ATM515 **Aerosol Physics**, Fall 2025

Instructor: Dr. Fangqun Yu; ETEC-333, (518) 437-8767; fyu@albany.edu

Homework # 4 (due date Nov. 24)

For any parameter that is needed for the calculation but its value is not given, you can decide a reasonable value with proper justification (i.e., source or formula used, etc.)

1. (20 points) (a) For a particle in the kinetic regime with an initial diameter of D_{p0}, how does D_p change with time if the concentration of condensing vapor molecule is c_∞ far from the particle and c_s is its vapor-phase concentration at the particle surface. (b) If the observed growth rate (diameter) of 5-10 nm particles is 5 nm/hour and H_2SO_4 is assumed to be the only condensing gas, what is the concentration of H_2SO_4 gas? The particle density is 1.5 g/cm^3, T =280 K, P=1000 mb. (c) Calculate the growth rate of cloud droplet with initial size of 1 μm in the cloud with water supersaturation ratio of 0.2% (i.e., RH=100.2%), T=280 K, and P=950 mb.

2. (15 points) By what factor does the average particle size of tobacco smoke increase as a result of coagulation during the 2 s that it takes for the smoke to travel from the cigarette to the smoker's lungs? Assume that the inhaled concentration is10^{10} cm^{-3} and that the initial aerosol diameter is 20 nm. Show your work on the calculation of coagulation coefficient using proper formula from the textbook. T=298 K. Particle density = 1.5 g/cm^3.

3. (15 points) Calculate the characteristic time for coagulation for: (1) Polluted urban regions with initial number concentrations of $2x10^5$ cm^{-3}; (2) Marine boundary layer with initial number concentrations of 1000 cm^{-3}; (3) Geo-engineered stratospheric aerosol layer with initial number concentration of 100 cm^{-3}. Assume an average coagulation coefficient of 2×10^{-9} cm^3 s^{-1} among these particles.