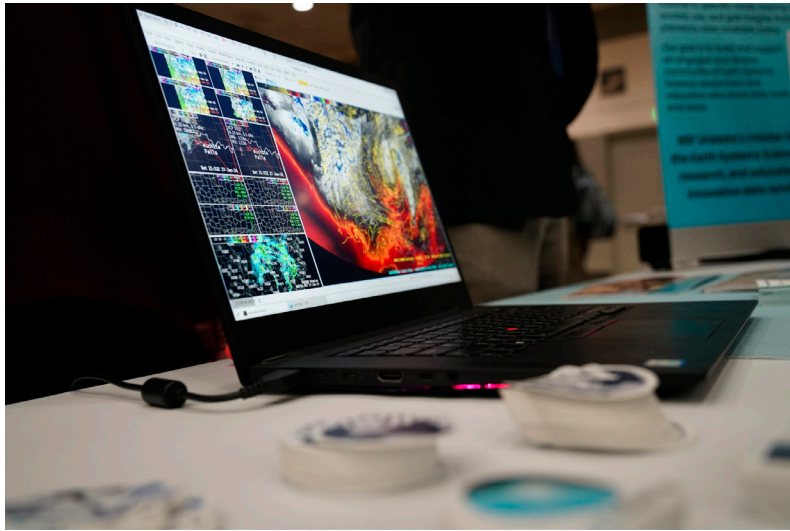


## Strategic Goal

Foster community action to improve ESS teaching and research

## Approaches to Achieve this Goal

- Act as a community hub for collaborative learning and data-centric investigation
- Marshal and build strategic partnerships and liaise on behalf of the community to acquire ESS data
- Support community readiness and adoption of new techniques and approaches to solve Earth System Science problems
- Work collaboratively with a broad and expanding community of ESS researchers, educators, and students to create and share data, tools, resources, and knowledge



## Innovate on Technology

As NSF Unidata has worked to fulfill its mission to make ESS data available, we have developed a base of expertise in moving, managing, storing, analyzing, and visualizing that data. At the same time, we have built an actively involved user community, where members contribute everything from feedback and ideas to software code to community-accessible data servers. We will continue to leverage our experience

and relationships in these fields to bring new software tools and techniques to our community, allowing them to be more effective in their scientific endeavors.

### Strategic Goal

Guide the ESS community toward innovative technical solutions

### Approaches to Achieve this Goal

- Identify, shape, and consolidate trends to advance community capabilities with next generation of cutting-edge solutions
- Support development and use of sustainable modern workflows, tools, infrastructure, and resources
- Harness community expertise and encourage collaborative contributions in development and use of modern and novel workflows



# NSF Unidata's Vision for the Future

NSF Unidata envisions a future in which a broad range of Earth System Science practitioners — researchers, educators, and students from organizations large and small, long-established or new participants — join together to share tools and data that advance our collective understanding. NSF Unidata's position as a hub for this expanding community gives us the opportunity to both increase access to our existing services and to help create modern, easy to use tools and workflows that facilitate discovery and knowledge creation.

With support from the National Science Foundation, and in partnership with our community, this strategic plan will enable NSF Unidata to realize that vision.

## **Thanks to Our Community**

The NSF Unidata Program could not serve its community effectively without ongoing input from a broad spectrum of geoscience researchers and educators. Our governing committees serve as an important interface between the Program Center and this wide community, and we thank them and all who provide ideas and information for their ongoing efforts.

In particular, we appreciate the input provided by the members of our Users and Strategic Advisory Committees who contributed their insights to the creation of this plan.

## **Thanks to Our Funders**

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