



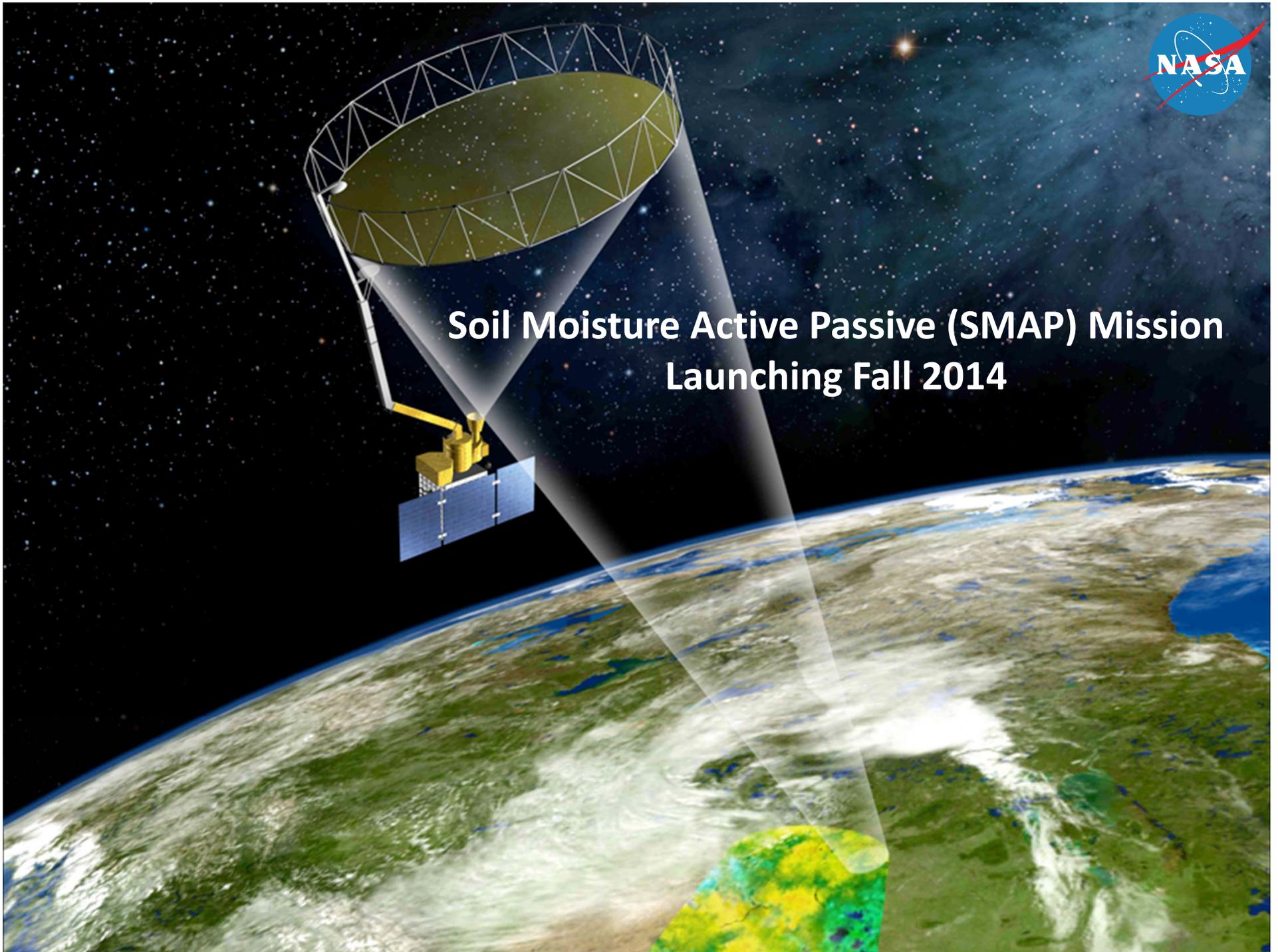
**NASA Soil Moisture Active Passive (SMAP)
And GLOBE: A Soil Moisture Partnership**

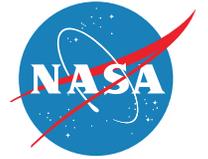
**17th GLOBE Annual Partner Meeting
UMUC & NASA GSFC**

Brian A. Campbell, SMAP Mission Education Lead



**Soil Moisture Active Passive (SMAP) Mission
Launching Fall 2014**

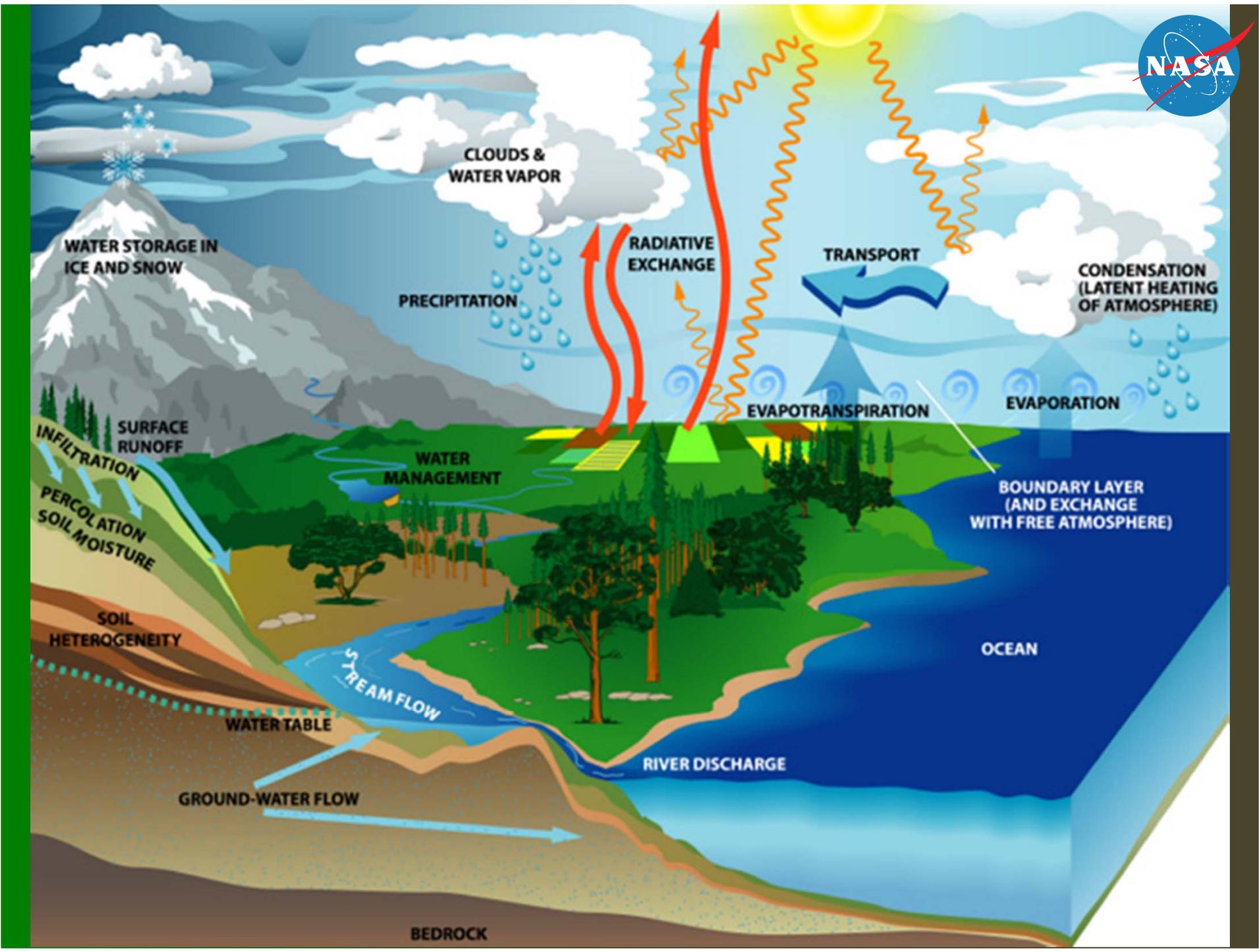


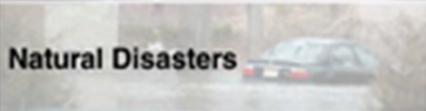
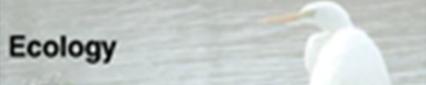
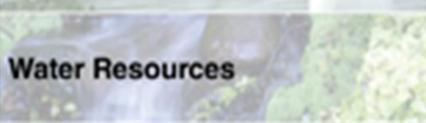


What is SMAP?

SMAP stands for Soil Moisture Active Passive

- **SMAP will provide a capability for global mapping of soil moisture and freeze/thaw state with unprecedented accuracy, resolution, and coverage. SMAP science objectives are to acquire space-based hydrosphere state measurements over a three-year period to:**
- **Understand processes that link the terrestrial water, energy and carbon cycles**
- **Estimate global water and energy fluxes at the land surface**
- **Quantify net carbon flux in boreal landscapes**
- **Enhance weather and climate forecast skill**
- **Develop improved flood prediction and drought monitoring capabilities**



Area	Likely Mission Applications	Potential Mission Applications
 Weather	More accurate weather forecasts; prediction of severe rainfall	Regional weather prediction improvements
 Natural Disasters	Drought early warning decision support; key variable in floods and landslides; operational flood forecasts; lake and river ice breakup; desertification	Fire susceptibility; heat-wave forecasting
 Climate Variability and Change	Extended climate prediction capability; linkages between terrestrial water, energy, and carbon cycles; land/atmosphere fluxes and carbon (CO ₂) source/sink activity for atmospheric greenhouse gases	Long term risk assessments
 Agriculture and Forestry	Predictions of agricultural productivity; famine early warning; monitoring agricultural drought	Crop management at the farm scale; input to fuel loading models
 Human Health	Landscape epidemiology; heat stress and drought monitoring; insect infestation; emergency response plans	Disease forecasting and risk mitigation
 Ecology	Carbon source/sink monitoring; ecosystems forecasts; improvements in monitoring of vegetation and water relationships over land	Wetlands resources and bird migration monitoring; cap-and-trade carbon inventory assessment and monitoring
 Water Resources	Regional and local water balance; more effective management	Variability of water stored in lakes, reservoirs, wetlands and river channels monitoring
 Ocean Resources	Sea ice mapping for navigation, especially in coastal zones; temporal changes in ocean salinity	Provision of ocean wind speed and direction, related to hurricane monitoring
 Insurance Sector	More accurate forecasts of weather; prediction of severe rainfall; operational severe weather forecasts; mobility and visibility	Crop insurance programs; flood insurance programs; tourism and recreation
 Coastal Inundation	Input to sea level rise products	Maps of coastal inundation; ocean winds monitoring for hurricanes
 Drought	Early warning decision support; drought monitor products	Desertification identification
 Flood	Improved forecasts, especially in medium to large watersheds; flood mapping; protection of downstream resources; soil infiltration conditions; prediction of ice breakup	Prediction of the impact of tropical storms on hydrology
 Ecosystem Health	Improvements in monitoring of vegetation health and change; ecosystem dynamics	Wetlands and bird migration monitoring; Rangeland forage productivity forecasts
 Wildfires	Input into fire potential models	Improvements in fuel loading models, especially for non-heavily forested areas

SMAP System Characteristics

	RADAR	RADIOMETER
Frequency	1.2 GHz	1.41 GHz
Polarizations	VV, HH, HV	V, H, U
Resolution	1-3 km*	40 km
Antenna diam	6 m	
Rotation rate	14.6 rpm	
Incidence angle	40 degrees	
Swath width	1000 km	
Orbit	Polar, Sun-Synchronous	
Local Time asc node	6 am	
Altitude	670 km	

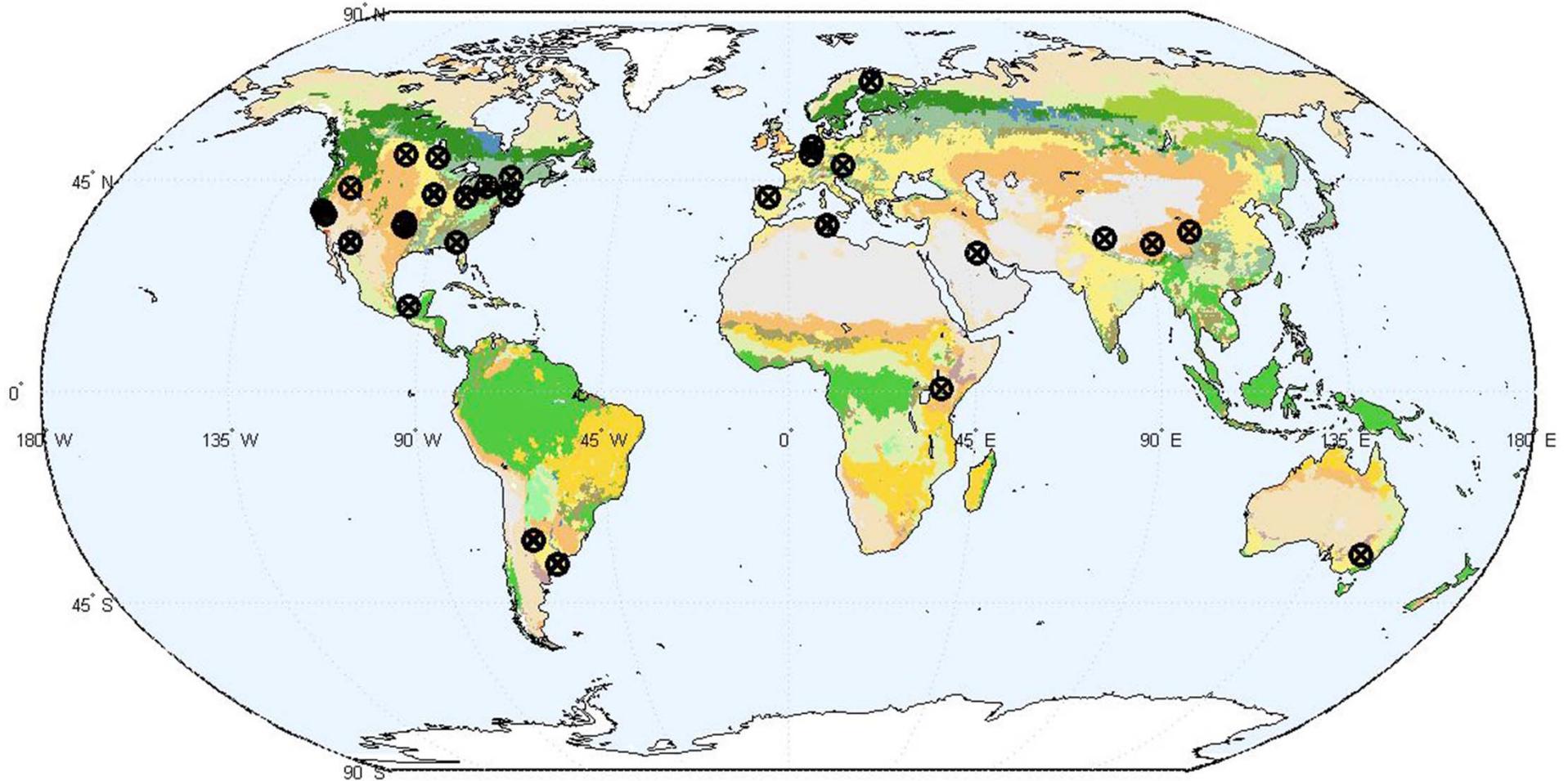
* Over outer 70% of swath

- SMAP will produce a global map of soil moisture every 2-3 days
- SMAP will be traveling at approximately 15,000mph (24,140mph)

The SMAP-GLOBE Partnership

**Hands-On Soil Moisture
Measurements meet Global
Satellite Measurements**

SMAP Cal/Val Partner Sites



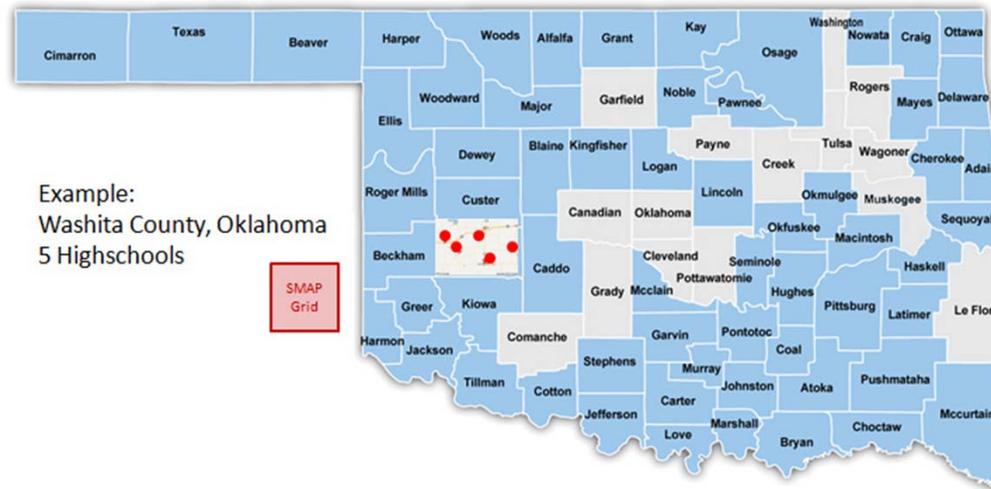
Our goal is to set-up a network cluster of 10 GLOBE schools within a 50 km radius of several of the above SMAP Calibration/Validation (Cal/Val) Partner Sites

...in addition

- **SMAP scientists will develop sampling strategies for GLOBE students at these cluster schools to collect gravimetric measurements of surface soil moisture following an existing GLOBE protocol.**
- **SMAP scientists will provide guidance on the scientific integrity of the GLOBE soil moisture protocols and measurement procedures.**
- **SMAP Education professional will work directly with GLOBE to monitor the activities of the cluster schools.**
- **SMAP scientists are working with GLOBE to make sure ground-based protocol measurements are aligned to the measurements of the SMAP sensors (same type of data reported)**
 - **i.e. Measuring Soil Moisture by Volume vs. Soil Water Content (more about this later)**

An Opportunity For Engagement With GLOBE

High priority for comparison to SMAP data will be clusters of 10 or more schools routinely measuring surface soil moisture (to 5 cm depth) within an area of roughly 40 km x 40 km. SMAP has selected 23 calibration/validation sites around the world and would like clusters of schools surrounding them.

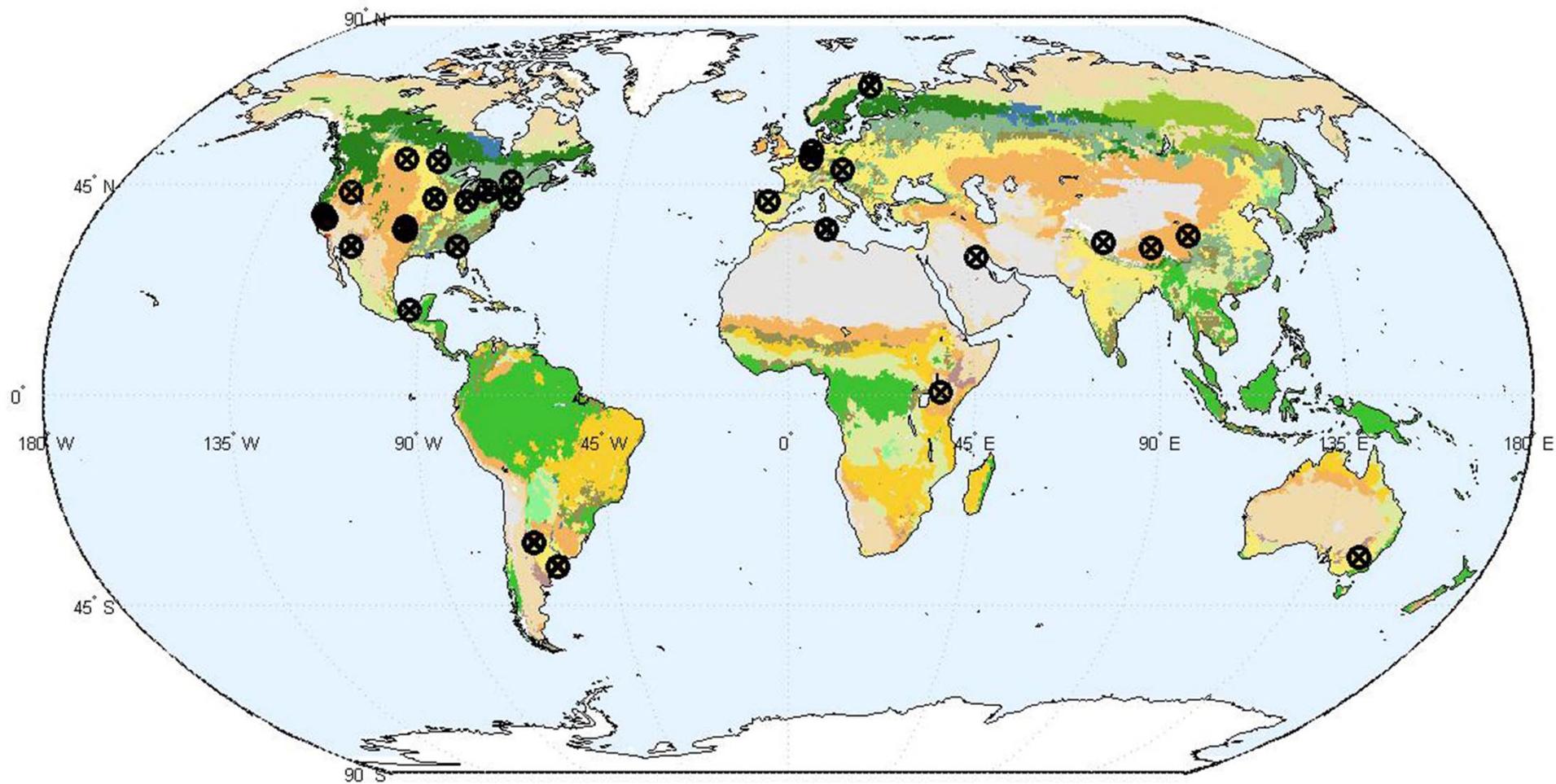


SMAP can work with GLOBE to provide visualizations that compare SMAP, calibration site, and student data.

SMAP scientists can work with GLOBE teachers and students through the GLOBE International Scientist Network (GISN).

SMAP Cal/Val Partner Sites

SMAP Cal/Val Partner Sites



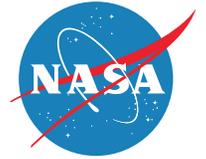
Mutual Support During an SMAP – GLOBE Partnership

- SMAP
 - Provide material for publication through the GLOBE website that explains the SMAP mission, the contributions to it that can be made by GLOBE schools, and attract and inspire GLOBE school participation
 - Establish routine review of all student soil moisture data contributed by GLOBE students
 - Participate in GLOBE events in person and via technology [August 2013 through 2018]
 - Assist in forming partnerships between GLOBE and other organizations interested in or partnering with SMAP such as 4-H and building ties between the agricultural research and applications communities and GLOBE partners, schools, and teachers
- GLOBE
 - Distribute and publicize the SMAP activities and materials through www.GLOBE.gov and incorporate SMAP specific data collection requirements in GLOBE training and materials
 - Develop and provide appropriate data reporting, archiving, visualization, and data distribution capabilities in support of the SMAP partnership and establish routine provision of soil moisture and related data to designated SMAP team members for quality and accuracy review
 - Include SMAP in the planning of and participation in GLOBE events, partner meetings, learning expeditions, etc.
 - Work with SMAP to build partnerships with agricultural research, applications, and education communities

Post Launch Activity in an SMAP – GLOBE Partnership

- Organize and provide supporting material and judges for student research contests (science fairs) [several occasions between October 2014 and 2018];
- Provide periodic reports to the GLOBE community on the SMAP mission and its scientific achievements, blog posts from science team members, visualizations of SMAP data and explanations of its results appropriate to K-12 audiences (at different developmentally appropriate levels of sophistication)
- Support the annual assessment of the SMAP – GLOBE partnership [June 2015 and annually thereafter through June 2018]
- Include the partnership with GLOBE in SMAP's publicity and other communications activities [throughout the duration of the partnership].
- Support student research contests organized by SMAP [several occasions between October 2014 and 2018]
- Provide periodic reports to the SMAP community on GLOBE activities and scientific, educational, and environmental achievements, participation levels, and data reporting
- Conduct an assessment of the GLOBE – SMAP partnership [June 2015 and annually thereafter through June 2018]; and
- Include the partnership with SMAP in GLOBE's publicity and other communications activities [throughout the duration of the partnership].

USEFUL LINKS



SMAP Mission:

Main URL: <http://smap.jpl.nasa.gov>

Facebook:

<http://www.facebook.com/NASA.SMAP>

Twitter: http://twitter.com/NASA_SMAP

Soil Science Education Home Page

<http://soil.gsfc.nasa.gov/>

Soil Climate Analysis Network

<http://www.wcc.nrcs.usda.gov/scan/>

NRCS Soils Website

<http://soils.usda.gov/>

Soil Lady

<http://soillady.com>