University of British Columbia, Vancouver
GEOS 300 - Microscale Weather and Climate
Knox

Study Questions - Lecture 21

1. At a tower you measure the following average air temperatures: $\overline{T_1} = 15°\mathrm{C}$ and $\overline{T_2} = 10°\mathrm{C}$, at heights $z_1 = 1\,\mathrm{m}$ and $z_2 = 11\,\mathrm{m}$. Calculate $\Delta\overline{T}/\Delta z$ and $\Delta\overline{\theta}/\Delta z$.

2. Redo the calculation for air temperatures $\overline{T_1} = 10.0°\mathrm{C}$ and $\overline{T_2} = 11.0°\mathrm{C}$, at heights $z_1 = 1\,\mathrm{m}$ and $z_2 = 6\,\mathrm{m}$.

3. For question 1 and 2 calculate Q_H using the K-Theory. Given is the eddy diffusivity $K_H = 0.2\,\mathrm{m^2\,s^{-1}}$. Use appropriate values form Tables in Oke, T. R. 'Boundary Layer Climates'.

4. At the tower you measure a carbon dioxide concentration of $\overline{\rho_{c1}} = 14\,\mathrm{mmol\,m^{-3}}$ and $\overline{\rho_{c2}} = 15\,\mathrm{mmol\,m^{-3}}$, at heights $z_1 = 1\,\mathrm{m}$ and $z_2 = 11\,\mathrm{m}$. Calculate $\Delta\overline{\rho_c}/\Delta z$ and the mass flux density of carbon dioxide using the K-Theory and the Reynolds analogy.

5. At the tower you measure also measure absolute humidity of $\overline{\rho_{v1}} = 5,\mathrm{g\,m^{-3}}$ and $\overline{\rho_{v2}} = 4\,\mathrm{g\,m^{-3}}$, at the same heights $z_1 = 1\,\mathrm{m}$ and $z_2 = 11\,\mathrm{m}$. Calculate $\Delta\overline{\rho_v}/\Delta z$ and the mass flux density of water vapour E (in $\mathrm{g\,m^{-2}\,s^{-1}}$) using the K-Theory and Reynolds analogy.

6. Calculate Q_E from question 5.