Remote Sensing Observations
AOSC 200
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Class Web Site: http://www.atmos.umd.edu/~tcanty/aosc200

Topics for today:

• Maps
• Radar
• Satellite Observations

Lecture 04
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Temperature Maps

Temperature maps are often colored based on how warm (red) or cold (blue) the surface temperatures are.
The black lines indicate “isotherms” or lines of constant temperature. These maps help us identify the air masses that are controlling surface conditions and the temperature frontal boundaries between them.

A cold front is a region where cold air is replacing warm air. It’s indicated by a blue line with blue triangles pointing in the direction the air mass is moving.
A warm front is a region where warm air is replacing cold air. It’s indicated by a red line with red half circles pointing in the direction the air mass is moving.

The black lines indicate “isobars” or lines of constant pressure. These maps help us identify regions of high pressure (“H”) and low pressure (“L”). They also give some indication of surface wind speed and direction. The numbers are the actual pressure (no conversion needed).
Generally, isobars are plotted at 4 hPa intervals. If it helps, consider this like a map of surface height and you’ll get an idea of where air is flowing too and how fast it’s moving.

Closed contours define regions of high pressure and low pressure.
Isobars that aren’t closed can still help us define regions of increasing ("ridges") and decreasing ("troughs") pressure.

**Fig 2-6 Weather: A Concise Introduction**

We can combine the different ways of looking at surface data to create what you may recognize as a modern weather map.

**Fig 2-2 Weather: A Concise Introduction**
We can combine the different ways of looking at surface data to create what you may recognize as a modern weather map.

**Figure 2-2 Weather: A Concise Introduction**

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**Upper Level Maps**

We can look at pressure maps at a some particular altitude but the mathematics becomes very complicated 😞

Instead, we look at altitude of a specific pressure level. The figures to the right show the height (in meters) of the 850 hPa surface.

**Figure 2-8 Weather: A Concise Introduction**

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The station model provides slightly different information than at the surface. The height of the pressure surface is in the position where pressure used to be. Maps of this information are called “isobaric” maps.

We can combine the different ways of looking at surface data to create what you may recognize as a modern weather map.
The color contours represent wind speed (in knots). Notice that the fastest winds in the central US are almost above the position of the surface low pressure. Here the black lines are in “decameters”.

Sometimes this information is plotted as the 1000-500 hPa thickness.
Mean Sea Level Pressure

Pressure and altitude are connected: pressure decreases with height

The air pressure at the top of a mountain is lower than at the beach.

If you didn’t account for this then your forecasts would assume there’s always a low pressure system over the mountains.

You need to correct for this by determining what the pressure on the top of the mountain would be if you brought it to sea level (~10mbar for every 100m).

RADAR: RAdio Detection and Ranging

RADAR measures the time it takes for the signal to return
Doppler RADAR measures changes in the return signal

RADAR Coverage: United States
**Geostationary satellites**: Orbits the Earth at the same angular speed as the Earth. They are “parked” in orbit over Earth and stay over the same location.

Provide a lot of information at all times but only at one location and have difficulty seeing the polar regions...

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**Polar orbiting satellites**: Travel over the poles. Orbits wrap around the Earth. Need to travel quickly to provide cover the globe. Can be very high resolution because they orbit closer to the surface than geostationary satellites

Problems: Data gaps in time and space.
Satellite Imagery: Visible

On the day side, sunlight is reflected off Earth’s surface...

...but there is no sunlight and no reflection on the night side.

What’s the main limitation of the visible image? You need light to see anything!
Satellite Imagery: Infrared (heat)

This is a “false color” image. The lighter the color, the colder the temperature. What does this tell us about clouds? Can you think of a limitation of the infrared image?
This is a “false color” image. Water vapor absorbs and emits energy. You can tune an instrument to only “see” the wavelengths where water vapor absorbs and emits energy.
Satellites: NOAA GOES16

Satellites: OMI Ozone

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