

# NWS and Navy Plans for the ATCF and AWIPS2

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HFIP Annual Review Meeting  
8-9 November 2017, Miami, FL

# Outline

- ATCF
  - Brief history
  - 2017 improvements
  - Future outlook
- N-AWIPS and AWIPS2
  - NHC current usage and future plans
  - Navy plans
- ATCF in AWIPS2
  - Current transition efforts
  - Future plans

# Brief History of the Automated Tropical Cyclone Forecasting (ATCF) System

- **Prior to 1988:** Motivated by cumbersome, manually intensive process to generate TC forecast products
- **1986:** ATCF software development began at NRLMRY
- **1988:** Delivered to JTWC in Guam. Ran on IBM-AT class personal computer under MS-DOS operating system
- **Early 1990s:** NHC adopted and modified ATCF for its operational needs
- **1996:** Transitioned from MS-DOS to Unix
  - C, FORTRAN, XVT toolkit, Unix/Python/Perl scripts
  - NRL manages C & GUI code, NHC manages site-specific “standalone” code
- **Many iterative upgrades since 1996:** Annual meeting of developers - make decisions whether to implement new features requested by TC forecasters (requirements lists).
  - Partial support from HFIP

# NHC/NRL ATCF Improvements for 2017

- 8 slots for running HWRF/HMON models (5 for NHC)
- Changes to NHC consensus aids (GFDL removed)
- Ability to write advisories on Potential TCs
- New NHC Public Information Statement (PNS) generator available under "Messages" menu
- Headers for NHC mixed-case text products in proper format
- Advisory Composition now remembers when user selected "Last Advisory"

# NRL ATCF® Development

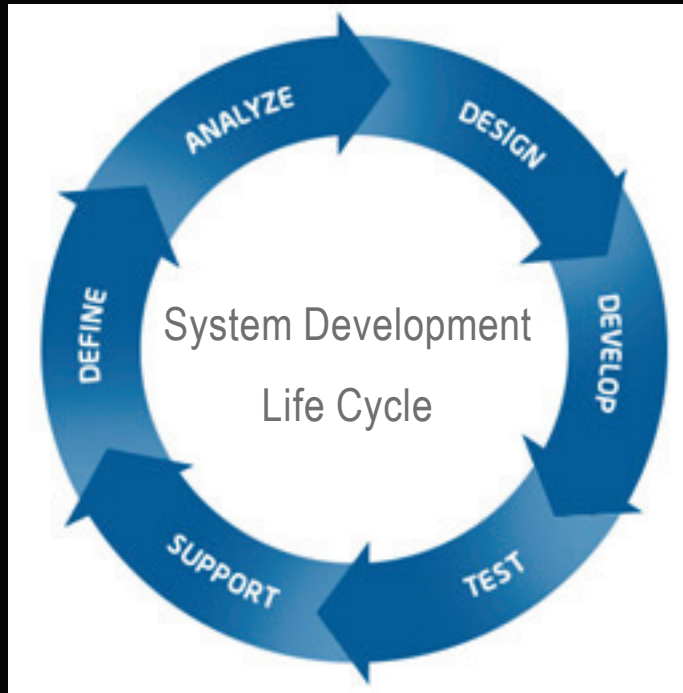
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# ATCF® DEVELOPMENT

Ticketing - Trac

CM - Subversion



## HFIP Funding to NRL

FY14 - 100K

FY15 - 0K

FY16 - 25K

FY17 - 75K

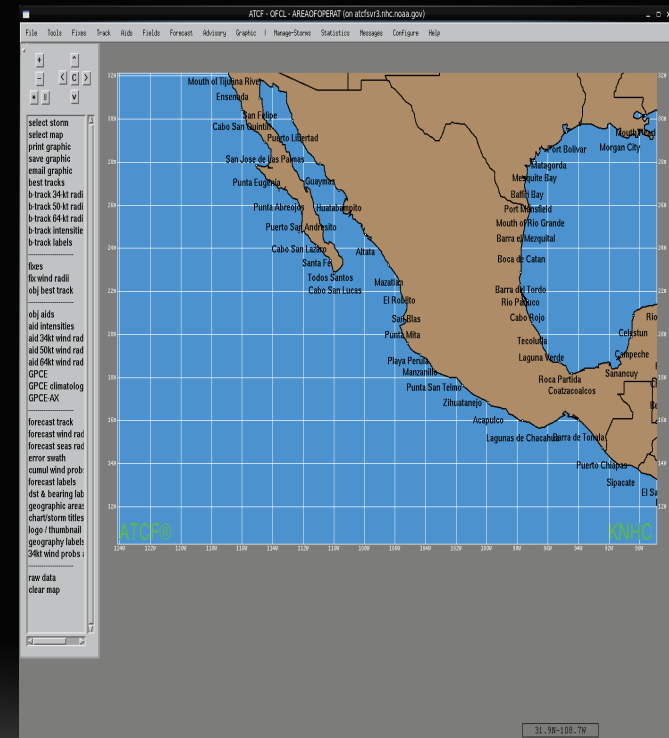
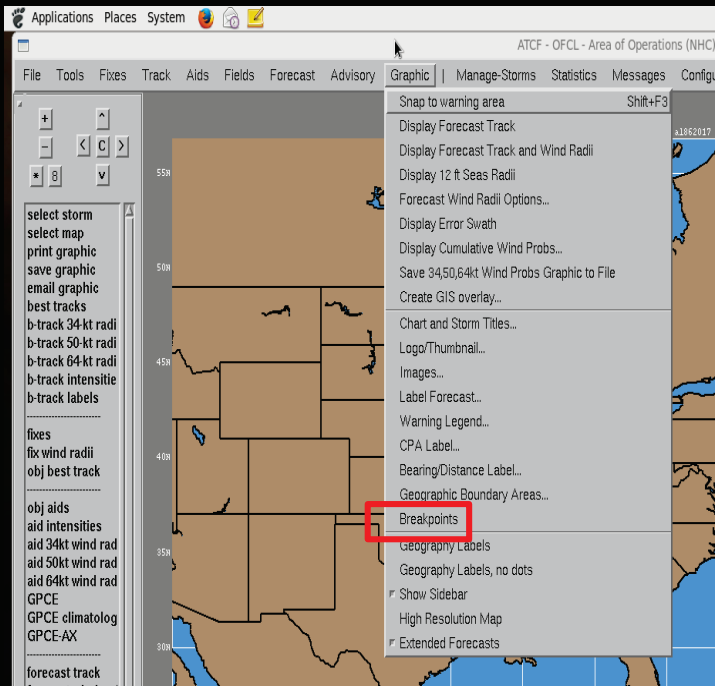
ATCF 5.8.3

~25 NHC specific tasks

Few examples follow

# TC Watch/Warning Breakpoints

Coastal watch/warning breakpoints can now be displayed on the ATCF:  
Graphic -> Breakpoints



# Shortcuts in Forecast Dialog Boxes

**Forecast Track Dialog - TEST al872017 (on atcfsvr x)**

- Tau Labels
- Complete Tracks
- Consensus Aids
- GPCE Prob.
- GPCE Climatology
- GPCE-AX

Forecast:  Forecast,  Delete

TAU: 12, 24, 36, 48, 60, 72, 96, 120, 144, 168

Other Aids... Priority CPA's...

TAU (hours)	LAT.	LON.	DIR.	SPEED (knots)
0	35.0N	60.0W	42	12
3	35.7N	58.4W	61	30
12	37.7N	53.3W	62	30
24	40.4N	46.6W	60	29
36	43.1N	39.9W	59	28
48	45.8N	33.2W	58	27
72	51.3N	19.8W	53	26
96	54.8N	5.3E	67	38
120	42.5N	3.2W	207	34

Help Apply **OK** Cancel **>**

**Intensity Forecast - TEST al872017 (on atcfsvr3.nhc.noaa.gov)**

Intensity Forecast

	00h	12h	24h	36h	48h	60h	72h	96h	120h	144h	168h
Intensity	30	30	30	30	30	0	30	30	30	0	0
Gusts	40	40	40	40	40	0	40	40	40	0	0
Development	TD	TD	TD	TD	TD	DB	TD	TD	TD	DB	DB
RI Prob	0	0	0	0	0	0	0	0	0	0	0

View Intensity Graph / Make Forecast... Use Consensus

Intensity Guidance

AID	12h	24h	36h	48h	60h	72h	96h	120h	144h	168h
OFCL	30	30	30	30	0	30	30	30	0	0

Rapid Intensification Guidance

AID	12h	24h	36h	48h	60h	72h	96h	120h	144h	168h

Help **OK** Cancel **<** **>**

**Forecast Wind Radii Dialog - TEST al872017 (on atcfsvr3.nhc.noaa.gov)**

TAU 12

	NE (nm)	SE (nm)	SW (nm)	NW (nm)	TAU:
34 kt	0	0	0	0	12
50 kt	0	0	0	0	24
64 kt	0	0	0	0	36
					48
					60
					72
					86
					96
					120

Use previous TAU Delete Radii Display Options... Use DRCL Use RVCN Use RVCN - All Taus

Graph/Select radii (radial graph) 34 kt... 50 kt... 64 kt...

Wind Radii Guidance for TAU 12

Tech	TAU	V-Max (kts)	34 knot radii (nm)	50 knot radii (nm)	64 knot radii (nm)
	0	30			
	3	30			
	12	30			
	24	30			
	36	30			
	48	30			
	72	30			
	96	30			

Current Forecast

TAU	V-Max (kts)	34 knot radii (nm)	50 knot radii (nm)	64 knot radii (nm)
0	30			
3	30			
12	30			
24	30			
36	30			
48	30			
72	30			
96	30			

Help Apply **OK** Cancel **<**



# Wind Radii Consensus Buttons

TAU 12

NE (nm) SE (nm) SW (nm) NW (nm) TAU: 0

34 kt: circle quad 170 120 130 180 12

50 kt: circle quad 95 85 80 95 24

64 kt: circle quad 55 50 50 55 36

72 48

60

72

86

120

Use previous TAU Use TAU 0 - all TAUs Delete Radii

Use DRCL - this TAU Use DRCL - all TAUs Display Options...

Use Con - this TAU Use Con - all TAUs

Graph/Select radii (radial graph) 34 kt ... 50 kt ... 64 kt ...

Max Wind 140 kts  
Dir: 283  
Spd: 9 kts

Wind Radii Guidance for TAU 12

Tech	TAU	V-Max (kts)	34 knot radii (nm)				50 knot radii (nm)				64 knot radii (nm)			
EPK	12	64	204	187	167	135	59	0	0	55	33	0	0	0
AYNI	12	133	205	189	162	185	98	76	80	100	50	50	49	52
AYNO	12	80	271	169	161	235	85	77	78	100	63	60	61	69
COIC	12	119	278	277	243	269	140	179	70	129	73	56	48	81
COII	12	130	112	187	168	100	101	79	98	95	53	52	55	56
CFCI	12	123	186	97	78	105	68	66	78	64	43	44	50	45
CFCK	12	104	292	269	221	260	180	153	159	144	117	102	87	91

Current Forecast

TAU	V-Max (kts)	34 knot radii (nm)				50 knot radii (nm)				64 knot radii (nm)			
0	135	145	115	115	145	95	75	75	95	55	45	45	55
12	140	170	120	130	180	95	85	80	95	55	50	50	55
24	145	205	150	155	215	105	95	85	100	65	60	60	65
36	140	250	205	175	260	115	110	100	105	70	65	70	75
48	135	310	255	215	315	135	120	105	125	75	70	75	80
72	125	515	390	285	470	170	140	115	175	95	85	75	100
96	110	470	390	335	370	190	120	110	175	85	80	75	80
120	95	370	355	300	295	175	120	125	150	100	90	60	135

Help Apply OK Cancel

# FY-18 and Beyond

## ~13 New NHC-specific requirements

Improve performance of ATCF forecast dialog and display GUIs for systems with large a-decks - specifically wind radii forecast dialog GUI, polar wind radii forecast dialogs, and graph aid intensity vs. time for multiple DTGs.

Add “Storm State” selections for “Tropical Cyclone” and “Potential Tropical Cyclone” to “Forecast Type” menu in Advisory Composition GUI and display them when selected in the TCM and TCD.

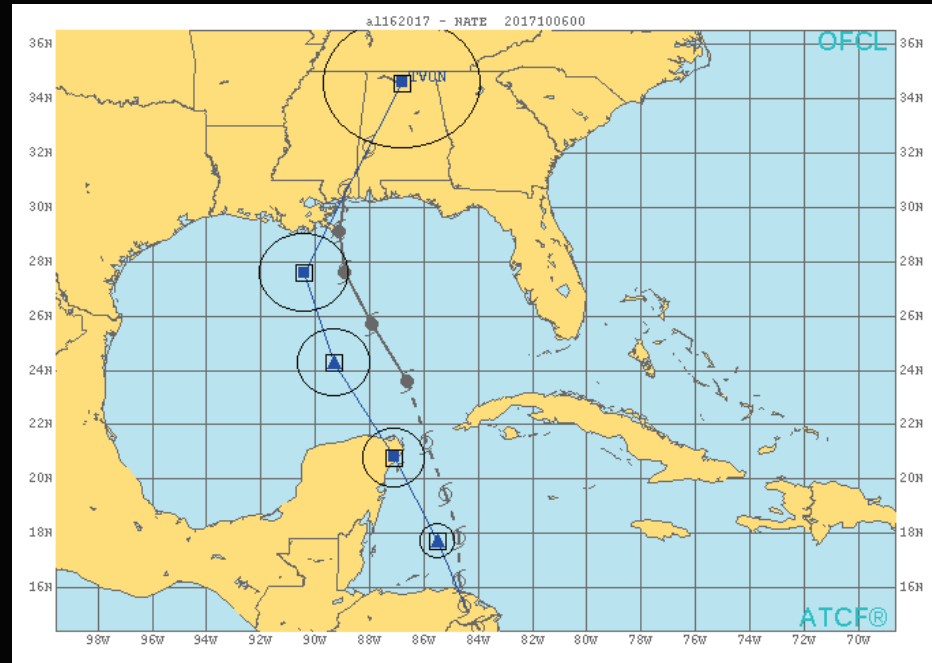
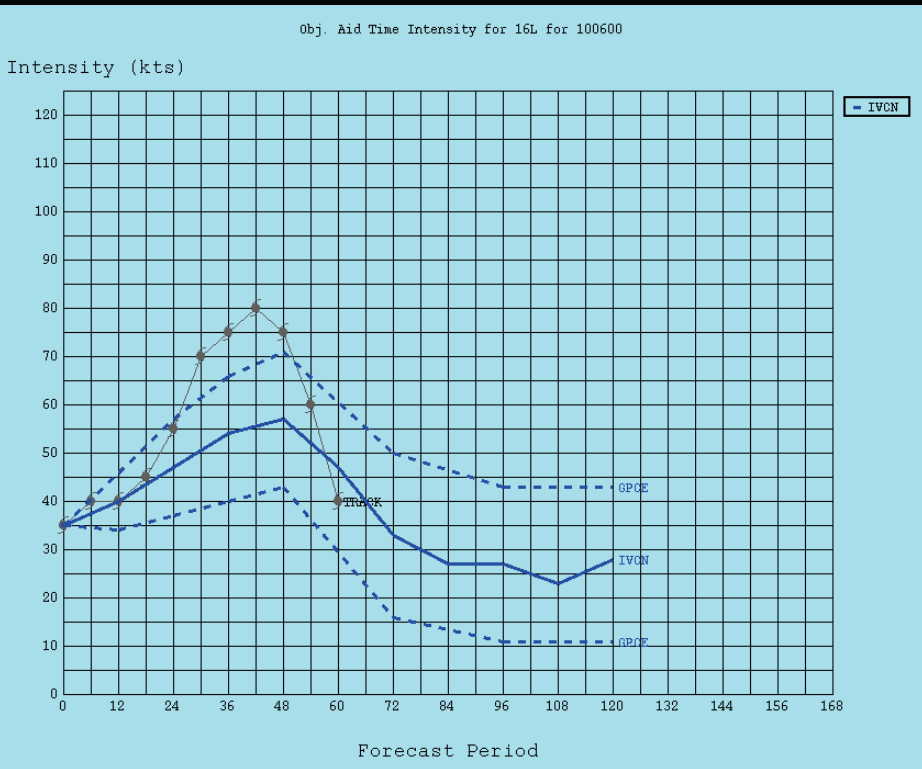
Make any necessary changes to the f-deck format and the vortex fix entry GUI to account for new vortex message format.

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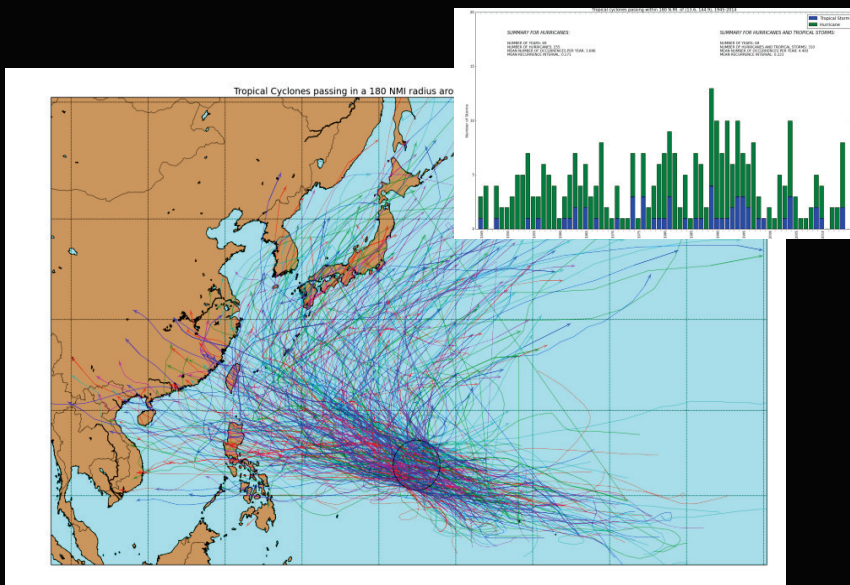
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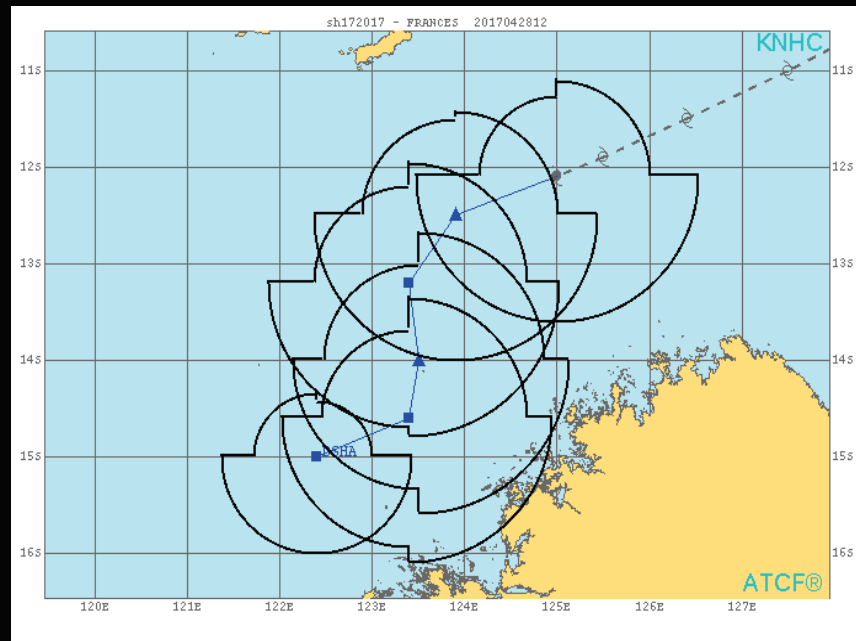
# Track and Intensity GPCE (Not updated since 2015)



# Climatology (HURISK-like) and SHIPS Wind Radii



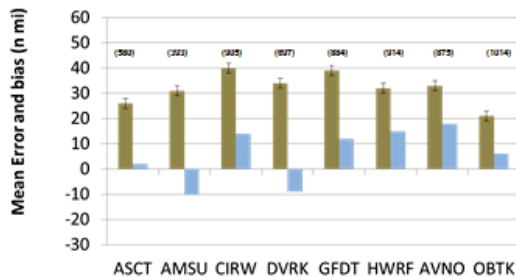
ATCF Climatology (NRL)



SHIPS Wind Radii (CIRA)

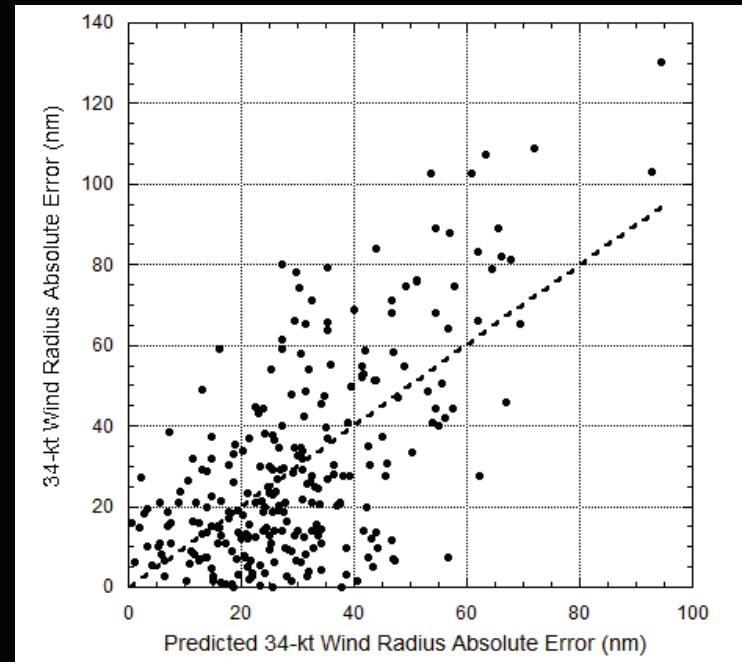
# Wind Radii Guidance

## Objective R34 Performance



34-kt wind radii fix mean errors (brown) and biases (blue) relative to JTWC 2014-2016 besttracks coincident with ASCT. Objective besttrack (OBTK) give reasonable estimates. Standard error is shown as black bars on means.

R34, R50, R64 estimates  
(NRL and CIRA)



R34 GPCE for RVCN (NRL)

# NHC NAWIPS and AWIPS2 usage

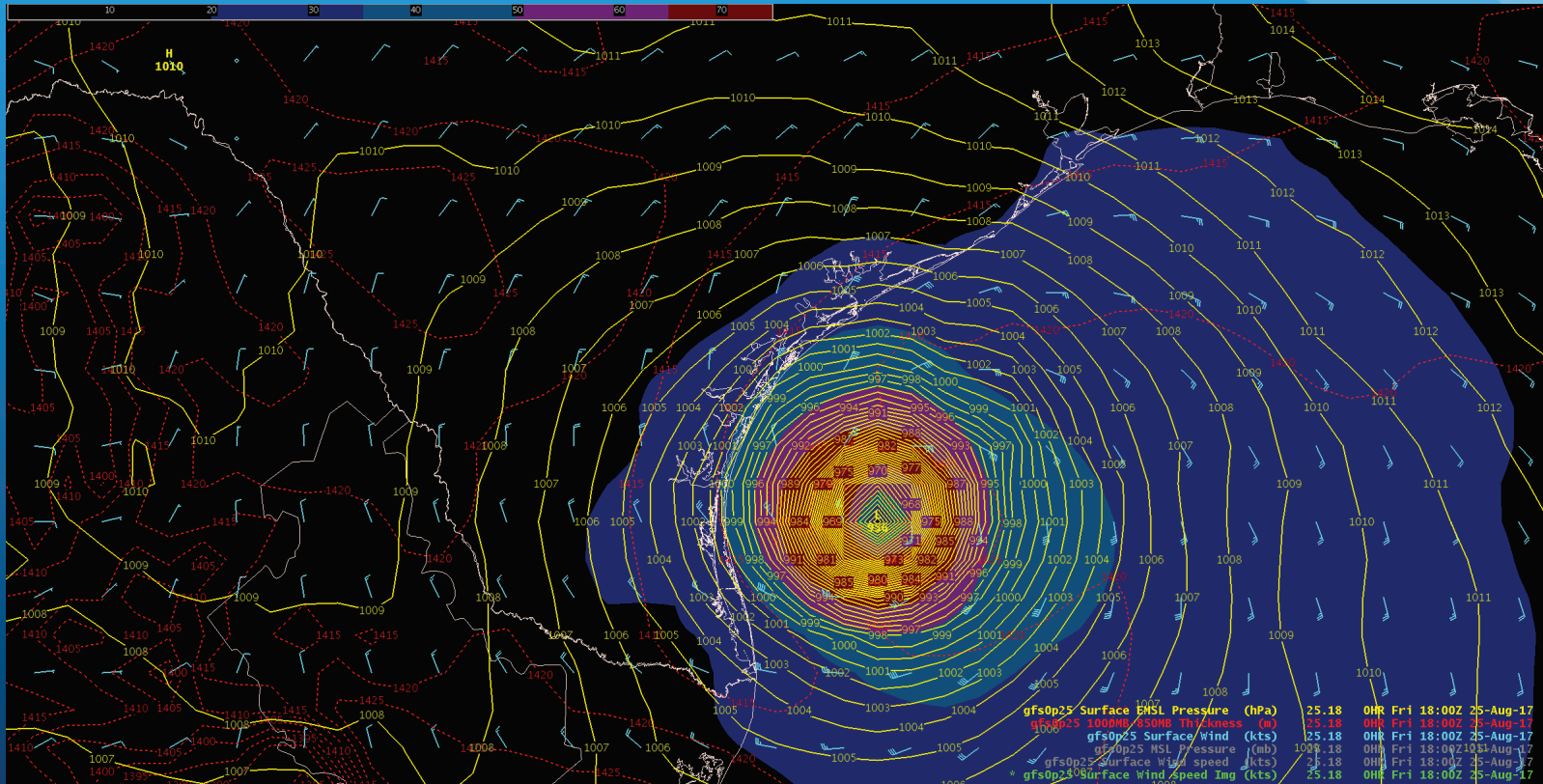
- NAWIPS and AWIPS2 jointly used to view all gridded model, satellite, surface observations and radar data
- NAWIPS PGEN used to create TAFB surface analysis maps, and Graphical TWO
- NHC uses NAWIPS to view legacy GOES13 and GOES15 imagery
- AWIPS2/GFE creates all storm surge watches and warnings and gridded forecasts to blend with WFO's forecasts
- NAWIPS used for creation of coastal tropical cyclone wind based watches and warnings for graphics
- AWIPS2 preferred for viewing radar and GOES-16 data

# NHC NAWIPS to AWIPS2 Transition

- ~95 percent metadata transition complete
- AWIPS2/D2D much quicker load times than NAWIPS
- AWIPS2/D2D color curves and contours still need work to match NAWIPS
- PGEN now has ability to create all legacy NAWIPS products in AWIPS2
- Still uncertainty to which AWIPS2 perspective, NCP or D2D, will become the preferred viewing option for NHC moving forward

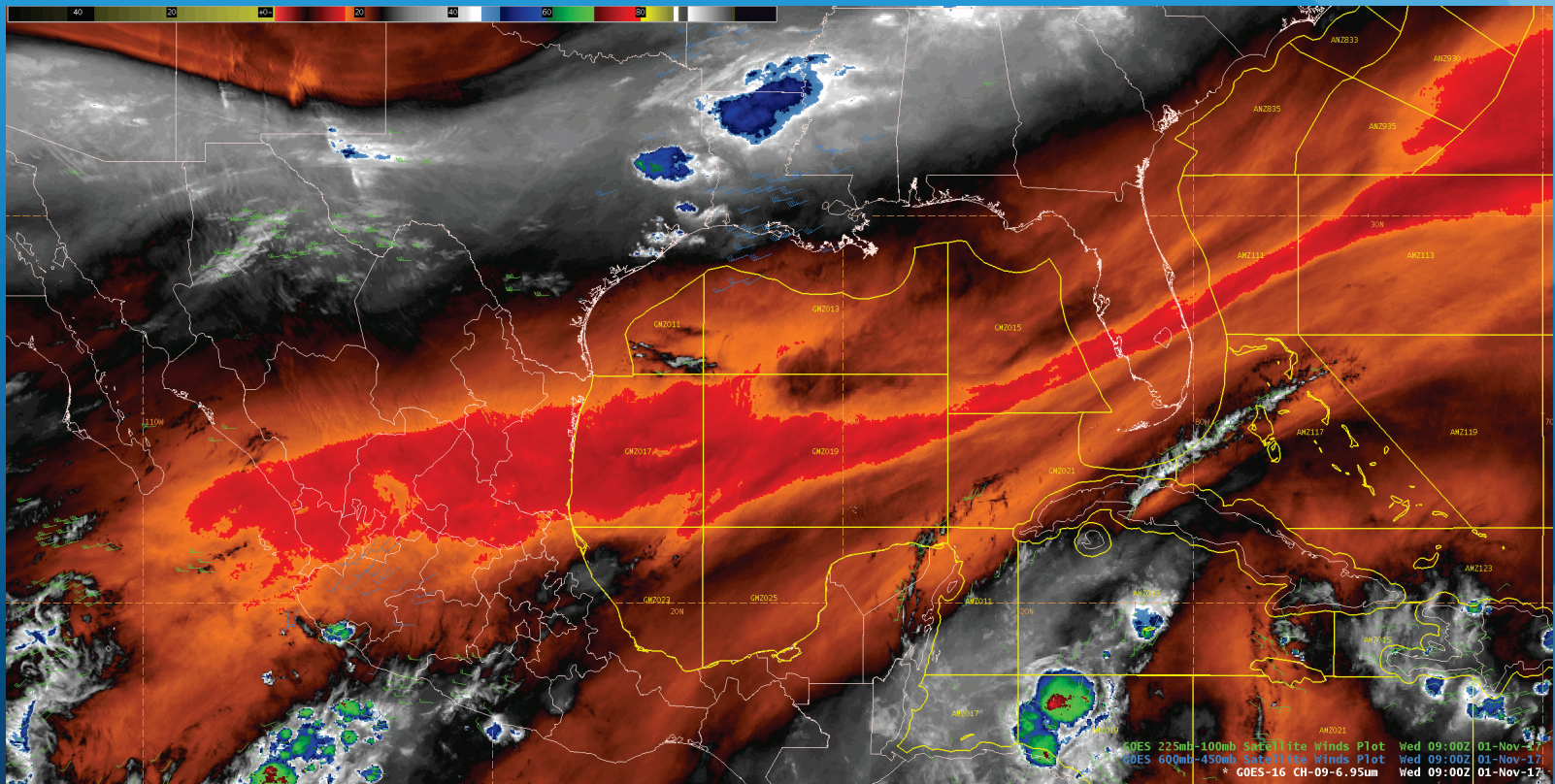


# AWIPS2 at NHC- GFS Harvey





# AWIPS2 at NHC - GOES 16 WV



# Navy Plans for AWIPS2

- Being implemented at JTWC, FWC-San Diego, FWC-Norfolk
  - FWC-Norfolk leading
- Awaiting authority to operate
  - IT security issues need to be addressed
- Implementation ~1 year away
- NRL has exploratory project to put ship routes and ship-relevant products in AWIPS2

## ATCF Transition to AWIPS2

- NRL supported ATCF *remains* the primary tool for tropical cyclone product generation at NHC, CPHC and JTWC
- Factors affecting ATCF usage by NWS
  - Consolidation of product generation systems
  - Consistency between NCEP and WFOs
  - Long-term maintenance and support
  - Ever increasing IT security constraints
- Pilot project to transition some ATCF capabilities initiated in 2014
  - Initial support from HFIP
  - Support transitioning to the AWIPS program office in FY18

# ATCF Transition to AWIPS2

- Progress so far: Import/Export of A/B/E/F decks, GUI development, track plots
- Primary computer language: Java
- ATCF will run in CAVE-D2D (Common AWIPS Visualization Environment - Display 2 Dimensions) GUI developed by Raytheon
- NHC requirements: no radical changes in forecaster workflow, ability to make rapid changes to source code and system functionality
- Functional requirements specification document written and approved by NCO (NCEP Computer Operations) on Oct. 30, 2015

## ATCF Transition to AWIPS2

- Project managed by David Plummer, National Centers' AWIPS Team Lead
  - Single contractor effort since 2015
  - NHC Hurricane Specialists and TSB developers provide input and oversight
  - Monthly meetings between NCO and NHC
- Transitioning to APO in 2018
- Future Tech Support provided by AWIPS Network Control Facility (NCF)
- Much more work to be done, 4 to 5 year effort

# ATCF Transition to AWIPS2 CAVE-NCP Graphical User Interface

**ATCF**

Select profile:  
 CWL  
 Ensemble  
 ESB1200z

Save New Profile...  
 Delete Profile...

Select DTG(s):  
 2016100506  
 2016100512  
 2016100518  
 2016100600  
 2016100606  
 2016100612  
 2016100618

Select Objective Aids:  
 TCON Consensus of all: AVN  
 TCCE Consensus of all: AVN  
 TCOA Consensus of all: AVN  
 TCCN Corrected version of  
 ICON Consensus of all: DSH  
 TVCN Consensus of >=2: AVN  
 TVCE Consensus of >=2: AVN  
 TVCA Consensus of >=2: AVN  
 TVCC Corrected version of  
 GFEX Consensus of AVNI and  
 TVCX Consensus of >=2: AVN

Partial Aid Display  
 Display to TAU:  
 Full  
 12  
 24  
 36  
 48  
 60  
 72  
 96  
 120  
 144  
 168

-48 -36  
 -24 -18  
 -12 -6

Latest DTG

Toggle Bold Selected Aids  
 Display aid intensities  
 GPCE  
 GPCE Climatology  
 GPCE-AX  
 34 kt aid wind radii  
 50 kt aid wind radii  
 64 kt aid wind radii  
 Bold Lines (all aids)  
 Colors by intensity (TD, TS and TY/HU)  
 Colors by Saffir-Simpson scale

Clear Aids Display  
 Different Storm...  
 PrintnSave

Help APPLY OK Cancel

**AWIPS II**

Select profile:  
 CWL  
 DR  
 Ensemble  
 ESB1200z

Save New Profile...  
 Delete Profile...

Select DTG(s):  
 2016100412  
 2017100418  
 2017100500  
 2017100506  
 2017100512  
 2017100518  
 2017100600

Select Objective Aids:  
 CARQ Combined ARQ Position  
 OFCL NHC official forecast  
 OFCI NHC official forecast (Interpolated 06 h  
 OCD5 Combination of CLP5 and Decay-SHIF  
 XTRP Extrapolation using past 12-hr motion  
 CLP5 CLImatology-PERsistence model 5-day  
 TCLP Trajectory CLIPER model 7-day  
 TABD Trajectory and Beta Model from GFS, d  
 TABM Trajectory and Beta Model from GFS, n  
 TABS Trajectory and Beta Model from GFS, s  
 HWRF HWRF model

Partial Aid Display  
 Display to TAU:  
 full  
 12  
 24  
 36  
 48  
 60  
 72  
 96  
 120  
 144  
 168

DTG vs. Latest  
 -48 -36  
 -24 -18  
 -12 -06  
 Latest DTG

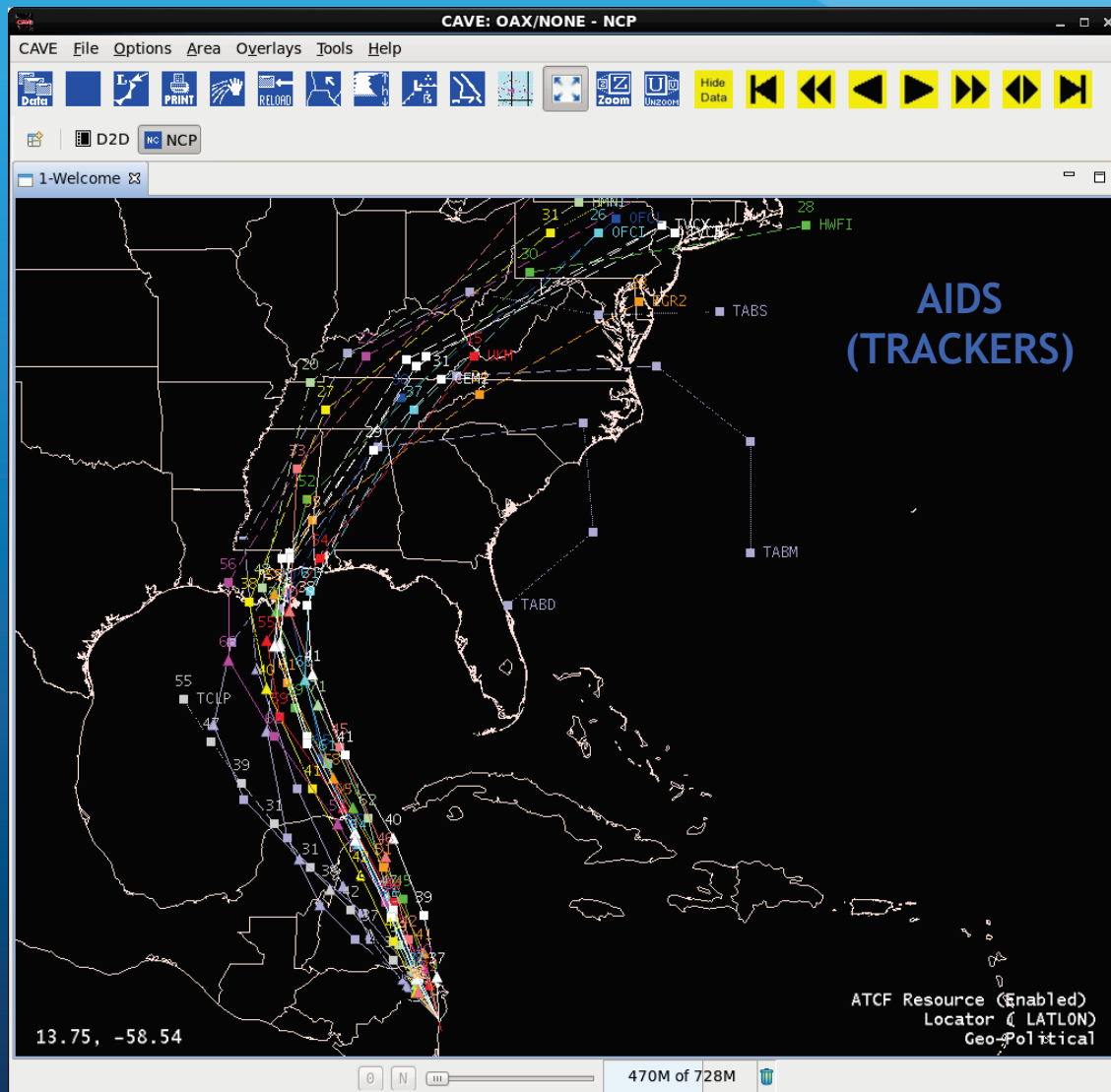
Clear  
 Select Defaults  
 Select All

Display Options  
 Toggle Bold Selected Aids  
 Display Aid Intensities  
 GPCE  
 GPCE Climatology  
 GPCE-AX  
 34 kt aid wind radii  
 50 kt aid wind radii  
 64 kt aid wind radii  
 Bold Lines (all aids)  
 Colors by intensity (TD, TS, and TY/HU)  
 Colors by Saffir-Simpson scale

Clear Aids Display  
 Different Storm...  
 PrintnSave

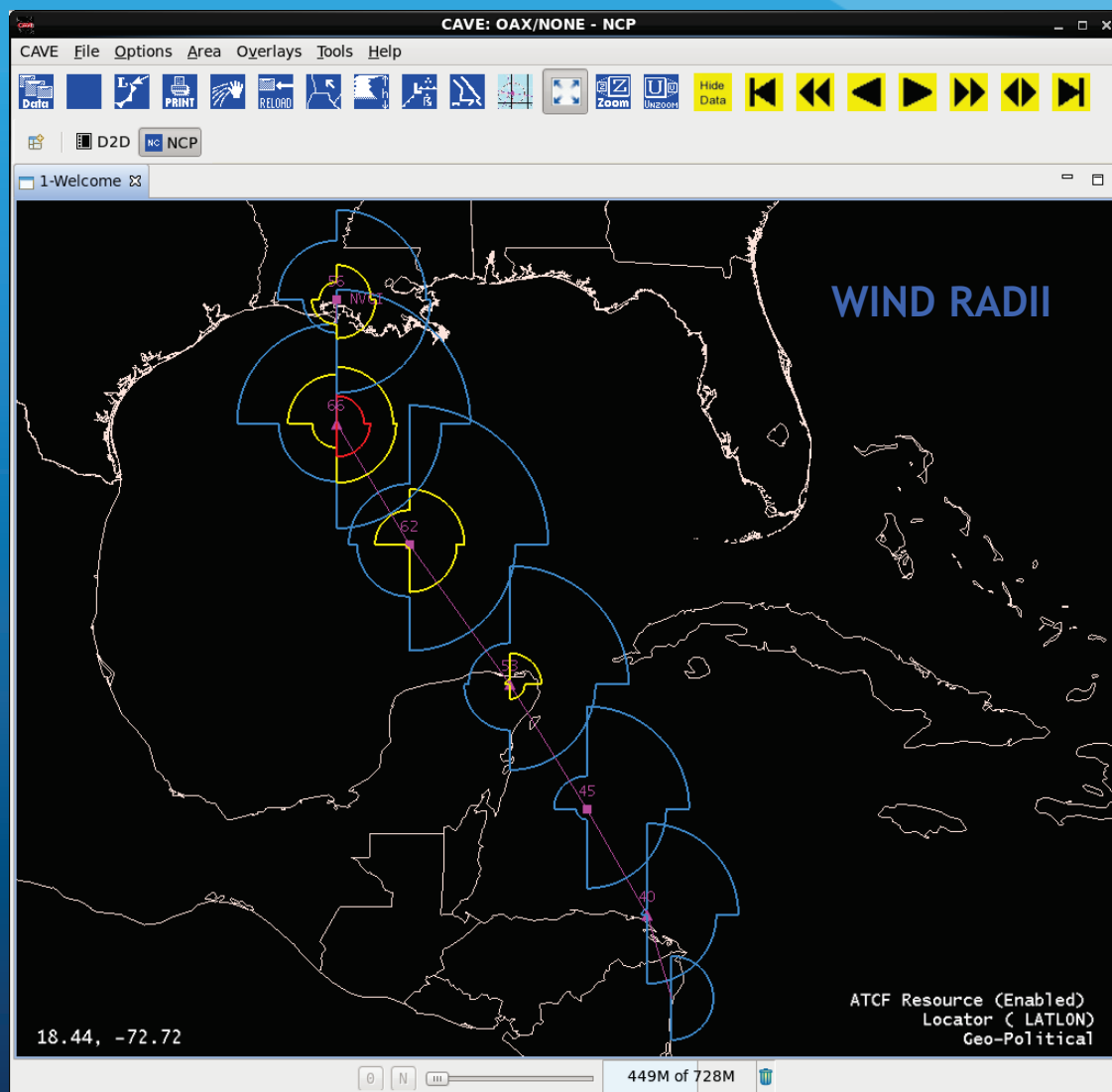
APPLY OK Cancel

# ATCF Transition to AWIPS2 CAVE-NCP Graphical User Interface





# ATCF Transition to AWIPS2 CAVE-NCP Graphical User Interface





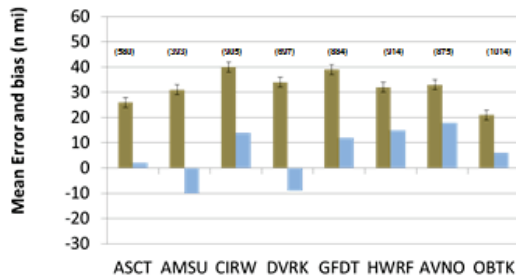
# Summary and Conclusions

- ATCF will remain the primary tool for NHC, CPHC and JTWC tropical cyclone product generation for the next several years
- NWS is moving towards common display and product generation system
  - N-AWIPS transition to AWIPS2
- ATCF capabilities in AWIPS2 development will migrate to AWIPS Program Office in 2018

# Extras

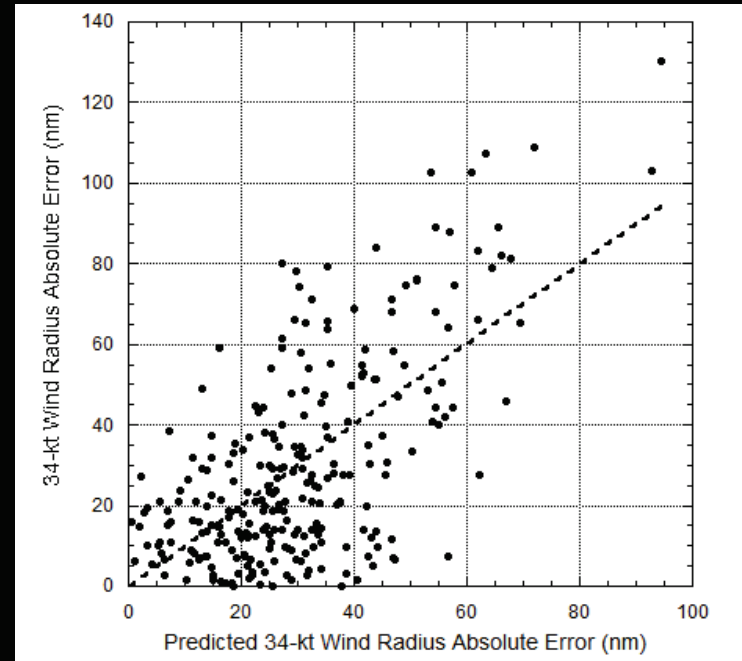
# Implemented at JTWC

## Objective R34 Performance



34-kt wind radii fix mean errors (brown) and biases (blue) relative to JTWC 2014-2016 besttracks coincident with ASCT. Objective besttrack (OBTK) give reasonable estimates. Standard error is shown as black bars on means.

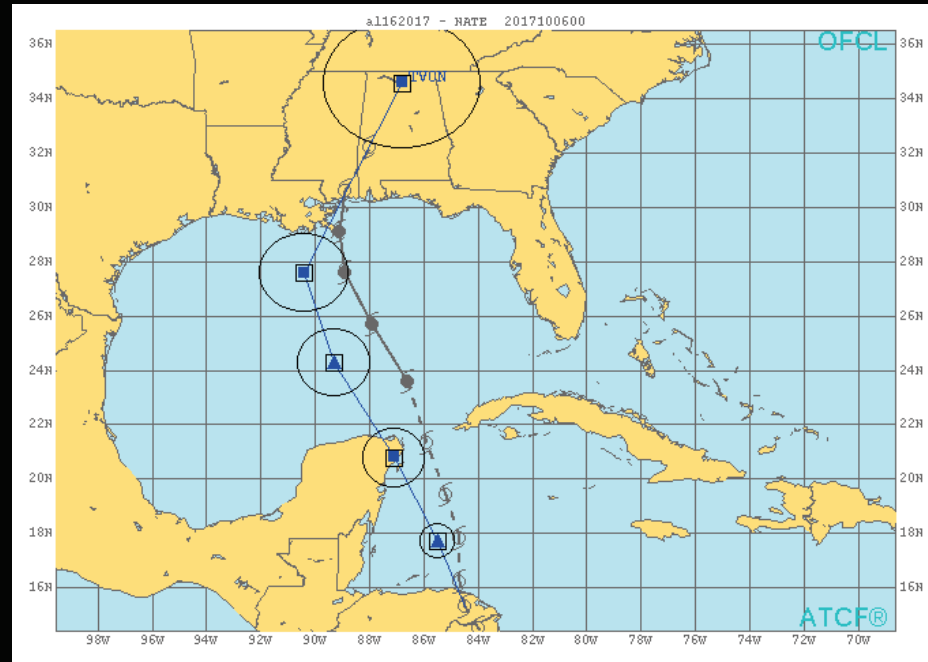
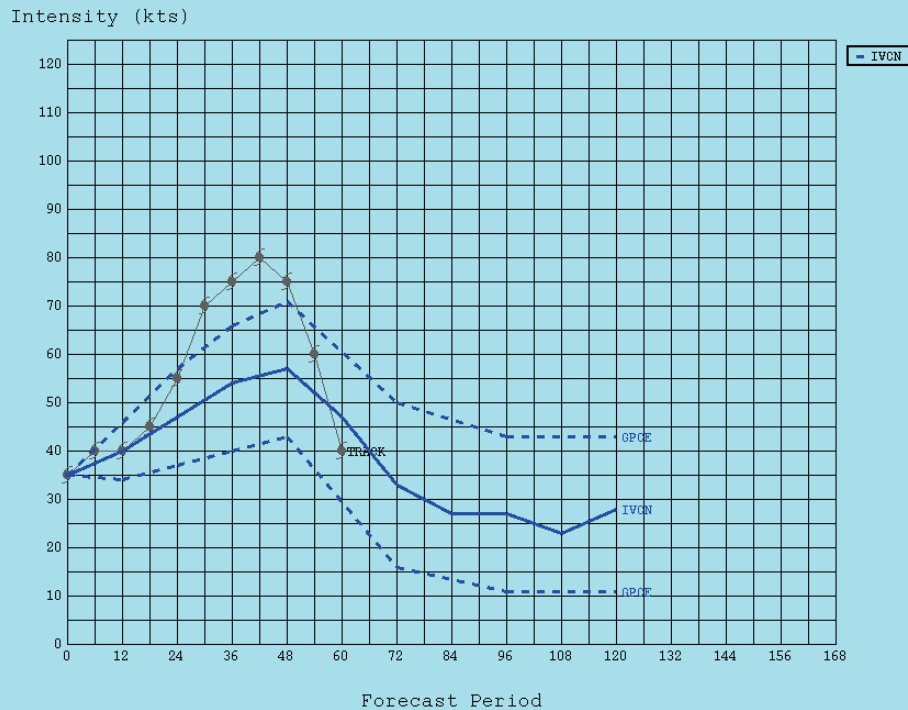
R34, R50, R64 estimates  
(NRL and CIRA)



R34 GPCE for RVCN (NRL)

# Track and Intensity GPCE not updated since 2015

Obj. Aid Time Intensity for 16L for 100600



# NHC Forecast Cycle

<b>Time (HR:MIN)</b>	<b>Event</b>
<b>00:00</b>	<b>Issue Tropical Weather Outlook, Issue Intermediate Public Advisory (if necessary)</b>
<b>00:45</b>	<b>Receive satellite fix data, plot fixes, determine initial location, intensity, size</b>
<b>01:00</b>	<b>Initialize models, send model guidance job to supercomputer</b>
<b>01:10</b>	<b>Receive model guidance and <i>prepare forecast</i> (track, intensity, wind radii)</b>
<b>02:00</b>	<b>NWS / DOD hotline coordination – coordinate US/international watches/warnings, rainfall, surge, other hazards. Prepare products.</b>
<b>03:00</b>	<b>Advisory deadline</b>
<b>03:15</b>	<b>FEMA conference call</b>
<b>06:00</b>	<b>New cycle begins</b>

# ATCF Capabilities and Usage

- **Purpose:** a dedicated, interactive software application to automate and streamline the monitoring, tracking and forecasting of tropical cyclones (TC).
- 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.
- 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

# Up to 8 HWRF Slots

The screenshot shows a window titled "NWP Model Priority - COLEMAN al842017 (on atcfsvr3.nhc.noaa.gov)". The window contains a list of model runs with columns for name, region, grid size, and priority. Below the list is a "Priority" dropdown menu with the value "8" selected. At the bottom are "Help", "OK", and "Cancel" buttons.

Model Name	Region	Grid Size	Priority
TWENTY-ONE	Northeast Pacific	86 E 16	TD 2016080412 9999999999
TEST	Northeast Pacific	87 E 16	TD 2016080312 9999999999
FOURTEEN	North Atlantic	14 L 17	TD 2017092706 9999999999
CHARLEY	North Atlantic	73 L 17	HU 2017081218 9999999999
CAROLINE	North Atlantic	80 L 17	HU 2017071006 9999999999
TEST	North Atlantic	81 L 17	TD 2017032012 9999999999
TEST	North Atlantic	82 L 17	HU 2017011818 9999999999
GRISALES	North Atlantic	83 L 17	HU 2017042812 9999999999
COLEMAN	North Atlantic	84 L 17	HU 2017042812 9999999999
TEST	North Atlantic	86 L 17	TD 2017013012 9999999999
TEST	North Atlantic	87 L 17	TD 2017013118 9999999999
TEST	North Atlantic	88 L 17	TS 2017031512 9999999999
OPAL	North Atlantic	89 L 17	HU 2017100100 9999999999
CHARLES	Northeast Pacific	80 E 17	HU 2017050312 9999999999

You can now submit up to 8 HWRF runs from the ATCF, but NHC/CPHC can only use 5 slots unless we pre-coordinate with JTWC.

Note that HMON will only run for the first 5 slots.

Option under the Aids menu labeled "NWP Model Priority".



# NCEP/NHC ATCF Migration to AWIPS II Project Status as of 11 July 2017



## G Project Information and Highlights

Points of Contact: Carmen Jenkins, David Plummer

### Scope

- Migration of Automated Tropical Cyclone Forecast (ATCF) System application functionality to AWIPS II
  - Document functionality in legacy ATCF System
  - Implement same (or equivalent) functionality in AWIPS II
  - Center Specific Training
  - Migrating NHC/CPHC product production and dissemination to AWIPS II

### Success Criteria

- Operational production and dissemination of all NHC and CPHC products currently done in legacy ATCF migrated to AWIPS II.

### Not Included

- Migration of functionality currently in scripts and standalone programs external to the legacy ATCF application itself.

## G Issues and Risks

### Issues and Risks / Mitigations

- None.

NOAA  
Quad Chart

## G Scheduling

Milestone	Completion Date	Status
<b>Investigate ATCF legacy "File" Menu Entries</b>	May 12, 2017	Completed
Investigate Print and Graphics-related entries	Apr 21, 2017	Completed
Investigate Inter-site Data Exchange entries	May 5, 2017	Completed
<b>Develop "Fixes" Menu Entries</b>	Aug 18, 2017	On Track
Develop "Display Fixes..." entry and dialog	Jun 9, 2017	Completed
Develop "Display Fixes..." display resource	Jul 14, 2017	Delayed
Develop "Enter Fix Data..." entry and 8 type dialogs	Aug 14, 2017	Not Started
Develop "View Fix Data..." entry and dialog	Sep 18, 2017	Not Started
<b>Develop "Track Management" Menu Entries</b>	Nov 30, 2017	Not Started
<b>Develop "Objective Aids Management" Menu Entries</b>	Apr 6, 2018	Not Started
<b>All ATCF coding delivered to the AWIPS baseline</b>	Jun 30, 2019	On track

## G Resources

NCO/SDBBruce Hebbard (contractor): 0.9-1.0 FTE. (See Issues and Risks)  
NHC/TSB: Monica Bozeman, Mark DeMaria, Craig Mattocks

External Resources: NCO/RODO/APO resources assisting with certain issues (e.g., AWIPS networking and comms for data exchange with external ATCF partners such as JTWC)



# Thank you!

## 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](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/](http://www.nrlmry.navy.mil/atcf_web/docs/)