Name _____

MTEOR 605

Fall 2017

Supplementary problem for Chapter 5

Using a simplified form of the TKE equation such as we have shown in class, or the equation in problem 5.5 of Stull, we can find time scales for each term that indicate how "fast" each term acts. This gives us an idea of the relative importance of each term in affecting the TKE tendency $\partial\overline{e}/\partial t$.

Consider two locations, one with TKE having some value $\overline{e}$ and the other with comparatively negligible TKE. (A real-world example might be a region near a coastline, with the first location being over heated land and the second over cold water.) A time scale for advection of TKE between these locations would be how long it takes for an air parcel to travel the distance between them. This is distance divided by speed, or $\Delta x/\overline{u}$. A time scale for dissipation would be the magnitude of TKE at a given time divided by the dissipation rate, or $\overline{e}/\varepsilon$.

(a) Using these time scales with a typical near-surface value of $\overline{u}$ and typical mid-day values of $\overline{e}$ and ε, find the distance (length scale) for which advection and dissipation act comparably fast.

(b) For what length scales do you think that it would be a reasonable approximation to neglect advection of TKE?