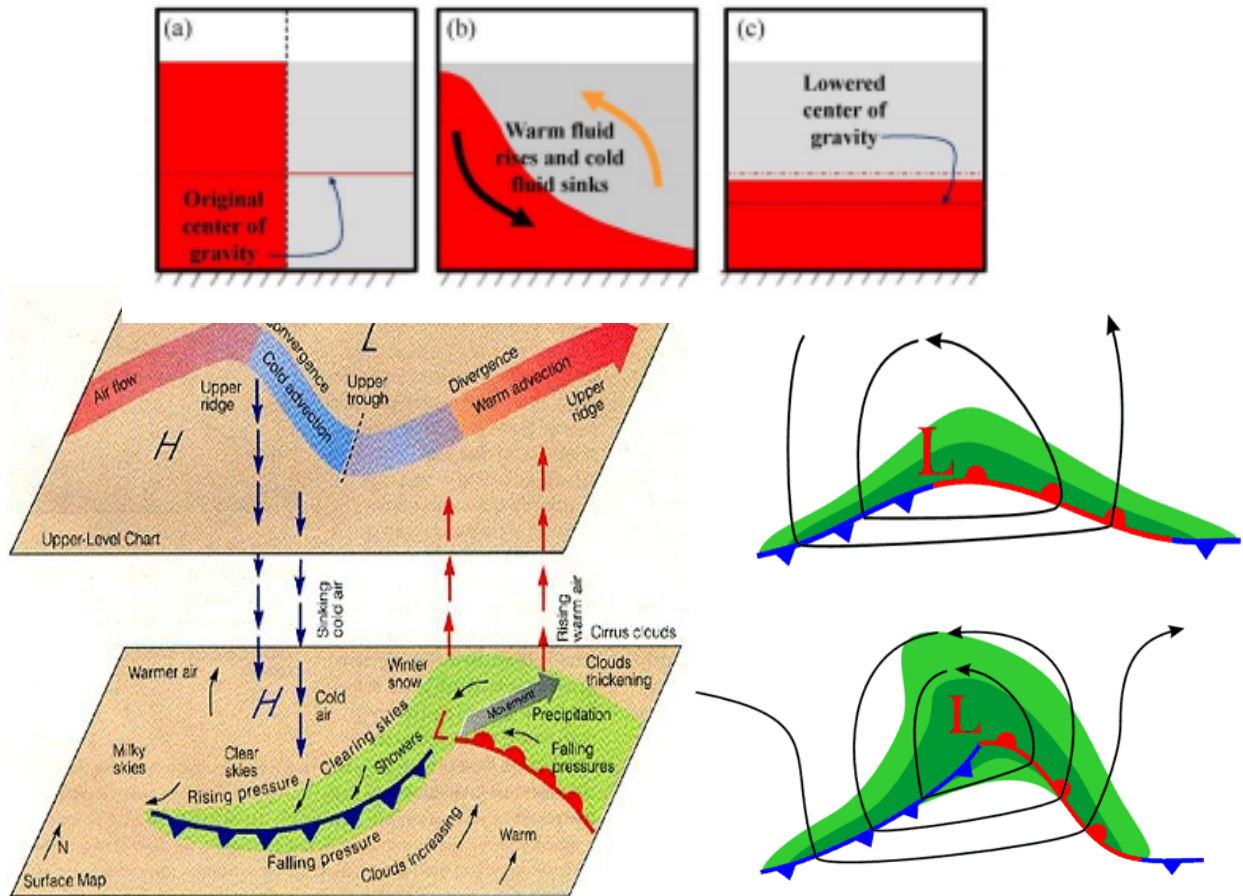
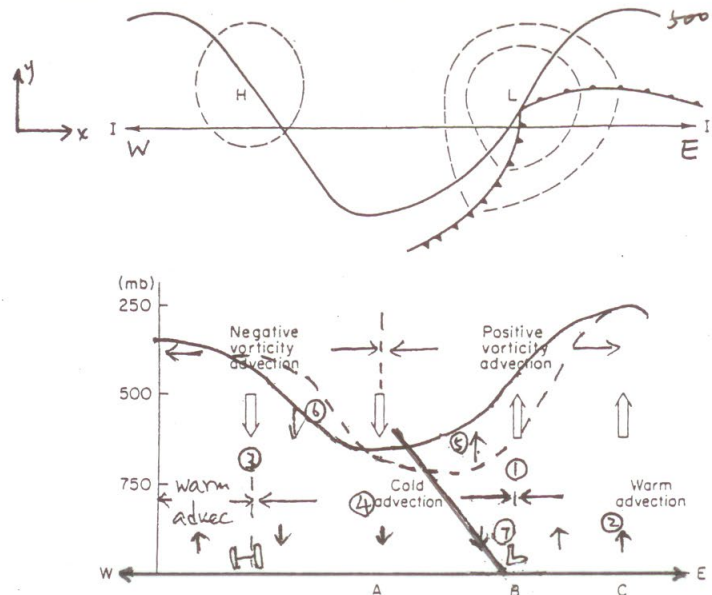


11. Baroclinic Instability and Cyclogenesis

Converting the Available Potential Energy (APE) to Kinetic Energy (KE)



Idealized Model of Cyclogenesis



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

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

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

(6): Ahead of 500mb ridge \rightarrow NVA $\rightarrow \phi \uparrow$ and

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

B. Based on ω 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 \rightarrow Positive differential VA $\rightarrow w > 0$.

(2): Warm advection $\rightarrow w > 0$.

(3) & (6): NVA at 500mb \rightarrow Negative differential VA $\rightarrow w < 0$.

(4): Cold advection $\rightarrow w < 0$.

C. Development of the surface low

(7): (i) Overall $w > 0$ creates surface convergence \rightarrow spin up surface positive vorticity \rightarrow low deepens.

(ii) 500 mb vorticity strengthens due to PVA \rightarrow coupled with surface low.