**Atm 622 Fall 2012**

**Problem Set #4**

1. Compute the mean zonal wind at the 200-hPa level at 30oN under the assumptions that **= 0** at the equator and that the absolute angular momentum is independent of latitude. What is the implication of this result for the role of eddy motions?
2. Using the observed data given in Fig. 10.13 in Holton (2004), compute the time required for each possible energy transformation or loss to restore or deplete the observed energy stores. (One watt equals 1 J s-1.)
3. Compute the surface torque per unit horizontal area exerted on the atmosphere by topography for the following distribution of surface pressure and surface height:

Where, and where,  **rad** is the latitude and **a** is the radius of the earth. Express the answer in kg s-2.

1. Starting from (10.66) and (10.67) in Holton (2004), show that the group velocity relative to the ground for a stationary Rossby wave is perpendicular to the wave crests and has a magnitude given by (10.68).
2. In spherical coordinates , the zonally averaged continuity equation may be written as:

where and are the zonally averaged mean meridional and vertical velocities, respectively, and is a measure of latitude. It is possible to introduce a “streamfunction”, , for the total mass flow such that:

**and**

where “**a**” is the mean radius of the earth. Compute the meridional profiles of  **(kg s-1)** and  **(10-3 hPa s-1)** from the attached data for subject to the boundary condition that  **= = 0** along the earth’s surface. Convertto the appropriate units after preforming the calculations. Plot and sketch your results.

