University of Maryland Baltimore County - UMBC
Phys650 - Special Topics in Experimental Atmospheric Physics
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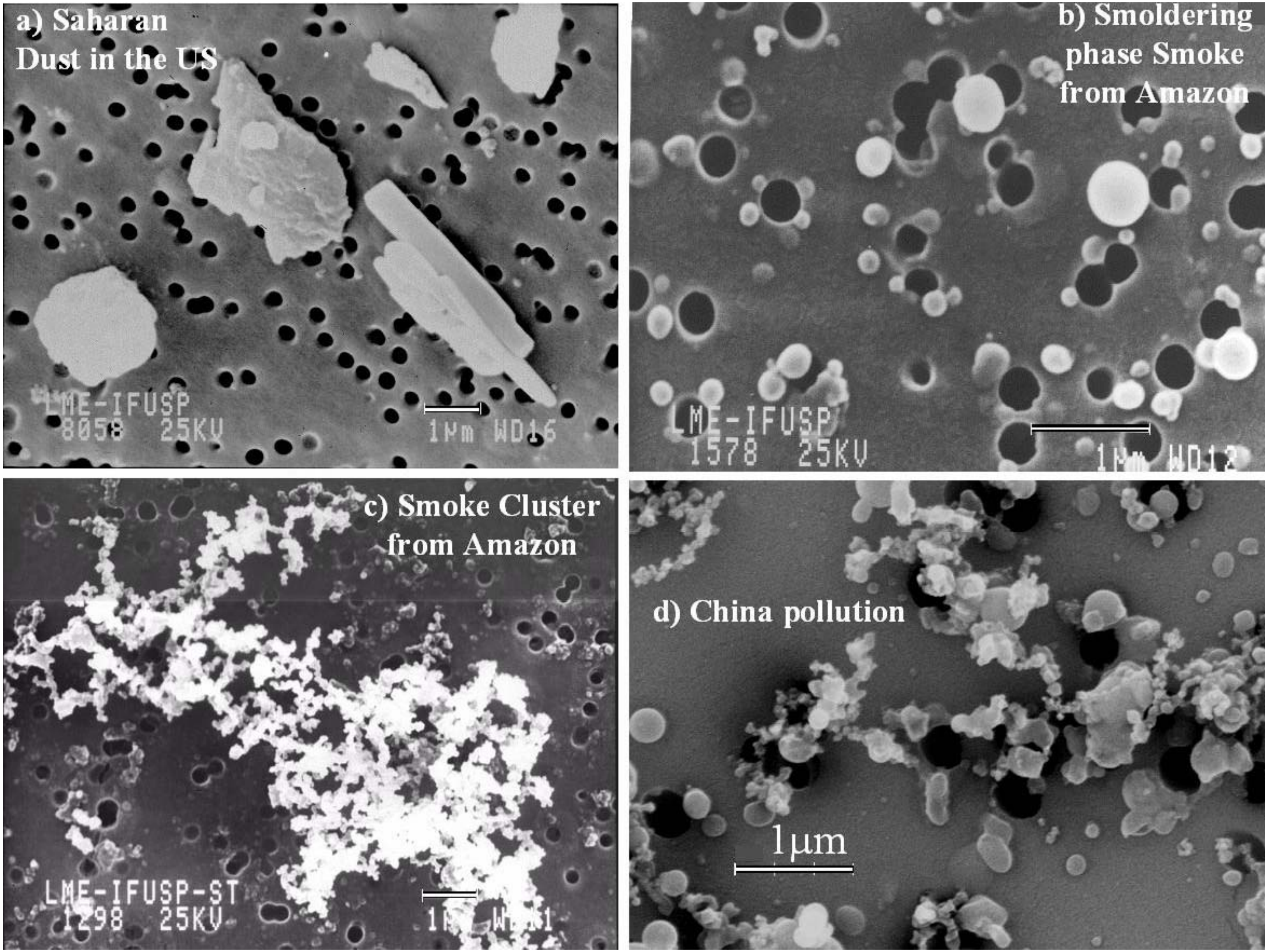
CLASS6 – 3/4/2009

Aerosol Particle Sizing

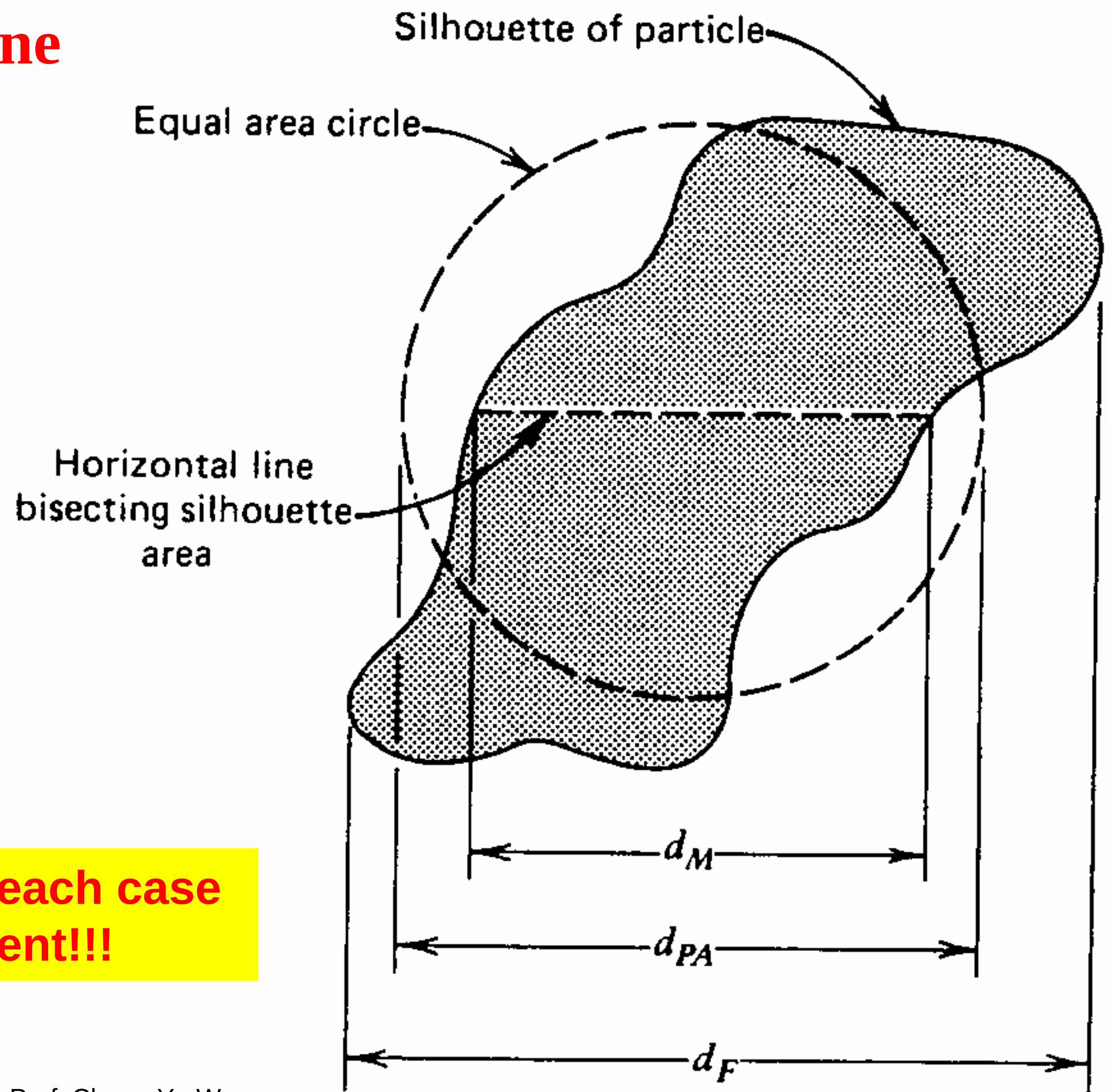
Aerosols have all shapes and sizes. How to measure the particle sizes???



Microscopic Measurement of Particle Size

Q: how do you determine this particle's size?

- Equivalent sizes of Irregular Particles
  - Martin's diameter:
  - Feret's diameter:
  - Projected area diameter:



The particular size to use in each case is highly application dependent!!!

Adapted from ENV 6130 Course on Aerosol Mechanics by Prof. Chang-Yu Wu, University of Florida, Department of Environmental Engineering Sciences

Aerodynamic Diameter

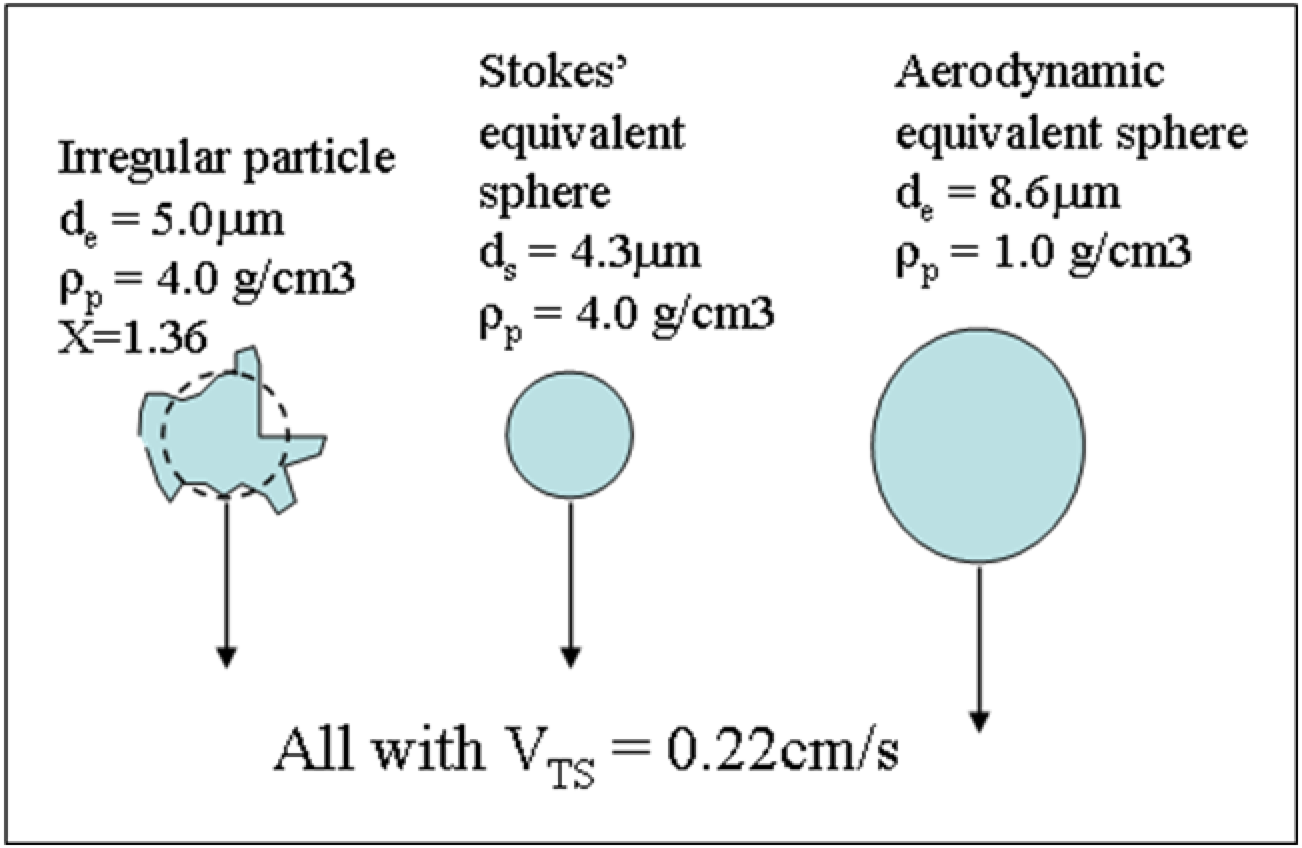
- The **Stokes diameter**, d_s, is the diameter of the sphere that has the same density and settling velocity as the particle.

- The **aerodynamic diameter**, d_a, is the diameter of the unit density (ρ_0 = 1 g/cm^3) sphere that has the same settling velocity as the particle.

$$V_{TS} = \frac{\rho_p d_e^2 g}{18\eta X} = \frac{\rho_s d_s^2 g}{18\eta} = \frac{\rho_0 d_a^2 g}{18\eta}$$

$$X = \frac{\rho_p}{\rho_0}\left(\frac{d_e}{d_a}\right)^2 = \frac{\rho_p}{\rho_s}\left(\frac{d_e}{d_s}\right)^2$$

$$d_a = d_e\sqrt{\frac{\rho_p}{\rho_0 X}} = d_s\sqrt{\frac{\rho_s}{\rho_0}}$$



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- Log-Normal Distributions

- Number X Surface Area X Volume Distributions
  - Particular applications require different size distributions
  - Particular instruments measure different size distributions
  - The Mathematics is trivial but the uncertainty can grow out of control when going from one distribution to the other and in many cases this transformation may not make sense.