Soil Moisture Smart Sensor Web Using Data Assimilation and Optimal Control

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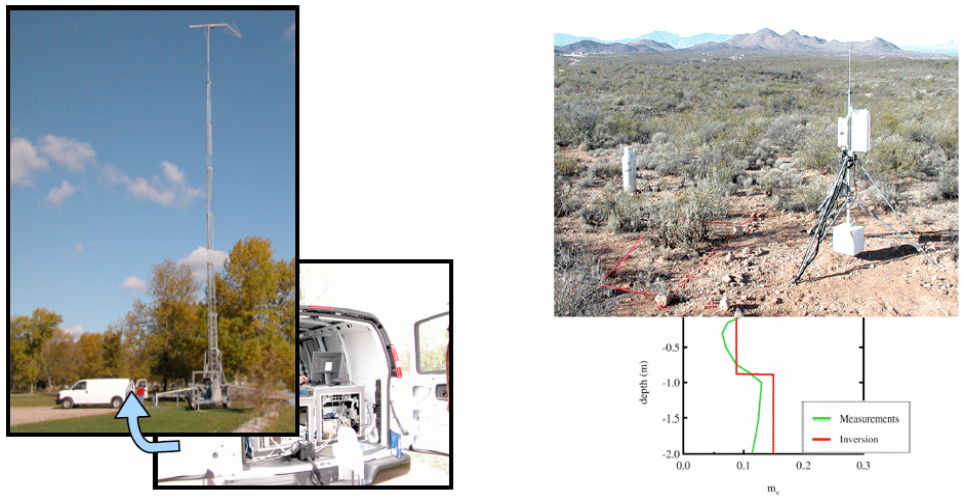
Objective

The objective of the project is to enable a guided/ adaptive sampling strategy for the in-situ sensor network to meet the measurement validation objectives of the spaceborne sensors with respect to resolution and accuracy. The sensor nodes are guided to perform as a macro-instrument measuring processes at the scale of the satellite footprint, hence meeting the requirements for the difficult problem of validation of satellite measurements. The design and demonstration of the smart sensor web including the control architecture, assimilation framework, and actuation hardware are the goals of this project.



Using the sensor web at multiple scales to provide information to the data assimilation and control system.

Approach

The in-situ network can be dynamically controlled to sample the field in a guided fashion. We will develop a coupling between data assimilation and the command of the sensor web such that the measurements are taken strategically within the network. The real-time data assimilation will track the conditions for variability in soil moisture and guide the sensor web to modulate its measurement duty-cycle and other parameters across the network. This is an adaptive sampling network guided by the data assimilation system that can feed back the value of each additional measurement.

Co-I's/Partners

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- Demos Teneketzis / University of Michigan

Key Milestones

- Data Assimilation
  - design, implementation, and simulation 11/07
  - initial integration with control system 05/08
- Control System Architecture
  - design of architecture 06/07
  - numerical implementation 11/07
  - initial integration with assimilation 05/08
- Logic Actuation
  - design and simulation 05/08
  - initial integration with control system 11/08
- Integration and Demonstration
  - control system and assimilation 12/08
  - actuation & control system, multiple nodes 08/09
- Reporting: bimonthly, annual, final

$TRL_{in} = 2$

ESTO Earth Science Technology Office