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層状性降水時の地上マイクロ波放射計による Off-Zenith 観測の検証
Verification of Off-Zenith Observations by Ground-Based Microwave Radiometer under Stratiform Precipitation Conditions

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The radiometric observation by ground-based microwave radiometer (MWR) has been used for the retrieval of precipitable water vapor (PWV) and liquid water path (LWP) for many decades. However, raindrops cause mainly two critical errors in radiometry; the first is the effect that raindrops wet the radome, which produces absorption losses. The second is the effect of absorption/emission and scattering by large raindrops in the air.

To solve especially the first issue, the effectivity of off-zenith radiometric observations by MWR under the stratiform precipitation conditions in all seasons is investigated. Stratiform precipitation periods were extracted by using the criteria of rainfall rate (RR) observed by an optical disdrometer and LWP retrieved from off-zenith observations at the elevation angle of 15 degrees. By comparing PWVs derived from radiometric observations at the elevation angle of 15 degrees with PWVs derived from global positioning system, it's found that the reliable PWVs are obtained under the stratiform precipitation conditions with RR less than 10 mm h^{-1}. The precipitation particles are mostly classified into snow and graupel at RR over 7 mm h^{-1}, and the particle type of rain is found at small RR. A case study shows that microwave radiometry can be conducted with small errors under the stratiform snow conditions even with RR over 10 mm h^{-1}. By solving a simplified radiative transfer equation applied to the typical stratiform rain cases with small RRs, it's found that the observations at the elevation angles over 30 degrees are affected by the effect of the wetness on the radome. From the result of the fundamental experiments which estimates the errors quantitatively, the errors in zenith observations in the cases are comparable to the error due to the wetness on the radome. The off-zenith observations at low elevation angle are valuable under the stratiform precipitation conditions when the Rayleigh approximation assumed in the retrieval method is appropriate.

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