

ComRAD Update

Peggy O'Neill / NASA GSFC

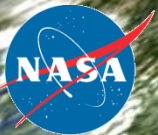
Alicia Joseph / NASA GSFC

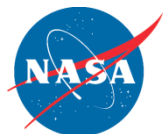
Mike Cosh/USDA

Sab Kim / JPL

Roger Lang / GWU

*4th SMAP Cal/Val
Workshop
Pasadena, CA
November 6, 2013*

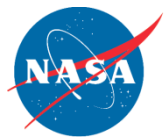




ComRAD Crop Active / Passive Experiment [APEX12]



- **APEX12 Objective** – to obtain a continuous active/passive L band data set over an entire growing season for use in refining SMAP algorithms
- Use **ComRAD** truck-mounted SMAP simulator instrument system
- Baseline SMAP L2 soil moisture data products include:
 - radar-only SM at 3 km resolution (**L2_SM_A**)
 - radiometer-only SM at 40 km resolution (**L2_SM_P**)
 - combined radar/radiometer SM at 9 km resolution (**L2_SM_AP**)
- Possible **analyses** of APEX12 data:
 - improvements to radar data cubes for L2_SM_A
 - better parameterizations of *tau-omega* model for L2_SM_P
 - additional validation of β parameter and RVI for L2_SM_AP



ComRAD Active / Passive L Band Instrument System



Frequency: 1.403-1.424 GHz L radiometers;
1.25-1.3 L band radar

Polarization: dual pol radiometers (LH & LV)
quad pol L radar (HH,VV,VH, HV)

Antenna: 1.22 m parabolic dish w/broadband feed

Incidence Angle Range: 0° - 175°

Azimuth Angle Range: 0° - 300° autonomous
0° - 360° manual

Platform: 19-m hydraulic boom truck

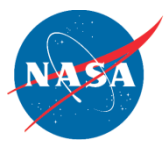
Power: standard AC line power

TIR sensor installed for scene temperature

Can accommodate CropScan VISIR sensor



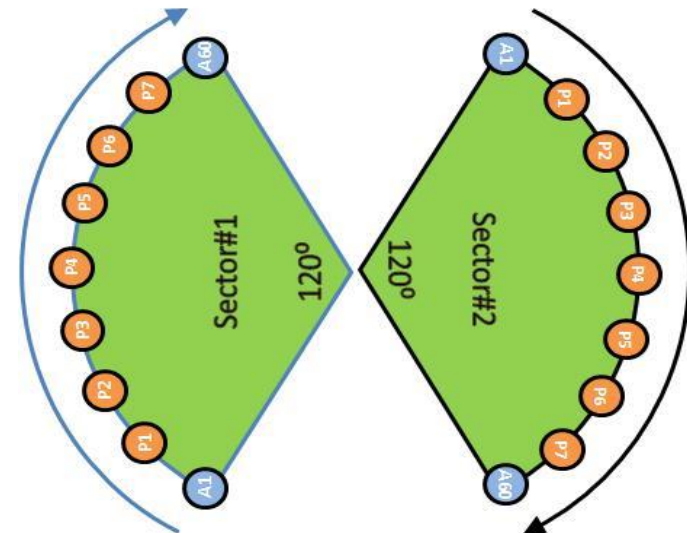
Deployed Over Corn Stubble During SMAPVEX08 (Oct. 2008)

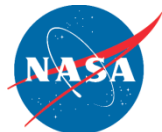


ComRAD L-band Active/Passive Measurements Summer 2012 [APEX12]



- **Vegetation Types:** Corn and Soybeans planted
- **Duration:** June 1 to late October, 2012 (planting to harvest)
- **L-band Active/Passive data** were acquired at a look angle of 40° from nadir at both horizontal & vertical polarization
- **Radar** - 120° azimuthal scan in 4 min. (60 independent measurements)
- **Radiometer** measurements every 15° in azimuth in a span of 120° in 20 min. (7 independent measurements)
- **Plant** architectural measurements of stalk and leaf sizes, orientations, densities, and VWC on each field (weekly)
- **In situ** soil moisture, soil temperature & leaf wetness measurements made (also TIR measurement from ComRAD)
- **CropScan** visible/IR spectral data (handheld)



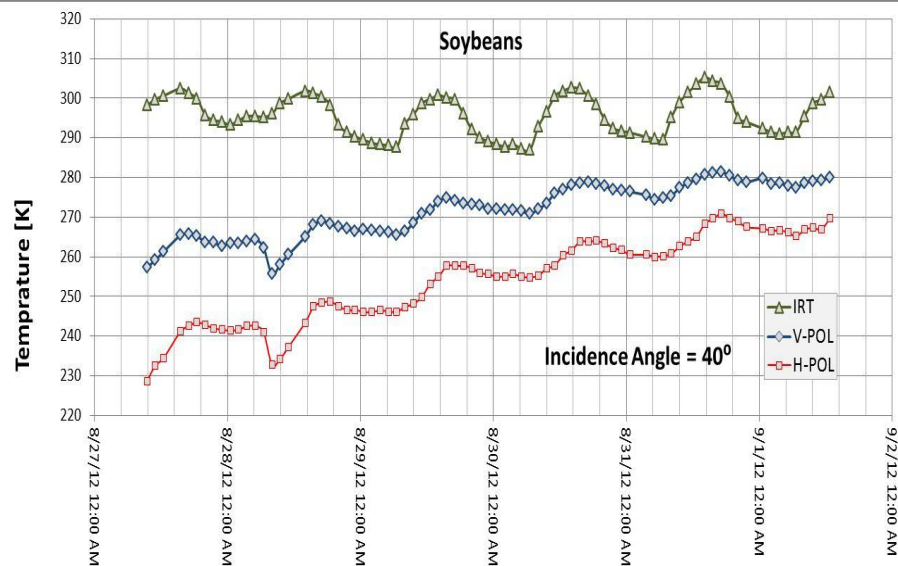
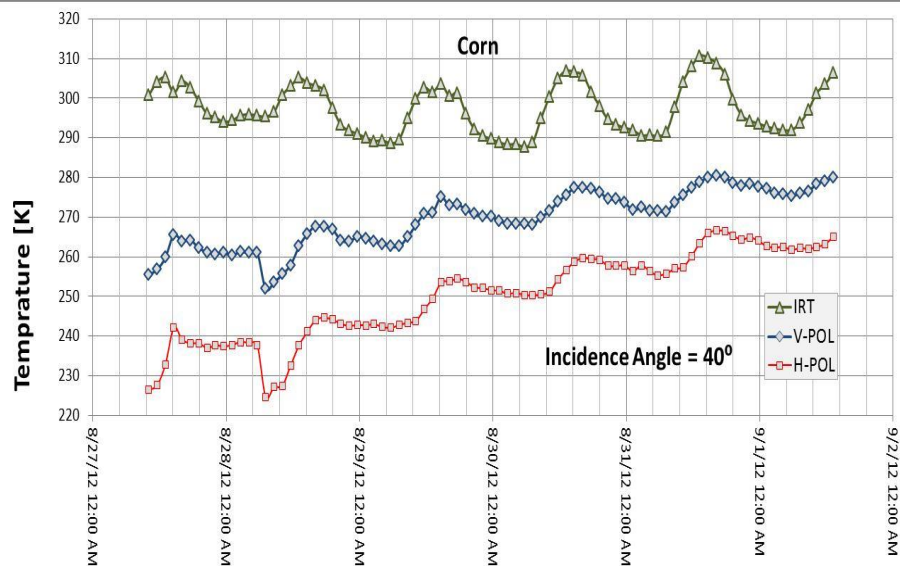


Example of ComRAD Time Series Data

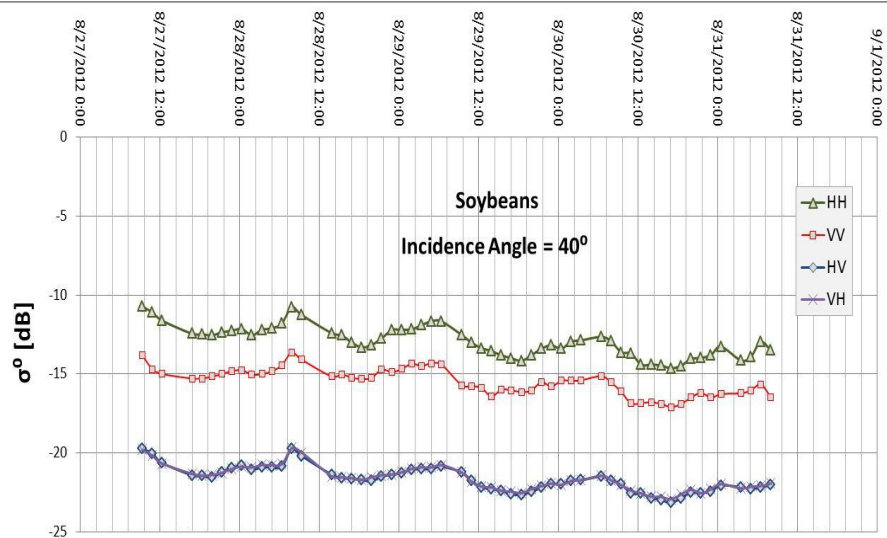
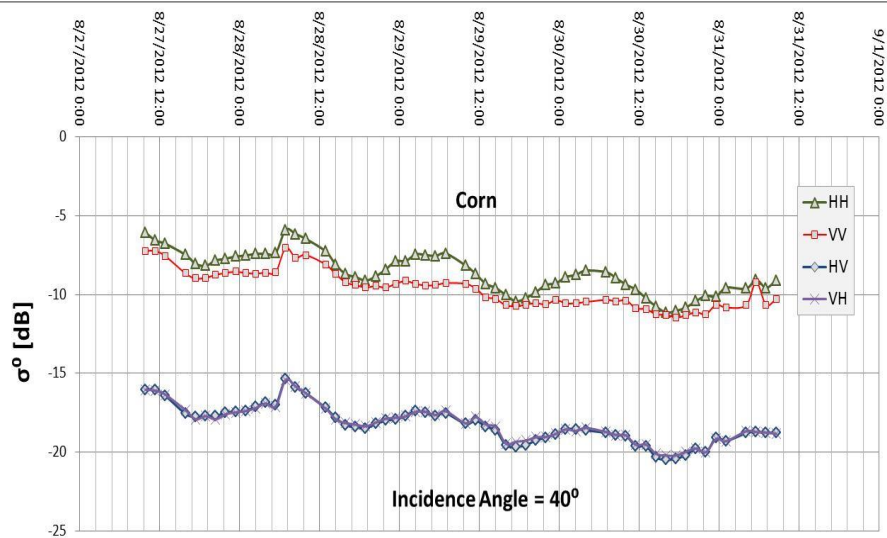
August 27 – September 1, 2012

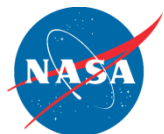


Radiometer



Radar

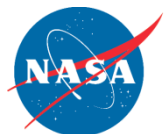




APEX12 Data Delivered



- **Mike Cosh / USDA delivered all ground truth data to JPL:**
 - Soil Moisture / Soil Temperature from 10 installations at 5 cm depth – Hourly
 - Precipitation - Hourly
 - Vegetation Water Content / Biomass / Physical parameters - sampled on a weekly and twice a week repeat
 - Estimated daily vegetation water content estimates for each sensor position during the growing season from 2 m resolution imagery
- **Mehmet Kurum / GSFC delivered all ComRAD microwave data to JPL:**
 - **RADIOMETER master files:**
 - O312SOY.40R2 : contains individual azimuth measurements over soybean field
 - O312SOY.40P2 : contains average of seven independent azimuth measurements over soybean field
 - O312CRN.40R2 : contains individual azimuth measurements over corn field
 - O312CRN.40P2 : contains average of seven independent azimuth measurements over corn field
 - **RADAR master files:**
 - SOY12.40 : contains average of up to 60 (sixty) independent measurements within about 120 degrees radar sweep over soybean field
 - CRN12.40 : contains average of up to 60 (sixty) independent measurements within about 120 degrees radar sweep over corn field
 - **ANGLE file**
 - **README file**



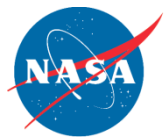
Data Cube Status



IGBP class	Mv range covered?	VWC range covered?	Can APEX14 help?	Comment
Evergreen needle	Δ	Δ	no	CanEx
Evergreen broadleaf	Δ	Δ	no	CanEx
Deciduous needle	Δ	Δ	no	CanEx
Deciduous broadleaf	O	Δ	maybe	CanEx, SMAPVEX12
Mixed forest	Δ	Δ	no	CanEx
Closed/Open shrub	Δ	Δ	no	TarraDowns
Woody Savanna	Δ ?(Tonzi)	Δ ? (Tonzi)	maybe	TarraDowns. Dara found an anomaly.
Savanna	Δ	Δ	no	SMAPEX
Grassland	O	Δ	yes	SGP99, CLASIC, CanEx, SMAPVEX12
Cropland: wheat	O	O	yes	CLASIC, SMAPVEX12
corn	O	O	no	SMEX02, APEX12, SMAPVEX12
soybean	O	O	no	SMEX02, APEX12, SMAPVEX12
rice				Not applicable (flooded)
Crop/pasture mix				Not applicable (too rare)

O: yes, Δ: partly when at least one value within the entire range is observed.

Note: 'roughness range' is not evaluated here because covering its range is impossible.

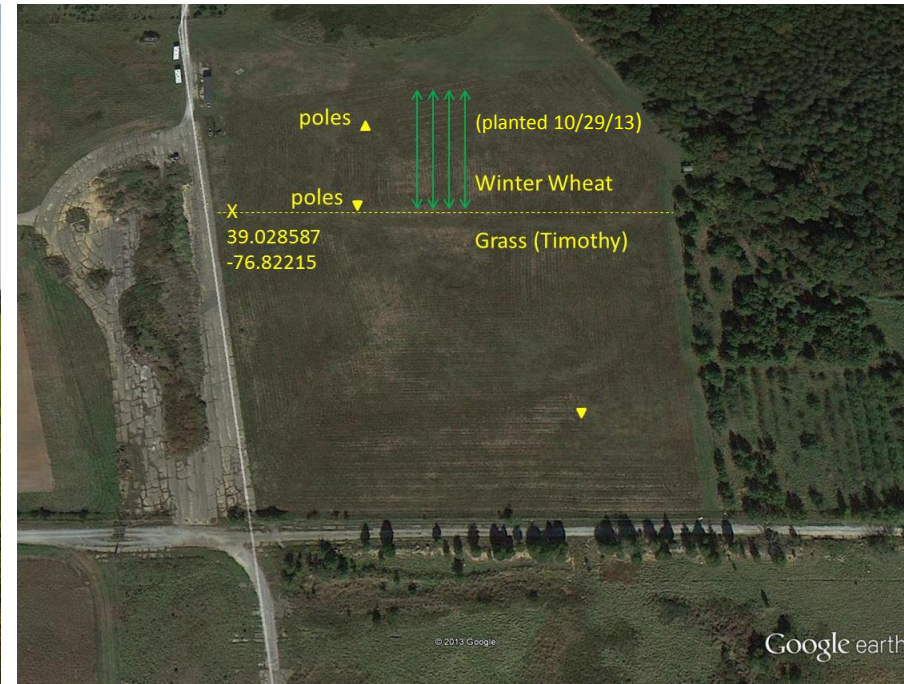


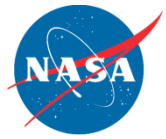
ComRAD Field Experiment in 2014 [APEX14]



- address data cube needs by measuring winter wheat and timothy grass (hay)
- proposed start is early spring 2014, continuing through harvest [winter wheat planted 10-29-13]
- ComRAD updates over winter (in addition to some component checks/replacements):
 - convert hardware signal path and measurement programs to new E5072A VNA (more VNA power should increase cross pol response to short vegetation)
 - antenna waveguide feed being redesigned to reduce small amounts of cross talk between polarizations
 - new hydraulic valve in truck for more consistent rotational speed

APEX14 test site near GSFC & USDA in Beltsville, MD





BACKUP