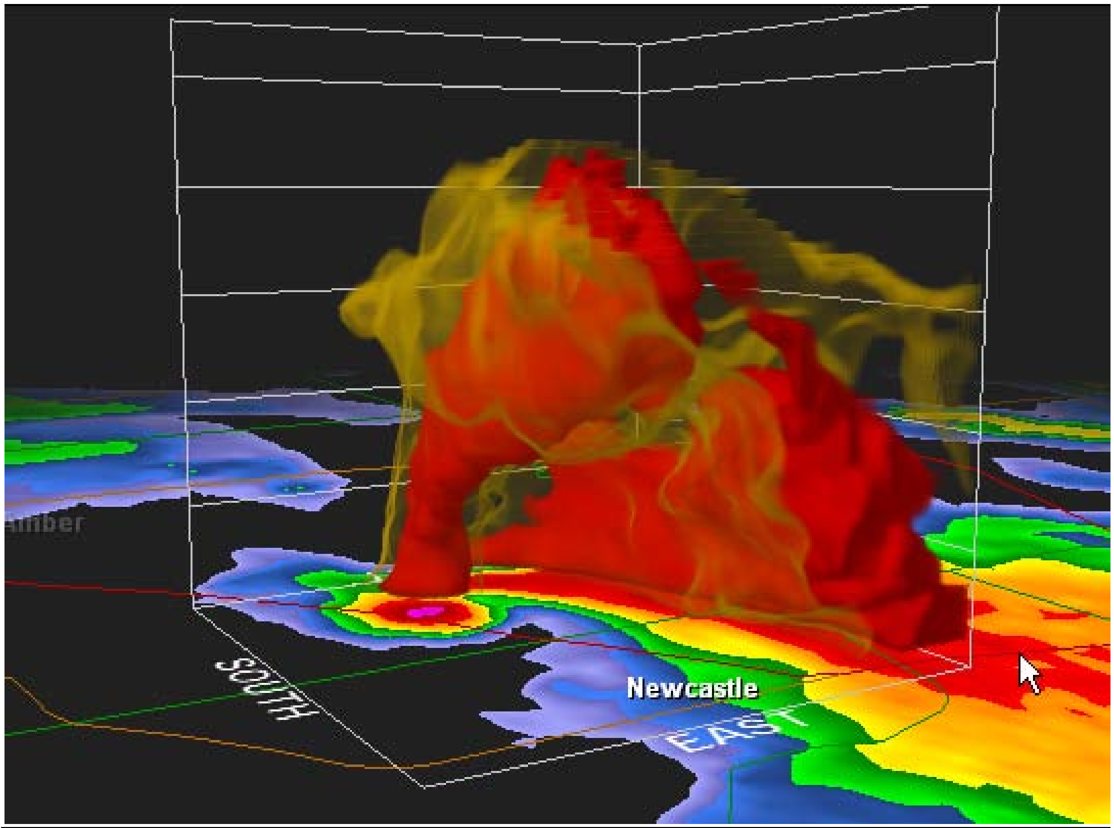
Three dimensional radar analysis to examine the weather



A lab exercise

In this lab you will learn about

- Radar analysis in general
- State of the art software called GR2Analsyt which one uses to analyze the radar data
- Meteorology related to Hurricane Katrina and the current weather

Funding to obtain software and hardware for this lab was obtained from
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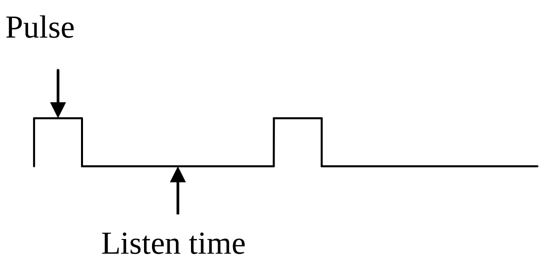
First, some things you should know.
Weather stations are frequently given a four letter code in meteorology, each starting with the letter K. For instance, you will be looking at data from New Orleans (LA) with the identifier KLIX and Mobile (AL) with the identifier KMOB. You will later be looking at Tampa's data.
QU 1. Fill in the 4 letter identifier for Tampa (you will get this data at the end of the lab) _______________.

You should know how radar works. It sends out pulses at approximately the speed of light which is 300 million m/s. The time between pulses is about 1.6 milliseconds. Between the pulses being sent out is the listening time (see figure 1 below).



When the radar hits something, it sends a return back to the radar. This is then displayed with software like GR2Analyst. The radar scans at different heights as it rotates 360 degrees. Using the information given to you previously, see if you can answer this.
QU2. What is the maximum distance that a radar can see? (Yes – you need to do some calculations! ☺)

For more information on radars, go to ece.uprm.edu/~pol/RadarShortCourse1.pdf

BR refers to the term "BASE REFLECTIVITY". This is a measure of the radar returns sent out from a radar site e.g. KMOB. The radar return indicates intensity. You can see a scale on the left hand side when you load this in GR2Analyst. Note the larger the number, the stronger the radar return which is normally indicative of more rain. So the green color shows a few raindrops, but the red color indicates very intense rain.

BV refers to “BASE VELOCITY”. This is the velocity of the storm in relation to the radar site. The Red color indicates air moving away from the radar and the green color refers to air moving towards the radar site. The wind speed is accurate at locations only orthogonal (at right angles) to the radar site.

Data you are using for this lab (which you can also download for free) is available from NCDC (National Climatic Data Center).

Order Data From NCDC Lab

Link: HYPERLINK "http://www.ncdc.noaa.gov" www.ncdc.noaa.gov
Click on the Free Data link on the left side of the page.
Click on Radar at the top center.
Click on Data Inventory/Order Data.
Click on the radar site you want to get the data from.
    (In this case, it will be KTBW, the bubble just south of Tampa)
Choose the date
    We will choose 08/13/2004
Question: Why do you think I have asked you to choose this data?
Choose Level II Base Data, and create graph.
Enter your email address, and select the time period you want
    We will choose 1900 GMT to 2200 GMT
When you get the email with your HAS number, you will then need to ftp the data. There are multiple ways to do this. The easiest is to click on the link in the email, click on each file, and choose “save to disk.” This will save the data to your desktop.

The software GR2Analyst costs $250 for an individual license. However, you can download a free 21-day trial version if you would like to use the software more. To download the trial and learn more about the software, go to http://www.grlevelx.com/gr2analyst/

A) First start the GR2Analyst program.
- go to START at bottom left of screen
- click on ALL PROGRAMS
- click on GRLevelX
- move across to GR2Analyst
- click on GR2Analyst

B) Then open a file.

- Go to FILE then OPEN
- Browse for the I drive and double click on the folder named AMS, then double click on the folder named 6500KLIX20050829_08-15
- Click on the first file and the last file while holding down the "SHIFT" key. Then press OPEN. This will open all the files together.

If you can't open all the files, it is possible that GR2 will only let you open 23 files at a time. This is equivalent to 1 and 1/2 columns in the "open" dialog box. So then open the first 23 files.

C) First, let's have a look at some tools within GR2Analyst.

i) Let's play the loop and watch Katrina come ashore. Click on the play button at the top.

QU3. What time of day did the eye come ashore (morning, afternoon, night?)? ______________

ii) Let's zoom in on an area. With mouse, go to top tool bar looking for the tool that looks like a magnifier. Click on this and zoom in on an area. (If your mouse has a center button, you may also use this for zoom in and out).

iii) Now we can pan area. Go to the tool bar and look for the button that looks like a + sign with arrows, then move the mouse over map and click and move the map.

iv) Now we are going to look at the volume tool. Make sure you are on the scan at time 08:15:29. Click on the box in the tool bar that looks like 2 squares connected then put this volume box over the area where you see a hail size of 0.53 and a diamond shape. You now get a 3d view and you can move your image around and turn it anyway. Notice that the hail extends to quite an altitude. This is a really tall thunderstorm

v) Now we are going to change the image to just see the red color (and a little yellow) i.e. the really heavy precipitation. Click on the alpha settings button at the top (looks like a bar chart with some colors below). You should see a line. Make a vertical line at the beginning of the purple color. Click at last point and take across to red. After this, we can include a little yellow by taking the line up from the bottom and then connecting with the bottom of the existing vertical line at the beginning of the red. You have now omitted the lower dbz values. Your image in the alpha settings should look like this:

Use the mouse to move the image around. Zoom out to accurately see the height that the 50 and greater dbz values extend.

QU 4. The height of the 50 and greater dbz values is ____________.

D) Now, leave the volumizing box and go back to main window. Click on BR (if it is not already there). Go to the last slide you loaded by hitting the last volume scan button on the upper tool bar that looks like a play button with a vertical line on the right.

Take the volume box and center it over KLIX. Tilt this image.

QU 5. What do you think this is?

____

E) Next, open a new file. Go to the C drive. Then program files, then GRLevelx, then GR2analyst. You want the file named ktlx19990503_235123

i) Click on the volume box icon on the cell closet to KTLX, i.e. Oklahoma City.

QU 6. What do you see? ________________

ii) Put the curser over the triangle,

QU 7. What do you notice about the dimensions of this storm?

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Go to the volume box. Place it over the center of storm, then zoom out to see whole cell. Move your image around. Look at the top of the storm.

QU 8. Why is the top of the storm flattened?________________________________

You are looking at the Moore tornado of 1999. This is a classic mid-west tornado.

iii) Use the cross-section tool (upper tool bar) and draw a line from an east to west direction through the center of the purple area. On the right hand side you can slide the POSITION tool, taking a look at the storm along the line you drew. You can slide the SWING tool too taking a look at the system from a different perspective.

F) Reload the Katina data at KLIX (see step B). Go to BV. Review comments on BV earlier.

iii) Note a clear S-curve in this image. The S-curve shows no motion along the S. You can loop the image for a few seconds to see the curve doesn't move. As the radar tilt increases, the radar is shooting higher up in altitude. Select the tilt. Look at this image as you change tilt from 0.4 degrees to 1.4 degrees to 2.3 degrees then 3.3 degrees.

QU 10. What changes do you see as you increase the tilt?

_________________________________.

Qu 11. Considering what you know about hurricanes, why might this be happening?

______________________________________.

G) View the data files from KLIX and KMOB. Notice that KLIX data is only available until about 2pm on the 29th August whereas KMOB data is available all day till midnight.

QU 12. Why do you think the KLIX data is available only for part of the day?

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H) **Compare the Size of the Eye**

We are now going to compare the size of the eye of Katrina to the storm we downloaded the data of at the beginning of this lab. We already downloaded the data ahead of time and it is available in the ? drive, see folder ?

Open the new data. Find the eye of the storm at the time noted by the instructor.

In order to do this, zoom in so that you can clearly view the extent of the eye.
Use the cross-section tool (between the volume and zoom tool) to measure the distance across the eye.
In the cross-section window, the width will display on the right side.

Now open the Katrina data again and repeat these steps to find the size of the eye.

QU 13. Why do you think such a large difference in size of the eye for both storms?

I) View current weather. For this you will need to watch the instructor or be using a full license version of the software which I have and an additional download. I will load GR2Analyst and then click on the location I am interested in e.g. Tampa. I click on FILE and then POLING. When the tilt is at 4.5 degrees for a max, it is in clear air mode. There is no precipitation so the radar is scanning lower. When you see returns of 10-20 dbz, it is showing clutter. This could be returns from bugs or birds. I will zoom out by using my middle mouse button and then look at a different location to see what the weather is like there. You can look at BV and see what direction the system is moving.

All the information in this document is accurate at the time of this writing on December 3, 2007 (updated April 14, 2009).