

Foundation for Earth Science NASA Progress Report

October 2014-September 2015

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Executive Summary

The Cooperative Agreement (12-TWSC12-0003) between NASA and the Foundation for Earth Science (FES) provides NASA with the Federation for Earth Science Information Partners (ESIP) community network, which substantially increases the agency's reach and impact. This partnership seeds innovation, develops best practices and advances technologies across broad-based, distributed communities of science, data and information technology practitioners. NASA employees benefit from the partnership through exposure to new technology and emerging concepts; the Earth science data community as a whole benefits through the advancement of Earth science information best practices in an open and transparent fashion.

During the third year of this project FES made significant progress toward meeting and exceeding stated goals. Through these accomplishments, FES enables science, data and information technology practitioners to confront the myriad, complex challenges in their fields, which benefits all members of this community, from graduate students to senior scientists. Our success can also be measured, in part, through the continued growth of the ESIP Federation, which draws a diverse group of partners that now numbers 173 member organizations; 16 of these were added in the first six months of 2015.

Our partnership with NASA also enables us to support and provide professional development opportunities for early career researchers through the ESIP Student Fellows program, FUNding Friday mini-grant competition and Raskin Scholarship. We also engage K-16 educators, and their students, in STEM education initiatives through professional development workshops and direct interactions between ESIP members and educators.

We wish to stress the importance of, and our gratitude for, NASA's ongoing support, which has enabled our long and versatile history of service to NASA and the wider Earth science data community.

Progress on FY15 Statement of Work Goals

The Foundation for Earth Science (FES) provides coordination services to the Earth science data and technology community by providing both virtual and face-to-face collaborative meetings. The following goals were met and/or are still in progress in 2015:

1. Planned and executed Ignite@AGU at the 2014 AGU Fall Meeting

FES planned and executed the 2014 Ignite@AGU on December 17, 2014. The event featured 14 talks from six different NASA offices, which covered concepts such as air quality, climate, disaster response, the DEVELOP program, oceans, ecology and more. The event was attended by more than 200 people and emceed by FES Chairman Karl Benedict of the University of New Mexico.

Ignite@AGU talks included:

- Data Curation: What's in It for Me? — Dharma Akmon, University of Michigan
- Why We Do What We Do — Ross Bagwell, NASA Goddard/Columbus Technologies
- Women in STEM in the Media — Cat Bobino, In the Know Science Show
- Cheatgrass: Cheating the West! — Cheryl Cary, NASA DEVELOP
- There Once Was a Man from Nantucket: A Lesson In Archiving Told in Verse — Kenneth S. Casey, NOAA NODC
- Chamonix! My Favorite Place (45.92° N, 6.87° E, 1035-3842m elevation) —Jeff de La Beaujardière, NOAA
- Space 2100 —Tia Ferguson, NASA/MSFC

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- Automated Data-Aggregation Factories — Dave Fulker, OPeNDAP
- Roll the Credits? A Case Study in Dataset Attribution — Chung-Yi Hou, University of Illinois, Champaign
- Sierra-Way to Heaven: A Cloud-Based Decision Support System — Emily "Chippie" Kislik, NASA DEVELOP
- We Want You(ng Women in Science)! — Jessica McCarty, Michigan Tech University
- Collections at the 'core' of the field — Sarah Ramdeen, University of North Carolina, Chapel Hill
- Perform better at school: either don't exhale or increase the ventilation! — Paul Roberts, Sonoma Technology
- Radar for Life, Ignited — Sang-Ho Yun, NASA JPL

2. Planned and executed semi-annual ESIP Federation meetings

These semi-annual meetings bring together Earth science data and technology experts to discuss and exchange current trends, technologies and expertise across the Earth science domain, functional and cross-sector communities.

The **2015 Winter Meeting** showcased Food Resilience and included plenary talks by Joseph Fiskel, Center for Resilience at Ohio State University; Molly Jahn, University of Wisconsin; and a panel discussion moderated by Lawrence Friedl on User Needs for Food Resilience. The second day plenary featured a panel discussion on the Enhanced Use of Earth Observations for Societal Benefit moderated by Curt Tilmes, NASA with Tim Stryker (OSTP), Fabien Laurier (USGCRP) and Rick Driggers (Climate Resilience Toolkit).

- 250+ participants, mostly in-person (approximately 5% remote)
- NASA participation: 70+ people, either in-person or remote at ESIP Meeting
- 40+ breakout sessions covering a range of technical and nontechnical topics

The **2015 ESIP Summer Meeting** was held July 14-17 in Pacific Grove, CA and focused on the theme of ESIP and data-driven community resilience. Participants spent four days discussing the many dimensions of community resilience, from place-based to virtual communities, and how technology enables communities to bounce forward in the face of stress and adversity.

- 295 in-person participants and 22 remote attendees
- NASA participation: 80 people, both in-person and remote
- 62 breakout sessions covering data analytics, registries and standards and interoperability improving technical resilience

The plenary session and half-day Community Resilience Workshop focused on developing a framework to enable:

- Increased communication and exchange among climate resilience stakeholders (data producers, data users such as policy makers and decision makers, and data translators)
- Development of a set of data related protocols, best practices and standards to support climate resilience (e.g., assessing vulnerability and adaptability levels)
- Identification of gaps in available data, knowledge and technology necessary to support climate resilience
- Removal of barriers to data experimentation and encouragement of data innovation around climate resilience

Output: Proceedings from the two meetings:

Winter 2015: <http://commons.esipfed.org/proceeding/Winter%20Meeting%202015>

Summer 2015: <http://commons.esipfed.org/proceeding/Summer%20Meeting%202015>

3. Extend NASA's reach through the ESIP platform

The long-standing relationship between NASA's ESDSWG and the ESIP Federation continues to provide benefits to both organizations. Erin Robinson, FES Executive Director, attended ESDSWG and supported activities following the March 2014 Annual ESDSWG: (1) Information Quality will spin up in ESIP and the Data Quality ESDSWG will use the Summer and Winter meetings to vet recommendations with the community; (2) Open Source WG in ESDSWG is looking forward to continued collaboration with ESIP; (3) Data-Intensive Architecture is looking to connect across NASA, ESIP, EarthCube and others. FES and ESDSWG are working together to identify other opportunities for collaboration.

In addition, ESIP was represented at the following meeting and conferences:

- NESTA/ESIP NSTA Workshops, Spring 2014 and Fall 2014
- CODATA/WDS SciDataCon, India, November 2014
- GEO Plenary, Geneva, Switzerland, November 2014
- RDA, San Diego, CA, March 2015
- OGC, Boulder, CO, June 2015
- AGU's Data Management Maturity Model Advisory Board, June 2015

4. Hosted the annual FUNding Friday competition at the 2015 ESIP Summer Meeting (July 2015)

In July 2015, FES hosted the seventh annual mini-grant funding competition, known as FUNding Friday for ESIP Federation members and ESIP student fellows. The competition showcases how the ESIP Federation leverages current technologies and member skills to add new services with a modest amount of effort and funding; it encourages collaborations across member organizations that demonstrate the value of ESIP participation; and is open to the imaginations and the needs of the ESIP Federation members.

Output: There were six FUNding Friday winners at the Summer Meeting: four students received \$3000 each for their project and three ESIP Federation partners received \$5000 prizes. In addition, the ESIP Federation provided \$8000 in seed funding to the new ESIP Drone Cluster to allow them to experiment with designing a drone.

5. Grow and nurture the ESIP Federation Testbed

Interest in the ESIP Federation Testbed continues to increase. Projects related to the semantic web, digital identifiers, data quality and others are underway or complete. In 2015, the ESIP Testbed started a new tradition of showcasing funded work, beginning at the ESIP Winter Meeting poster session. The following Testbed projects were featured in the session: (1) Disaster Life Cycle: Establishing a Collaborative Common Operating Picture; (2) ToolMatch Service Project to Expand Community Engagement: An entity linking service for documents and datasets in Earth and environmental sciences

(3) Connect, Share and Discover ESIP Research and Expertise using VIVO

(4) FUNding Friday:

- (1) Leveraging the Power of Google Earth Engine to Derive High Quality Water Reference Data for Flood Disaster Decision Support
- (2) Enhancing and Educating with the WxSat Mobile App
- (3) HDFCRAFT – Making Earth Data Fun!
- (4) ToolMatch Extension

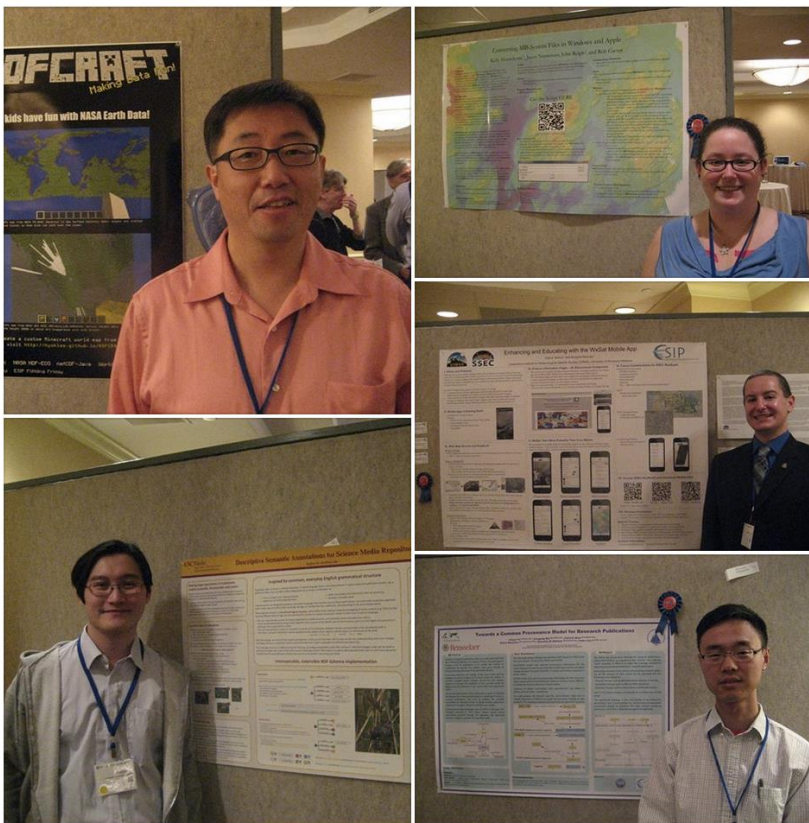


Figure 1: Some of the FUNding Friday grant recipients at the 2015 ESIP Winter Meeting poster session, January 7, 2015. Clockwise: Joe Lee, Kaijian Xu, Kelly Monteleone, Kyle Nelson, Linyun Fu and their teams.

A new class of incubator Testbed proposals was invited in the Spring 2015 from across the ESIP Federation community. The two projects funded in this round are: Evaluating Prototypes in ESIP's Testbed Ecosystem and Collaborative Common Operating Picture Testbed, with StormCenter Communication, NASA JPL and others.

In addition to the incubator projects, in spring 2015 the ESIP Testbed Configuration Board held a 1.5 day workshop in Boulder, CO April 24-25, 2015 on the next phase of the ESIP Testbed. To date, projects have primarily focused on incubation. Moving forward, the Testbed will also include a second stage of prototype assessment. Over the next eight months, the Products and Services Committee will pilot a small prototype assessment phase with several NASA AIST projects.

Outputs:

The following reports and resources were produced as the result of the ESIP Testbed:

- ESIP GitHub Repository: <https://github.com/ESIPFed>
- April Workshop Summary: https://docs.google.com/document/d/1HCKx5Eg1LnzZW7CPHpNdcQL-JC xv_7U1fHPNdsYArIA/edit
- Project Documentation: <http://testbed.esipfed.org>

6. Support ESIP Federation Collaboration Areas

The ongoing activities of the ESIP Federation's collaboration areas (Data/Informatics, Societal Benefit/Applications, Education/Outreach) continue to produce vast amounts of knowledge that benefits NASA and the Earth science data community as a whole.

Data Stewardship Committee

- Data Stewardship Maturity Matrix
- Defining data publication (see session)
- Continued PCCS work, including Eos and [D-Lib](#) articles
- Dynamic data citation workshop was held Thursday afternoon at ESIP Winter Meeting; [Details](#)
- Supporting GEO Data Management Principles

Documentation Cluster

- Attribute Convention for Data Discovery Version 1.3; Approved December 2014: <http://wiki.esipfed.org/index.php/ACDD>
- Documenting the Big Earth Data Initiative (BEDI): http://wiki.esipfed.org/index.php/Category:Documentation_Connections_2015
- Encoding metadata groups/attributes in HDF and netCDF

Semantic Web

- Ontology Repository
- ToolMatch

Agriculture & Climate Cluster

Continued engagement with: (1) USDA LTAR (Long-Term Agroecosystem Research) Network and (2) National Agricultural Library (NAL), which handles the data system aspect of LTAR, in exploring areas of collaboration, with current focus on linking NASA and other satellite data with LTAR sites.

Energy & Climate Working Group

Focuses on issues related to data provenance, access and transparency issues for energy apps (with breakout session at the 2015 ESIP Winter Meeting). Stakeholder engagement and observation gap identification (participated in NCSE meeting in late January 2015). Supporting the second USGEO Earth Observation Assessment energy SBA.

Disaster Response Cluster

Established a “Collaborative Common Operating Picture” Testbed with StormCenter Communication, NASA JPL and others.

Output:

- State of the Federation January 2015: <http://commons.esipfed.org/node/7861>
- State of Federation July 2015: <http://live.commons.esipfed.bluedotapps.org/node/8224>

7. Hosted Non-Traditional Trainings

The ESIP Federation supports the HDF Workshop, Cloud 101 and Data Analytics Trainings. In addition, the current cohort of ESIP Student Fellows offered their first training at the 2015 ESIP Summer Meeting on how to use GitHub and data management best practices. At this point these topics are generally self-taught. These trainings provide a chance for the technology practitioners to teach themselves and begin to think about how these concepts will be taught more systematically to new data scientists.

Some common themes emerging from these sessions: (1) Data is created in a manner to facilitate its generation NOT its use, thus data scientists, via data analytics, need to facilitate making data more useful; (2) Data scientists should be interdisciplinary from the start of their training; (3) It is important to know the importance of the data lifecycle from data collection through analysis all the way to archival; this requires cross domain training; (4) Information science or data curation must be complemented by background in and understanding of what the data says and how to understand the data; (5) One method for building better data scientists would be for students to do internships from the start of their schooling and training.

Output: Presentations and notes are linked from the [ESIP Summer Meeting page](#).

8. Evaluate activities of the ESIP Federation

ESIP Vice President Emily Law and the ESIP Assembly are in the final stages of completing the 2015-2020 ESIP Strategic Plan. Law worked with ESIP Committee and Collaboration Area leaders to align work plans with the roadmap (mapping of goals and tasks) and has created a wiki page to document background, status and lessons learned, and to manage execution of the plan. The near-final draft of the strategic plan and an implementation plan is posted on the ESIP wiki:

wiki.esipfed.org/index.php/2015-2020_Strategic_Plan_Workspace

While internal evaluation and planning have been successful, the ESIP Federation requires professional insight in order to capture success and document progress of the organizational program. The Foundation for Earth Science will work with a professional evaluator to perform an evaluation of its activities under this cooperative agreement.

Output: To date, no output from this activity in Year 3.

9. Engaging Students and Teachers to Educate Future Scientists, Engineers and Educators

In Year 3, FES administered the Raskin Scholarship, awarding it to University of Alaska Fairbanks Ph.D. student Chris Waigl, who studies wildfire dynamics in interior Alaska. Waigl received the award and gave a plenary talk about her research at the ESIP Summer Meeting.

FES also supported a fourth class of ESIP Student Fellows; this year’s cohort consists of six graduate students and post docs interested in bridging the gap between informatics, technology and Earth Science and applying research to real-world problems.

In addition to these student opportunities, FES supported collaborative ESIP/NESTA workshops at National Science Teacher's Association (NSTA) National Conference. We also held a professional development workshop for educators at the 2015 ESIP Summer Meeting. This one-day workshop brought a group of 17 California high school science teachers and community college faculty to ESIP Summer Meeting to learn how to integrate Earth science data into the grades 9-14 science curriculum.

Outputs:

- Student Fellow blogs: <http://esipfed.org/taxonomy/term/512>
- NESTA/ESIP Workshops: <http://www.nestanet.org/cms/calendar/5305>
- ESIP Teacher Workshop: <http://commons.esipfed.org/node/8214>

10. Produce a Year-in-Review Report

Output: this report, as modified through the end of July 2015, fulfills the Year-in-Review report.

ESIP News and Governance

In addition to the activities stated in the FY15 Statement of Work, the Foundation for Earth Science is pleased to provide updates on ESIP governance and FES activities.

Staff

In November 2014 Erin Robinson was appointed as the Foundation for Earth Science's Executive Director. Four new FES staff members were hired in spring 2015: Dan Keyes and Annie Keyes fill a single full-time position focused primarily on operations and logistics. Annie Burgess joined FES in April as the ESIP Community Director and Rebecca Fowler joined FES in May as the Communications and Outreach Director.

ESIP News and Leadership Changes

In January 2015 the ESIP Federation elected new leadership. The new officers began their terms on January 10, 2015 at the conclusion of the ESIP Federation's Winter Meeting in Washington D.C. The new leadership is as follows:

President: Peter Fox, Tetherless World Constellation Chair and Professor of Earth and Environmental Science and Computer Science at Rensselaer Polytechnic Institute

Vice President: Emily Law, Science Data Systems Manager at NASA/JPL serves as Vice President.

Chair, Constitution and Bylaws Committee: Ken Keiser, University of Alabama-Huntsville,

Chair, Finance and Appropriations Committee: Bill Teng, NASA GSFC

Chair, Partnership Committee: Tyler Stevens, Associate Scientist, NASA Global Change Master Directory

Chair, Education Committee: LuAnn Dahlman, NOAA

Chair, Information Technology and Interoperability Committee: Ethan Davis, UCAR/Unidata

Chair, Data Stewardship Committee: Justin Goldstein, USGCRP

Type I (data center) Representative: Danie Kinkade, Woods Hole Oceanographic Institution/BCO-DMO

Type II (research) Representative: Steve Richards, Arizona Geologic Survey

Type III (applications) Representative: Ted Haberman, The HDF Group

In July 2015, ESIP President Peter Fox was named a 2015 American Geophysical Union (AGU) Fellow.

Membership

Two classes of new members were added to the ESIP Federation in first six months of 2015, with the addition of eight members each time, bringing ESIP's total membership to 173 partner organizations.

January 2015

- COOPEUS – ESIP Type I (primarily data centers)
- E-DECIDER – ESIP Type II (primarily research)
- GeoGateway – ESIP Type II (primarily research)
- Geological Data Center, SCRIPPS – ESIP Type I (primarily data centers)
- Kitware – ESIP Type III (primarily applications)
- Marymount University – ESIP Type II (primarily research)
- Purdue Libraries – ESIP Type II (primarily research)
- UC Berkeley Libraries – ESIP Type I (primarily data center) 1.9 UNAVCO – ESIP Type I (primarily data center)

June 2015

- Center for Ocean-Atmospheric Prediction Studies, Florida State University (COAPS) – ESIP Type II (primarily research)
- Center for Research in Water Resources (CRWR) – ESIP Type II (primarily research)
- US Global Change Research Program GCIS Team (USGCRP GCIS) – ESIP Type II (primarily research)
- Monterey Bay Aquarium Research Institute (MBARI) – ESIP Type II (primarily research)
- University of New Mexico Library – ESIP Type III (primarily applications and education)
- Liquid Robotics Inc – ESIP Type I (primarily a data center/archive)
- University of California Natural Reserve System (UCNRS) – ESIP Type II (primarily research)

Digital Assets

In the first half of 2015, ESIP developed and announced a new app, ESIP Connects. The goal of this app is to enhance the ESIP meeting experience by allowing meeting attendees to more easily find meeting information and connect with each other. The app is free to download (<http://visitors.genie-connect.com/esipsummermeeting>) and was piloted at the ESIP Winter and Summer Meetings.

FES uses social networking infrastructure to facilitate ways for people to connect, collaborate, share and discuss work in an online environment. We also use these platforms, primarily Facebook and Twitter, to increase awareness of FES and ESIP Federation events and opportunities, such as the ESIP Federation annual meetings and student fellowship program. In addition, to foster and maintain a sense of ESIP community, a weekly email update, sent each Monday to a mailing list of 950+ people, provides subscribers a summary of ESIP Federation news, events, funding opportunities and telecon reminders. The ESIP Federation listservs, also used to maintain the sense community and share ideas, consisted of more than 2,000 people as of May 2015.

A reorganization and redesign of the FES website (<http://earthsciencefoundation.org>) was completed in July 2015, with the aim of better communicating the nature and purpose of the organization and programs, such as ESIP, it supports.