
*****There is a newer version of this for use in 2012*****

Objectives:
-Become familiar with using a software package (IDV) to view satellite images
-Understand the differences between Visible, IR, and Microwave Imagery
-Observe the influence of dry air and wind shear on TC development

Background:
Researchers use many different software tools to analyze data and images. Integrated Data Viewer (IDV) is a meteorological software package created to allow for easy viewing of satellite, observation, and model data. In this lab, we will use IDV to compare visible, IR, and Water Vapor Satellite Images on a few recent Tropical Cyclones.

Note:
IDV is known to have problems with memory. Make sure to delete your previous image before making a new one. If the program becomes lethargic, try closing and reopening. The satellite loops are especially large. Loops with too many images may cause the program to crash.

Part 1: Learning IDV

The best way to learn is to reference the User's Guide:
http://www.unidata.ucar.edu/software/metapps/docs/userguide/userguide.pdf

Specifically, this lab will reference the following sections.
2.0-2.1: Getting Started and creating an animation loop of Satellite Imagery
-Do not need to go step by step, just use as a reference for navigating IDV
2.4: Surface Observations—METAR and Synoptic Plots
3.0: Dashboard
3.4: Choosing Satellite Imagery
5.2: Image Control (only the Satellite part)
5.4: Data Probe/Time Series
5.7.4: Drawing Control
6.2: Color Table Editor
6.9: Image and Movie Capture

Navigating the Map Viewer:

Option 1: Use the control panel on the left side to pan and zoom

Option 2:
Pan left/right: **Ctrl + Mouse Wheel**
Pan up/down: **Shift + Mouse Wheel**
Pan freely: **Ctrl + Hold/Drag Right Mouse Button**
Create box to zoom in: **Shift + Hold/Drag Left Mouse Button to create box**

Zoom in/out freely: **Mouse Wheel**

Part 2: Look at Imagery
Tropical Wave in the Atlantic Basin:

1. Load the data from the "Data Choosers" Tab
    -Select "Images" under "Sat & Radar" on the left menu
    -Server: adde.ucar.edu
    -Dataset: RTIMAGES
    -Image Type:
        -For visible, choose GOES-East 0.65 µm Visible
        -For IR, choose GOES-East 10.7 µm IR
        -For Water Vapor, choose GOES-East 6.5 µm WV
    -Choose the timeframe you want to see
    -Data Type:
        -Visible: Brightness
        -IR: Temperature
        -WV: Temperature
    -Check the "Create Display" Box
    -Click "Add Source"

2. Using the "Field Selector" tab on the Dashboard, select GOES-East 0.65 um Visible and make a loop by selecting about 10 images from today or yesterday. Note: satellite loops with too many images are prone to crash due to memory overload. Practice doing the same for IR and Water Vapor. Make appropriate color tables for the IR and WV imagery.
    -Note: delete old loops from the Legend by clicking the trash can before making new loops

3. Add surface observations to your satellite images/loops:
    -Data choosers tab
    -Select "Point" from the left menu
    -Server: adde.ucar.edu
    -Data type (add all three kinds one by one):
        -Surface (METAR) Data
        -Synoptic Data
        -Ship/Buoy data
    -Choose timeframe and click "Add Source"

Use the handout to learn how to read surface observations (if you do not know already). Pay attention to the surface pressure and wind speed/direction.

Questions to consider:
-For all questions, capture and save any images that helped you explain the answers.
(a) Observe the general flow of clouds in each satellite image. Which direction are the clouds moving in the tropics compared to the mid-latitudes? Are the lower clouds moving the same direction as the high

clouds? What about the upper-atmosphere water vapor? Do the clouds move the same direction as the wind barbs on the surface observations?
(Note: Regions where the upper level clouds are moving a different speed/direction than the lower level clouds indicates a high amount of wind shear, which is unfavorable for TC development)

(b) Compare the visible and the IR image. Notice that it is easier to see low clouds on the visible image compared with the IR. Why do you think it is difficult to see low clouds in the IR?

(c) What is the swirl in the clouds to the east of the Leeward Islands on the visible imagery? Is it rotating cyclonically or anticyclonically? Pick a time where the swirl is more readily visible and use the drawing tool to mark its center of circulation.
Hint: you may need the higher resolution 1 km visible loop to see it in more detail:
http://www.ssd.noaa.gov/goes/east/tatl/flash-vis.html

(d) Look for deep convection or cold cloud tops around the swirl using the IR imagery. Create a Data Probe of your IR loop by going to the Field Selector and clicking the "Data Probe/Time Series" option in the upper right and then clicking "Create Display". The probe gives the measured IR Brightness Temperature (of the top of the clouds or the surface if there are no clouds).
-What is the coldest IR temperature that you can find near the swirl? How much colder is it than a region with no clouds?

(e) Look at the environment around the swirl using the Water Vapor imagery. Is the upper atmosphere wet or dry near the feature? Can you see any rotation in the IR image?

(f) Considering the satellite imagery, do you think this feature has any chance of developing into a tropical cyclone?

(g) Are there any ship or buoy observations nearby that could help your analysis? If so, is there a noticeable decrease in pressure? If there was a hurricane in this area, would surface observations be very helpful?

(h) Capture images of any other clouds or features that interest you.

Tropical Storm Emily and Hurricane Eugene:

1. Load the data from the "Data Choosers" Tab
    -Select "Images" under "Sat & Radar" on the left menu
    -Server: adde.ucar.edu
    -Dataset: GLOBAL
    -Image Type:
        -Global Thermal IR Composite
        -Global Water Vapor Composite
    -Timeframe: Use the "Absolute" to scroll back to August 3, around 12-1800 UTC.
    -Data Type:
        -Only "Brightness" is available for the global images, which is an inverted version of Brightness Temperature on a 0-255 color scale. The brighter colors correspond to colder cloud tops, but they do not have any quantitative physical meaning. The data probe will not work properly for this section.
    -Check the "Create Display" Box
    -Click "Add Source"

-Tropical Storm Emily (Atlantic) and Hurricane Eugene (Eastern Pacific) were both were active on August 3, 2011. Using the Global IR and Water Vapor Imagery, make loops of the imagery on 8/3.

Questions to consider:
-For all questions, capture and save any images that helped you explain the answers.
(a) Eugene is a well developed major hurricane and Emily is a weak tropical storm. Compare the structure of the two on the IR imagery.
-Where are the coldest cloud tops (brightest colors)? What is the shape of the coldest IR clouds in Eugene compared with Emily? (i.e. circle, oval, ring, blob, etc.)
-Are the cloud tops colder in Eugene or Emily, or are they about the same in both?
-Capture IR images of each.

(b) Look at the Water Vapor imagery at the same time (August 3 12-1800 UTC). The darker colors correspond to try upper level air, the lighter colors are moist upper level air.
-Is there any dry air located near Hurricane Eugene? Do you think dry air is affecting Eugene's intensity?
-How about Emily? Do you think dry air is affecting Emily's intensity?
-Capture IR images of each

(c) Make new IR and Water Vapor loops from August 4 1800Z to August 5 0000 Z.
-Has Eugene gotten larger or smaller? Are Eugene's IR cloud tops warmer or colder than on August 3rd?
-What about Emily? Can you locate a cyclonic circulation on the IR image?
-For both storms, has the water vapor imagery changed as well?

(d) Why do you think Hurricane Eugene weakened from August 3-5?
Hint: Think about the global ocean currents…

(e) Why do you think Tropical Storm Emily dissipated on August 5th?
Hint: Think about the topography of Hispaniola…

(f) Capture any other interesting images from the lifecycles of Emily or Eugene

Part 3: Present Images to Class

-Make a quick power point presentation of your saved images as instructed above and/or any other interesting images that you created.
-Prepare to present your images to the class in a 3-5 minute presentation
-When presenting, please explain:
    -Visible, IR, or Water Vapor Image
    -Explain or show color table
    -Discussion of interesting features on the satellite image and how they relate to the evolution of the TC of interest
    -When finished, email your presentations to jzagr001@fiu.edu

If you still have time:

-Look again at the global images from August 4-9. Are there any tropical cyclones in the Western Pacific? Follow their lifecycle and estimate their intensity changes using the satellite imagery.