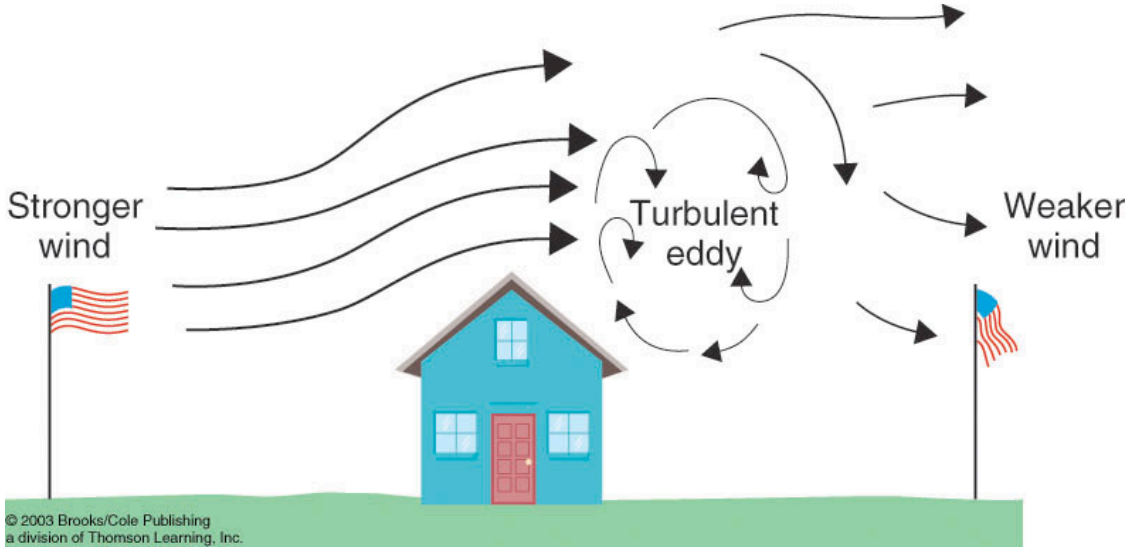
Small scale winds

- Turbulent eddies
- Small-scale winds in the continental US
  - Coastal fronts, cold-air damming
  - Microbursts
  - Gravity waves
  - Sea breezes
  - Lake effect snow
  - Mountain/valley breezes
  - Santa Anas (+ Chinooks)

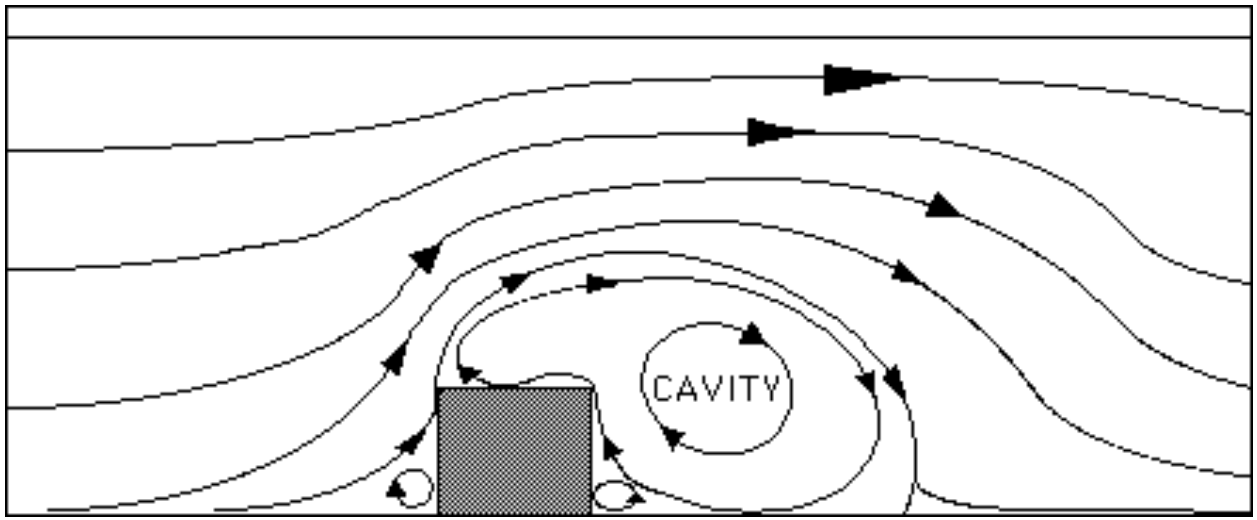
Turbulent eddies



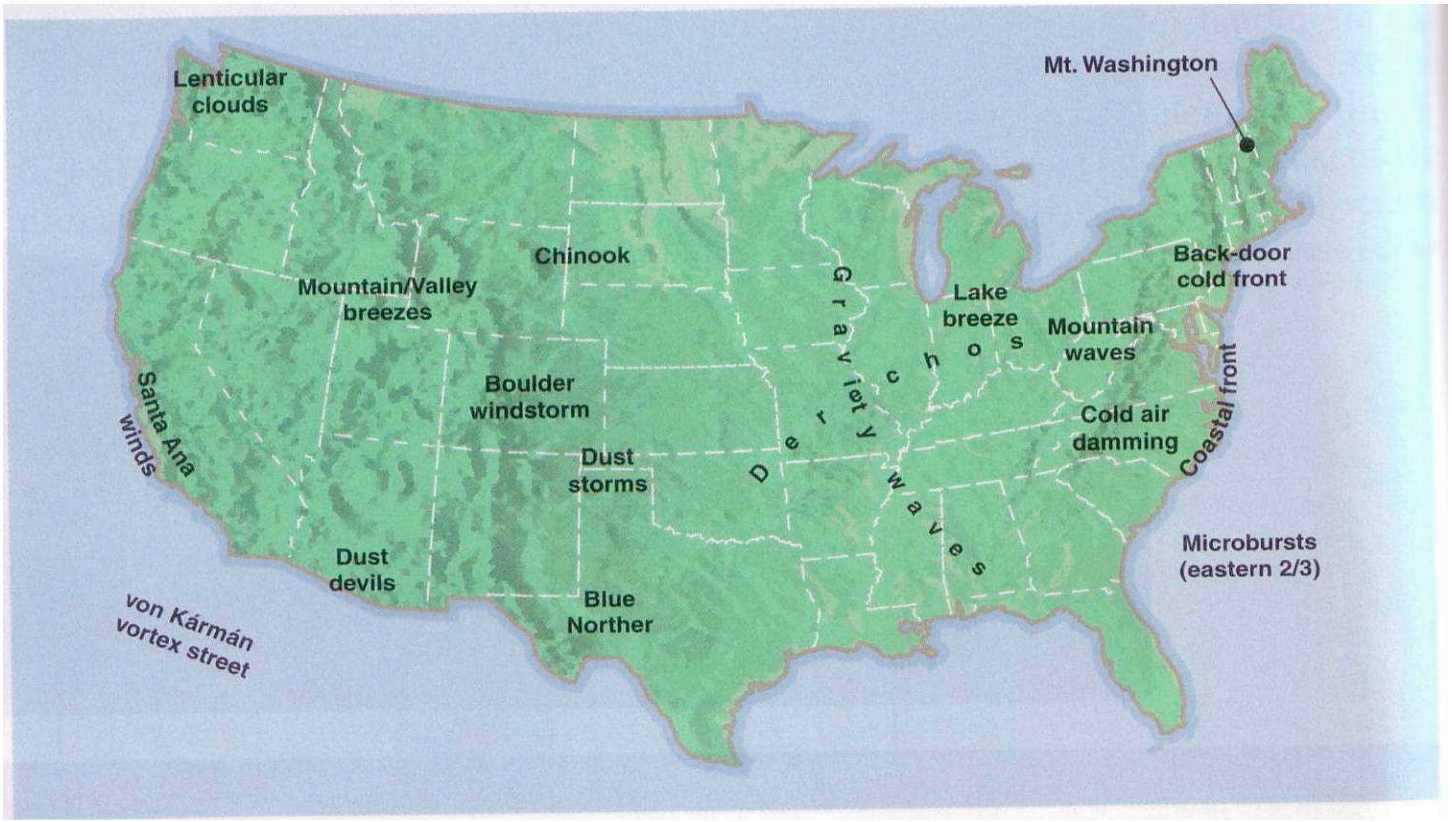
Air is forced up and over an object

Air closest to the object is forced to slow down

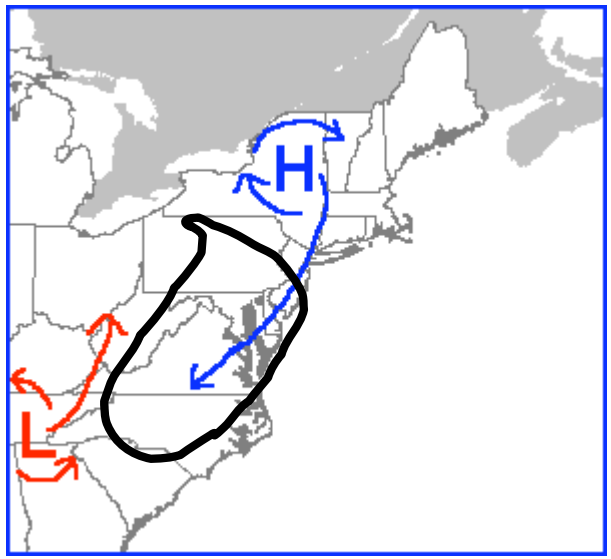
Strongest wind is higher up. The shear creates vertical vorticity



Location of main small-scale wind events



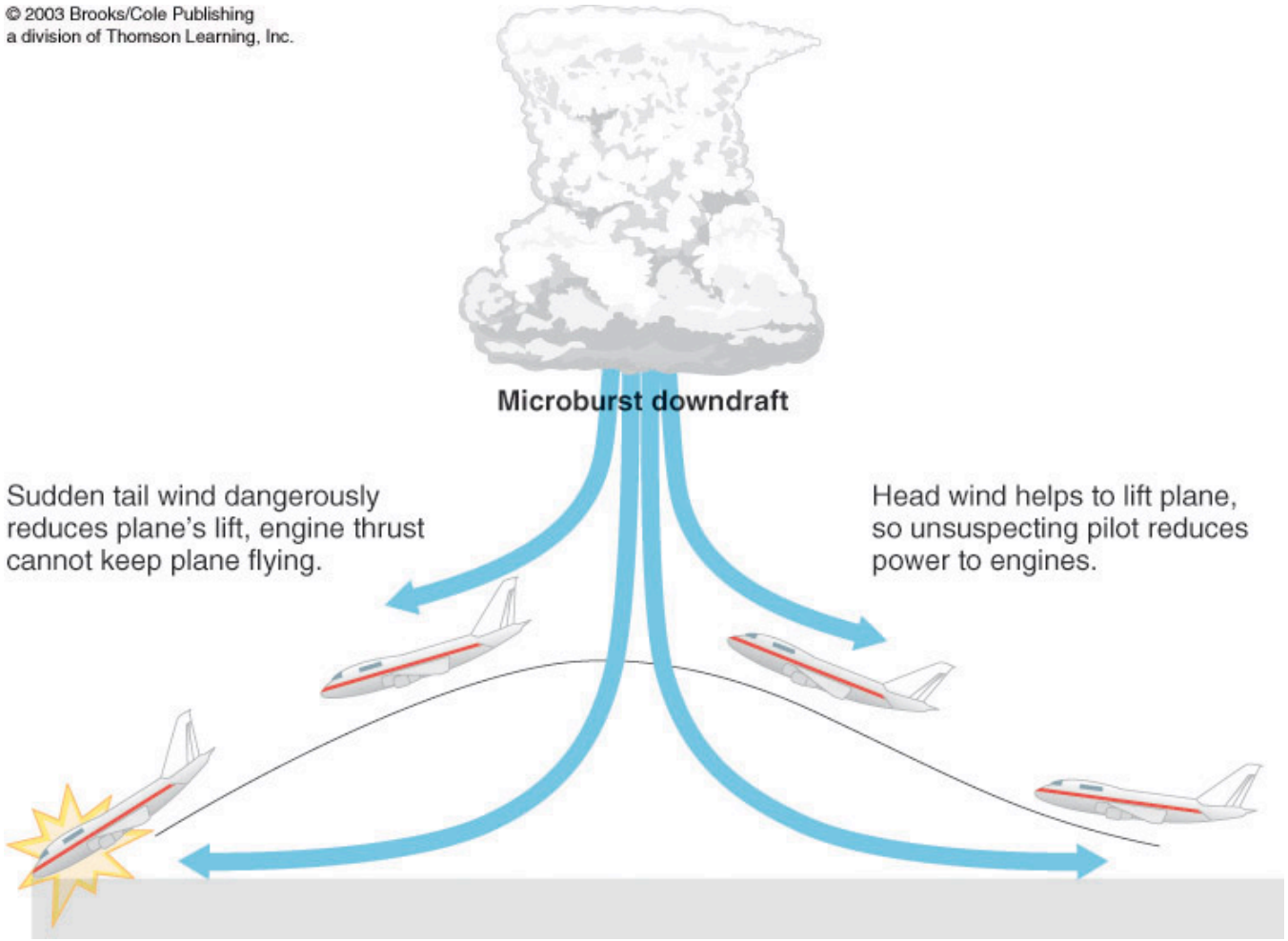
Cold Air Damming/ Back Door Cold Front



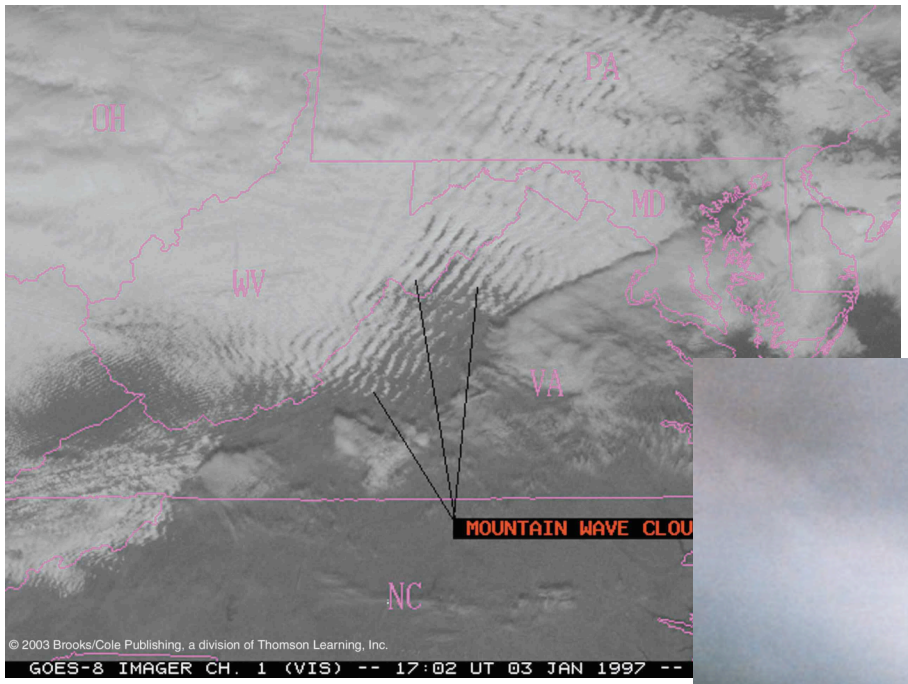
High pressure send winds down the narrow corridor between the coast and the Appalachain Mtns

Tail end of a cold front actually moving “backwards” (westwards)

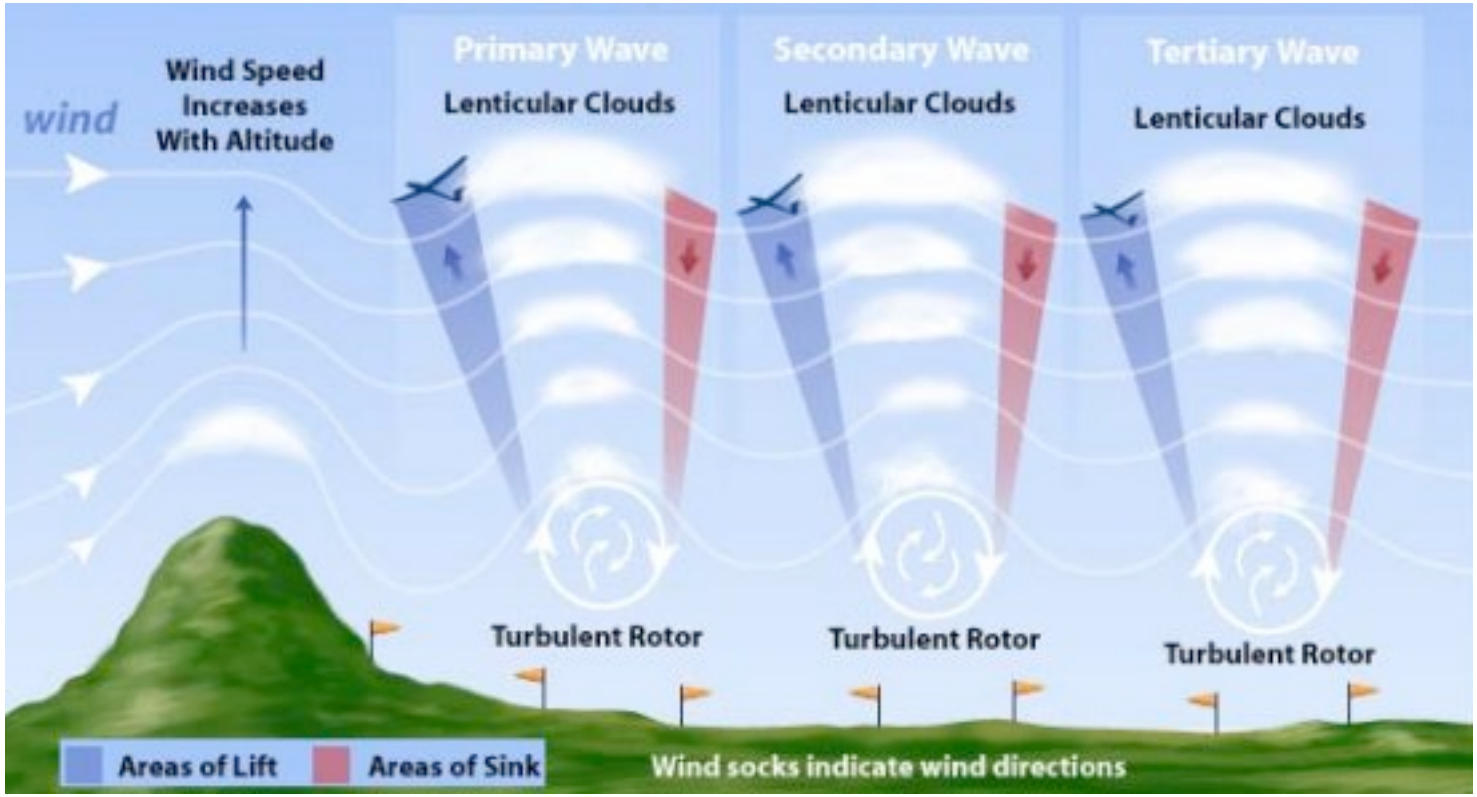
Microburst and aviation

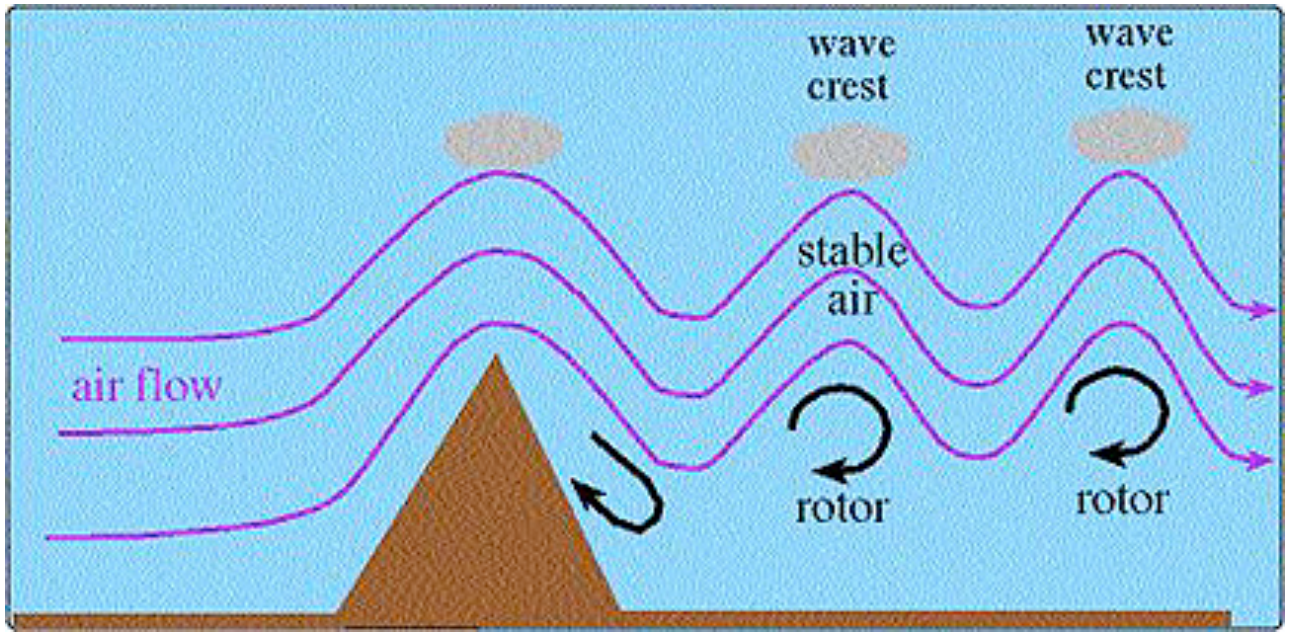


Gravity waves / Mountain Waves (Lenticular Clouds)

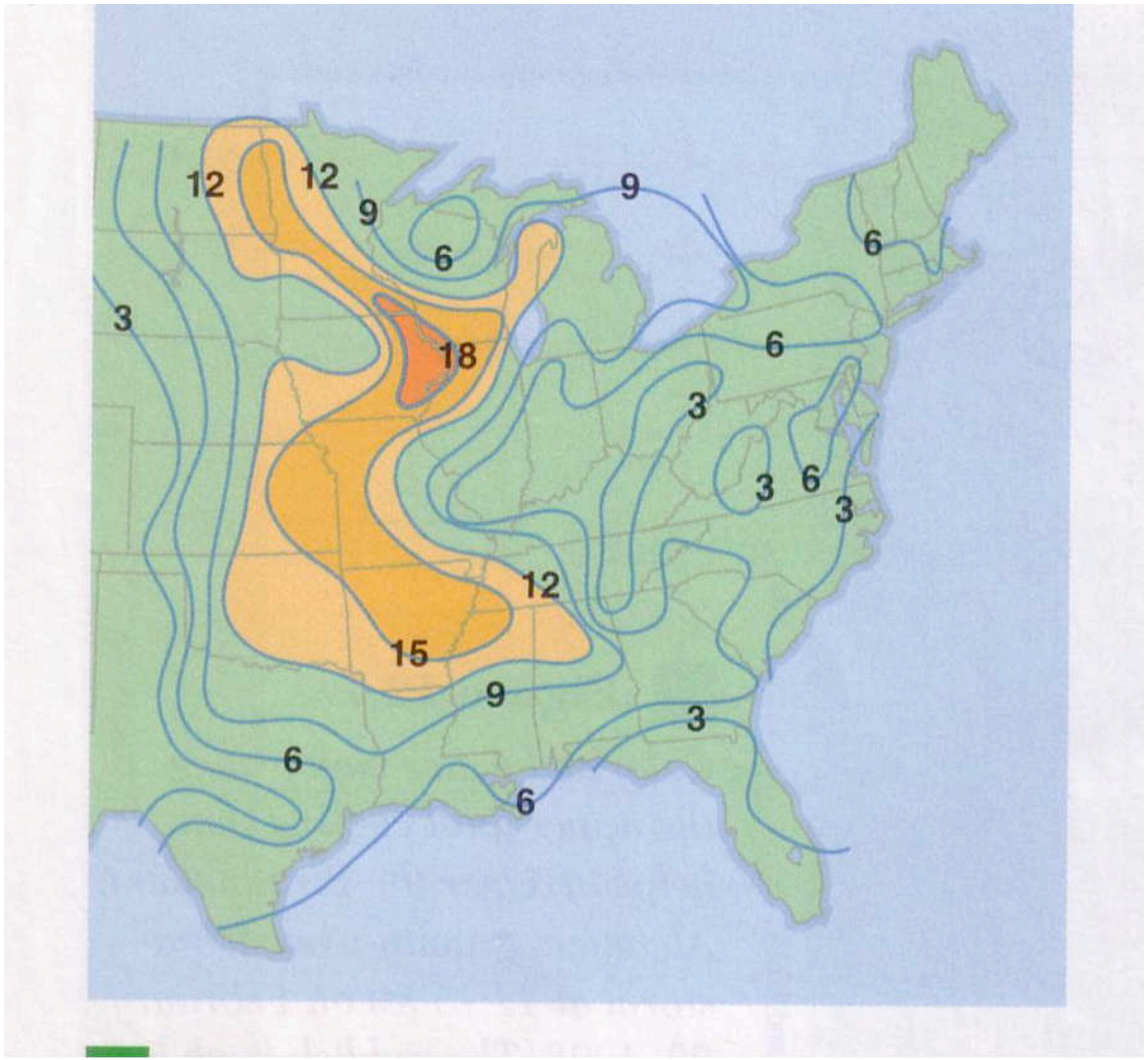


Indicative of atmospheric stability


wind
Wind Speed
Increases
With Altitude
Primary Wave
Lenticular Clouds
Secondary Wave
Lenticular Clouds
Tertiary Wave
Lenticular Clouds
Turbulent Rotor
Turbulent Rotor
Turbulent Rotor
Areas of Lift
Areas of Sink
Wind socks indicate wind directions

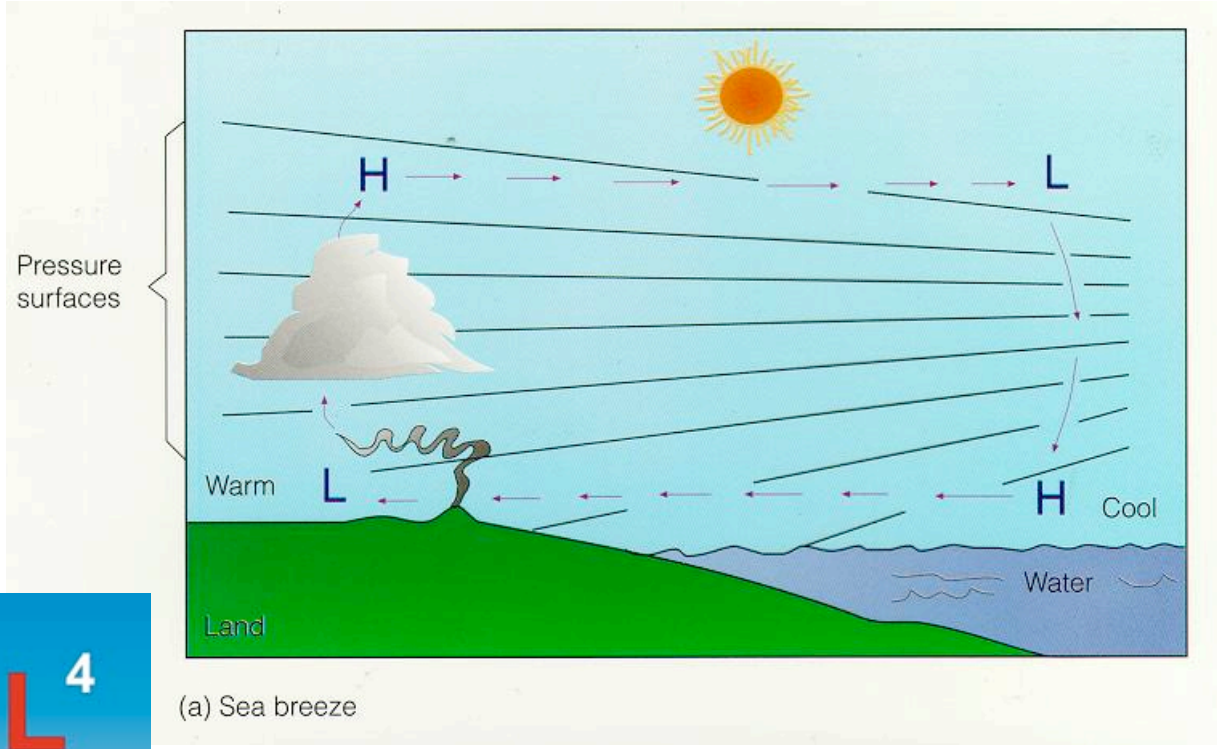

wave
crest
wave
crest
stable
air
air flow
rotor
rotor

25-year climatology of gravity waves

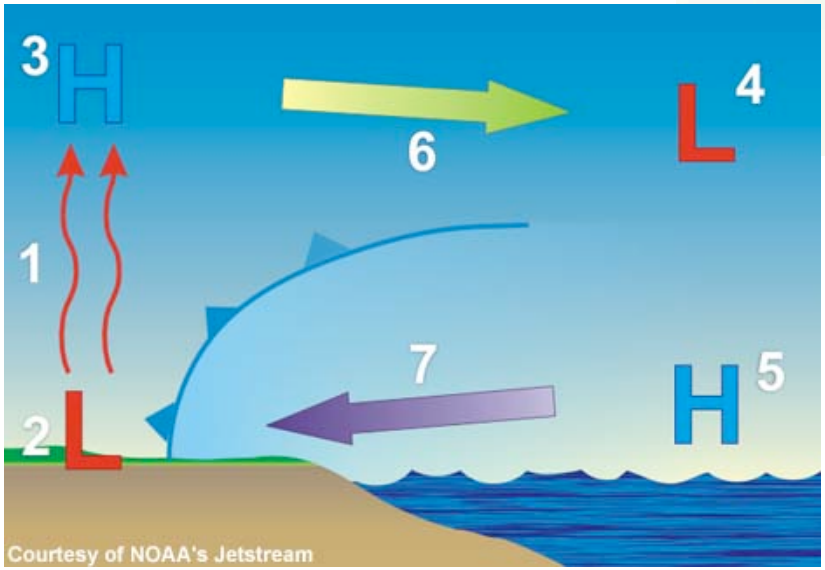


Gravity waves into the stratosphere

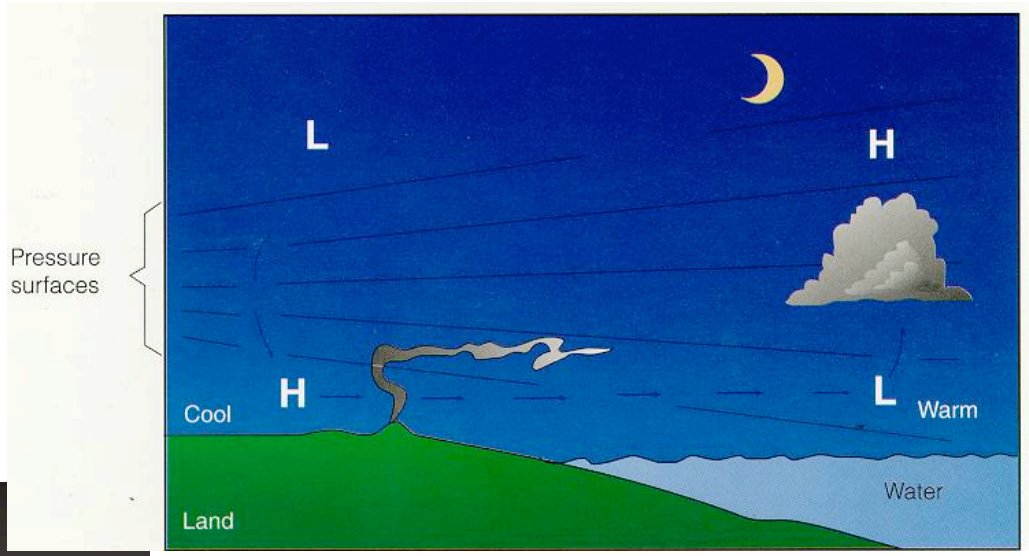
Sea Breeze (daytime)

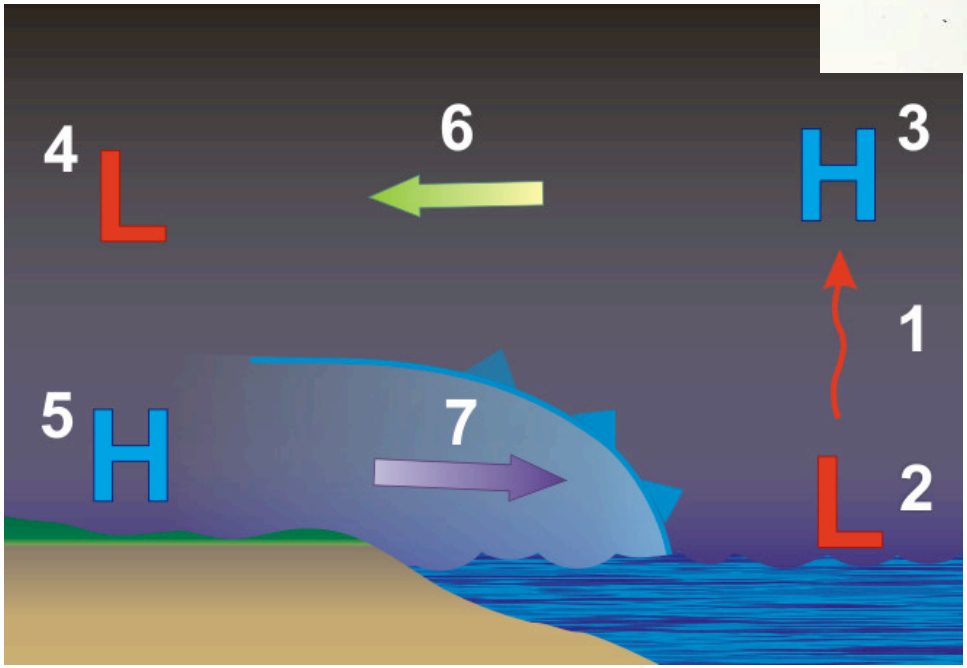


(a) Sea breeze

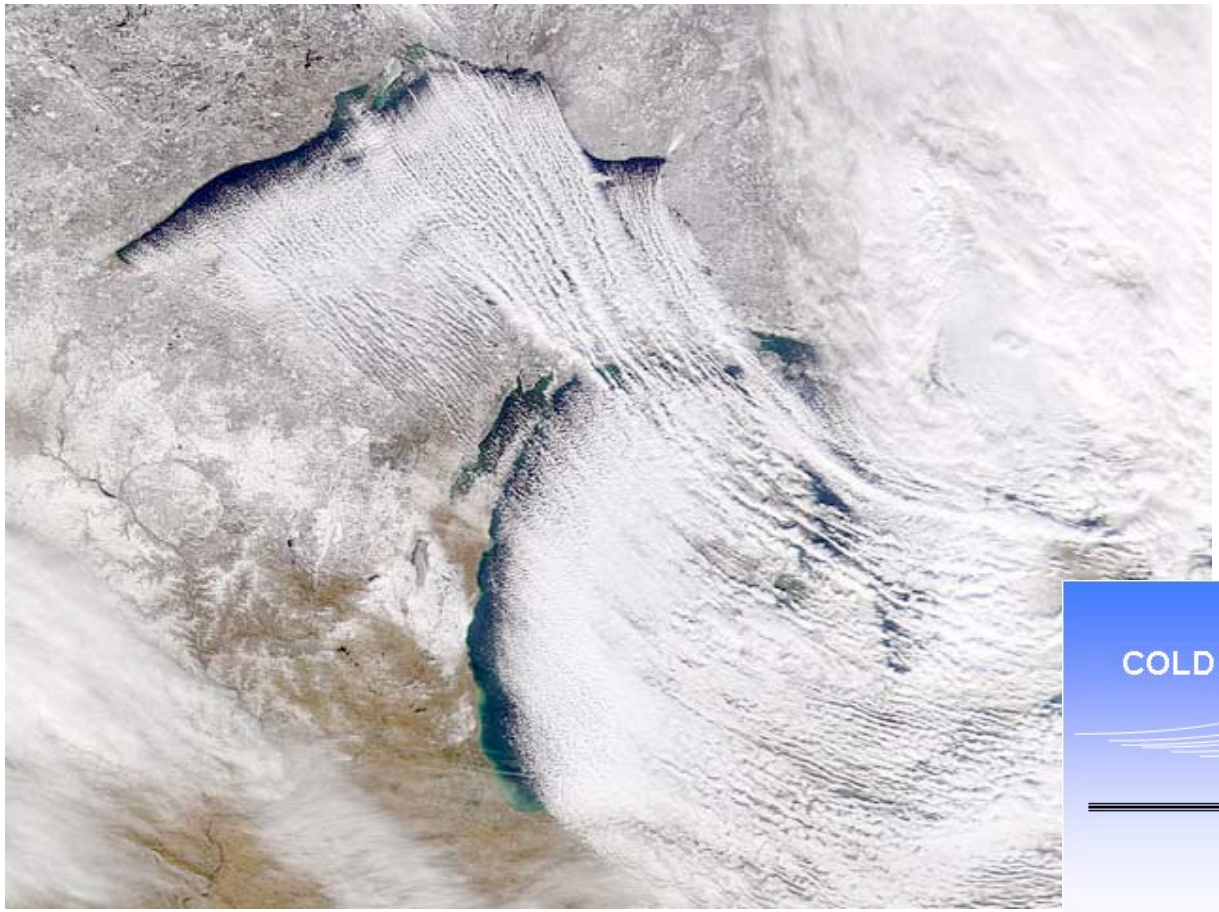


Land Breeze (nighttime)



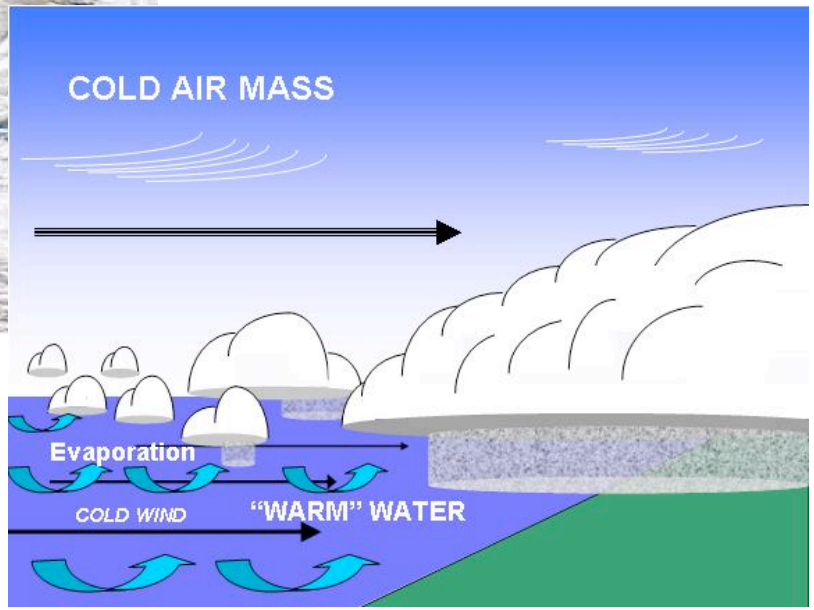


Lake-effect Snow

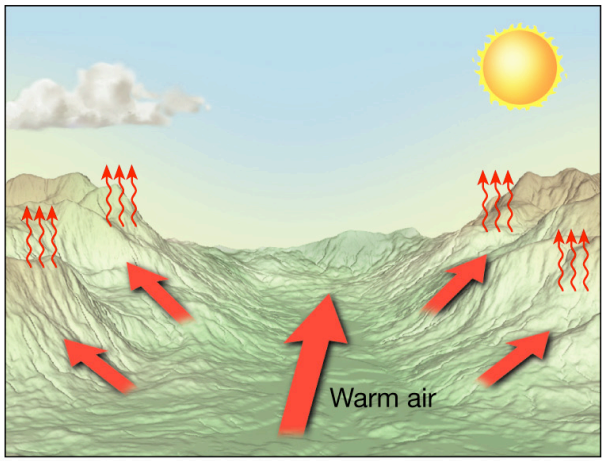


Very cold, arctic air blows over relatively warm lake water

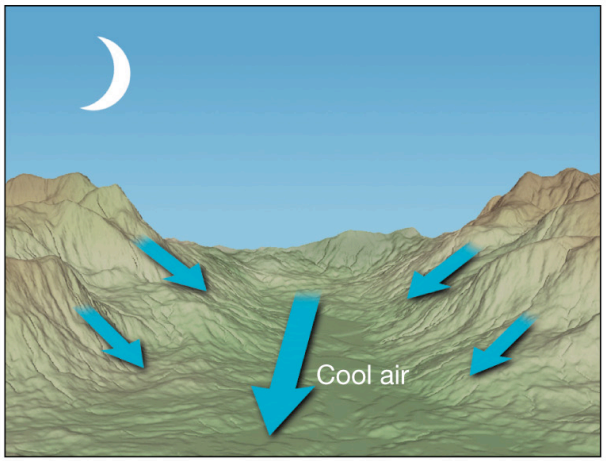
Water is evaporated off the lakes



Mountain and valley breezes



(a) Valley breeze



(b) Mountain breeze

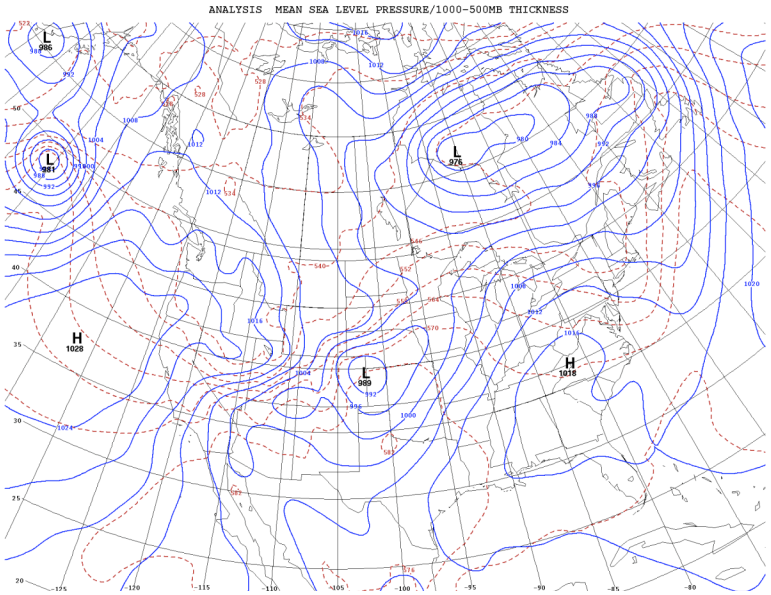
Thinner air warms faster during day

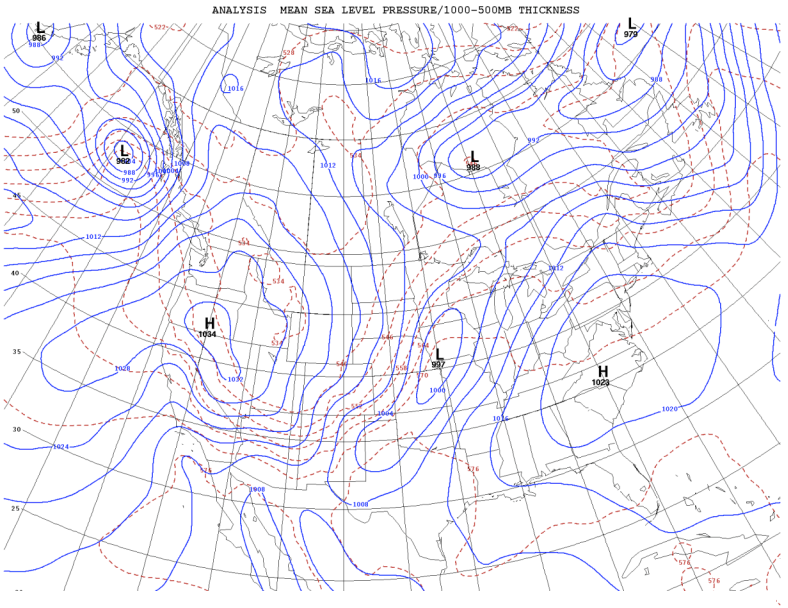
Warm air on slopes creates local “low” pressure, drawing air out of the valley

… and cools faster at night

Cold air on slopes is dense and sinks into the valley

Santa Anas


ANALYSIS MEAN SEA LEVEL PRESSURE/1000-500MB THICKNESS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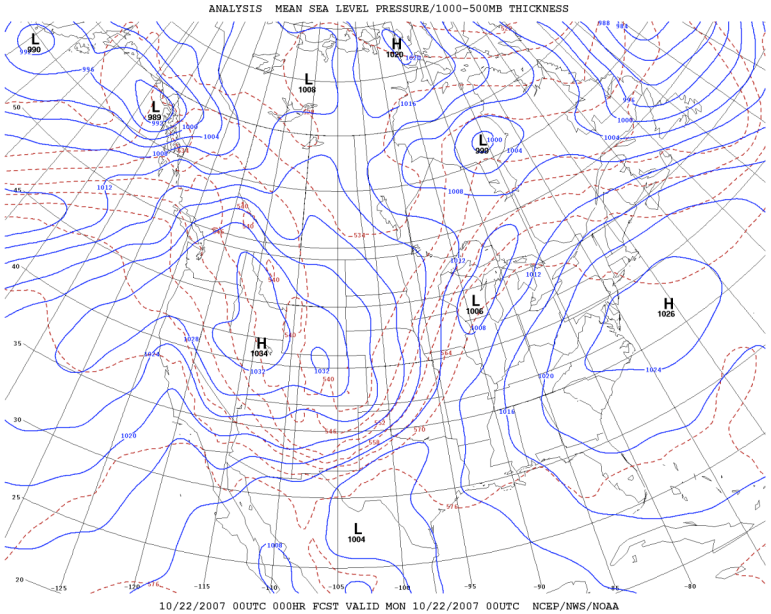
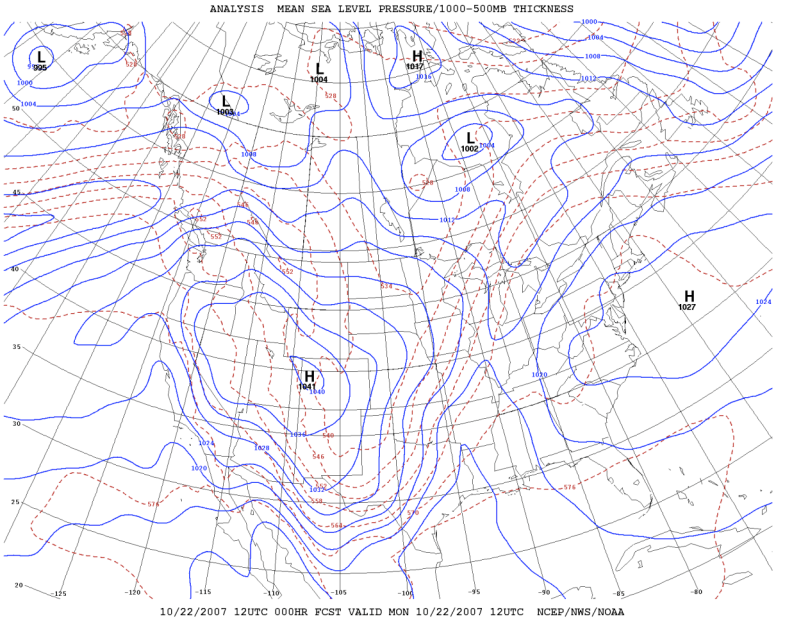
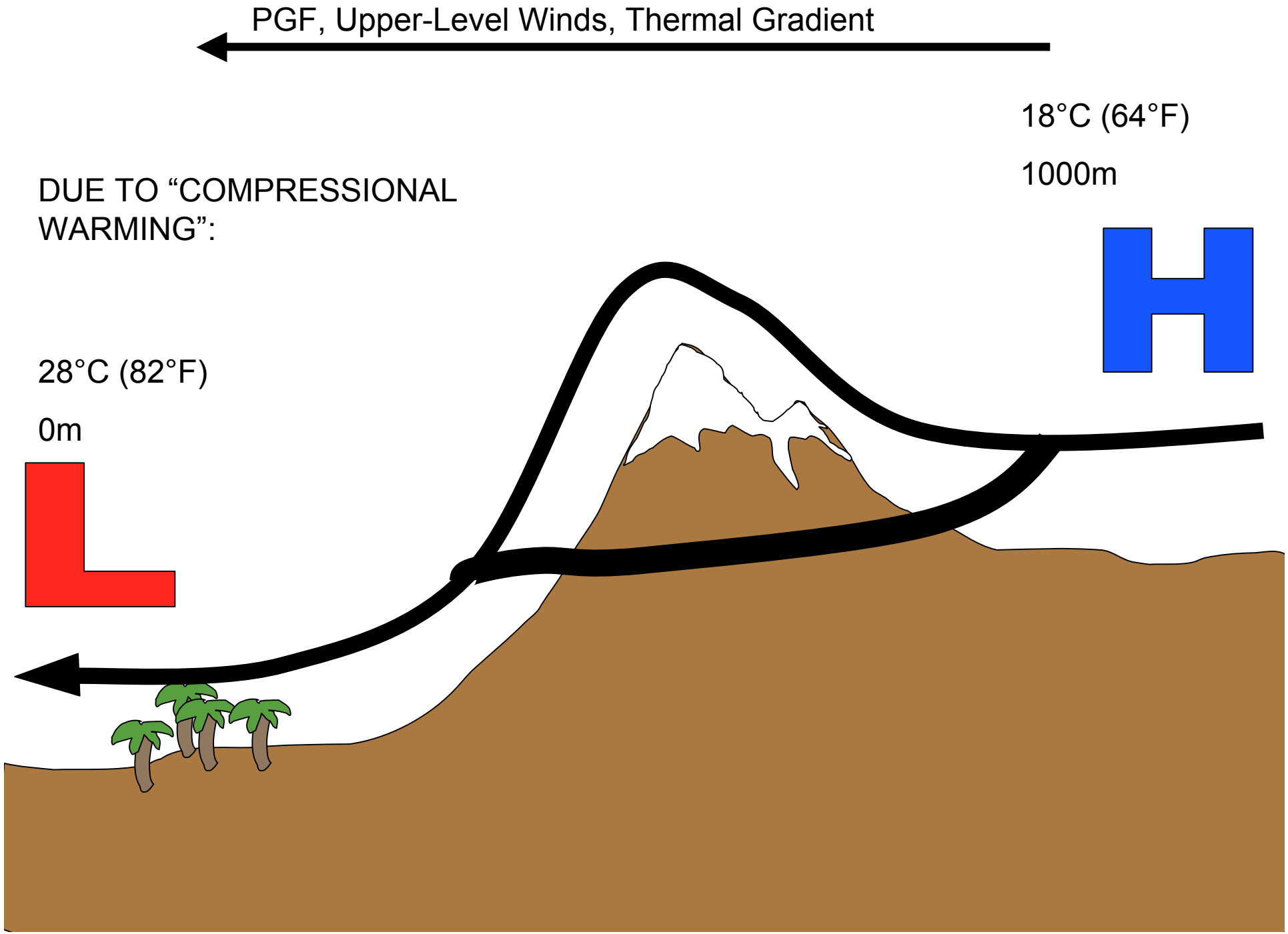

ANALYSIS MEAN SEA LEVEL PRESSURE/1000-500MB THICKNESS
10/22/2007 00UTC 000HR FCST VALID MON 10/22/2007 00UTC NCEP/NWS/NOAA


ANALYSIS MEAN SEA LEVEL PRESSURE/1000-500MB THICKNESS
10/22/2007 12UTC 000HR FCST VALID MON 10/22/2007 12UTC NCEP/NWS/NOAA


PGF, Upper-Level Winds, Thermal Gradient
18°C (64°F)
1000m
DUE TO “COMPRESSIONAL WARMING”:
28°C (82°F)
0m
H
L

Santa Ana Wind Events - Oct 22

Southern California Firestorm October 2007