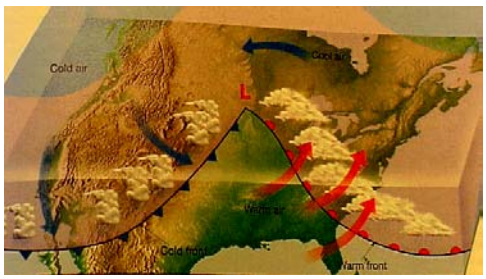
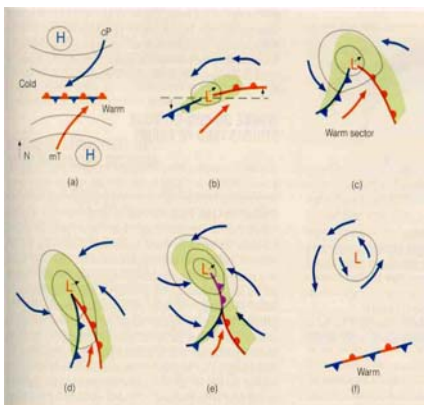
The Midlatitude Cyclone



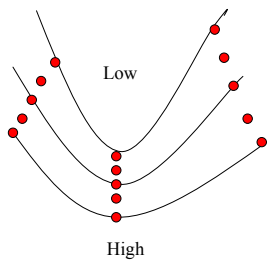
The Wave Cyclone Model
(Norwegian model)

- Stationary Front
- Nascent Stage
- Mature Stage
- Partially Occluded Stage
- Occluded Stage
- Dissipated Stage



Stages of cyclone development

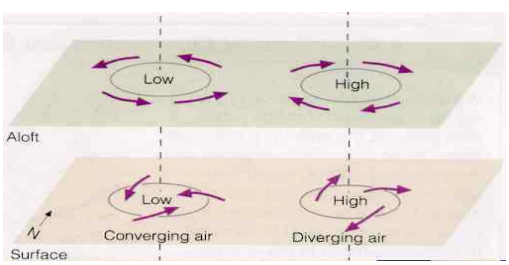
What initiates cyclogenesis?

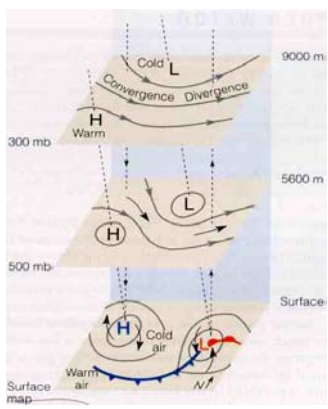


500-hPa height

What maintains the surface low?

Imagine a surface low forming below an upper level low.





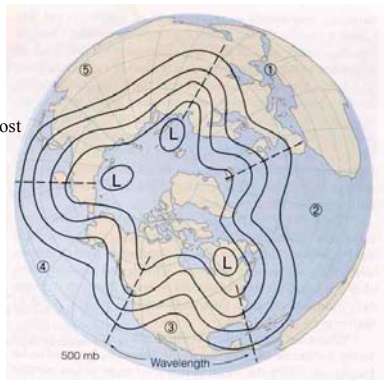
Actual vertical structure:

Upper level low is tilted westward with height with respect to the surface.

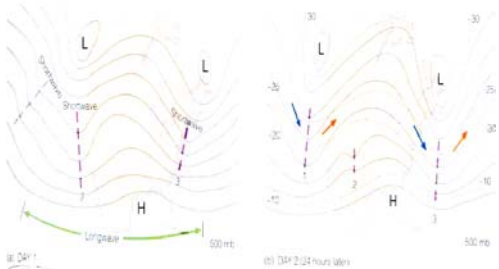
UPPER LEVEL DIVERGENCE INITIATES AND MAINTAINS A SURFACE LOW.

A look at the large scale.

Where is upper level divergence most likely to occur?

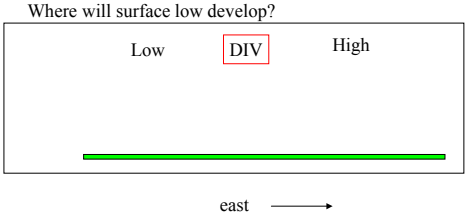


Cyclone initiation:
Passage of a shortwave often initiates the formation of a surface low.

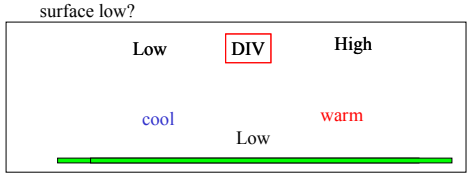


Cyclone development:
•baroclinic instability (baroclinic means temperature varies on an isobaric surface) causes initial 'perturbation' to grow.
•occurs in the presence of strong temperature gradients.

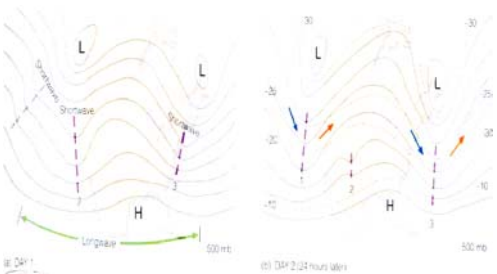
Imagine a short wave trough passes overhead (*looking North*):
Where will surface low develop?

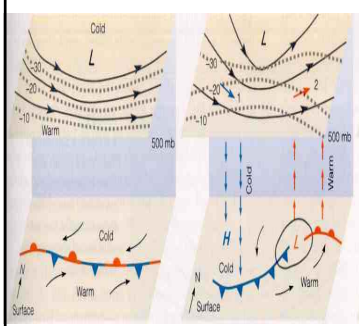


(*looking North*):
Near the surface, where will we have cold and warm advection?
Will this amplify or weaken the upper level low?
How about the upper level divergence?
Will a more intense upper level low strengthen or weaken the surface low?



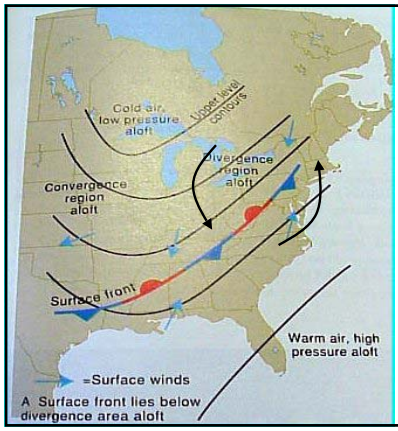
Cyclone development:
Strong north south gradient+passage of a shortwave trough
Can lead to rapid cyclogenisis via baroclinic instability
(baroclinic means temperature varies on an isobaric surface)



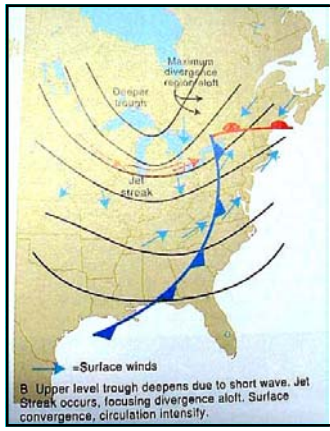


Baroclinic instability
•Upper level shortwave passes.
•Upper level divergence -> sfc low.
•Cold advection throughout lower troposphere.
•Cold advection intensifies upper low.
•Leads to more upper level divergence.
•Intensifies sfc low.

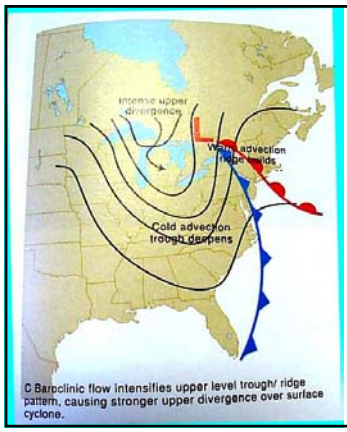
ADVECTION IS KEY.



1. Divergence aloft
2. Leads to lower SLP underneath divergence
3. Flow associated with low SLP leads to cold/warm advection on lower troposphere.
4. Temp advection increases upper level trough, and hence leads to more divergence.



Intensification occurs typically just ahead of upper air trough axis.



- What is the vertical structure of a developing storm?
- Where is the largest upper/lower level divergence/convergence occurring?
- Why aren't the 'lows' vertically stacked?
- What is required for a storm to develop?
- Where is rising motion occurring?
- Precipitation?
- What is the ultimate source of energy for a midlatitude storm?
- Why does a storm "die"?
- During what time of year would you expect more midlatitude cyclones?
- Why doesn't baroclinic instability occur in the tropics?
- Why is cold advection more 'effective' at the surface than in the middle troposphere?