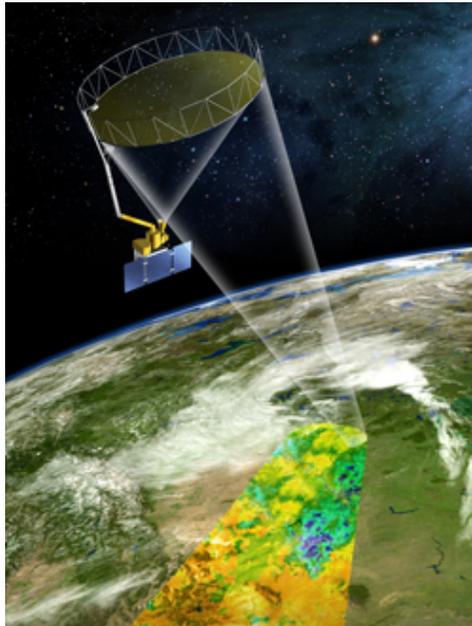




National Aeronautics and
Space Administration

Soil Moisture Active Passive (SMAP) Mission Applications Plan

Operations Phase E SMAP Post-Launch Applications Activities



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The Soil Moisture Active Passive (SMAP) Mission Applications Plan was first published in July 2012 (JPL Document D-53082) and was made available for download from the SMAP Applications web page (<http://smap.jpl.nasa.gov/science/applications/>). The first published version of the Plan was intended to guide the SMAP applications program during the period from early 2012 up to the launch of SMAP, which took place on January 31, 2015. This document is an update to the SMAP Applications Plan and describes applications activities planned for the post-launch operations phase of the mission (Phase E).

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Operations Phase E

SMAP Post-Launch Applications Activities

Introduction

After over a decade of work and investment, SMAP was launched on 31 January 2015. During the Phase E post-launch period (starting launch+90 days), it will be important to 1) evaluate the value of pre-launch application efforts, 2) document uses of SMAP data in applied science, and 3) foster and grow the SMAP applications community.

In Phase E, the SMAP Applications Team (Table 1) will continue supporting the goal of the pre-launch SMAP Applications Plan “to engage SMAP end users and build broad support for SMAP applications through a transparent and inclusive process.” The SMAP Applications Coordinator will design and execute the Phase E activities in coordination with the SMAP Project. The SMAP Science Team and SMAP Project will provide support and guidance to the SMAP Applications Coordinator for the proposed activities. NASA Headquarters will continue to be a valued partner in the Early Adopter Program providing guidance on how to work with outside institutions and to propagate the program to other ESD missions. This document has been drafted with clear guidance from NASA Headquarters, the SMAP Project and the SMAP Science Team regarding the need for continuation of the SMAP Applications Program in Phase E.

Table 1. SMAP Applications Team.	
Affiliation to SMAP Mission	Current member, April 2015
SMAP Deputy Project Administrator (DPA)	Vanessa M. Escobar and Narendra Das
SMAP Applications Coordinator	Vanessa M. Escobar
SMAP Applications Working Group Chair	Susan Moran
SMAP Science Team Leader	Dara Entekhabi
SMAP Project Scientist	Simon Yueh, previously Eni Njoku
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Evaluate the value of pre-launch application efforts

The overall goal of the pre-launch SMAP Applications Plan was to engage SMAP end users and build broad support for SMAP applications through a transparent and inclusive process. During Phase E, work will be done by the Project to evaluate whether the pre-launch SMAP Applications Program has met its goals and can quantify the benefits of the program (Table 2). Because this is the first NASA mission to have an active Applications Program throughout the pre-launch period, the evaluation of the program must be developed in a way that is beneficial to NASA and the project, while maintaining the high standards of NASA’s flight programs. Here it is described how the SMAP Applications Coordinator will develop a lessons-learned document that seeks to determine if the goals of the program were met. The evaluation of the SMAP Project Applications Program will be conducted through a coordinated effort between the NASA HQ Applied Science Program and the SMAP Applications Team. The scope of the review will be an assessment of how the Project has performed with regards to the five metrics defined in this Plan.

Table 2. Sub-goals of the <i>pre-launch</i> SMAP Applications Plan.
Develop a community of end-users and decision makers that understand SMAP capabilities and are interested in using SMAP products in their application;
Reach out to end-users that are unfamiliar with SMAP capabilities but have the potential to benefit from SMAP products in their application;
Identify "Early Adopters" who will partner to optimize their use of SMAP products, possibly even before launch as part of the SMAP testbed activities and SMAP calibration/validation;
Provide information about SMAP applications to the broad science community to build support for SMAP applications; and
Facilitate feedback between SMAP Users and the SMAP Mission and Science Team.

The NASA Applied Sciences Program has as one of its strategic goals to “ensure that NASA’s flight missions plan for and support applications goals in conjunction with their science goals, starting with project planning and extending through the project life cycle” (NASA Applied Sciences Program, Program Strategy 2010-2015). An action item related to this goal is to “evaluate the potential for current and planned NASA missions to meet societal needs through applied sciences participation in mission science teams.”

Lessons learned from the SMAP Applications Program for future projects will be partly based on three qualitative and quantitative metrics:

- 1) A comparison of actual SMAP application activities with the SMAP Level 1 requirement for applications;
- 2) The SMAP Applications Working Group (AppWG) composition and activities leading to launch; and
- 3) The results of pre-launch applications research.

Metric 1: The SMAP Level 1 requirement states the *SMAP Project shall organize and host a SMAP data product application workshop annually. The workshop will share information on the SMAP science data applications and define the potential applications that can be supported with the existing SMAP data requirements. Results will be provided to the SMAP science team and at other SMAP workshops and meetings (Appendix O, The Earth Systematic Missions Program Plan Program Level Requirements on the Soil Moisture Active Passive Project).* In addition to workshops, other applications activities conducted by SMAP through its applications program have included tutorials, focus sessions and town hall meetings. All activities help define the

potential applications that can be supported with the existing SMAP data requirements as well as provide feedback to the SMAP project on the potential uses of the data. The action items and follow-ons that have been documented in reports of these events will be used to determine the impacts of these activities. A summary of feedback and action items from SMAP applications events can be found in Appendix A.

Metric 2: It will be possible to assess how the user community has changed during the SMAP mission phases by analyzing the composition of the SMAP AppWG each year from 2007 to 2015. Analysis will look at membership by thematic interest, geographic location and participation in SMAP activities.

Metric 3: Pre-launch applications research will be assessed, in part, by the downloads and quantitative uses of pre-launch data products by users in research and planning, and the utility of SMAP products made available through the DAAC in the SMAP Early Adopter's activities. The SMAP project was the first to provide users with access to simulated pre-launch data through a restricted portal provided by the DAAC. Assessment will also draw upon research papers published in peer-reviewed journals by the Early Adopter teams (see References from SMAP Early Adopter Program below). This pre-launch research will offer a quantitative assessment of whether the SMAP data are able to meet the data requirements of the user community, and whether the use of SMAP observations impacted modeling outputs and to what capacity.

Document uses of SMAP data in applied science

During Phase E, work will be done to document and evaluate the use of SMAP science products in applications, as well as promote uses of SMAP data in new applied science cases. The evaluation needs to demonstrate how the investment in applications has contributed to the mission, provided new information about the eventual use of the data in critical decision support projects and programs, and conducted new research that contributes to the use of mission products enhancing mission success. Input from all users of SMAP products, including the Early Adopters (EAs), will be used to make these assessments. Specifically, the Phase E SMAP Applications Plan proposes to:

- 1) Conduct case studies about how SMAP science products are used in decision support systems and about how the new data stream affects the system performances.
- 2) Identify new applied science uses of Level 1 instrument, Level 2/3 geophysical retrieval and Level 4 model value-added SMAP data products.

Qualitative and/or quantitative metrics will be used for this assessment, as described below.

UPDATE 3 Nov 2015: After 10 weeks of post-launch measurements the SMAP radar stopped transmitting on July 7th 2015. In response, the SMAP Early Adopters (EA) and Applications Users (AU) have begun investigations of products other than soil moisture and freeze/thaw to increase the science and applications value of SMAP radiometer data stream. They are also conducting short-term studies with the 10-week SMAP radar/radiometer product stream to report on the value of the unique SMAP radar/radiometer data for applications. Some EA and AU are assisting to develop and test SMAP science recovery of higher resolution soil moisture and FT. Starting with the *SMAP Applications Benchmark Workshop* in May 2015 and following with one-on-one contacts with users, the SMAP Applications Team is engaging with EA and AU to provide feedback to the mission. Results of these efforts are being reported at weekly SMAP Science Team telecons, monthly Applications Team telecons, quarterly SMAP Early Adopter

telecons, and semi-annual SMAP Science Team meetings. This unexpected, yet important, effort will be added to the annual summary reports (metric 5) and the lessons learned document (metrics 1-3).

Metric 4: Comprehensive case studies (at least one study per applications theme (Table 3)) will enable quantification of the benefits of an application by the end of the first two years after launch. This effort will require the full-time attention of the Application Coordinator and an additional application scientist through Phase E.

The SMAP Application Coordinator will begin this process in summer 2015 with a workshop focused on initiating evaluation of SMAP data within users' activities, termed the *SMAP Applications Benchmark Workshop: Evaluating Methods for Using SMAP data in Societal Applications*. This workshop will be focused on SMAP Early Adopters and will enable discussion of the methods SMAP EAs used to evaluate the utility of SMAP data in their activities. Each participating EA will provide specific feedback to the SMAP project and NASA Headquarters about the value of pre-launch applications efforts to enable integration of SMAP data into their activities.

Table 3. SMAP applications themes from <http://smap.jpl.nasa.gov/science/early-adopters/>.

Weather and climate forecasting	Agricultural productivity
Droughts	Human health
Floods	National security

Metric 5: The SMAP Applications Team will continuously solicit updates after launch on SMAP application user activities. This will include updates on SMAP Early Adopter Quad Charts (1. Objectives, 2. Status, 3. Methodology/Approach and 4. Schedule/Issues) which the SMAP Applications Team will use to draft annual summary reports.

By the above activities, the SMAP Applications Team plans to gather information that demonstrates a strong and well-defined user community. The lessons learned from the pre-launch and post-launch Applications Program and documentation of uses of SMAP data in applied science should provide strong support for SMAP extended operations, if necessary. The Applications Team will seek to put the results into the peer-reviewed literature, and provide feedback to NASA Headquarters.

Foster and grow the SMAP applications community

In Phase E, continued relationships with end users will transition pre-launch research into post-launch observation studies. The plan to foster and grow the SMAP user community includes four facets: 1) the SMAP Early Adopter Program, 2) SMAP Applications Users, 3) SMAP Applications Working Group (AppWG), and 4) Workshops, Tutorials, Focus Sessions, and Town Halls.

SMAP Early Adopter (EA) Program

The SMAP Project is the first NASA decadal survey mission to implement an Early Adopter (EA) Program. The goal of the SMAP Early Adopter program is to facilitate feedback on SMAP products *pre-launch*, and to accelerate the use of SMAP products *post-launch*, by providing specific support to Early Adopters who commit to engage in applied research. This is a non-

funded activity for the Early Adopters, though the SMAP project provides funding for an Applications Coordinator and project staff to support this activity. SMAP Early Adopters are defined as those groups and individuals who have a direct or clearly defined need for SMAP-like soil moisture or freeze/thaw data, and who are planning to apply their own resources (funding, personnel, facilities, etc.) to demonstrate the utility of SMAP data for their particular system or model (see current list of EAs at <http://smap.jpl.nasa.gov/science/early-adopters/>). This research promotes understanding of how SMAP data products can be scaled and integrated into policy, business and management activities to improve decision-making efforts.

The SMAP Applications Team plans to continue its SMAP EA Program through the end of the project to continue broadening the mission's understanding of SMAP data applications. However, no additions will be made to the selected group of Early Adopters after May 2015. In Phase E, all Early Adopters will continue under the Early Adopter agreement in place during the prelaunch phase (see commitments at <http://smap.jpl.nasa.gov/science/early-adopters/>). These commitments will remain in place until both parties agree to discontinue. As such, Early Adopters will participate in a formal evaluation of how SMAP pre-launch application research impacted their decision-making through improvements in their systems, models and analysis. Research and collaboration between the SMAP ST and each EA organization will continue with each EA working to provide clear metrics and an analysis of the value of soil moisture or freeze/thaw data in their application (Metrics 4 and 5).

During the short period before beta release to the general public, approved Early Adopters will be given access to pre-beta-release products for their research. The Early Adopter will make a request to the SMAP Applications Team, and the request will be reviewed and approved on a case-by-case basis. Preliminary data (pre-beta-release products) will be restricted to approved Early Adopters during the period before beta products are released to the general public via the DAAC. This agreement differs from the request for simulated and cal/val data in several ways:

- 1) Proposals will be submitted by the EA, the ST contact, and end-user, rather than just the EA.
- 2) Pre-Beta Data Release Access Requests will include:
 - a) Title
 - b) Contact information for EA, ST contact, and end-user (if not EA);
 - c) Report on status of EA research and metrics;
 - d) Justification for request of pre-beta-release products; and
 - e) Proposed new milestones and quantitative metrics.
- 3) The approval criteria for access to pre-beta data release are:
 - a) A good record of success with SMAP data
 - b) Strong commitment from end-user and SMAP ST contact
 - c) Good metrics
 - d) Deep understanding of SMAP products

NASA Headquarters is looking to the SMAP project as a role model or prototype for implementing applications activities and EA engagement through Phase E. We plan to conduct an impact analysis, explain the benefits of being a SMAP EA (early awareness, data access and explanation, etc.) and quantify the value of early mission engagement and using SMAP data in government and commercial applications (saved resources, increased revenue, increased job opportunity, saved lives, improved decisions/market, etc). A 'lessons learned' document will be written by the SMAP Mission Applications Coordinator for the project at the end of Phase E.

SMAP Applications Users (AU)

In Phase E, a special effort will be made by the SMAP mission to engage with the broader community of applications users, including commercial and other domestic and international applications users. By definition here for SMAP, Applications Users are any groups or individuals who download SMAP products from the DAAC after beta release (when the data will be available to the public) for their applications, including policy, business and management activities, to improve decision-making efforts. The SMAP Applications Users (AU) would pursue use of SMAP data in their applications in a manner paralleling the Early Adopters but without entering into the formal agreements that define the Early Adopters. After beta release when all data will be available to the public, the Early Adopters would continue as a special category of the broader set of Applications Users.

The SMAP AppWG is geographically limited, weighted heavily (over 80%) toward members with U.S. affiliations. To increase the international involvement in SMAP, an effort will be made to promote capacity building and use of SMAP data through organizations such as CEOS (Working Group on Capacity Building), GEO, United Nations and others, to support global users. Holding international data tutorials at key locations around the world in coordination with international conferences and other workshops organized by sister agencies to NASA (GRSS, CEOS, COSPAR, UN, ESA, etc.) will help bring a larger international representation to the SMAP AppWG.

This activity will be carried out in coordination with NASA Applied Sciences Program plans for capacity building (<http://www.nasa.gov/applied-sciences/capacitybuilding.html>).

SMAP Applications Working Group (AppWG)

The SMAP Applications Working Group (AppWG) is an inclusive group with the responsibilities of SMAP application development and feedback to the SMAP project. The AppWG is used to

- Assess current applications benefits and requirements for SMAP products;
- Develop a broad community of Applications Users that understand SMAP capabilities and are interested in using SMAP products in their application;
- Foster Early Adopters who can work with the SMAP project during the pre-launch and post-launch period, particularly to assess impacts on their applications;
- Provide information about SMAP and its products to the broad user and science community; and
- Provide guidance to future solicitation processes.

The AppWG was initiated in 2008 and populated through networking and invitation. As SMAP applications workshops were conducted, the attendees were notified that they would be added to the AppWG. Members have also been added at their request through registration on the SMAP website at <http://smap.jpl.nasa.gov/science/wgroups/applicWG>. Through these avenues, the SMAP AppWG membership has increased from 0 in Jan. 2009 to 150 by Aug. 2010, to 270 by June 2011, and to its current number of 600+ members.

Considering the important responsibilities of this group, a focus in Phase E will be to update and engage the membership of the SMAP AppWG. This will be partly accomplished by maintaining a SMAP ST scientist as Chair of the Applications Working Group.

An aim in Phase E will be to continue the steady increase in members of the AppWG and initiate activities to increase interactions among members (e.g., an expanded set of tutorials, and ATAGs, as discussed below). To retain the AppWG of highly engaged members, membership will continue to be pursued through networking, invitation and self-nomination. The most productive means of engaging users has been the face-to-face interactions through Workshops, Tutorials, Focus Sessions and Town Halls. It is proposed here to continue work by the SMAP Applications Coordinator(s) to recruit users to join the AppWG at the already-planned SMAP applications activities.

SMAP Workshops, Tutorials, Focus Sessions and Town Halls

A series of SMAP applications activities will be planned and conducted by the SMAP Applications Coordinator(s) as follows:

Year 1

- Post-launch *SMAP Early Adopter Benchmark Workshop: Evaluating Methods and EA's plan for Using SMAP data in Societal Applications*, Summer 2015
- One SMAP applications focus session on SMAP data application co-hosted by EAs at an EA facility
- 3-4 SMAP applications tutorials conducted in conjunction with international scientific conferences and/or international organization capacity building workshops and training sessions.

Year 2

- 4th SMAP Applications Workshop, Data Release event, tentatively scheduled for 9-11 February 2016
- One SMAP applications focus session on SMAP data application co-hosted by EAs at an EA facility
- 3-4 SMAP applications tutorials conducted in conjunction with international scientific conferences and/or international organization capacity building workshops and training sessions.

Year 3

- 5th SMAP Applications Workshop on assessment of SMAP data's impact, early 2017
- One SMAP applications focus session on SMAP data application co-hosted by EAs at an EA facility
- 3-4 SMAP applications tutorials conducted in conjunction with international scientific conferences and/or international organization capacity building workshops and training sessions.

Concluding Remarks

This document presents the post-launch plan and new activities for the SMAP Applications Program in Phase E. The plan is based on continued funding of the SMAP Science Team, continued support by the SMAP Project for the numerous applications workshops organized by the SMAP Coordinator, and continued commitment from Early Adopters to participate in SMAP applications efforts.

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Other:

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Appendix A. Summary of pre-launch SMAP events and action items taken

A summary of SMAP application event goals and action items from those events are summarized below. All events listed were hosted during the prelaunch stages of the SMAP mission.

SMAP Applications Workshops provide an update of the mission and its progress to the community of interest and are set up to exchange information about SMAP soil moisture and freeze/thaw state products on a broad scale. Workshops are organized annually or every two years and provide feedback to the SMAP mission about SMAP product applications. SMAP Applications has hosted the following workshops during the prelaunch stages of the mission:

- **April 9-10, 2014**

- **3rd SMAP Applications Workshop**

- **National Center for Atmospheric Research, Boulder, CO.**

- The goal of the 3rd SMAP Applications Workshop was to focus on preparing users for applications of SMAP products. This 1.5 day workshop was a one-stop-shop for users to interact with the SMAP community and the mission. This workshop provided 1) the Early Adopters' progress and ideas to inspire others to start preparing, and 2) personal attention to potential applications that show promise. There were talks and posters by Early Adopters and members of the SMAP Applications Working Group. A help desk was available during the entire event and staffed by a rotation of knowledgeable Mission personnel and Science Team members. Workshop attendees received one-on-one discussion with someone familiar with the algorithm, product, DAAC, or other details needed. The workshop was then followed by a half-day hands-on tutorial using simulated SMAP and real ESA SMOS data products.

- **Actions taken from 3rd SMAP Applications Workshop:**

- Conducted a SMAP impact workshop for Early Adopter research (after launch) to evaluate the methods and (later) the impact of SMAP data in select Early Adopter projects.
 - Organized Thematic Applications Groups for interested SMAP community and Early Adopters (action continuing into Phase E as guidance/feedback to the NASA Applied Science Program Thematic Science Teams).
 - Coordinated SMAP data tutorials with the DAAC for future events after launch.
 - Agreed to host another Early Adopter workshop 2 year after launch to showcase SMAP Early Adopter research results (with impacts) (action continuing into Phase E).
 - Promoted Early Adopters internationally.
 - Promoted the use of SMAP for carbon applications and permafrost (action continuing into Phase E).

- **October 12-13, 2011**

- **2nd SMAP Applications Workshop**

- **U.S. Department of Agriculture, South Building, Washington, DC.**

- The goal of the 2nd SMAP Applications Workshop was to report progress on implementation of the Applications Plan, expand the applications community, promote SMAP applications and engage Early Adopters. This information was fed back to the SMAP mission and NASA Headquarters.

- **Actions taken from the 2nd SMAP Applications Workshop**

- Expanded the Early Adopter Program.
 - Highlighted Freeze/Thaw applications for SMAP.
 - Included more commercial users (reinsurance, agriculture) (action continuing into Phase E).
 - Brought more emphasis to health applications for SMAP (action continuing into Phase E).
- **September 9-10, 2009**

1st SMAP Applications Workshop

NOAA Science Center Auditorium, Silver Spring, MD.

The goal of the 1st SMAP Applications Workshop was to provide a mechanism to share information about SMAP applications and to inform the SMAP mission about the challenges facing SMAP data users. The workshop aimed to strengthen the relationship between the SMAP mission and SMAP data users, and to provide inputs needed to develop the SMAP Applications Plan.

Actions taken from 1st SMAP Applications Workshop

- Developed an Applications Plan
- Hired an Applications Coordinator

SMAP Applications Focus Sessions and Tutorials

Focus Sessions provide a forum for a user group to receive specific support and information on the utility of SMAP soil moisture and freeze-thaw state products for thematic mission objectives. Focus sessions are concentrated one-day events focused on a thematic community. The community helps organize the event and SMAP mission personnel participate. **Tutorials** are organized to discuss products and applications of multiple NASA decadal missions. Tutorials are SMAP's proactive work for linking to other NASA missions. Tutorials combine cross-mission product application opportunities and leverage innovation for how to best combine data sets from multiple missions. Tutorials are hosted by an end user group such as USDA or USGS but are organized and managed by the decadal mission or the SMAP Applications Team. SMAP Applications has planned, organized and hosted the following Focus Sessions and Tutorials:

- **August 18-19, 2014**

SMAP/ICESat-2 Sea Ice Focus Session

Stennis Space Center, Mississippi

Focus Session Goals: To Examine the challenges and opportunities related to the use of SMAP and ICESat-2 data for sea ice; to assess the potential efficacy of ICESat-2 and SMAP data in operational and decision-making contexts; and to explore possibilities for combining ICESat-2 and SMAP data products to leverage the functionality of the products for sea ice applications for the NRL.

Actions taken from SMAP/ICESat-2 Sea Ice Focus Session

- Confirmed developing an experimental SMAP 1km product over Alaska
- Developed Focus Session report with SMAP and ICESat-2 addressing the discussion and questions from the meeting.
- Communicated Sea Ice Early Adopter research efforts to NRL and the reinsurance community (action continuing into Phase E).
- Connected SMAP and ICESat-2 researchers to discuss the development of joint mission product(s) (action continuing into Phase E).

- **June/July 2014**

- **European Focus Sessions**

- As a member of the NASA SMAP Science Team, Susan Moran conducted a series of focus sessions in Europe with the goals: (1) to liaison with the international applications community and identify SMAP Early Adopters and (2) to coordinate applications efforts with the SMOS and FLEX missions. Formal presentations were made to scientists and managers at

- 10 June University of Valencia, Spain

- 13 June SMOS Expert Center, Barcelona, Spain

- 17 June ESA Center for Earth Observation (ESRIN), Frascati, Italy

- 18 June Institute of Applied Physics (IFAC-CNR), Florence, Italy

- 19 June UN World Food Program (WFP), Rome, Italy

- 20 June Italian Civil Protection Department (DPC), Rome, Italy

- 23 June UN Food and Agriculture Organization (FAO), Rome, Italy

- 14 July GEWEX Conference, The Hague, The Netherlands

- 15 July Delft University of Technology, The Netherlands

- 16 July University of Twente, The Netherlands

- 22 July National Geographic Institute (IGN), Madrid, Spain

- Actions taken from European Focus Sessions**

- Three new SMAP Early Adopters were selected
 - Nine actions items are under consideration by the SMOS and SMAP mission science management teams
 - At the nation-wide meeting of the Italian Civil Protection Dept. (DPC) and nation-wide Technical Seminar of the Spanish National Plan of Remote Sensing 22 July in Madrid, a number of opportunities for SMAP/SMOS/FLEX fusion were identified

- **May 18, 2014**

- **2014 US-IALE Symposium, Soil Moisture Active Passive (SMAP) and NASA's Carbon Monitoring System (CMS) Initiative Joint Mission Tutorial, Anchorage, AK.**

- The workshop goals were to bring together experts from the NASA SMAP Mission, CMS initiative, and the US International Association for Landscape Ecology (IALE) community to discuss synergistic opportunities for enhancing the applications for SMAP and CMS data products. The workshop described the planned SMAP and CMS carbon products, including product uncertainties, and provide an opportunity to address the potential application (addressing the individual resolution, access and accuracy concerns by thematic discipline). The event focused on identifying individuals and institutions that work in the area of methane and permafrost analysis, especially those relevant to high latitude carbon cycle dynamics and permafrost change. Finally, the event explored effective ways of communicating carbon modeling and analysis uncertainties and biases in data products to decision makers.

- Actions taken from 2014 US-IALE Symposium:**

- Successfully connected SMAP Carbon science to CMS and the NASA ABoVE campaign (action continuing into Phase E).
 - Engaged with Alaska stakeholders for future product applications (BLM, Forest Service and National Parks).
 - Confirmed Carbon SMAP Early Adopter candidates.

- Identified areas for collaboration between SMAP and the NASA ABoVE Campaign (action continuing into Phase E).
- **January 7-8, 2014**
SMAP Focus Session on Health and Disease Exposure
Centers for Disease Control and Prevention, Atlanta, GA.
Focus Session Goals were to identify the challenges and needs of communities within CDC (Drought, Hazard, Heat Famine and Zoonotic) and provide information on value of soil moisture applications; to incorporate SMAP data into the Environmental Public Health Tracking database; and to link SMAP Community to CDC so health related research can leverage expertise, data and models from both agencies.

Actions taken from SMAP Focus Session on Health and Disease Exposure
 - Connected SMAP Early Adopters focused on health to the appropriate branches within CDC (action continuing into Phase E).
 - Provided SMAP soil moisture data to the CDC Health Tracking Database.
 - Agreed to plan a follow on discussion for specific health impacts that will benefit from SMAP data (action continuing into Phase E).
 - Created a Poster for NASA HQ on Health Impacts of SMAP Data.
- **October 17-18, 2012**
SMAP/GRACE/GPM and SWOT Joint Mission Tutorial
USGS National Center, Reston, VA.
Tutorial Goals were to identify a large target audience for multi-sensor hydrology data; to understand user requirements for using soil moisture and other NASA data in various fields of hydrology; to merge mission data products in order to leverage research in hydrology and water management; to identify data models and research where SMAP, GPM, GRACE-FO and SWOT can help address climate and hydrology policy questions; and promote SMAP Early Adopter research and collaboration opportunities.

Actions from SMAP/GRACE/GPM and SWOT Joint Mission Tutorial
 - Planned more communication between SMAP, GRACE and GPM to understand how product will be synergistic (action continuing into Phase E).
 - Communicated solicitation for Early Adopter candidates seeking to use SMAP in conjunction with Grace and GPM.
 - Coordinated with SWOT mission to develop an Applications Program and Early Adopter Program similar to SMAP mission-future collaborations to be discussed.
 - Expanded of Early Adopters internationally (India, United Kingdom).
- **September 18-20, 2012**
SMAP/ICESat-2 Joint Mission Tutorial
Alaska Satellite Facility, Fairbanks, AK.
Address value-added data products and science returns from combined SMAP/ICESat-2 data; identify the challenges and needs of cryosphere, northern forests, land and ocean science applications; identify new users for SMAP mapping radar and ICESat-2 altimetry data, e.g. vegetation mapping, sea-ice mapping, etc.; motivate joint mission efforts and innovative applications with prelaunch hydrosphere and cryosphere applications using other mission products from existing missions; and promote SMAP Early Adopter research and collaboration opportunities.

Actions from SMAP/ICESat-2 Joint Mission Tutorial

- Identified needs and applications of a SMAP 1km product potential-development to be discussed with the mission.
- Discussed data format (HDF 5) challenges for some end users. Action taken by NASA Headquarters to make KMZ a standard format. KMZ decision implemented 2013.
- Identified collaborators in Alaska interested in applying SMAP data-New SMAP Early Adopters
- Linked the use of SMAP Freeze Thaw data to Sea Ice and Permafrost communities.
 - Follow on meetings planned for Sea Ice and Permafrost were promised (action continuing into Phase E).

• **February 29, 2012**

Focus Session at Palo Verde Nuclear Power Plant

Tonopah, AZ.

The goal of the Focus session was to translate the applications of remote sensing products (e.g., those from SMAP) and explain how the data products may offer an effective means of meeting the Palo Verde Environmental Awareness and safety requirements. The safe operation of such an innovative system is contingent on plant operators having access to timely and accurate information on a variety of environmental factors. Satellites can monitor changing water resources (crucial for maintaining reactor cooling under the stress of climate change) and track field operations; this information can be made available to decision makers in remote areas. Other products might address the environmental factors that would trigger changes to emergency responses and decisions.

Actions from Focus Session at Palo Verde Nuclear Power Plant

- Identified format issues. HDF5 not compatible with Emergency Response community needs
- Follow up discussion with other Emergency Centers in an effort to coordinate resources for applying satellite data product for emergency planning (action continuing into Phase E)
- Request for SMAP products in GIS format communicated to NASA HQ and to DAACs.

• **February 16-17, 2012**

**Focus Session for Arizona State University Urban Modeling Community
Arizona State University (ASU), Phoenix, AZ.**

The goals of this Focus Session were to assess the value of SMAP in relation to water resource management in the world's arid regions; to discuss the format and delivery mechanisms for SMAP data products; ensure rapid ingestion of SMAP data after it's 2015 launch; identify challenges and opportunities related to the use of SMAP data in urban settings; and explore possibilities for collaborative research between NASA and ASU

**Actions from Focus Session for Arizona State University Urban Modeling
Community**

- Collaborated with ASU for researching water management projects in Urban areas.

- Communicated details of data products and format for urban modeling community.
- Solicited Early Adopters for using SMAP in Urban settings

- **October 14, 2011**
USDA Focus Session , U.S. Department of Agriculture
Washington, DC

The goal of this Focus Session was to determine what form an agreement should take with regards to cooperation between USDA agencies and the NASA SMAP mission. Multiple agencies were invited to present how soil moisture remote sensing products could be incorporated in their mission.

Actions from USDA Focus Session

- Drafted MOU between NASA and USDA on Soil Moisture Science and remote sensing (MOU will be signed by the Secretary of Agriculture and the NASA Administrator in early 2015).
- Formed a USDA Soil Moisture Working Group to coordinate USDA cooperation with SMAP and other NASA activities

- **February 2011**
Focus Session for Interagency Surface Dynamics Working Group (ISDWG),
Tucson, AZ

The goal of this Focus Session was to introduce this interagency group to SMAP products and discuss how SMAP ties into their capabilities.

Actions from ISDWG Focus Session

Completed Early Adopter proposals from USACE CRREL and DoD Soil Moisture Applications Consortium (ARL, NRL, ERDC)