

**Unit 9 ATM401, ATM601 and CHEM601****Application, analysis, and evaluation**

1. Graduate students: A  $1\text{ km}$  extending cumulus cloud has drops with an initial radius of  $100\ \mu\text{m}$  and  $10\ \mu\text{m}$ . The concentration of the larger drops is 1 per liter. The updraft is  $5\text{ cm s}^{-1}$ . Derive an approximation for the drop size at cloud base. Which assumption do you have to make and how do they affect your result? What would be the precipitation flux at cloud base? What is the time scale for the depletion of all liquid water in this cloud?
2. Graduate students: How far can a rain drop fall before completely evaporating when the layer in which it falls has a relative humidity of 99, 95, 90, 70, and 25%? To get a rough idea consider a small rain drop ( $r = 500$  microns) falling into a layer of constant temperature of  $10^\circ\text{C}$  and constant relative humidity. Assume a fall speed of  $v_T = 8000r$ . Hint: Rewrite the drop decrease in terms of distance not time. What do you have to assume for surface tension?