

Course: Dynamics 1
Exercise: 26. October 2006

1. From the weather chart in today's newspaper or internet site of your choice, identify the horizontal extent of a major atmospheric feature at mid-latitudes and the associated wind speed. From these length and velocity scales, determine a time scale.

2. The potential temperature in the atmosphere is defined as

$$\theta = T (p_0 / p)^{R/c_p}$$

with $p_0 = \text{const}$. Calculate the vertical temperature gradient

$$\gamma = -\frac{dT}{dz}$$

What is the result when assuming the hydrostatic equilibrium

$$\frac{dp}{dz} = -\rho g$$

with $g = 9.81 \text{ m/s}^2$?

What is the condition for which the potential temperature is constant in the vertical?

3. Given $f(x,y,z,t)$. What is the definition of partial derivatives for these variables? What is the definition of nabla, Laplace, divergence, total (substantial) derivative, total differential?

4. Please list the fundamental and derived quantities for the ocean and atmosphere. What are the typical length and time scales for the ocean and atmosphere?