Study Questions - Topic 21

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

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

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

4. At the tower you measure a carbon dioxide concentration of $\overline{\rho_{c1}} = 14\,mmol\,m^{-3}$ and $\overline{\rho_{c2}} = 15\,mmol\,m^{-3}$, at heights $z_1 = 1\,m$ and $z_2 = 11\,m$. 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 $\overline{\rho_{v1}} = 5, g\,m^{-3}$ and $\overline{\rho_{v2}} = 4\,g\,m^{-3}$, at the same heights $z_1 = 1\,m$ and $z_2 = 11\,m$. Calculate $\Delta \overline{\rho_v}/\Delta z$ and the mass flux density of water vapour E (in $g\,m^{-2}\,s^{-1}$) using the K-Theory and Reynolds analogy.

6. Calculate Q_E from question 5.