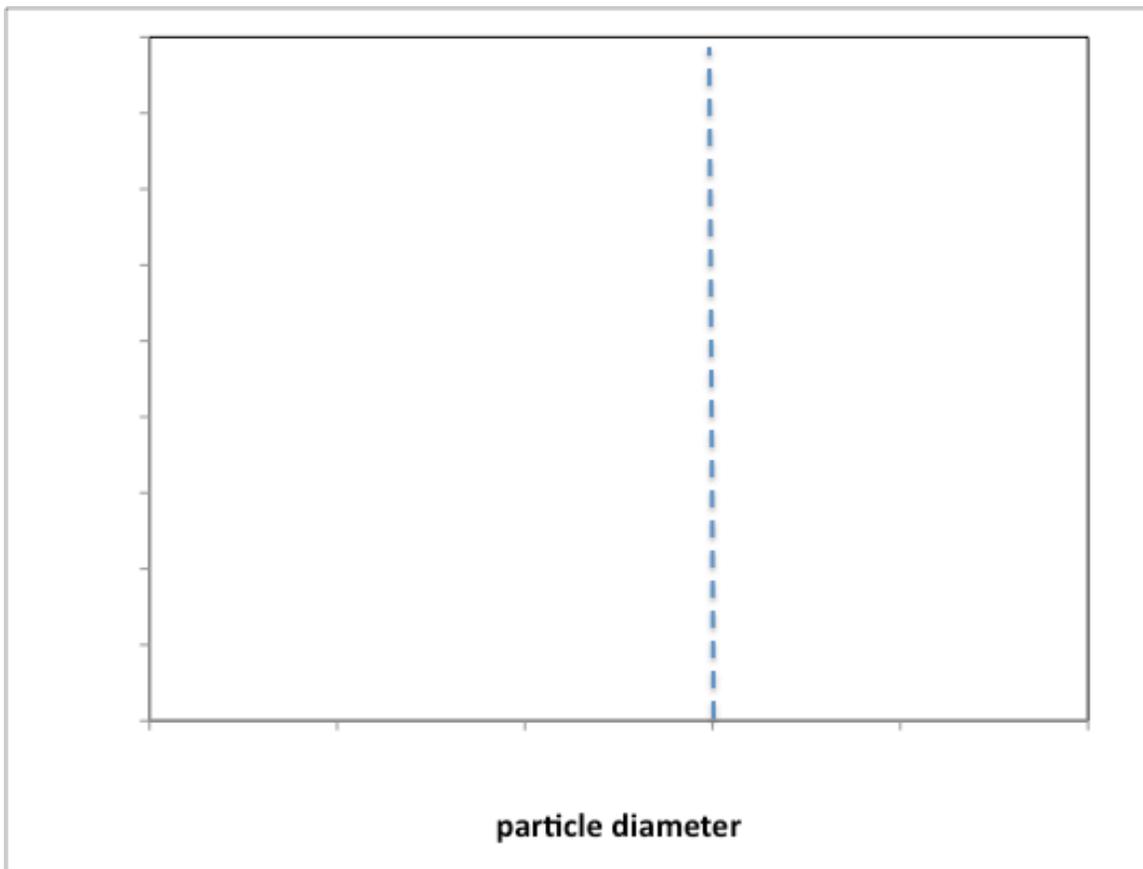


Clausius-Clapeyron

<http://www.youtube.com/watch?v=QuSeKS9sbZg>

Aerosols

Sketch the “typical” ambient atmospheric aerosol size distribution below. Indicate the particle sizes at the tick marks (show scale and units; add a label and give units on y-axis). Give at least 2 chemical constituents you would expect to find in particles of sizes to either side of the vertical line.

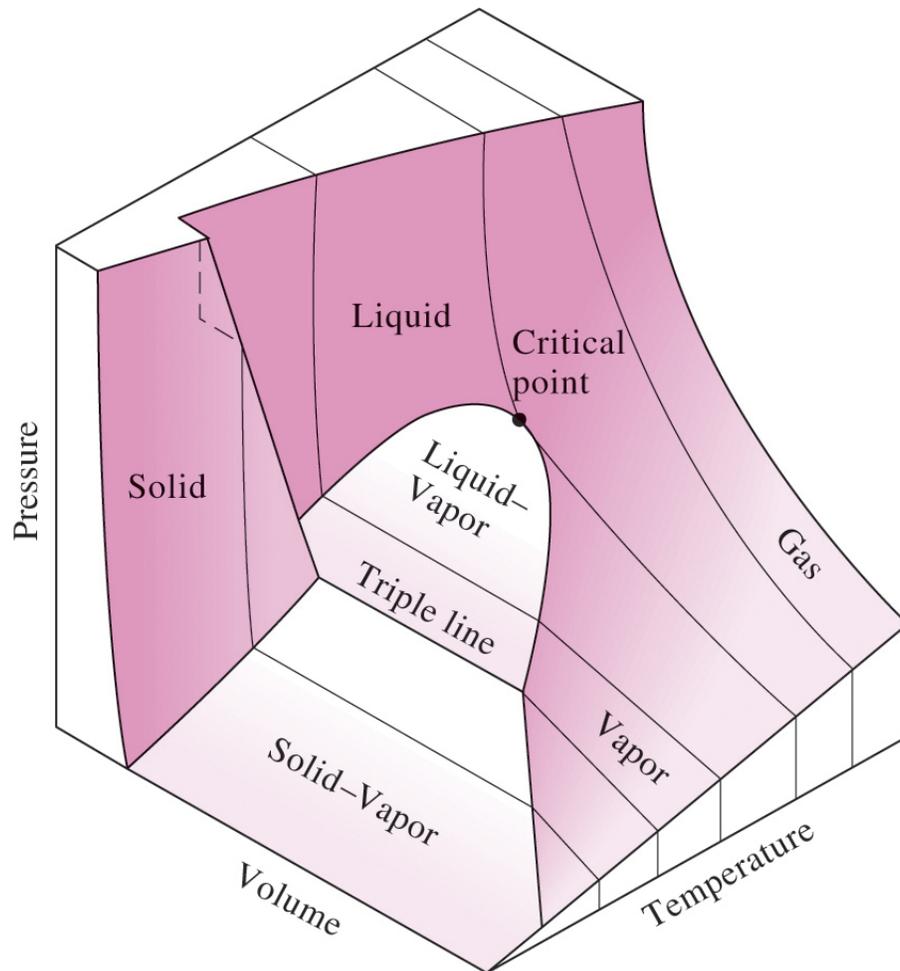


Gibbs phase rule

•For systems with ϕ phases and c constituents with non-curved interfaces, the degrees of freedom w are:

$$w = 2 + c - \phi$$

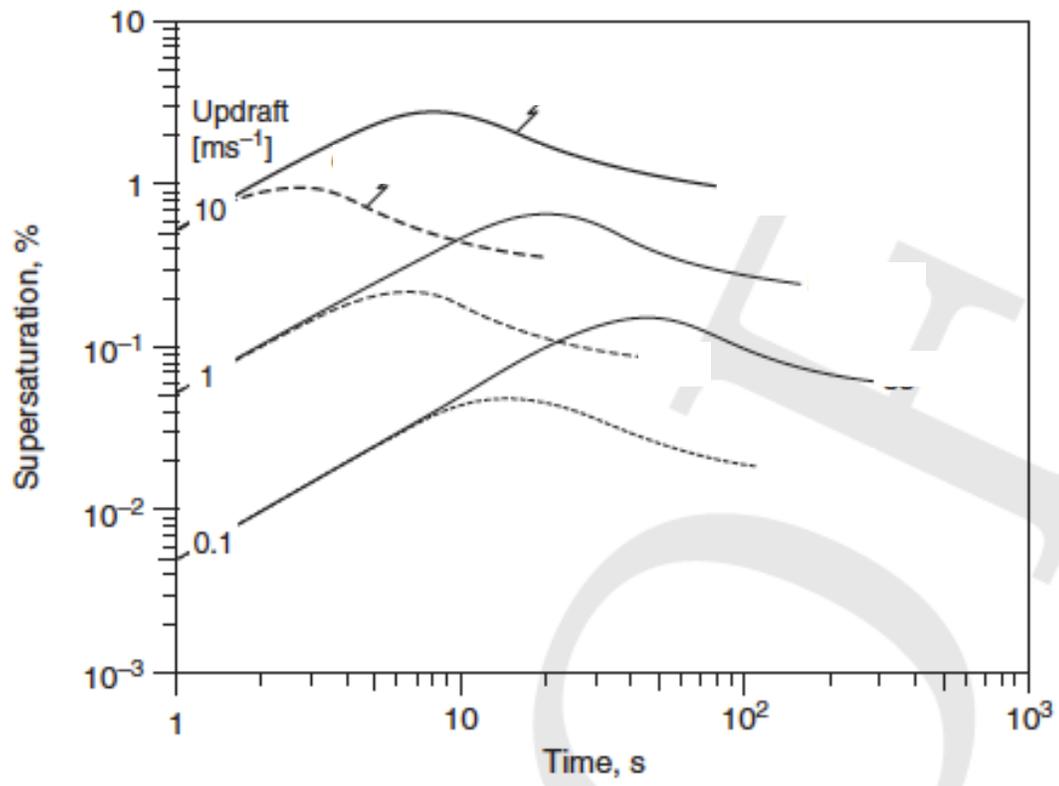
For pure water ($c=1$), compute w for the following and show where to find this on the phase diagram below. What are the variables that are generally used as the degrees of freedom?



- (1) one phase (i.e., what do you need to specify to determine which phase water is in?)
- (2) two phases
- (3) three phases

Maximum supersaturation

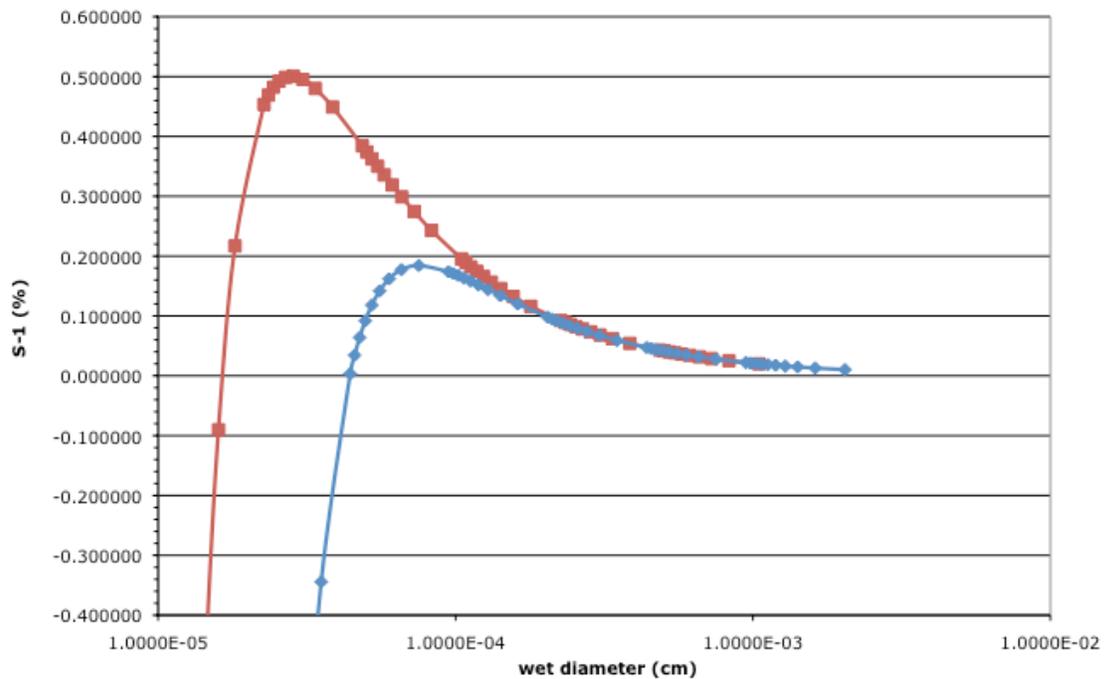
(1) For the diagram below, indicate which curves are for polluted and which are for clean clouds. Explain your reasoning.



(2) Draw a vertical profile of water saturation ratio for a cloud-topped marine boundary layer (stratus cloud). Show cloud base and cloud top, and attach approximate values to S at various vertical levels.

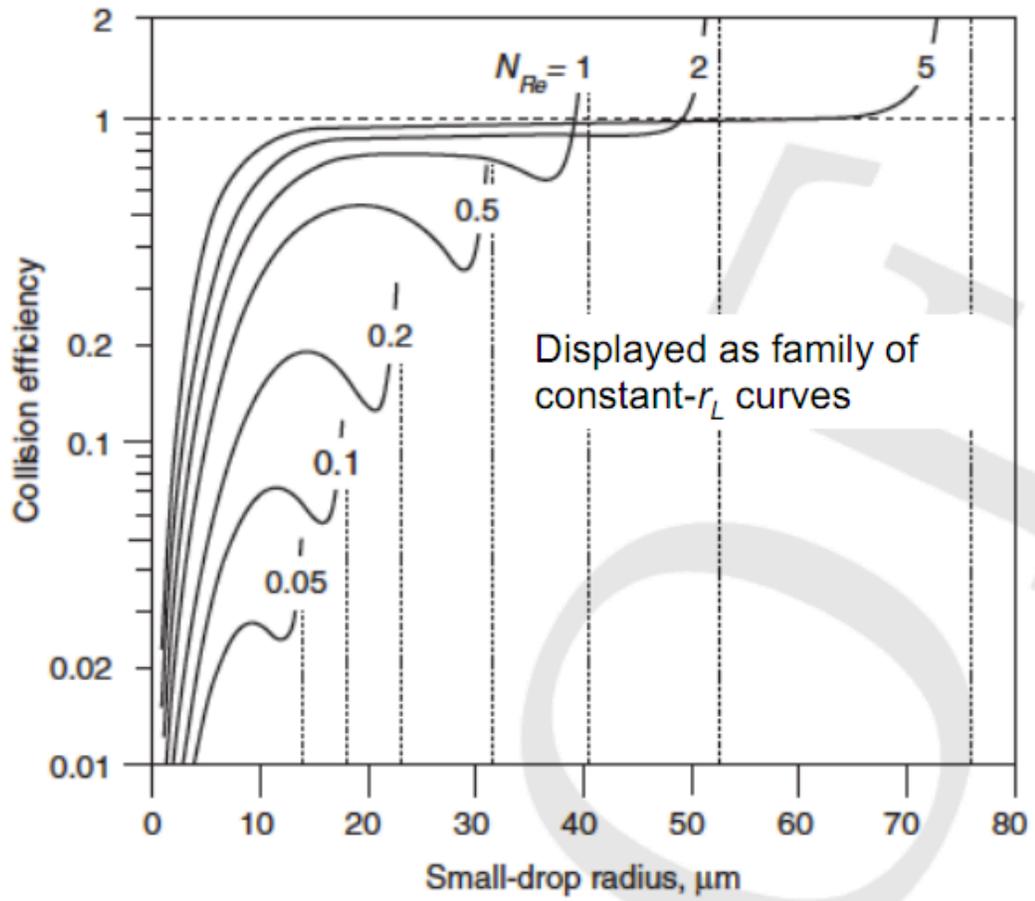
Kohler curves

- (1) For the curves shown below, which formed on the larger dry aerosol particle? explain your choice.
- (2) Explain how to compute the total condensation rate onto a drop population.
- (3) Indicate on the plot how large (approximately) you expect the activated drops to grow by condensation alone. What supersaturation inside the cloud corresponds to your choice? explain your reasoning.



Continuous Collection

- (1) Derive an equation for the time rate of change of mass of a collector drop as it falls through a cloud having liquid water content w_L .
- (2) Sketch the efficiency curves for collection (include labels with approximate values for drop diameter) and explain briefly why they have the shape they do.



Small drop threshold? WHY?