Simulation of remote sensing of clouds and humidity from space using a combined platform of radar and multi-frequency microwave radiometers

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We present a simulated simultaneous retrieval of mass mean cloud ice particle effective diameter, ice water content, water vapor, and temperature profiles using a combination of a 94-GHz cloud radar and multi-frequency (118, 183, 240, 310, 380, 664, and 850 GHz) millimeter- and submillimeter-wave radiometers from a space platform. The retrieval capabilities and uncertainties of the combined radar and microwave radiometers are quantified. We show that this combined active and passive remote sensing approach with SmallSat technologies addresses a gap in the current state-of-the-art remote sensing measurements of ice cloud properties, especially deriving vertical profiles of ice cloud particle sizes in the atmosphere together with the ambient thermodynamic conditions. Therefore, this new approach can serve as a plausible candidate for future missions that target cloud and precipitation processes to improve weather forecasts and climate predictions.