MODELING DRIZZLE IN VOCALS CLOUDS

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The (wonderful) problems:

What aspects of the aerosol size distribution is most important for the generation of drizzle?

Outside POCs?
(Well-mixed and upper-level)

In the strong convection on the edge of POCs?
(cumulus + anvil)

Within the POCs?
(cumulus + anvil)
Well-mixed stratocumulus: Background

Simplified view:

Variability in small aerosols
\( r_d < 0.5 \, \mu m \)
Sulfate,
natural + pollution

Variability of giant aerosols
\( r_d > 0.5 \, \mu m \)
Sea salt
Well-mixed stratocumulus: Background

Simplified view:

Variability in small aerosols
\((r_d < 0.5 \, \mu m)\)
Sulfate, natural + pollution

Variability of giant aerosols
\((r_d > 0.5 \, \mu m)\)
Sea salt
Which aerosol sizes forms drizzle drops?
(Jensen and Lee, 2008, JAS Dec. issue)

Model:
Adiabatic parcel
Kinematic motion
Condensation from near sea-surface through cloud
Start with aerosol particles
Gillespie (1975) Monte-Carlo coalescence - no numerical broadening
Tracking of individual aerosol particles through coalescence events
500 drop sizes => several hundred thousands
Which aerosol sizes contribute most to the drizzle flux?

Jensen and Lee, 2008
Model *cumulus* rising into *stratocumulus*
Model cumulus rising into stratocumulus

Photo by John Cowan, 2008
Calculate drop spectra at top of clouds in POC and out of POC (Very preliminary)

Theoretical supersaturation spectrum, $N = 50 S^{0.3} ; 8 \text{ m/s sea salt}$

$w = 1 \text{ m/s}$
$z_{\text{top}} = 1350 \text{ m} \ (h=579 \text{ m})$
$t = 579 \text{ s}$

$w = 1 \text{ m/s} + 0 \text{ m/s}$
$z_{\text{top}} = 1350 \text{ m} \ (h=579 \text{ m})$
$t = 579 \text{ s} + 900 \text{ s}$
Calculate drop spectra at top of clouds in POC and out of POC (Very preliminary)

Theoretical supersaturation spectrum, \( N = 12 S^{0.3} \); 8 m/s sea salt

\[ w = 1 \text{ m/s} \]
\[ z_{\text{top}} = 1350 \text{ m (h=579 m)} \]
\[ t = 579 \text{ s} \]
VERY - VERY - PRELIMINARY

GOAL:

DETERMINE IF GIANT SEA-SALT AEROSOL PARTICLES ARE IMPORTANT FOR DETERMINING DRIZZLE IN VOCALS STRATOCUMULUS.

COMBINE OBSERVATIONS AND MODELING (CONDENSATION + STOCHASTIC COALESCENCE)

EXAMINE POC VS. NON-POC CONDITIONS

THE END