EVALUATION OF THE LDM DRIZZLE PARAMETERIZATION USING MEASUREMENTS FROM VOCALS

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Archived data products are at:

ftp://ftp.asd.bnl.gov/pub/ASP%20Field%20Programs/2008VOCALS/Processed_Data

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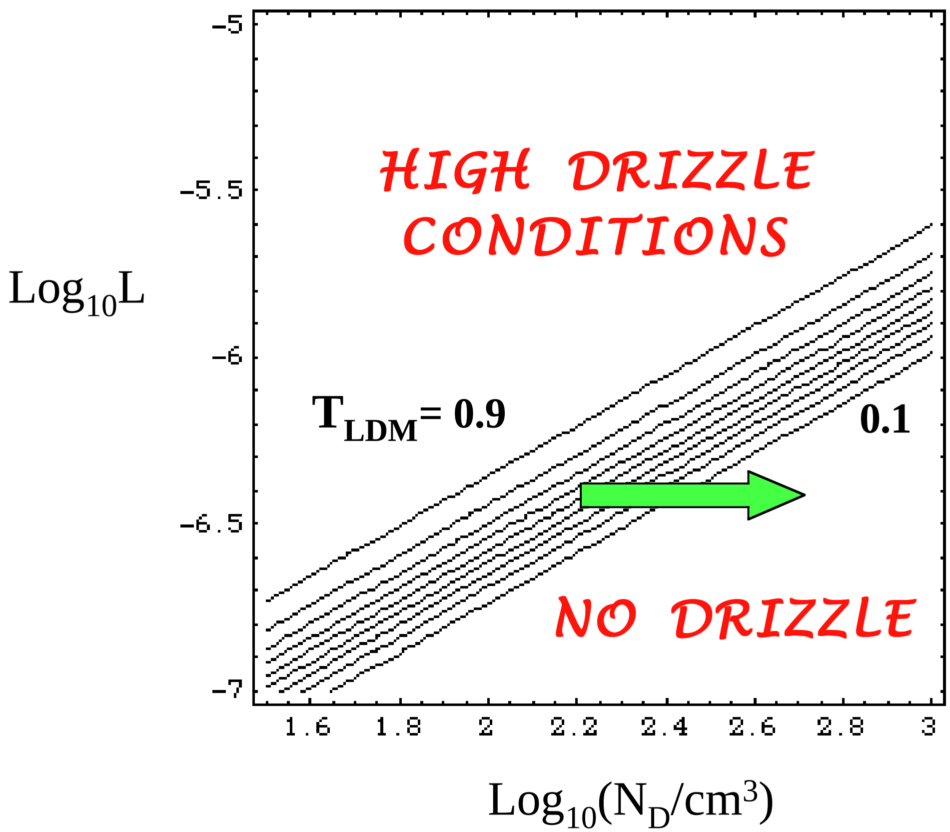
BACKGROUND (1): LDM THRESHOLD FUNCTION

Y. Liu, P. H. Daum & R. McGraw, GRL 32, L11811 (2005)



T_{LDM} **contours of constant barrier height {0.1, 0.2, … , 0.9}**

N_D = droplet concentration (cm^{-3})

L = liquid water fraction (cm^{3}cm^{-3})

Arrow shows the effect of increasing droplet concentration on reducing drizzle rate

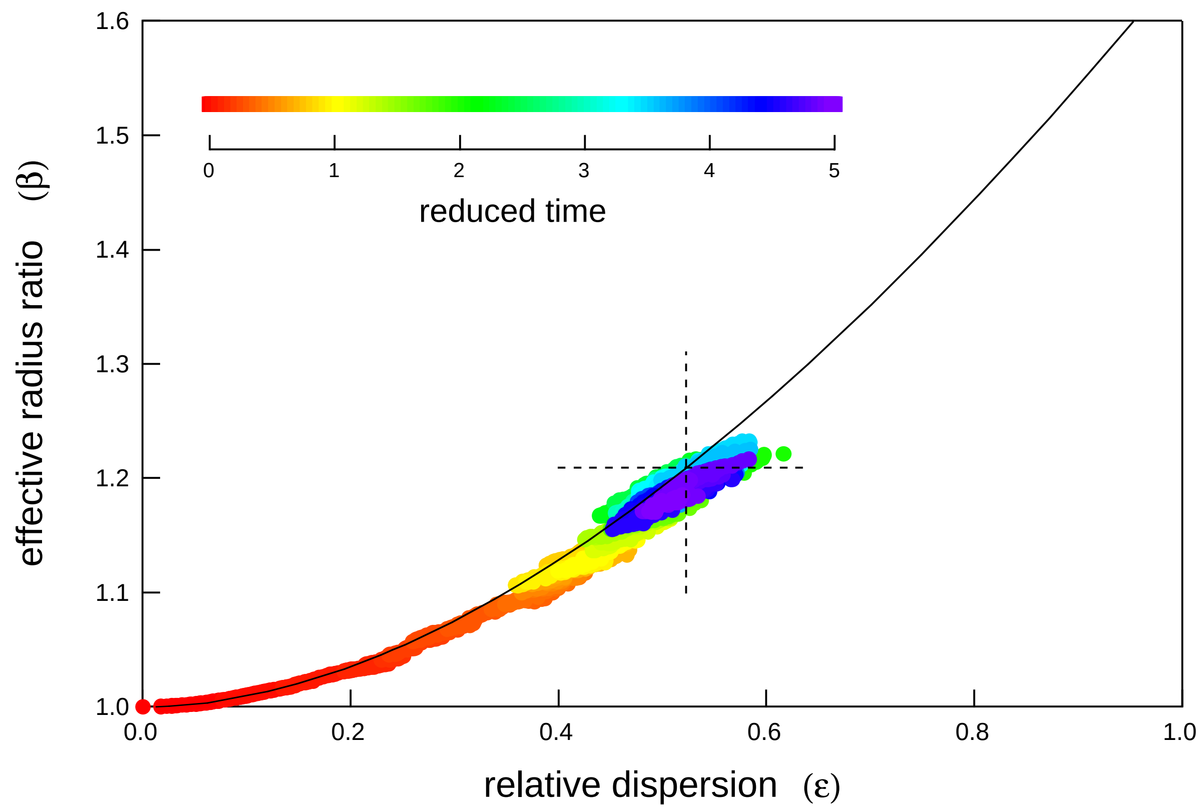
BACKGROUND (2): BROWNIAN DRIFT-DIFFUSION MODEL (EVOLUTION OF CLOUD DROPLET PDF)

R. McGraw & Y.Liu, GRL 33, L03802 (2006)

$$\beta = r_{eff}\left(\frac{4\pi N_D}{3L}\right)^{1/3}$$

$$r_{eff} = \frac{\int_0^\infty r^3 f(r)dr}{\int_0^\infty r^2 f(r)dr}$$

$$\varepsilon = \frac{\sigma}{\bar{r}}$$



Monte-Carlo simulations of droplet distribution evolution in turbulent clouds.

COMPARISONS

CASE 1: CLOUDY DAY WITH DRIZZLE (10/28/08)

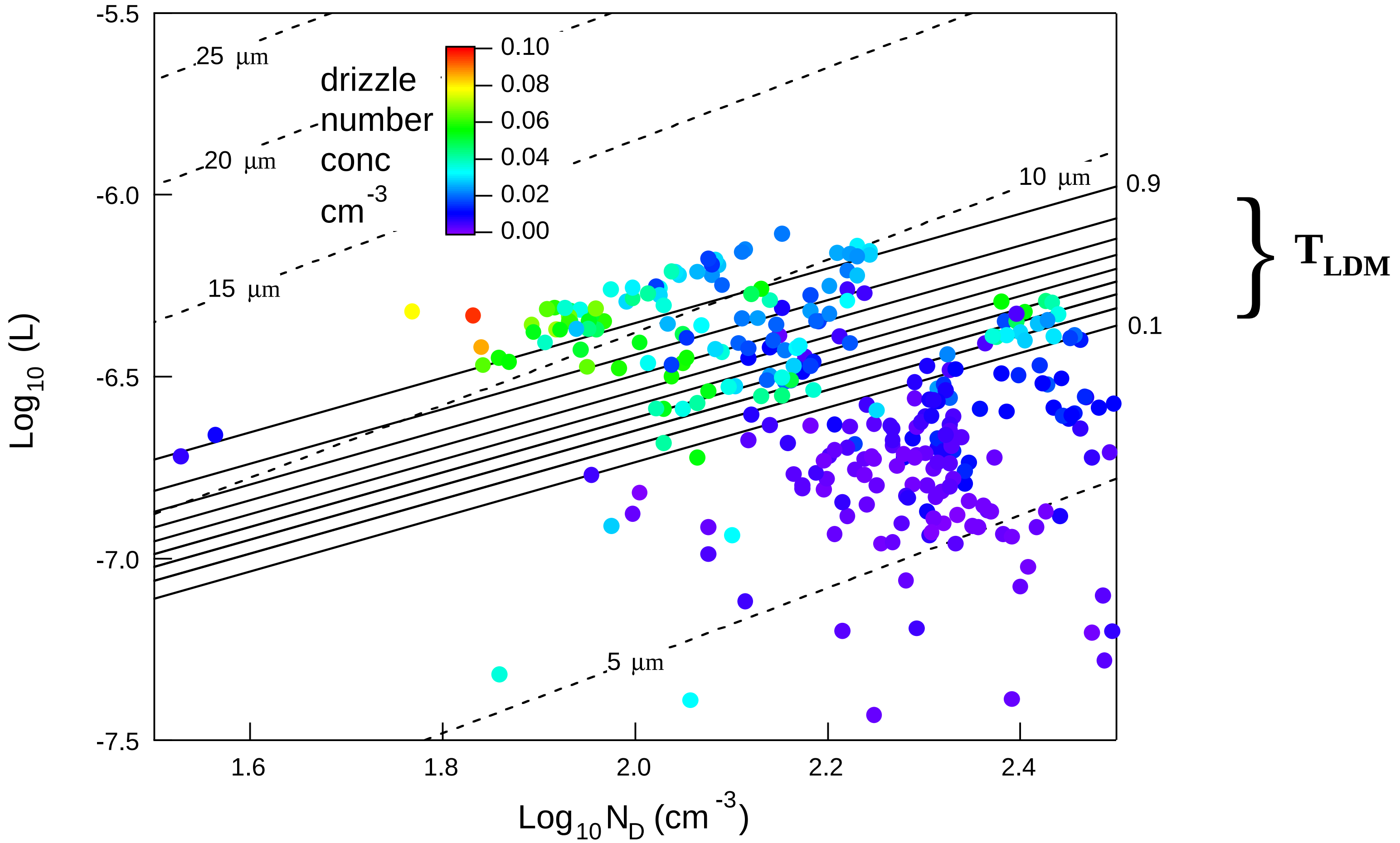
CASE 2: CLOUDY DAY WITHOUT DRIZZLE (10/29/08)

CASE 3: HEAVIEST DRIZZLE DAY (11/01/08)

CASE 1: CLOUDY DAY WITH DRIZZLE

(10/28/08)

LDM THRESHOLD FUNCTION



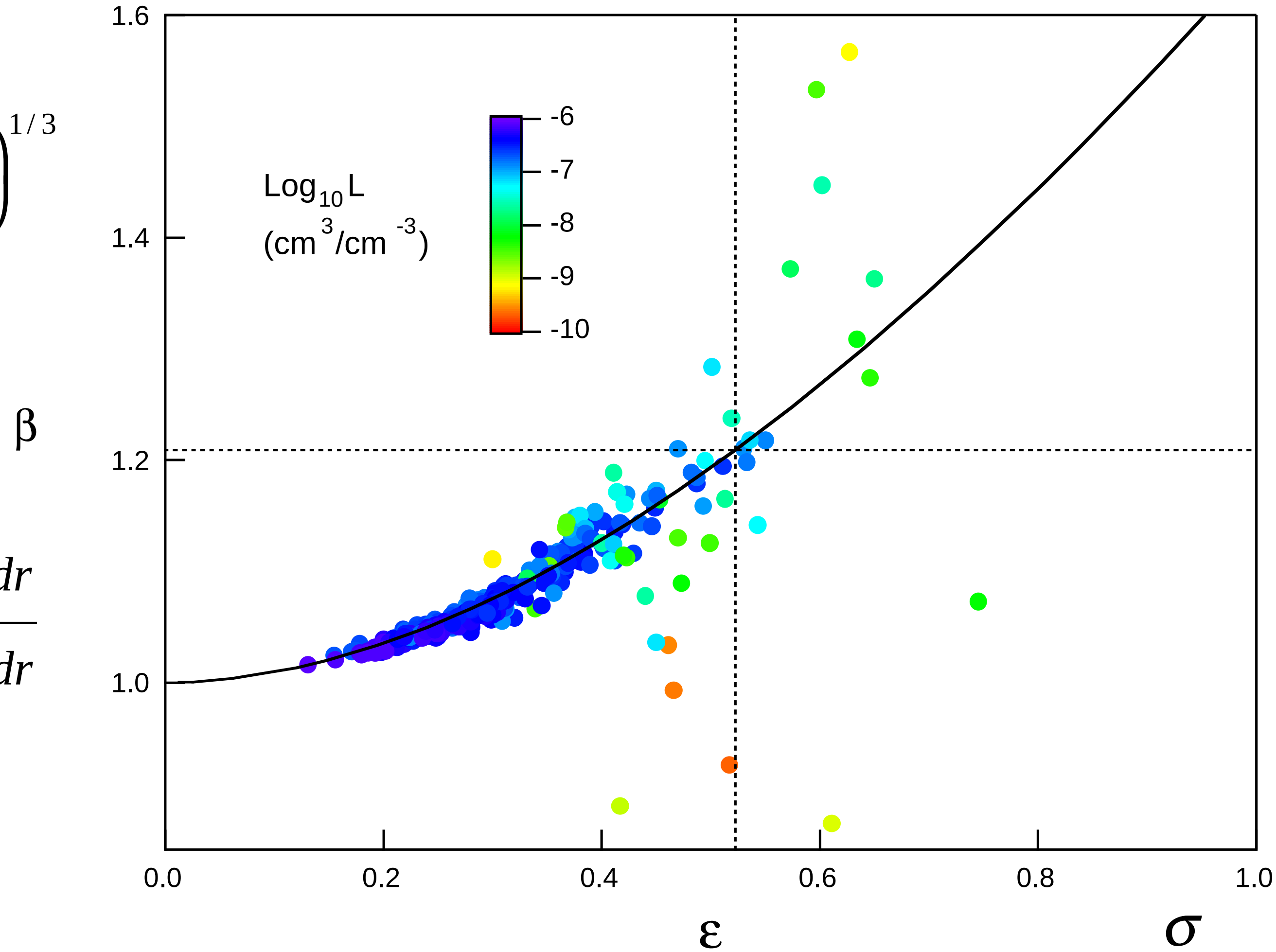
**** Generally good agreement****

(10/28/08)

CLOUD DROPLET DISTRIBUTIONS

$$\beta = r_{eff}\left(\frac{4\pi N_D}{3L}\right)^{1/3}$$

$$r_{eff} = \frac{\int_0^\infty r^3 f(r)dr}{\int_0^\infty r^2 f(r)dr}$$



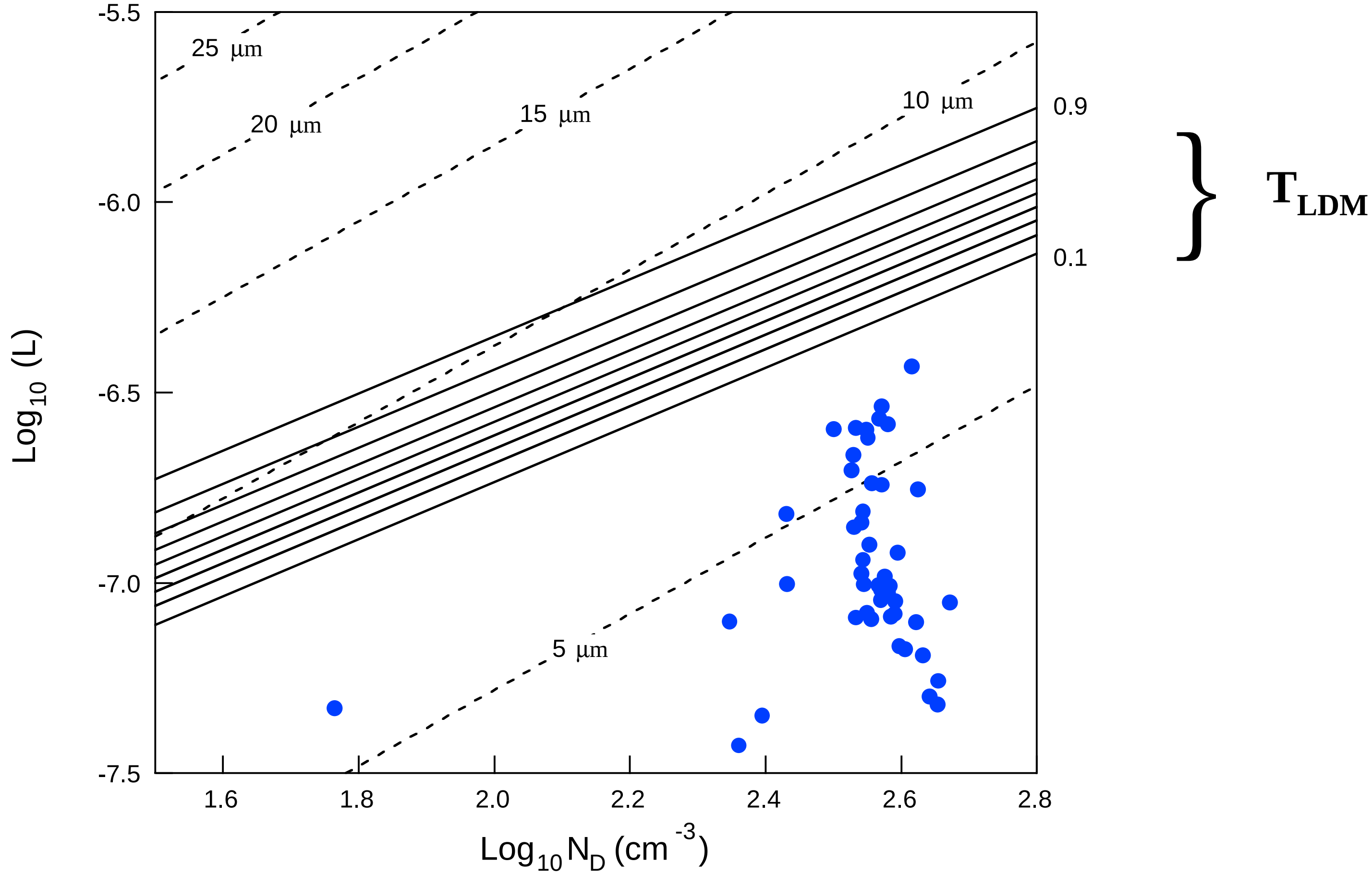
$$\varepsilon = \frac{\sigma}{\bar{r}}$$

*** Excellent agreement for L in cloud range ***

CASE 2: CLOUDY DAY WITHOUT DRIZZLE

(10/29/08)

LDM THRESHOLD FUNCTION



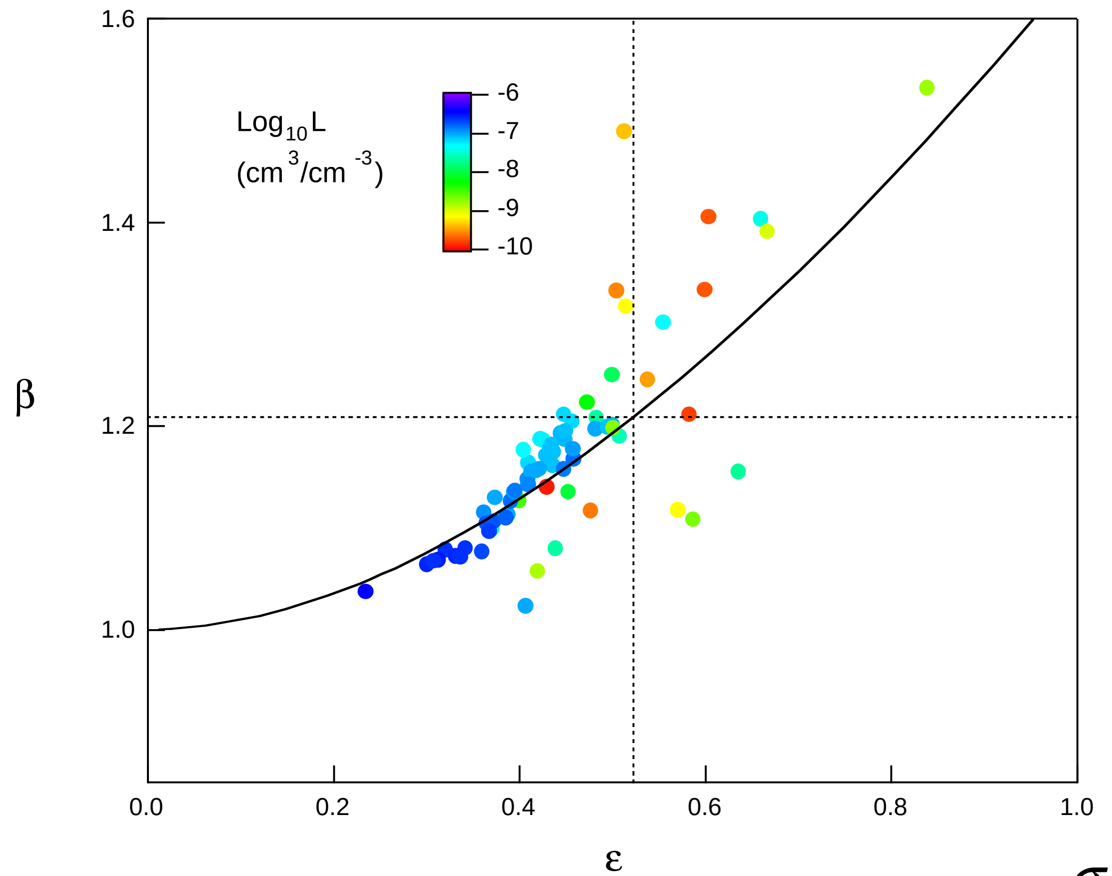
**** Sub-drizzle threshold as expected****

(10/29/08)

CLOUD DROPLET DISTRIBUTIONS

$$\beta = r_{eff}\left(\frac{4\pi N_D}{3L}\right)^{1/3}$$

$$r_{eff} = \frac{\int_0^\infty r^3 f(r)dr}{\int_0^\infty r^2 f(r)dr}$$



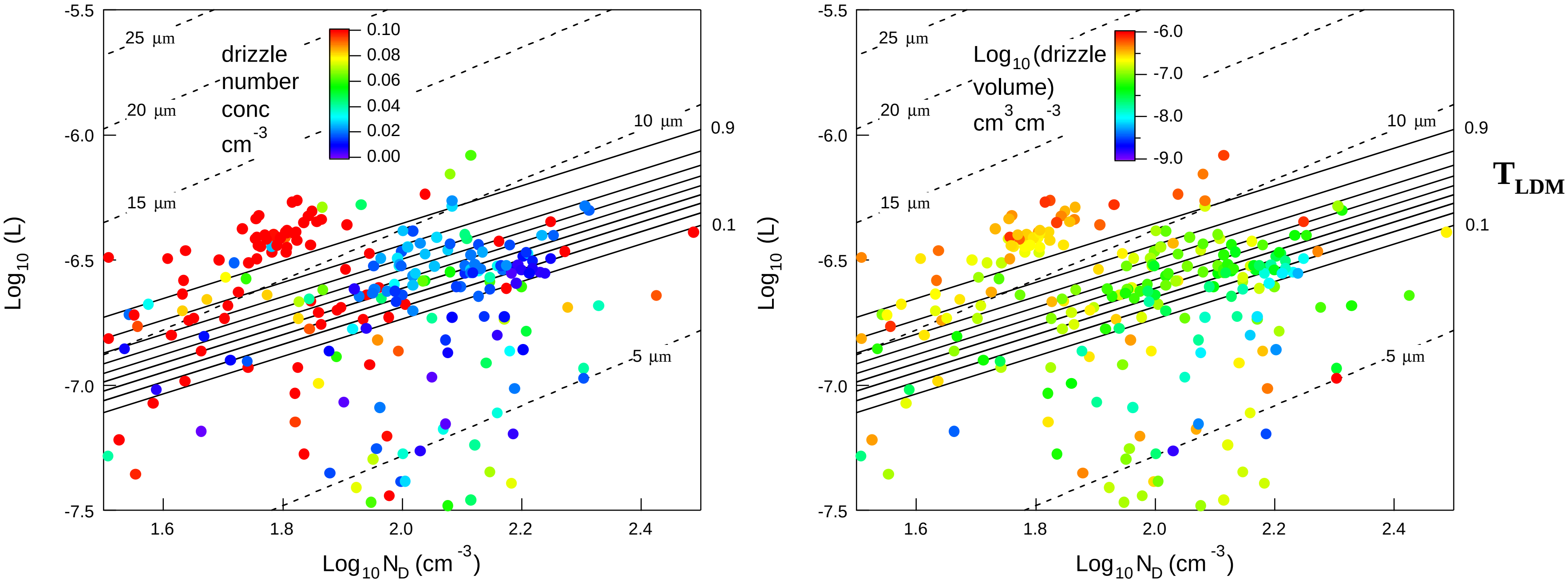
$$\varepsilon = \frac{\sigma}{\bar{r}}$$

*** Many low L values (non-cloud cases), less reliable statistics***

CASE 3: HEAVIEST DRIZZLE DAY

(11/01/08)

LDM THRESHOLD FUNCTION

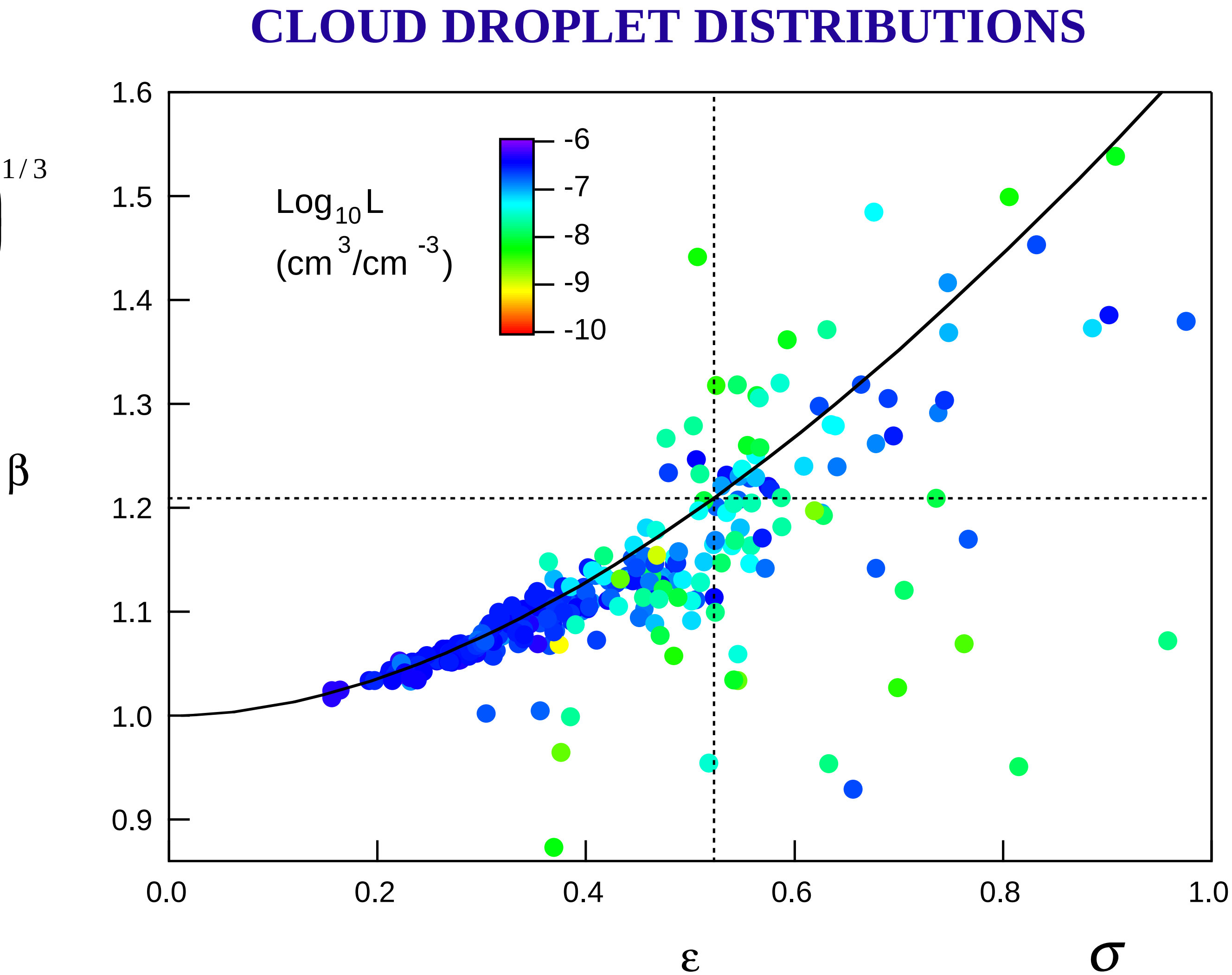


*** *Seeing lots of drizzle fall through****

(11/01/08)

$$\beta = r_{eff}\left(\frac{4\pi N_D}{3L}\right)^{1/3}$$

$$r_{eff} = \frac{\int_0^\infty r^3 f(r)dr}{\int_0^\infty r^2 f(r)dr}$$



$$\varepsilon = \frac{\sigma}{\bar{r}}$$

*** Mostly good agreement for L in cloud range***