

A.22 SCIENCE UTILIZATION OF THE SOIL MOISTURE ACTIVE-PASSIVE MISSION

NOTICE: Amended on October 19, 2015. On July 7, 2015, SMAP's radar instrument stopped collecting data, though its radiometer continues to function nominally. Due to the change in SMAP data collections, this amendment allows previous proposers an opportunity to withdraw previous submissions and submit revised proposals. New proposers may respond to the amended solicitation. New text is in bold and deleted text is struckthrough. Notices of Intent (NOIs) are requested to inform NASA regarding both withdrawal and submission of proposals to this amendment. Notices of Intent are requested by December 2, 2015. Proposals are due January 20, 2016.

1. Scope of Program

Proposals are solicited for science investigations that ~~exploit~~ **utilize** data from the Soil Moisture Active-Passive (SMAP) mission.

The SMAP satellite launched on January 31, 2015, and started taking science data in April. The radar instrument functioned nominally until July 7 when it stopped returning data. Level one data for both instruments (i.e., backscatters and radiances) can be found at <https://www.asf.alaska.edu/smap/data-imagery/> and <http://nsidc.org/data/smap/smap-data.html>, respectively. As the radiometer continues to function and return high quality observations, SMAP will be an important data sources to aid Earth system modeling and studies.

The Soil Moisture Active-Passive mission will **primarily** use ~~both active (radar) and~~ passive (radiometer) L-band microwave remote sensing to determine the land surface soil moisture and freeze/thaw state. These measurements will advance the study of the water, carbon, and energy cycles, both individually and at their points of interconnection.

SMAP is identified as a first-tier mission in the National Research Council report *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond* (http://www.nap.edu/catalog.php?record_id=11820). This report is hereafter referred to as the Decadal Survey. Information on the SMAP mission and its capability to fulfill the objectives laid out for it in the Decadal Survey can be found in the SMAP Workshop report (<http://nasascience.nasa.gov/earth-science/decadal-surveys>), as well as at <http://nasascience.nasa.gov/missions/smap>. SMAP is the first planned mission from the Decadal Survey recommended series of missions.

The objective of this solicitation is to select research projects that will respond to the Decadal Survey outlined science priorities for the SMAP mission, as well as enable pursuit of new methods of exploiting SMAP's observations for Earth System Science. These priorities and possibilities include:

- 1) Enabling advances in the study of the water, carbon, and energy cycles, especially on those topics that deal with the intersections of these cycles.
- 2) Exploring the impact of soil moisture variability and its role as the ‘memory’ for the land surface, on weather and climate.
- 3) The role of soil moisture in floods, droughts, agricultural productivity, and public health related concerns (e.g., vector borne diseases).

2. Types of Proposals Solicited

2.1 Utilization of SMAP Products for Process Studies

The state and amount of water in the soil is a critical determinant in many complex Earth System processes. For example, it can limit or enable photosynthesis. It can determine the ratio of precipitation and snowmelt that percolates into the ground or runs off. The amount of water in the soil will affect if incoming radiation is used to heat the lowest layer of the atmosphere or to evaporate water, which might later be used to form clouds and/or precipitation. Studies are encouraged that use the SMAP observations to improve our understanding of these and other processes, be they aspects of the water, carbon, or energy cycles.

2.2 Utilization of SMAP for Model Evaluation and Improvement

SMAP's ~~9-km active-passive product~~ **36 km passive product**, with some inherent radio frequency interference mitigation, will offer an unprecedented look at global soil moisture variability. This should be instrumental in global evaluation of land surface model performance and highlight areas that can be improved. Through this work, evaluation and improvement of other types of models (i.e., those used for weather forecast, climate prediction, or vegetation activity) should also be possible.

2.3 New Algorithms

2.3.1 *Novel topics*

The L-band observations of the SMAP ~~radar and~~ radiometer could be used to observe aspects of the Earth System other than land surface moisture. NASA will accept proposals that seek to develop new uses for SMAP data that are not duplicative to other supported efforts (e.g., L-band measurements for sea surface salinity are already supported by the Aquarius project). New uses of the SMAP data will be viable only if they pursue high priority gaps in our global observing system.

2.3.2 *Similar Data products*

The level one data products (e.g., brightness temperatures, ~~radar backscatters~~) can be used in other fashions than planned by the SMAP project to produce soil moisture (both surface and root-zone), freeze-thaw state, and carbon-cycle metrics (e.g., net ecosystem exchange). NASA will accept efforts that propose new algorithms that would offer data products that would be significantly different than those produced by the SMAP project, provided that they present

substantial added value. This may be accomplished by combining SMAP data with other satellite data products (e.g., surface temperature or precipitation). Proposed new algorithms should not require ongoing ingesting of limited area land-based or airborne-based observations. **With the loss of SMAP's radar, NASA is interested in alternative methods to downscale the radiometer soil moisture to finer spatial scales.**

2.4 Exploitation of Radar informed data products

Although of limited temporal coverage, the SMAP data products that incorporate its radar data may be used for successful scientific study, particularly the possibility of evaluating NASA's intended approach to create a 9 km active-passive product. Significant use of these discontinued radar-informed data products may contribute to remotely-sensed earth system science studies.

3. Requirements

All proposals submitted in response to this solicitation must exhibit comprehensive knowledge of the relevant SMAP data products to be employed. Details on these products are available in the SMAP handbook (<http://smap.jpl.nasa.gov/mission/description/>) and Algorithm Theoretical Basis Documents (ATBDs). Proposers should also be knowledgeable of the currently planned SMAP calibration and validation efforts and should not look to duplicate those. Any proposed activities that might replicate calibration and/or validation activities should explicitly defend those with a description of their well-documented additional value.

All proposed studies must plan to use SMAP data in a critical way. Proposed studies should not be accomplishable without SMAP data. Proposers must, therefore, be cognizant of the temporal limitations of SMAP data availability during the lifetime of their projects. Therefore, climatological studies are less likely to be relevant to this solicitation, given that no more than three years of SMAP data would be available to inform the proposed project.

New algorithms (Section 2.3) should be globally implementable, with an expectation of adequate performance over a majority of the relevant Earth surface. Proposals to develop new algorithms should include a description of:

- a.) Preparing and writing an ATBD
- b.) Product calibration and validation
- c.) Error characterization

Proposals from currently funded NASA investigators, especially those connected with the SMAP science team, Terrestrial Hydrology, and/or Ecology programs should make clear in their proposals how the proposed work is different from their currently funded projects.

4. Programmatic Information

Total funds available for work selected under this solicitation are approximately \$4.5M per year for three years. The program anticipates making a total of approximately 30 selections. There is

no a priori planned distribution of projects across the solicited areas of Section 2. Proposals that are outside of the research areas described in Section 2 and/or those that do not meet the requirements of Section 3 will not be considered. It is anticipated that project start dates would be **on or soon after April 1, 2016.** ~~between October 1, 2015, and January 1, 2016.~~

5 Science Team Membership

The current science team of the SMAP mission is focused on calibration and validation of the SMAP data products. This team will be active for a majority of the three-year operational phase of the mission. Principal Investigators of the selected investigations, solicited here, would be invited to join this team, and, as such, be invited to future SMAP science team meetings and should plan accordingly.

6. Instructions Regarding Previous Submissions

Investigators who have previously submitted proposals to this program element who wish to submit modified proposals must withdraw their previous submissions and resubmit the modified proposal. Investigators who wish to have their previous submission to this program element considered without modification need not resubmit.

7. Summary of Key Information

Expected annual program budget for new awards	~ \$4,500K
Number of investigator awards pending adequate proposals of merit	~30
Maximum duration of awards	3 years
Due date for Notice of Intent to propose (NOI)	December 2, 2015
Due date for proposals	January 20, 2016
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the <i>NASA Guidebook for Proposers</i>
Relevance	Every proposal must address one or more Decadal Survey outlined science priorities for the SMAP mission and/or the priorities and possibilities in Section 1 of this Program Element.
General information and overview of this solicitation	See the <i>ROSES Summary of Solicitation</i> .
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted. See also Section IV of the <i>ROSES Summary of Solicitation</i> and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .

Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH15ZDA001N-SUSMP
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