The Next Generation of Microbase at NSA

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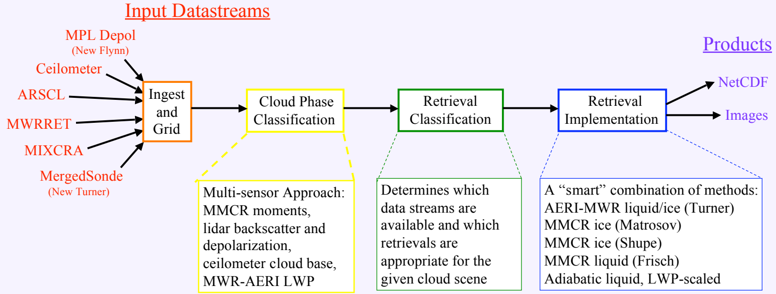
1) Introduction

- The specification of cloud macro- and microphysical properties are critical for the accurate computation of radiative heating rate profiles.
- ARM's standard Microbase product ("BNL") specifies cloud properties at all times and altitudes above the ARM sites. However, it has deficiencies in LWP and identifying cloud phase, which result in large errors in the computed radiative fluxes (and hence heating rates).
- We've developed a new algorithm that uses additional inputs to provide an improved Microbase product ("ST").

The General Idea for ST Microbase



2) ST Microbase Cloud Property Selection Logic

LIQUID PROPERTIES	Liquid-only	Mixed-phase and liquid	Precipitation and/or no LWP
MIXCRA available	LWC: Frisch et al. 1995 (LWP-scaled) Re: MIXCRA	LWC: Adiabatic[2] (LWP-scaled) Re: MIXCRA	LWC: Adiabatic[2] (unscaled) Re: climatology
No MIXCRA available so LWP comes from MWRRET[1]	LWC: Frisch et al. 1995 (LWP-scaled) Re: climatology	LWC: Adiabatic[2] (LWP-scaled) Re: climatology	

1. MIXCRA-derived offset applied to MWRRET data
2. If adiabatic calc doesn't work (due to specific T/q profile) a reflectivity power law is used

ICE PROPERTIES	Ice-only	Mixed-phase and ice	Precipitation and/or no LWP
MIXCRA available	IWC: Matrosov 1999 (τ-scaled) Re: MIXCRA	IWC and Re: Matrosov 1999 (τ-scaled)	IWC and Re: Reflectivity using empirical coefficients[1]
No MIXCRA available	IWC and Re: Reflectivity using empirical coefficients[1]		

1. Empirical coefficients derived from NSA obs and account for local climatology

3) Main Improvements to ST Microbase

- Better LWP specification by using the MIXCRA / MWRRET combined product
- Better cloud phase specification by using the polarization-sensitive MPL and the improved LWP product

- Shippert & Mlawer performed BBHRP calculations using the ST Microbase product from Mar - Aug 2004
- Compared results at CERES overpass times to results from original (BNL) Microbase BBHRP runs

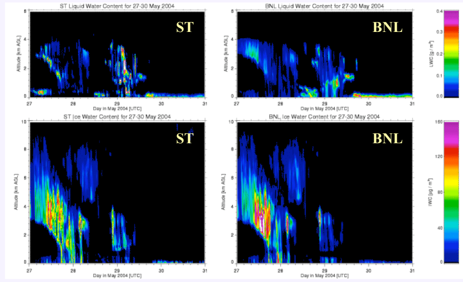
Cases at CERES overpass times

Classification "Confusion" Matrix		BNL Microbase: Liquid-only	BNL Microbase: Mixed-phase	BNL Microbase: Ice-only
ST Microbase	Liquid-only	17	22	2
ST Microbase	Mixed-phase	0	205	33
ST Microbase	Ice-only	0	26	57

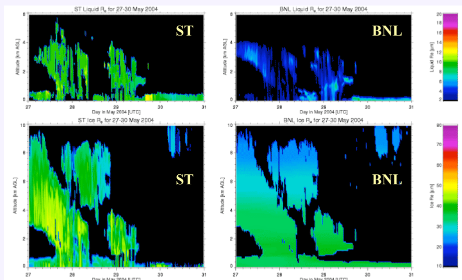
4) Original (BNL) vs. New (ST) Microbase

Case study: 27 - 30 May 2004 at NSA

Liquid (top) and Ice (bottom) Water Contents

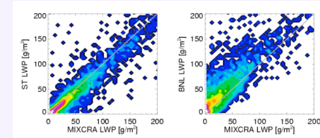


Liquid (top) and Ice (bottom) Effective Radius

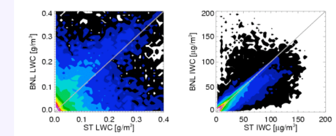


Statistics: March - August 2004 at NSA

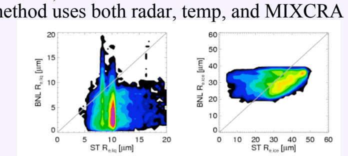
- ST method constrained by MIXCRA LWP
- BNL method has bias in LWP relative to MIXCRA
- Pt. Reyes analysis and comparisons with HSRL (last ARM STM) demonstrate MIXCRA very accurate for LWP < 100 g/m^2



- Different LWP and cloud phase classification lead to scatter in LWC comparison
- Both methods use Z - IWC for ice, so are similar



- BNL $R_{e,liquid}$ appears to be biased quite low
- BNL $R_{e,ice}$ is a function of temp only, whereas ST method uses both radar, temp, and MIXCRA



5) Impact on Radiative Fields

- Radiative flux calculations performed using BBHRP framework using both BNL and ST Microbase products (Mar - Aug 2004)
- ST product produces better surface longwave and shortwave diffuse flux results, both in terms of bias and standard deviation
- ST product is essentially equivalent to BNL product in TOA residuals
- Differences in the heating rate profiles are significant, with differences exceeding ± 5 deg / day frequently

Mixed-phase cloud Flux closure cases Obs - calc [W/m^2]

	BNL Microbase: Bias	BNL Microbase: Sdev	ST Microbase: Bias	ST Microbase: Sdev	N
LW TOA	-4.0	13.1	-4.3	11.9	257
LW SFC	-4.0	20.6	1.4	13.1	286
SW TOA	-96.1	67.8	-67.5	65.8	65
SW SFC	29.9	131.0	1.8	103.3	70