

AOSC201: Weather and Climate Lab

Week 7: Forecasting - Analysis

Section 103/105

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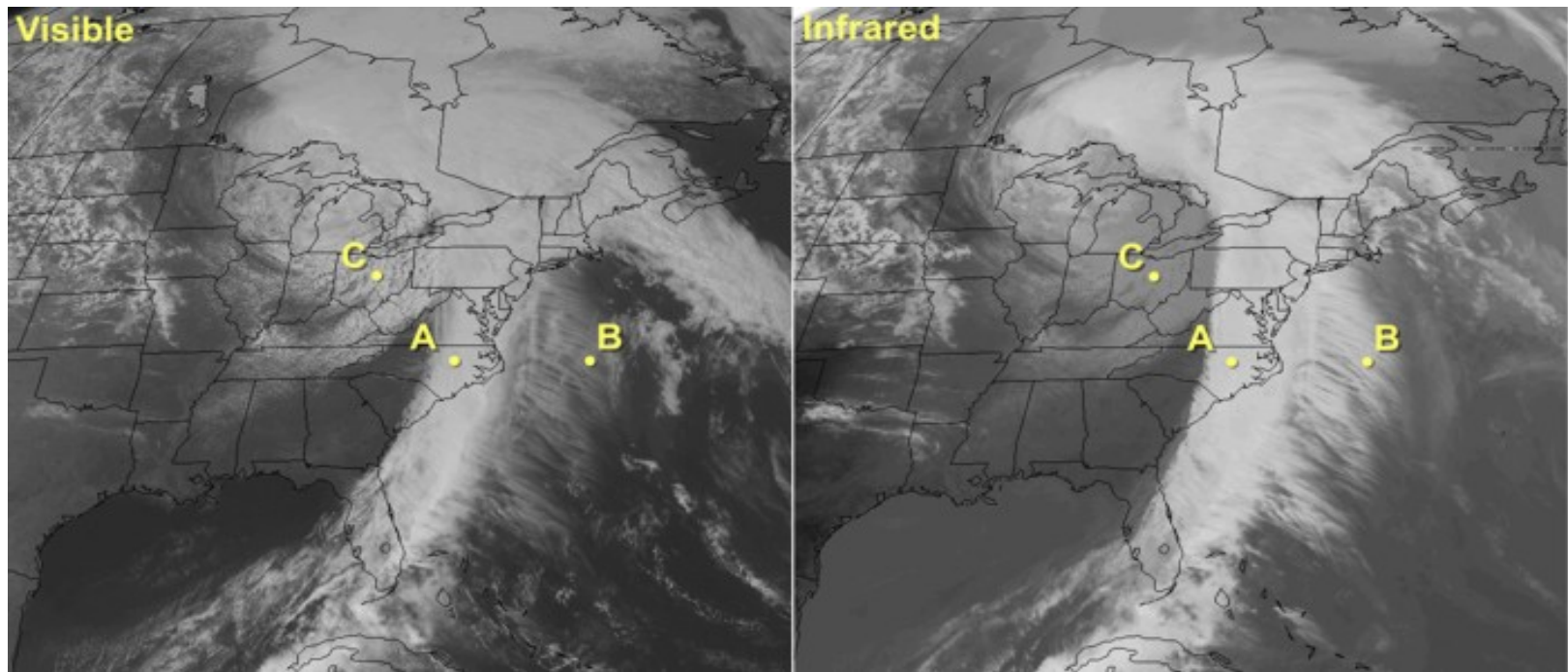


DEPARTMENT OF
ATMOSPHERIC &
OCEANIC SCIENCE

Week 7 Lab: *Forecasting - Analysis*

- ❑ Lab #7 of Lab Manual (pages 41-49)
- ❑ 50 points in total
- ❑ INDIVIDUAL Work for the entire lab

Satellite Imagery: Visible and IR



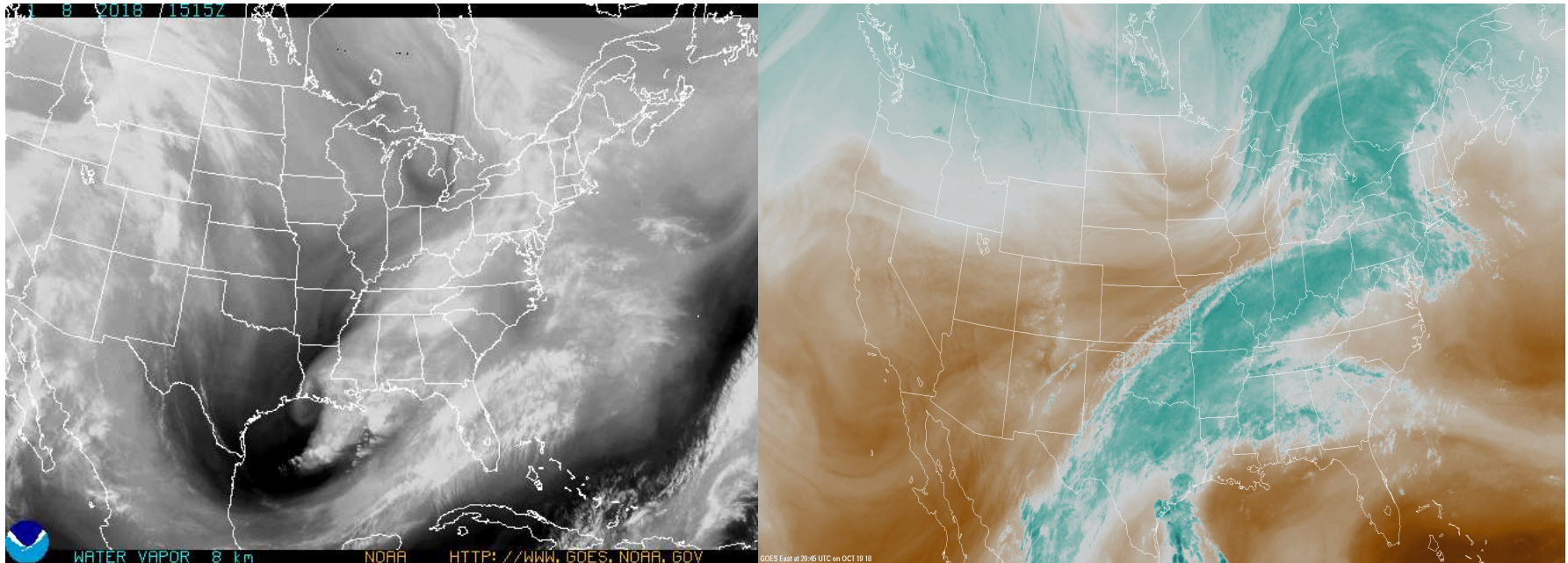
Visible imagery (reflected solar radiation) distinguishes between thick and thin clouds, while infrared imagery (emitted thermal energy) distinguishes between high and low clouds.

Location A: bright on both visible and IR imagery → what is the weather at A ?

Location B: not as bright on visible, bright on IR imagery → ?

Location C: somewhat bright on visible and not bright on IR imagery → ?

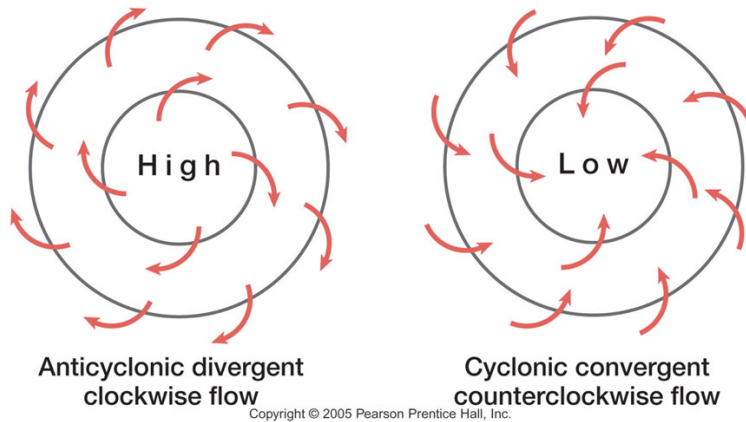
Satellite Imagery: Water Vapor



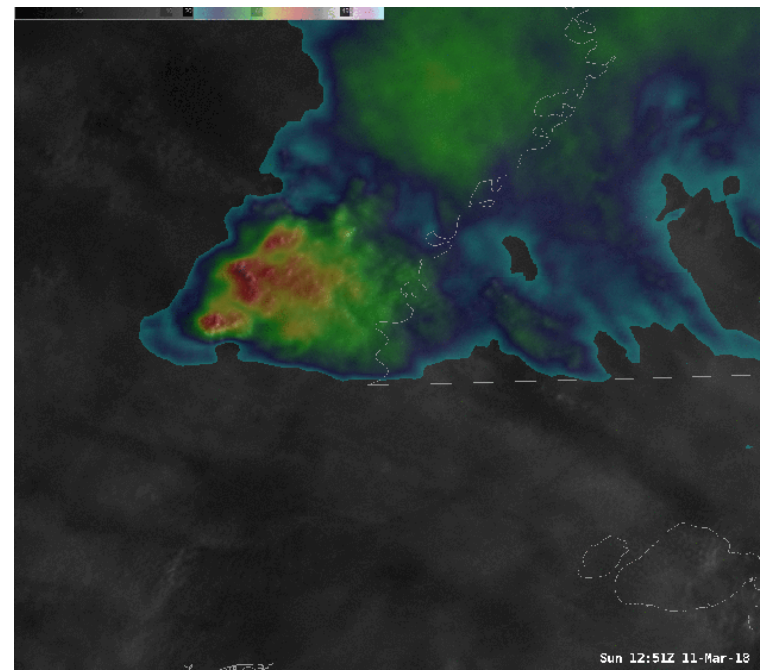
- Looks at radiation emitted by water vapor and shows how much water vapor is present in the middle and upper levels of the troposphere
- Can use to see where there are cyclones, anticyclones, and frontal systems
- Whiter colors mean more water vapor is present (interpreted as high absorption by water vapor, or colder temperatures); in false color image (right) the moist areas are seen in blue

Satellite Imagery

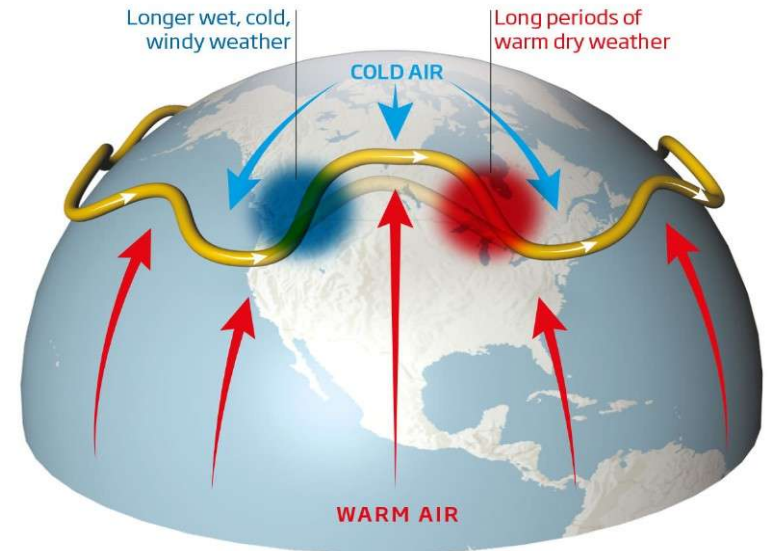
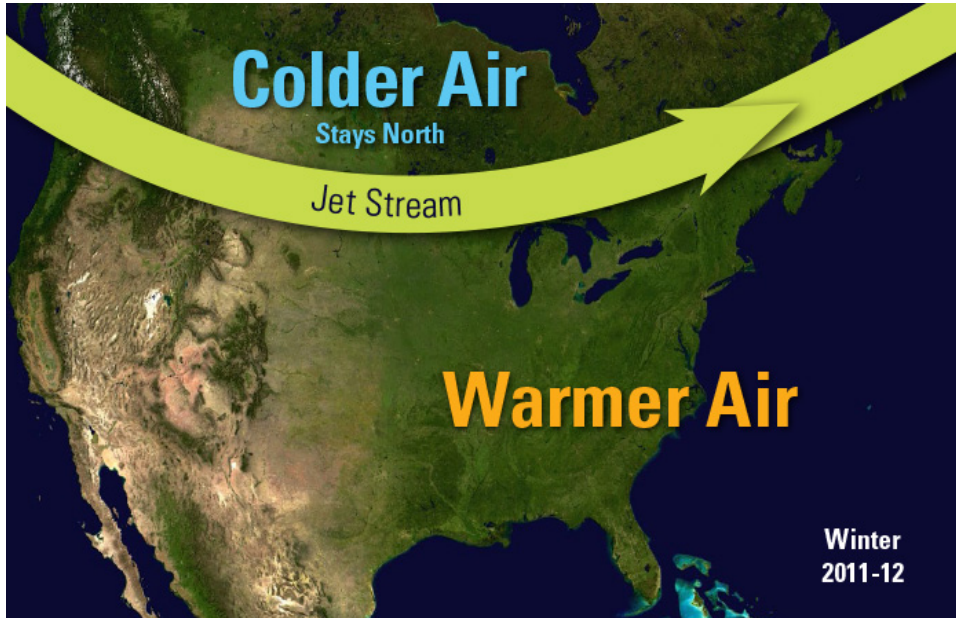
- We can use this imagery to find upper level cyclones, air mass boundaries (fronts), and convection
- Cyclones/anticyclones:



Convection: warm, moist air is buoyant and rising → good indicator of thunderstorms



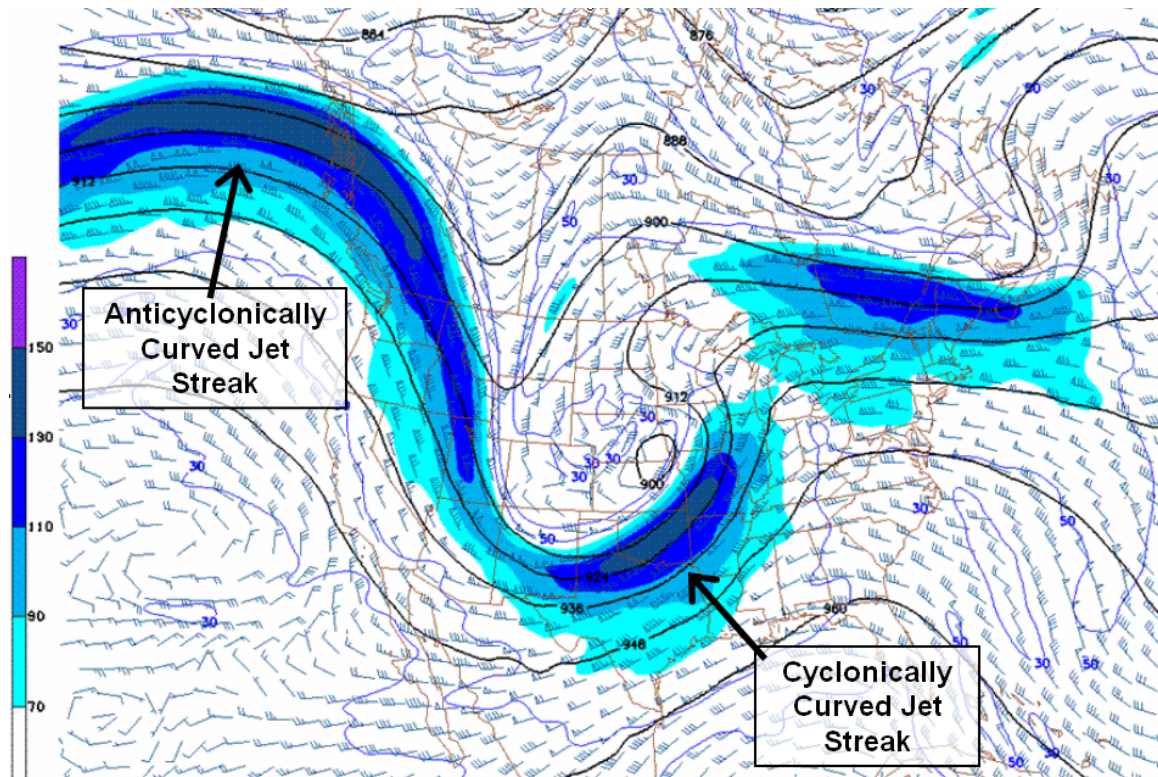
Jet Stream



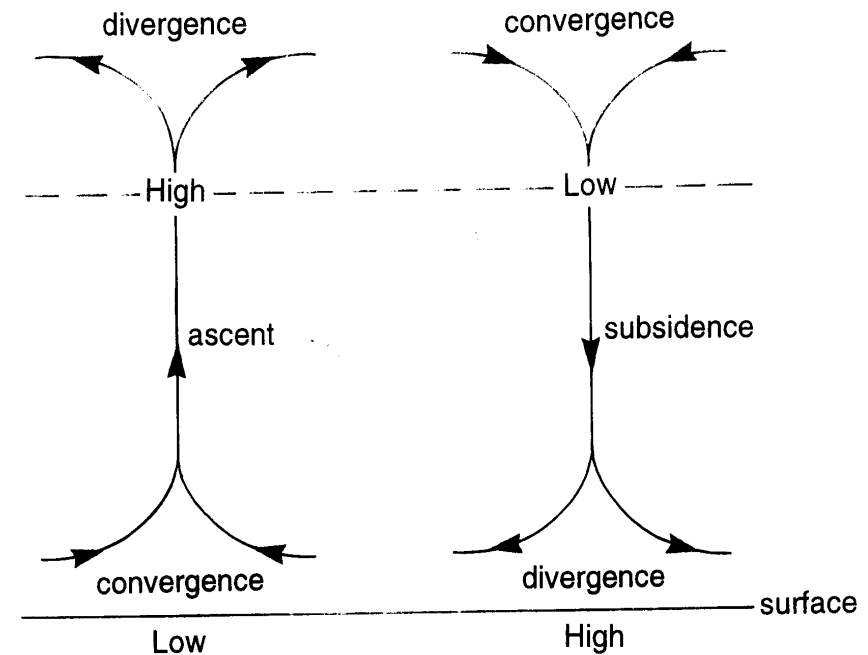
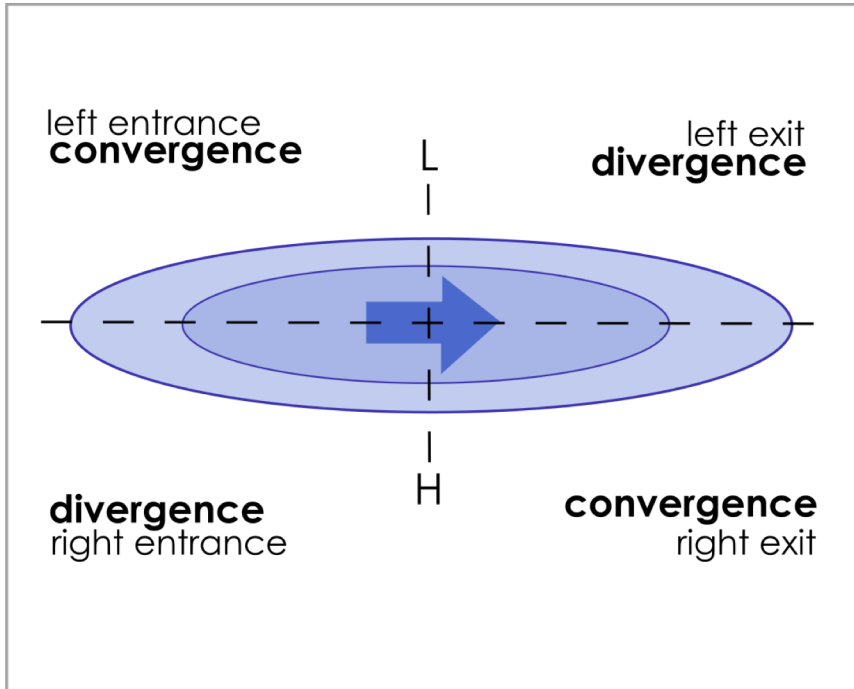
- **Jet streams** are relatively narrow bands of strong wind in the upper levels of the atmosphere. The winds blow from west to east in jet streams **but the flow often shifts to the north and south**.
- Jet streams follow the **boundaries between hot and cold air**. Since these hot and cold air boundaries are most pronounced in winter, jet streams are the strongest for both the northern and southern hemisphere winters.

Jet Streaks

- Localized areas (within the jet stream) of fast moving winds
- Play a major role in the weather we experience at the surface



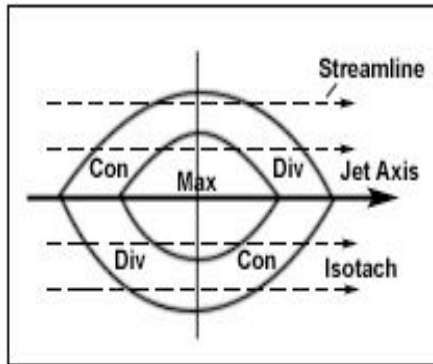
Jet Streaks and Vertical Motion



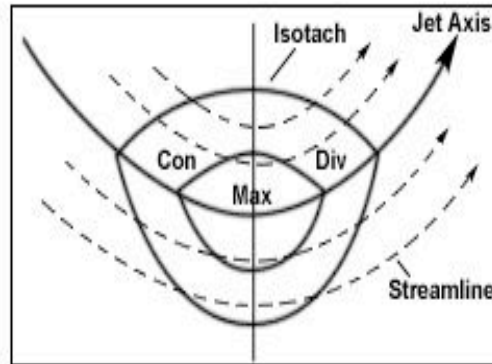
- Jet streaks have four quadrants: left exit (front left), right exit (front right), left entrance (rear left), and right entrance (rear right)
- Vertical motion happens in → right entrance and left exit

Curved Jet Streaks

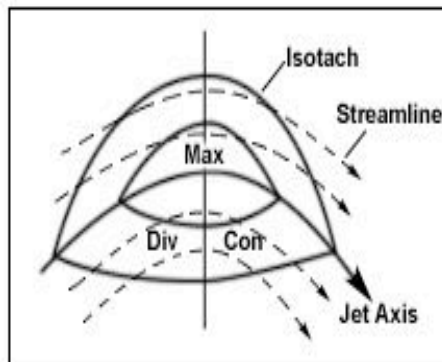
Effect of Curvature on Jet Dynamics



Straight-Line Jet Streak



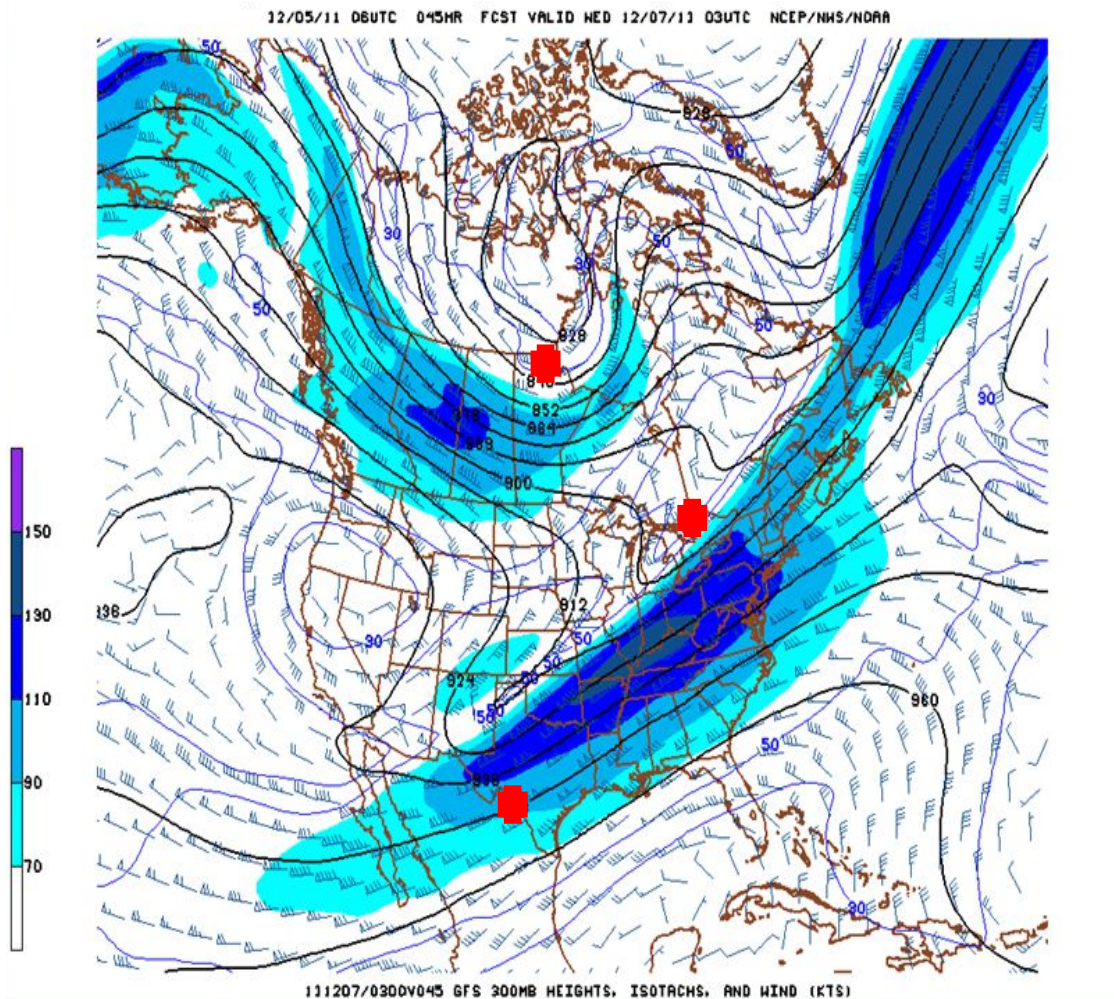
Cyclonically Curved Jet Streak



Anticyclonically Curved Jet Streak

- Quadrants on the inside of a curved jet have enhanced effects
- Quadrants outside of a curved jet have a much smaller effect

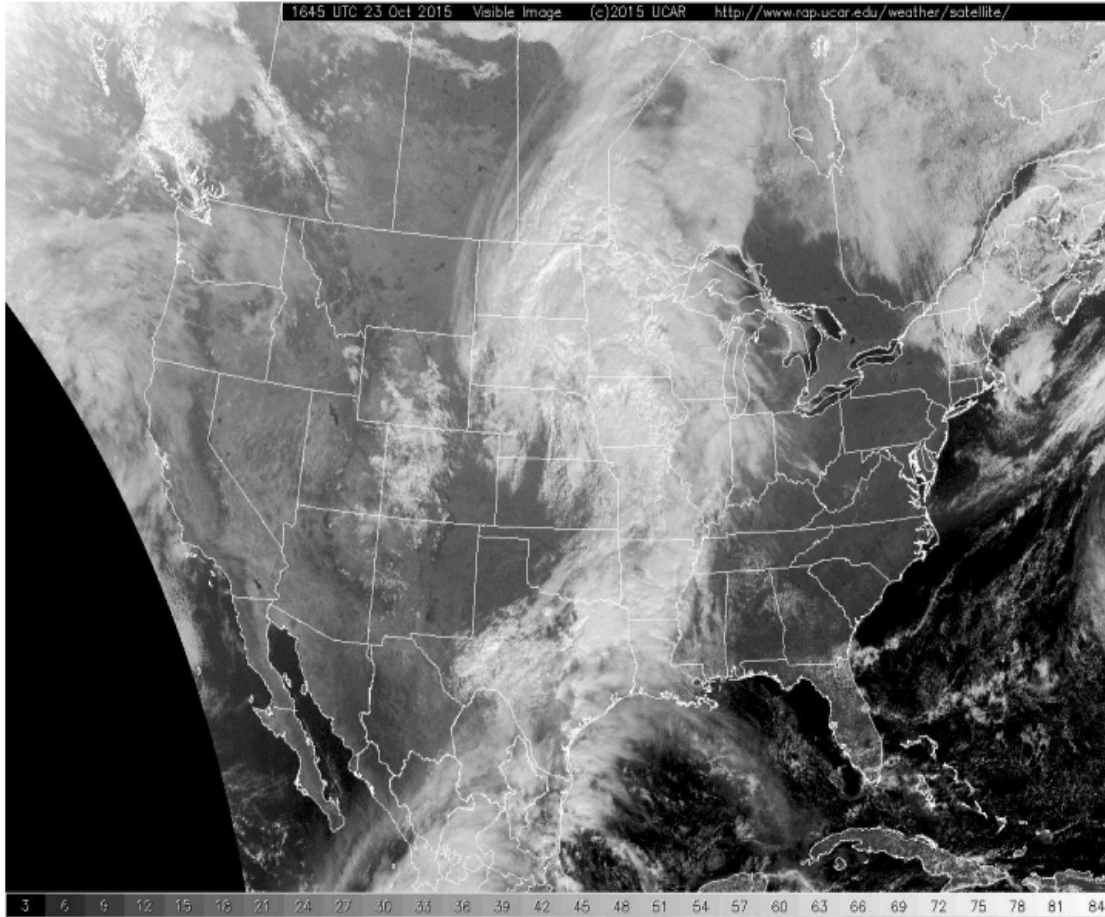
Week 7 Lab: Forecasting - Analysis



- Vertical motion in southern Texas, area around Great Lakes, north of Washington state, and central Canada
- Enhanced vertical motion in central Canada due to curvature of the jet streak (cyclonic curvature)

Week 7 Lab: Forecasting - Analysis

Question 1 (3 points each) Directions:



Correction: Use the Visible Image provided here (to the left) rather than the current loop from the websites listed in the manual.

For the questions, be specific and tell me the STATES where there are thick clouds, where it is nice and clear, and the situation over our area (i.e. Maryland).

Week 7 Lab: Forecasting - Analysis

Question 2 – 6 Directions:

- For questions 2, 3, 4, 5, and 6 you should be going to the NCAR website below and following the directions to get real-time data.

NCAR: <http://weather.rap.ucar.edu/satellite/>

Follow the directions below once you get to the site:

- 1) Choose your **satellite type (visible, IR, water vapor)**.
- 2) Choose your **loop duration in the dropdown to 12 hours** (if you want a single image then just click single image).
- 3) Change the button located above the map to “large size” or “small size”.
- 4) Click on “**contiguous US**” on the map.

Question 2 Directions (4 points):

Use the NCAR website above to get 12 hour loops. What is the major downside looking at visible light compared to IR/WV imagery at different times?

Week 7 Lab: Forecasting - Analysis

Question 3 Directions (3 points):

Using the NCAR website imagery, try to figure out which type of imagery (visible or IR or WV) lets you see all fine little details of the clouds.

Question 4 Directions (4 points):

Use the NCAR website. Hints: Remember what a thunderstorm is: convection. What drives convection? What kind of timescale does convection happen over?

Question 5 Directions (3 points):

- You are running a [12 hour loop of the water vapor imagery](#) on the NCAR website.
- Make sure you are telling me where there is A LOT OF moisture, not just moisture in general.
- Tell me this in terms of general [regions/states](#) (i.e., around the west coast, Southwest, near Mexico, etc.).
- The question reads funny, so just think of it as “where is there a lot of moisture?”

Week 7 Lab: *Forecasting - Analysis*

Question 6 Directions (6 points):

- Use the same loop on the NCAR website as in question 5.
- Try to find each of the three features described in question 6 and give me a **geographic location**.
- Some features may not be present.

Question 7 (2 points)

SKIP Questions 8 and 9

Week 7 Lab: Forecasting - Analysis

Question 10 Directions (8 points):

Correction: Use the Infrared Image and the Visible Image provided on my website (and not what is stated in the manual).

Tell me what *types of clouds* you see in:

- 1) southeastern Texas, and,
 - 2) off the southeastern coast of Texas in the Gulf of Mexico.
- Remember to identify **cloud type** and what **type of precipitation** could be associated with them.
 - Don't choose your own locations.

Week 7 Lab: *Forecasting - Analysis*

Question 11 (2 points) and Question 12 (3 points) Directions:

- Use the handout that has been provided for answering these questions.
- Mention the **maximum wind speed**, and the **minimum wind speed** for Question 11.
- **Draw a line on the map to label where the jet stream is** for Question 12. Note:
sometimes both the polar and the subtropical jet streams will be visible.

Week 7 Lab: Forecasting - Analysis

Question 13 (4 points) Directions:

- Use the **Jet Stream map**, and try to correlate it with the **Surface Temperature figure** (both from my website) in order to figure out where the division of warm and cold air masses is.
- Indicate where the division between air masses is on your printed map by writing either a **C (for colder than normal)** or **H (for warmer than normal)** in the following places:
1) Kansas 2) West Virginia.
- As the jet stream moves, warm or cold air is transported and so the location of the troughs and ridges determine which places are warmer than normal or colder than normal.

Question 14 (3 points)

Week 7 Lab: *Forecasting - Analysis*

Question 15 (5 points) Directions:

- For this question, label the individual jet streak axes on Figure 5, and mark with solid circles (for e.g. red colored circles) the areas of upward vertical motion on it.
- Also, use abbreviations such as FL (front left), FR (front right), RL (rear left), RR (rear right) to better understand the case.

SKIP Questions 16 and 17

*Thank
you*

A close-up of a golden fountain pen nib, positioned as if it has just finished writing the word 'you'.

Questions ?