ATM 317

Homework 4.1

Due: Mon. April 15

1. In Sutcliffe's derivation of what we now know as the "Sutcliffe Development Theorem" we took the Laplacian of a set of term that involved the product of the column average geostrophic wind and the thermal wind. The following is an example of one of the terms in Sutcliffe's derivation:

$$\nabla^2\left(\bar{u}_g v_T\right) = \frac{\partial}{\partial x}\left[\frac{\partial}{\partial x}\left(\bar{u}_g v_T\right)\right] = \bar{u}_g \frac{\partial^2 v_T}{\partial^2 x} + 2\frac{\partial \bar{u}_g}{\partial x}\frac{\partial v_T}{\partial x} + v_T \frac{\partial^2 \bar{u}_g}{\partial^2 x}.$$

   Sutcliffe, however, assumed that he could neglect the collective group of terms that involved the product of derivatives in his derivation — these terms are called *the deformation terms*.

   a. *Identify* the deformation term in the above expression.
   b. *Describe* the characteristics of a flow that would lead to the deformation term being greater than 0.
   c. *Draw* an example of the flow that you described in (b).