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)

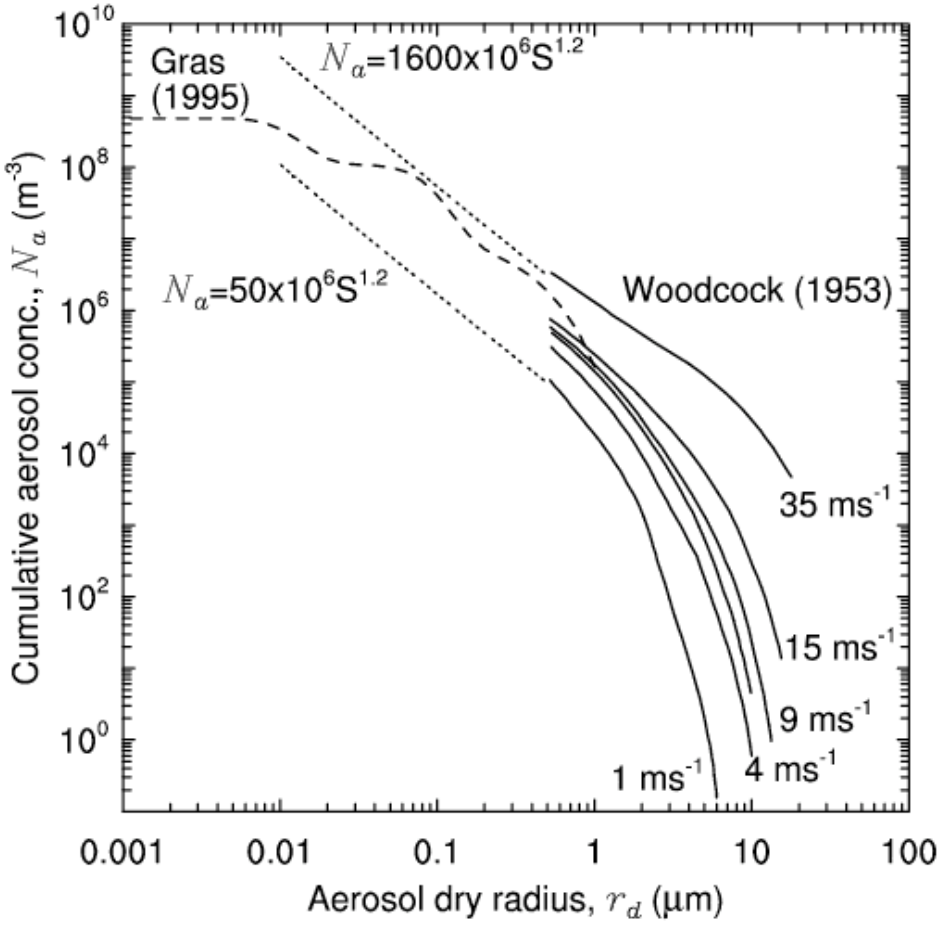
Within the POCs?
(cumulus + anvil)

Well-mixed stratocumulus: Background

Simplified view:

Variability in small aerosols
(r_d < 0.5 μm)
Sulfate,
natural + pollution

Variability of giant aerosols
(r_d > 0.5 μm)
Sea salt



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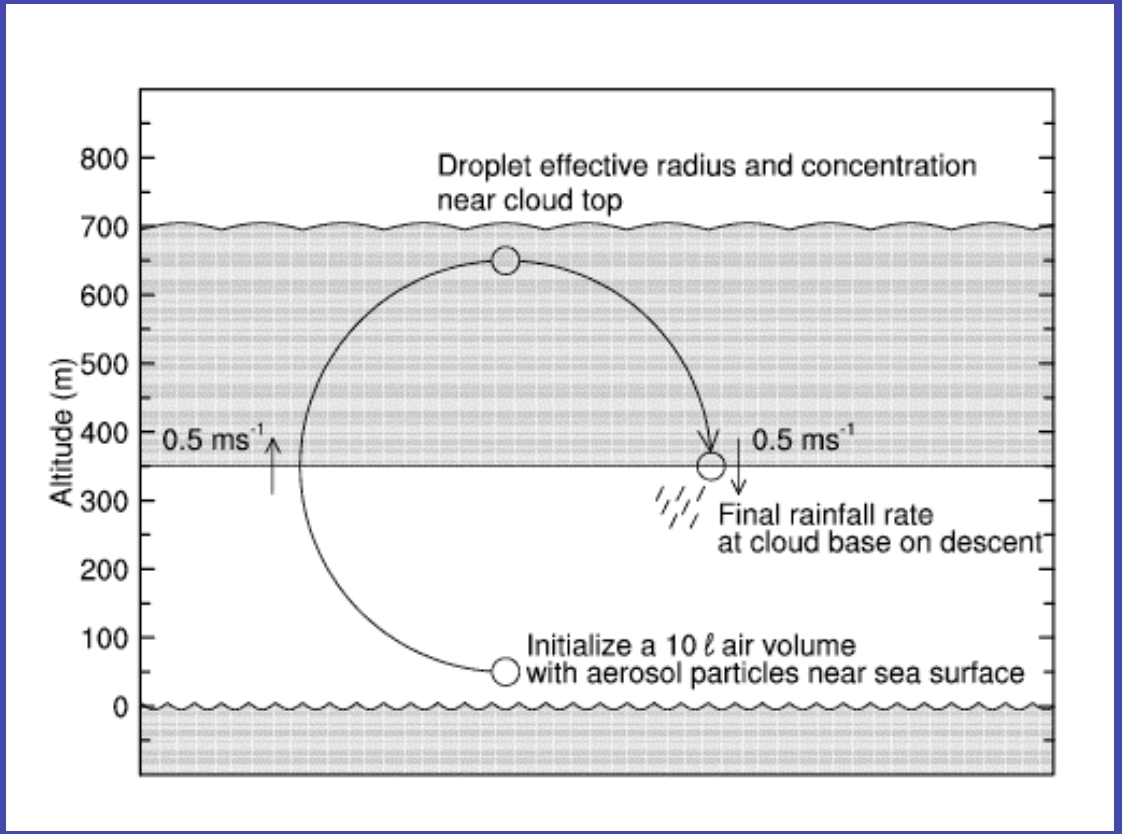


Which aerosol sizes forms drizzle drops? (Jensen and Lee, 2008, JAS Dec. issue)

Model:

Adiabatic parcel

Kinematic motion

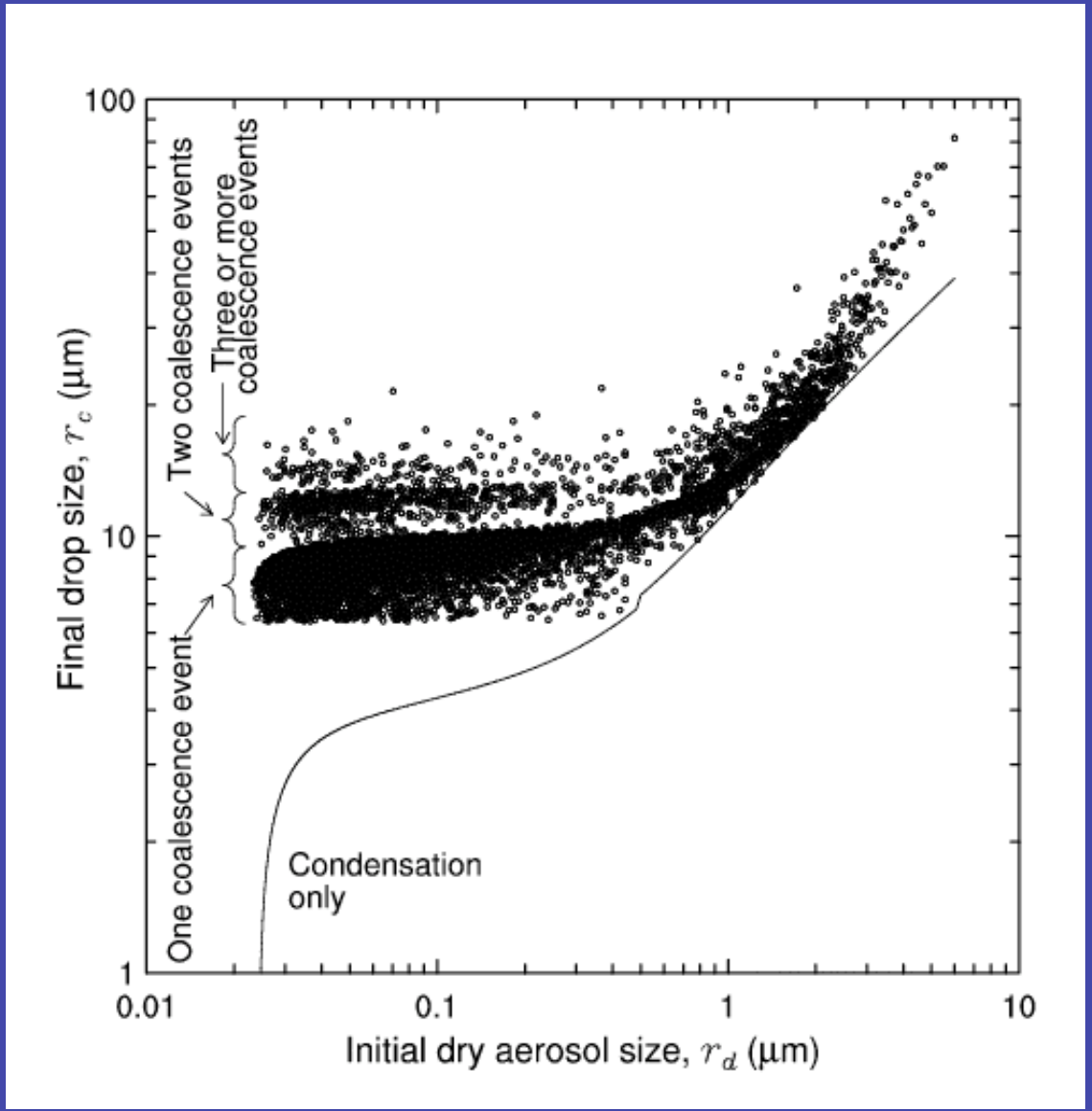
Condensation from near sea-surface through cloud

Start with aerosol particles

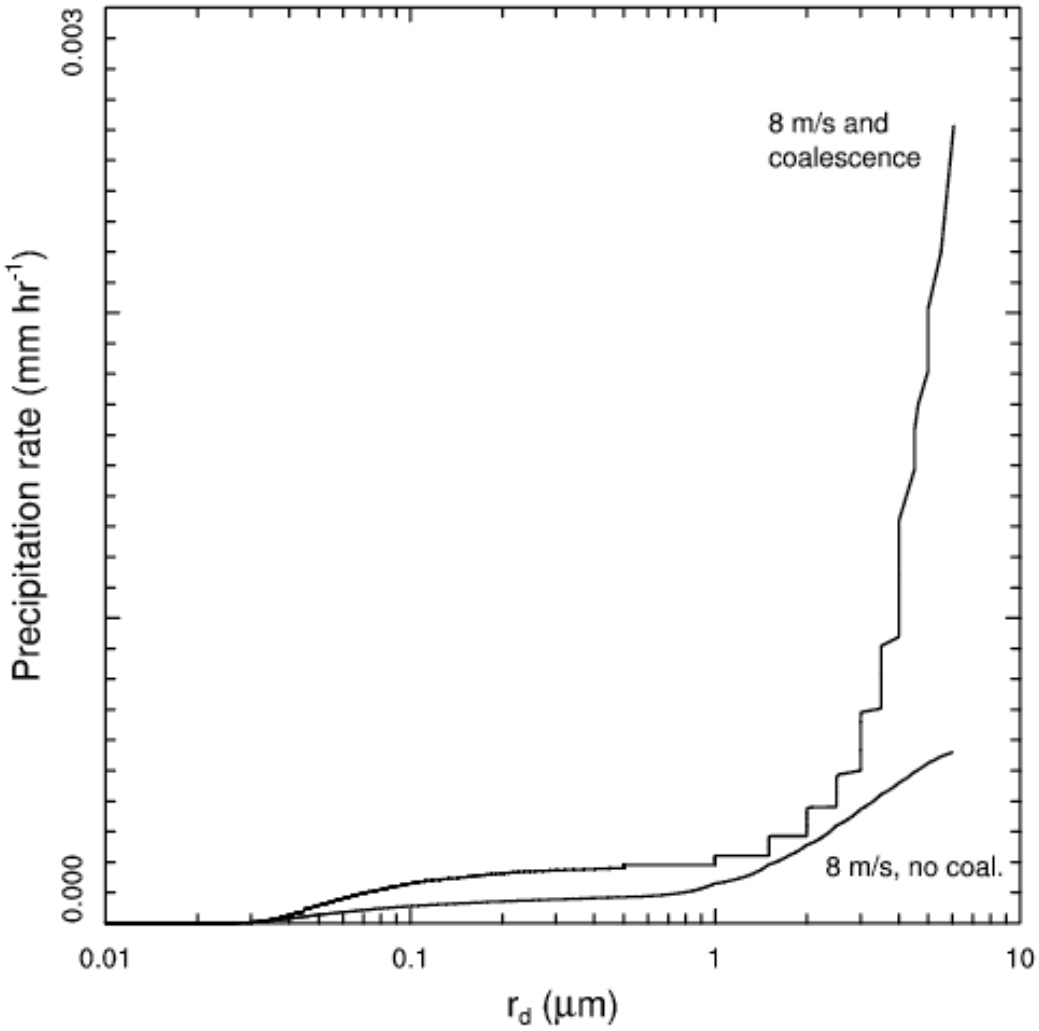
Gillespie (1975) Monte-Carlo coalescence -
no numerical broadening

Tracking of individual aerosol particles through coalescence events

500 drop sizes =>
several hundred thousands



Which aerosol sizes contributes most to the drizzle flux?



Jensen and Lee, 2008

Model cumulus rising into stratocumulus

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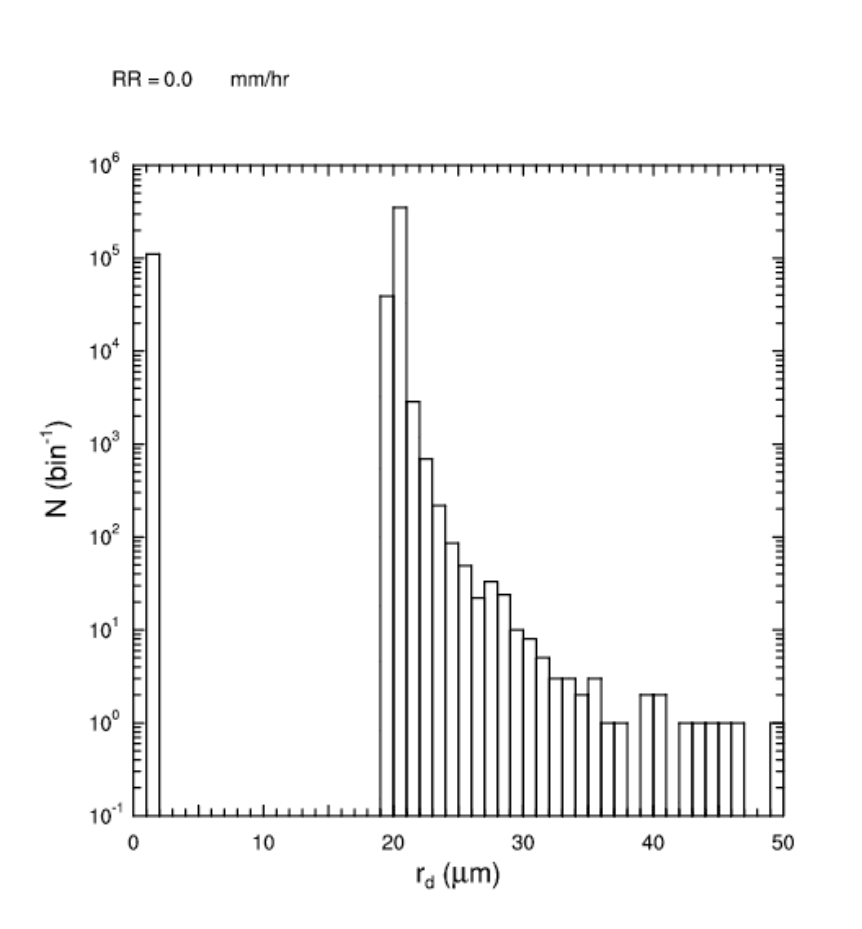
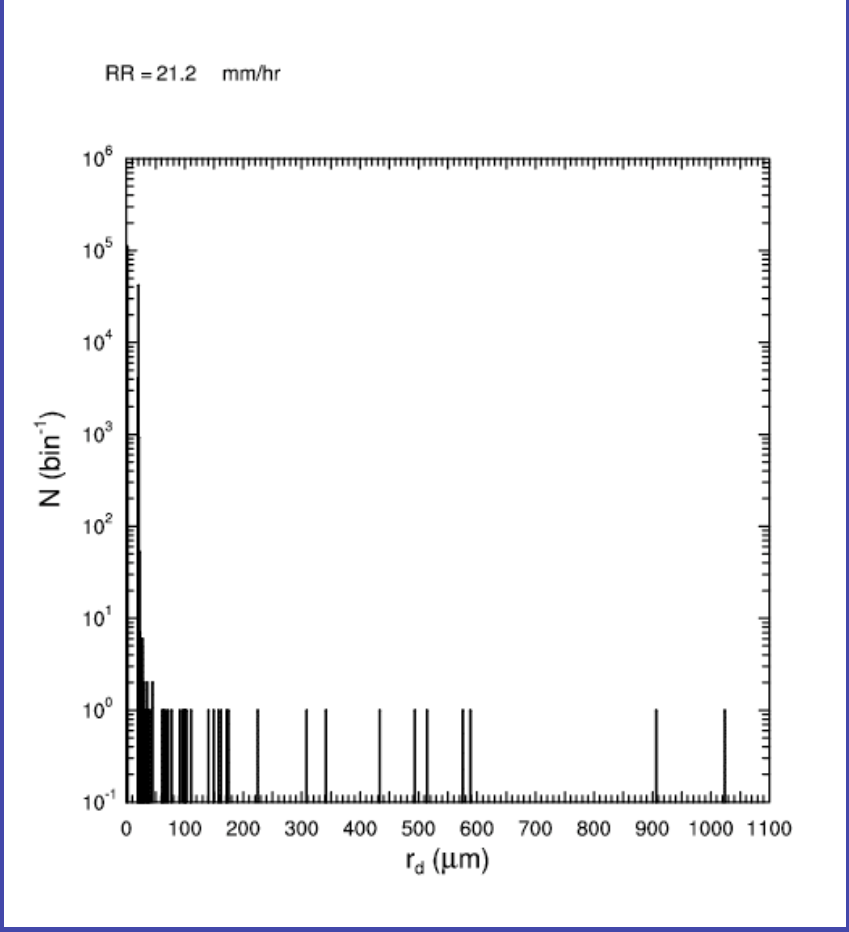
Photo by John Cowan, 2008

Calculate drop spectra at top of clouds in POC and out of POC (Very preliminary)

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





w = 1 m/s

z_{top} = 1350 m (h=579 m)

t = 579 s

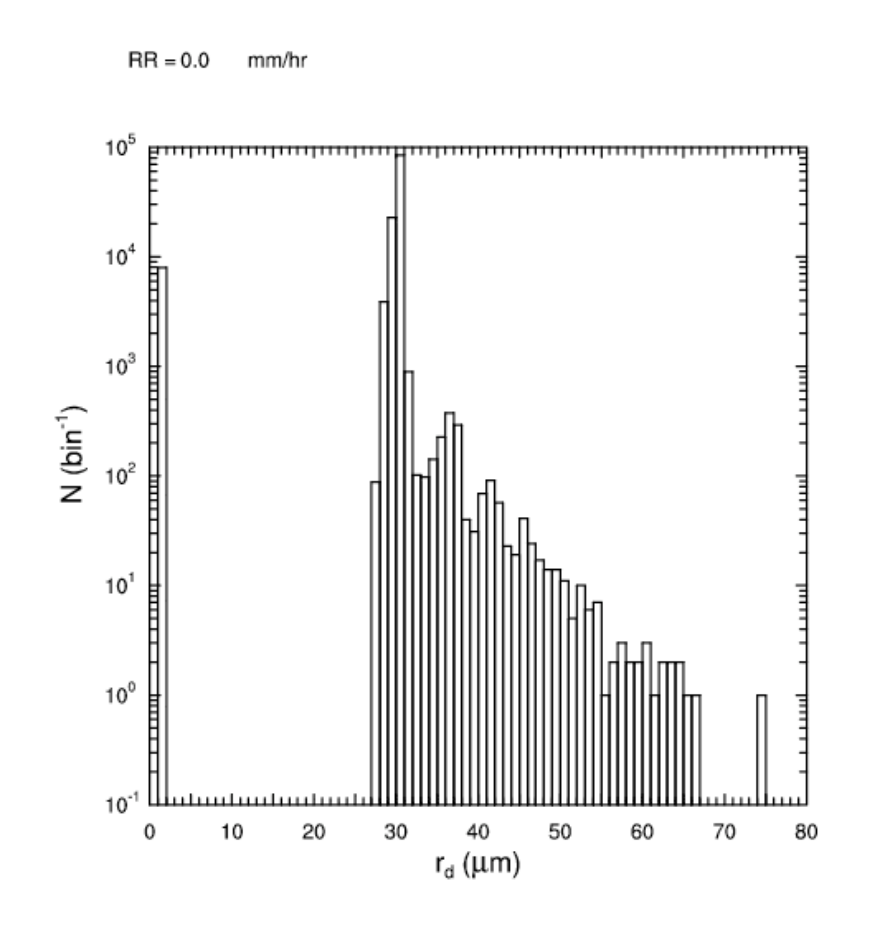
w = 1 m/s + 0 m/s

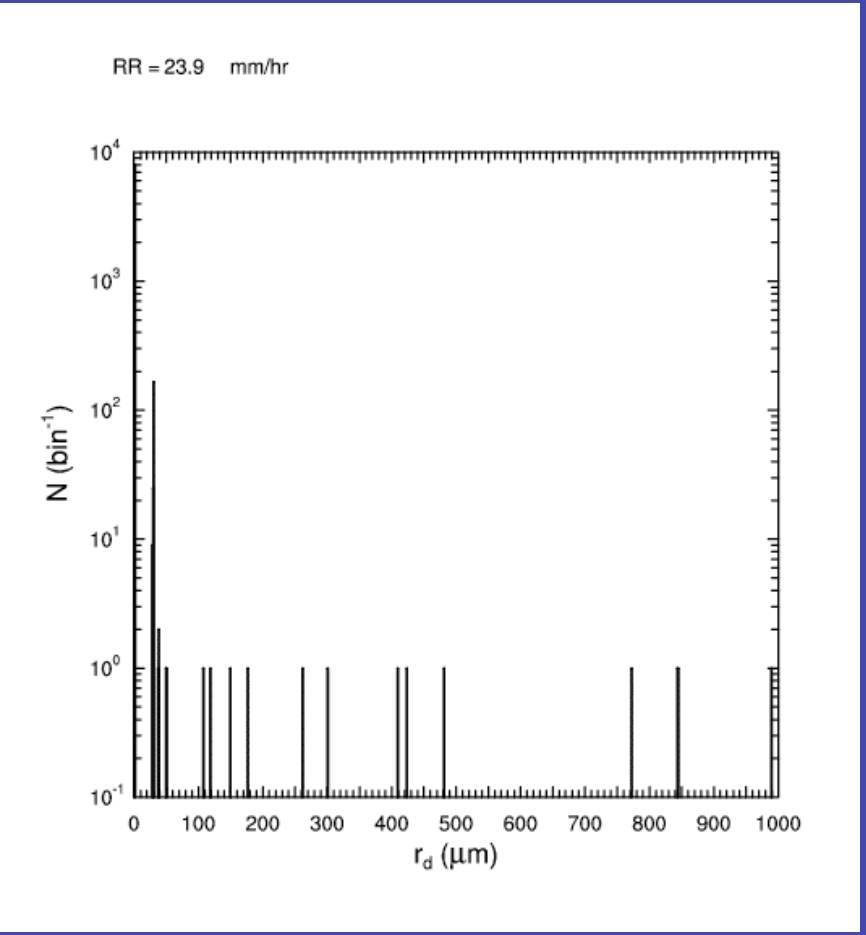
z_{top} = 1350 m (h=579 m)

t = 579 s + 900 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





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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