October 31, 2013

NPP Tropical Cyclone Software Processing Flow

Preliminaries

For every active tropical system worldwide, plots of the surface pressure and the horizontal and vertical structure of the wind field will be made from the temperature retrievals constructed from ATMS measurements using the MIRS algorithm. This document outlines the flow of code, which produces these plots. Because of the several datasets used and the varying times of their availability, the following table will be referenced.

T_0 (0,6,12,18Z)	T_{+1}	T_{+2}	T_{+3}	T_{+4}	T_{+5}	T_{+6}
(Analysis time, first run)	(CARQ arrives)	(Second run)	(GFS, OFCL arrive)	(Final run)		(Next synoptic hour)

October 31, 2013

I. Input Data

A. ATMS MIRS Retrievals. These files contain the vertical profiles of the atmosphere. Because the ATMS currently flies aboard one polar-orbiting satellite, each tropical system can be sampled up to twice daily – once on the ascending mode, and once on the descending mode.

B. ATCF A-Decks. These files are generated 4 times a day and contain information about active tropical systems worldwide. The first relevant entries are the CARQ lines, which contain the position and intensity information every 6 hours from the current synoptic time (T_0) to 24 hours prior to the synoptic time. The CARQ lines are available about an hour after the synoptic time, i.e. in the T_{+1} time frame. The second relevant entries are the official forecast lines (OFCL, or JTWC, depending on ocean basin). These give the forecast position and intensity every 12 hours, starting with the current position and intensity at T_0. This information is usually available in the T_{+3} time frame. The necessary data from the A-Deck are the position and intensity of the system at T_0 and at T_{-12}.

C. GFS Analyses. These are used for the boundary conditions for the wind retrieval code. The analysis for T_0 is usually available in the T_{+3} time frame.

II. Timing Issues

A. Running the Code. For each synoptic time (00Z, 06Z, 12Z, and 18Z), the wind retrieval code will be run three times: at the synoptic hour (T_0), 2 hours after the synoptic hour (T_{+2}), and 4 hours after the synoptic hour (T_{+4}). All three runs are valid for time T_0, but the T_{+2} and the T_{+4} runs will likely have updated data sets to work with.

B. The Three Runs.

1. First run (T_0). This run will use the GFS analysis from the previous synoptic time (T_{-6}). It will be assumed to be valid at T_0, however. The T_{-12} position will come from the 0-hour entry from the T_{-12} CARQ. The T_0 position will come from the 12-hr line of the T_{-12} OFCL forecast.

2. Second run (T_{+2}). This run will use the GFS analysis from the previous synoptic time (T_{-6}). It will be assumed to be valid at T_0, however. The T_{-12} and T_0 positions will, likely come from the T_0 CARQ entries.

3. Third (final) run. This run will use the GFS analysis from time T_0. The T_{-12} and T_0 positions will come from the T_0 CARQ entries.

III. Structure of the Code

A. Copy all necessary scripts, executables, configuration and data files into the working directory. This includes the MIRS retrievals, A-Decks, and GFS analysis.

B. Convert the GFS grib files to pack files utilizing NPP_TC_GRIB2PACK.sh and bin2pack.x

C. Extract the relevant MiRS ATMS data sub-domian (data_pool.py)

D. Start the TC processing loop. For each storm in the given basin, Steps E-K will be performed.

E. Run program ShortTermTrack.x to create a file of positions and intensities (*.inp files). The second and third runs (at T_{+2} and T_{+4}, respectively) will likely be able to use the CARQ lines from the T_0 A-Decks. The first run (T_0) will need to use the CARQ and OFCL lines from the T_{-12} A-Decks. If neither the T_0 nor the T_{-12} A-Deck information is available, the program will not proceed any further.

F. Run the program afdeck.x. This program uses the results of the previous step to create the first line of the file COORTIMES. This first line contains position, motion, and intensity information for the system at time T_0 and T_{-12}.

G. Run the MIRS processing code (pool_query.py). This generates text files of all of the necessary information from the MIRS retrievals.

H. Run the program satcenter.x. This program finds the time of the shortest distance between the center of the tropical system and the center of the ATMS scan line. The position of the system is determined from interpolation or extrapolation of the line between the T_0 and T_{-12} positions. The times and locations of the center of the ATMS scanline comes from the MIRS processing done in the previous step. This position of the system and the centerline, along with the time of the occurrence of the shortest distance is used for the second line of the file COORTIMES. The last line of COORTIMES contains the number of MIRS retrievals found in the previous step.

I. Run the program oparet.x. This program computes the wind field and MSLP from the MIRS measurements. It uses the COORTIMES file, the GFS analysis, and the MIRS retrievals processed in Step D – lat.txt, lon.txt, pressure.txt, tpw.txt, clw.txt, ptemp.txt, and pvapor.txt. If the closest approach of the system to the center line of the ATMS scan is greater than 700 km, oparet does not complete the wind field computations.

J. Plot the wind fields at multiple levels (main_read_plot_xya.py)

K. Distribute the output and image files. The output files, as well as the log files will be distributed according to NESDIS procedures.