MICROPHYSICAL RETRIEVALS OF DUAL POLARIZATION AND DUAL FREQUENCY GROUND RADAR FOR GPM GROUND VALIDATION

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1. ABSTRACT

A dual-frequency precipitation radar (DPR) will be deployed aboard GPM (Global Precipitation Measurement) core satellite in order to enhance our knowledge of precipitation microphysics. A ground based dual-frequency (Ku and Ka band) and dual-polarization radar D3R is being built to perform cross validation with GPM which helps provide insight into the physical basis of the retrieval algorithm. This paper presents a new algorithm to retrieve precipitation microphysics from D3R radar observations. The retrieval philosophy is based on combining the features of the DFR (dual frequency ratio) and dual-polarization approach. The algorithm evaluation is focused on full profile including ice, melting ice and rain.

2. INTRODUCTION

GPM is a science mission with integrated application goals for advancing the knowledge of the global water/energy cycle variability as well as improving weather, climate and hydrological prediction capabilities through more accurate and frequent precipitation measurements around the globe. The GPM mission concept is centered on the deployment of a core observatory satellite with dual-frequency (Ku and Ka band) precipitation radar which is expected to improve our knowledge of precipitation process relative to the single-frequency radar used in TRMM (Tropical Rainfall Measuring Mission) by providing greater dynamic range, more detailed information on microphysics, and better accuracies in precipitation retrievals.

Ground validation is an integral part of all satellite precipitation missions. It helps to quantity measurement and model uncertainty, and most importantly, provide insight into the physical and statistical basis of the retrieval algorithm. The GPM validation falls in the general class of validation and integration of information from a variety of space-borne observing platforms with ground-based measurements. Dual-polarization weather radar is

a very powerful validation tool that can be used to address a number of important questions that arise in the validation process, especially those associated with precipitation microphysics and algorithm development [1].

A dual-frequency (Ku and Ka band) and dual-polarization ground radar D3R is being developed to perform cross validation with GPM-DPR. The conventional DSD retrieval algorithms applied to dual-polarization ground radar are not well suited for this retrieval [2][3][4]. *Minda et al* (2009) presented a new DSD retrieval algorithm for D3R radar and evaluated the performance of the algorithm mainly focused on rain region [5]. The diagram of the algorithm is shown in figure 1. The results showed good agreement between the algorithm retrieved DSD and the simulation truth.

This paper is based on the *Minda et al* (2009) paper and will extend the algorithm evaluation from only rain region to full regions including rain, melting ice and ice region. Simulated Ku and Ka band realistic observations, synthesized from S band measurements collected by CSU-CHILL radar will be used to test the performance of the algorithm. The boundaries of rain, melting ice and ice region of S band data will be decided from the fuzzy hydrometeor classification method described in [6]. Preliminary result based on one full profile showed the algorithm works well [5]. More extensive study will be performed based on full scans. The performance of the algorithm will also be tested when system errors are added.

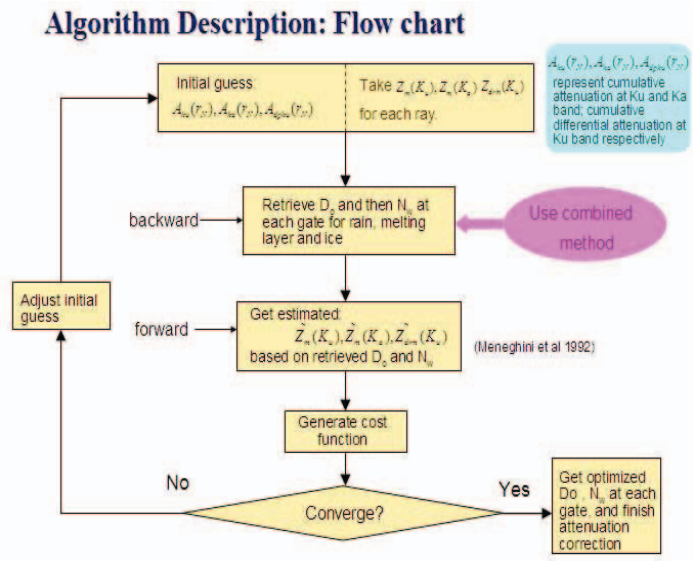

Figure 1, Diagram of the D3R ground radar DSD retrieval algorithm.

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