The 2019 NISAR Ecosystem Cal_Val Exercise in the SE USA

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Abstract

The ecosystem science requirements for the NASA ISRO Synthetic Aperture Radar (NISAR) will need to be validated after its launch in the 2022 time frame. Out of all disciplines that are encompassed by the NISAR mission, ecosystems are the one in most need of pre-launch proxy data, consisting of repeated L-band observations over an extended period of time. The solid earth, cryosphere, and hazards research communities have been able to use historical and contemporary spaceborne data available from ERS-1/2, Radarsat, TerraSAR, Sentinel-1, and others for developing and evaluating products similar to what NISAR would be able to provide. This has been possible, in part, because of the focus of these disciplines on sparsely vegetated surfaces and the fairly straight-forward correspondence of surface scattering properties at both L- and C-band (wavelength of 24 cm and 5 cm respectively). Time series data from L-band sensors of value for ecosystem science disciplines, in contrast, have been sporadic and irregular. Ecosystems targets are almost always vegetated, with the scattering components and volume scattering nature of the target giving different scattering responses at the different wavelength regimes. For this reason, the use of C-band observations as a proxy for NISAR's L-band, as is often done for other disciplines, is not possible for the development and testing of NISAR algorithms.

In 2018, a plan was developed for a field/airborne/spaceborne campaign to acquire data in 2019 for NISAR pre-launch ecosystem algorithm development and for evaluation of NISAR ecosystem Cal/Val protocols. This plan includes the acquisition of not just L-band SAR data from the NASA/JPL UAVSAR airborne SAR, but also the acquisition of spaceborne data, airborne data, and field measurements to fully exercise the NISAR protocols for validation of its ecosystem science measurement requirements. Included in the plan is the processing of the field, airborne, and spaceborne data into validation products and the generation of NISAR-like level 3 science products.

By their very nature, ecosystems thrive on the presence of water, and in regions where water is the most prevalent, we find an equivalent degree of vegetation. For this reason, the characterization of ecosystems in these regions will be one of the largest beneficiaries of the NISAR mission, which will have an unprecedented consistent and reliable 12-day repeat period over most of the world's vegetated regions. Yet, because of the lack of proxy observations at this frequency and intensity of observations, it is exactly what is missing from the inputs for the pre-launch calibration and validation period of NISAR. While there have been high resolution spaceborne SAR sensors at L-band (Seasat, JERS, SIR-C, ALOS-1, ALOS-2, and now SAOCOM), the data acquired by these sensors have not formed

a good set of proxy observations for development of NISAR ecosystem science algorithms due to their limited temporal sampling for localized regions. The NISAR ecosystem science algorithms are uniquely defined by extensive time series analysis of observations acquired at frequent intervals.

The NISAR project has been tasked with addressing several broad science objectives of interest by NASA and its research community, and is required to demonstrate that products derived from NISAR data can meet specific predefined measurement accuracies. During the pre-launch phase of the NISAR mission, the project must therefore insure that there are calibratable algorithms that can produce these products from the data, and that techniques and protocols are in place for validating these science measurement requirements after launch. During the NISAR ecosystem Cal/Val exercise in 2019, data will be acquired that will simulate the Cal/Val activities of the post-launch NISAR mission, and includes the acquisition of NISAR-like L-band time series data and validation products.
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