ATM 651: one last homework on “transport” (flux or advection), the bookkeeping core

1. Using the Primitive Equations continuity equation, and assuming ω=0 at the surface and top of atmosphere (TOA), show that the vertical integral of the transport tendency for some scalar s or q can be expressed as EITHER the vertical integral of 3D advection (obviously), OR the vertical integral of the HORIZONTAL convergence of horizontal flux.

2. Explain why horizontal advection can never create a horizontal maximum in a field

3. If localized heat waves occur because of atmospheric thermal-energy transport into an unsaturated column of air,

    a. what kind of advection is involved?

    b. In the flux form, at what altitude at which the horizontal transport of thermal-energy into the column that makes the column get hot?

    c. If dry static energy s is used as the measure of thermal energy, what quantity is (puzzlingly) being advected downward?