Ensemble Detection Analysis in Space-borne Doppler Measurements
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It has been reported that measuring Doppler velocities of clouds and aerosols via space-borne radars is challenging since high velocity and finite antenna beam width of Low-Earth-Orbiting (LOE) satellites create high uncertainties and errors mainly due to spread in Doppler spectra and non-uniform antenna beam filling. Longer integration of Doppler velocities is suggested to reduce the uncertainty; and bias-correction algorithms based on certain cloud and rainfall models have been developed to minimize errors due to non-uniform beam filling. This presentation will, however, discuss new approaches based on ensemble detection, a noise assisted data analysis technique, to reduce such uncertainties and errors in space-borne Doppler measurements.

During the presentation the Ensemble Detector (ED) and Correlation Ensemble Detector (CED) will be introduced as noise assisted signal analysis tools. By mixing observations from a random process with wide-sense stationary noise signals, ED creates ensemble sets which provide comprehensive statistical description of the random process that otherwise can't be characterized with a single realization. CED, on the other hand operates on the in-phase and quadrature (I/Q) components of the random process to be analyzed. Utilization of ED and CED in space-borne Doppler problems will be demonstrated where the Doppler phase measurements are treated as random processes to be characterized. Analyses of the first and second moments of Doppler phases, thus mean and variance of Doppler velocities, using ED and CED will be presented. Advantages and disadvantages of the application of the ensemble detection approach will be examined in comparison with the classical methods of averaging and bias correction to reduce the uncertainties and biases in space-borne Doppler measurements.