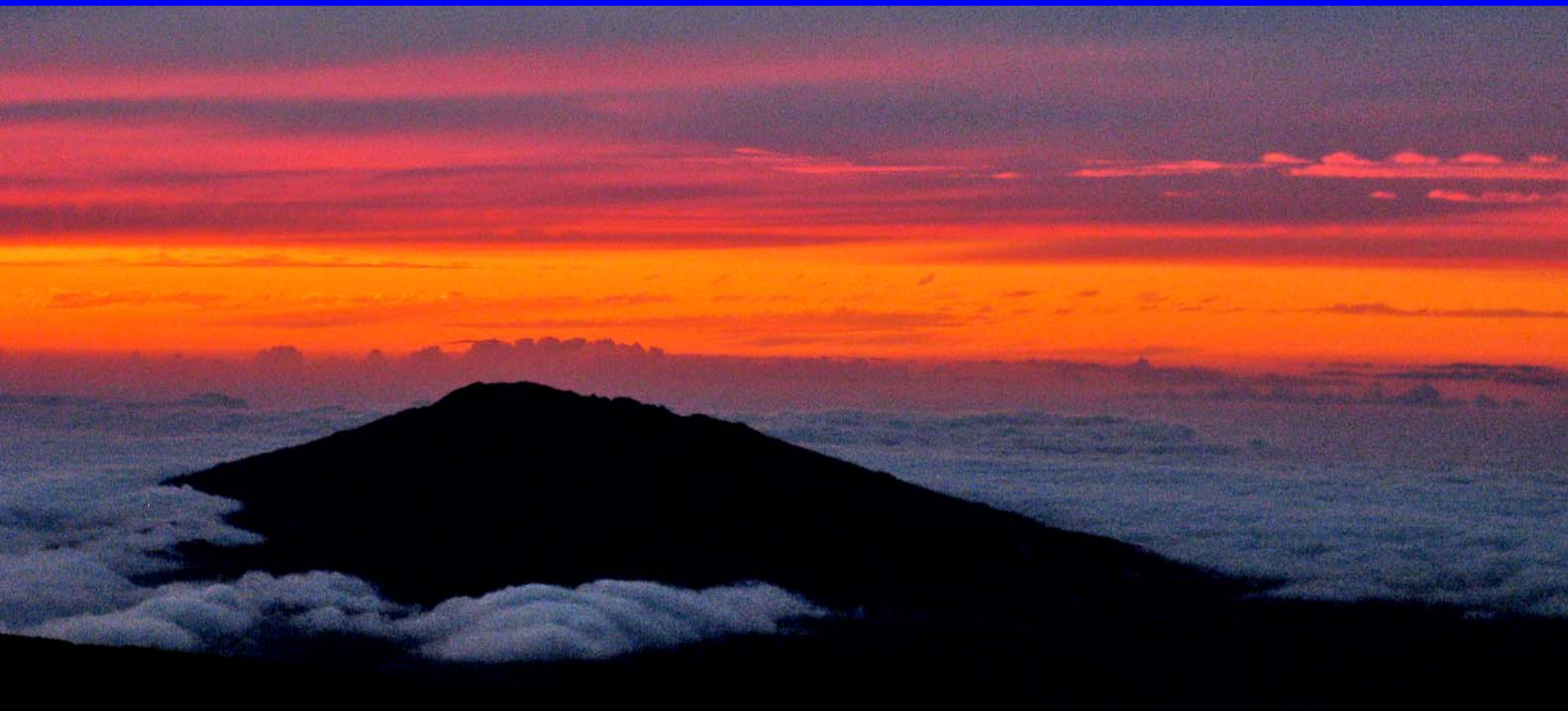


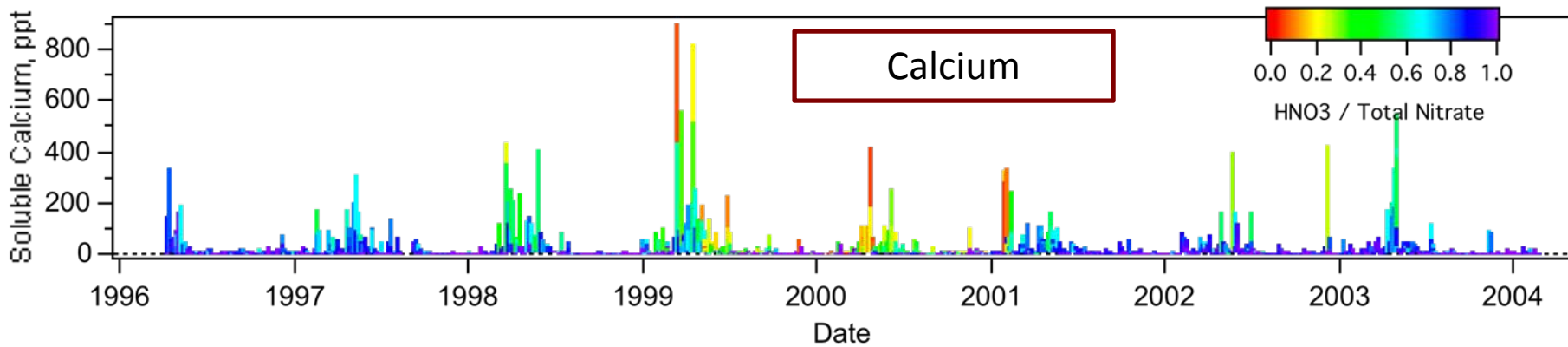
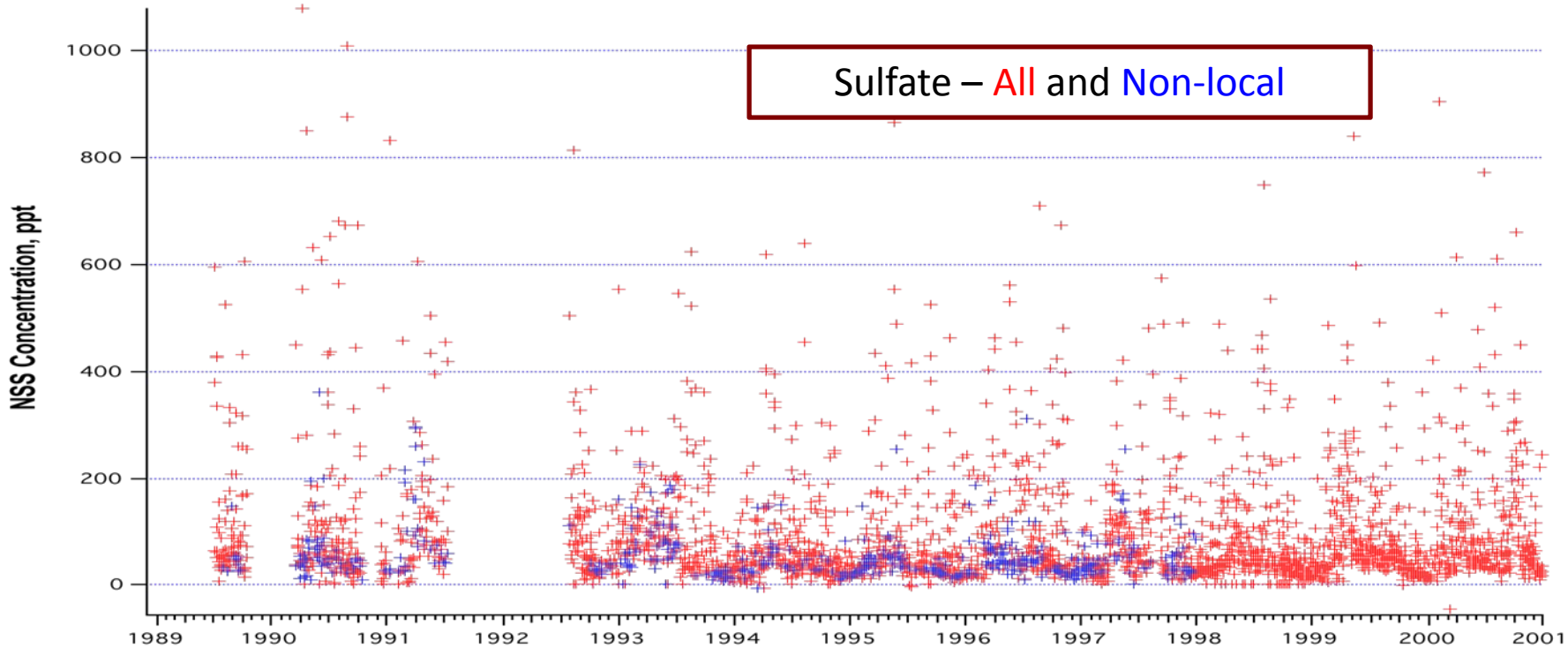
{Total Aerosol Carbon / Sulfate} in the Free Troposphere at MLO

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Department of Oceanography
University of Hawaii
Honolulu, HI 96822 USA
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Big thanks to MLO Staff (!!), NSF-ATM, and whoever paved the road

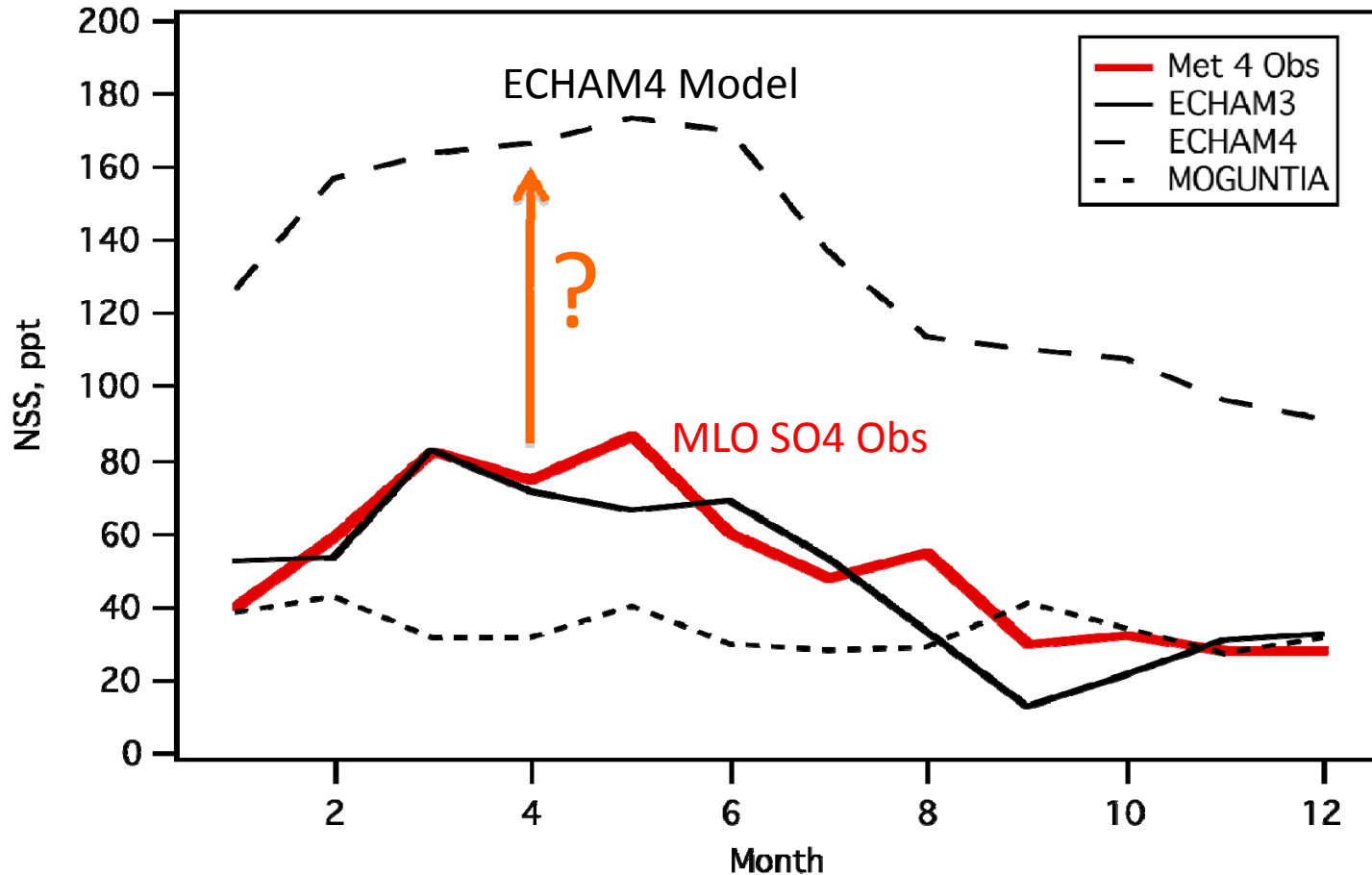


Two Decades of Nightly Anions and Cations at MLO



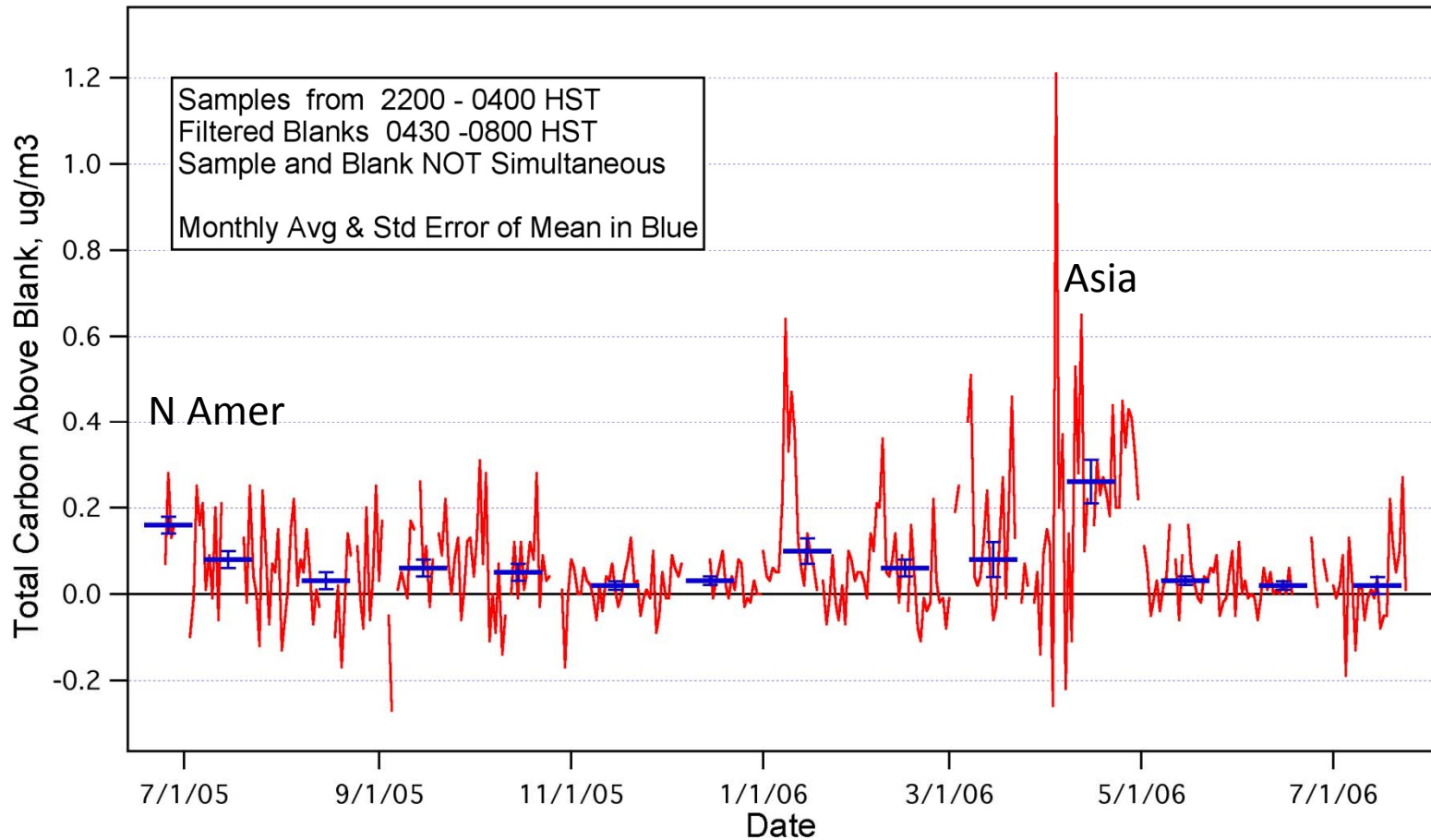
I ran out of time – still going in 2009

Models have had difficulty with BL-to-FT transport upstream of MLO,
But they do very well with aerosol scavenging enroute



Huebert, Phillips, Zhuang, Kjellstrom, Rodhe, Feichter, and Land (2001), Long-term measurements of free-tropospheric sulfate at Mauna Loa: comparison with model simulations, *J. Geophys. Res.*, 106, 5479-5492.

Daily and Monthly variability of Total Carbon Aerosol



Recent Good News:
Newer Sunset NDIR detector has much lower noise!
Resolved Sunset/PC problem

Spring 2009 UH Carbonaceous Aerosol Intensive at MLO

Does the OC/SO₄ ratio increase in Asian Dust?

How much OC and BC in the FT comes from Asia?

Sulfate

Filter collections and IC analysis – one nightly sample

Aerodyne AMS

Carbonaceous Aerosols

Dual Sunset Labs Thermal/Optical analyzers – Doing Total Carbon, TC (no OC nor EC)

Aerodyne AMS

Aethalometer (absorbing aerosols, BC)

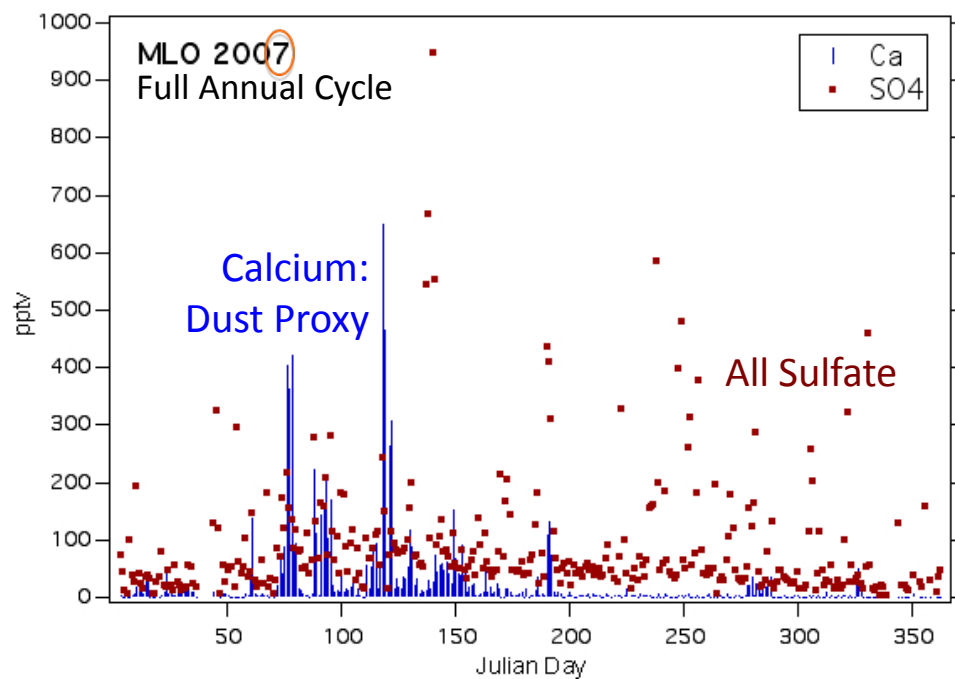
SP3 soot probe

Ogren Data (Thanks!)

PSAP, Nephelometer, Meteo

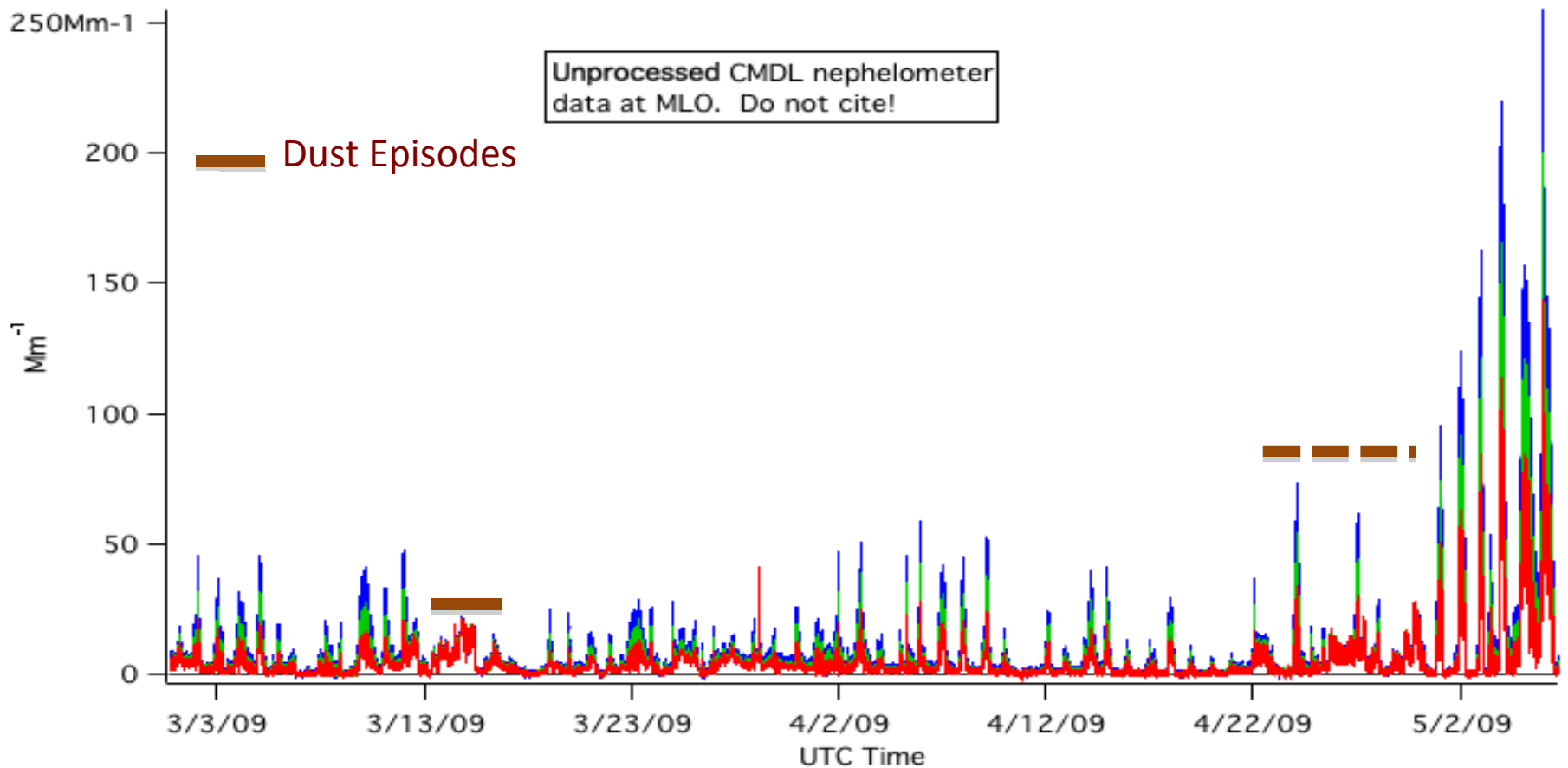
Duration: March and April, 2009

All the 2009 Intensive Data is Preliminary



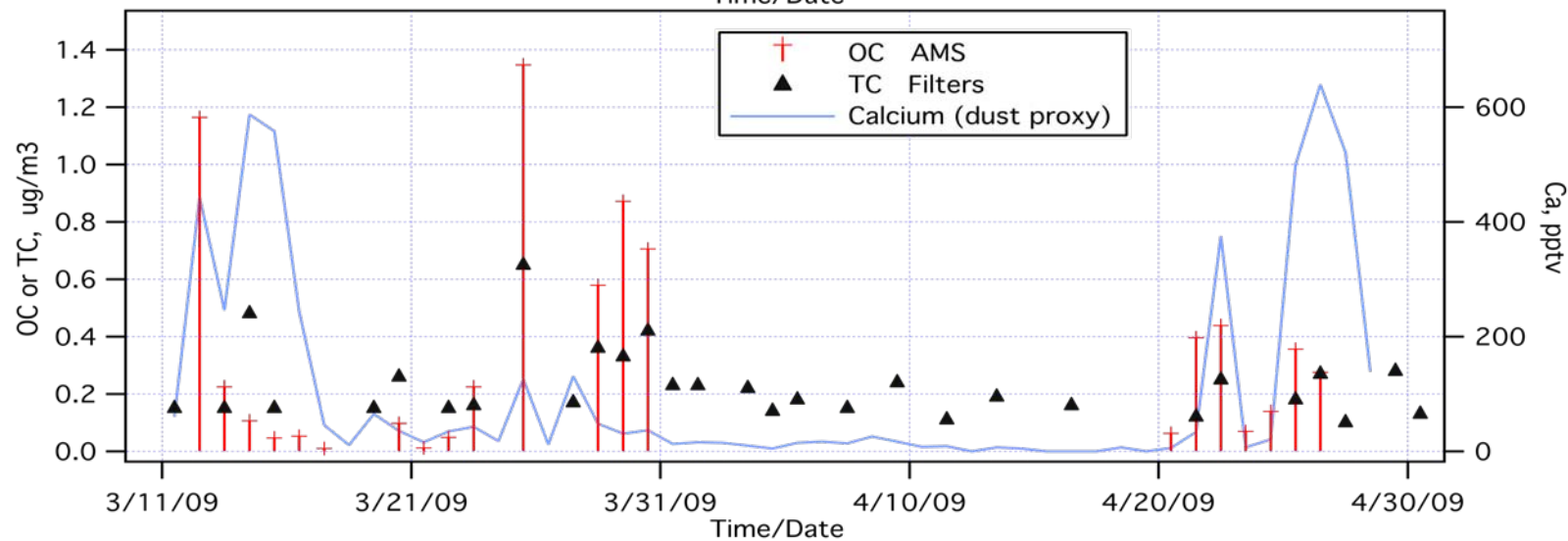
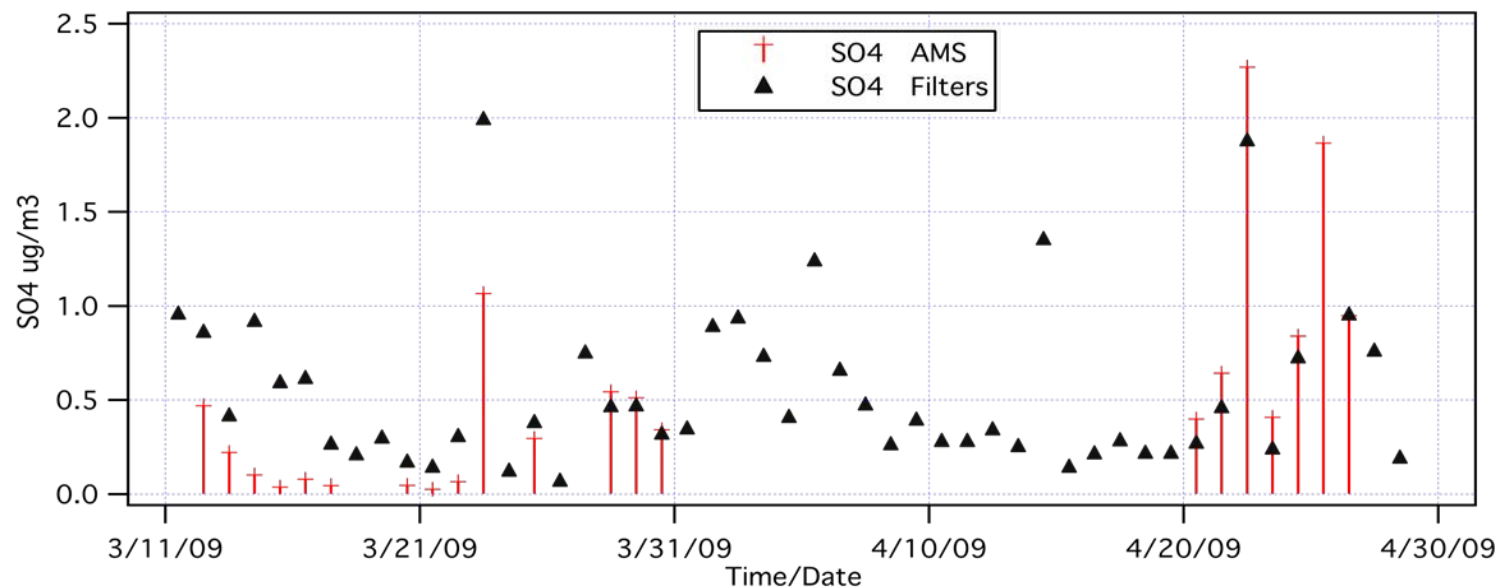
Two months UH Intensive Aerosol Chemistry Observations at MLO

The following data are *preliminary* - Hot off the mountain and not yet fully QC'd.



Spring 2009 Time-Series for Sulfate and for OC & TC

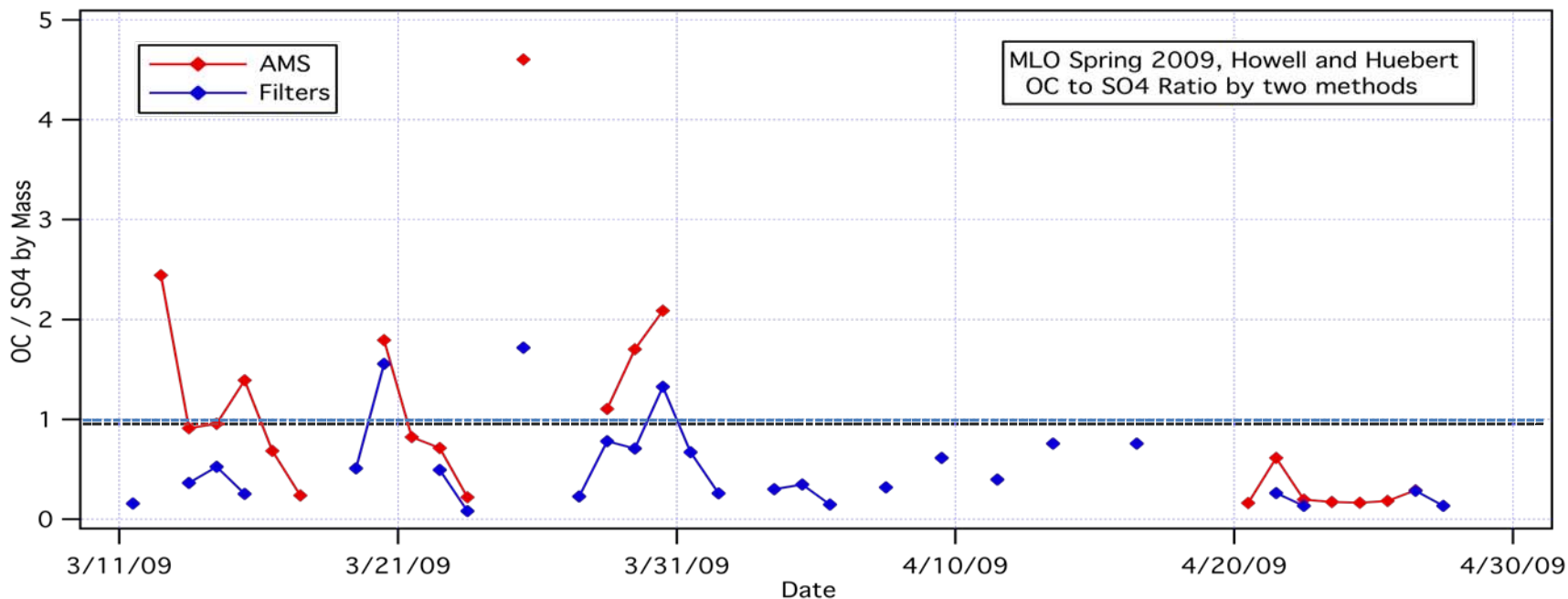
Aerodyne AMS and Filter data in each plot



AMS-OC vs Sunset-TC plot slope = 1.8, R² = 0.72

Thanks to Tony Clarke for AMS data

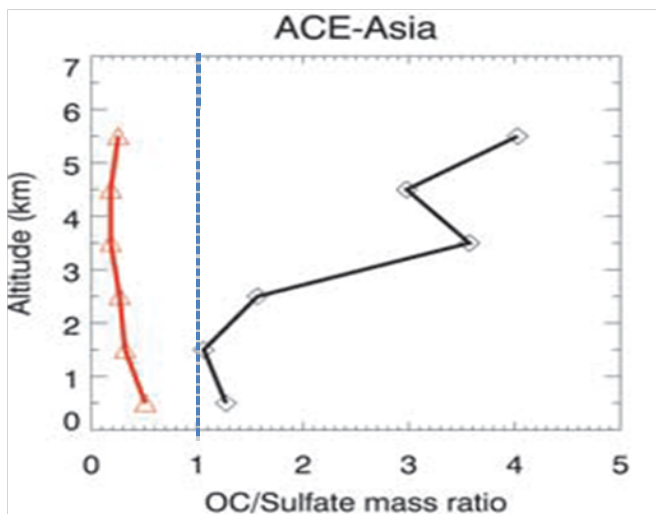
TC/SO₄ (Filters) and OC/SO₄ (AMS) ratios:
Is there more Aerosol Carbon than Sulfate in the FT?



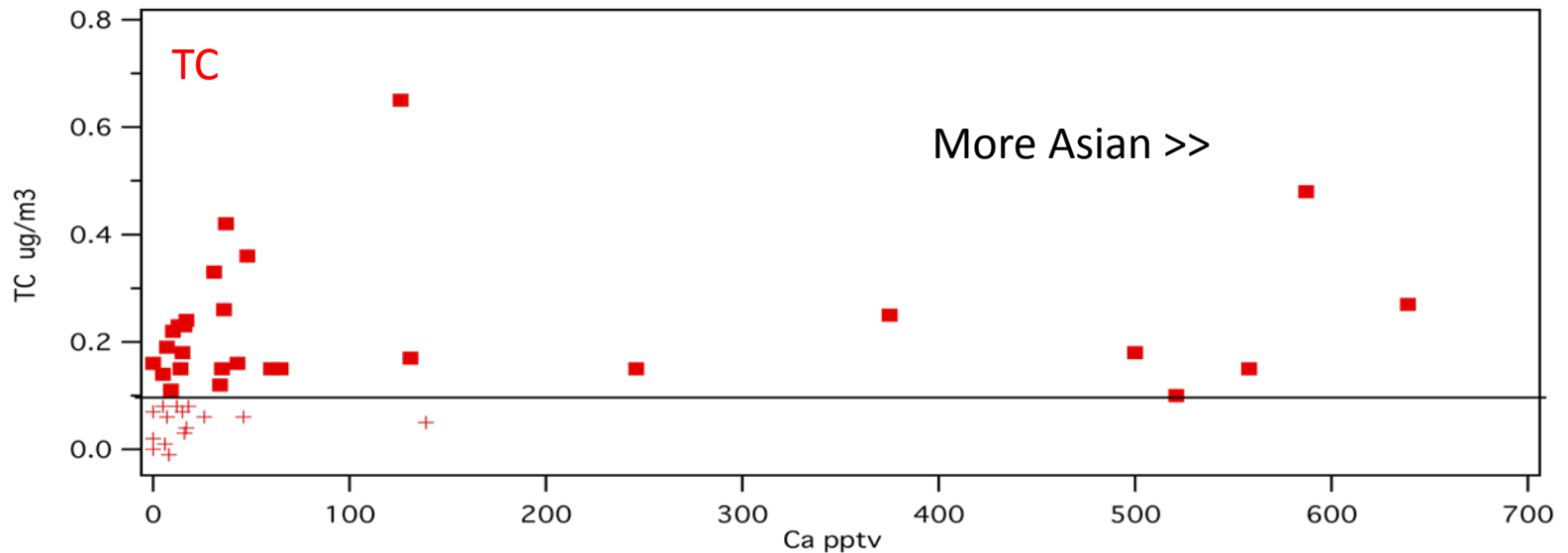
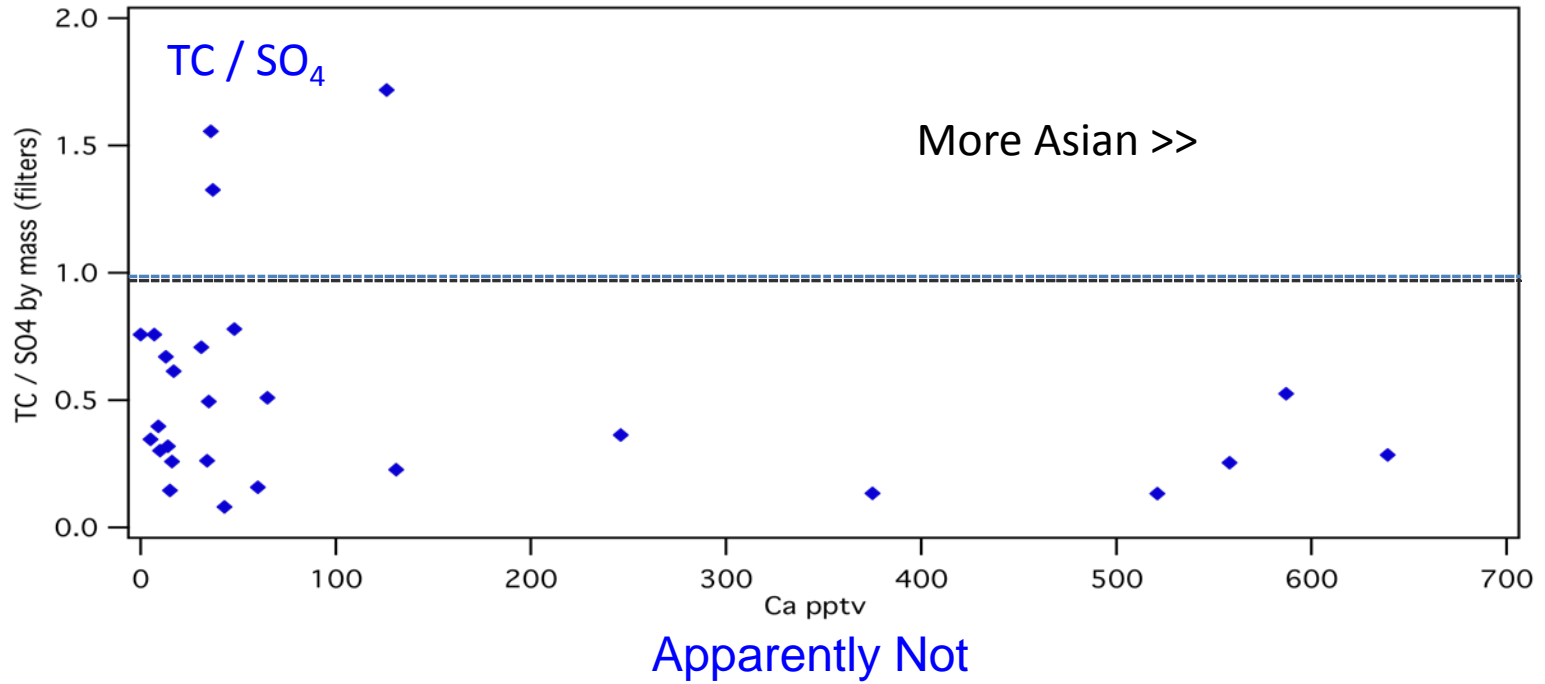
Heald et al., “A large organic aerosol source in the free troposphere missing from current models,” *GRL*, doi:10.1029/2005GL023831:

Their modeled (red) OC/SO₄ ratio in the FT was 0.2 – 0.3, while the ACE-Asia measured (black) value was 3 – 4.

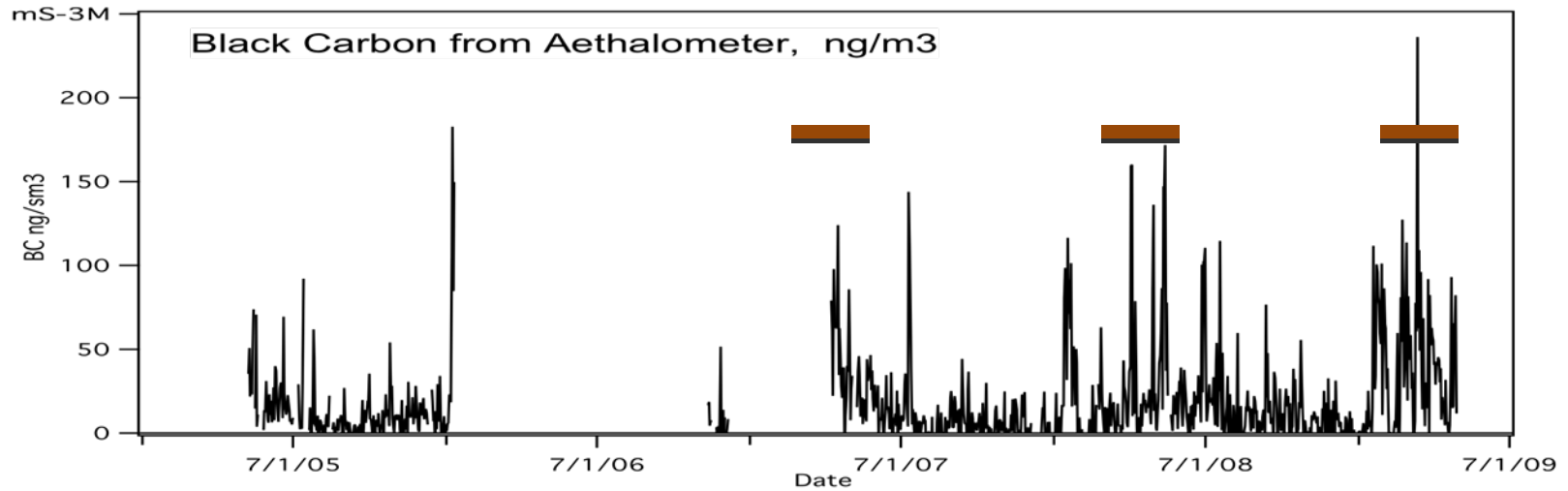
Our MLO data agree a bit better with the model, although a few samples have ratios close to those off the Asian coast. *Is “a large OC source missing?”*



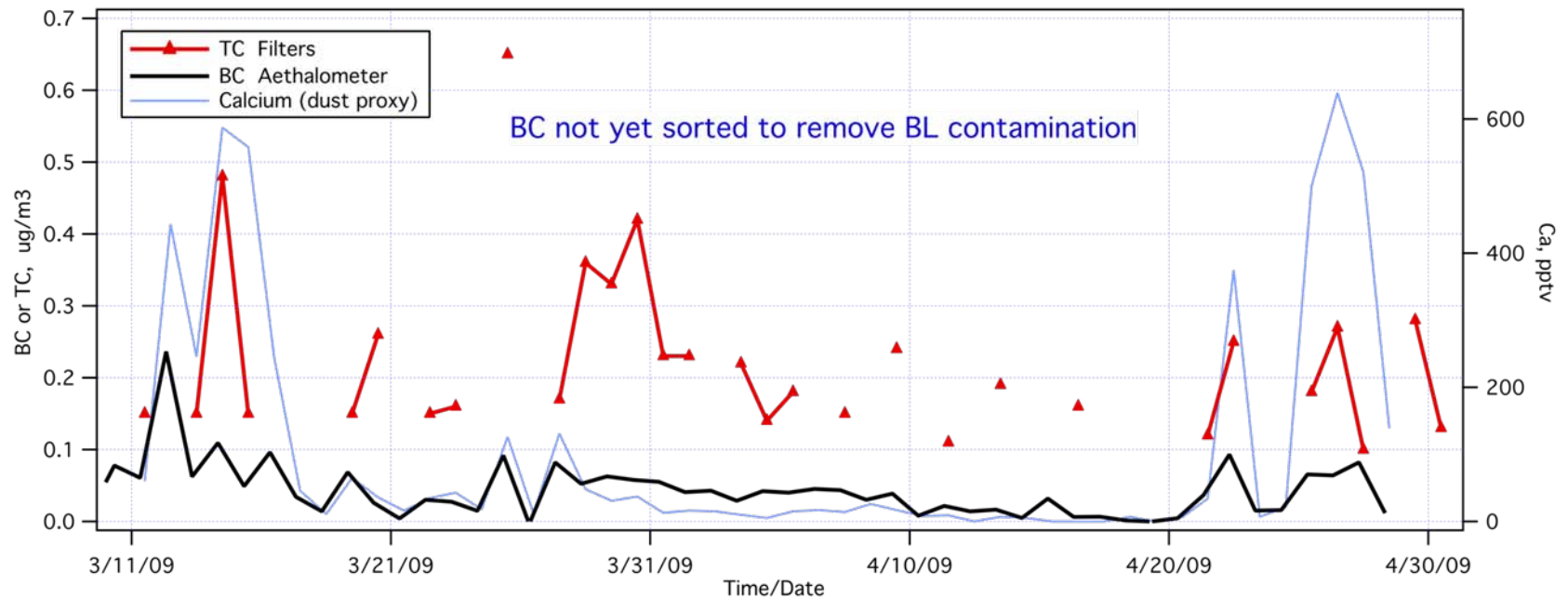
Do dust events (Asian outflow) change TC/SO₄?



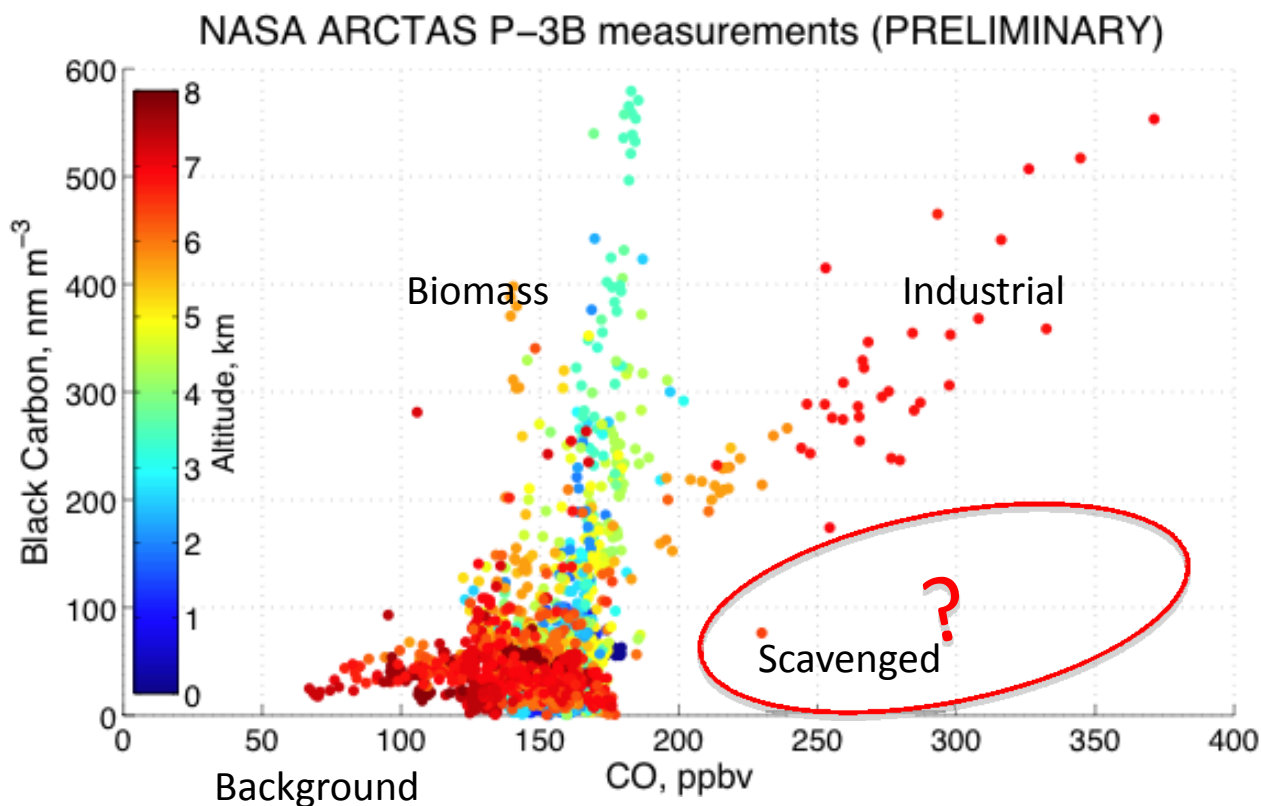
Black Carbon (bap, really) *does show* the **springtime** Asia peak



Black Carbon was 10-50% of Total Carbon during the 2009 Intensive



How scavenged is the BC at MLO?



- CO is a non-scavenged tracer of industrial and biomass-burning plumes
- CO/BC ratio changes with different sources

Clarke & Howell: Airborne data over Alaska, Northern Canada, and the Arctic Ocean in April 2008

We can't do this analysis for MLO: we can't get CO data yet