

Mid-Latitude Storms



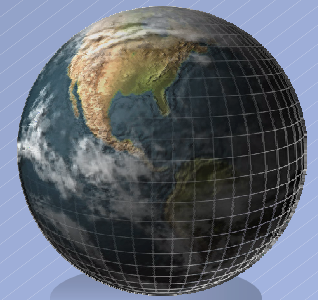
Nature's Giant
Eggbeaters

SFSU Workshop 11/2/02

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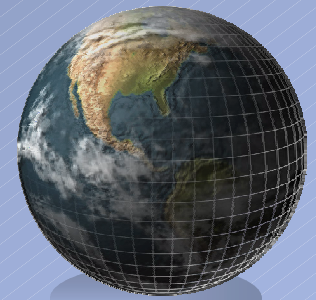
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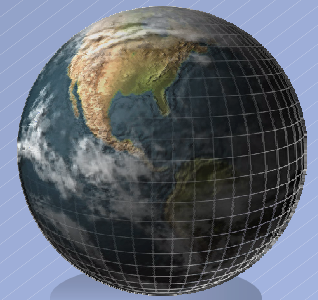
Agenda - November 2, 2002

1. Energy imbalances between tropics (low latitudes) and polar regions (high latitudes) - winter and summer
2. Hot and getting hotter, cold and getting colder...
3. Something needs to happen to mix the hot and cold air (to even out imbalances)
4. Mid-latitude storms come to the rescue
5. All about mid-latitude storms - not quite...
6. Good place to get fog pictures

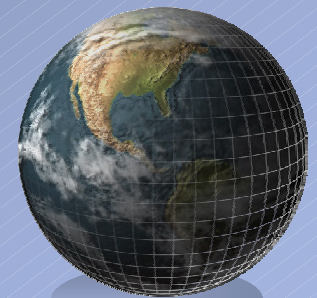
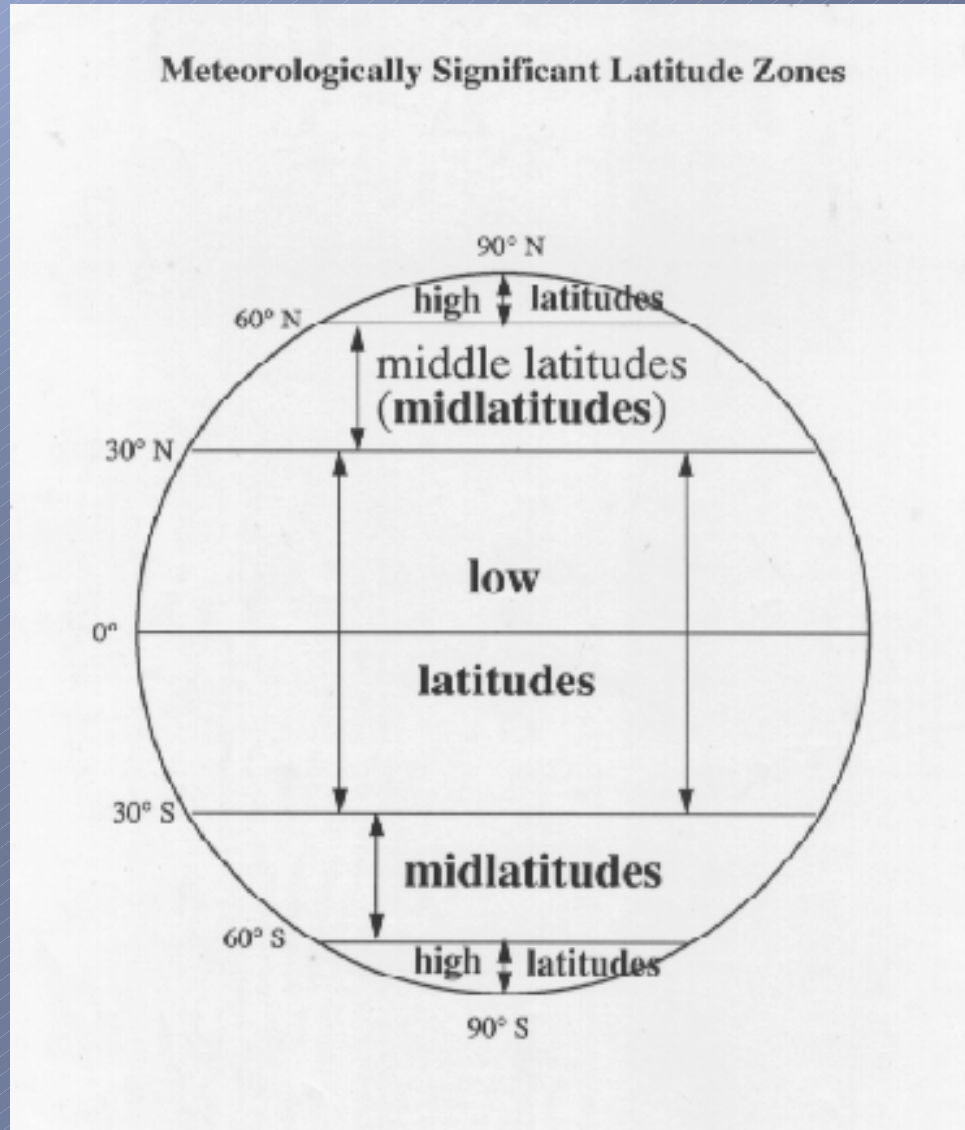


Warming up the earth

- Solar energy received depends **on the angle** at which sunbeams arrive
- Flashlight analogy

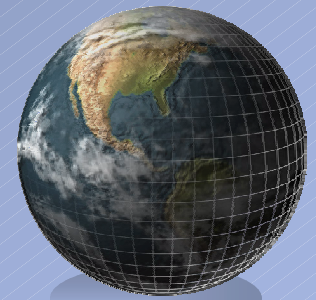


High and low latitudes



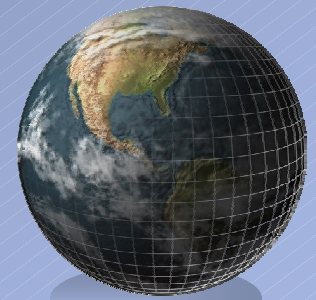
Angle at which sunbeams arrive

- The angle depends on the time of year, time of day and your location (latitude)
- Let's compare what happens at a **high latitude** location (Alaska) and a **low latitude** location (Mexico) during **summer** and **winter**



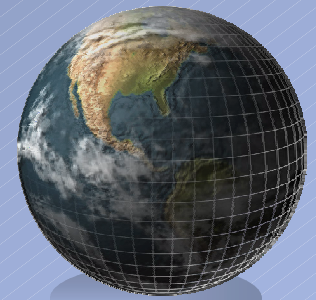
Figuring out how much solar energy different places get

1. Go to <http://virga.sfsu.edu/javascripts/wx>
2. Visit “Earth-Sun Geometry” module/
3. Select Latitude for Alaska (60 N) and for Mexico (20 N)
4. Let it run for a year. How do the angles of the two sunbeams compare in summer? Winter? When is the **difference** between the two sunbeams the greatest?



What happens to the air temperature as a result?

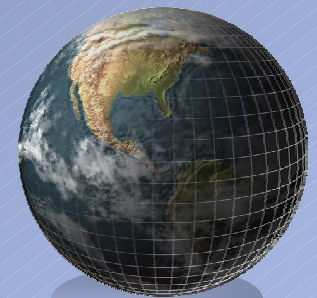
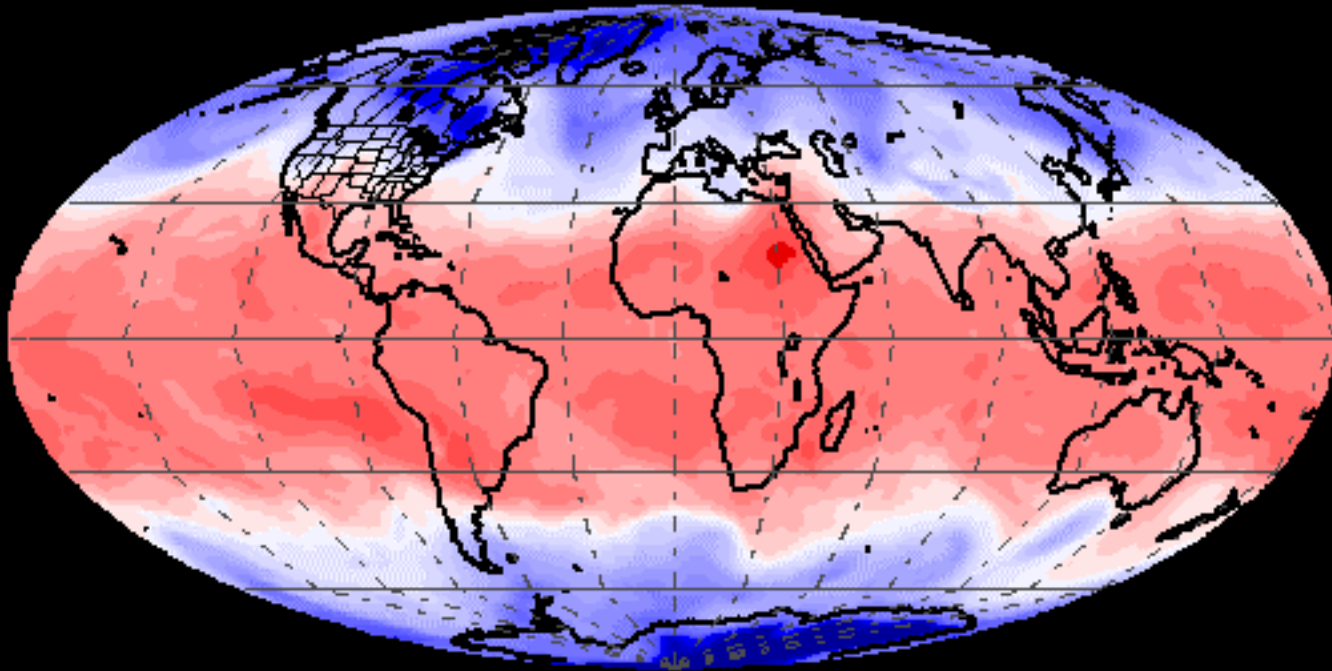
- Visit http://virga.sfsu.edu/scripts/temp_700_mw_archloop.html
- Look at areas that have **cold** air (**blue**) and **warm** air (**red**)
- Notice where the (white) boundary between the cold and warm air is
- The boundary is “wavy” and it moves!
- **Mid-latitude storms form at that “wavy” boundary**



Snapshot of temperature differences between latitudes

Temperature (C) at 700 mb

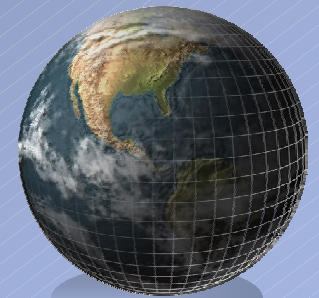
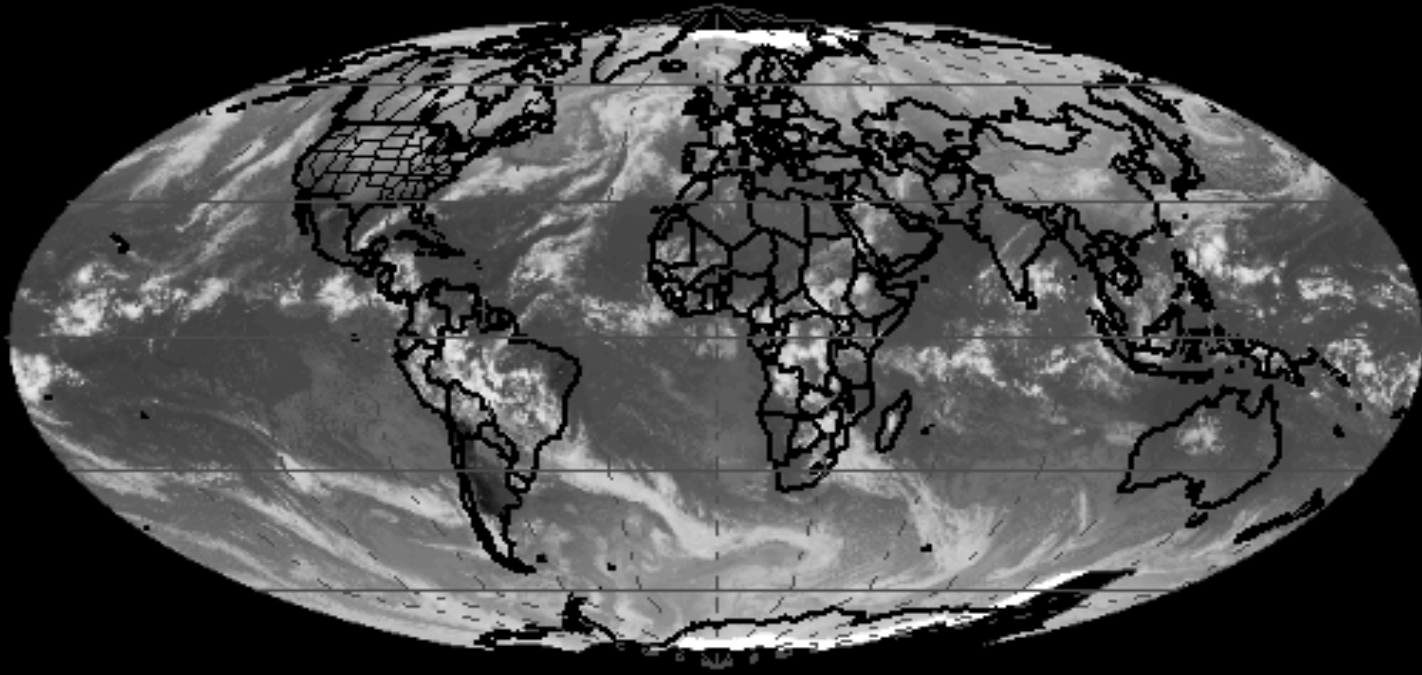
AVN analysis for 00Z 11 MAR 2002



What do mid-latitude storms look like from space?

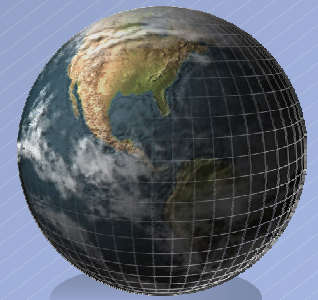
Mollweide Composite IR Image

18Z 30 OCT 2002



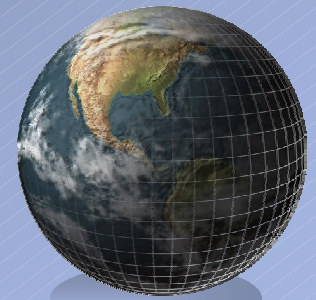
Identifying mid-latitude storms

- They occur in the mid-latitudes
- Their clouds are arranged in a “comma” shape in the northern hemisphere
- Their clouds are arranged in an “upside down comma shape” in the Southern Hemisphere



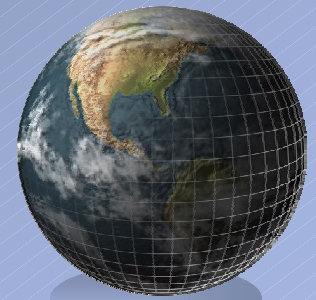
Mid-latitude storms in motion

- To see the **temperature differences** between high and low latitudes in motion go to:
http://virga.sfsu.edu/scripts/temp_700_mw_archloop.html
- To see the **storms** that develop as a result of these differences go to:
http://virga.sfsu.edu/scripts/mwir_archloop.html



What do mid-latitude storms do?

- They mix cold air from the high latitudes with warm air from the low latitudes (giant eggbeaters!)
- They produce a lot of clouds and rain as a result
- They produce almost all the rain we get in San Francisco during the winter

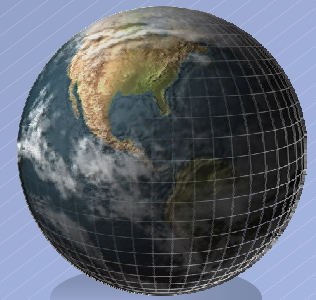


When a lot of mid-latitude storms visit San Francisco

- Movie of February 1998 - a very wet month (during the last El Niño period)

Visit:

<http://virga.sfsu.edu/sfrocks/precip/images/feb1998.mov>



Finally...fog pictures

- Best place to see what parts of California have fog.
- Daytime pictures only
- <http://www.wrh.noaa.gov/satellite/1km/Monterey/VIS1MTR.GIF>

