WEBINAR Q&A

The Applications and Benefits of Synthetic Aperture Radar (SAR)

How can I share a recording of this webinar?
A recording of this webinar can be found here.

Are the SAR tutorials available to anyone?
Yes they are! There are several SAR tutorials available on the SARmap website at the bottom of the page (http://www.sarmap.ch/wp/index.php/software/sarscape/). We are also in the process of developing more SAR tutorials that will be available on our website (https://www.harrisgeospatial.com/Learn).

Can we use SAR for detecting landslides induced deformation of 10s of meters? / I am interested in mm surface deformation linked to landslide. Can this be obtained using Sentinel-1 data?
SAR can be used to detect cm to mm scale changes of deformation on landslides, and yes this can be done with Sentinel-1 data. To get these finer scale changes, you want to use workflows such as SBAS and PS, which have much higher accuracy with a large stack of temporal data versus single paired interferometry. To get a view of landslides that have meters of deformation we have two specific tools. The issues with large deformation is there is such low coherence from the pre and post SAR data that you may be unable to track specific pixel changes. The first tool is the DInSAR MAI, which is best for large deformations with meters of movements such as earthquakes, the other is amplitude tracking, which tracks the movement change of fast moving features such as some landslides and glacier movements.

Can you give examples of geological applications?
There are several ways SAR data can be used in geological investigations. Typical examples are volcano and earthquake deformation using interferometry (InSAR, PS, SBAS). However, you can also use SAR interferometry for monitoring of land subsidence or uplift due to karst and/or sinkhole development, salt diapirs, oil and gas extraction, and aquifer depletion. SAR intensity data may be used for change detection like identifying permafrost melt, and pixel amplitude tracking to monitor activities such as glacial movement.

Could we classify double bounces of flooded vegetation and urban?
The type of reflection can be distinguished if you have quad-polarimetric data. With quad-pol data you can differentiate between volume scattering, specular, single bounce, and double bounce reflection. Distinguishing between flooded vegetation and an urban area can be done by comparing the reflection types before and during flooding. An unflooded vegetated area will be dominated by volume scattering, with an increasing proportion of double bounce reflection during the time of flooding. Urban areas are dominated by double bounce reflection at all times.

Does SARscape have any airborne (not satellite based) use plans or workflows?
Absolutely. SARscape can import multiple airborne SAR sensors, such as E-SAR and TELAER, and these will run through the same workflows for DEM, DInSAR, Coherent Change Detection, and others that are available in the SARscape toolkit.

How can we use SAR data for specific crop classification?
SAR can be used for crop classification, you are able to track in field surface changes, such as going from soil to crop growth, as well as features such as soil moisture when using specific band satellites. As such, every crop has different response especially temporally that can be used to track growth and can be classified based off those changes. The most important part about crop detection, and possible health applications is that you need in situ knowledge of the field, and then can build off that knowledge with SAR.

What is the advantage of using SAR in change detection compared to using imagery?
Two major advantages for SAR data are the ability to get temporal data with little to no interference scene by scene, and the fact that SAR data gets surface characteristics. Meaning that if you need data over a long period of time, SAR is much more likely to have cleaner usable data, whereas imagery may have many scenes that are cloud polluted. This makes it so you have more data to work with for analysis. SAR's ability to define surface characteristic changes also helps in these matters, especially when looking at regions with crop growth, soil moisture, or land surface deformation, as some physical characteristics may help definition more than optical results. That being said, there is no reason these systems can't be used in tandem to offset each other's flaws.

How easy or difficult is it to map soil moisture using SAR data? Also, are L and P bands the only way to identify soil moisture in a densely vegetated area?
As SAR is sensitive to dielectric properties of surfaces, differences in soil moisture should be visible in your intensity values. If investigating soil moisture in heavily vegetated areas L or P band SAR is necessary to see through the vegetation and to the soil. Higher frequency SAR bands will not penetrate vegetation down to the forest floor.

How does rainfall impact SAR? What about heavy rain?
Rainfall, light or heavy, does interact with the wavelengths that SAR data is collected at. It will induce noise into the scene if it is taken at a time of rainfall. However, the data can still be usable, and is very much dependent on the objects of interest and the certain methods that are being applied.

Can Sentinel-1 be used for DEMS?
Sentinel-1 is designed to measure displacement, not topography, and so should be avoided for high accuracy DEM making. DEM's using SAR need to have a large baseline, a large change of viewing angle or position, and the satellites for Sentinel-1 are have very high accuracy for the same orbital pattern so that is no usually a possibility. What this means is, no you shouldn't use Sentinel-1 for DEMs, but it does a fantastic job of tracking displacements over areas of tectonic interest.