Establishing a Global In-Situ Soil Moisture Measurement Network

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Outline

- **Introduction**
- **Rationale for a soil moisture in-situ measurement network**
  - IGOS-P: ISMWG
  - GCOS
  - GEOSS
- **Measurement Protocol**
- **Strategy?**

Water Cycle Theme: Soil Moisture Recommendations

a) A coordinated plan for soil moisture networks should be developed first at the national and then at the international levels. (*However international standards should be developed and observed (to avoid cross calibration issues*)

b) The capabilities to measure (estimate) soil moisture from space have been demonstrated, but committed missions are needed to perfect these measurements and to determine the utility of soil moisture measurements derived from space.

c) Space measurements provide estimates of the water in the upper 5-10 cm of soil, frequently referred to as soil wetness measurements. While these meet the needs for some applications, many applications require moisture measurements through the soil profile. The relationships between surface soil wetness and deep soil moisture profiles needs to be quantified or at least understood.

d) Vegetation cover can obscure the radiation arising from warm wet soils. Research is needed to find better ways of removing the vegetation effect from the signal that is being used to derive soil moisture.

e) A supersite program is needed to provide the comprehensive data sets needed for sensor evaluation and calibration, and to provide a basis for developing soil wetness algorithms for satellite measurements and the evaluation of climate model outputs. (*These can be used as basis for development of in-situ networks in regions where they can be part of capacity development efforts (e.g. certain African regions))*

The Global Climate Observing System (GCOS)

The Latest Version of the GCOS IP:

- **Recognizes Soil Moisture as an Emerging Climate Variable**
- **Commits to a Global Network of in situ Soil Moisture Measurements**
- **Commits to Developing a Quasi-Operational Soil Moisture Data Product**

WMO IOC UNEP ICSU

GEOSS
10 yr implementation plan

- Several references e.g.:

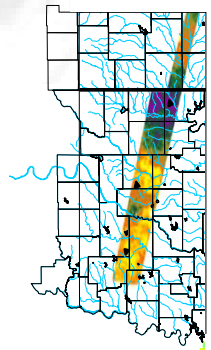
- Water: Improving water resource management through better understanding of the water cycle
- Water-related issues addressed by GEOSS will include: precipitation; soil moisture; streamflow; lake and reservoir levels; snow cover; glaciers and ice; evaporation and transpiration; groundwater; and water quality and water use. GEOSS implementation will improve integrated water resource management by bringing together observations, prediction, and decision support systems and by creating better linkages to climate and other data. *In situ* networks and the automation of data collection will be consolidated, and the capacity to collect and use hydrological observations will be built where it is lacking.

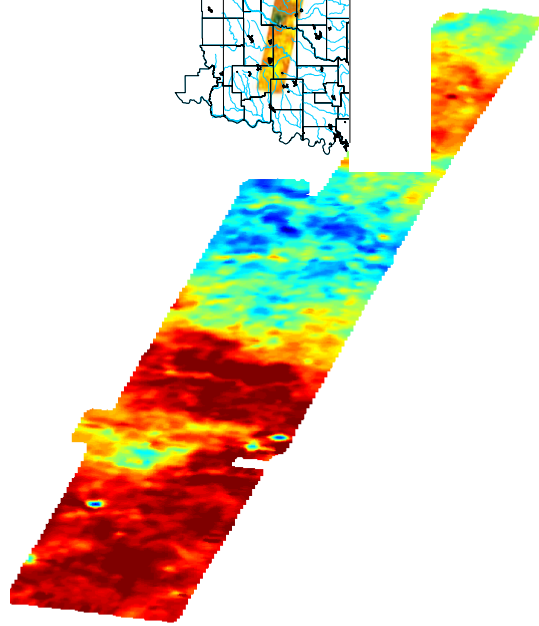
Other Organisations...

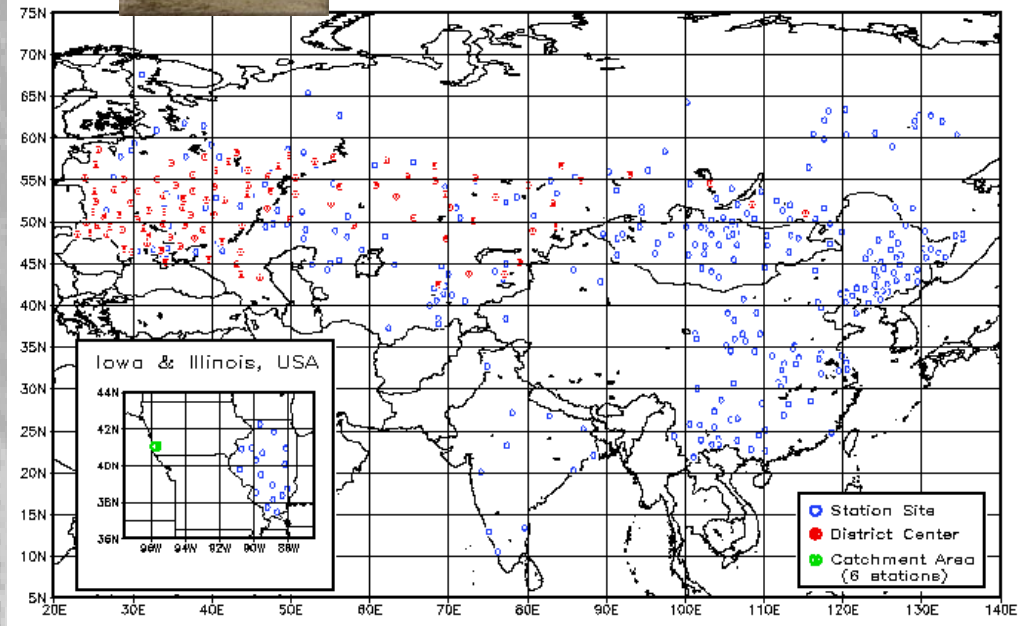
- FAO
  - GTOS
  - AGRYHMET
- UNEP
- UNDP
- Space Agencies
- EU etc.

GEOSS

Role For *In Situ* Sensor Networks







10 km

Measurement protocol

- Global consistent measurements
- Reduce cross-calibration issues and reduce (random) measurement errors
- Enable data (flow) control
- Relate to space-borne validation sites
- Enable unified instructions on installation and measurement procedure
- Discontinuity in series easier to take into account
- Full range of possible soil moisture values

- Important because time series are of essence (limited number of stations)

Measurement Inconsistencies

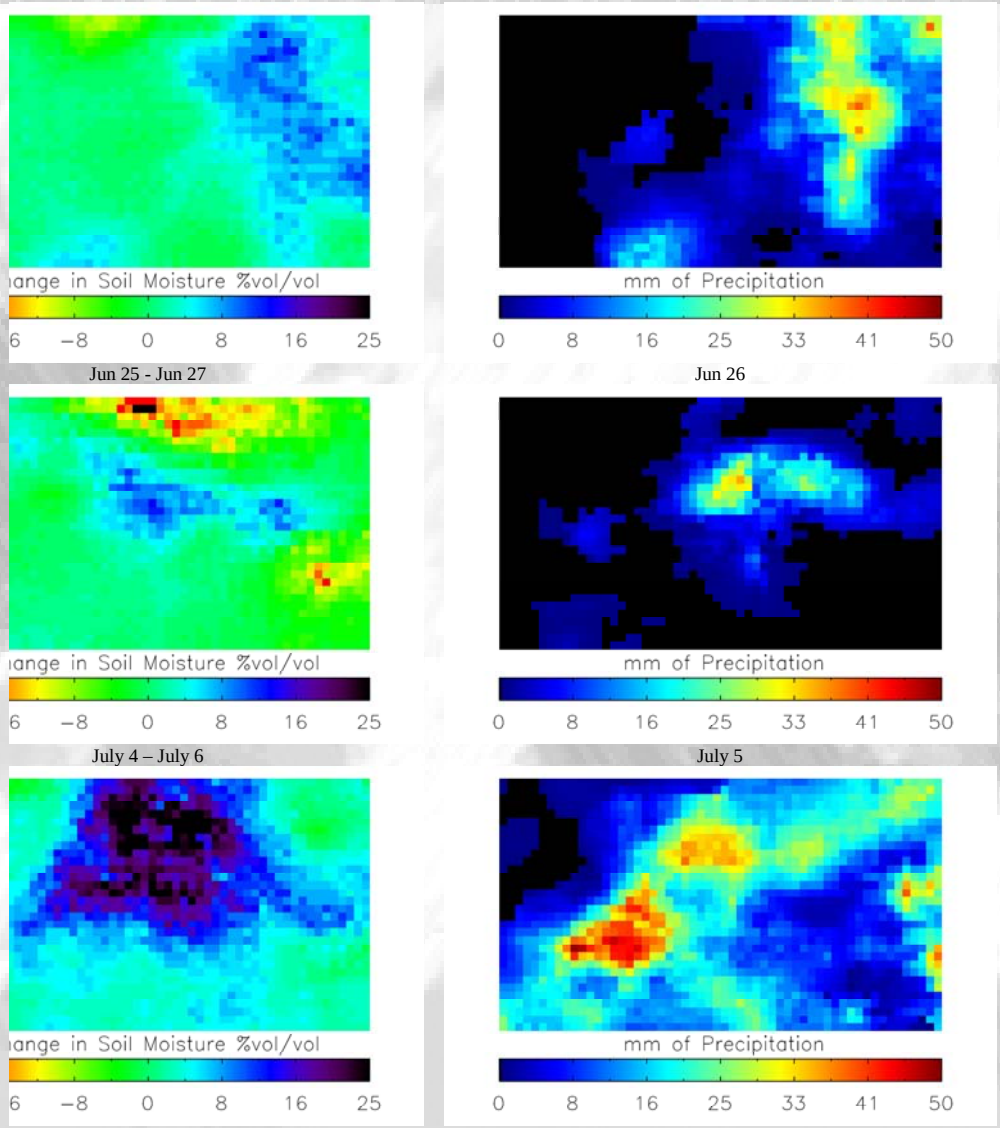
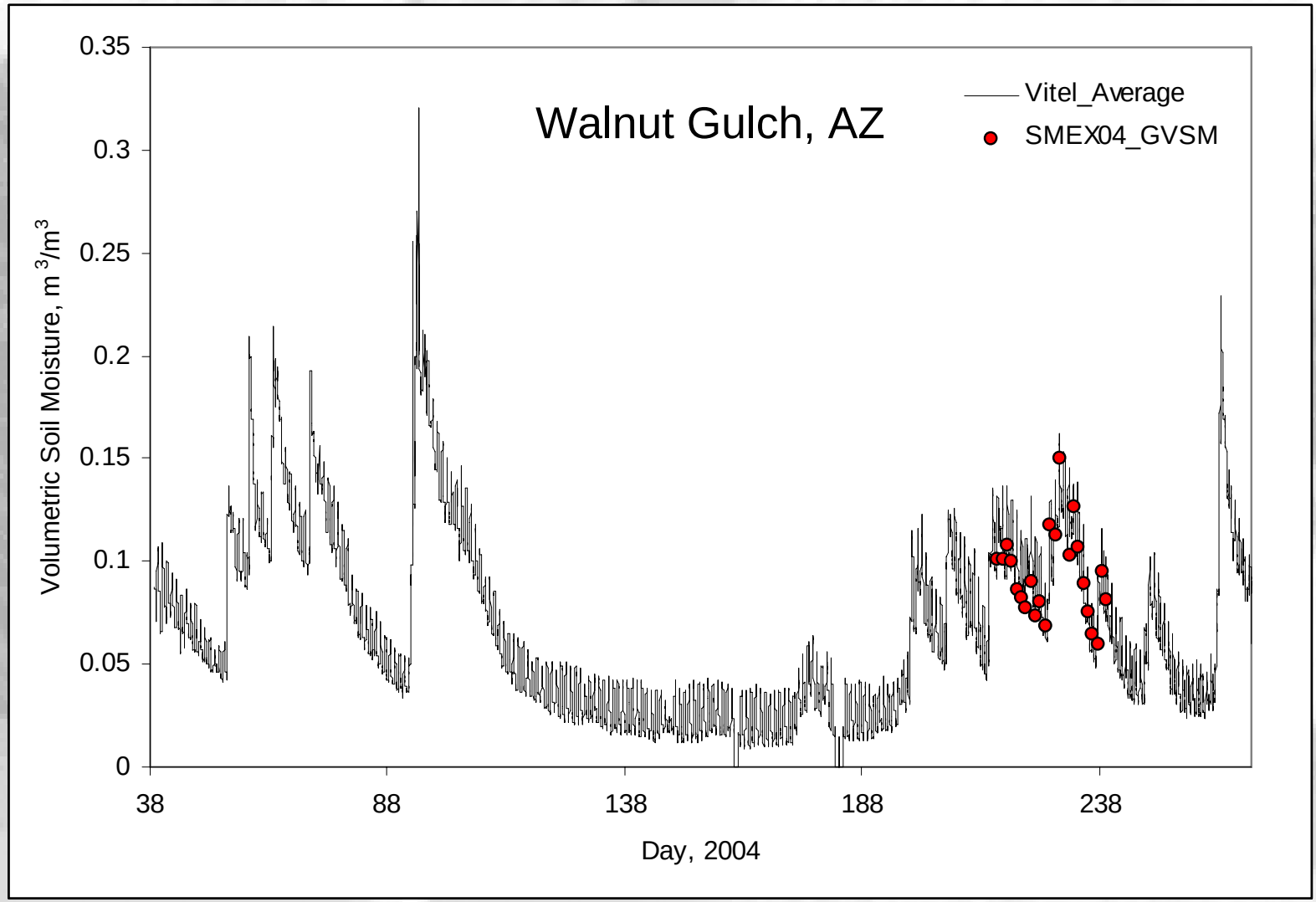


Figure 1. Two day soil moisture differences compared to precipitation events between the observing interval. Retrieved soil moistures are derived from the AMSR-AM overpass

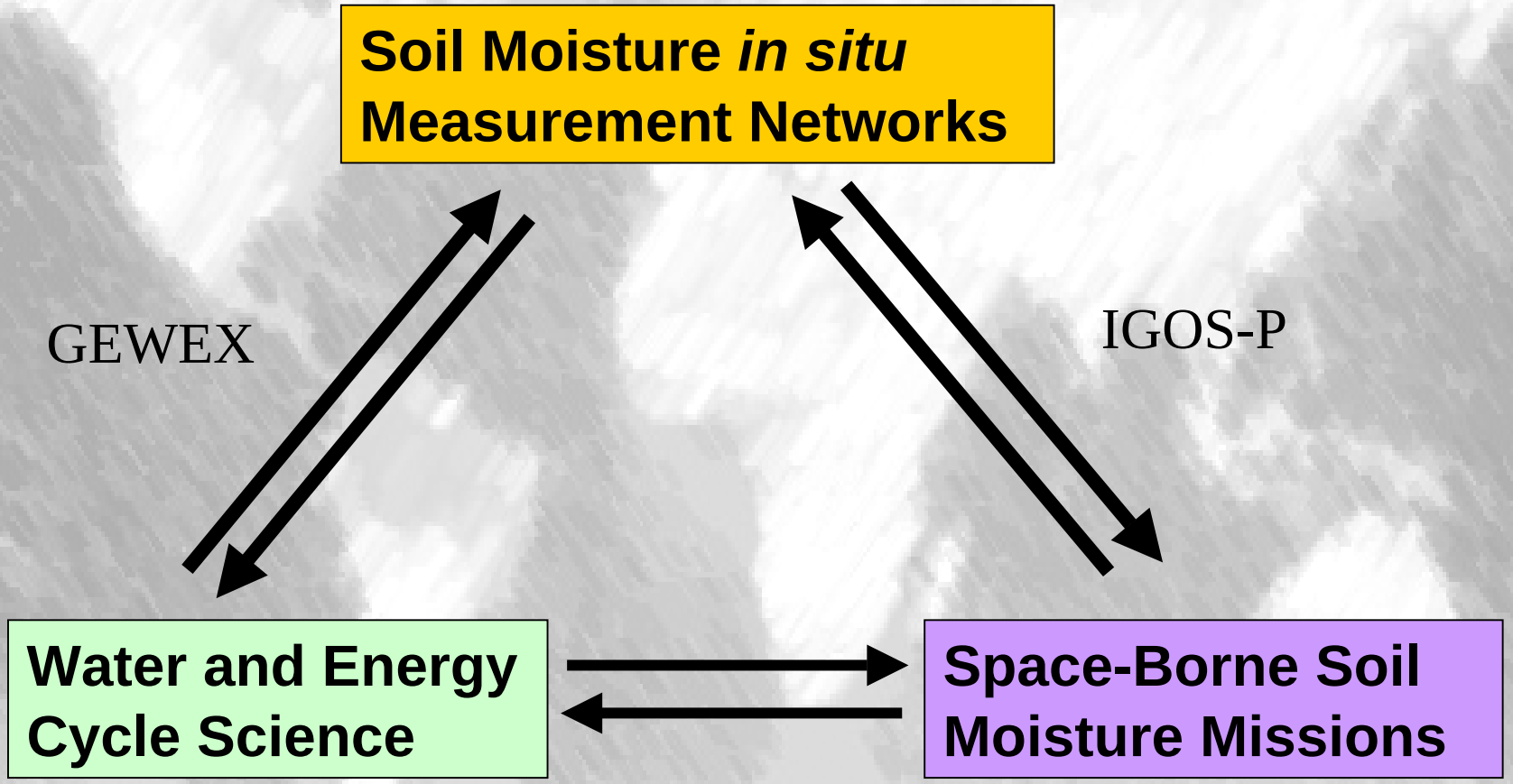
Time Variations Can Be Captured With Automatic Sensors



Benefits of a World-Wide Soil Moisture in situ Sensors:

1. Valuable Data for Evaluating the Time-Response of Environmental Data Record
2. Spawn New Scientific and Operational Developments
3. Link Soil Moisture to Fluxes (co-Location with Flux Towers) at Diverse Sites
4. Evaluate Models and Prepare for Assimilation of Space-Borne Measurements: footprint validation
5. Collect Below-Surface or Profile Measurements
6. Soil moisture index based upon precipitation subject to serious errors

GEOSS


Soil Moisture *in situ* Measurement Networks
GEWEX
IGOS-P
Water and Energy Cycle Science
Space-Borne Soil Moisture Missions