

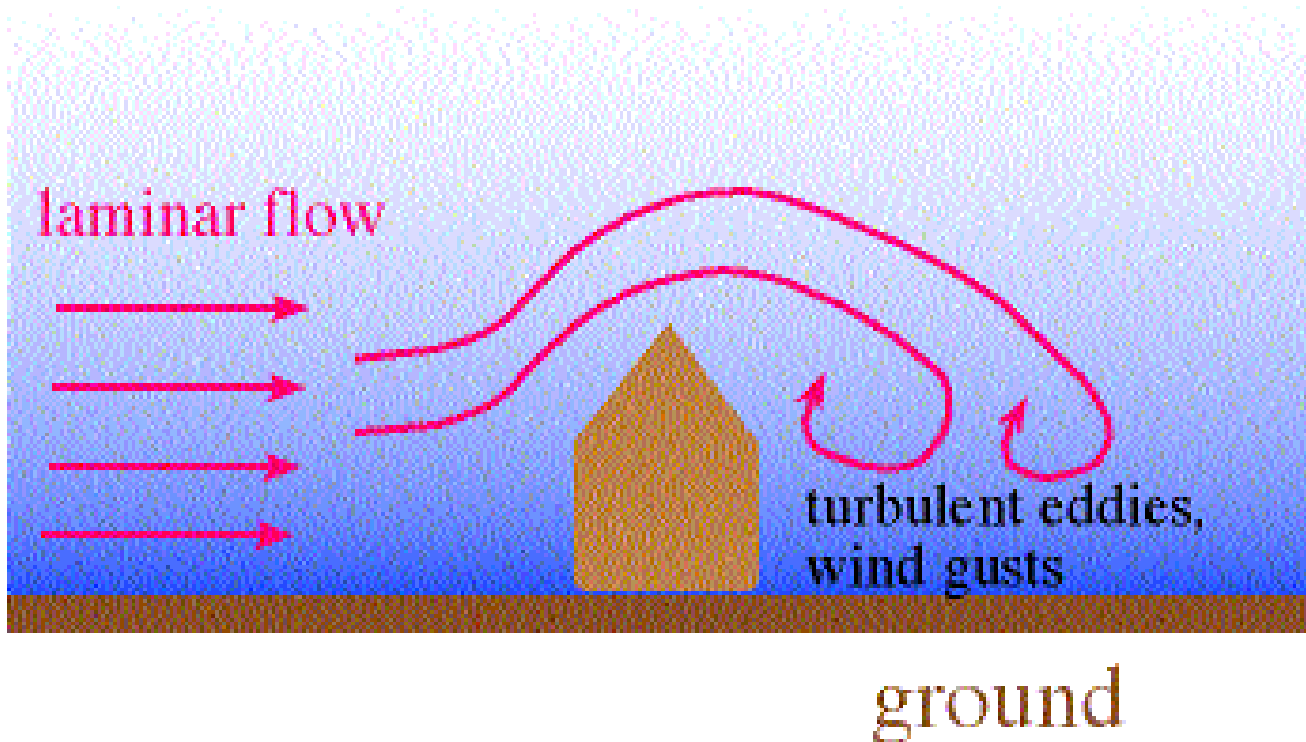
Turbulence

- **Eddies**: internal friction generated as laminar (smooth, steady) flow becomes irregular and turbulent
- Most weather disturbances involve turbulence
- 3 kinds:
 - **Mechanical turbulence** – you, buildings, etc.
 - **Thermal turbulence** – due to warm air rising and cold air sinking caused by surface heating
 - **Clear Air Turbulence (CAT)** - due to wind shear, i.e. change in wind speed and/or direction



Mechanical Turbulence

- **Mechanical turbulence** – due to flow over or around objects (mountains, buildings, etc.)



Mechanical Turbulence: Wave Clouds

- Flow over a mountain, generating:
 - Wave clouds
 - Rotors, bad for planes and gliders!

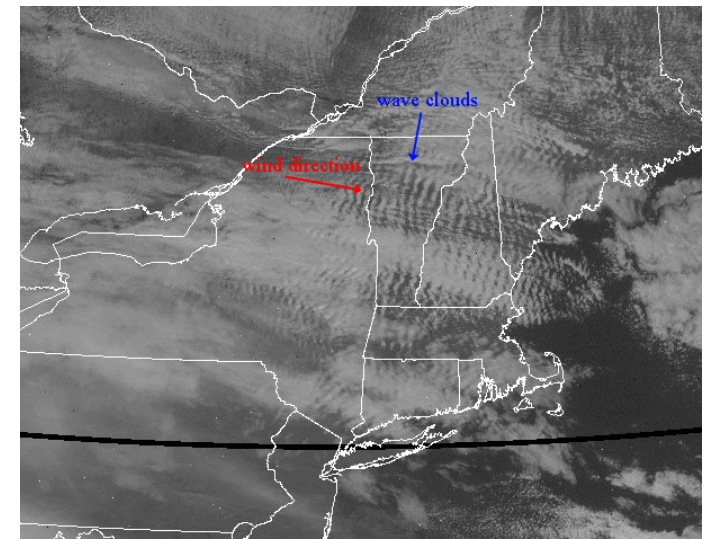
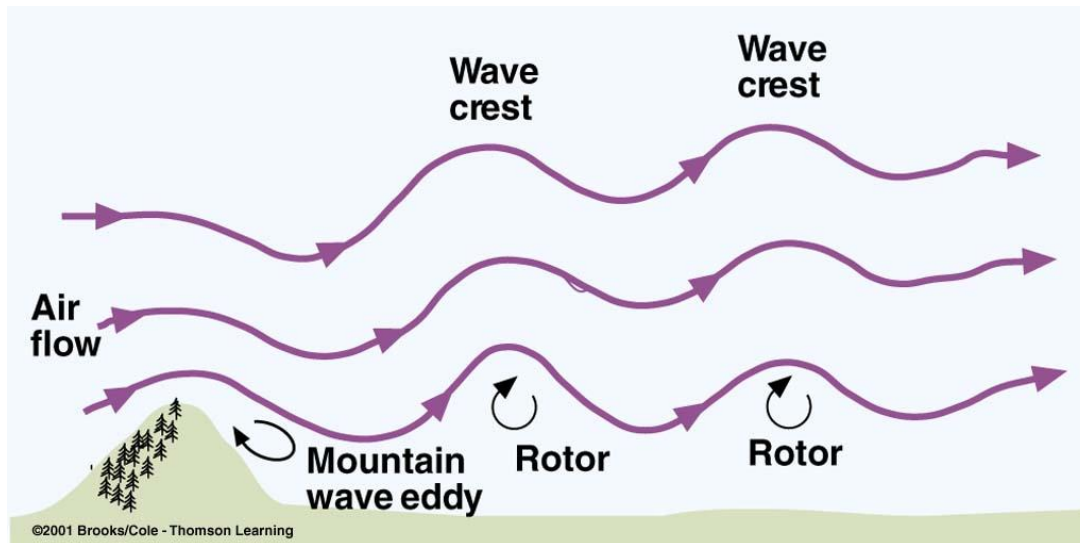
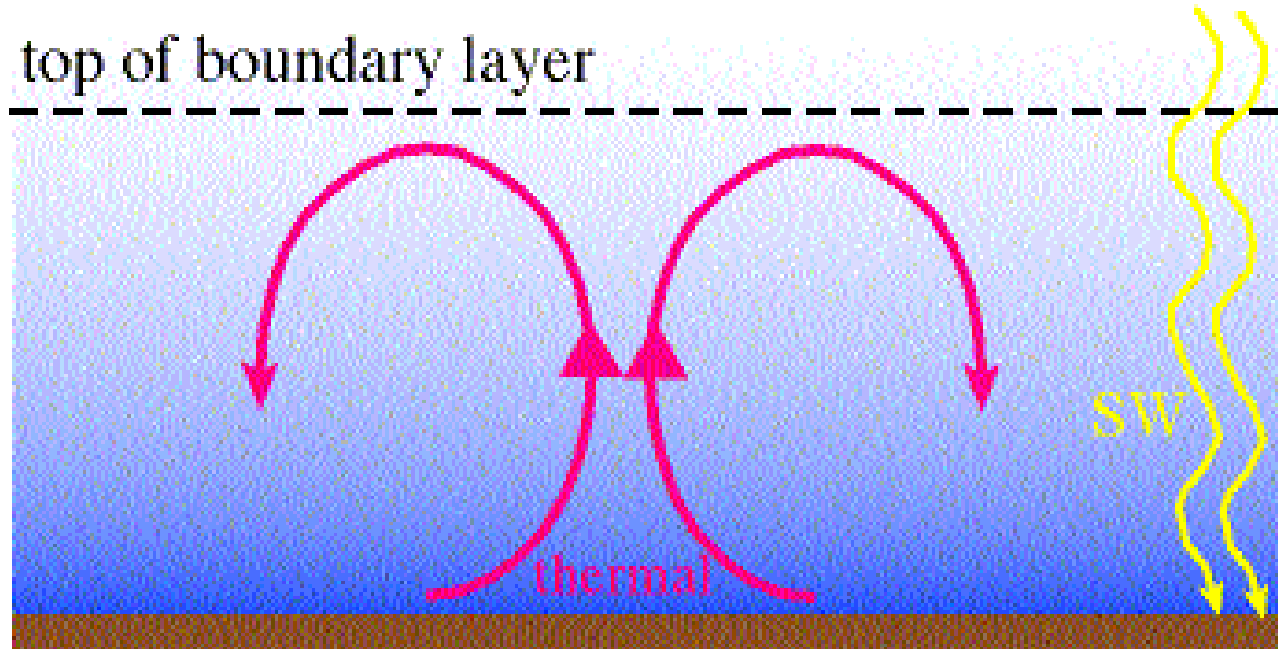
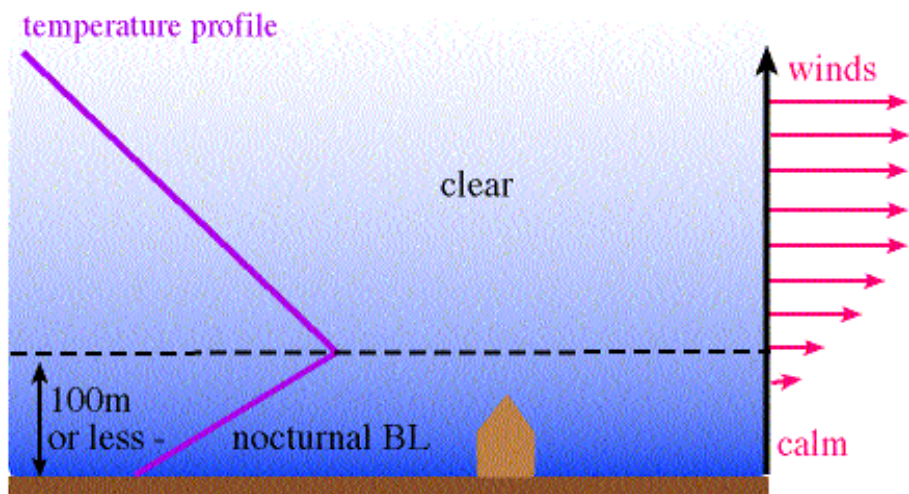


Fig. 7.2: Mechanical turbulence - Air flowing past a mountain range creates eddies hazardous to flying.

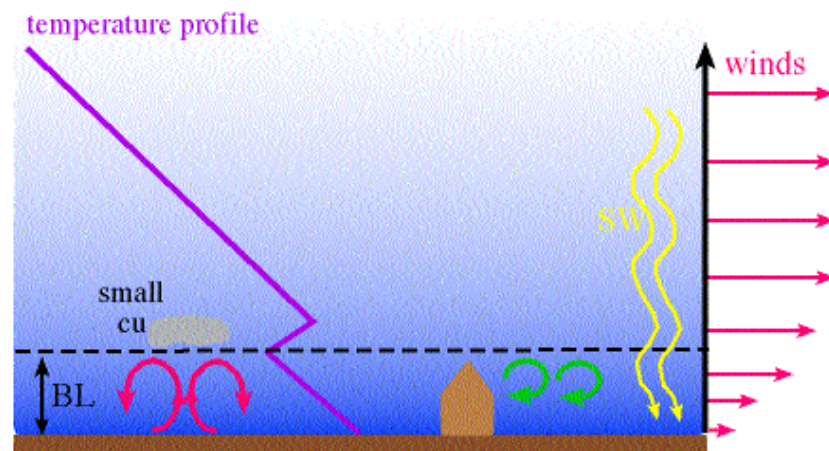
Thermal Turbulence

- **Thermal turbulence** - essentially rising thermals of air generated by surface heating
- Thermal turbulence is maximum during max surface heating - mid afternoon

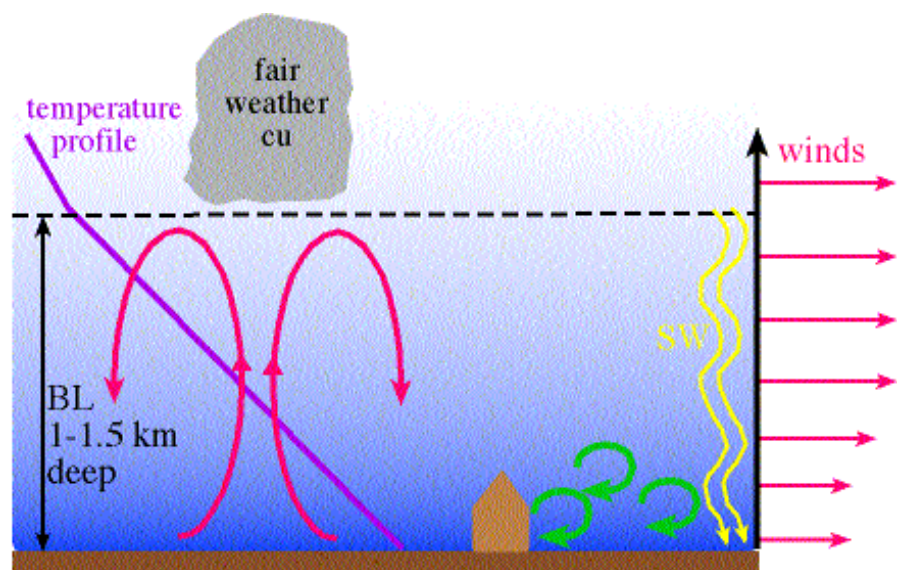




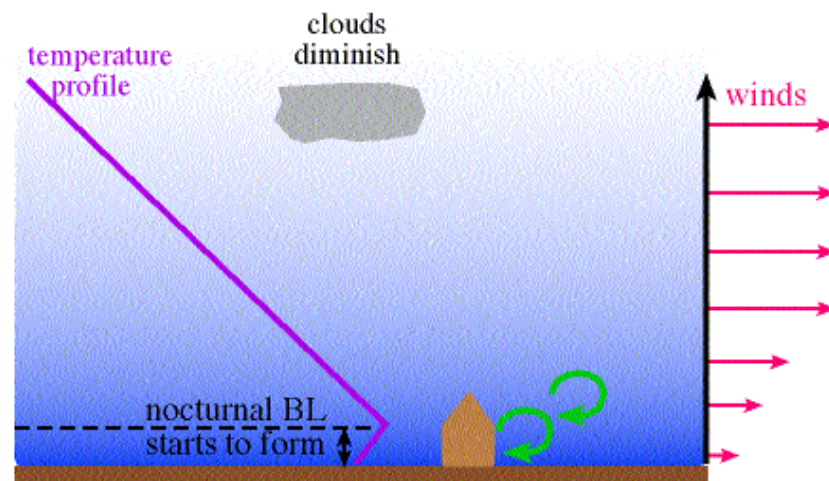
6 AM
 No **thermal turbulence**
 Little/no **mechanical turbulence**



11 AM
 weak-moderate **thermal turbulence** near surface
 weak-moderate **mechanical turbulence** near surface

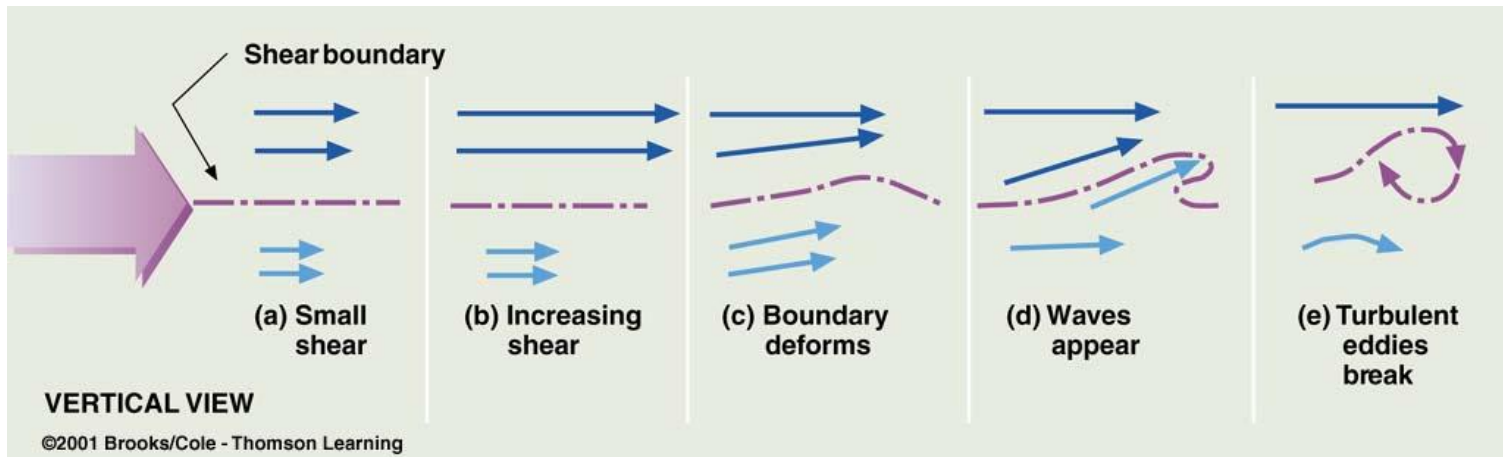


3 PM
 strongest **thermal turbulence** in BL
 strongest **mechanical turbulence** in BL



6 PM
thermal turbulence diminishes
 moderate **mechanical turbulence** that is also diminishing

Turbulence Aloft (Wind Shear)



Formation of **clear air turbulence** (CAT), responsible for 'air pockets'

Wind shear occurs at all altitudes and it can be horizontal or vertical

At high altitudes, shear is encountered at the jet stream with the wind increasing from less than 50 mph to 150 mph over a few miles.