SoOp-AD: Signals of Opportunity Airborne Demonstration

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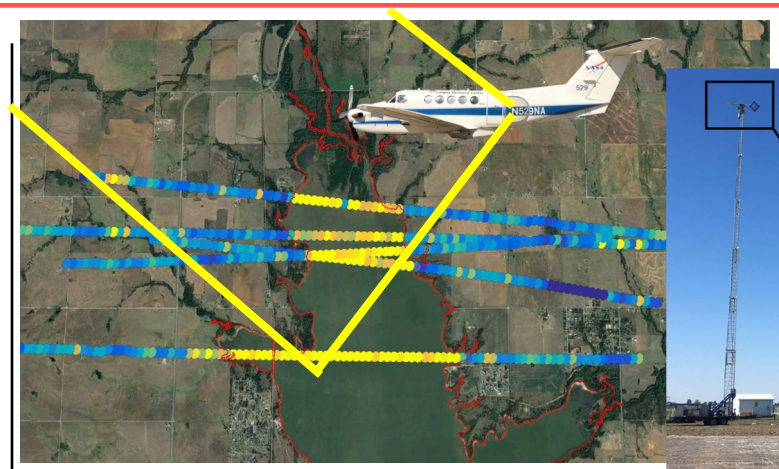
Objective

- Develop new microwave remote sensing instrument to measure root zone soil moisture (RZSM).
- Develop an airborne instrument to demonstrate concepts of Signals of Opportunity (SoOp) reflectometry at P- and S-band frequency ranges for RZSM.
- Measure soil moisture within 100 m resolution (airborne), 0-30 cm sensing depth (SMAP is 5-6 cm) and sensitivity of 0.04 (volumetric) below the first few cm of soil.
- Provide improved RZSM product, as compared to those from model assimilation.
- Enable a spaceborne SoOp instrument with substantially smaller antenna (75 x 75 cm) vs. radiometer and orders of magnitude lower power vs. radar, while meeting 1 km resolution requirement.



SoOp-AD utilizes reflected P- and S-band digital signals to measure RZSM. Overlay on first "quick-look" data from Little Washita OK experiment (10/16)

Field experiment at Purdue

Accomplishments

- Designed and built P/S-band (240 – 270 GHz) receiver system to demonstrate RZSM from B-200 aircraft
  - Developed a 2x2 for S-band and 1x2 for P-band dual linear polarization array antenna
  - Developed two 4-channel digital receivers for S- and P-band
- Conducted 6 flights over SMAP USDA/ARS sites in Little Washita Watershed, OK to measure reflectivity data over various soils
- Analyzed the data to demonstrate an estimate of surface reflectivity of various soil types (Clay, Sand, and Slit) and water bodies
- Conducted field experiments at Purdue Agronomy Center for Research and Education to characterize the reflected signals to demonstrate soil moisture variation over bare ground from depth of 5 cm to 40 cm.
- Conducted satellite mission feasibility study that included number of "satellites vs coverage on the ground" for future space mission based on CubeSat platform

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TRL_{in}= 3 **TRL_{out}= 5**

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