NWS Plans for the ATCF

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ATCF Capabilities and Usage

- Purpose: a dedicated, interactive software application to automate and streamline the monitoring, tracking and forecasting of tropical cyclones (TC)
- Data stored in a ASCII character CSV (comma-separated value) flat-file database known as the "decks":

  - a-deck: all available forecast aid projections for the entire storm history
  - b-deck: Best Track, the best operational estimate of TC parameters at 6-hr synoptic times
  - e-deck: probability records (track, intensity, RI, genesis)
  - f-deck: records of track/intensity fixes from multiple platforms

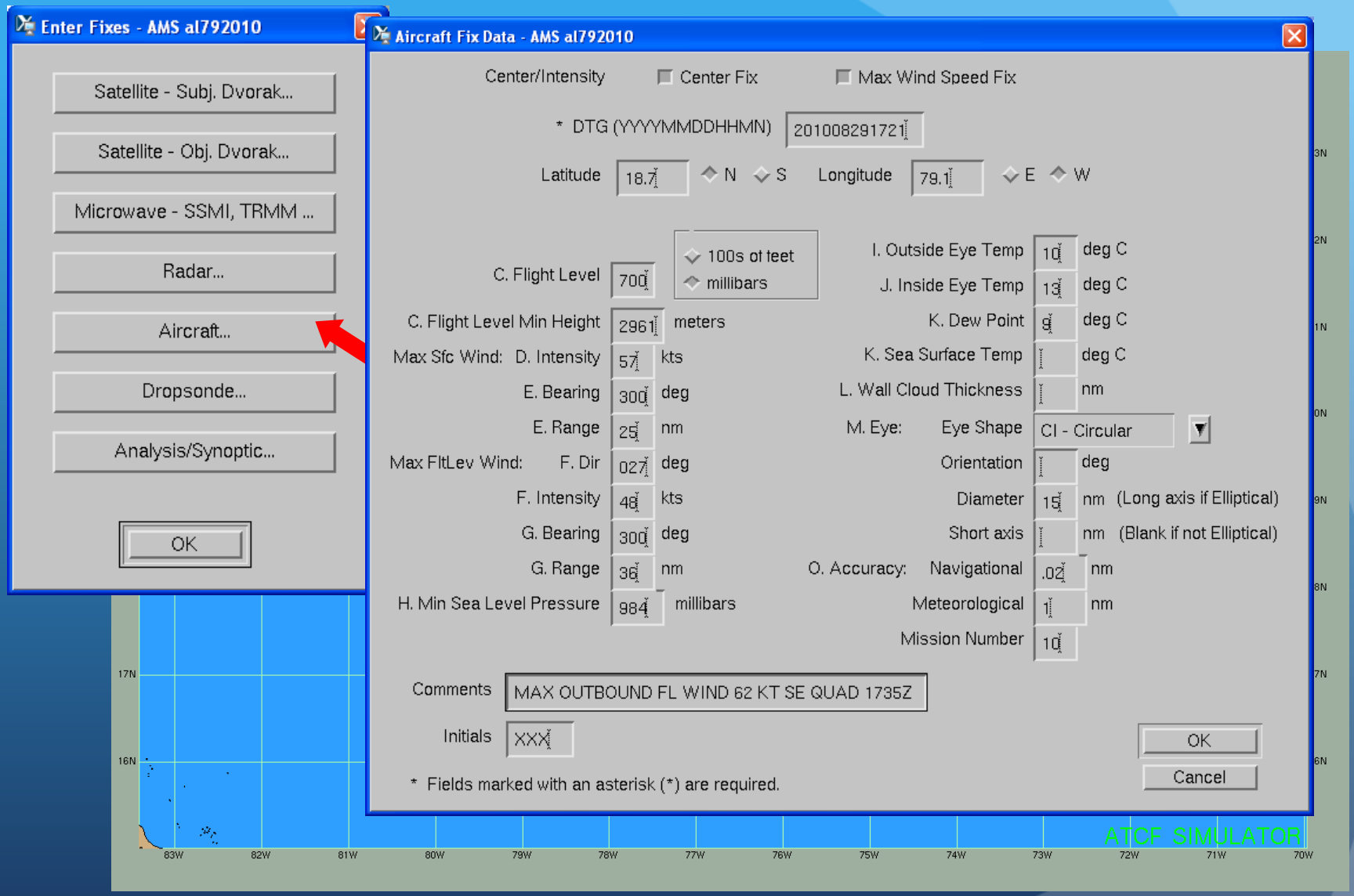
- Performs multiple analyses of TC state (center position, intensity, wind radii structure, forward motion, ocean wave height)
- Ingests fix data – TC data from Dvorak satellite estimation techniques, microwave satellite imagery interpretation methods, reconnaissance aircraft, NWP models, vortex trackers/aids (343 forecast aids in this year's ATCF techlist), etc.
- Prepares data for initializing a wide range of models (NWP, statistical, climatological), submits this data to supercomputing clusters, retrieves the results, and merges them together – on the screen, as weighted blends, or as consensus forecast products

Receive Fix from Reconnaissance Aircraft

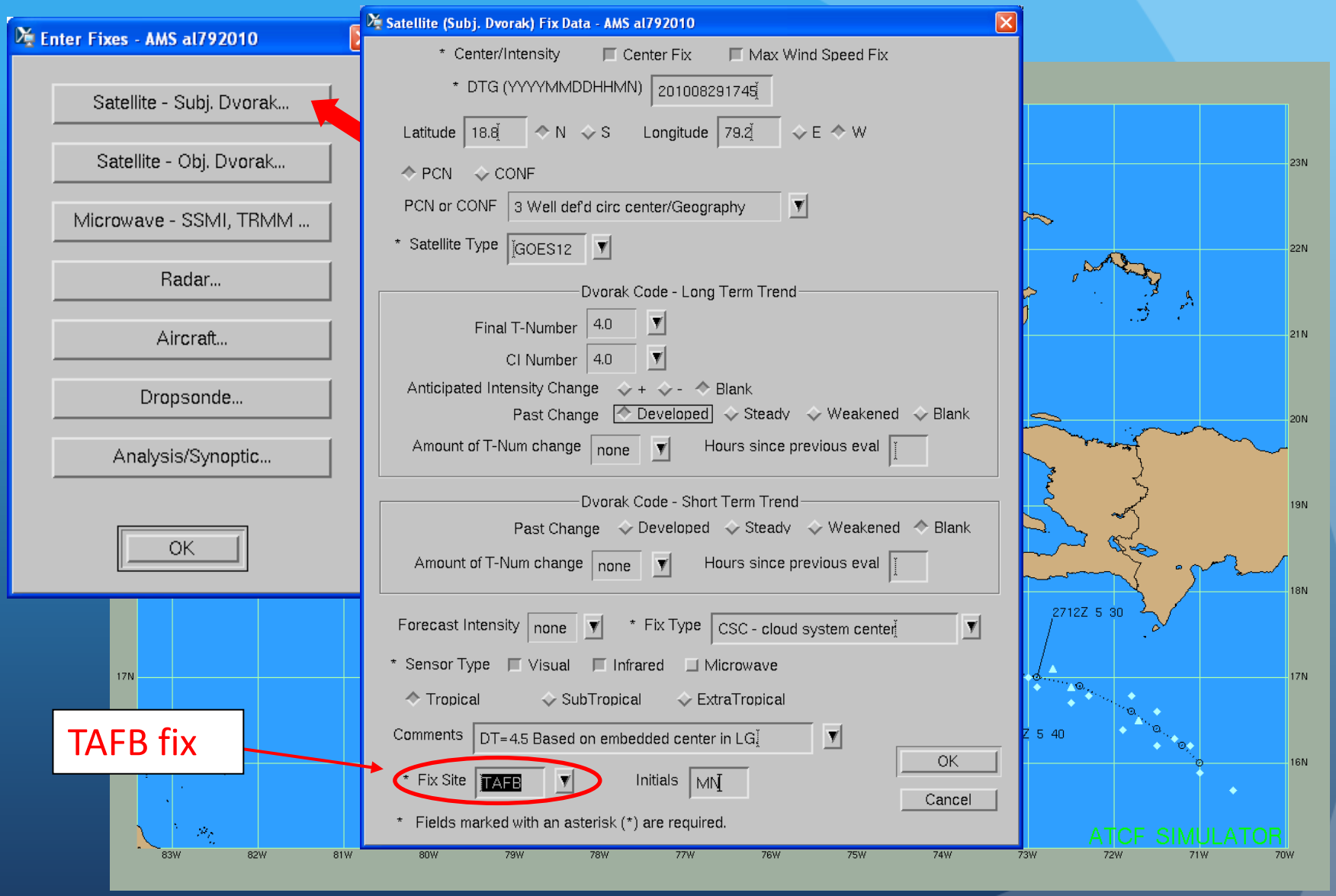
12 KNHC 291748
VORTEX DATA MESSAGE
A. 29/172050Z
B. 18 deg 44 min N
079 deg 08 min W ← position
C. 700 mb 2961 m
D. 57 kt ← max surface wind
E. 300 deg 25 nm
F. 027 deg 048 kt ← max flight-level wind
G. 300 deg 036 nm
H. 984 mb ← minimum pressure
I. 10 C/ 3048 m
J. 13 C/ 3044 m
K. 9 C/ NA
L. OPEN NE
M. C15
N. 12345/7
O. 0.02 / 1 nm
P. AF307 1007A OB 06 CCA
MAX FL WIND 48 KT NW QUAD 171040 Z
MAX OUTBOUND FL WIND 62 KT SE QUAD 173440Z ← max outbound flight-level wind
SURFACE WIND OBSERVED VISUALLY

Final fix with an outbound maximum flight-level wind of 62 kt, which equates to 56 kt (90%) at the surface.

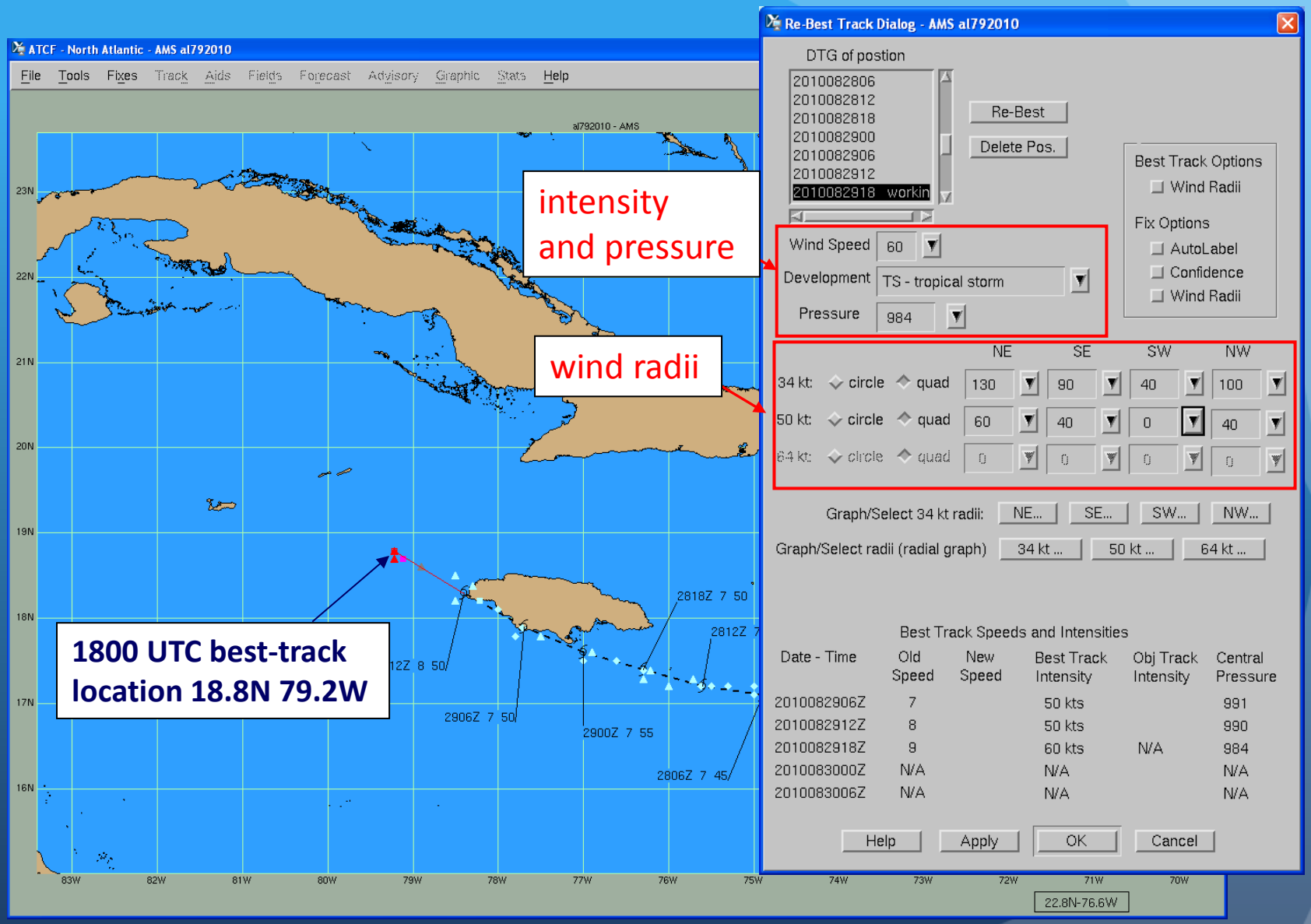
Enter a Recon Aircraft Fix



Enter Dvorak Fixes

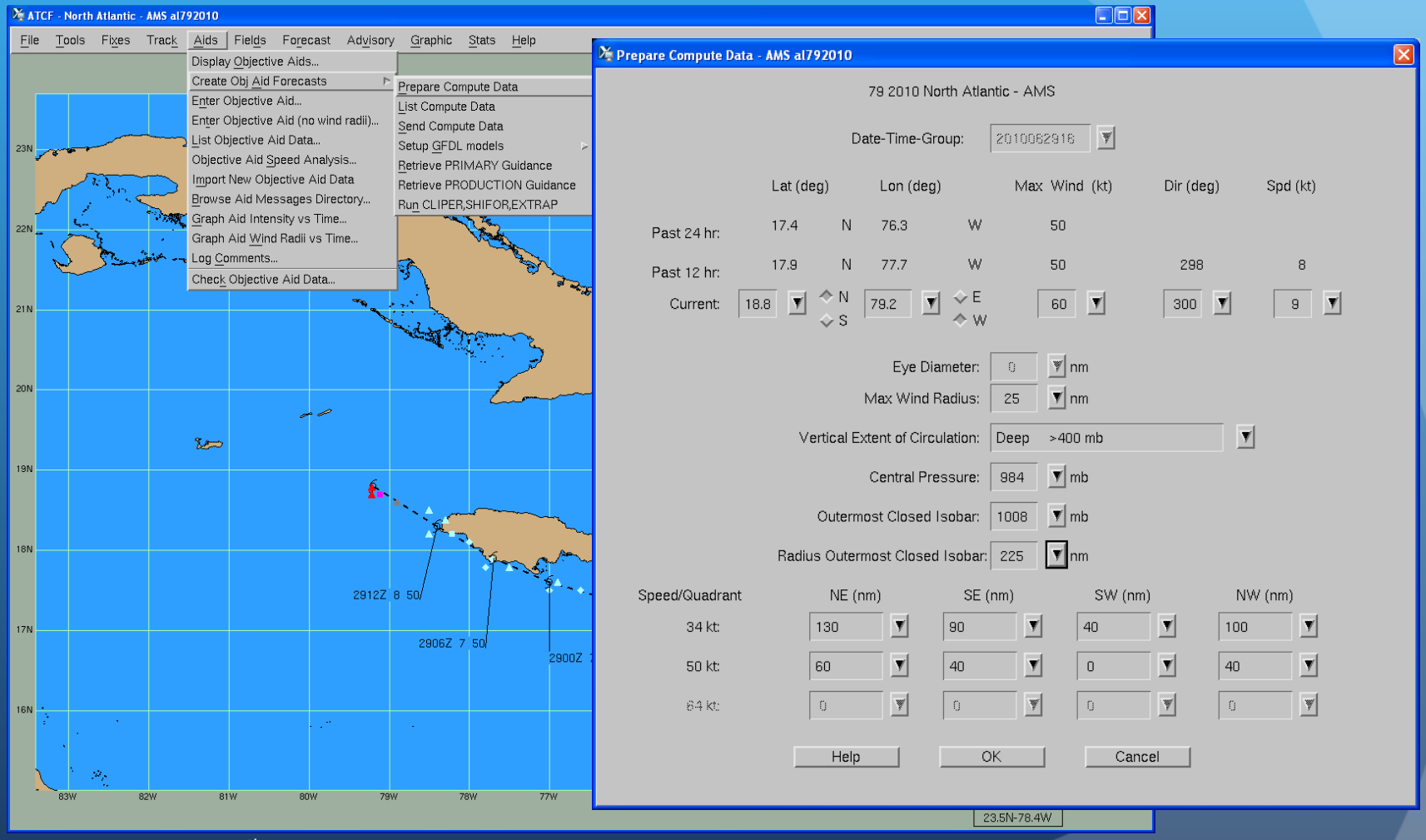


Enter Best Track Information



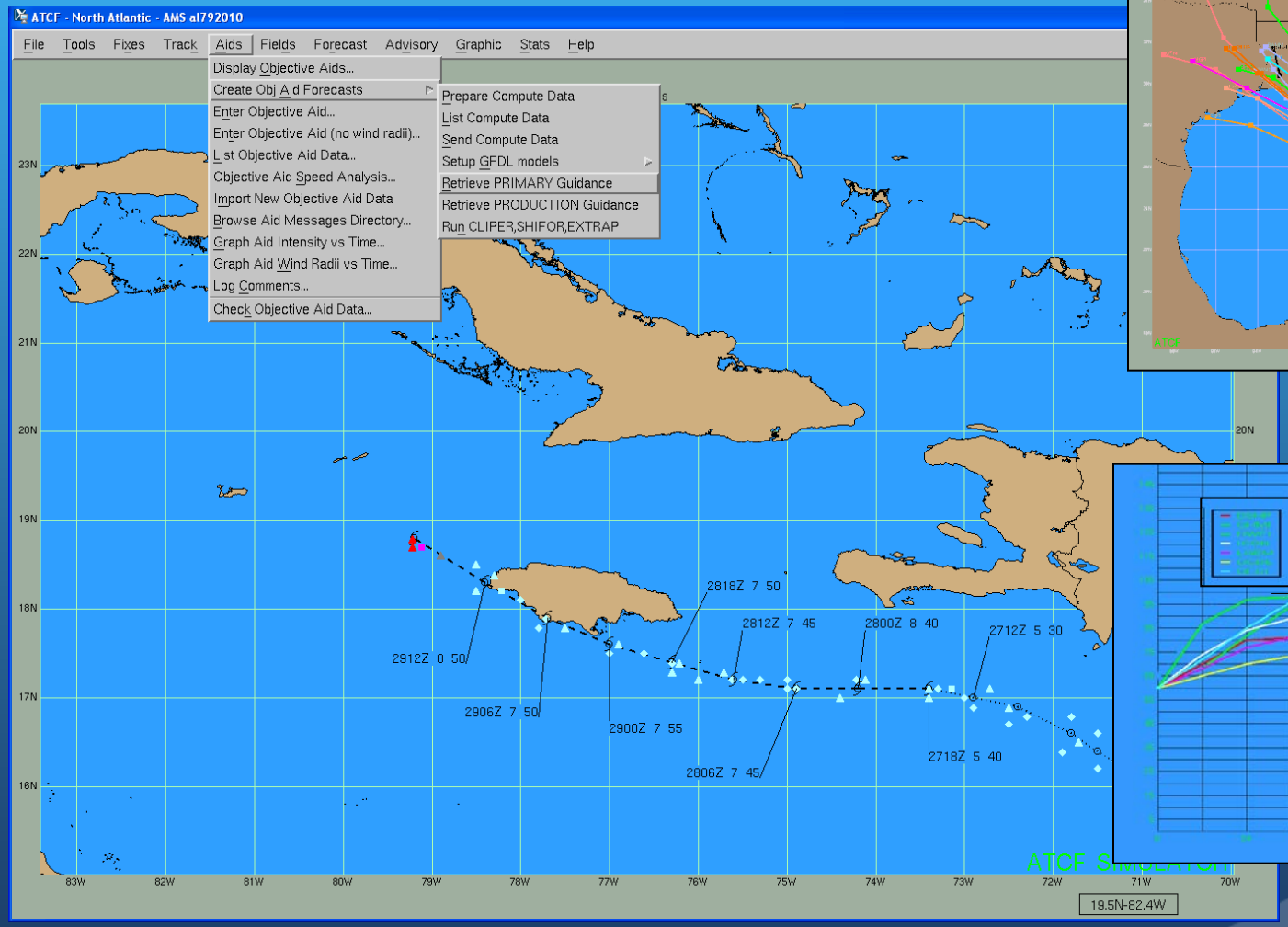
Initialize Models

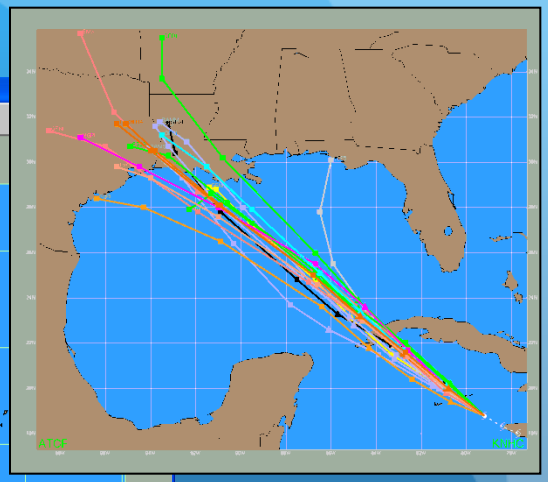
After determining the center, intensity, motion, and size of the tropical cyclone, the Hurricane Specialist sends that information to a supercomputer to run the models



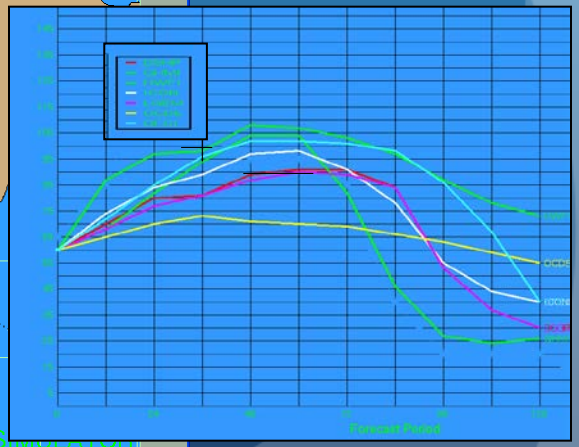
Receive Model Guidance

Then analyze numerical model output and prepare track, intensity, and wind radii forecasts.





Track Guidance

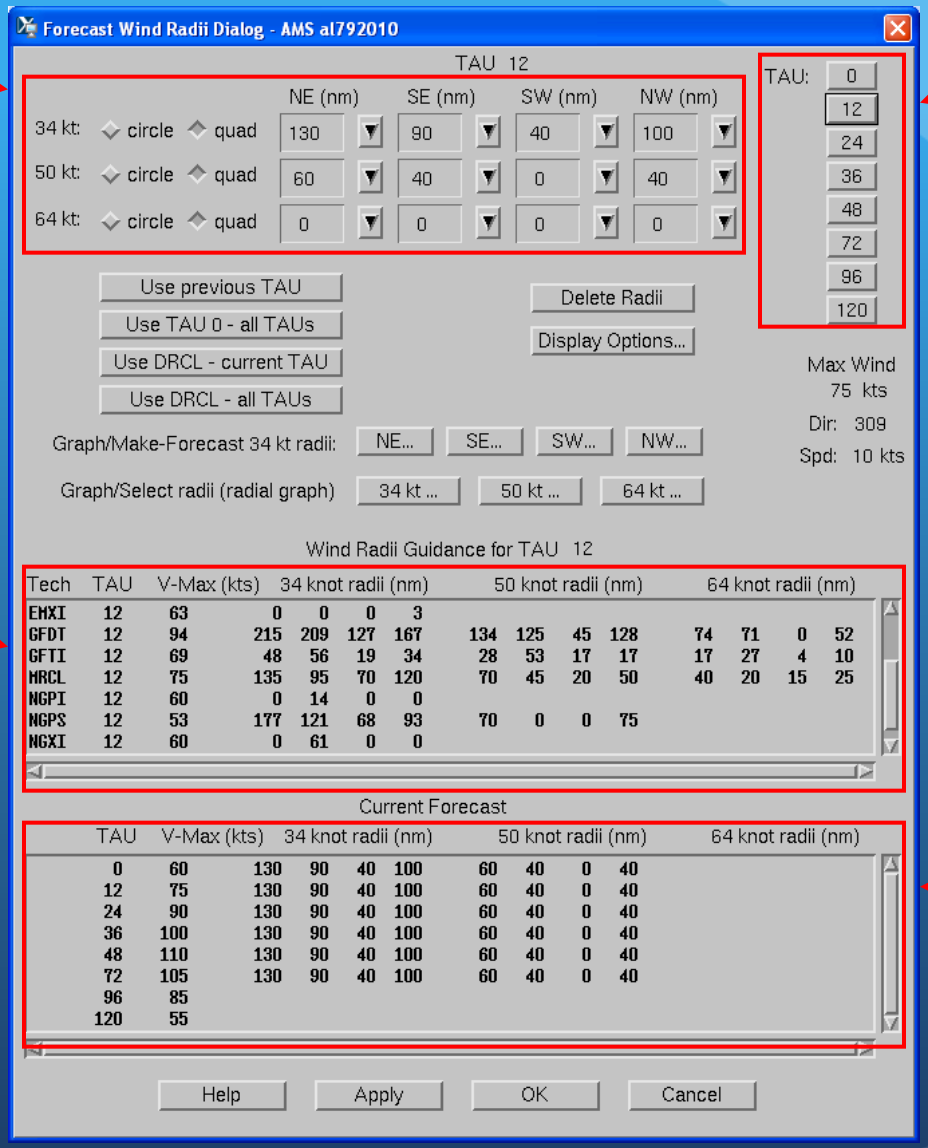


Intensity Guidance

Wind Radii Forecast Dialogue Box

Enter your radii prediction (n mi) for each forecast period

Guidance

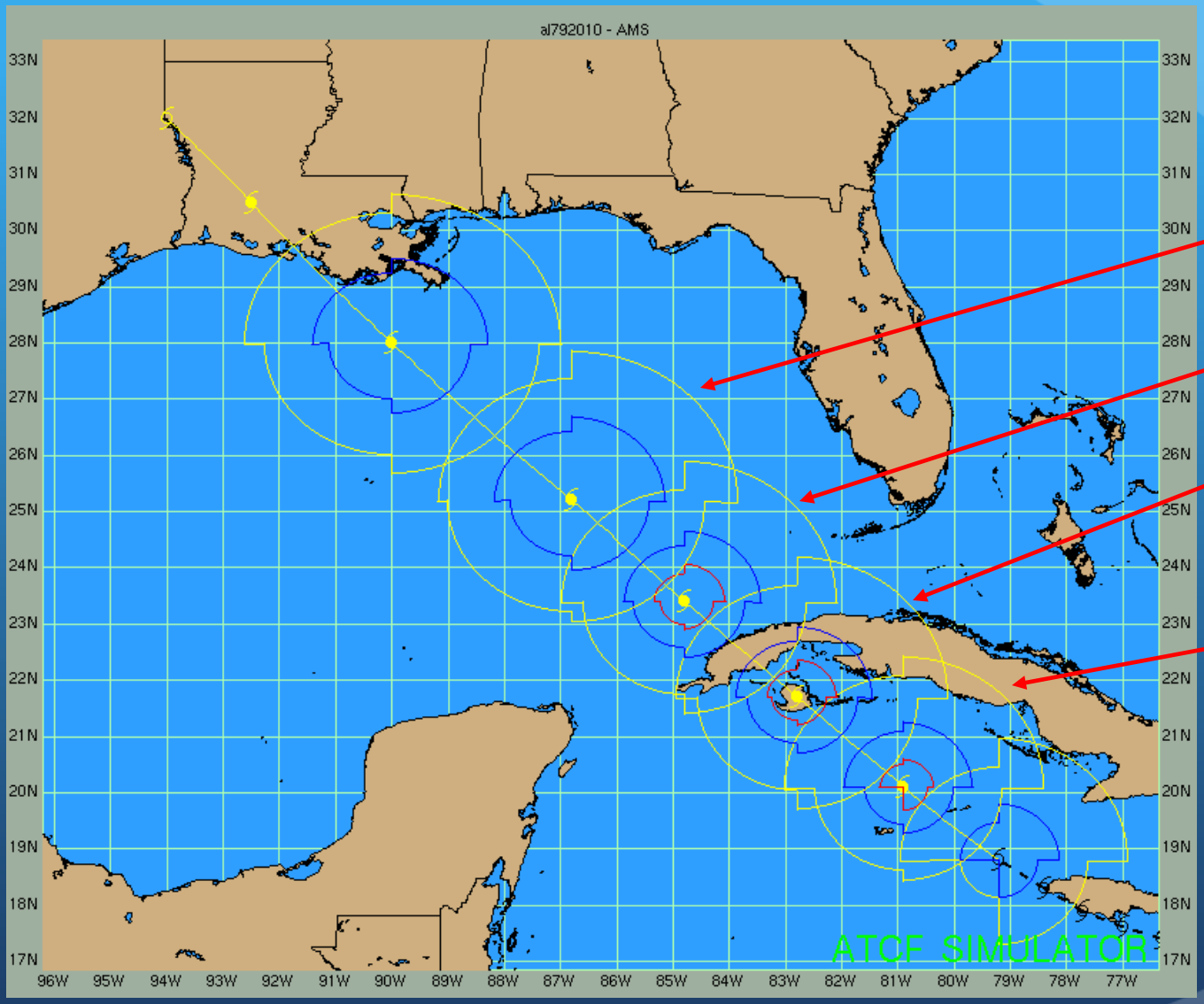


Select forecast period. Radii forecasts only out to 72 h

Summary of your radii forecasts

Do we need watches or warnings?

Remember to consider forecast uncertainty



48 h forecast- Still time for the Gulf Coast?

36 h forecast- Florida Keys and Dry Tortugas?

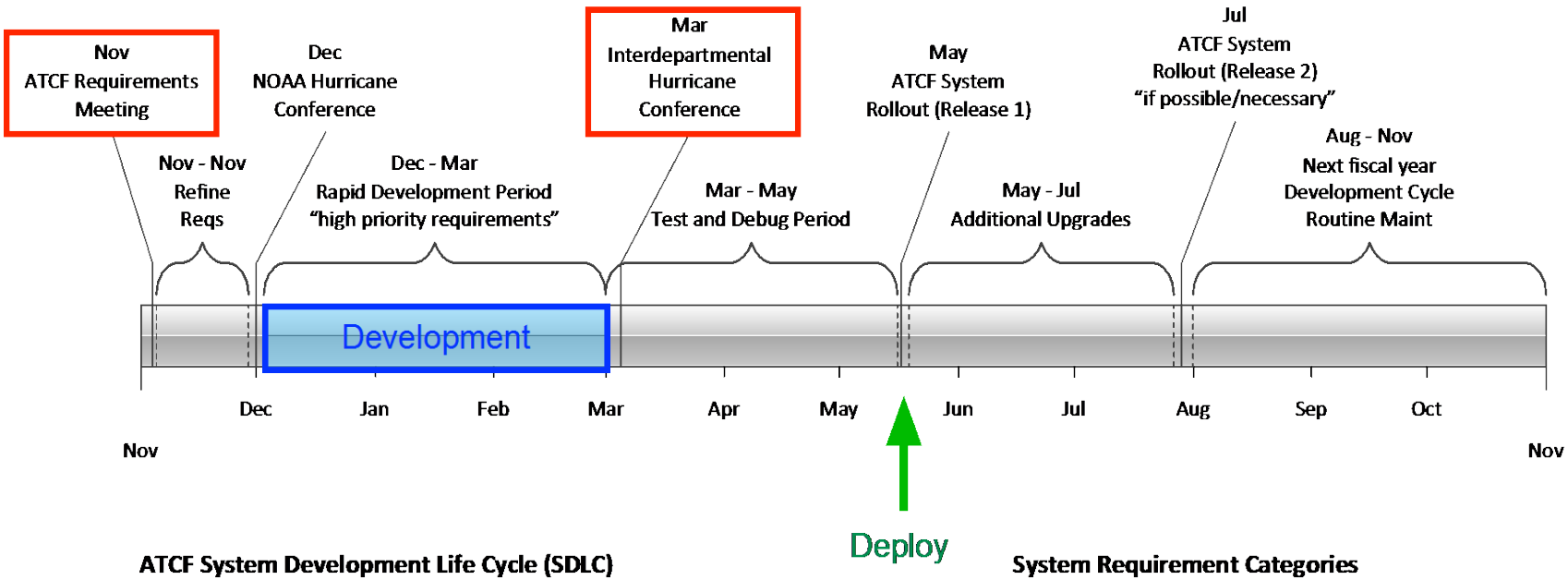
24 h forecast- Western Cuba and the Isle of Youth?

12 h forecast- Don't forget about the Cayman Islands.

ATCF Development Team at NHC

- Mark DeMaria – Chief of TSB
  - Management, oversight, funding
- Craig Mattocks – Meteorologist, Software Developer
  - Team Lead, ATCF software development
  - Develops/maintains NHC local "standalone" applications in Fortran/C
- Monica Bozeman – Meteorologist, Software Developer
  - Dataflow, scripting, documentation
- Mike Brennan – Sr. Hurricane Specialist
  - Testing, management of ATCF decks, annual requirements/improvements
- Dave Zelinski – Meteorologist, Software Developer
  - Web development, scripting, graphics, GIS

ATCF System Development Life Cycle (SDLC) – Timeline



ATCF System Development Life Cycle (SDLC)

1) Concept
2) Requirements
3) Design / Code
4) Test / Debug
5) Implementation
6) Maintenance

"iterative process"

System Requirement Categories

1) Tropical Cyclone Center Requirements
2) Inter-agency Requirements
3) WMO / International Partner Requirements
4) Product / Service Improvements
5) Research to Operations
6) System Maintenance / Upgrades

Annual Requirements (Improvements) List

docs.google.com/spreadsheets/d/1k3P-bIz0XNvuVAaCL_Az_fNxDfguNrFZQAKCwGQsUaA/edit#

FY16 ATCF Development Items - Google Sheets

File Edit View Insert Format Data Tools Add-ons Help Last edit was made 6 days ago by Monica Bozeman - NOAA Federal

	A	B	C	D	E	F	G	H	I
1	Item	Category	Assigned to	Description/Notes	Complexity	Risk	Priority	Percent Complete	Estimated Comple
2	Address bug for time zone determination prior to 06Z when going from EDT to EST for Atlantic TWO	Miscellaneous	Craig	Low priority, can be easily corrected by hand.	Medium	Medium	Low		Defer
3	Develop an extended safe mode of ATCF for TAFB to use to generate pre-genesis marine products, including wind speed probabilities.	Miscellaneous	All	Longer term item (2017?)	Medium	Medium	Low	0%	Defer
4	Possible to have ATCF return a 1st guess as to 48 hour motion and intensity trends in TCP?	Advisory Code	Craig	Current advisory code already returns intensity trend. Might be difficult to properly code up motion	Low	Low	Low	0%	Defer
5	Upgrade CPHC to current mixed-case advisory code	Advisory Code	Craig, Monica	Waiting to be implemented for CPHC	Low	Low	High	100%	Done
6	For a forecast lead time that lacks a forecast position (i.e., the storm is forecast to have dissipated), if the forecaster does not select "DISSIPATED" as the status for that particular forecast time in the "Forecast Type" dialog, then that forecast lead time is omitted from the TCM	Advisory Code	Craig	Waiting to be implemented	Medium	Medium	Low	100%	Done
7	Edit the nhc_get_aids.sh script to pull FNMOC aids for the previous two cycles (6 h and 12 h ago)	Guidance	Monica, Mike	1/26/2016: Script updated. Monica will implement this week	Low	Low	Medium	100%	Done
8	Ensure that "-C" and "-E" shows up in headers and products for post-tropical cyclones.	Advisory Code	Craig	1/20/2016: Already fixed in current version of NHC advisory code	Low	Low	Medium	100%	Done
9	Add wind speed probaiblity text products to public FTP server	Dataflow	Monica	1/20/2016: Request from user to add WSP products to FTP server like other advisory text products. Mike provided details. Monica will include in RFC. Implemented week of 1/26.	Low	Low	Low	100%	Done
10	Add points to Atlantic WSP text product	Products	Mike	1/20/2016: Already modified file offline and tested on atcf-build account svr2 - sent to Craig for repo	Low	Low	Medium	100%	Done
11	Modify consensus aid defintitions for 2016	Guidance	Mike	Modify files in $ATCFINC	Low	Low	High	100%	Done
12	Update techlist for 2016	Guidande	Mike	Modify file in $ATCFINC/tech	Low	Low	High	100%	Done
13	Ensure that XML file for webpage updates on issuance of TCU	Miscellaneous	Mike, Matt	Code was already set up to do this. Matt fixed typo in script, so it should now work.	Low	Low	Medium	100%	Done
14	b-deck truncation for GIS products	Decks	Craig	1/26: Will truncate b-deck - need to fix so that truncated decks don't get posted to opah/ftp. Do truncation in a temp directory and don't touch actual b-deck 2/1: GIS applications go to source for b-deck ($ATCFSTRMS) - Craig increased buffer to 500 characters - matches FORTRAN datalo.f files	Medium	Medium	Medium	100%	Done
15	Address bugzilla issue from the SPAs about Guidance suite input files not being the same on both tide and gyre	WCOSS	Monica	make nhc_putaids.sh send input files to both tide and gyre. written, and tested. Waiting for implementation date from CCB	low	low	high	100%	Done
16	Insert default watch/warning statement for TCM/TCP when .warn file is empty	Advisory Code	Craig	2/22: Tested on atcf-build@atcfsvr2 - seems to work on TCP, but not TCM in all cases. 2/25: Mike tested - works properly.	Low	Low	High	100%	Done
17	Fix bug that posts preliminary WSP graphics to the NHC web page prior to transmission of TCM	Miscellaneous	Monica, Dave, Craig	2/22: Comment out call to nhc_postprelim.sh in do_storm_prob script on atcfsvr1 and test to see if that works	Medium	Medium	High	100%	Done
18	~~Compute MOGREPS ensemble mean~~	Guidance	Monica	1/27: Met Office will compute ensemble mean for track for us to ingest	Low	Medium	Medium	100%	Withdrawn
19	~~Compute ensemble mean from GTS ECMWF trackers~~	Guidance	Monica	NCEP has fixed EEMN tracker issue, no longer needed	Medium	Medium	Medium		Withdrawn
20	Improve word wrapping of watch/warning section in TCM	Advisory Code	Craig, Mike	2/10: Some progress - word wrapping works OK on warning, but not rest of TCM - work with TCM warning file only and then paste in?	Low	Medium	High	100%	
				New version of Kwrite requires OS upgrade to RHEL 6.8, which is unlikely to be					

New Features and Bug Fixes for 2016

- Mixed-case advisory products for CPHC
- Preliminary/climatological predictions of wind radii (PRERCL) and track/intensity (PRETCM) for CPHC
- Add storm development type at end of TC Vitals files (used to initialize HWRF/GFS) to prevent re-bogus of a storm already spun up
- Ingest new forecast trackers/aids from ECMWF, UK Met Office, NRL, JMA (now 343 forecast aids in techlist)
- Fix bug that posts preliminary WSP graphics to NHC web page prior to transmission of forecast advisory (TCM)
- Create Best Track GIS products even when there are no wind radii or forecasts – prevents "blank spots" in the NHC web site, which implies to users that an error has occurred
- Fix bug caused by empty warning files
- Improve automatic word wrapping of watch/warning section in forecast advisory (TCM)
- Implement capability to run WSPs early on WCOSS supercomputing cluster
- Began work to enable the creation and issuance of "genesis" advisory products for potential tropical cyclones (PTCs) in 2017
- Many additional enhancements delayed one year because of 64-bit upgrade of XVT toolkit for GUI (NRL)

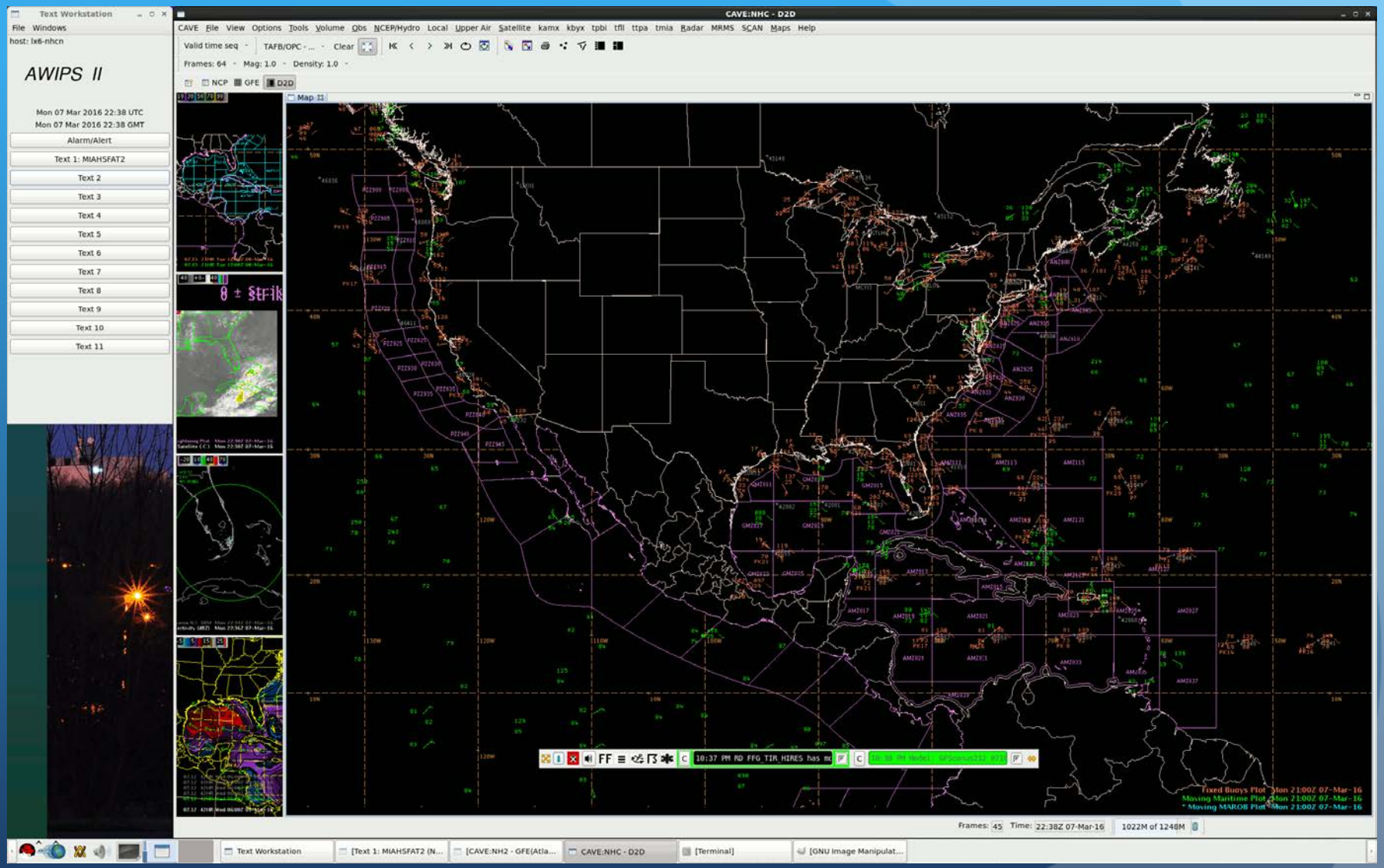
ATCF Transition to AWIPS II

- ATCF has grown "organically" over the past 30 years:
  - More and more TC forecasting capabilities from different centers (NHC, CPHC, JTWC) incorporated into application
  - ATCF now employs 6 different scripting languages (csh, sh, ksh, bash, perl, python),
  - Minimal coding standards (Fortran 66, 77, 90/95, 2003/2008/2013), lack of modularity
  - Different compilers used (PGI 2008-2014 pgcc/pgf77/pgf90, GNU gcc/gfortran, Intel 2016 icc/ifort)
  - No version control system or back-ups until recently
  - Huge increase in data flow, from plethora of sources (recently centralized on "opah" server at NCEP)
  - Security restrictions at NCEP/DoD complicate access to servers and supercomputers
- Result: ATCF has become a monster "mash-up" project, almost impossible to manage, even for teams of dedicated developers

ATCF Transition to AWIPS II

- Solution: Merge ATCF into AWIPS II
  - Functional requirements specification document written and approved by NCO (NCEP Computer Operations) on Oct. 30, 2015
  - NHC requirements: no radical changes in forecaster workflow, retain ability to make rapid changes to source code and system functionality
  - Project will be managed by David Plummer, National Centers AWIPS Team Lead
  - Initial funding allocated, contractors (software developers) hired
  - High-level scoping/development plan due at the end of this fiscal year (Sept. 2016)
  - At least a 5-year project
  - NHC Hurricane Specialists and TSB developers will provide input and oversight
  - Monthly meetings between NCO and NHC now underway
  - Primary computer language: Java
  - Initial software development efforts will focus on ATCF decks database
  - ATCF will run in CAVE-D2D (Common AWIPS Visualization Environment – Display 2 Dimensions) GUI developed by Raytheon
  - Tech Support will be provided by Network Control Facility (NCF), just like AWIPS II

ATCF Transition to AWIPS II
CAVE-D2D Graphical User Interface



Thank you!

- NHC Senior Hurricane Specialist Dan Brown provided the forecaster workflow scenarios from his ATCF instructional course entitled "Forecast Scenario: Filling the Role of NHC Forecasters"

References:

- Miller, R.J., A.J. Schrader, C.R. Sampson, and T.L. Tsui, 1990: The Automated Tropical Cyclone Forecasting System (ATCF), *Weather and Forecasting,* **5**, 653-660.
- Sampson, C.R. and A.J. Schrader, 2000: The Automated Tropical Cyclone Forecasting System (Version 3.2), *BAMS*, **81**, 1231-1240.
- NRL users manual for the ATCF:

  http://www.nrlmry.navy.mil/atcf_web/docs/pdf/ATCF_User%27s_Manual_10192010.pdf
- NRL documentation on the ATCF:

  http://www.nrlmry.navy.mil/atcf_web/docs/