

Snowfall Retrieval Algorithm Sensitivity to Variations in Ice Particle Physical Properties

Benjamin T. Johnson UMBC/JCET & NASA/GSFC (Code 613.1) Benjamin.T.Johnson@nasa.gov
 Gail Skofronick-Jackson NASA/GSFC (Code 613.1) Gail.S.Jackson@nasa.gov

1 Introduction and Motivation

Introduction

- Precipitating clouds consist of a wide range of particles with variable shape, size, number density, and composition, and microwave radiation is sensitive to these properties
- Furthermore, ice clouds, water clouds, and gases and attenuate/emit microwave radiation
- Therefore, physically-based microwave precipitation remote sensing methods require:
 - A physical description of the atmosphere + surface
 - Physical descriptions of hydrometeors (PSD, shape(s), composition)
 - Appropriate relationships between physical and scattering/extinction/backscattering properties
 - An inversion method for retrieving the desired physical properties given observations

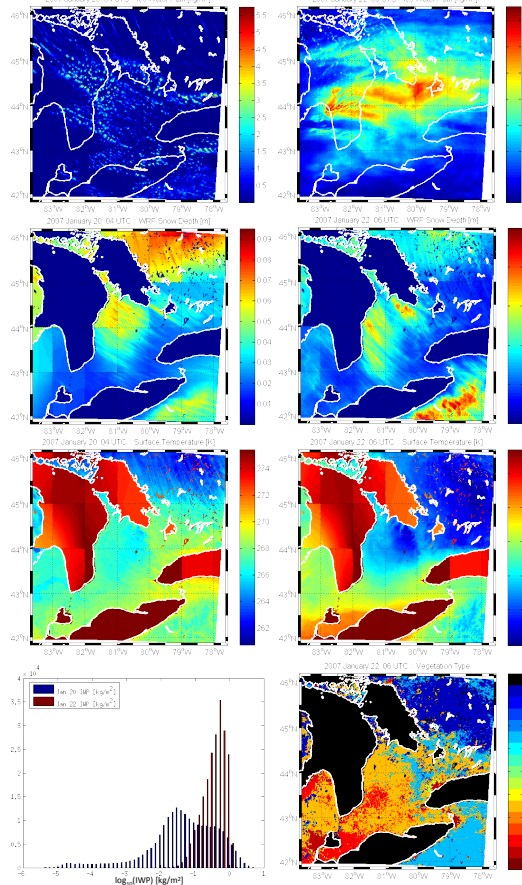
Relevant Key Problems

- Uncertainties in the distribution of CLW, WV, particle composition, size distribution, shape, etc., and their associated uncertainties.
- No in-situ measurements of MW scattering properties of snowflakes, aggregates, graupel, melting particles, so we focus here on simulation – based studies of sensitivities to variations in physical properties.

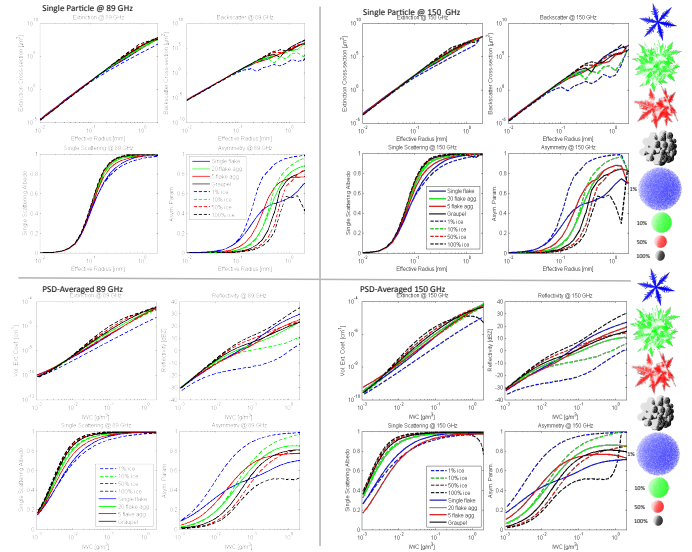
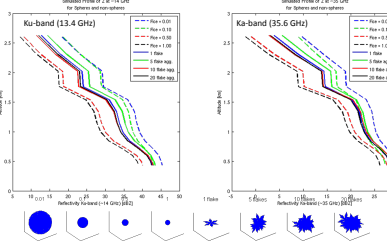
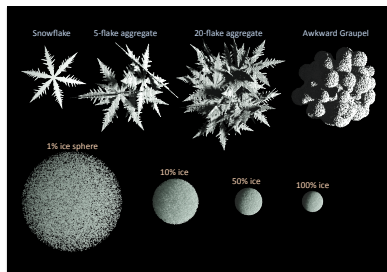
Retrieval Approach

- Physical method using “consistency matching” – Select profiles from database where simulations match observations, weight profiles according to how well they match, construct average weighted profile for each set of observations (e.g., Bayesian algorithm)

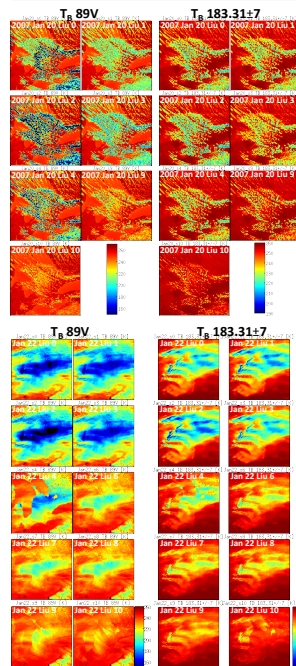
2 C3VP: WRF Model Simulations



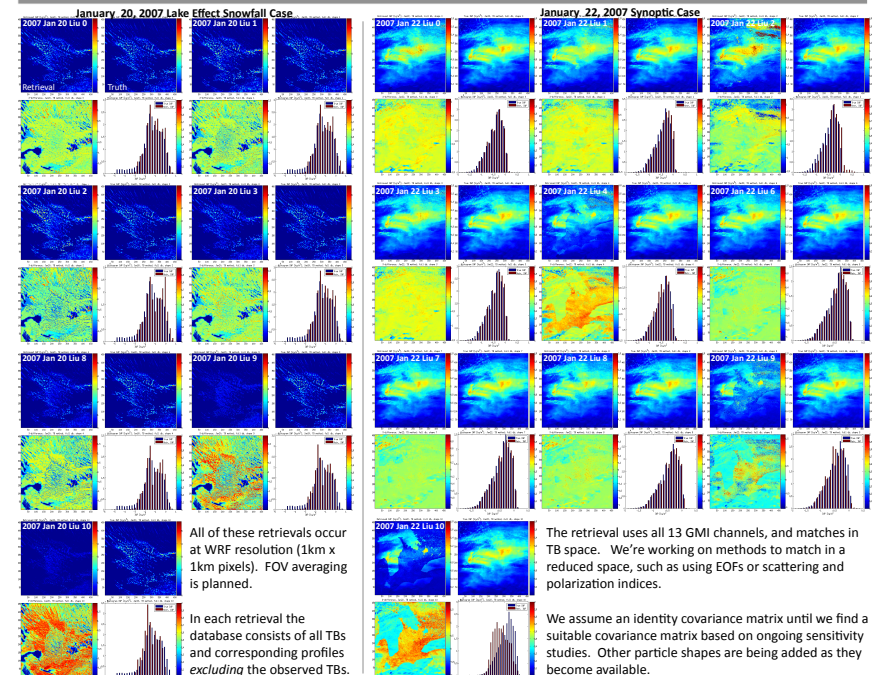
3 Ice Shape Properties



4 TB Database



5 IWP Retrieval Sensitivity (using Liu, 2008 shapes)



The retrieval uses all 13 GMI channels, and matches in TB space. We're working on methods to match in a reduced space, such as using EOFs or scattering and polarization indices.

We assume an identity covariance matrix until we find a suitable covariance matrix based on ongoing sensitivity studies. Other particle shapes are being added as they become available.