McGill University, Montreal
GEOG 321 - Climatic Environments
Knox

Study Questions - Topic 2

Let us write the general conservation equation for humidity in the air:

$$0 = \frac{\partial \rho_v}{\partial t} + u\frac{\partial \rho_v}{\partial x} + v\frac{\partial \rho_v}{\partial y} + w\frac{\partial \rho_v}{\partial z} \tag{1}$$

where ρ_v is vapour density (same as absolute humidity). For the purpose of this set of questions, we assume there is no condensation or vaporization happening.

1. What does the term $\frac{\partial \rho_v}{\partial t}$ describe, and what is the unit of the term?
2. What does the term $u\frac{\partial \rho_v}{\partial x}$ describe, and what is the unit of the term?
3. Assume horizontally homogeneous conditions, and $\frac{\partial \rho_v}{\partial z} = -1\,\mathrm{g\,m^{-3}\,m^{-1}}$. $u = 2\,\mathrm{m\,s^{-1}}$, $v = 0\,\mathrm{m\,s^{-1}}$ and $w = 0.1\,\mathrm{m\,s^{-1}}$ Is the air drying out, becoming more humid, or is the humidity staying constant?