AST 851 Dynamic Meteorology

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7.5 Idealized Model of a Developing Baroclinic Wave



A. Based on \omega equation [simple form: $w \propto \frac{\partial}{\partial z} (-V_g \cdot \nabla \zeta_g) - V_g \cdot \nabla T$]

- (1) & (5): PVA at 500mb -> Positive differential VA \rightarrow w>0.
- (2): Warm advection \rightarrow w>0.
- (3) & (6): NVA at 500mb -> Negative differential VA -> w<0.
- (4): Cold advection \rightarrow w<0.

B. Based on \chi equation [simple form: $-\chi \propto -V_g \cdot \nabla \zeta_g + \frac{\partial}{\partial z} \left(-V_g \cdot \nabla T \right)$]

(5): Ahead of 500 mb trough -> $PVA \rightarrow \phi \downarrow$ and

cold advection near surface -> $\frac{\partial}{\partial z} \left(-V_g \cdot \nabla T \right) > 0 \Rightarrow \phi \downarrow$.

(6): Ahead of 500mb ridge -> NVA -> $\phi \uparrow$ and cold advection near surface -> $\frac{\partial}{\partial z} (-V_g \cdot \nabla T) > 0 \rightarrow \phi \downarrow . \phi$?

C. Development of the surface low

- (7): (i) Overall w>0 creates surface convergence -> spin up surface positive vorticity -> low deepens.
 - (ii) 500 mb vorticity strengthens due to PVA -> coupled with surface low.