Synoptic Meteorology Lab 6
1 April, 2015 – due 8 April

Data analysis in IDV

This week we use radiosonde, radar, satellite, and surface data to further examine the snow storm of 20 Dec 2012. We will also look at isentropic model output. It will also be an opportunity to become more acquainted with IDV (Integrated Data Viewer), software built on UWisc's VIS5D by Don Murray and Jeff McWirther at Unidata between 2003-2010 (they have since left Unidata, but Unidata still supports the software).

How to access IDV? You can download it to your machine (Windows, Apple, or Linux) from http://www.unidata.ucar.edu/software/idv/ . The current version is 5.1. If you have a 64 bit machine, do install the 64 bit version, IDV will perform much better for memory-intensive tasks (big data files). The lab computers have an older version of IDV installed.

Alternative ways to access IDV (older version only): on a Windows machine, you can go to Map Network Drive, open \\batcivet\atscapps , and in that directory, click on **runIDV.bat** (this is an old version at 32 bit).

A. Downloading archival operational measurements, and displaying them in IDV

First, you need to download archived weather data. That alone may prove to be a useful for your own graduate research. Next, we will plot the data in IDV.

How to download archived weather data, and open them in IDV?
In general, the main source of weather & climate data is the National Climate Data Center (http://www.ncdc.noaa.gov/)

- Archived radar data can be requested from http://www.ncdc.noaa.gov/nexradinv/. Select your choice radar and specify your date(s). I suggest Evansville IN, KVWX. On the next pages, specify your time(s). Don't make your data period too long – the data interval is ~10 min, but you can under-sample time-wise. I suggest 11-13 UTC on 20 Dec 2012. Collect both short range "base reflectivity" and "radial velocity" (0.5° elevation), N0R and N0V. The data will be made available, typically after 5-10 minutes, on an ftp server, from where you can copy them on your local disk. IDV can read the files (format: "NEXRAD", or "I am feeling lucky")

  For extra credit or future reference: you can also download level II data from this site. This gives reflectivity, velocity, and other products at all elevation angles in the volume scan. Then you can import the entire 3D volume of data in IDV, and IDV will display the vertical structure of the storm. If you want to do this, just download a single volume scan closest to 12 UTC. I suggest that you display just 2 elevation angles, the 0.5 degree and a high-elevation scan (eg 4 degrees).

- Archived GOES West satellite data are available from two sites:
  - First choice: U Wisconsin: As you can read from a Unidata blog, http://www.unidata.ucar.edu/blogs/news/entry/free_satellite_archive_data_access , you do not need to download the data files. Just follow the directions in that blog to connect to the UWisconsin server. Make sure you register using your .edu email address, and you should not need further authentication. Choose image type OGOES13, and select the relevant time period (16-19 UTC on 2012/12/20) . Under image type, choose continental US (CONUS) and next choose first the 1 km visible (channel 1) images, and next the 4 km IR (channel 4) images. See under Tasks, about what to do with these animations. **This does not work because the IP address is determined dynamically. The only machine with a fixed IP is weather, but it does not have student accounts. To make progress, I have asked U Wisconsin a blanket acceptance for connects from 129.72.0.0/16 (whole campus)**
  - Second choice (if the 1st one did not work): NCDC CLASS: http://www.class.ncdc.noaa.gov/ . I suggest you start off by registering or logging in first. Then, on the right side of the CLASS

homepage (under *Search for data*), click on *Environmental Data from Geostationary Satellites*, and then *GOES Satellite Data - Imager (GVAR_IMG)*. On the next page, you specify your spatial and temporal data bounds. Pick "continental USA", and 16-19 UTC. No need to choose your satellite. Then click on Search, to make sure that the data are there, and "Select all". Then click on "gotoCart". On the next page, you should see a Table. Use the defaults, i.e. the *Output Format* is set at *Area*, the *Bits/Pixel* to 16, and your *spatial resolution* is 1 km. Channel 5 or 6 is the standard IR image, Channel 1 is visible, which is not available at night. Then click on *commit changes* (on top of the Table). Make sure the *Delivery Method* is set to FTP (free), and enter your email address under "You will be notified at". Then click on *Place your order*. You 'll get an email (maybe a couple of hours later) that tells you how to download the data. You can then open the file(s) in IDV, file format "I am feeling lucky", or "McIDAS area files".

- Archived radiosonde data are available from http://www.esrl.noaa.gov/raobs/. Specify your choice (date/time, location). Try Norman OK KOUN (WMO 72357) or Nashville KBNA (WMO 72327), at these three times: 2012/12/20 at 00Z and 12Z, and 2012/12/21 at 00Z. On the second page, set Format: NetCDF. Save the file locally. From IDV Data Chooser, click on Observations: RAOB (on the left side). Then select the tab "Soundings: Local". Make sure you set "Files of Type:" to "All Files". Click on "Select file" and navigate to the file you saved. Then click on your station of choice, then click on "Add source". That should bring you to the field selector window.
- Note: If you ever need archived gridded model output, it can be requested from the NOMADS system, http://nomads.ncdc.noaa.gov/ . Click on *Access* (upper left), then your model of choice, such as *GFS* (Global Forecast System), then, in the table, click on the box (with text *http*) that corresponds with GFS and http. Then navigate to the folder for the date of your choice. IDV can read .grb2 files, as well as .gem files. (format: "I am feeling lucky" or "Grid files")

Tasks

Note: to save images (or movies) in IDV, go to View → Capture → image (or movie)

Do the following:

- Examine the Evansville IN, KVWX radar level III base reflectivity (0.5° elevation) and base Doppler radial velocity (0.5° elevation) – look at an animation for a few hours around 12 Z on 20 Dec 2012, and save an image as jpg file, and a ~1 hour animation as a .mpeg file. To do this, go to View→ Capture
- **Up to 10% extra credit: display the level II reflectivity at all elevation angles around 12 Z. Choose two good viewing angles and capture each image.**
- Plot GOES East satellite imagery centered over SW Indiana, both an IR (infrared) and a visible image, at a time of your choice (e.g. 18 Z – it is still mostly dark at 12 Z). Save the two images as jpg files. First look at an animation for a few hours again. I suggest that you change the projection from the native distorted satellite view to a more typical Lambert projection, which you used in gdplot2.
- Plot the BNA sounding at 12 hour intervals between 2012/12/20 00Z and 2012/12/21 00Z, on a skew T diagram. Examine the sharp low-level inversion, and determine whether any CAPE is present. Save the sounding with the strongest inversion as part of your assignment. To save this image, if the IDV view/capture method does not work, use the Print Screen key on your keyboard.
- Include all these images in your lab report. Include captions detailed enough to let the reader know what is shown. The only questions to be answered are:
    - Determine whether any CAPE is present at BNA at any of the 3 times you examined.
    - What precip intensity do you expect around Evansville at 12 Z – convective or stratiform? Why?
    - What is the low-level (~lowest 1 km) wind direction around Evansville at this time, according to Doppler velocity data? What is it at a higher level, near the outer radar range?
    - What is the precip type (rain/sleet/freezing rain/snow/hail) at BNA at 12 Z? Why?

B. Isentropic maps in IDV

First, open your WRF model output gempak grid file (e.g. yyyymmdd_hh _f00_f36.gem): go to data chooser, navigate to your file, and "data source type" can be "I am feeling lucky" or "Grid files". Click on Add Source. Display the geopotential height (contour plan view), the vorticity field (color shaded plan view), and the actual wind

vectors at 300 mb at 12 Z on 20 Dec 2012 over your entire model domain. Compare this map to your map B1 in Lab #3 – they should be the same.
Hints:

- To show multiple fields on top of each other, you need to go back to the field selector.
- Both vorticity and wind are derived variables. For your WRF output, they may have to be calculated in IDV. In typical real-time model output, they are available. You can check this (data chooser → catalogs → Unidata IDD Model Data → choose your model)
- Play with the background (show state outline by going to background maps, choosing "hi-res US", and moving this map to the top; make background white), and with the color scheme: solid color for the height contours is preferred, with 60 m interval; for the color fill, choose a meaningful table, e.g. Basic VisAD which can be centered at zero vorticity, and can show cyclonic and anticylonic vorticity in different colors. You may want to change the displayed range as well.
- When you have finalized your figure, View → Capture it as a .jpg image to include in your lab, called IDV_B1, together with your map B1 from Lab #3 – I like to see both

Next, show the 3D undulations of the 295K and 310K isentropic surfaces, by selecting potential temperature: field selector→ potential temperature→ 3D surface → isosurface colored by another parameter (choose geopotential height). Then pan, shift and zoom the image to have a good look at the undulations from various directions. Improve the color table, and save this in your report. As usual, pls add brief figure captions.

Next, open your isentropic file, labeled e.g. yyyymmdd_hh _f12_isentropic.gem, select pressure (contour plan view) and specific humidity (color shaded plan view) and winds (vectors) on the 295K and 310K isentropic surfaces at 12 Z on 20 Dec 2012. In your report, include these two maps together with the corresponding ones in lab #6. No discussion is needed, but if you see something interesting, pls report it.