Airborne SAR observation of dependence of ocean surface backscattering on wind direction

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Synthetic aperture radar (SAR) has attracted attention as an oceanwinds measurement technique in coastal areas where high spatial resolution is required.

Oceanwinds measurement by SAR requires the normalized radar cross section (NRCS) model of ocean surface backscattering. However, the NRCS models currently developed is statistically analyzed by combination of NRCS measured by spaceborne SAR and meteorological data. In this study, by carrying out airborne SAR observations with multiple illumination directions in a short time, direct measurement of wind direction dependence of the NRCS at a certain wind speed was tried.

Using a model function of NRCS with the same format as the NRCS models, the coefficients of oceanwinds dependence of NRCS are determined by the airborne SAR. The results determined by airborne SAR are compared with NRCS models and results of the airborne scatterometer.

Regarding the wind speed dependence, the results of the airborne SAR showed good agreement with that of the airborne scatterometer. On the other hand, two NRCS models give a fairly large NRCS. In addition, the change of wind speed dependence with incidence angle determined by the airborne SAR and the airborne scatterometer show different tendency with those of NRCS models.

Regarding the wind direction dependence, the results by airborne SAR shows significantly large wind direction dependence compared with the NRCS model at the incidence angle of 32 degrees. On the other hand, the wind direction dependence by the airborne SAR almost agrees with that of the airborne scatterometer at the incidence angle of 32 degrees.

Comparing the measured NRCS by the airborne SAR with that by the airborne scatterometer, the possibility of influence of the observation configuration on measurement accuracy of the wind direction dependence is suggested.

In addition, the influence of size of spatial averaging may be important on the accuracy of oceanwinds measurement using SAR. Though the high spatial resolution oceanwinds measurement is expected for SAR, ocean surface phenomena like swells and ship wakes may influence the oceanwinds measurement by SAR. Moreover, SAR data cannot be free from speckle noise. The influence of spatial averaging size has to be grasped.

Keywords: Oceanwinds, Synthetic aperture radar, Ocean surface backscattering, Normalized radar cross section

