Plenary 5
Monitoring Fresh Water from Space with a Focus on Africa

Sponsored by the IAF GEOSS Subcommittee
Moderator: James Graf
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Overview of Fresh Water Measurements from Space

James Graf – USA
Moderator and Speaker
Deputy Director for Earth Science & Technology, JPL
GEOSS Subcommittee

Modeling and Data Distribution

Dr. Ahmed er Raji – Morocco
Principal Investigator for TIGER Project Phase II and investigator at the Royal Centre for Remote Sensing

Impacts and Policy

Hon. Dr. Wilbur Ottichilo – Kenya
Member of Parliament
Former Director General of the Regional Centre for Mapping of Resources of Development and SERVIR data distribution center
## Plenary Session Format

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Major Elements for Assessing Fresh Water Cycle

**Measurements**
- **Types:** In situ, airborne, spaceborne
- **Access:** Widely available
- **Quality:** Accurate calibration and validation

**Modeling**
- **Physical Scale:** Local, regional, global
- **Time Scale:** Daily, weekly, annually, decadal
- **Approach:** Transparent, widely available, “science stamp” of approval

**Decision Support / Action**
- **Level:** Regional, National, International
- **Action:** Policy and economic implications
- **Access:** Widely available, verification,
The GRACE twin satellites are making detailed measurements of Earth's gravity field and revolutionizing investigations about Earth's water reservoirs, over land, ice and oceans.

GRACE also measures changes in water level of large aquifers and surface water.

Launched: 03/2002
SMAP would use a rotating 6-m deployable mesh antenna shared by an L-band radar & radiometer to map soil moisture and freeze/thaw state and resolution of 10 km every 3 days.

*Proposed mission would launch in 2014.*

Improved climate models

Pre-decisional – for Planning and Discussion Purposes Only
Projected SMAP Data Applications

- NOAA/NCEP (X. Zhan): Transition of projected SMAP products to NOAA operational weather, climate, and hydrological forecasts
- USDA/NASS (Z. Yang): US national cropland monitoring using SMAP
- IRI/Columbia U. (A. Ines): Crop forecasting and food security early warning
- Env Canada (S. Belair): Assimilation of projected SMAP data in Environment Canada’s environmental prediction systems
- ECMWF (P. deRosnay): Crop forecasting and food security early warning applications
- Agri-Food Canada (C. Champagne): Soil moisture monitoring in Canada
- Masdar Inst, UAE (H. Ghedira): Mapping Saharan dust emissions for operational decision support

Pre-decisional – for Planning and Discussion Purposes Only
Surface Water and Ocean Topography (SWOT)*

SWOT would use a Ka-band interferometric SAR with 2 swaths, 60 km each to characterize the ocean circulation at a spatial resolution of 10 km and provide a global inventory of terrestrial water bodies.

*Proposed mission would launch in 2019

SWOT measurements would be critical to determining surface water availability and the ocean's capacity to absorb heat and carbon from the atmosphere.

Fresh Water Storage

Pre-decisional – for Planning and Discussion Purposes Only
TRMM placed in low earth orbit the first precipitation radar (PR) to be flown in space, along with a 9-channel SSM/I-like passive microwave imager (TMI), an AVHRR-like visible-infrared radiometer (VIRS), a lightning sensor and a cloud sensor.

The TMI measures the microwave radiation emitted by Earth’s surface and by cloud and rain drops.

Launched: 11/1997
Global Precipitation Measurement (GPM)

The GPM Core Observatory, will study rain and snow characteristics and provide detailed 3-D views of precipitation structure, which help scientists study and understand Earth's water cycle, weather, and climate. Carrying both a dual-frequency radar and a multi-channel microwave radiometer, the Core Spacecraft will provide a new reference standard for precipitation measurements from space.

Will launch in 2013.

GPM will:
- Improve knowledge of precipitation systems, water-cycle variability and freshwater availability;
- Improve climate modeling and prediction;
- Weather forecasting and 4-D climate reanalysis; and
- Hydrological modeling and prediction.

Storm Clouds over Lake Tahoe

Rainfall Data
CloudSat radar provides the global survey of cloud profiles (height, thickness) and cloud physical properties (water, ice, precipitation) needed to evaluate and improve the way clouds, moisture, and energy are represented in global models used for weather forecasts and climate prediction. Scientists are able to “see” inside layers of clouds and estimate the quantities of water and ice contained in the clouds.

Launched in April, 2006.
AIRS is a facility instrument whose goal is to support climate research and improve weather forecasting. AIRS uses infrared technology to create 3-dimensional maps of air and surface temperature, water vapor, and cloud properties.

Launched in May, 2002.

Temperature and Water Vapor Profiles are the primary standard products from AIRS. They are widely used for weather forecast improvement operations and research, climate model validation, and climate process studies. Like all the AIRS products, they are provided globally, daily, over land and ocean under clear and cloudy conditions.