Weather for GA Pilots

Part 1

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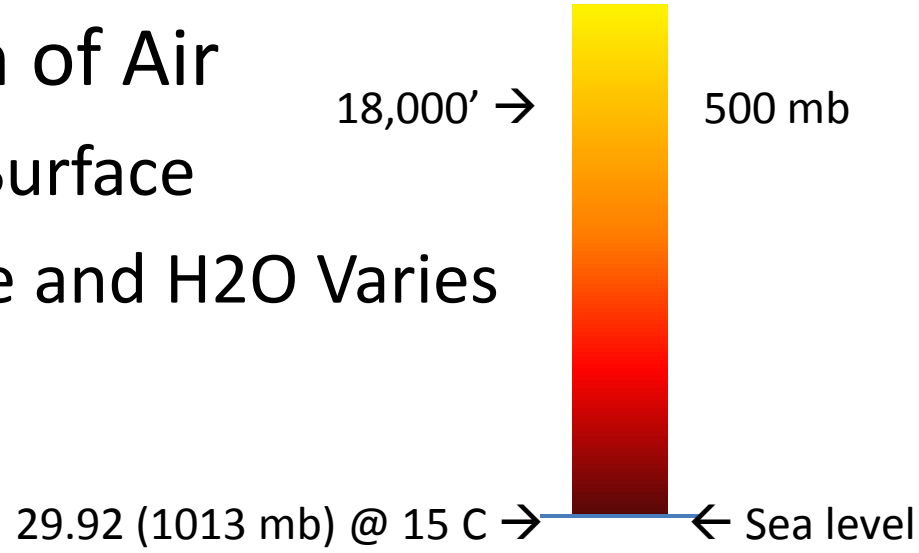
Agenda

- Composition of Atmosphere and Terms
- Air Pressure
- Energy and Air Masses
- Some Givens – Weather is Perishable
- Look at Winds
- Breezes
- Begin to Develop our Thought Process as a 3-D Picture

Pressure

- Air Composed of ~78% N and ~21% O2 and H2O
- Air Pressure Measured in millibars or inches of Mercury (Hg)
- Standard (average over the world) 29.92 in Hg
- Theoretical Column of Air
  - More Dense Near Surface
  - Actual Temperature and H2O Varies



How Can Air Pressure Increase?

- Reduce Temperature of the Column of Air
  - Gases become more dense – hence pressure increases
- Reduce H2O (Water Vapor) Content
  - Molecular mass of H2O is 18 g/mol while that of dry air is 29 g/mol
- A large area of air with similar Temperature and Water Vapor characteristics is called an Air Mass

How do These Air Masses Form?

- Earth Receives Uneven Solar Heating
- Oceans Store Thermal Energy Better Than Land
- Air Over Polar and Mid-Latitude Land Tends to be Dryer and Colder than Air Over Oceans
- Air Masses Have Relative Pressure Differences
- But, As Pressure Differences Form (Highs and Lows), Forces Form to Cause these Air Masses to Move

Some Givens

- Solar Energy Constant (~1.361 KW/sq meter) is Primary Source of Pressure Differences
- Land Mass, Ocean Mass, Inclination of Earth's Orbit, and Rotation Around the Sun Causes our Primary Seasons
- Long Term Weather is More a Climate Prediction
- Short Term Weather is both a Synoptic (observed) and a Forecast (**near term future to ~ 3 days**)
- Accuracy of a Weather Forecast Becomes Problematic With Time

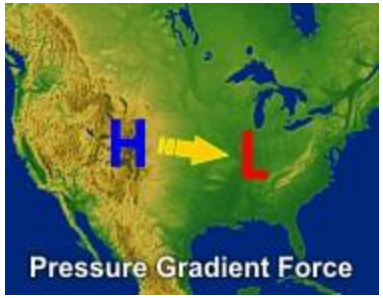
As Pilots

- Watch WX Trends 3-5 days Before Planned Flight
- Get Outlook Brief from FSS 6-24 hours ahead of Flight
- Get Full Briefing 1-6 hours ahead of Flight
- Get Updates during Flight from Flight Watch
- See my amplified note on this topic at:

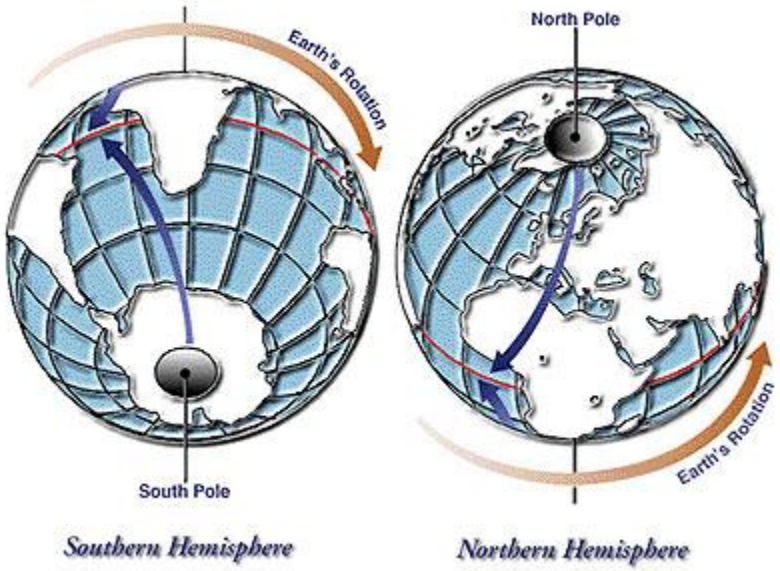
  http://w5gw.com/images/WX.pdf

Where Does Wind Come From?

- Pressure Gradient Force

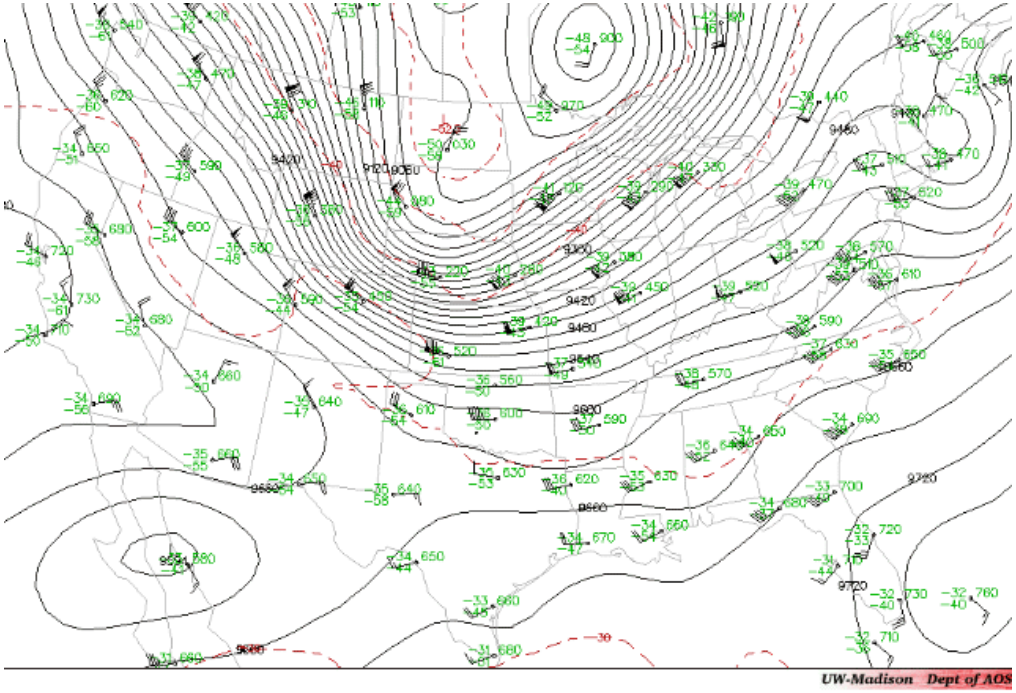


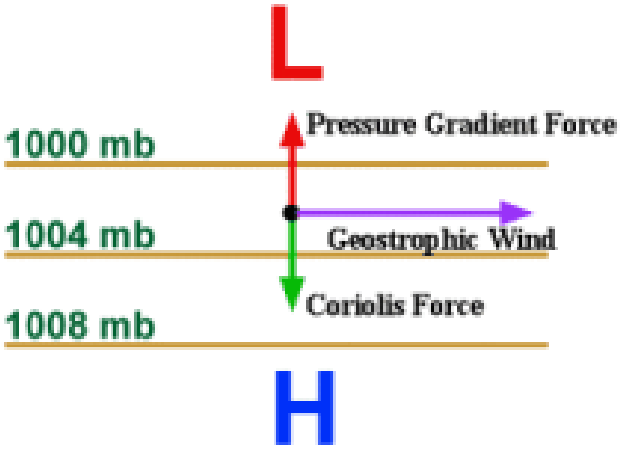
- But Earth Rotates, This Introduces a Coriolis Force (An Imaginary Force due to the Rotation of the Earth)



Wind (cont.)

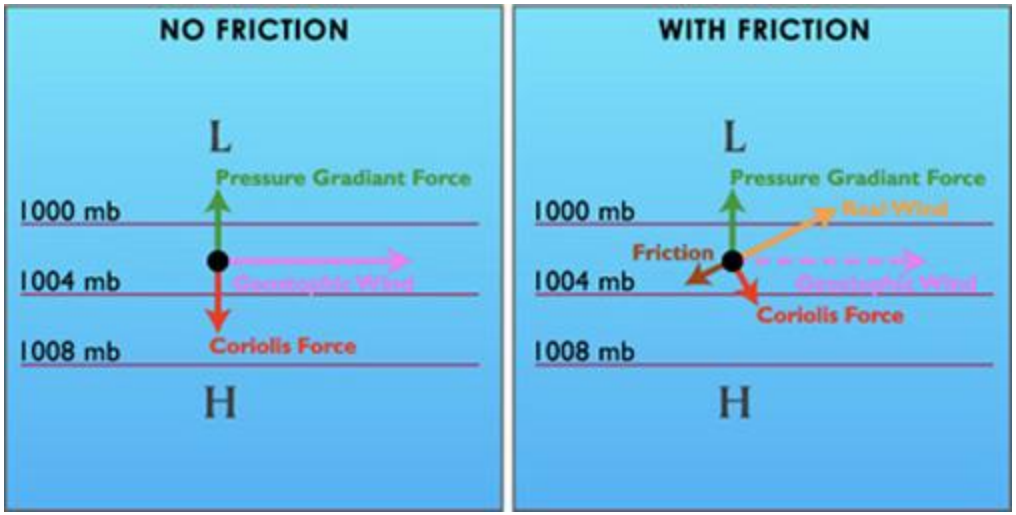
- When the PGF and the CF are Balanced there is a Geostrophic Wind
  - Pressure Gradient





Wind (cont.)

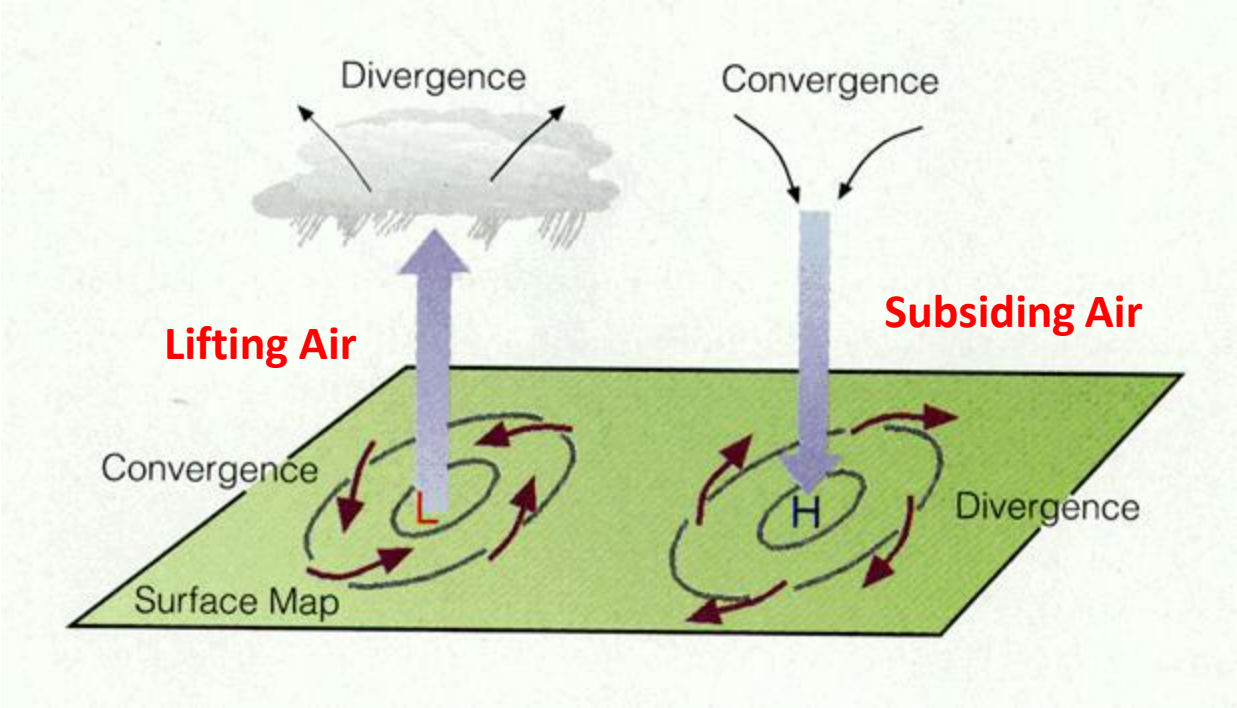
- Wind is Nearly Parallel (Geostrophic) to Isobars at Upper Altitudes and Over Smooth Ocean



- Near Surface Friction Causes Turning of Wind

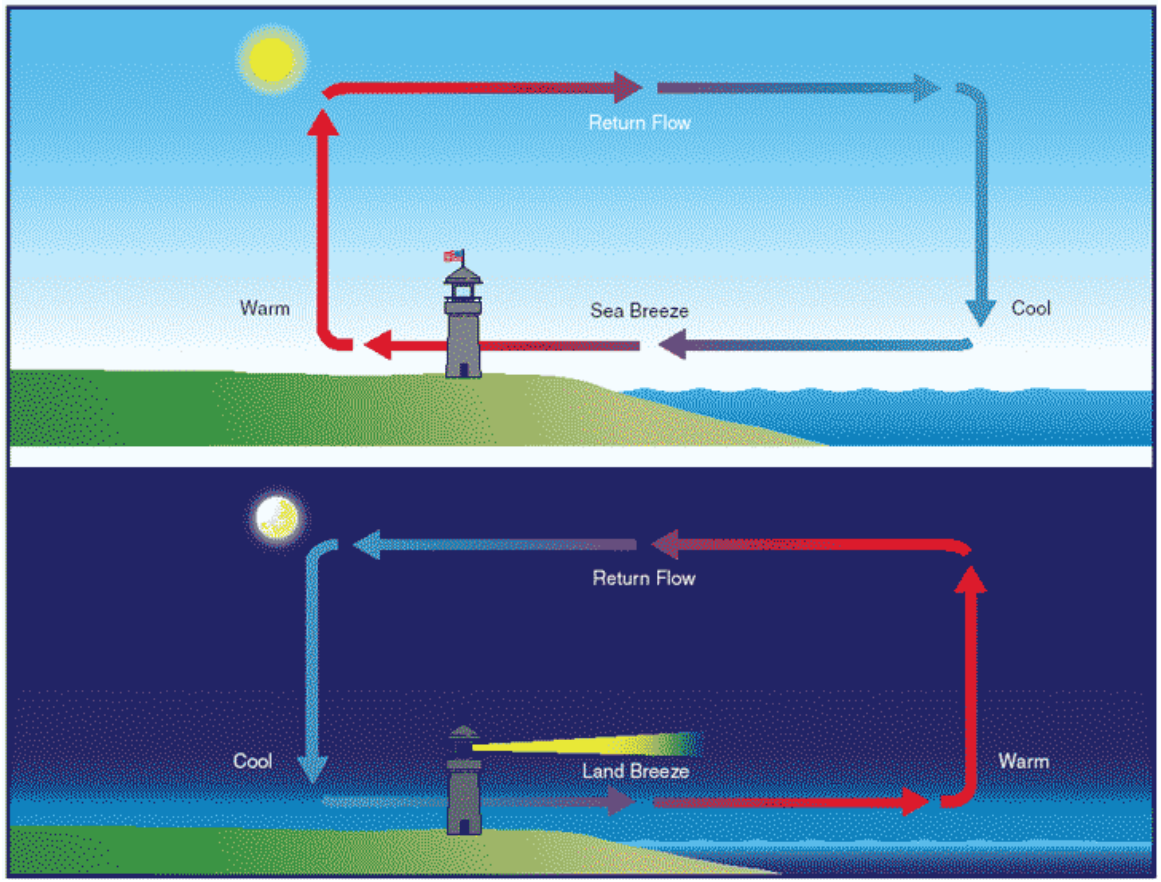
Wind (cont.)

- Air is Moving, Mixing and Exchanging it's Properties
  - We Call This Process Different Things Depending On Vertical Air Motion



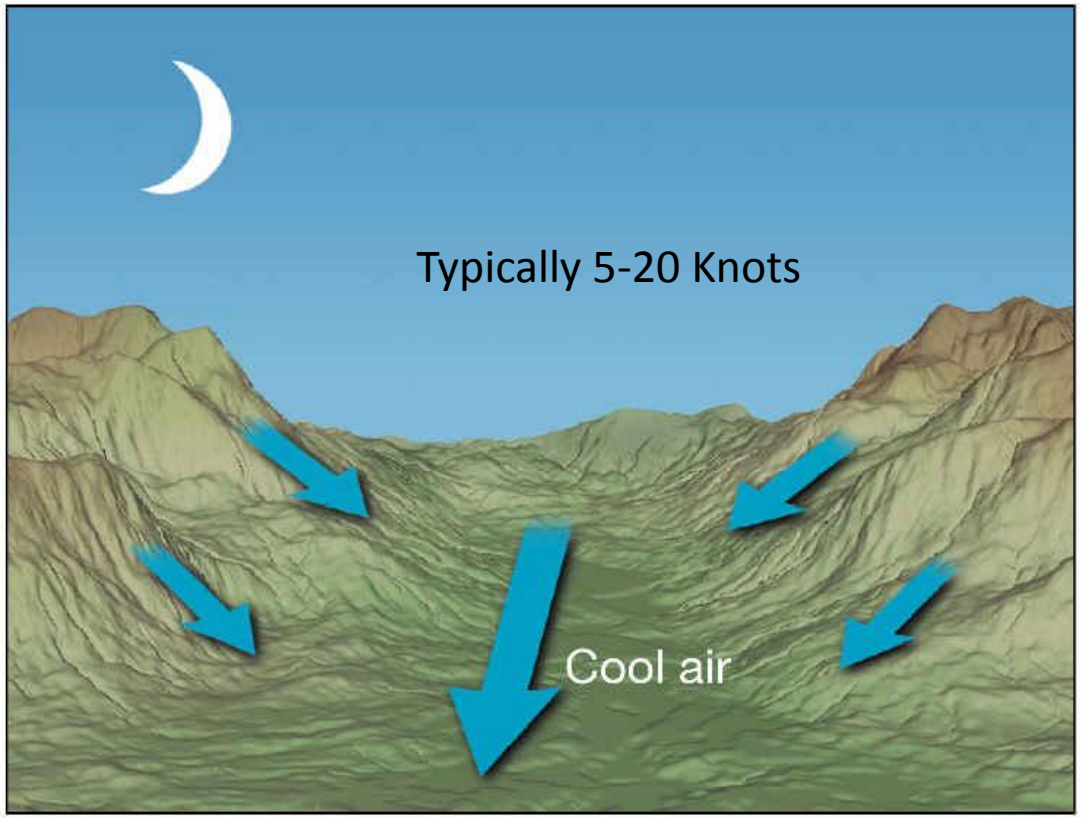
Breezes and Downslopes

- Sea Breeze/Night Breeze



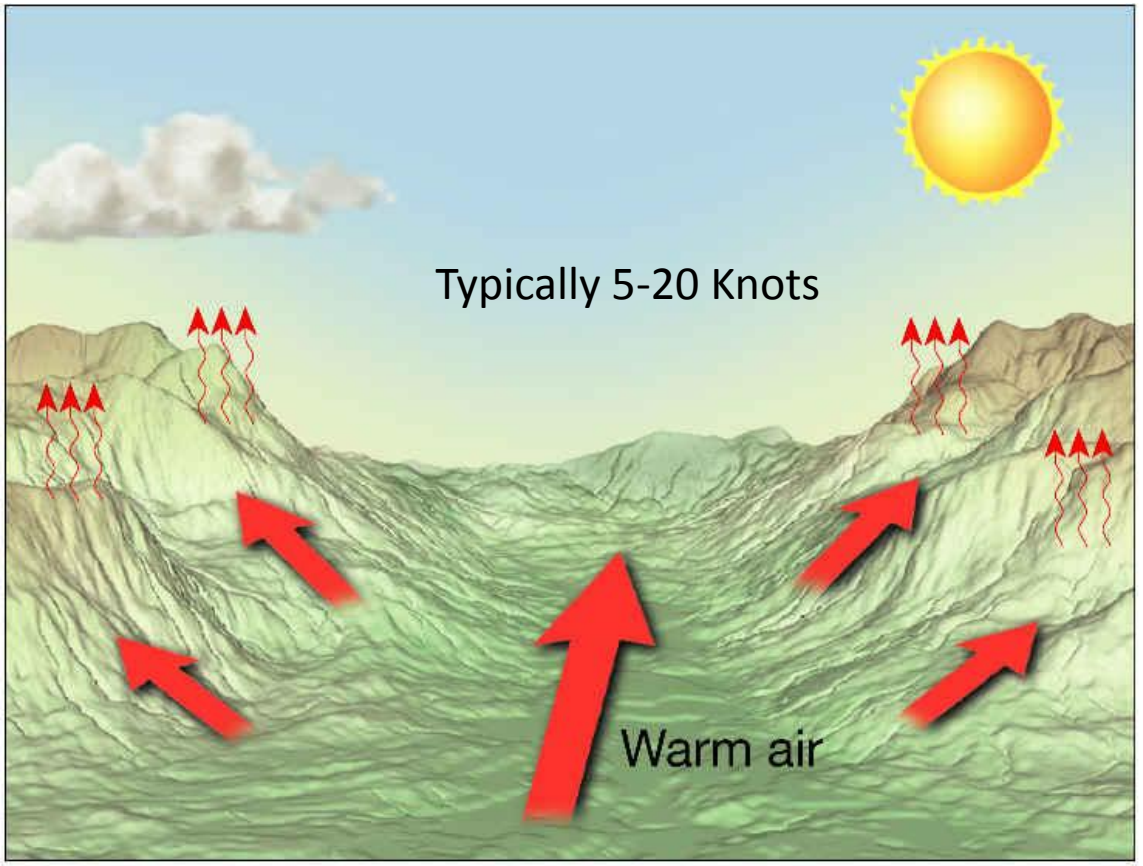
Breezes and Downslopes (cont.)

- Mountain Breeze
  - At Night Upper Air Cools Faster Than Lower



Breezes and Downslopes (cont.)

- Valley Breeze – Lower Air Warmer Causing Upslope

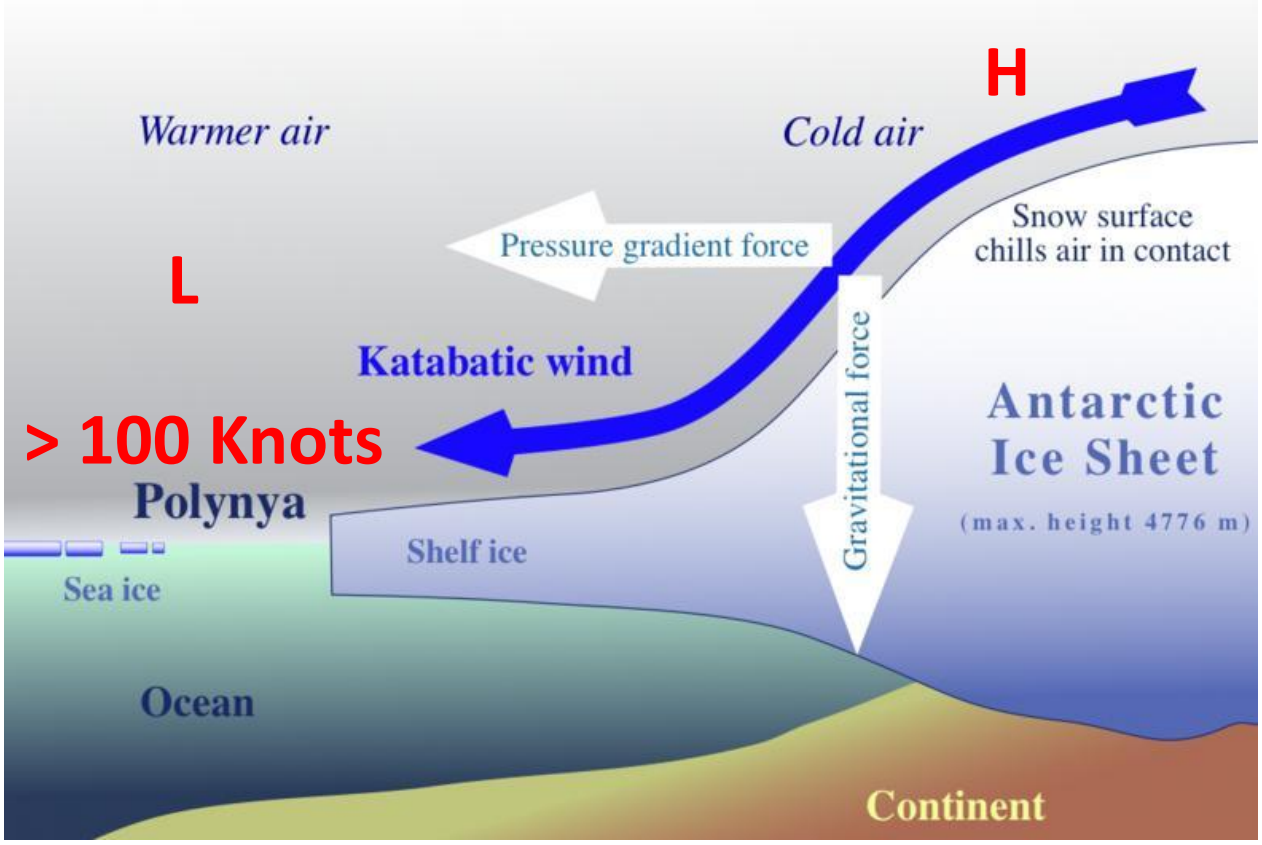


Downslope Winds

- Stronger Than a Breeze – Very Dangerous to Aviators – Some up to 100 Knots
- Called Katabatic, Bora, Chinook, and Santa Ana
- Two Types – Cold and Warm

Downslopes (cont.)

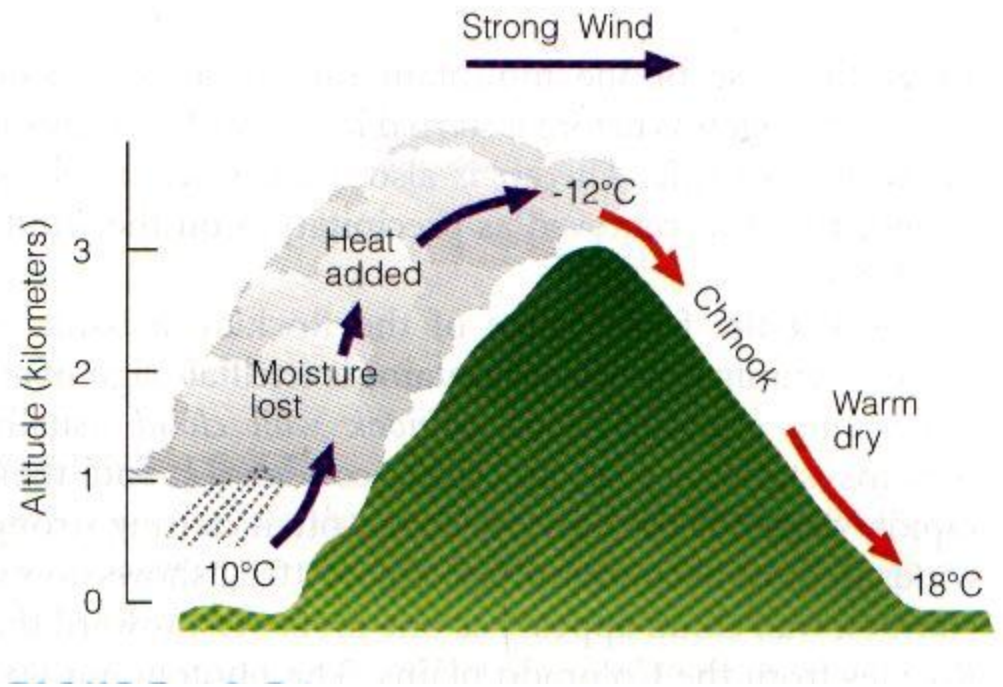
- Cold Downslope – Most Dangerous



Downslopes (cont.)

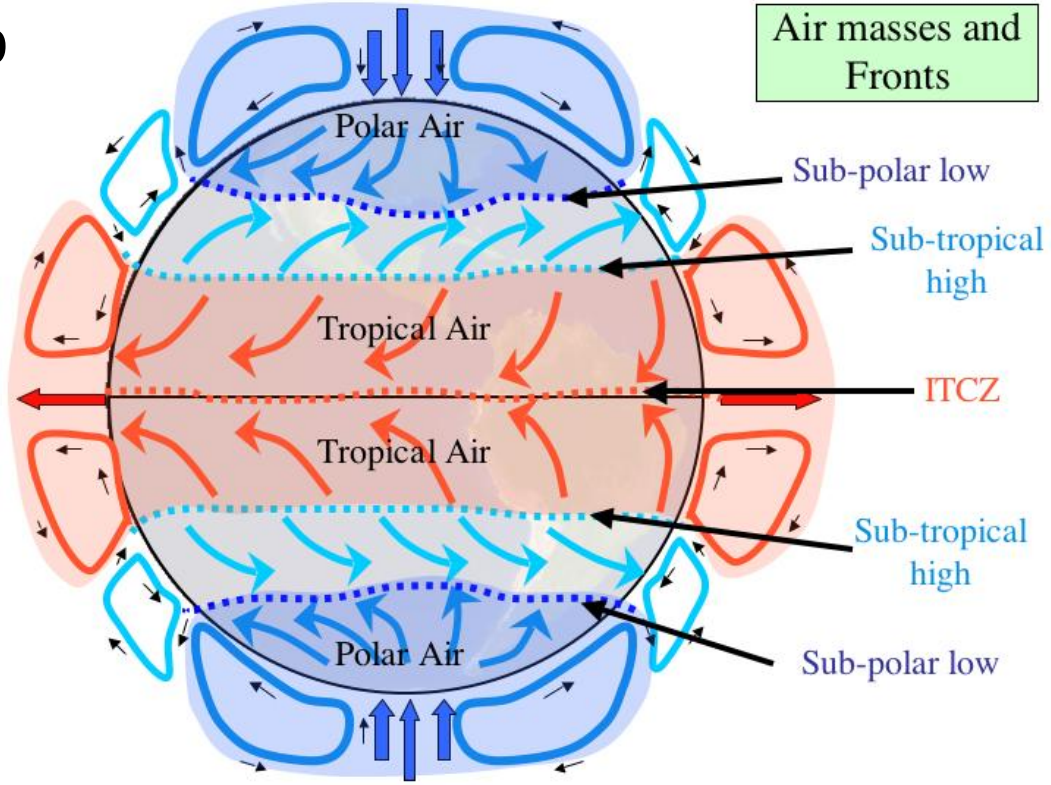
- Warm Downslope – e.g., Chinook East of Rockies
- Very Dangerous

Typically Up to 50 Knots
Can Approach 100 Knots



Our Thought Process About WX

- Large Models Help



- But As Pilots We Are More Impacted On a Smaller Scale

Looking Ahead

- Fronts and Associated WX
- Convective Systems
- Types of Phenomena
  - E.g., Fog, Icing, etc.
- Turbulence
- Reading a METAR/TAF
- Obtaining a DUATS Account
- Getting METARS and TAFs