Fog processing of atmospheric organic matter

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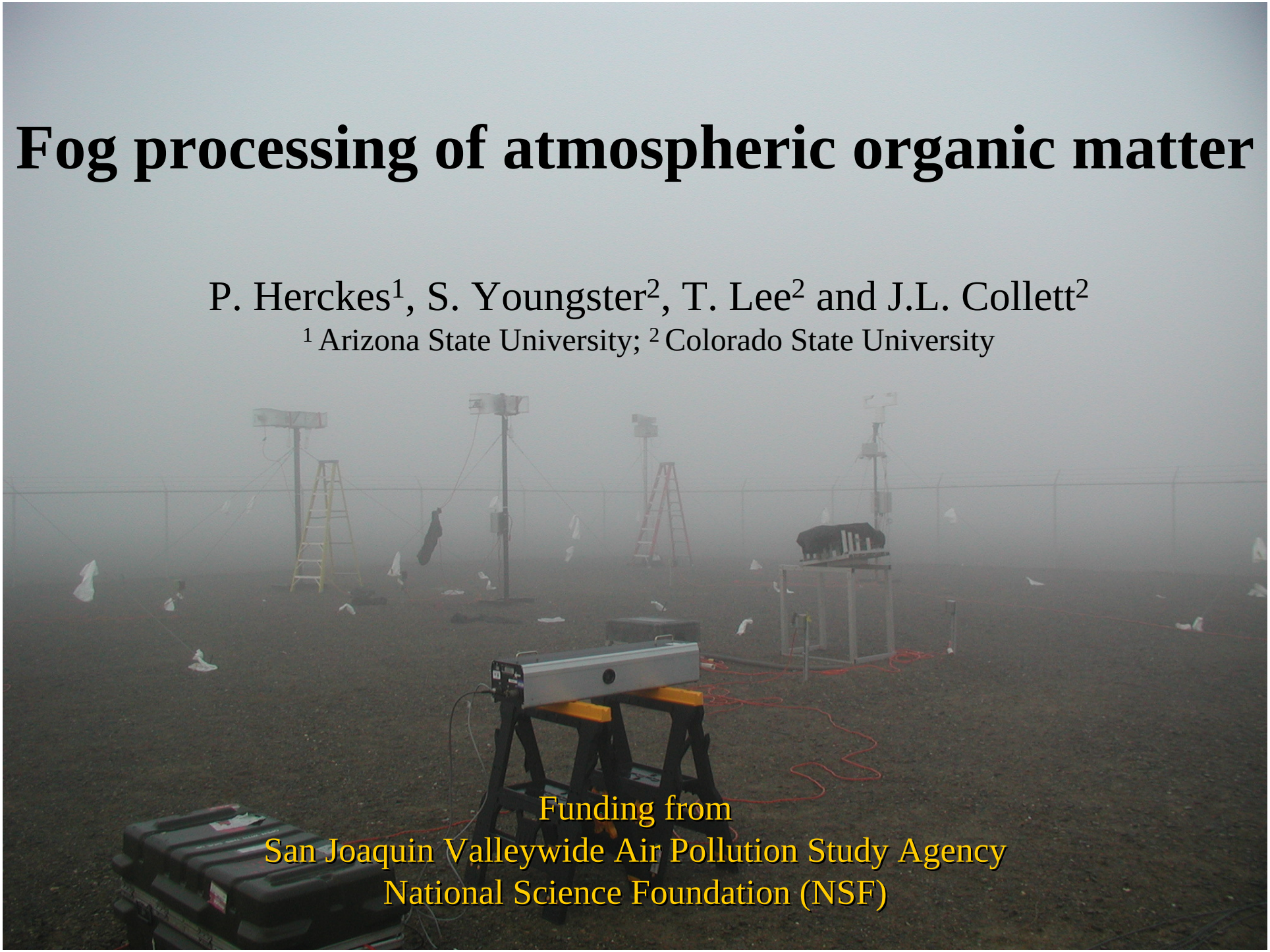

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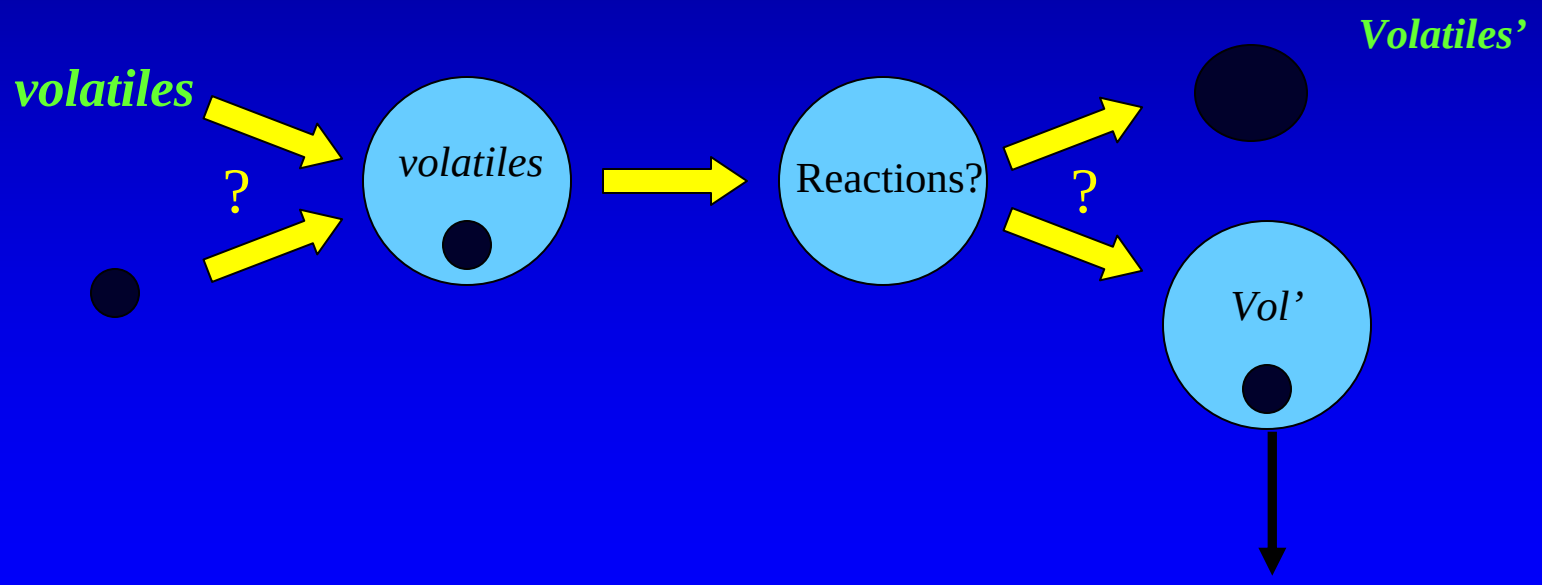
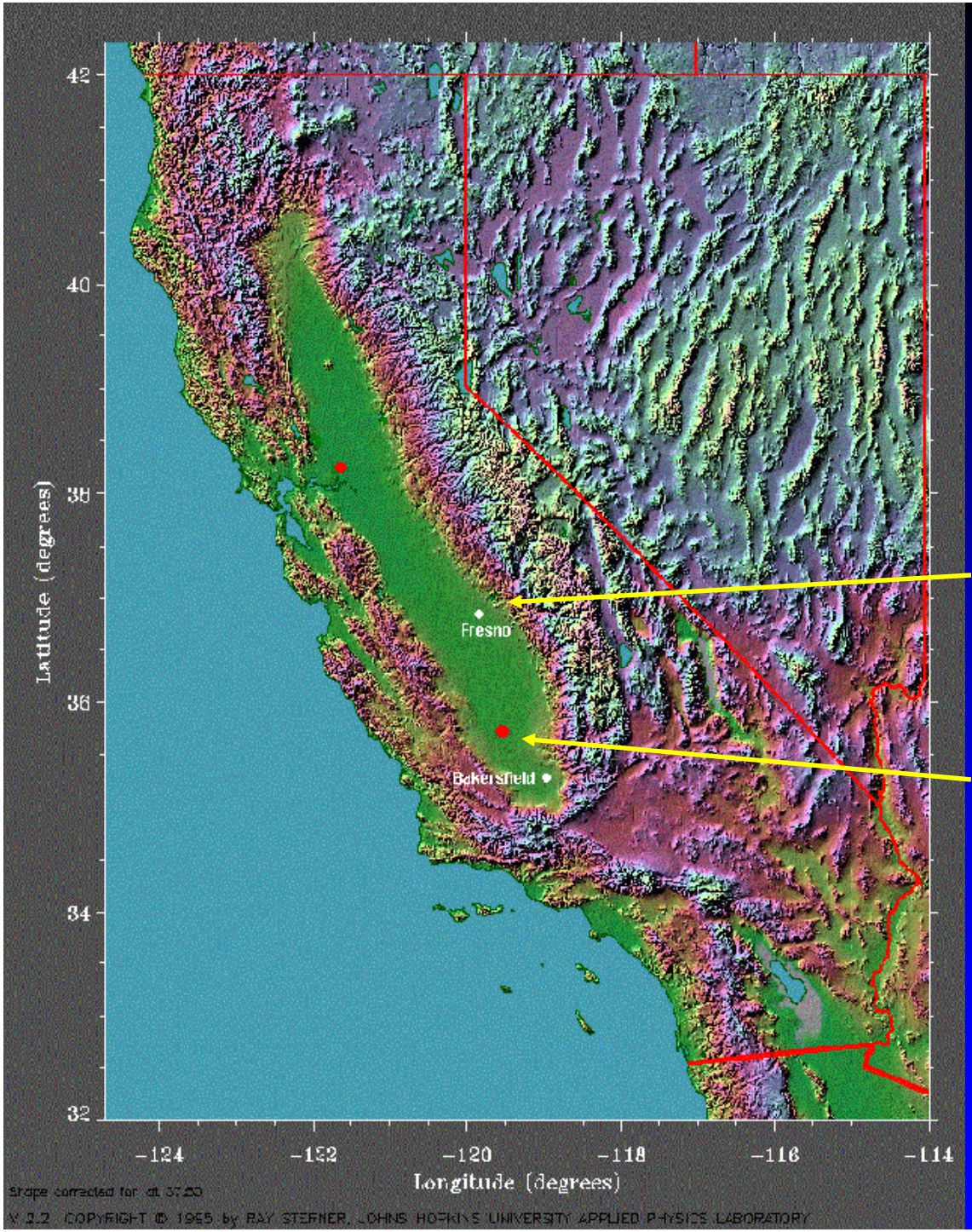
Processing of organic matter by fogs and clouds

Little is known about effects of fogs/clouds on carbonaceous material



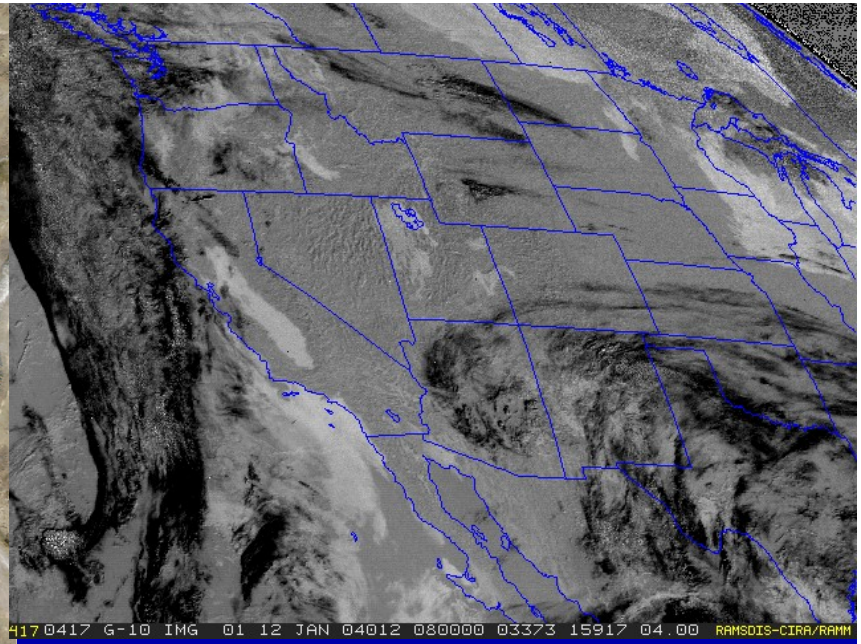
Fog collection



Fresno Winter 2003/04

Angiola (CA) Winter 2000/01 (California Regional PM10 / PM2.5 Air Quality Study)

NASA-MODIS-1-17-03


417 0417 G-10 IMG 01 12 JAN 04012 080000 03373 15917 04.00 RAMSDIS-CIRA/RAMM

FOG

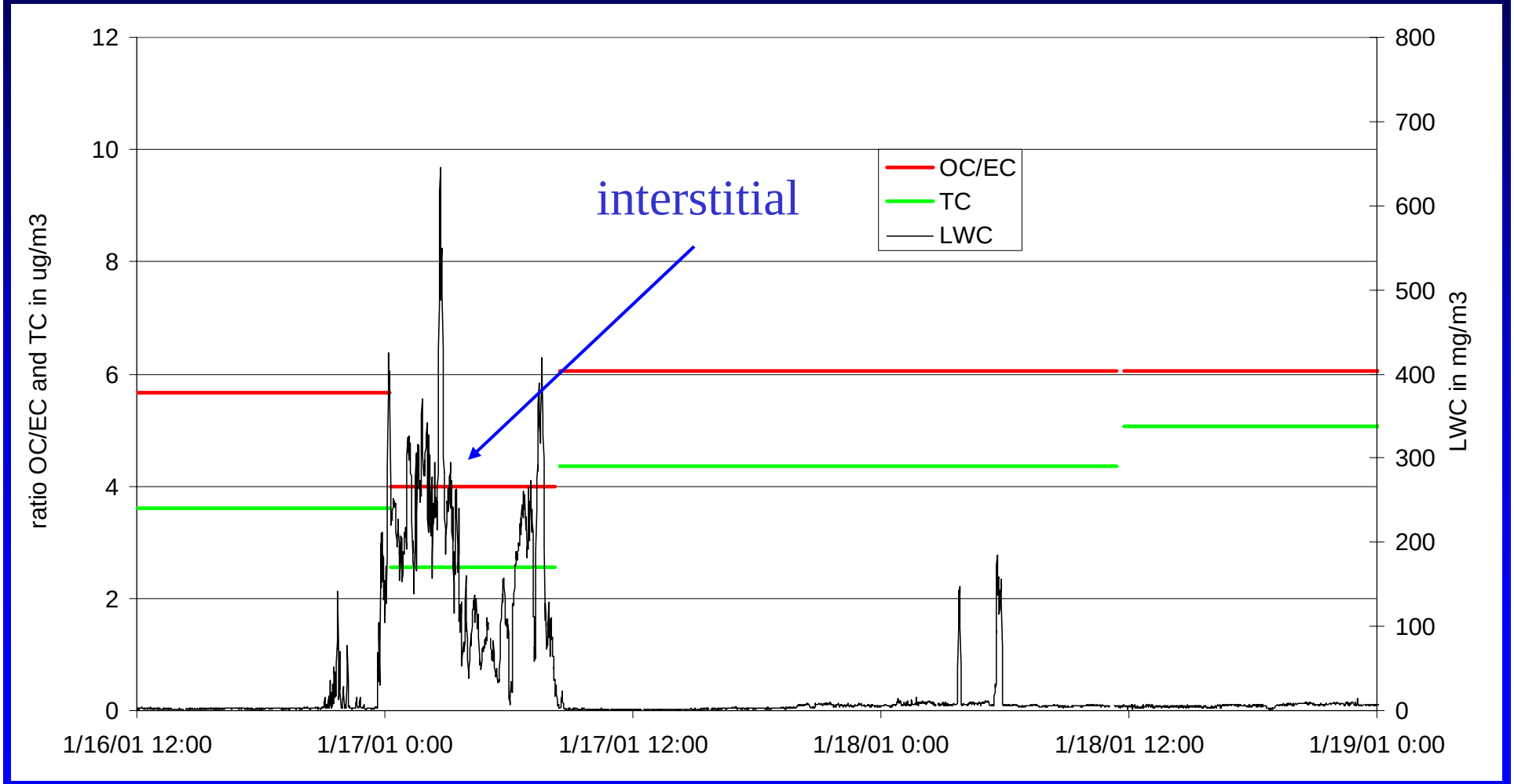
ss-CASCC –
PM2.5 sampler (120LPM)

ss-CASCC –
PM2.5 Hi-Vol (1,130LPM)

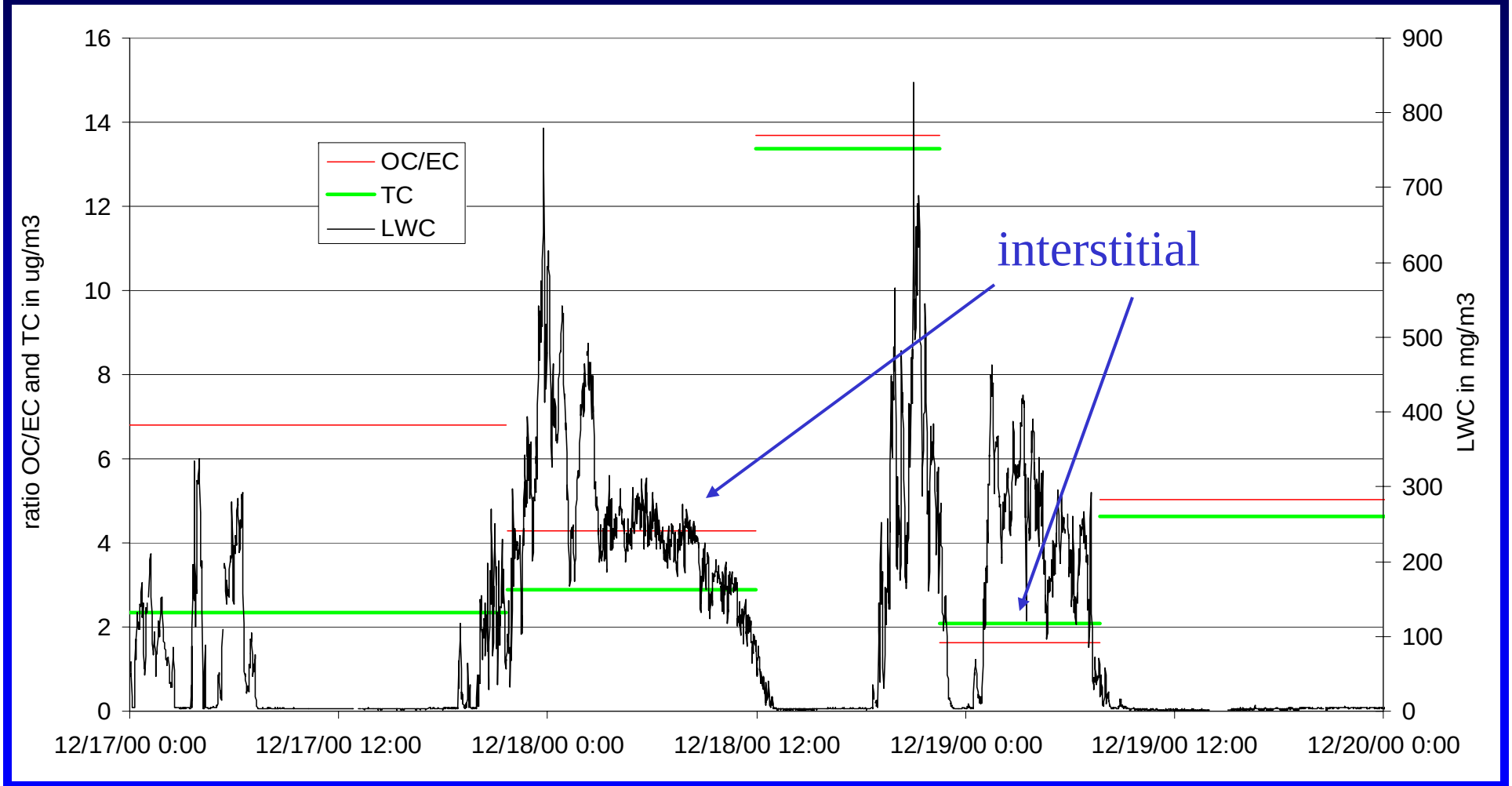
Continuous carbon measurements (Fresno)

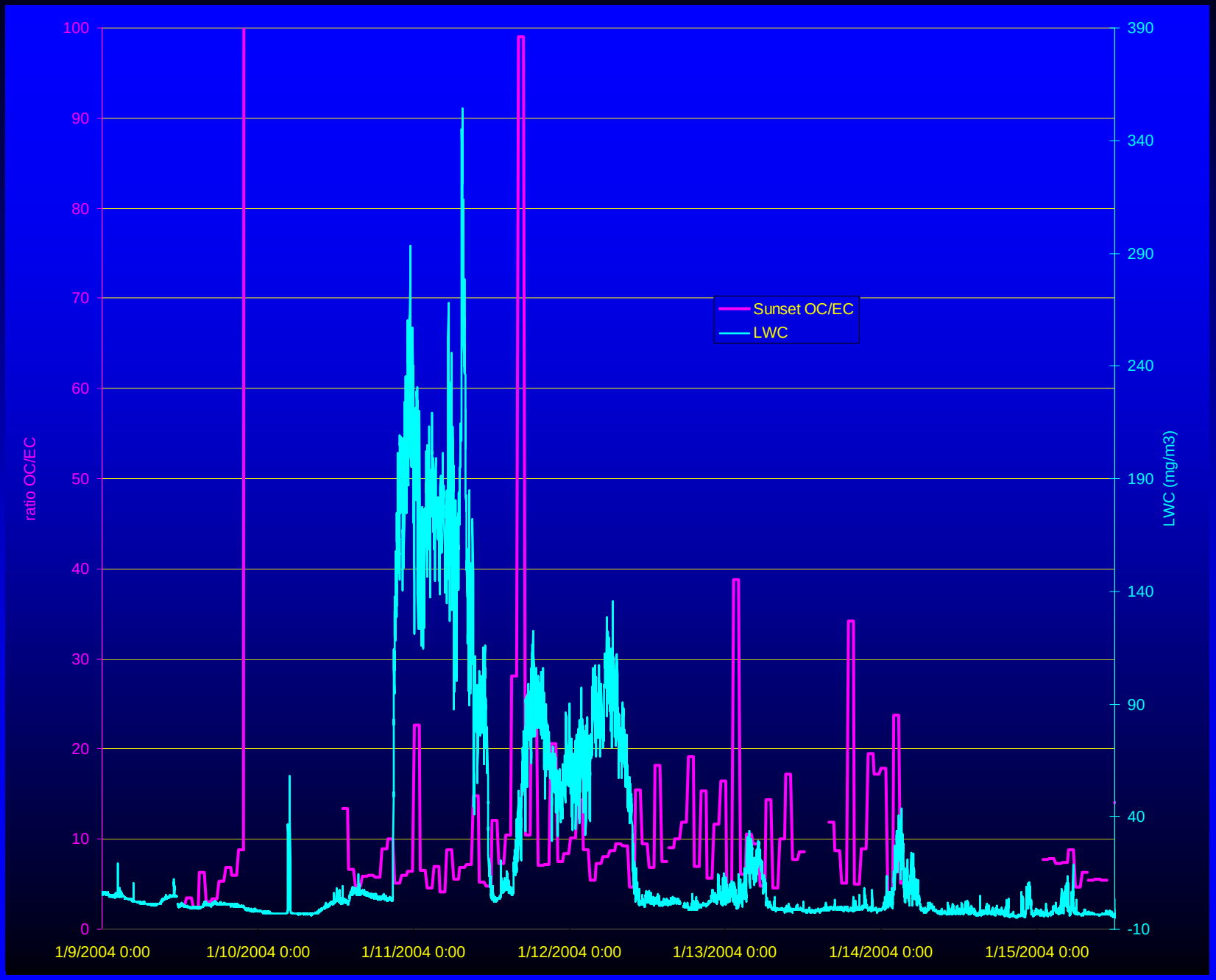
- 1h – TC, OC, EC Sunset (CASCC2-PM2.5-denuder)
- 1h - TC R&P (CASCC2-PM2.5)
- 5 min – BC Aethalometer (2 wavelengths)

Angiola (CRPAQS, Jan 2001)



Angiola (CRPAQS, Dec 2000)




Sunset OC/EC
LWC
ratio OC/EC
LWC (mg/m3)
100
90
80
70
60
50
40
30
20
10
0
390
340
290
240
190
140
90
40
-10
1/9/2004 0:00
1/10/2004 0:00
1/11/2004 0:00
1/12/2004 0:00
1/13/2004 0:00
1/14/2004 0:00
1/15/2004 0:00

Scavenging efficiencies

	ηOC	ηEC	ηTC
CRPAQS 12-19-00	0.9	0.12	0.84
CRPAQS 1-15-01	0.59	0.05	0.54
CRPAQS 1-17-01	0.33	0.06	0.29
Fresno 1-11-04	0.4	0**	0.36
Fresno aethalometer		0.20	
R&P			0.46

Fog scavenging of carbonaceous particles

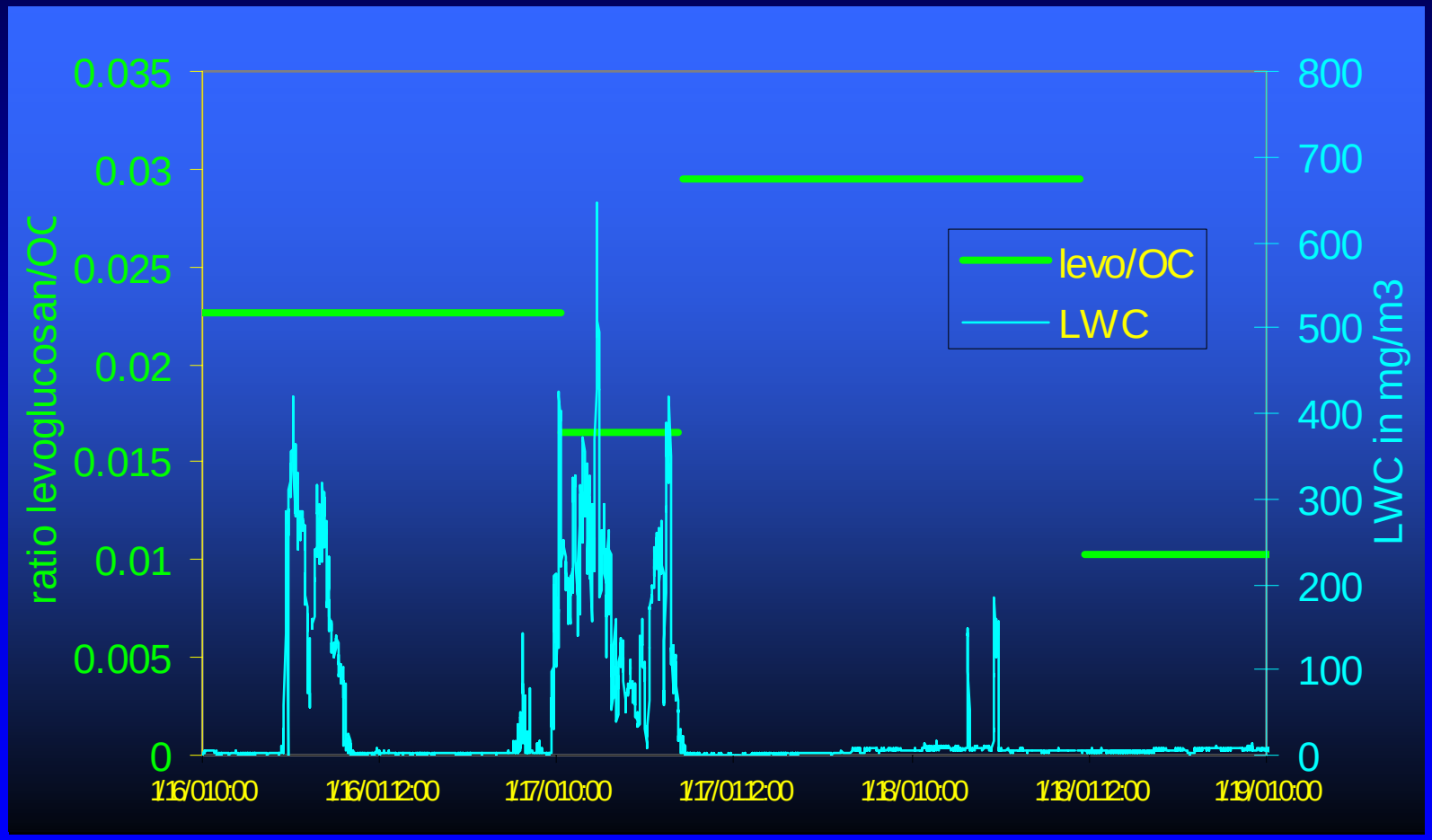
- carbonaceous particles get scavenged by fog
- OC gets scavenged preferentially over EC
- EC gets scavenged very poorly
- OC scavenging f(LWC, supersaturation)?

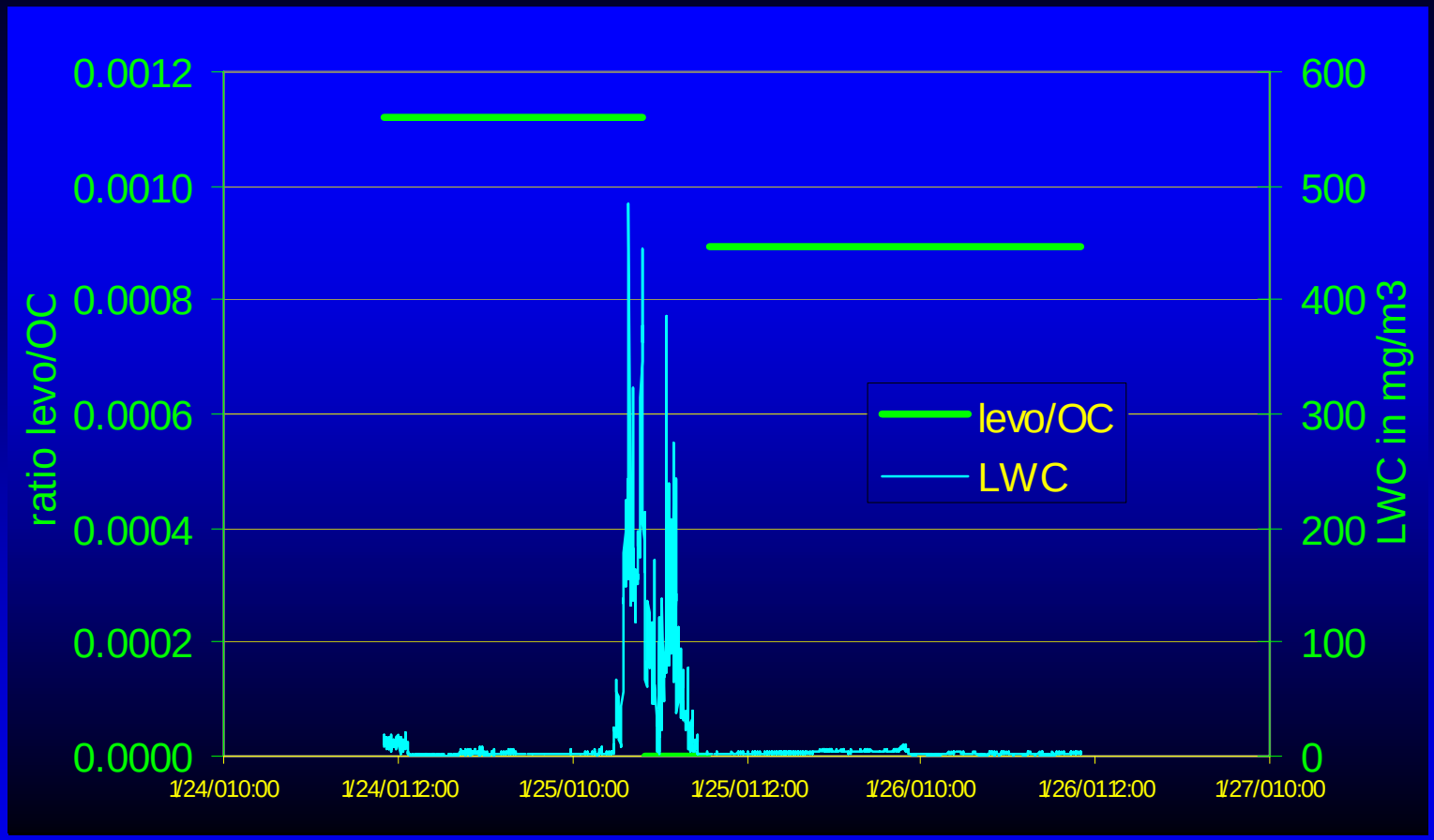
Is there preferential scavenging occurring

→ species?

→ sources (molecular markers)?

Levoglucosan (woodsmoke)

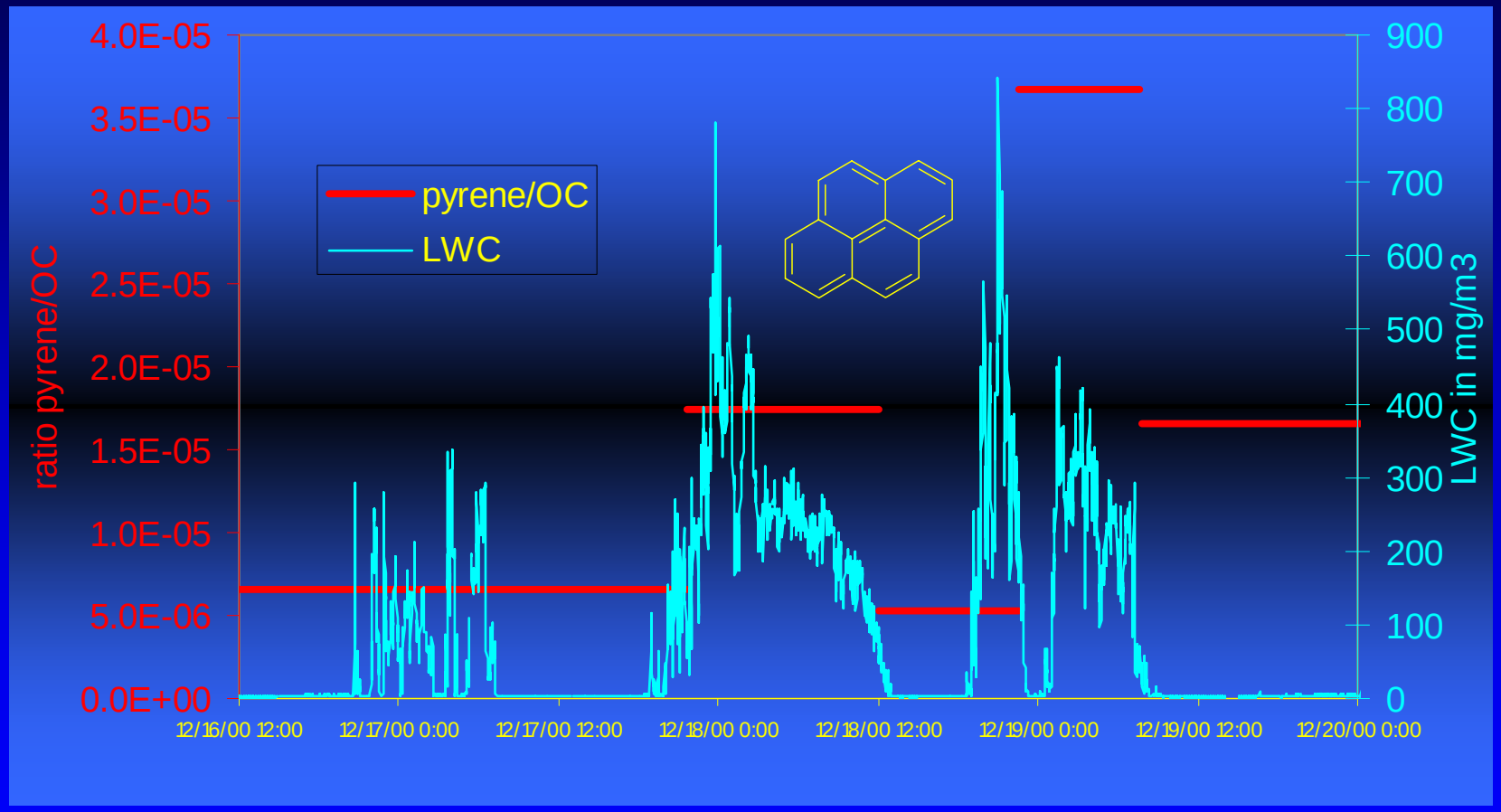




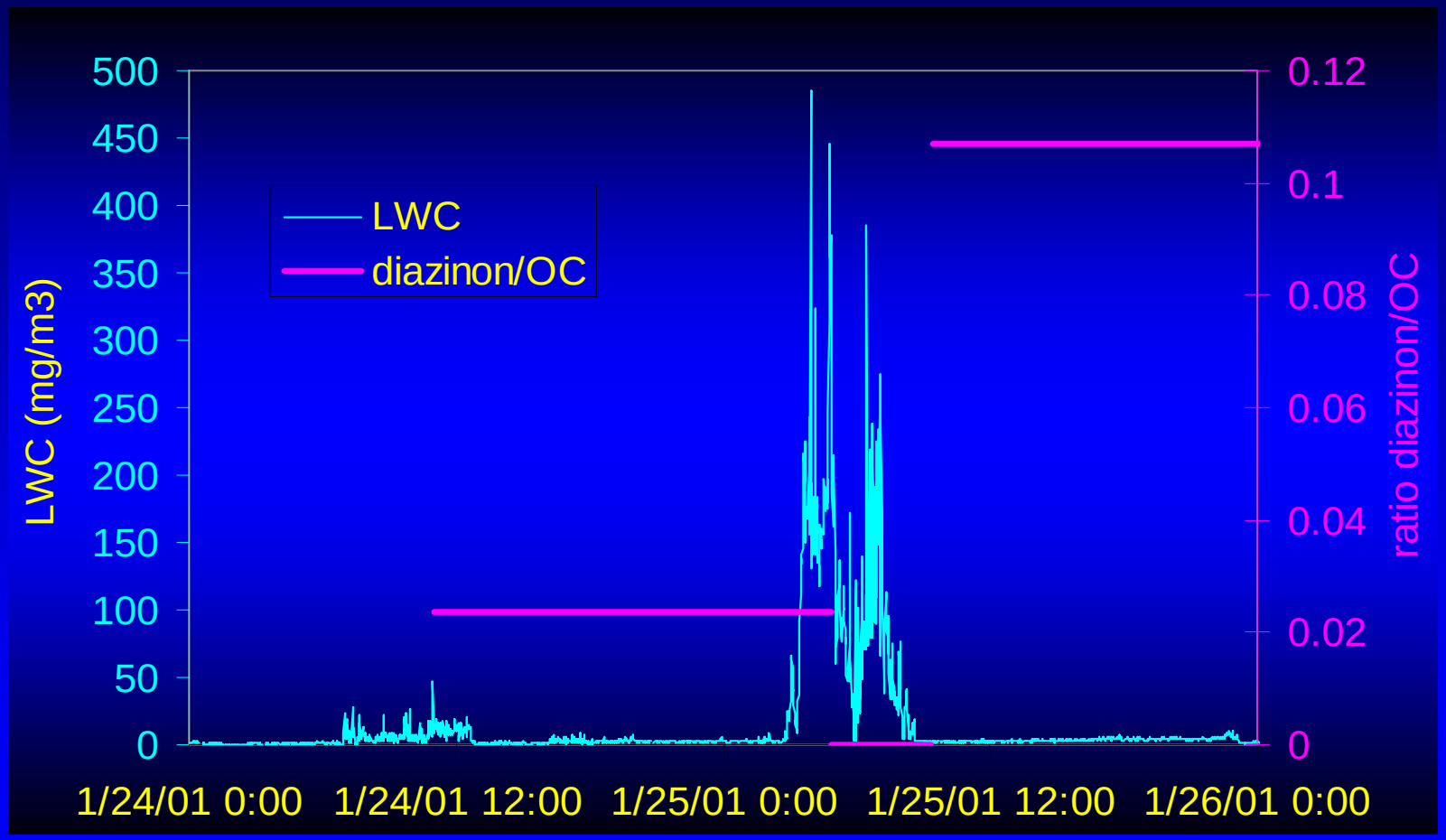
Levoglucosan (smoke) well scavenged

- Consistent with high fog levoglucosan concentrations
- (~2-3% of fogwater Total Organic Carbon)

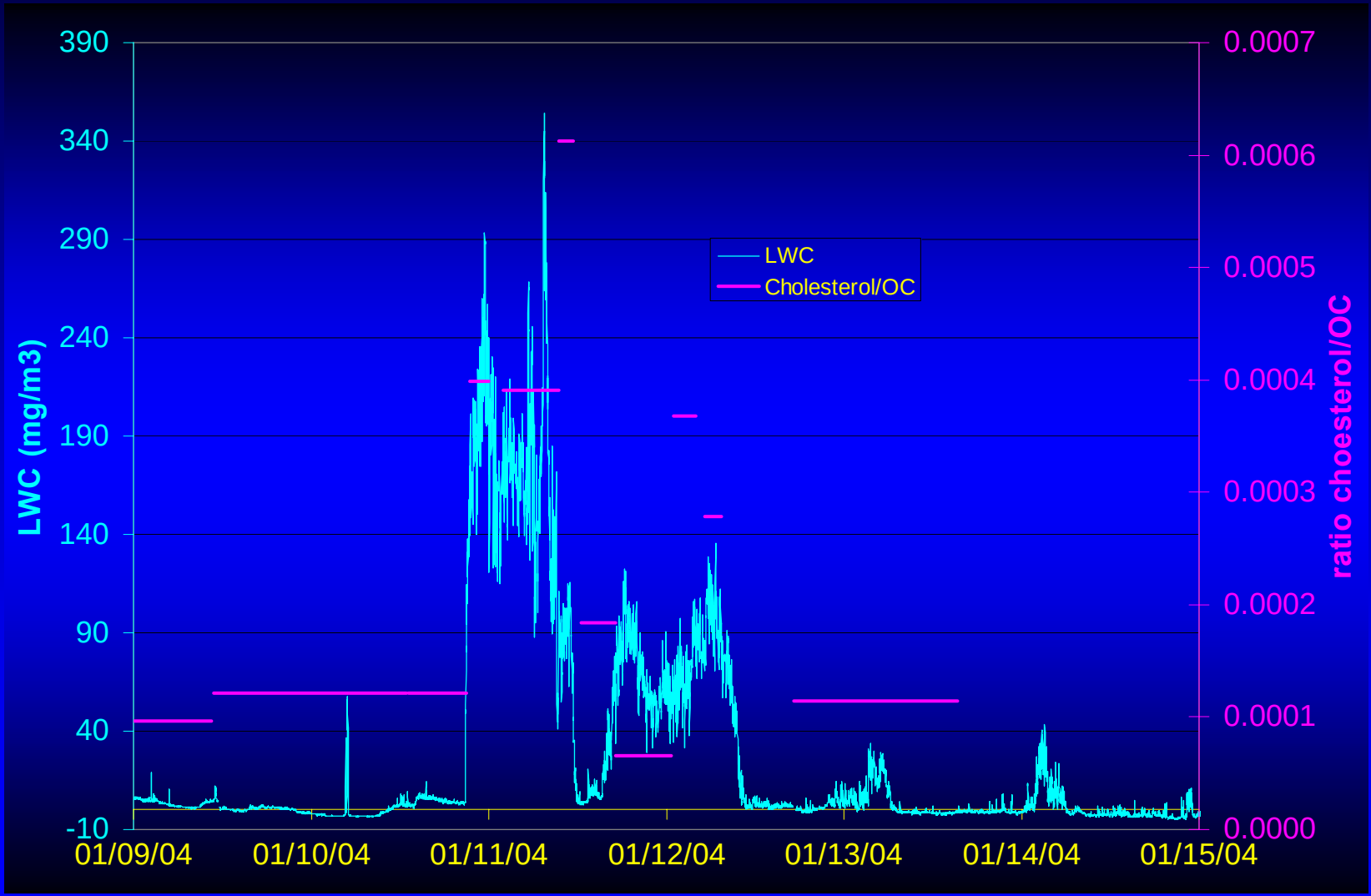
Polycyclic Aromatic Hydrocarbons



pesticide


500
450
400
350
300
250
200
150
100
50
0
LWC (mg/m3)
0.12
0.1
0.08
0.06
0.04
0.02
0
ratio diazinon/OC
LWC
diazinon/OC
1/24/01 0:00
1/24/01 12:00
1/25/01 0:00
1/25/01 12:00
1/26/01 0:00

Cholesterol



Fog scavenging of individual organic species

- soluble species preferentially scavenged
- scavenging more efficient for certain sources (woodsmoke)
- levoglucosan easily scavenged (reactivity)
- interpretation of data is very difficult
  - ➡ Dynamic process
  - ➡ Entrainment from the above the fog layer
  - ➡ Advection processes

Fog deposition fluxes

13 hour fog event in December 2000 @ Angiola:

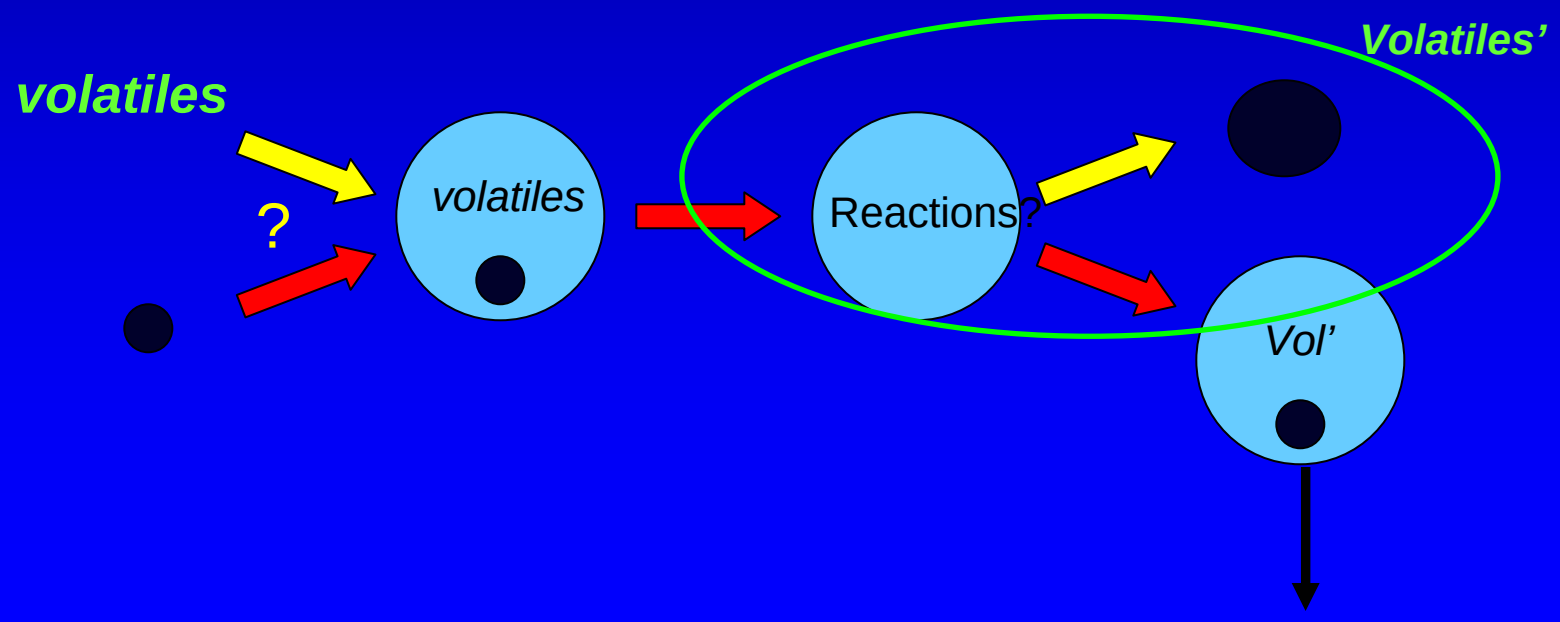
- 294 g/m^2 water (1 inch =25.4kg/m^2)
- 1.2 mg of C/m^2

Considering a fog layer of 100m depth

- decrease of 12 μgC/m^3
- significant removal of ambient OC (~10μgC/m^3)
  - some from volatile species!
  - entrainment from upper layers

14 hour fog event in January 2004 @ Fresno

1.8 mg of C/m^2

Future:

- What is the reactivity of larger organics in aq phase?
  - → levoglucosan is reactive in atmos. aq phase
- Formation of new organic material
  - → formation of Light Absorbing Carbon
  - → aldol condensation