

Simulation of airborne dual-polarization phased array radar observation of a typhoon

Nobuhiro Takahashi¹, Sachie Kanada¹

¹*ISEE, Nagoya University*

ABSTRACT

In this study, dual-polarization phased array radar observation is simulated by considering the electrical scan of the radar and flight path as well as the polarimetric observables aiming for the typhoon observation which has horizontal dimension of > 300 km and vertical extent of > 10 km. Assuming that the aircraft flies about 13 km in height where are the cloud-free height except for the eye-wall region and aircraft flies circular path centered the eye of typhoon or straight path cross the eye region, the radar specifications are set as follows: scan angle is -90 degree to $+ 10$ degrees, 1 degree intervals, scan direction is cross-track direction of the aircraft, and the observables are Z_h , ZDR , ϕDP , ρHV and Doppler velocity.

First, we demonstrated a simulation of radar observation with simple typhoon model to check the geolocation of the aircraft and beam locations. Radar observation is retrieved by assuming the particle shape as spheroid using T-matrix technique (Mishchenko, 2002). In this presentation, radar observation simulation is implemented to a simulated typhoon Trami (2018) simulated by Cloud Resolving Storm Simulator (CReSS, Tsuboki and Sakakibara, 2002) for the atmospheric component and the Non-Hydrostatic Ocean model for the Earth Simulator (NHOES; Aiki et al. 2006, 2011) for the oceanic part. This coupled model has been referred to as the CReSS–NHOES (Aiki et al. 2015). The aircraft flies butterfly patten that is a typical fly pattern of typhoon observation by giving the turning points (latitude and longitude) of the aircraft operation. Outputs from the simulated typhoon are wind vector (u , v , w) and qc , qr , qi , qs , and qg which means the cloud water, rain, cloud ice, snow and graupel mixing ratios, respectively. Cloud physical values are converted to particle size distribution assuming a Gamma type distribution and density and shape of ice particles (ice, snow and graupel). The preliminary test result shows that the radar simulation performed good enough. Detailed analysis and improvement will be done.

REFERENCES

- Aiki, H., K. Takahashi, and T. Yamagata, 2006: Cont. Shelf Res., 26, 1448–1468.
Aiki, H., J. P. Matthews, and K. G. Lamb, 2011: J. Geophys. Res., 116, C03023, doi:10.1029/2010JC006589.
Aiki, H., M. Yoshioka, M. Kato, A. Morimoto, T. Shinoda, and K. Tsuboki, 2015: Bull. Coastal Oceanogr., 52, 139–148.
Mishchenko, M. I., 2002: Cambridge University Press, Cambridge (2002).
Tsuboki, K., and A. Sakakibara, 2002: pp. 243-259, Springer, New York.

Keywords: phased array radar, radar observation simulation