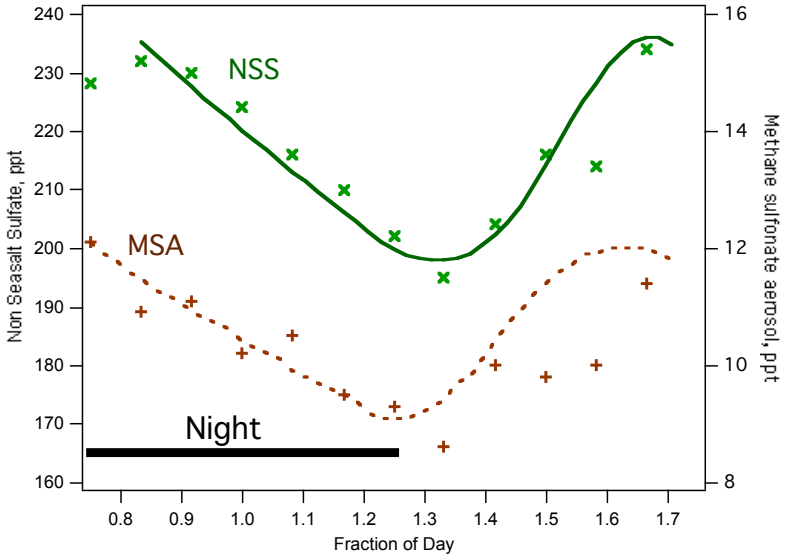
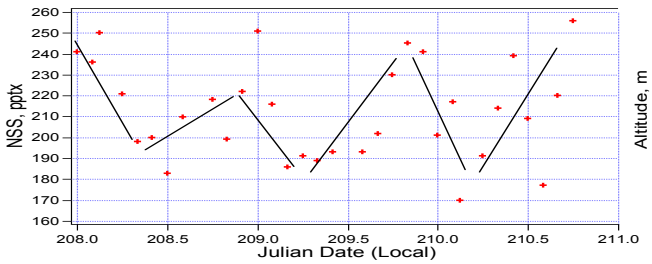
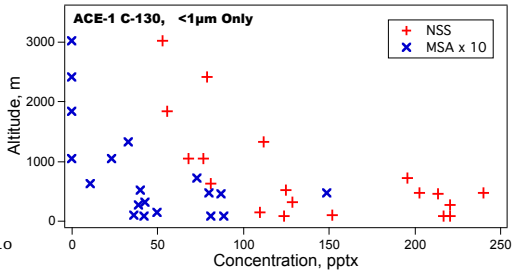
1994 and ACE-1





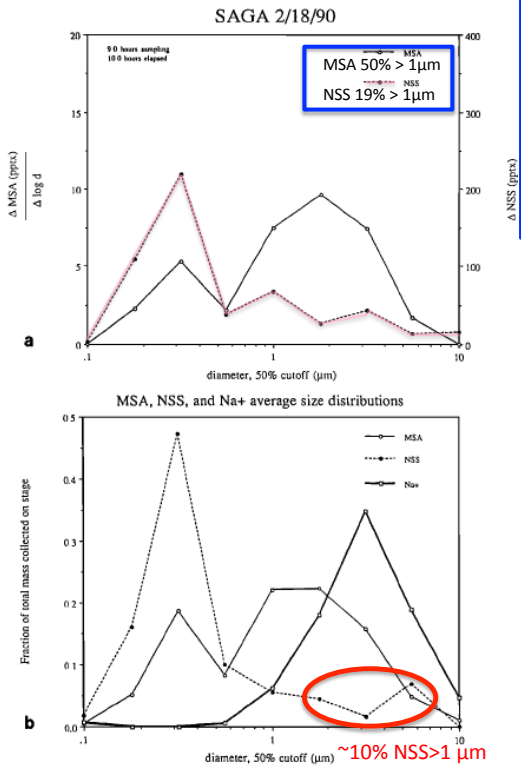


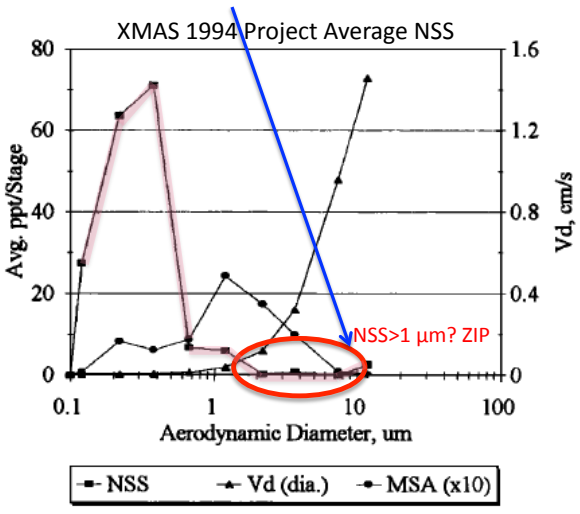
Remote Marine Aerosol Chemistry Measured by Impactors and IC

The majority of MS- is coarse.

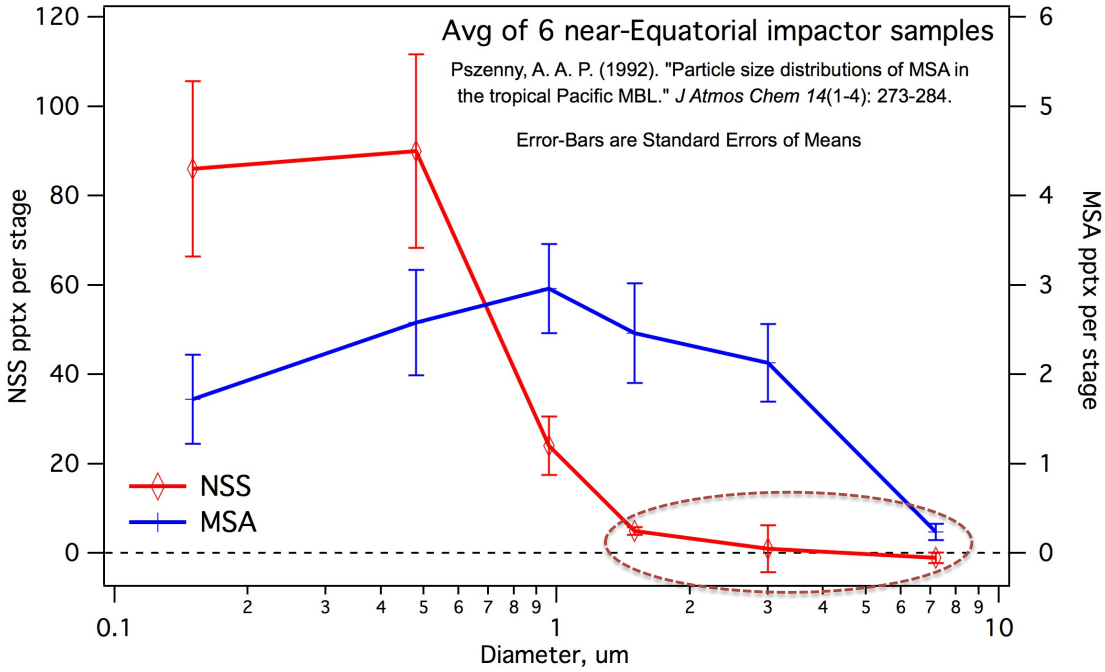
It is common to see as much as 10% of NSS above 1 µm, but in 1994 there was virtually none. The upper limit is around 20% coarse.

(The slight rise at 12 µm is in the noise, but the implied flux is 6 pptv/day)





Coarse NSS is usually a small fraction of the total



HNO_3 is without question taken up by sea salt at a diffusion-area limited rate.

If the same is true of SO_2, why does coarse NSS have such a different shape?

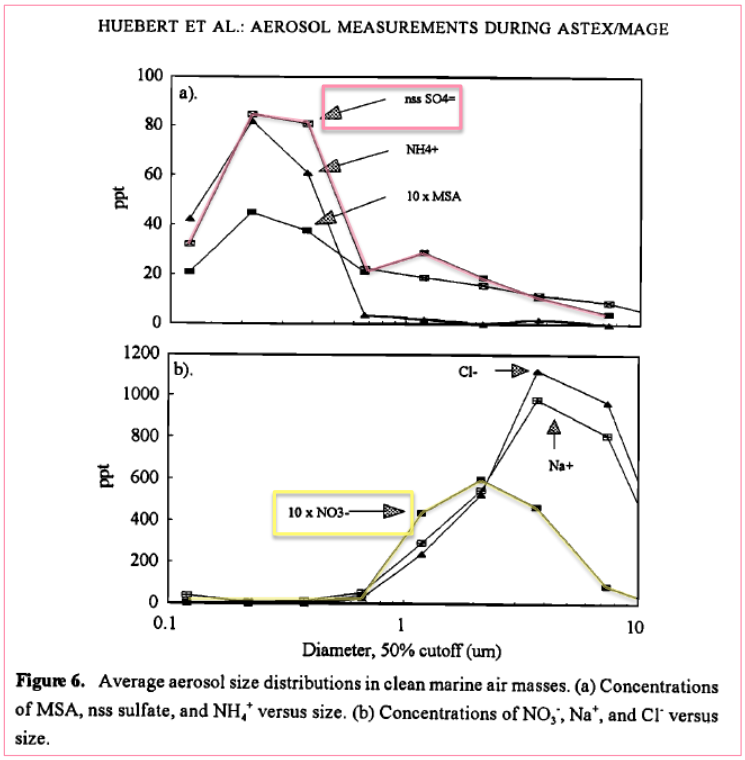


Figure 6. Average aerosol size distributions in clean marine air masses. (a) Concentrations of MSA, nss sulfate, and NH_4^+ versus size. (b) Concentrations of NO_3^-, Na^+, and Cl^- versus size.

HNO_3 is taken up by sea salt at a diffusion-area limited rate. Peak ~0.25 µm

If the same is true of SO_2, why does coarse NSS have such a different shape?

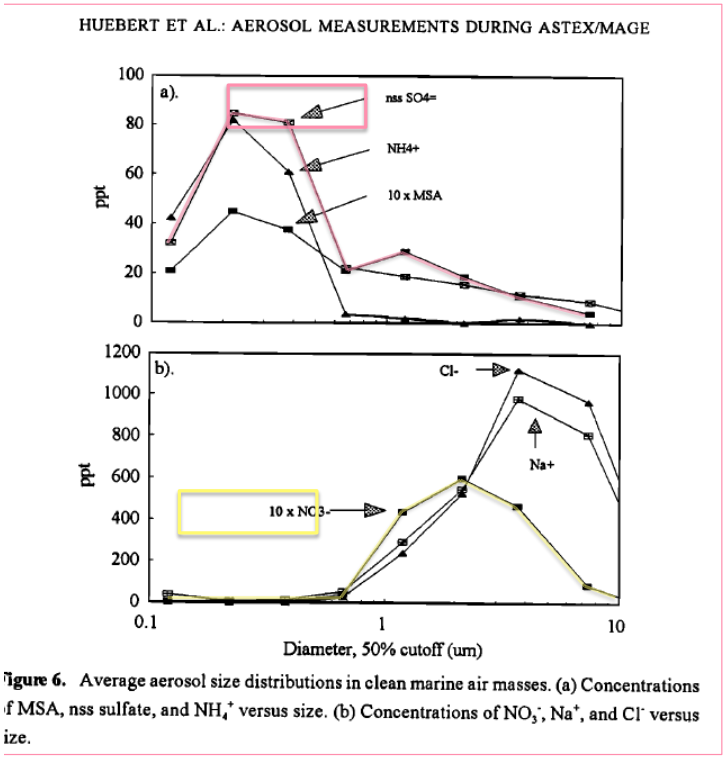
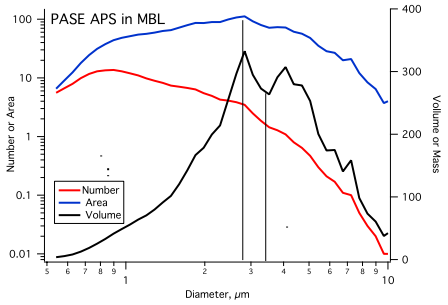
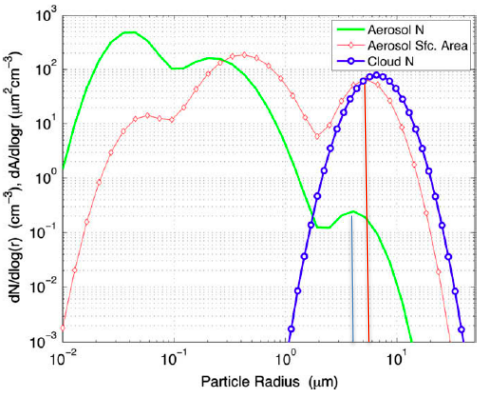


Figure 6. Average aerosol size distributions in clean marine air masses. (a) Concentrations of MSA, nss sulfate, and NH_4^+ versus size. (b) Concentrations of NO_3^-, Na^+, and Cl^- versus size.



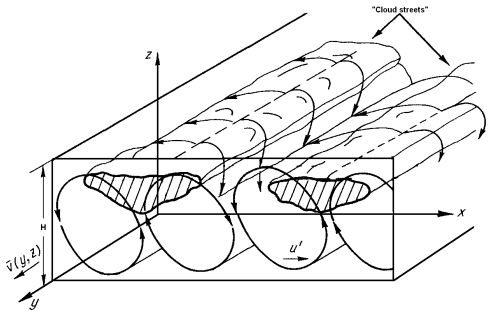
Surface area from Faloona 09

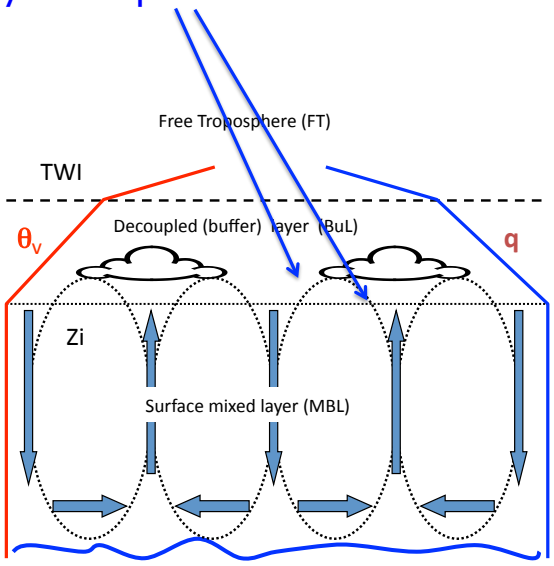


Boundary Layer Rolls in PASE

Oxidation in clouds

Is the BuL really decoupled?

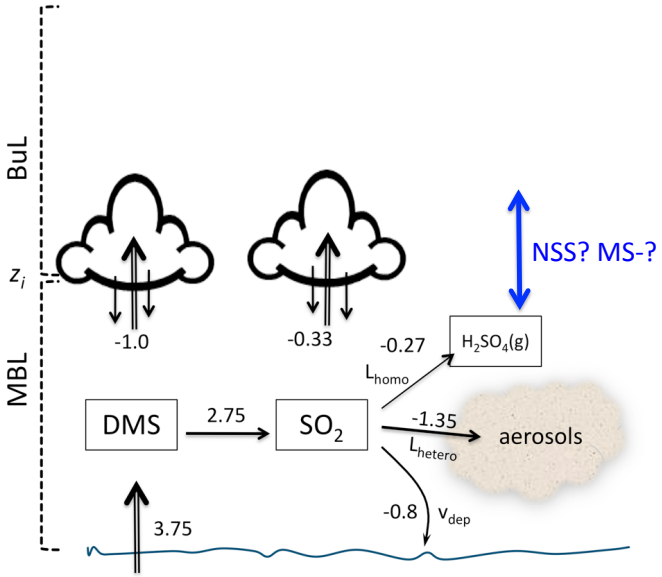




HIGEAR
Hawaii Group for Environmental Aerosol Research

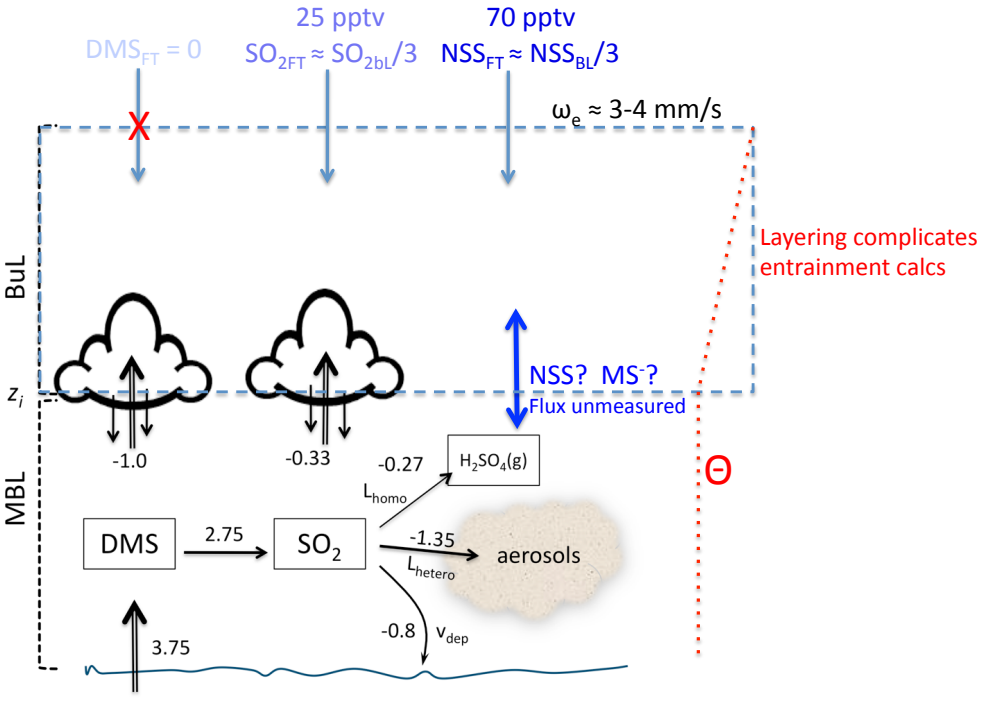
PASE BL-Only Sulfur cycle, per Faloona

But we haven't measured all the entrainment

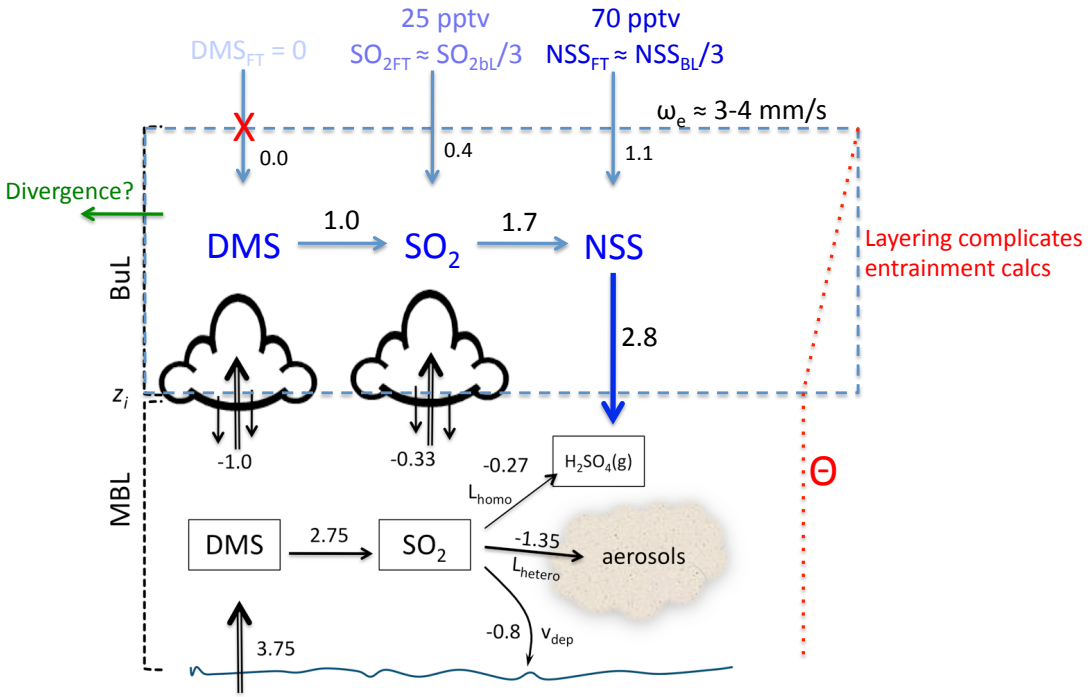


Units: µmol S / m2 day

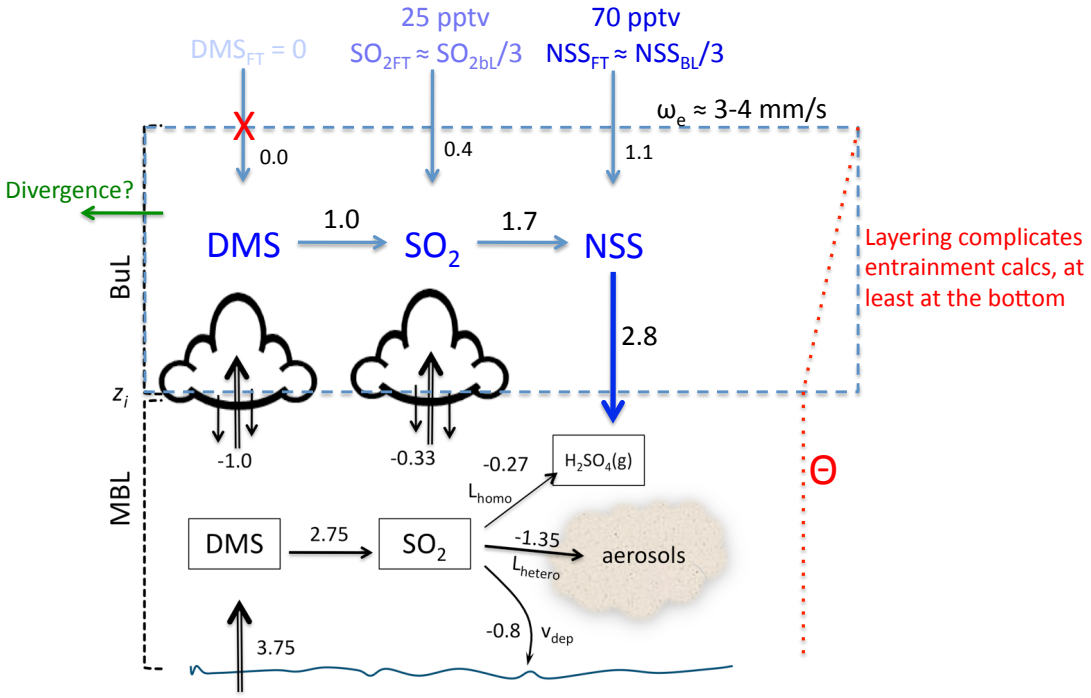
To understand the BL, we have to know more about the BuL.
We didn't measure all the critical sulfur fluxes to and from the BL



Entrainment of FT air brings Sulfur mass into the BuL

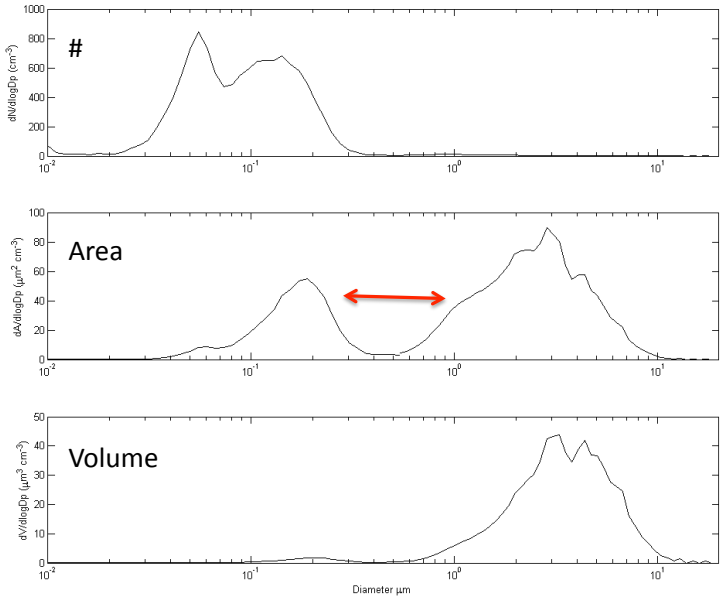


Divergence inthe BuL is a big unknown, but for now assume it's small.
To Balance the known DMS and SO_2 fluxes,
the BuL must export 2.8 µm NSS / m^2d



APS and LDMA Data in the BL on PASE

About 2/3 of Surface Area is in the Coarse Mode



So Coarse Hetero ~ 1.35 * 0.67 = 0.9 µmol S /m^2d

And Fine = {1.35 * 0.33} + 0.27 Homo + 2.8 BuL-Cloud = 3.5 µmol S /m^2d

Thus, with same removal rates, [NSS_C] / [NSS_{Tot}] = 20%

How did Sievering/Chamedies conclude that "45% of NSS is coarse", when impactors get 10-20% or less?

(in the absence of dust)

That motivated their need to explain lots of coarse NSS formation

Answer:

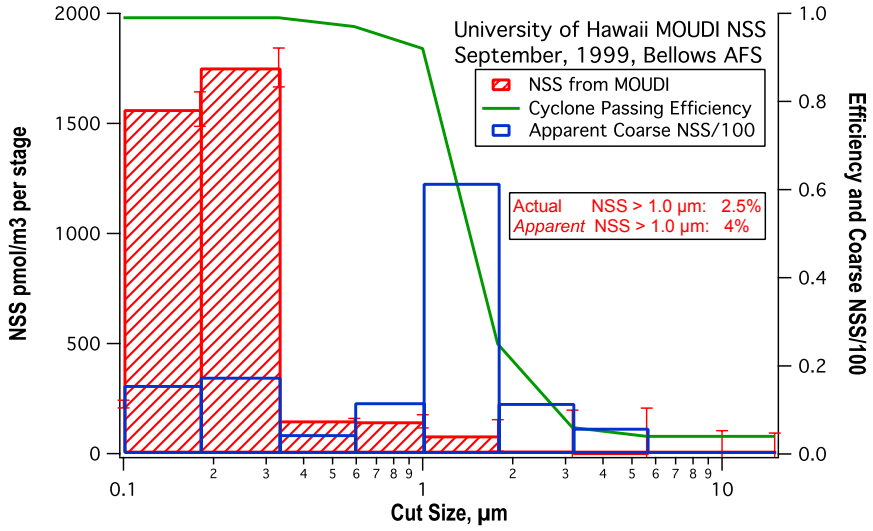
Luria, Van Valin, Galloway, Keene, Wellman, Sievering, Boatman (1989), The Relationship Between Dimethyl Sulfide and Particulate Sulfate in the Mid-Atlantic Ocean Atmosphere, *Atmos. Environ., 23, 139-147.*

They derived their measured coarse NSS by difference:

{Filter: Total NSS} – {1.5um Cyclone & Filter: ~Fine NSS} ≈ "Coarse NSS"

How could the characteristics of a cyclone affect this result?

Red is the ambient NSS distribution from a MOUDI
Green is a typical cyclone passing efficiency
Blue is the apparent NSS from filter minus cyclone filter



Because of the Cyclone's broad kernel function,
a significant amount of Fine NSS can be counted as Coarse

A small penetration of high concentrations can easily double the apparent coarse concentration. Factors of 2-5 are easily achievable under field conditions.

How did Sievering/Chamedies conclude that "45% of NSS is coarse",
when impactors get 10-20% or less?
(in the absence of dust)

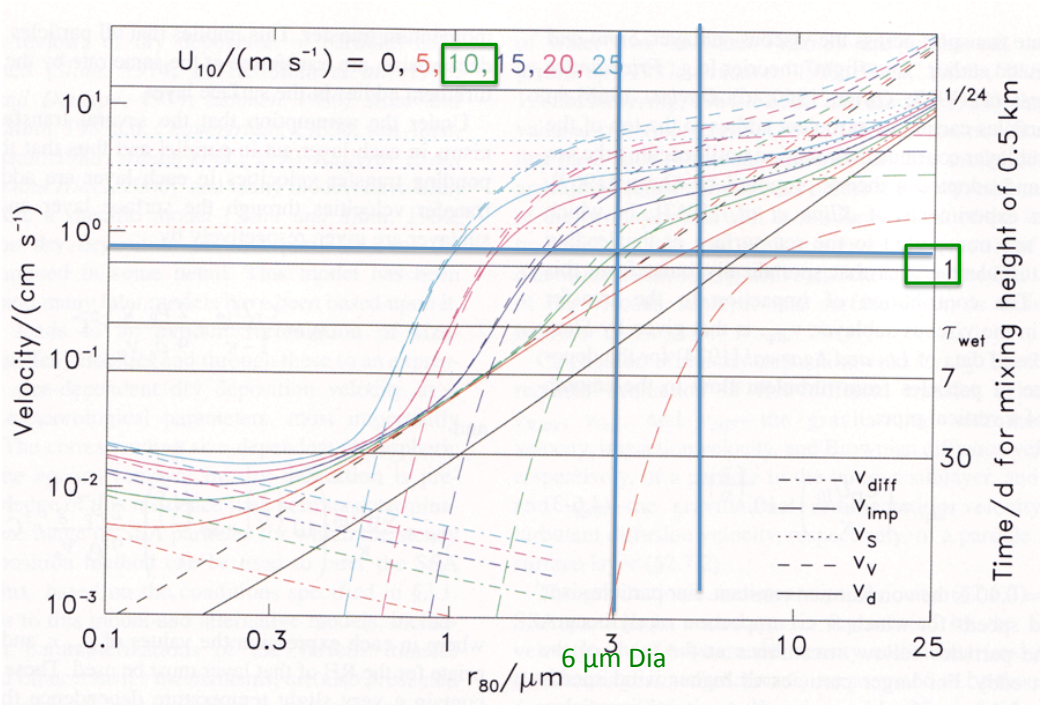
That motivated their need to explain lots of coarse NSS formation

Answer:

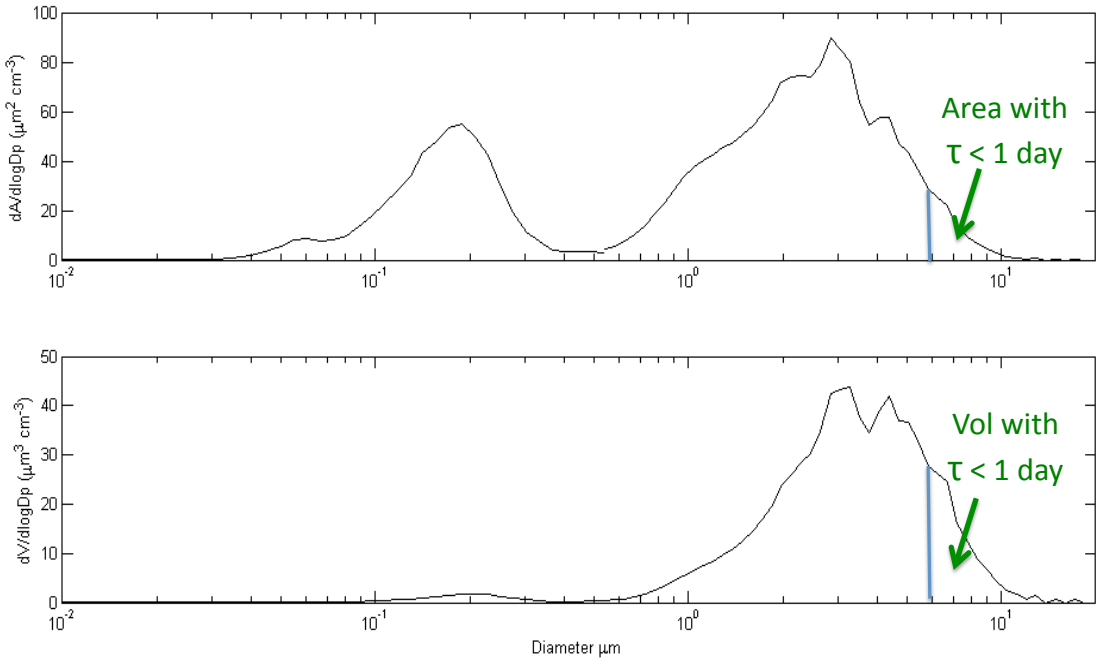
Luria et al. did not use a method with a sharp size cut.
Their measurement technology was not well-suited to answer the question of how coarse NSS is distributed by size.

Rapid Dry Deposition of 6-10 µm partcles?

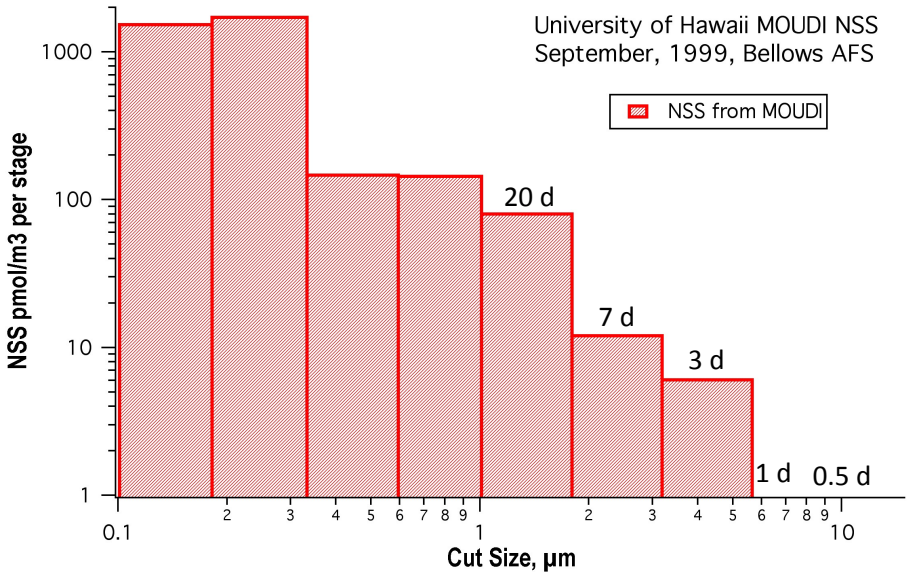
In 10 m/s winds, a 6 µm diameter particle
has a lifetime of just over a day in an 800m MBL. Sorta



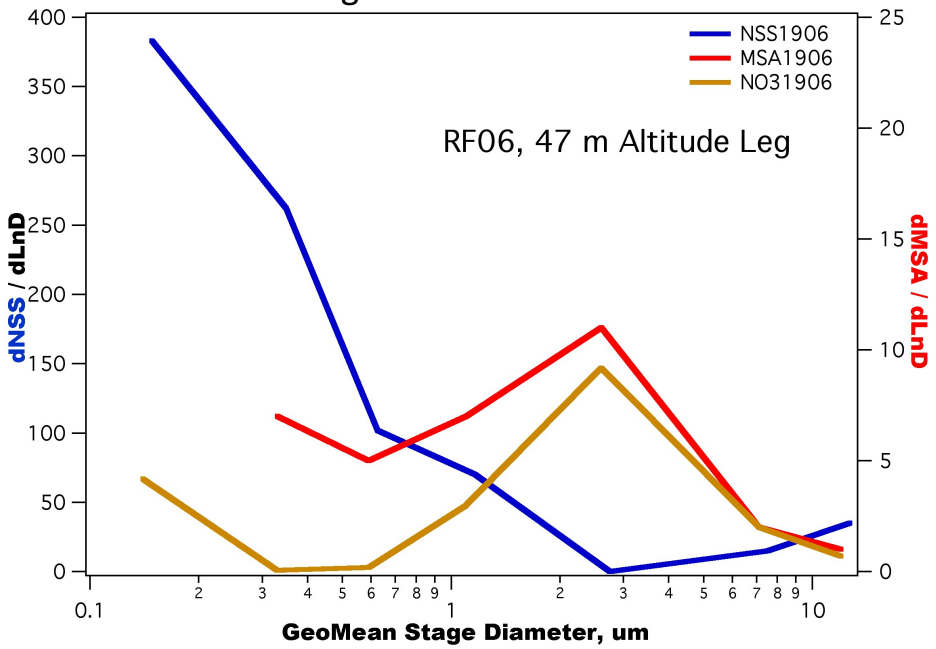
PASE MBL Area and Volume Distributions



Lifetimes Against Dry Removal for NSS Mass at Bellows
(a MOUDI has better size resolution than the PASE MOI)



RF06 MOI – flight with the most Coarse NSS



Conclusion: Nitrate and Methanesulfonate deposit on sea salt by Area. NSS does not.

The area-based analysis of Faloona 09 does not work here.

Disregard Wet Deposition?