feature articles

SMAP Applications: Improving Communication for the Palo Verde Nuclear Generating Station

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Introduction

NASA's Soil Moisture Active Passive (SMAP) mission—scheduled to launch in 2014—will use a combined microwave radiometer and high-resolution radar to measure surface soil moisture and freeze/thaw state. It is one of four first-tier missions recommended by the National Research Council's Committee on Earth Science and Applications from Space in its 2007 Decadal Survey.

SMAP data will have significant value for science and applications, as the accuracy, resolution, and global coverage of SMAP soil moisture and freeze/thaw measurements are invaluable across many relevant disciplines. Soil moisture information at high resolution enables improvements in weather, flood, and drought forecasts, and predictions of agricultural productivity and climate change.

In an effort to connect NASA Earth-observing satellite data to practical applications that benefit society, application strategies for the SMAP mission have been developed, and prelaunch activities are now being implemented across a variety of disciplines. These application strategies will provide a fundamental understanding of how SMAP products can be integrated into operational procedures to improve decision-making efforts across multiple disciplines. One such application is described here.

Practical SMAP Application Strategies: Palo Verde Nuclear Power Plant

On February 29, 2012, the SMAP Application Team facilitated a SMAP Applications Focus Session at the Palo Verde Nuclear Generating Station (PVNGS) in Tonopah, AZ. The PVNGS is the largest nuclear generation facility in the U.S., averaging over 3.3 gigawats (GW) of electrical power production in 2008 to serve some four million people. The plant is located approximately 55 miles west of downtown Phoenix and is the primary focus for the Arizona Division of Emergency Management's (ADEM) Radiological Emergency Preparedness (REP) Program. Drills and exercises are conducted regularly to evaluate emergency plans, response capabilities, and related protocols.

The PVNGS is the only nuclear generating facility in the world that is not situated adjacent to a large body of above-ground water. The facility evaporates water from the treated sewage of several nearby municipalities to meet its cooling needs. 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. The application of remote sensing products (e.g., those from SMAP) may offer an effective means of meeting these requirements. 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.

Many of the complex geographic information systems (GIS) tools used today by decision makers exist as standalone modules that are not designed to be interoperable. To address such deficiencies, the Focus Session exercise was designed to introduce a collaborative real-time tool—called the Envirocast® Vision™ Collaboration Module (EVCM)[1]—that will serve as the plant's geospatial Collaborative Common Operating Picture (C-COP) to facilitate the delivery of NASA data products for fusion with end-user products, datasets, and maps from other sources. EVCM also enabled other

[1] The Envirocast® Vision™ Collaboration Module (EVCM) was developed by *StormCenter Communications, Inc.*

federal agencies—such as the National Oceanic and Atmospheric Administration and the U.S. Geological Survey—that have external datasets and assimilation products, to collaborate with Palo Verde decision makers and provide interpretation of specialized data products and visualizations, such as weather model data, and air moisture model data affecting the impact of released radioactive iodine. This collaborative decision environment tool allows for Earth science datasets to be visualized together with the datasets typically used by decision makers, such as population centers, positions of deployed resources in the field, and classified facility information.

During a "hot wash" at the end of the training exercise, **Vanessa Escobar** and **Rafael Ameller** provided a summary of the event to all emergency response representatives and stakeholders at the Emergency Operations Facility (EOF), identifying areas of success and those that need to be improved. In addition to presenting the EVCM tool and its functionality, Escobar and Ameller used the EVCM recording capabilities to revisit and assess communications, data access and distribution, and decisions made during the exercise's scenarios. The visual recordings were played back on the main wall display of the EOF, showing the full collaboration between ARRA field teams, EOF personnel, and representatives from the Federal Emergency Management Agency in Washington, DC.

As part of February's SMAP Focus Session, **Vanessa Escobar** [NASA's Goddard Space Flight Center (GSFC)] and **Rafael Ameller** [StormCenter Communications, Inc.] were embedded in the Arizona Radiation Regulatory Agency (ARRA) team at the Emergency Operations Facility (EOF) during a training exercise designed to portray a response to a nuclear emergency. The ARRA is responsible for conducting a statewide radiological health and safety program as well as enforcing state rules and regulations to control the release and distribution of ionizing and nonionizing radiation. If a nuclear emergency were to occur, the ARRA would be the first entity to evaluate the situation and respond appropriately; thus, accessing and communicating the most up-to-date environmental information is critical. The SMAP Focus Session provided a forum for the ARRA and emergency response community to receive specific support and information on the utility of SMAP soil moisture data joined to the EVCM real-time collaboration tool. Similarly, the focus sessions helped the SMAP Applications Team better understand the data and communication needs of emergency planning facility representatives.

Conclusion

Applying observational data like those that will be available from SMAP via EVCM is seen as a dynamic strategy designed to complement and support emergency operations. Therefore, providing such support groups with prelaunch test algorithms will bring value to the mission's postlaunch applications and data implementation, strengthen the preparation for and response to emergency scenarios, and strengthen relationships with emergency operational agencies in the future. For future exercises, the infusion of NASA products (in particular for SMAP, soil moisture, and humidity) will greatly enhance the awareness of and decision support strategies for the ARRA and other, similar organizations. ■