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A calibration methodology for wind scatterometer radar using Gamma naught analysis over distributed homogeneous target

Saurabh Tripathi*, Shweta Sharma, Aloke Mathur
Space Applications Centre, e-mail: saurabh.iist12@gmail.com

Abstract-

A wind scatterometer is an active microwave radar sensor used to measure accurate wind velocity across oceans, which has numerous applications in the field of weather prediction, cyclone monitoring, commercial fishing zones etc. Accurate measurement of backscattering coefficient/sigma naught (σ^0), which is the major input for true wind vector retrieval using geophysical model functions (GMF) is necessary. Due to their low spatial resolution (in order of km) it is very difficult to calibrate scatterometers using suitable microwave calibration instruments like corner reflectors, ARC etc., as it will require very large homogeneous area. To overcome such difficulties homogeneous calibration natural sites such as Amazon Rainforest, Greenland and Antartica are selected which has less spatial and temporal variation of sigma naught(σ^0). A window is selected and backscattering measurements are calculated for different polarization modes (HH and VV), for different look directions (fore and aft) and for different path (ascending and descending). Bias and other statistical errors among different observations over selected window is calculated which gives indication of consistency among different observations and homogeneity of selected site.
Sigma naught is converted to Gamma naught (γ^0) in order to minimize incidence angle dependency and above window method is repeated for Gamma naught measurements also. Biases in Sigma naught and Gamma naught values for different observations at slice and footprint levels are used to calibrate scatterometers. This window method using Gamma naught values can also be used to cross calibrate scatterometers with pre-launched well calibrated scatterometer satellites as incidence angle dependency is minimized and homogeneity of calibration site is also achieved. Apart from this, several window over these homogeneous distributed sites can also be created with known Gamma naught values which can be used for calibration of scatterometer sensors.