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2/27/09 Lecture Summary

First, we learned how to scale the thermodynamic equation for large scale motion,

$$(\frac{\partial}{\partial t} + \boldsymbol{V}_g \cdot \nabla T) - S_p \omega = \frac{J}{C_p} \quad ,$$

where, $Sp = -T \frac{\partial \ln \Theta}{\partial p}$. Next, we found that we couldn't remove vertical motion, ω, from the equation, as the vertical temperature advection is just as important as horizontal temperature advection. We did a scale analysis of $-\boldsymbol{V} \cdot \nabla T$, the horizontal temperature advection, and $-w \frac{\partial T}{\partial z}$, the vertical temperature advection. using values of 10 cm/s for $\mathbf{V}_g$, 10 k per 10^6 m for ∇T , 10^{-2} m/s for w, and 10 k per 10^3 m for $\frac{\partial T}{\partial z}$, we found the vertical temperature advection to be roughly equal to the horizontal temperature advection, implying that vertical motions of as little as 1 mm/s have the same advective effect as horizontal motions of 10 m/s.