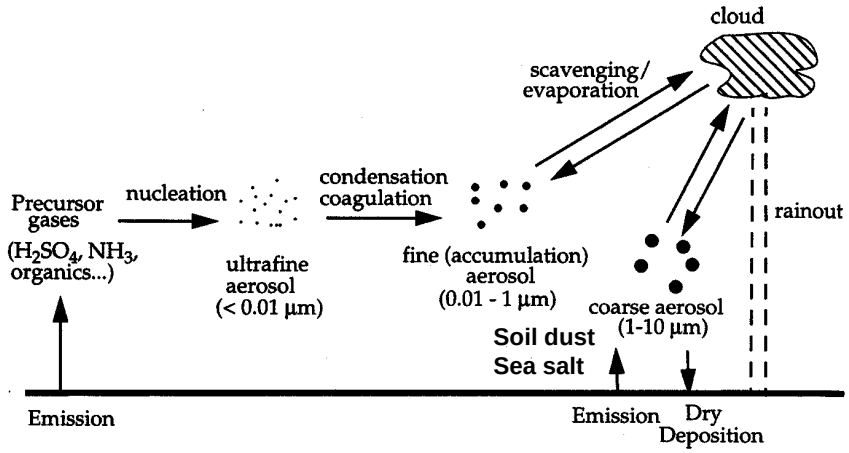
ORIGIN OF ATMOSPHERIC AEROSOL

Aerosol: dispersed condensed phases suspended in a gas
Size range: 0.001 μm (molecular cluster) to 100 μm (small raindrop)

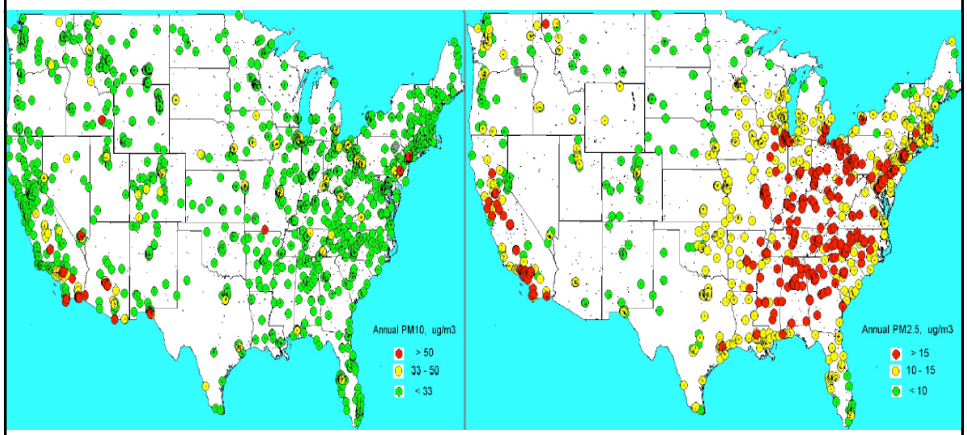


Environmental importance: health (respiration), visibility, radiative balance, cloud formation, heterogeneous reactions, delivery of nutrients…

ANNUAL MEAN PARTICULATE MATTER (PM) CONCENTRATIONS AT U.S. SITES, 1995-2000

NARSTO PM Assessment, 2002

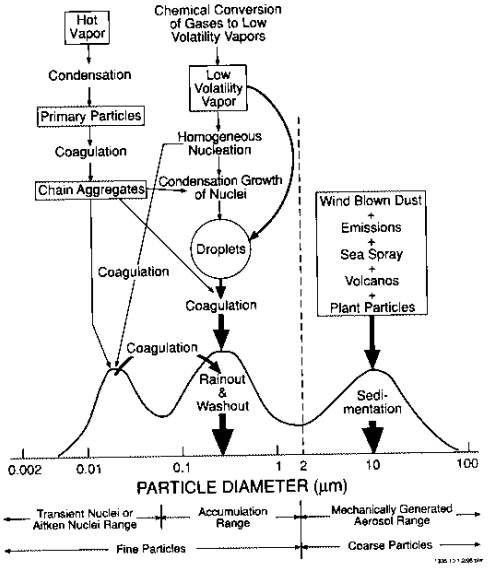
PM10 (particles < 10 μm) **PM2.5 (particles < 2.5 μm)**



Red circles indicate violations of national air quality standard:
50 μg m^{-3} for PM10 **15 μg m^{-3} for PM2.5**

Distribution of particle surface area

Figure 4.1. *Idealized schematic of the distribution of particle surface area in the atmosphere. Modes, sources, and removal mechanisms are indicated (Whitby and Cantrell, 1976).*



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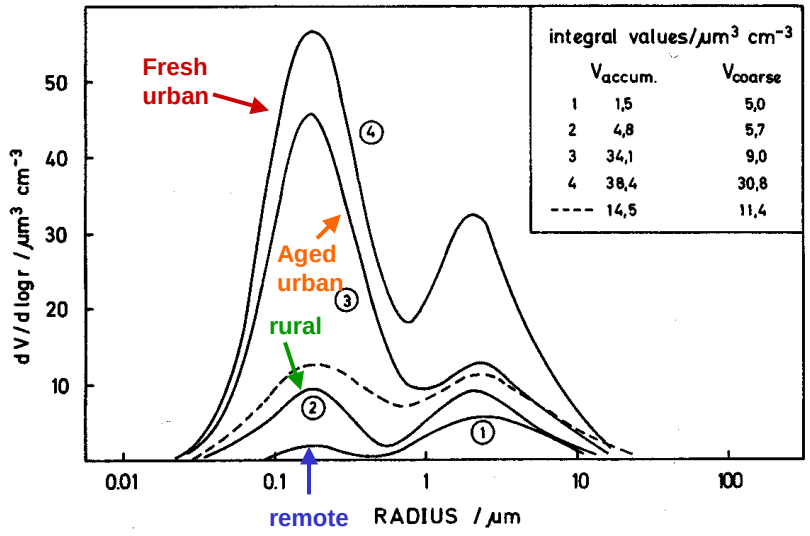
TYPICAL U.S. AEROSOL SIZE DISTRIBUTIONS



Warneck [1999]

Typical composition of continental aerosol

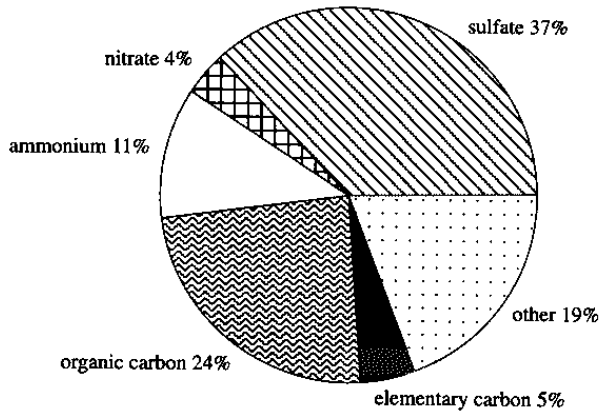
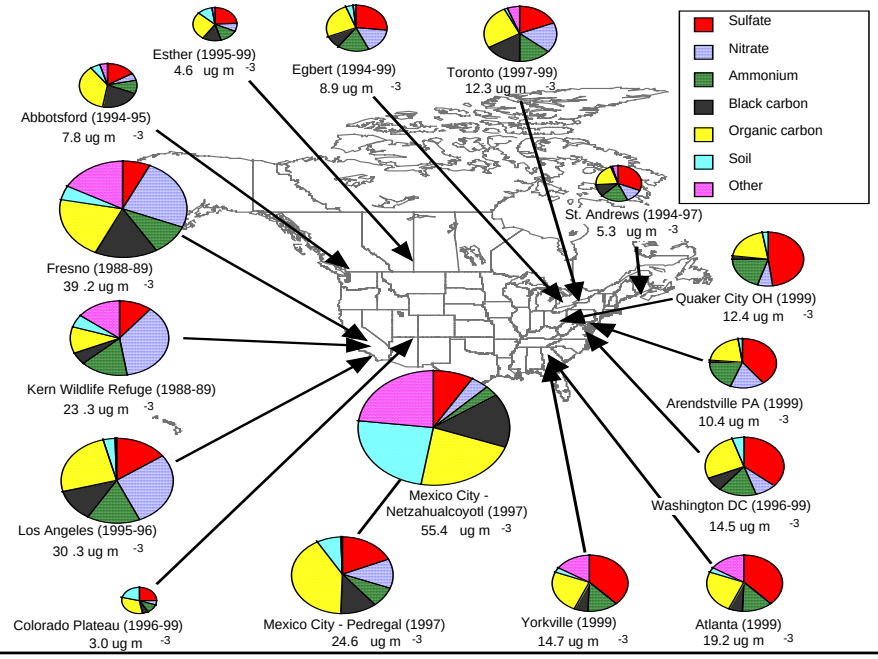


Fig. 8-1 Typical composition of fine continental aerosol. Adapted from Heintzenberg, J. *Tellus* 41B:149–160, 1989.

COMPOSITION OF PM2.5 (NARSTO PM ASSESSMENT)



Primary aerosol emissions (IPCC 2001)

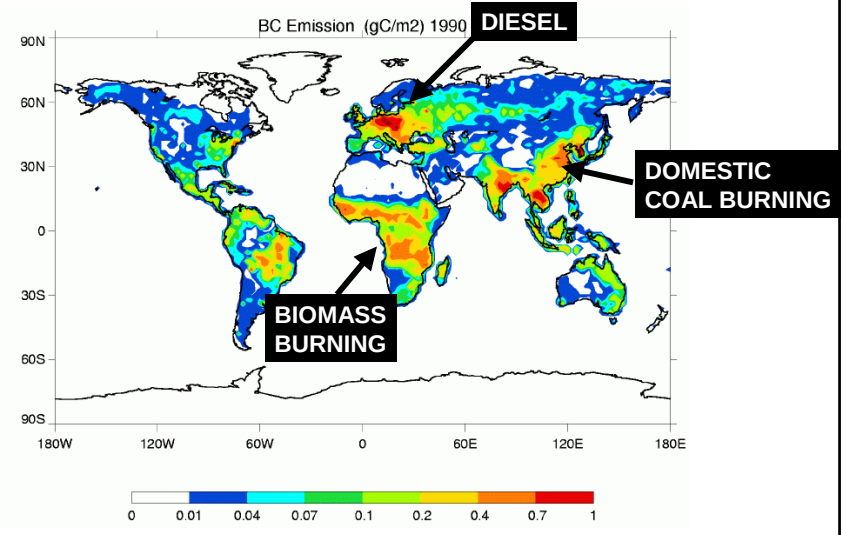
Table 5.3: Primary particle emissions for the year 2000 (Tg/yr)[a].

	Northern Hemisphere	Southern Hemisphere	Global	Low	High	Source
Carbonaceous aerosols						
Organic Matter (0–2 µm)						
Biomass burning	28	26	54	45	80	Liousse *et al.* (1996), Scholes and Andreae (2000)
Fossil fuel	28	0.4	28	10	30	Cook *et al.* (1999), Penner *et al.* (1993)
Biogenic (>1µm)	—	—	56	0	90	Penner (1995)
Black Carbon (0–2 µm)						
Biomass burning	2.9	2.7	5.7	5	9	Liousse *et al.* (1996); Scholes and Andreae (2000)
Fossil fuel	6.5	0.1	6.6	6	8	Cooke *et al.* (1999); Penner *et al.* (1993)
Aircraft	0.005	0.0004	0.006			
Industrial Dust, etc. (> 1 µm)			100	40	130	Wolf and Hidy (1997); Andreae (1995)
Sea Salt						Gong *et al.* (1998)
d< 1 µm	23	31	54	18	100	
d=1–16µm	1,420	1,870	3,290	1,000	6,000	
Total	1,440	1,900	3,340	1,000	6,000	
Mineral (Soil) Dust [b]						
d< 1 µm	90	17	110	—	—	
d=1–2µm	240	50	290	—	—	
d=2–20µm	1,470	282	1,750	—	—	
Total	1,800	349	2,150	1,000	3,000	

[a] Range reflects estimates reported in the literature. The actual range of uncertainty may encompass values larger and smaller than those reported here.
[b] Source inventory prepared by P. Ginoux for the IPCC Model Intercomparison Workshop.

BLACK CARBON EMISSIONS

Produced by incomplete combustion

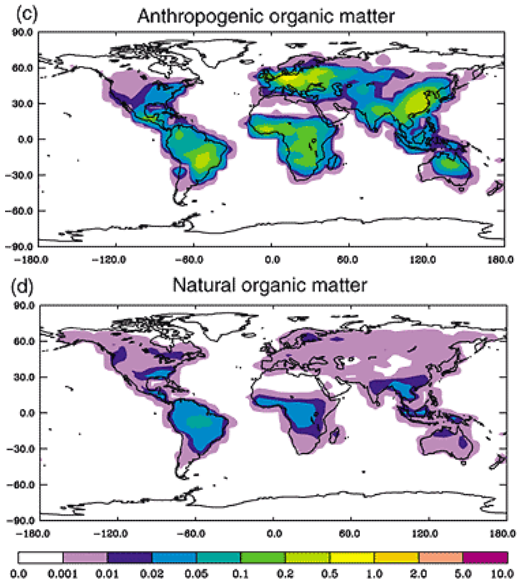


Chin et al. [2000]

Source distribution of organic aerosols

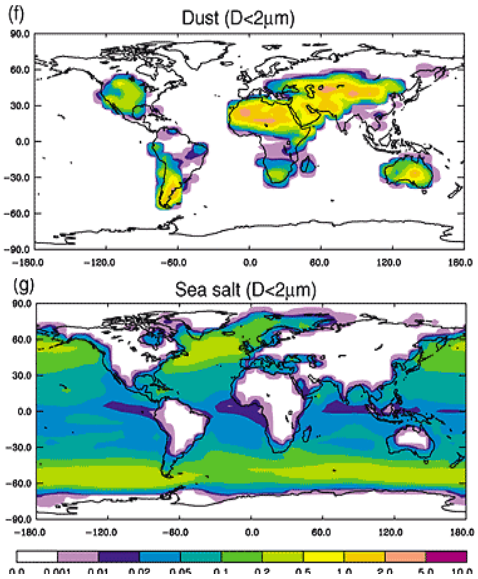
primary (biomass burning + fossil fuels) and secondary

secondary organic aerosols from biogenic VOC oxidation



Annual average source strength in kg km^{-2} hr^{-1}

Dust and sea-salt aerosols



Annual average source strength in kg km^{-2} hr^{-1}