a) Curvature effect from surface energy vs. surface tension. Energy of system (SE) must increase to form droplet of larger size if $e \leq e_s$. Small drops evaporate more easily relative to flat surface. Or... "$e_s$ (corp.) > $e_s$ (flat)."

b) This is related to heterogeneous nucleation and Rcault's. The salt reduces the saturation vapor pressure and increases likelihood of condensation, similar to cloud condensation nuclei.

c) Related to (a) above; even when air is saturated with respect to a flat surface ($e_s(\infty)$), it is unsaturated with respect to a curved droplet of pure water. Here for air must be supersaturated (wet flat sfc) for equilibrium or growth.

d) The growth equation by Wh (6.20) shows $d\sigma/dr$ is inversely proportional to $r$. Therefore, drops grow quickly at initial time (if larger than critical radius), but asymptote to some value around ~20-30 μm (much too small to fall out as rain and not evaporate).

e) Because of lack of CCN and different types of CCN in marine environments (salt) vs. continental (misc.) the drop sizes in marine clouds are larger and cover a broader spectrum (Wh Fig. 6.7). This results in higher likelihood of forming "collector drops" and accelerating the collision coalescence process. Continental clouds
Do not from drop = 20 μm. See discussion on page 230 (unfig).

f) because of break-up processes and collisions.

G) Lightning is associated with convection/updrafts. Solar heating impacts land more than ocean - heating up more quickly, reaching convective temperature (more instability), etc.

\[
\frac{2\sigma}{nkT\ln\left(\frac{E_i}{E_j}\right)} \implies \ln\left(\frac{E_i}{E_j}\right) = \frac{2\sigma}{nkT}
\]

\[n = 3.3 \times 10^{28} \text{ m}^{-3} \quad \kappa = 1.38 \times 10^{-23} \quad T = 273 \text{ K}
\]

\[\sigma = 0.076 \text{ J/m}^2 \quad r = 0.5 \times 10^{-4} \text{ m}
\]

\[\ln\left(\frac{E_i}{E_j}\right) = \frac{2(0.076 \text{ J/m}^2)}{(3.3 \times 10^{28} \text{ m}^{-3})(1.38 \times 10^{-23})(273 \text{ K})(0.5 \times 10^{-4} \text{ m})}
\]

\[\ln\left(\frac{E_i}{E_j}\right) = 2.4452 \times 10^{-3}
\]

\[\therefore \text{ RH} \gg 100245 \text{ or } 100.245\%
\]

\[a) \text{ SS} \approx 0.14, \quad \text{Im} = 10^{18} \text{ kg}, \quad \text{NaCl} \quad \gamma \approx 0.75 \text{ Mm} - \text{(curve #3)}
\]

\[b) \text{ curve #5, } r = 0.05 \mu\text{m} \quad \therefore \text{ RH} \approx 97\%
\]

\[c) \text{ SS}_e, \text{ curve # 5, SS}_e \lesssim 0.45\%
\]
\[
\frac{dm}{dt} = \pi r^2 V E w_c \quad \text{We cloud under constant volume of water (variation of \text{wt } w_c)}
\]

\[
m \cdot \frac{4}{3} \pi r^3 \rho \quad \text{plug into } \frac{dm}{dt} \text{ to get in terms of } \frac{dr}{dt}
\]

\[
\frac{4}{3} \pi \rho_0 (3r^2) \frac{dr}{dt} = \pi r^2 V E w_c
\]

\[
4 \pi \rho_0 r^2 \frac{dr}{dt} = 2 \pi r^2 V E w_c
\]

\[
4 \rho_0 \frac{dr}{dt} = V E w_c
\]

\[
\frac{dr}{dt} = \frac{V E w_c}{4 \rho_0} \quad \text{here } \rho_0 = 1000 \frac{\text{kg}}{\text{m}^3}
\]

Now, \( V = 6 \times 10^3 \) plug in

\[
\frac{dr}{dt} = \frac{(6 \times 10^3) r E w_c}{4 \rho_0}
\]

\[
\frac{1}{r} \frac{dr}{dt} = \frac{(6 \times 10^3) E w_c}{4 \rho_0}
\]

Compute \( w_c \): 100 \( \frac{\text{drops}}{\text{cm}^3} \), \( \frac{10^6 \text{ cm}^3}{\text{m}^3} \)

\[
5 \quad W_c = \frac{4}{3} \pi (r_2)^3 \rho_0 \left( 100 \times 10^6 \text{ drops/ m}^3 \right)
\]
\[ \frac{1}{r} \frac{dr}{dt} = \frac{(6 \times 10^3)(0.8)(\frac{4}{3} \pi (r_2)^3 P_c)(100 \times 10^6 \text{ dyne/m}^2)}{4 P_c} \]

Smaller: \( r_2 = 10 \mu m = 10^{-5} \text{ m} \)

\[ \frac{1}{r} \frac{dr}{dt} = \frac{(6 \times 10^3)(0.8)(\pi)(10^{-5} \text{ m})^3 (100 \times 10^6 \text{ dyne/m}^2)}{3} \]

Integrate for \( r_1/2 \) from \( 100 \mu m (10^{-4} \text{ m}) \) to \( 1 \text{ mm (10}^{-3} \text{ m) } \)

\[ \int_{10^{-4}}^{10^{-3}} \frac{1}{r} dr = \int_0^t \frac{(6 \times 10^3)(0.8)(\pi)(10^{-5} \text{ m})^3 (100 \times 10^6 \text{ dyne/m}^2)}{3} dt \]

\[ \ln(10^{-3}) - \ln(10^{-4}) = (0.0005-0.0006) \cdot t \]

\[ t = \frac{\ln(10^{-3}) - \ln(10^{-4})}{0.0005-0.0006} \]

\[ t \approx 4580.9 \text{ s} \approx 76 \text{ minutes} \]