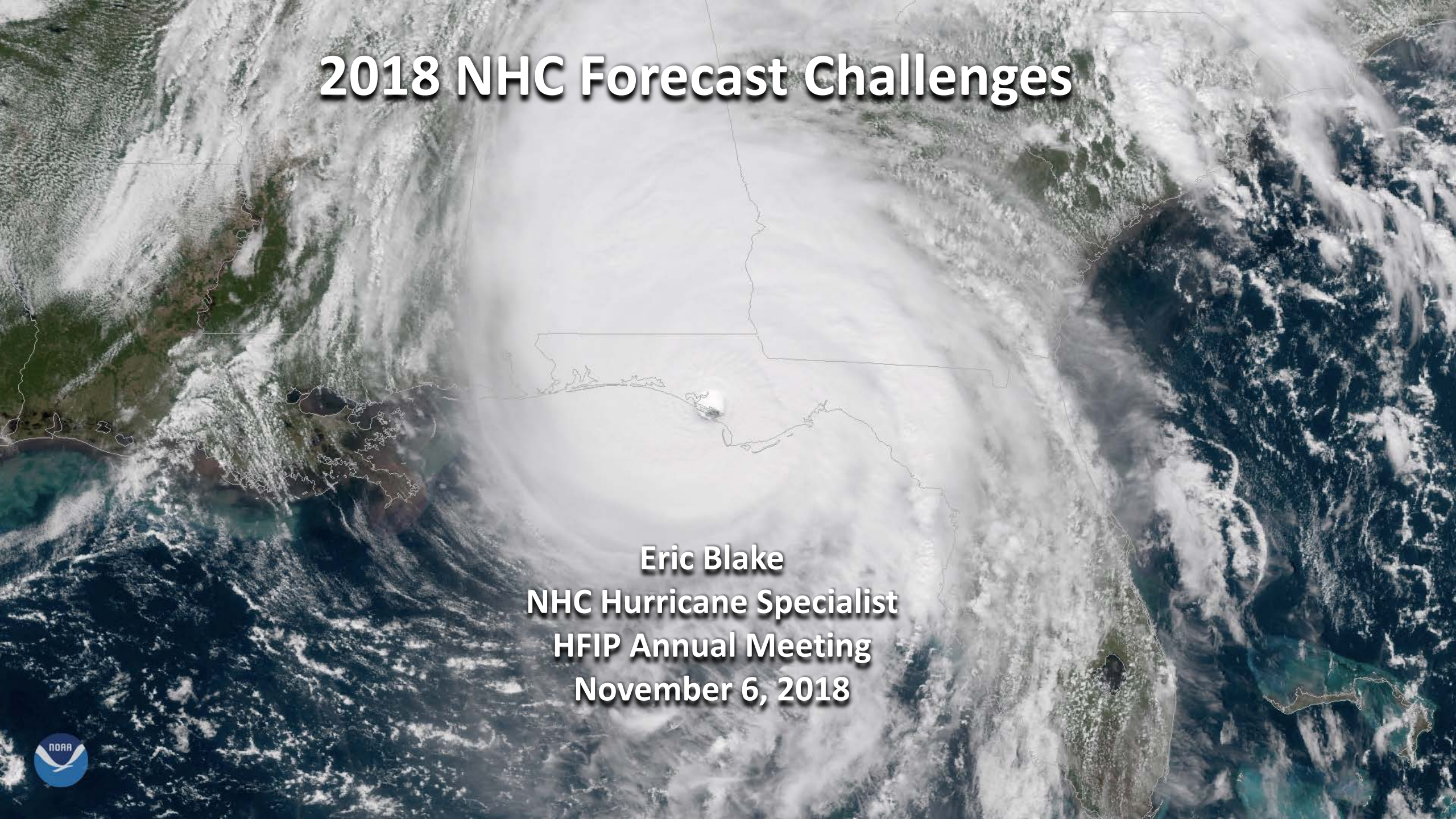
2018 NHC Forecast Challenges



Eric Blake
NHC Hurricane Specialist
HFIP Annual Meeting
November 6, 2018

Outline

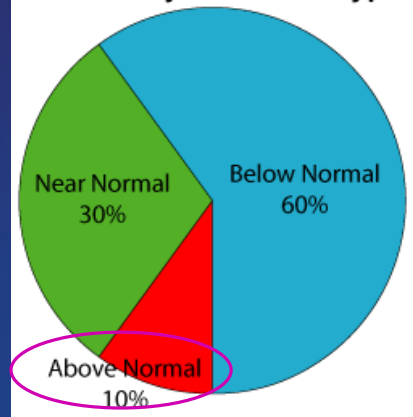
- Hurricane Florence track and intensity forecasts
- Hurricane Michael intensity problems
- Hurricane Leslie in eastern Atlantic
- Hurricane John in eastern Pacific
- Genesis challenges and other concerns

NOAA's 2018 Atlantic Hurricane Season Outlooks

Updated Outlook Issued 9 August

Below- or Near-Normal Season

Probability of Season Type



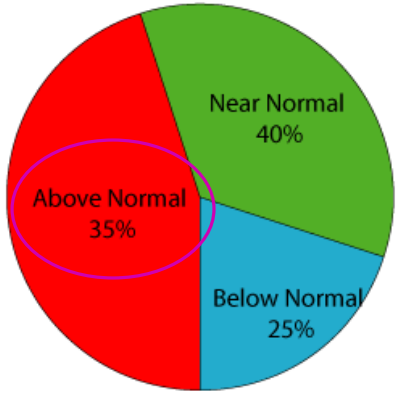
70% Probability For Each Range

August Update	
Named Storms	9-13
Hurricanes	4-7
Major Hurricanes	0-2
ACE (% median)	50-100%

Pre-Season Outlook Issued 24 May

Near- or Above-Normal Season

Probability of Season Type



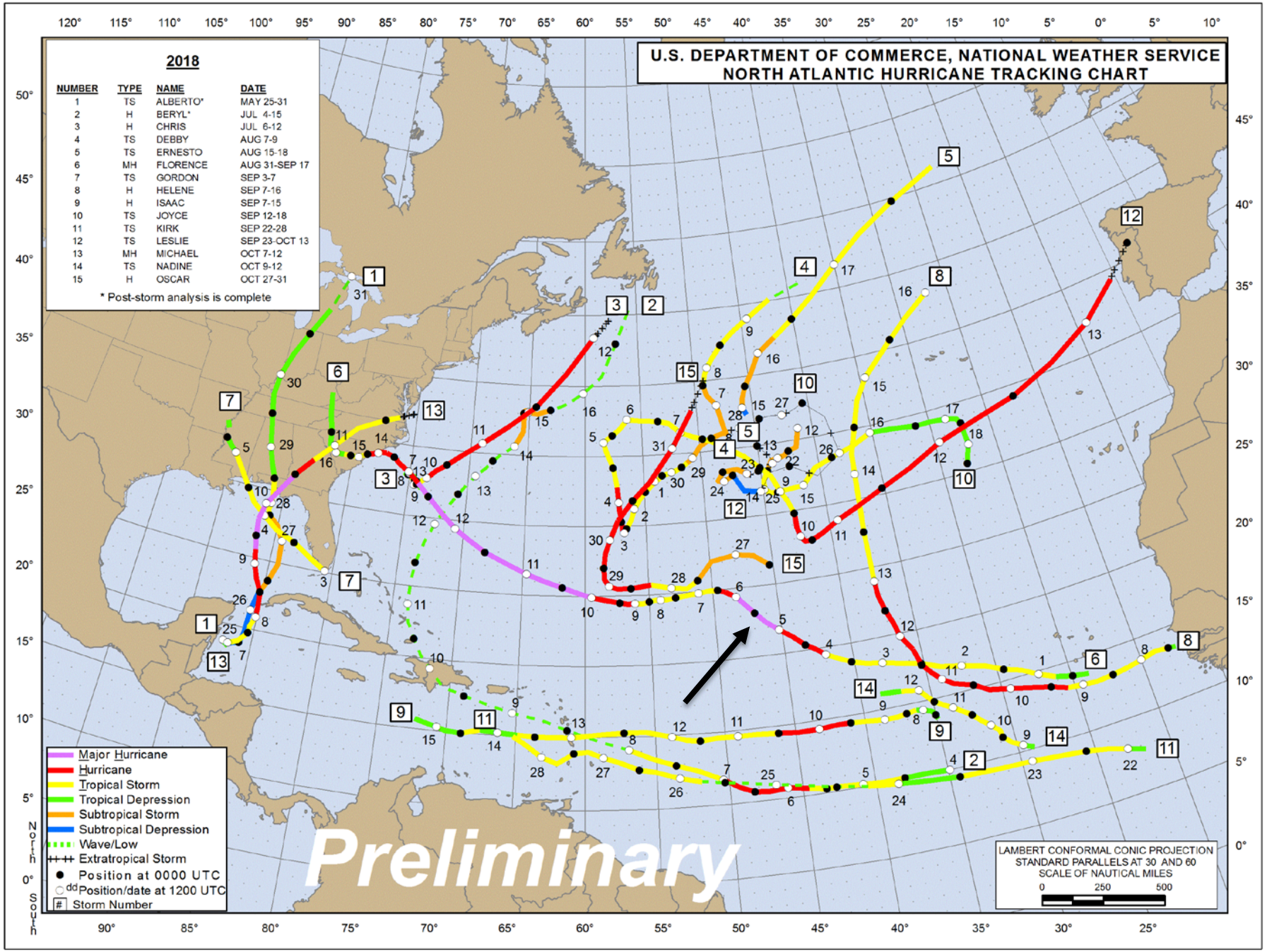
70% Probability For Each Range

	May Outlook
Named Storms	10-16
Hurricanes	5-9
Major Hurricanes	1-4
ACE (% median)	65-145%

Actual:
15
8
2

130

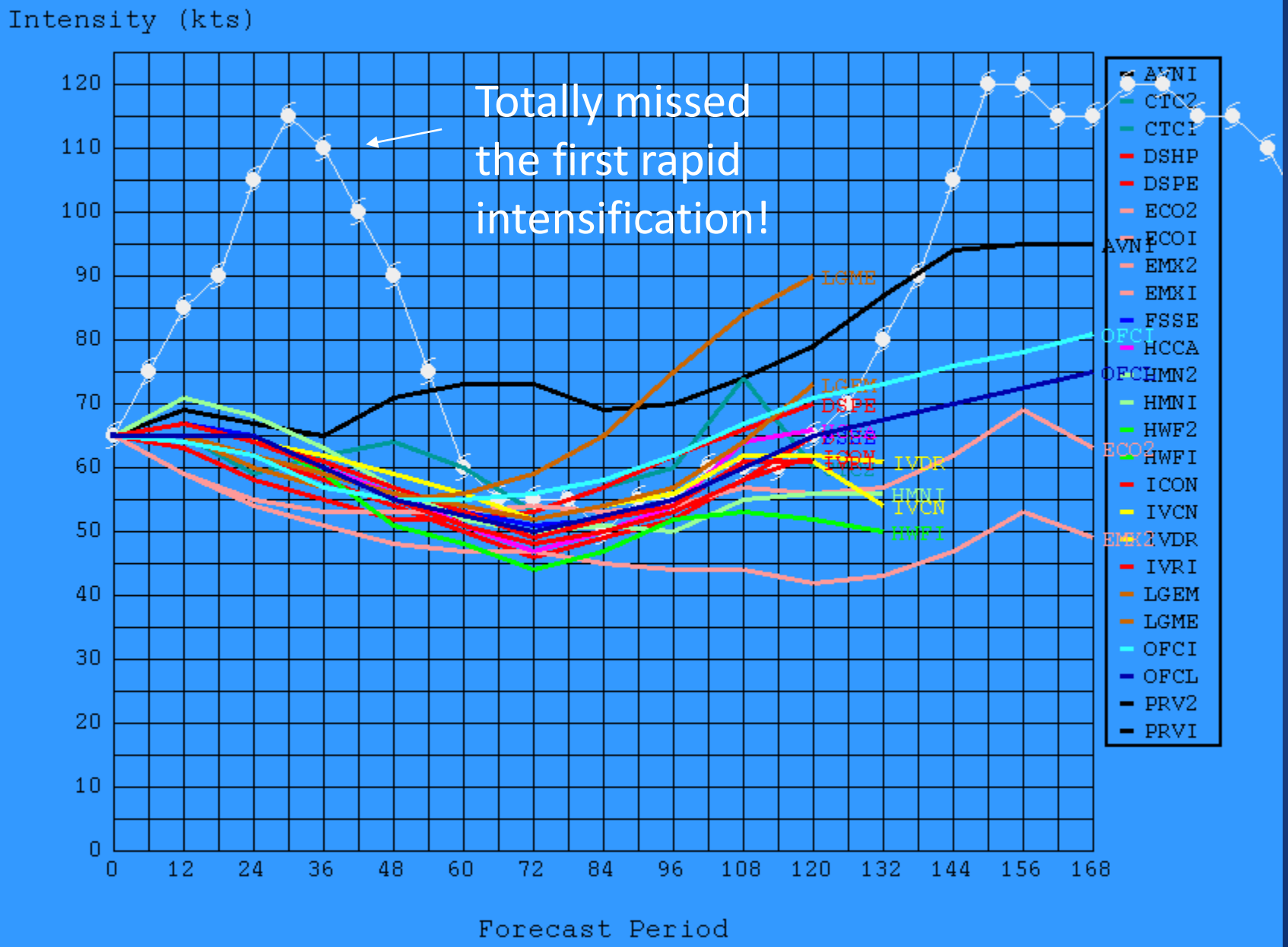
Notable August forecast bust- hopefully can expect better climate forecasts when CFSv2 is replaced in 2020 by the Unified Model



Lots of high-latitude activity

Overall systems really struggled at low latitudes

Florence intensity guidance 9/4/12z



Moderate and increasing shear

Marginally warm waters

Mid-level air fairly dry

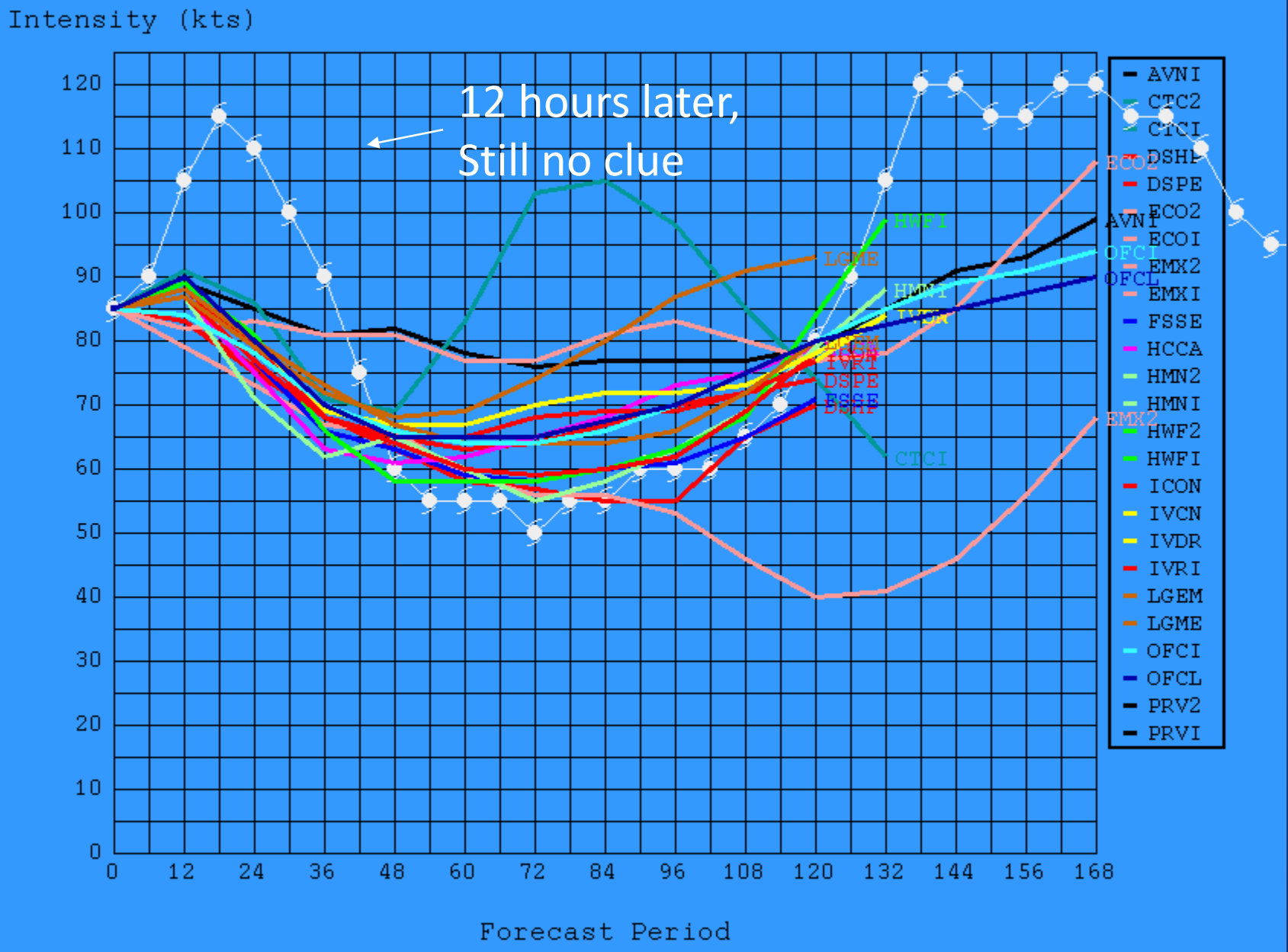
Upper-level divergence very low

* ATLANTIC 2018 SHIPS INTENSITY FORECAST *
* IR SAT DATA AVAILABLE, OHC AVAILABLE *
* FLORENCE AL062018 09/04/18 12 UTC *

TIME (HR)	0	6	12	18	24	36	48	60	72	84	96	108	120
V (KT) NO LAND	65	65	65	63	62	58	54	50	46	49	52	58	65
V (KT) LAND	65	65	65	63	62	58	54	50	46	49	52	58	65
V (KT) LGEM	65	66	65	64	62	59	56	54	52	54	57	64	73
Storm Type	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP	TROP
SHEAR (KT)	18	18	17	22	22	23	22	24	26	18	12	17	24
SHEAR ADJ (KT)	6	5	4	3	6	2	12	5	5	0	-1	0	-7
SHEAR DIR	244	249	244	243	244	246	255	263	273	244	266	202	186
SST (C)	26.5	26.6	26.7	26.9	27.1	27.6	28.0	28.3	28.6	28.7	28.9	28.9	29.0
POT. INT. (KT)	119	120	121	123	126	132	137	140	144	146	149	149	150
ADJ. POT. INT.	110	111	112	114	116	122	124	124	126	126	128	127	126
200 MB T (C)	-53.3	-53.3	-53.5	-53.5	-53.6	-53.7	-53.9	-54.0	-54.2	-54.6	-54.9	-54.7	-54.8
200 MB VXT (C)	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.7	0.4	0.4	0.3	0.5	0.6
TH_E DEV (C)	7	8	8	8	9	10	10	11	10	10	9	10	9
700-500 MB RH	52	51	51	51	50	48	50	54	56	56	56	52	54
MODEL VTX (KT)	20	19	20	19	20	18	18	17	17	19	20	22	26
850 MB ENV VOR	63	52	48	39	20	0	-21	-26	-34	-27	-22	-8	26
200 MB DIV	15	7	0	0	8	2	37	-7	6	11	6	2	1
700-850 TADV	17	15	15	17	19	11	7	7	1	-1	1	0	0
LAND (KM)	1977	1950	1929	1927	1927	1845	1671	1566	1519	1482	1461	1473	1505
LAT (DEG N)	19.5	19.9	20.3	20.8	21.3	22.3	23.5	24.7	25.7	26.6	27.5	28.6	29.6
LONG(DEG W)	42.0	43.1	44.1	45.1	46.2	48.5	50.6	52.2	53.3	54.4	55.5	56.6	57.5
STM SPEED (KT)	10	11	10	11	11	12	10	8	7	7	7	7	6
HEAT CONTENT	5	8	11	13	14	22	12	16	19	15	19	27	22

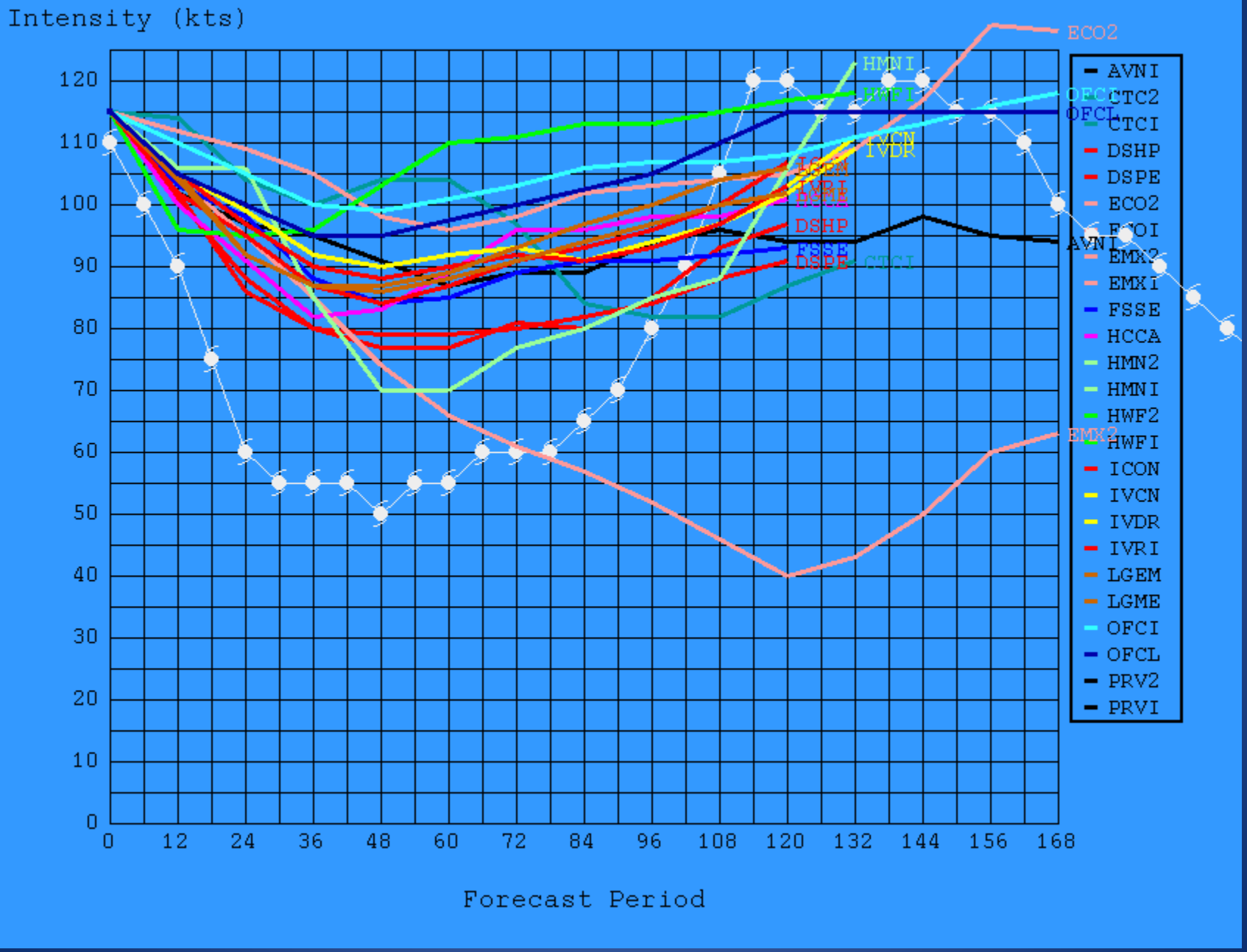
FORECAST TRACK FROM OFCI INITIAL HEADING/SPEED (DEG/KT):295/ 9 CX,CY: -7/ 4
T-12 MAX WIND: 60 PRESSURE OF STEERING LEVEL (MB): 615 (MEAN=619)
GOES IR BRIGHTNESS TEMP. STD DEV. 50-200 KM RAD: 12.7 (MEAN=14.5)
% GOES IR PIXELS WITH T < -20 C 50-200 KM RAD: 76.0 (MEAN=65.0)
PRELIM RI PROB (DV .GE. 55 KT IN 48 HR): 0.2

Florence intensity guidance 9/5/00z



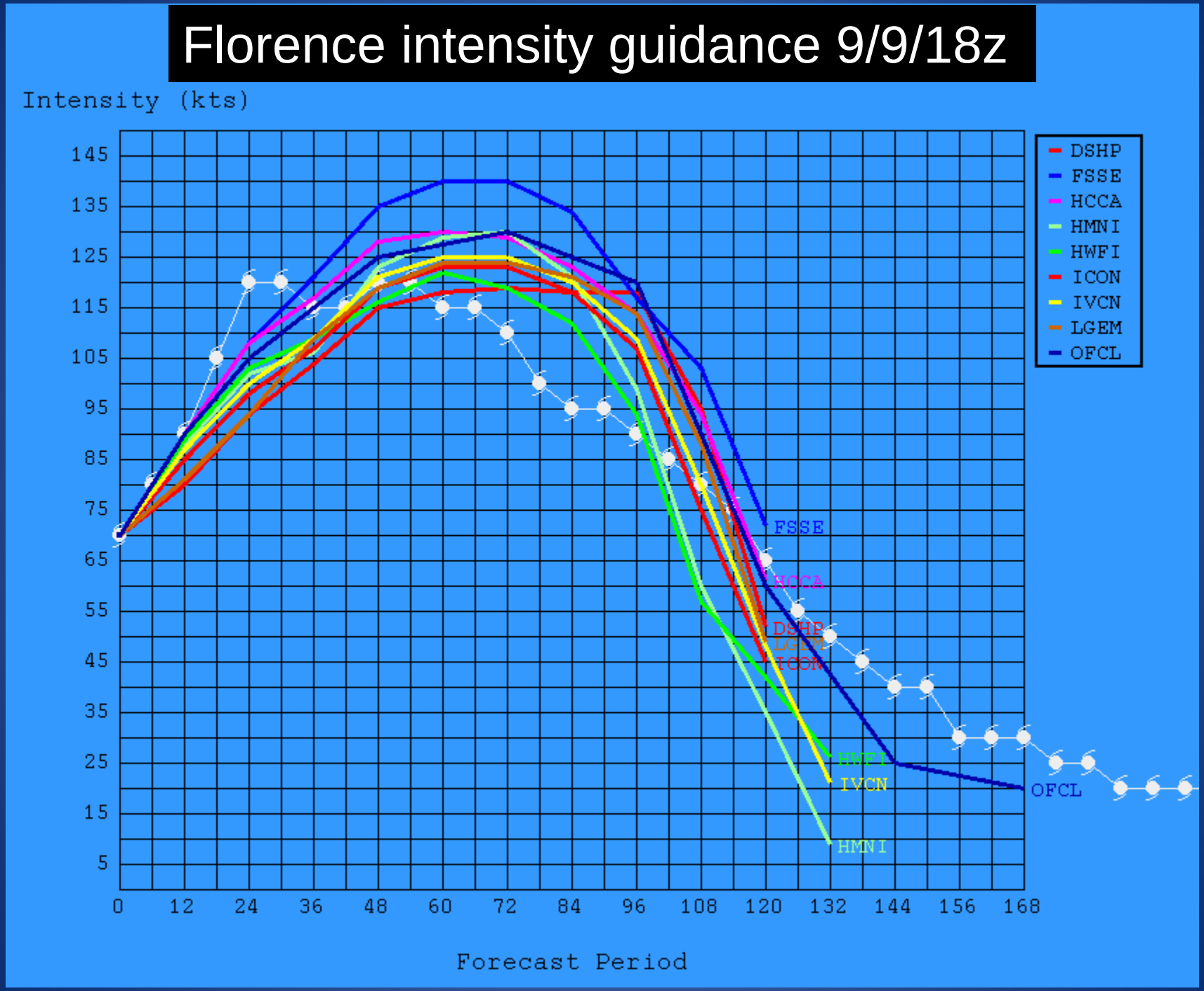
Florence intensity guidance 9/6/00z

Similar errors for rapid weakening phase!



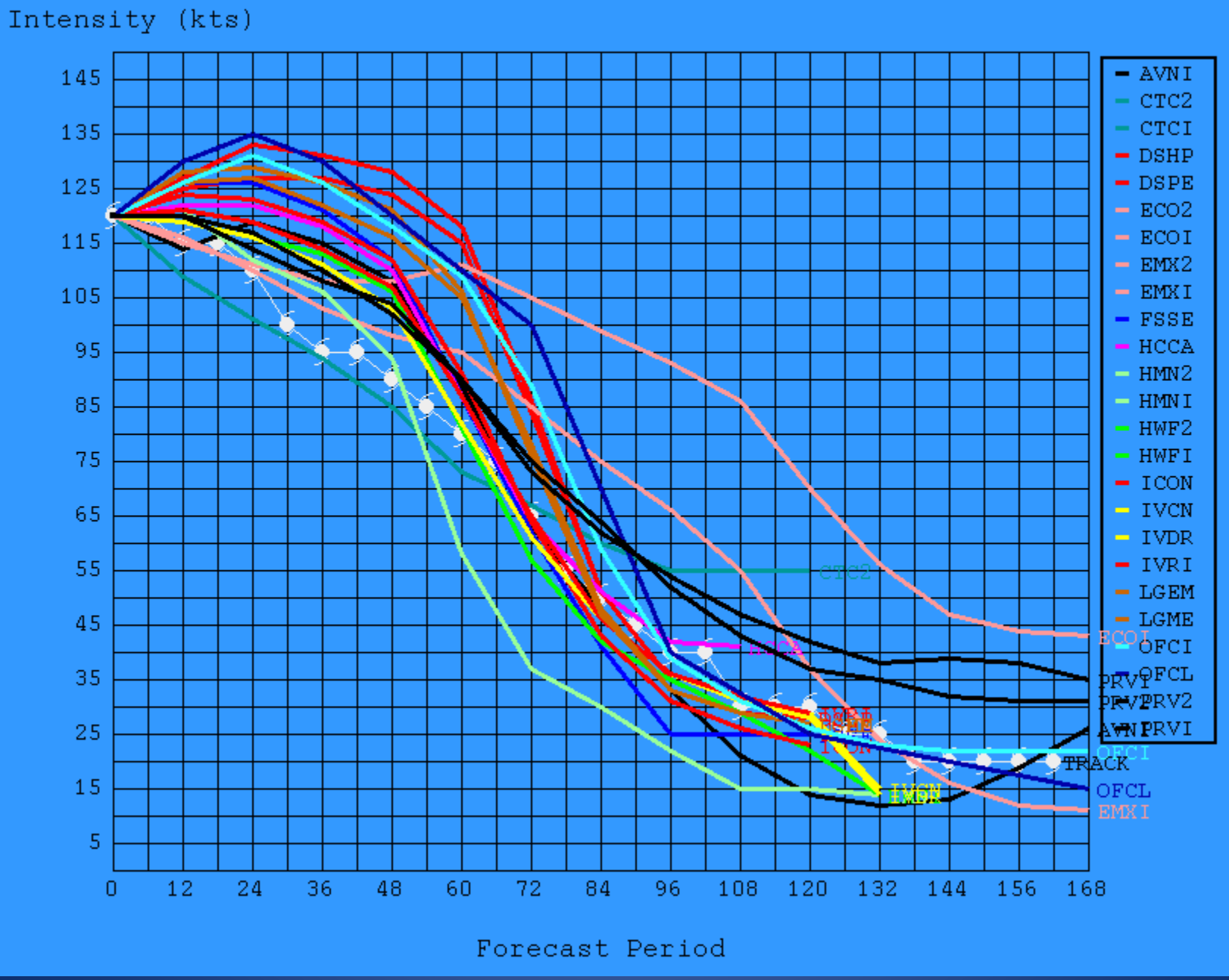
Florence intensity guidance 9/9/18z

Very solid forecast, albeit some timing issues



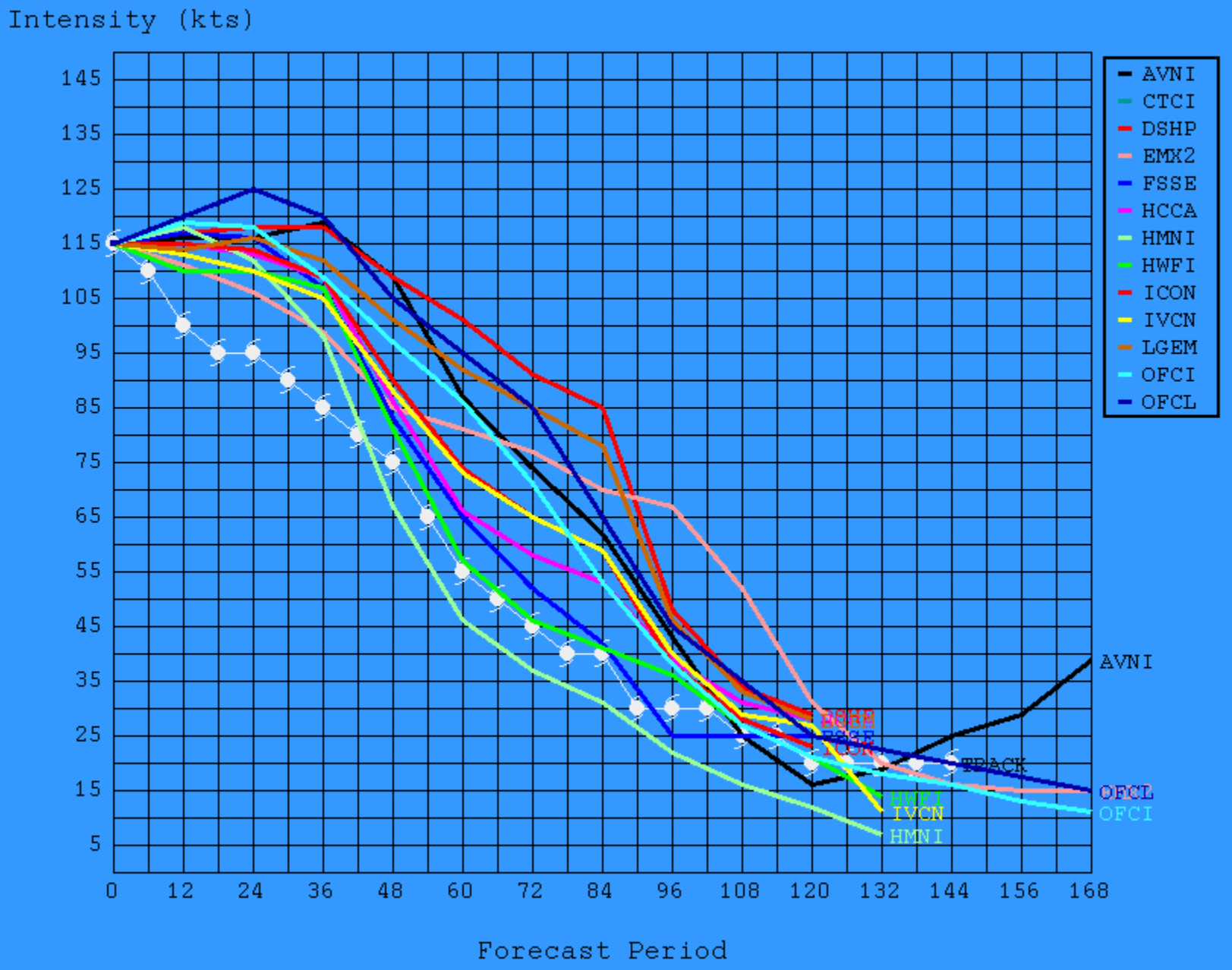
Florence intensity guidance 9/11/18z

Models generally overestimated the peak

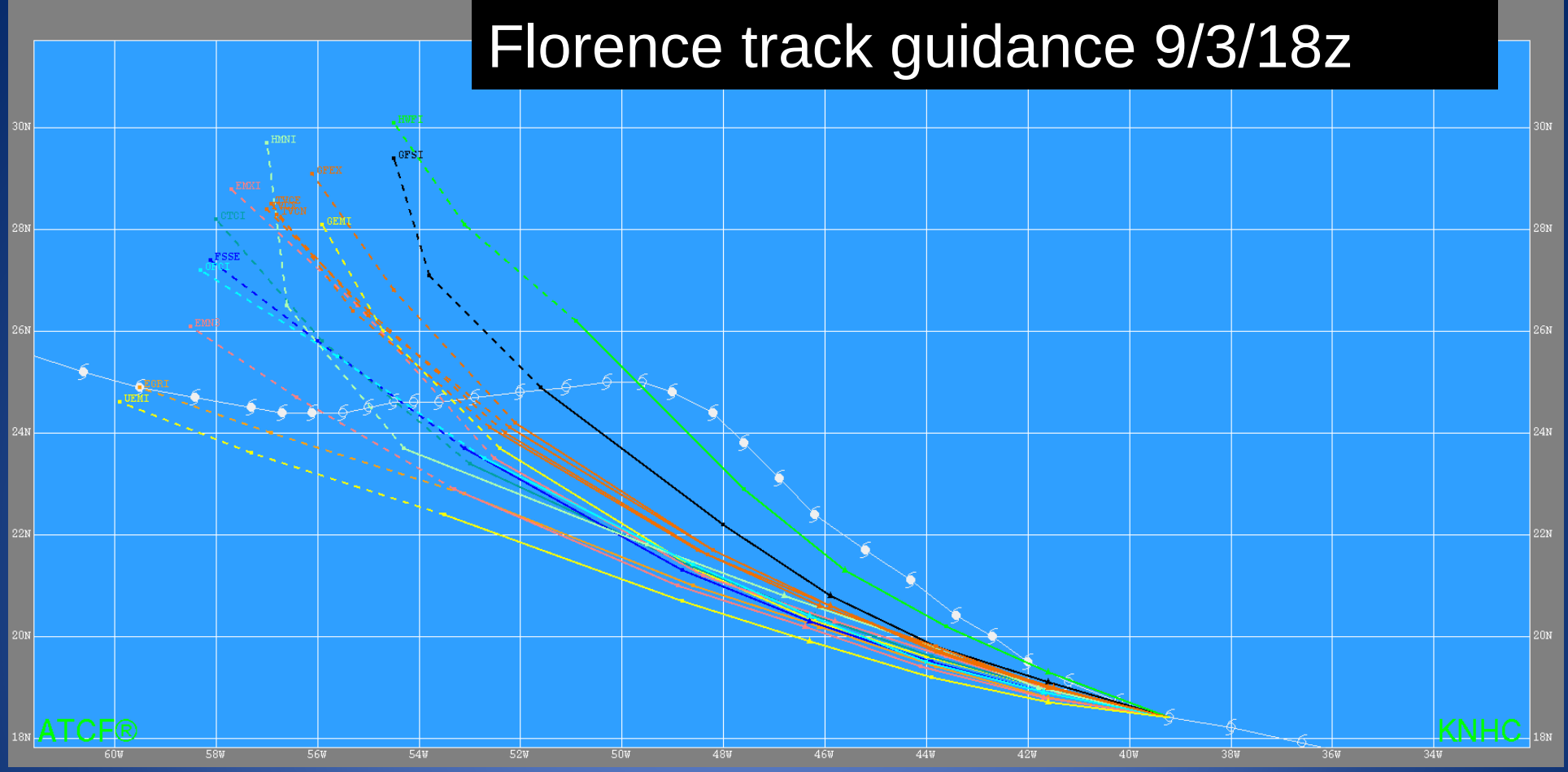


Florence intensity guidance 9/12/12z

Notable high bias as Florence approached land

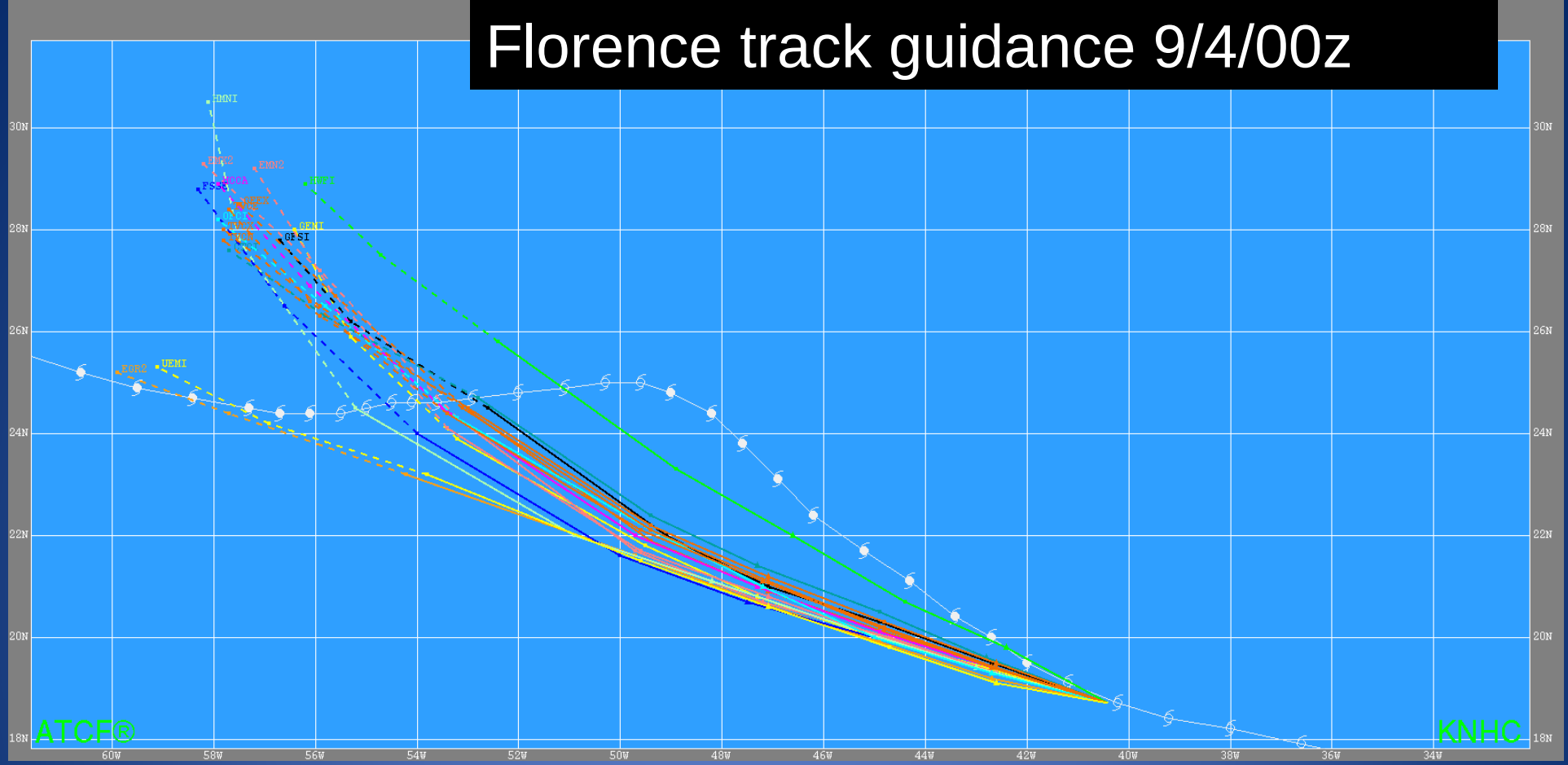


Florence track guidance 9/3/18z

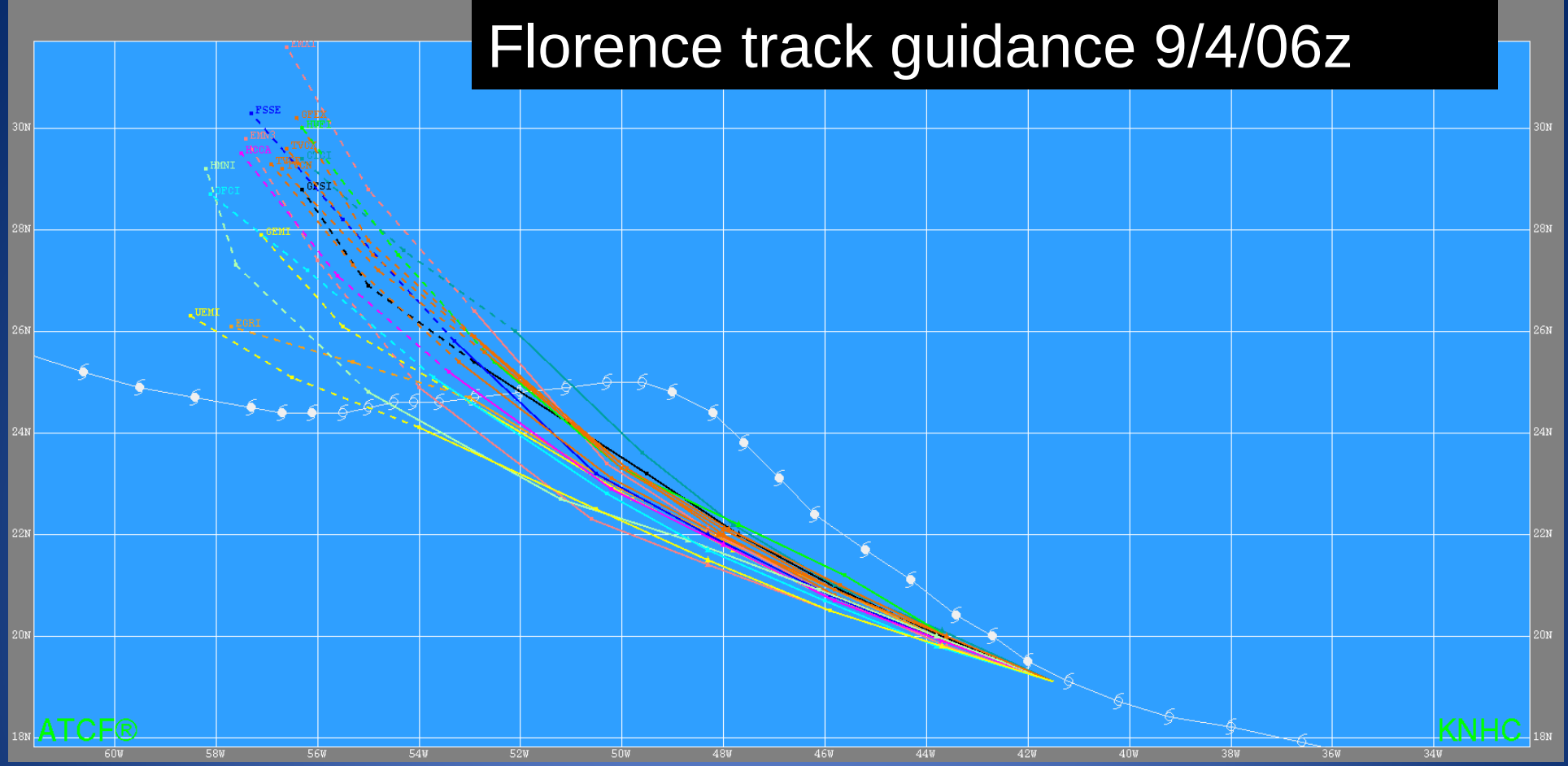


Not just the intensity guidance that suffered!

Florence track guidance 9/4/00z

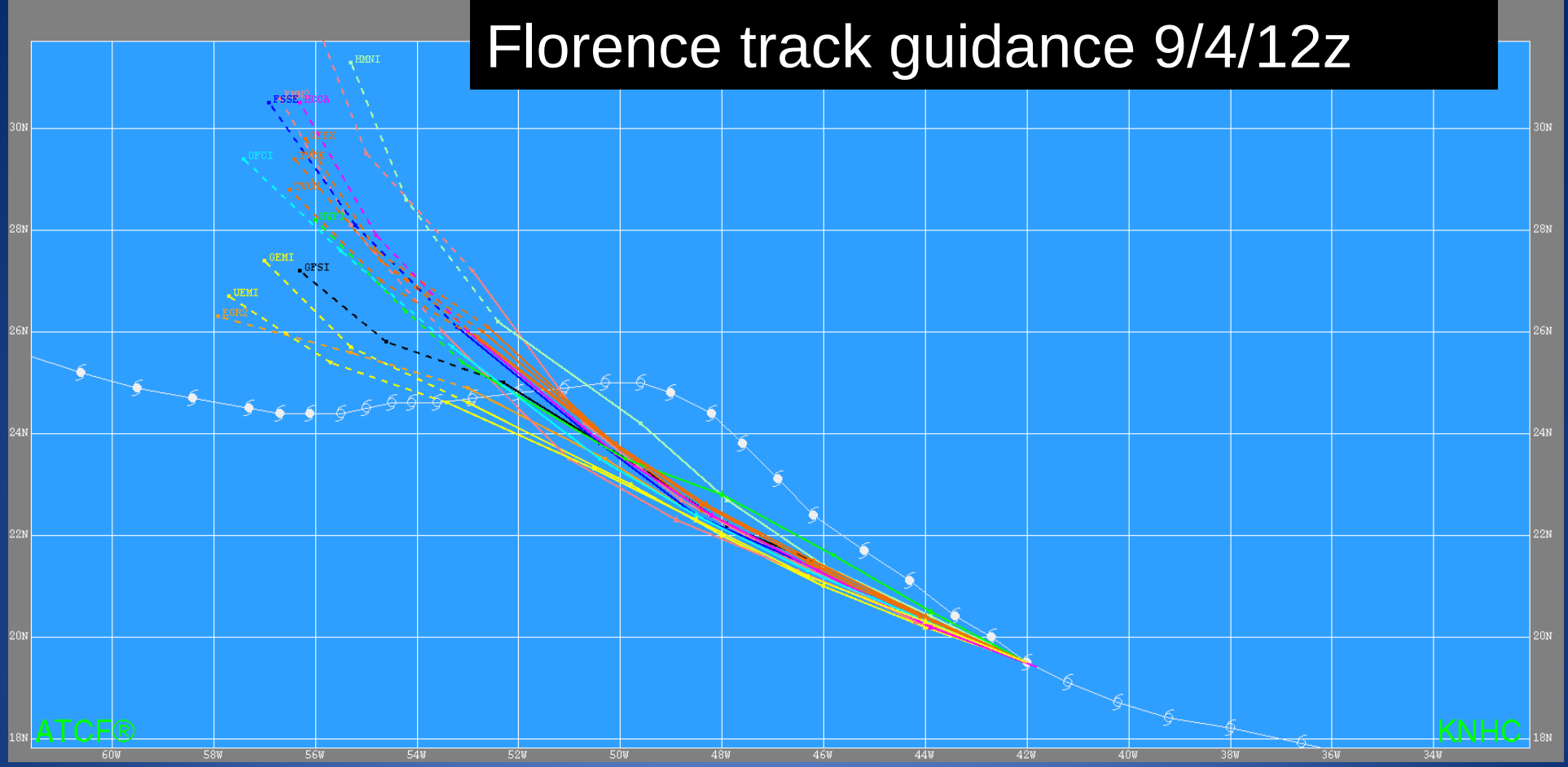


Florence track guidance 9/4/06z

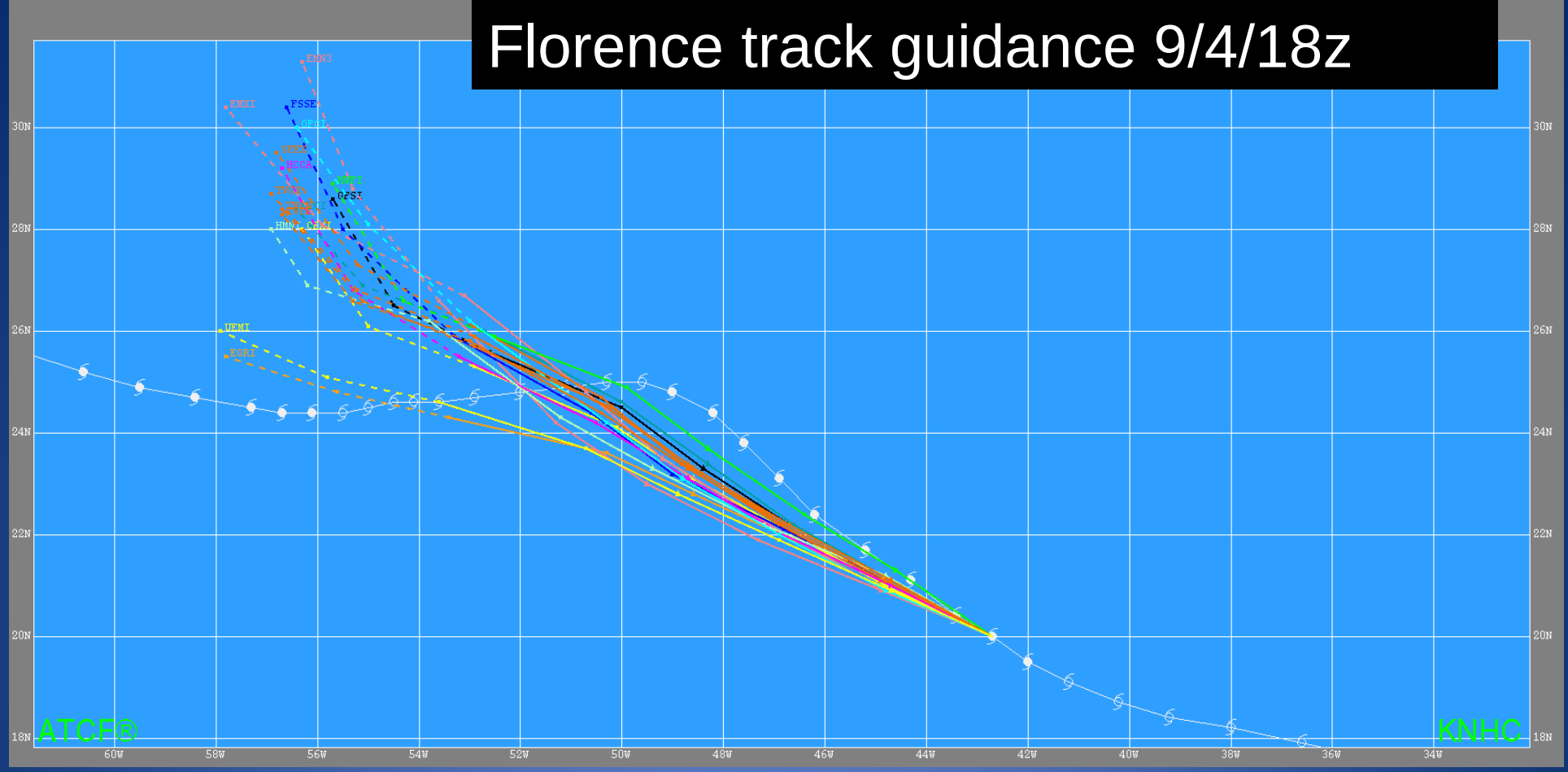


Tightly clustered models but very inaccurate short term forecasts, > 100 n mi error 24 h +

Florence track guidance 9/4/12z

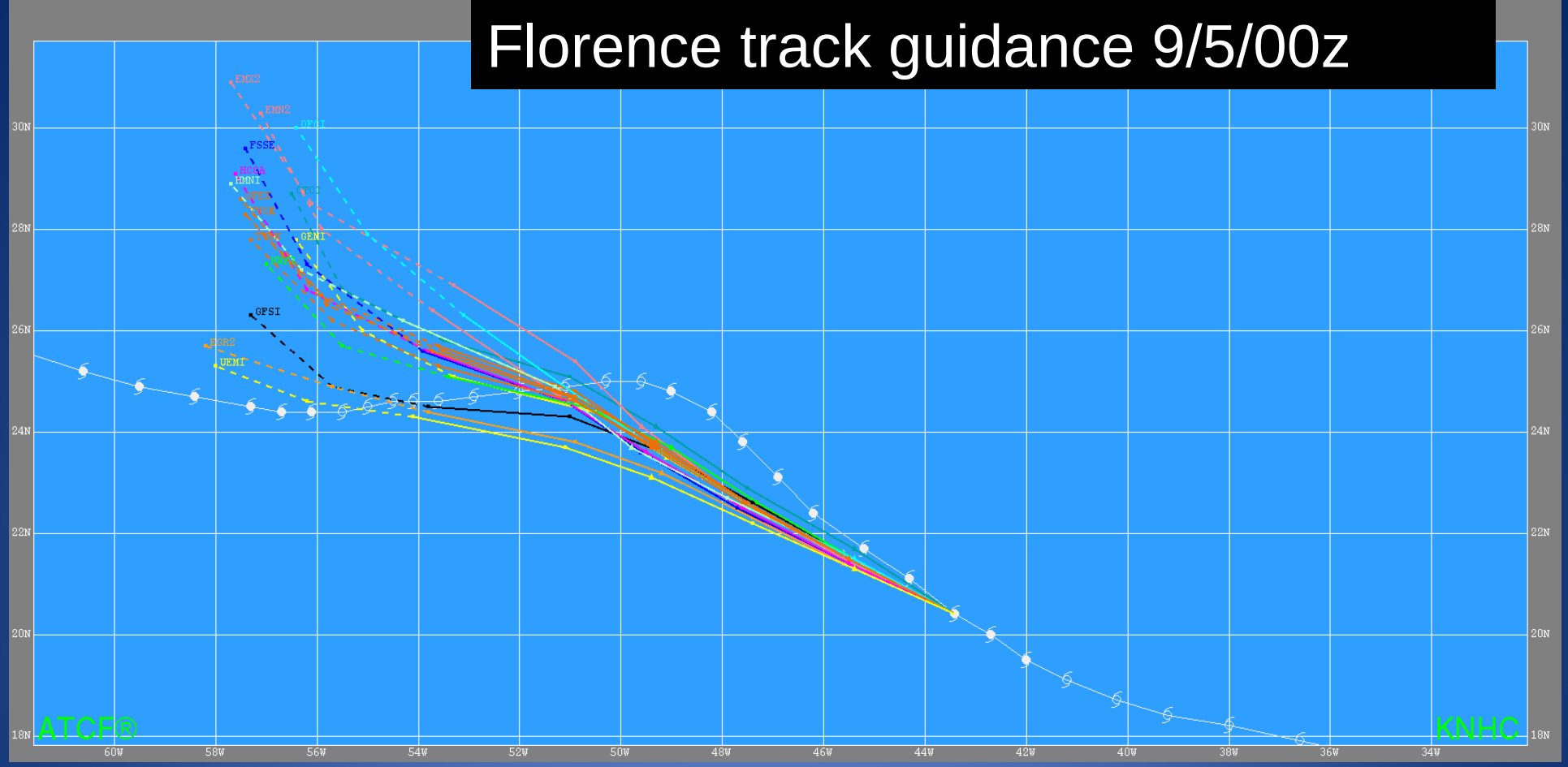


Florence track guidance 9/4/18z

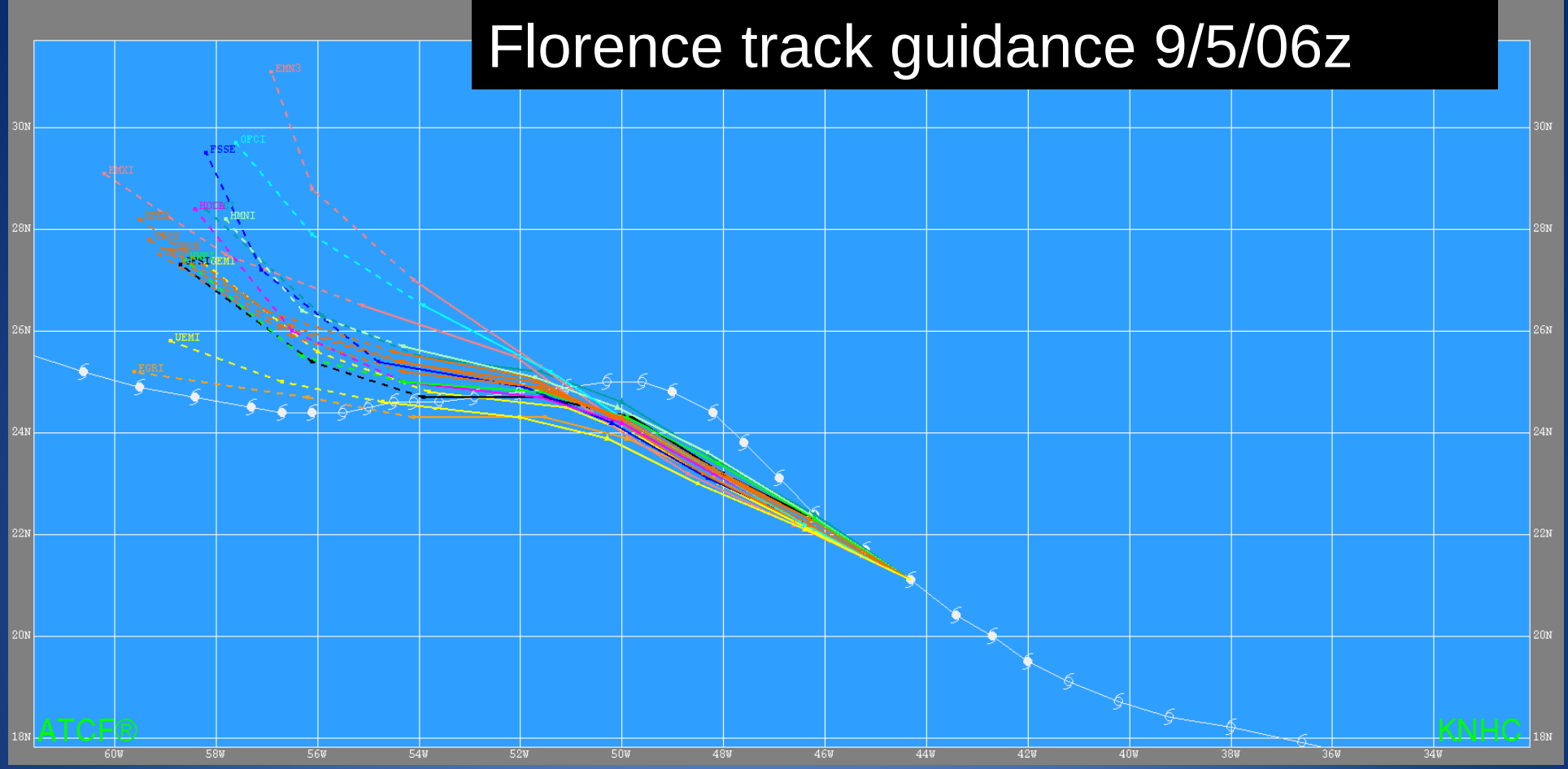


Models gradually adjusting but most still too far south at first then too far north at long range

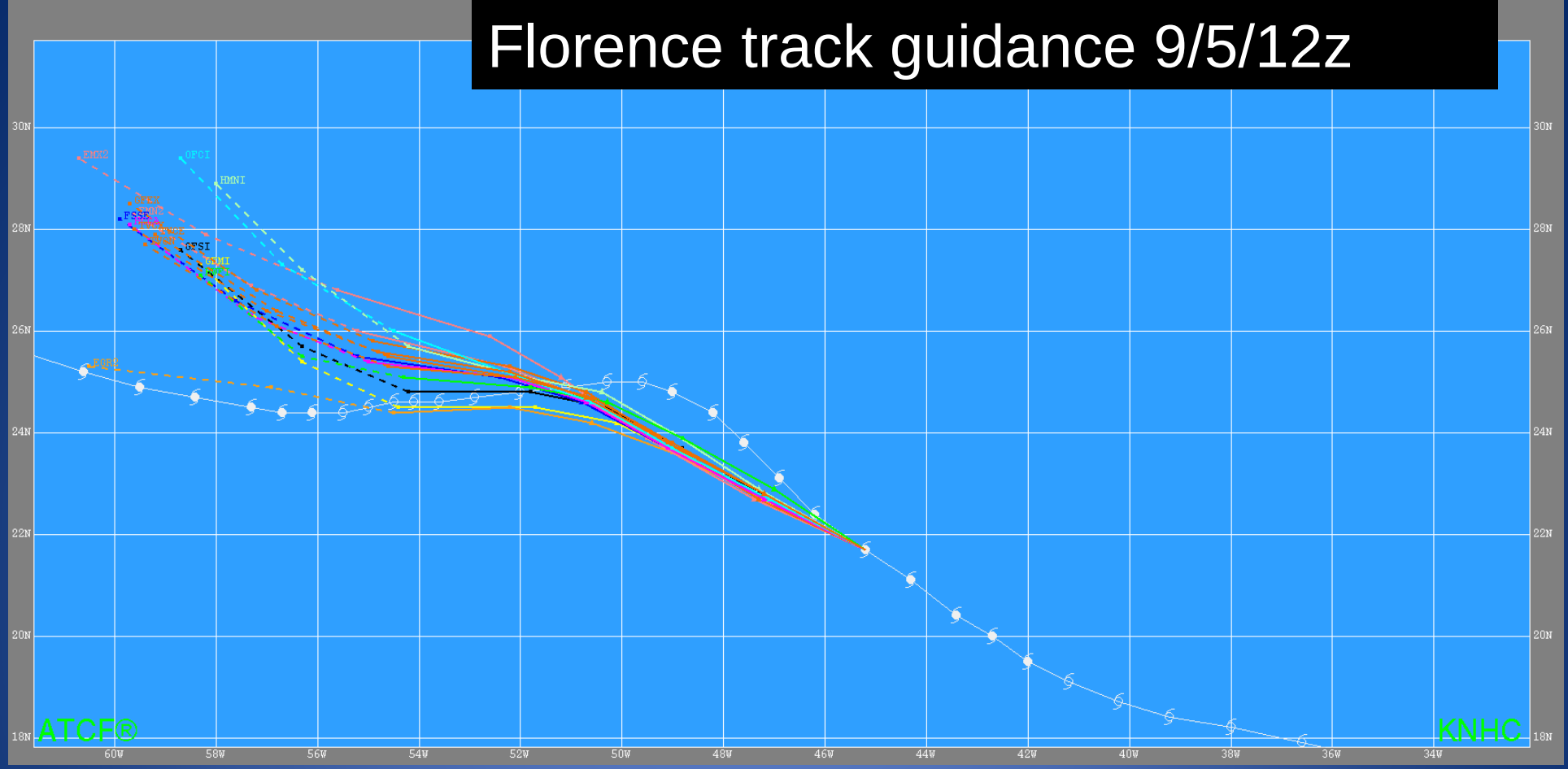
Florence track guidance 9/5/00z



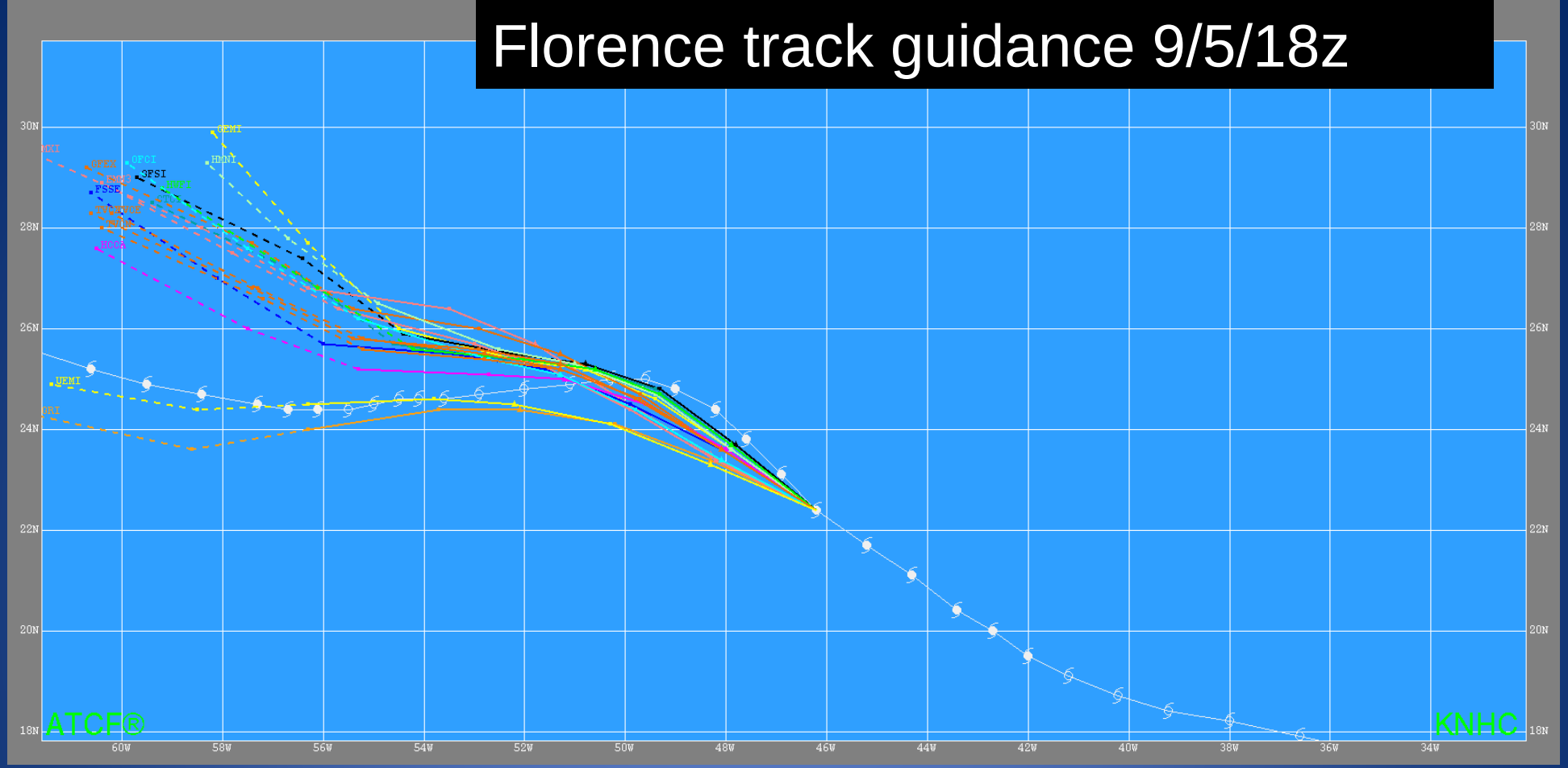
Florence track guidance 9/5/06z



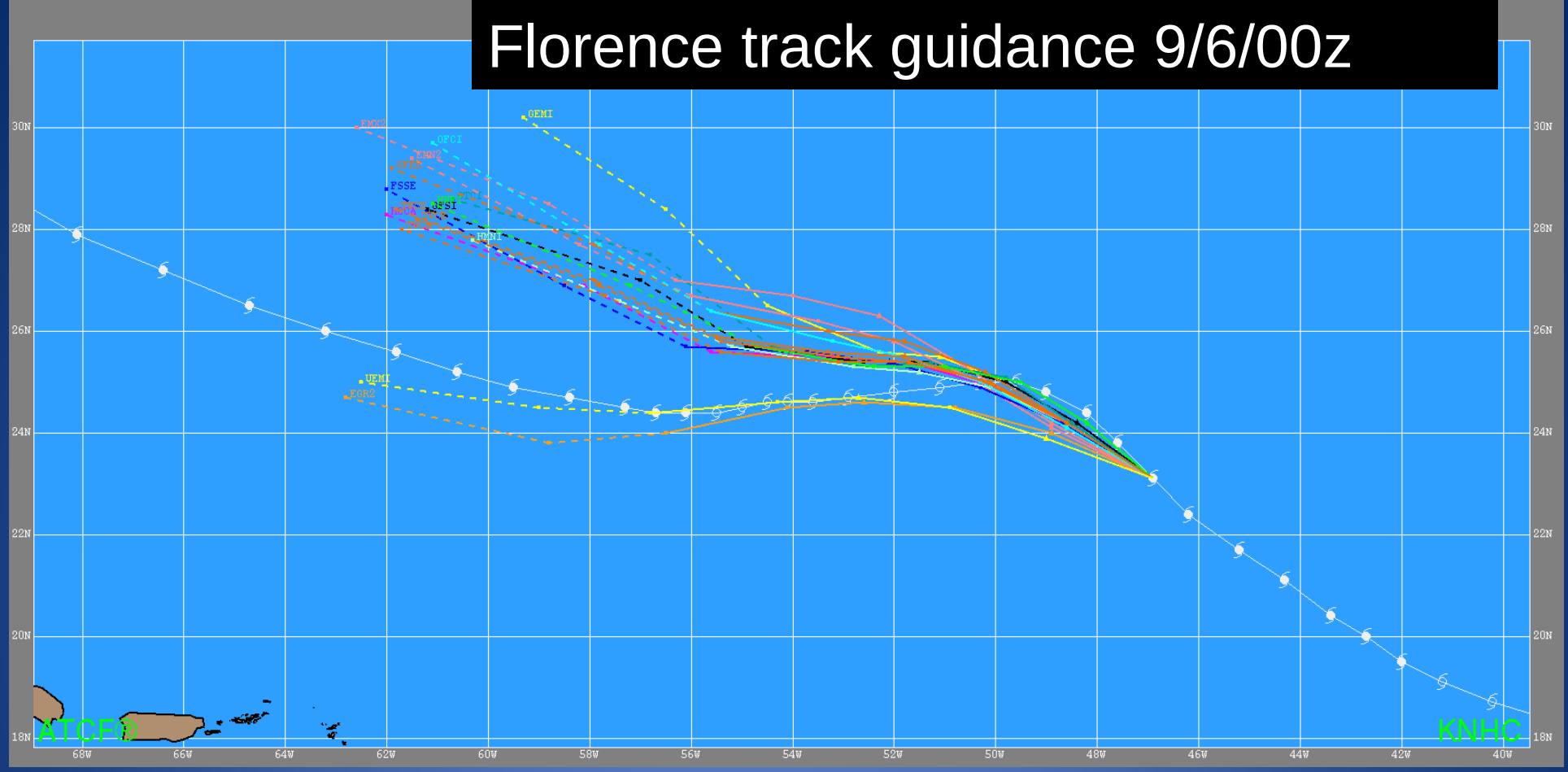
Florence track guidance 9/5/12z



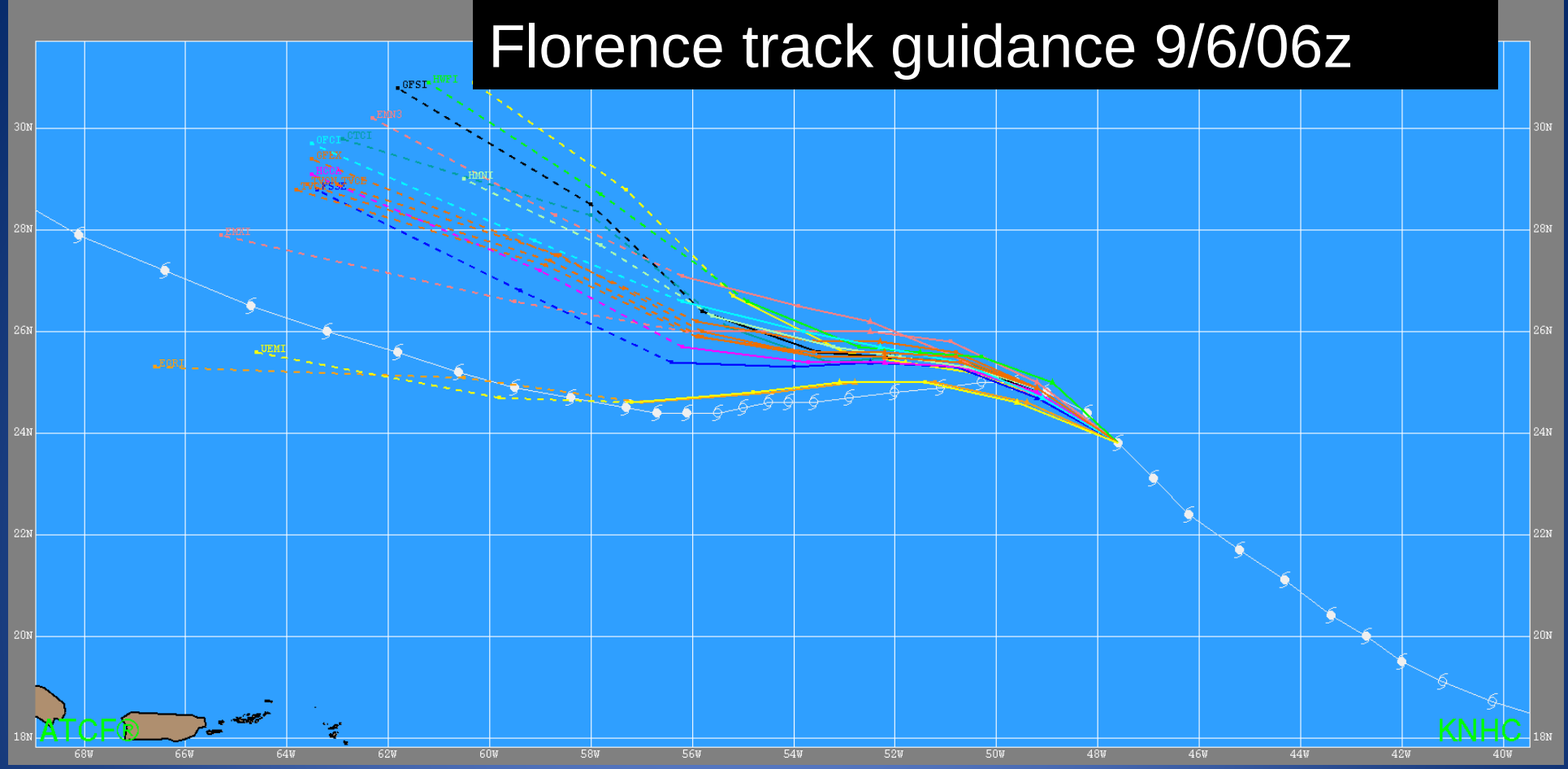
Florence track guidance 9/5/18z



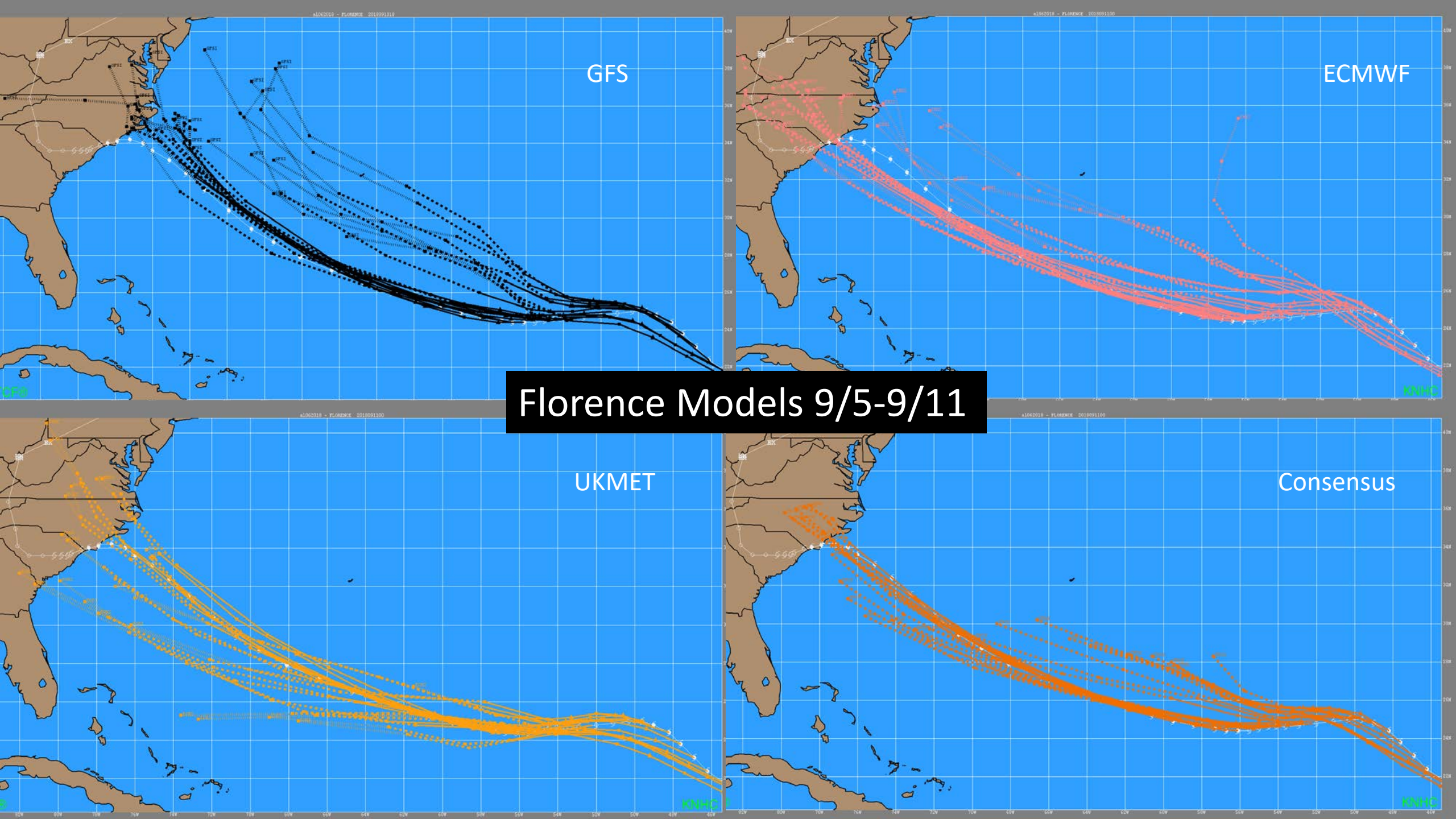
Florence track guidance 9/6/00z

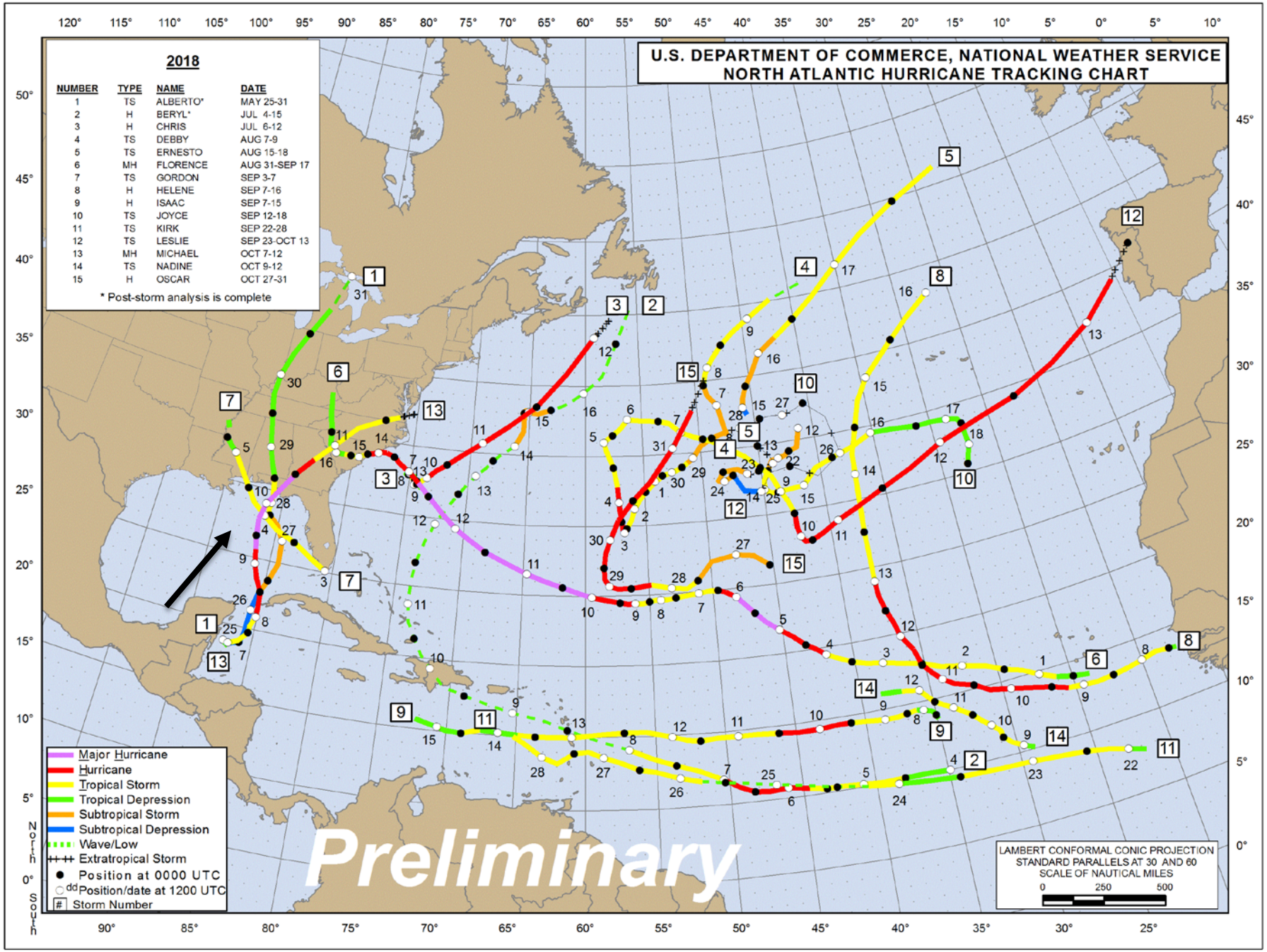


Florence track guidance 9/6/06z



Still a notable northward bias at long range even after first peak intensity


GFS
ECMWF
Florence Models 9/5-9/11
UKMET
Consensus

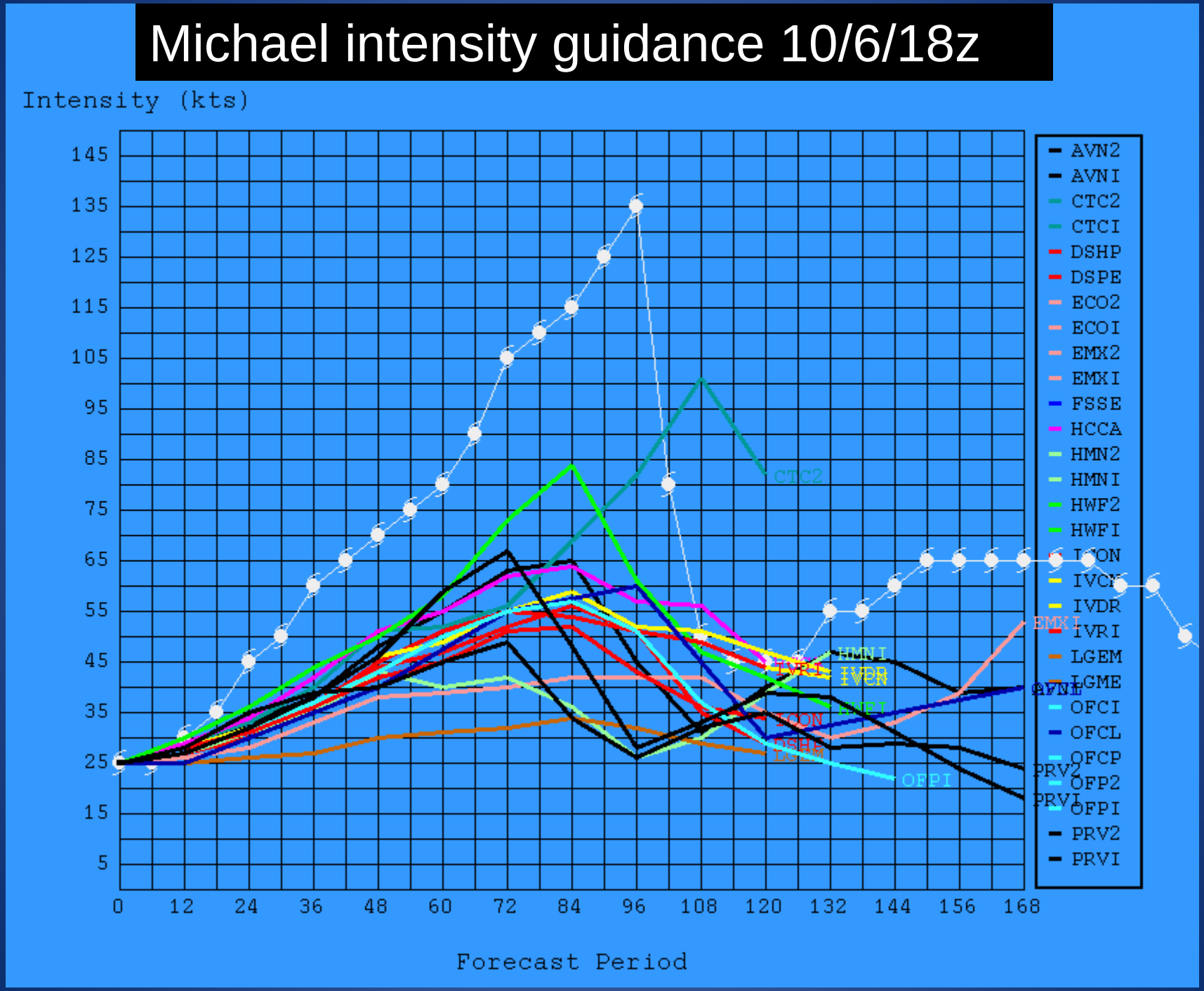


Hurricane Michael

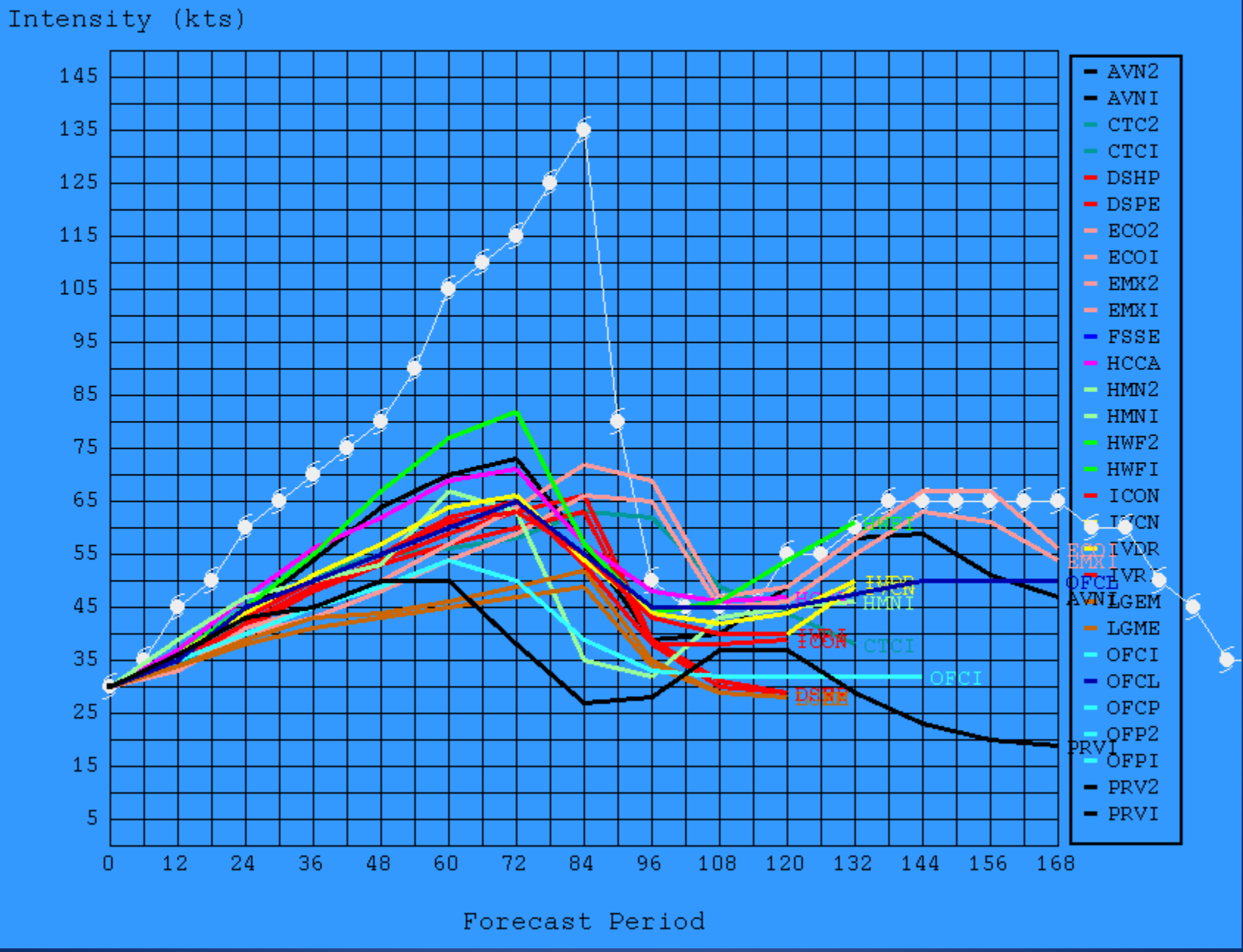
Strongest mainland US landfall since Andrew 1992

Michael intensity guidance 10/6/18z

HWRF & CTCI only models that showed even a category 2 hurricane a few days out

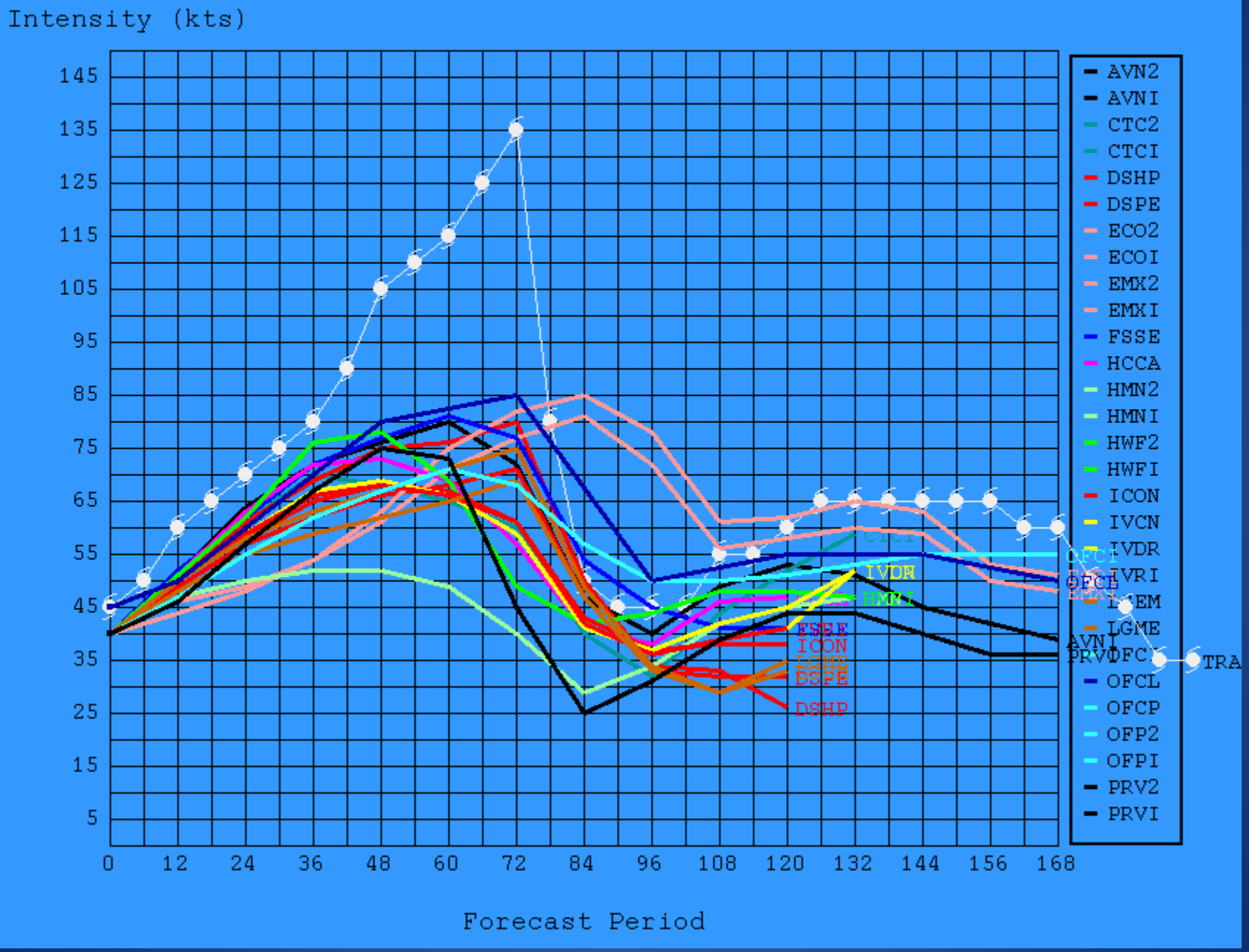


Michael intensity guidance 10/7/06z



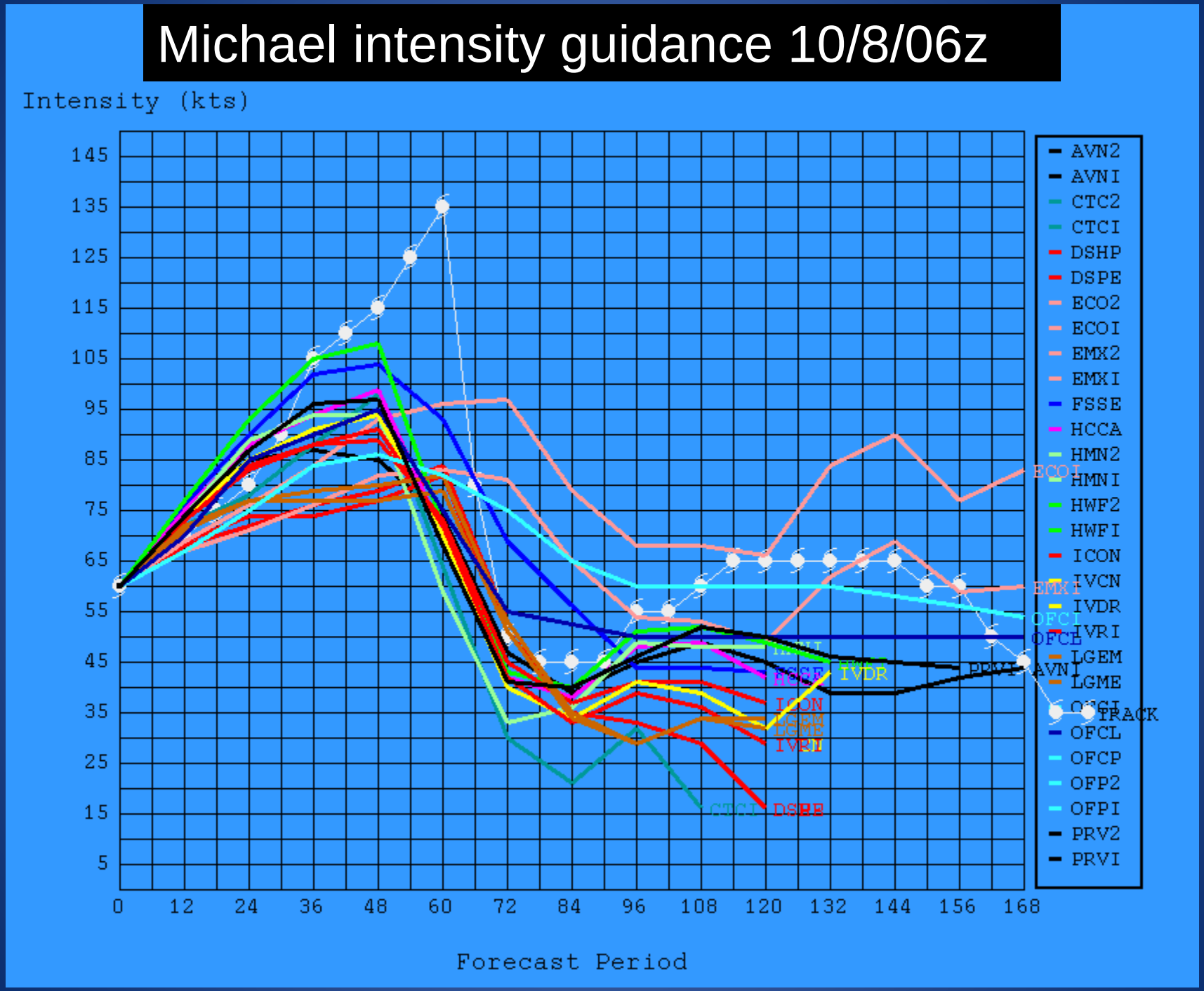
Michael intensity guidance 10/7/18z

Still only signs for steady strengthening



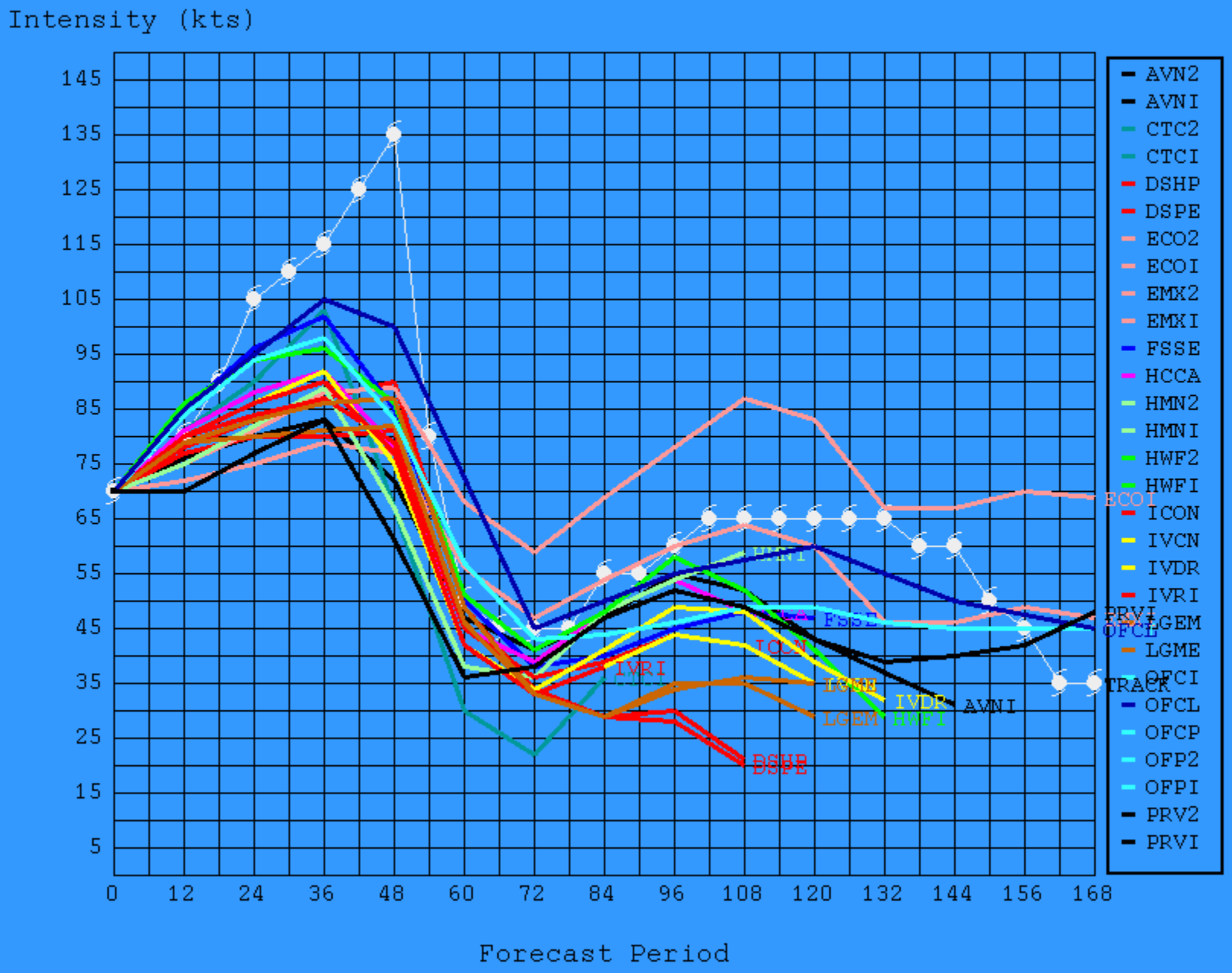
Michael intensity guidance 10/8/06z

HWRF finally shows major hurricane, but stops strengthening too soon



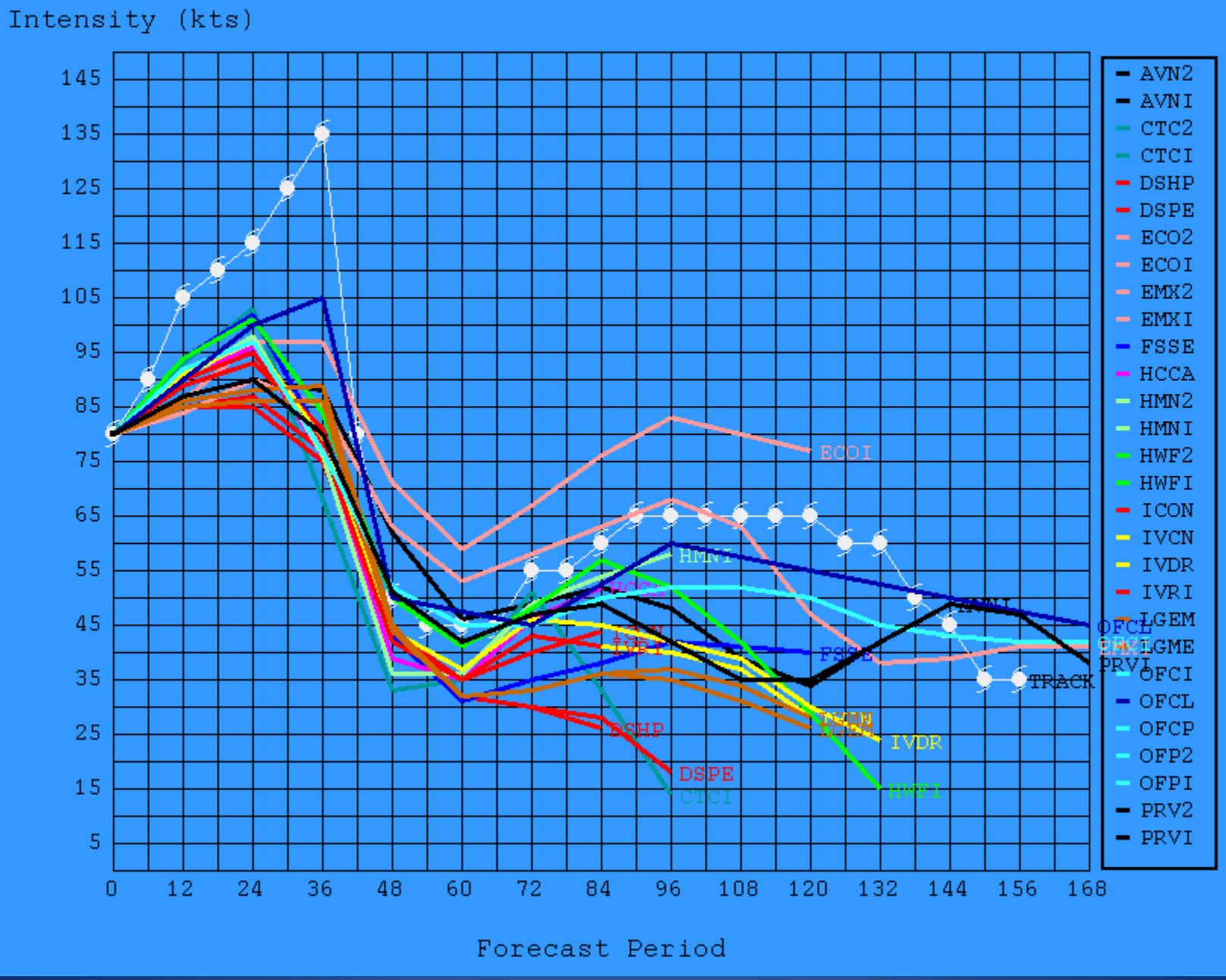
Michael intensity guidance 10/8/18z

Stat/Dyn models lower for Michael

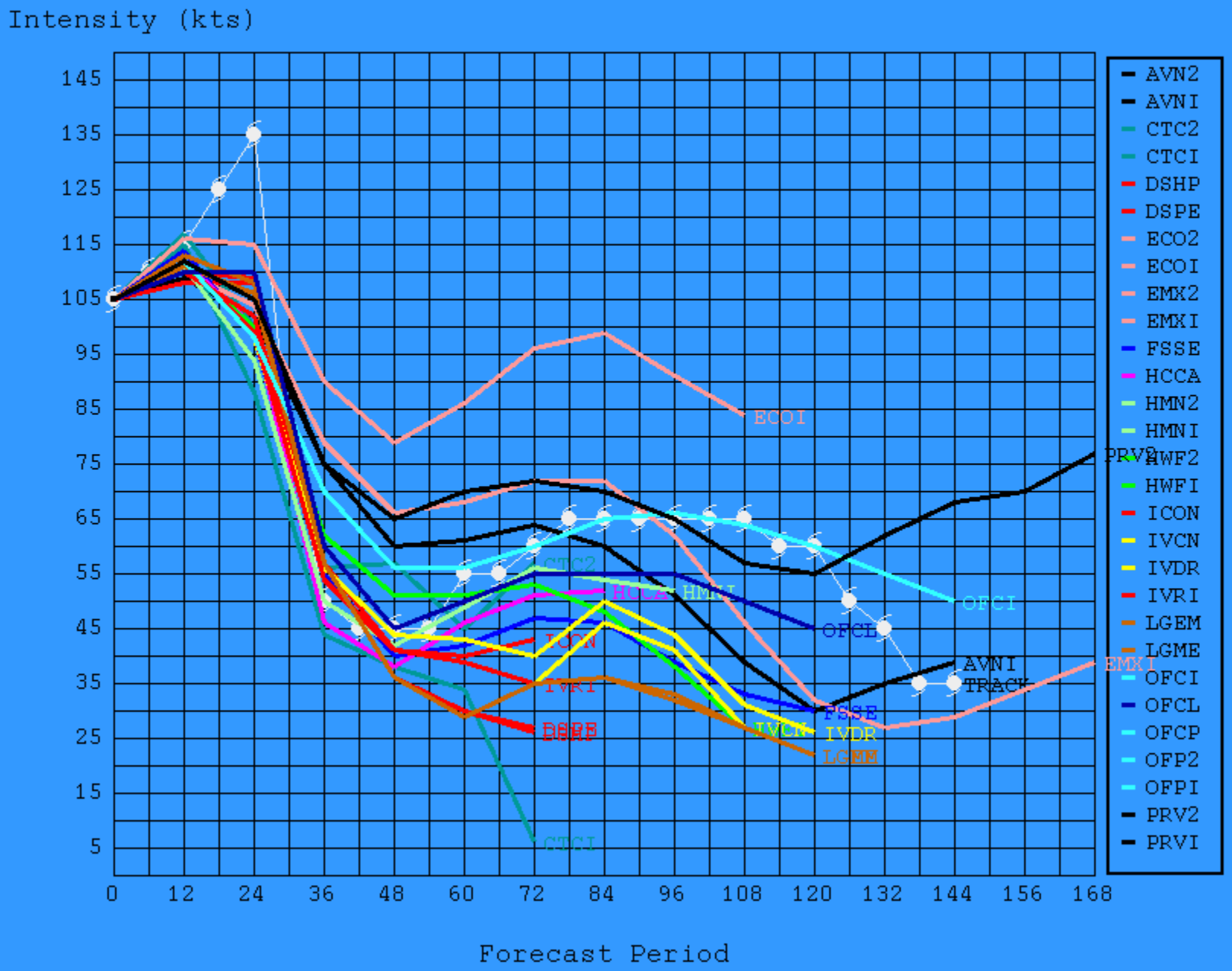


Michael intensity guidance 10/9/06z

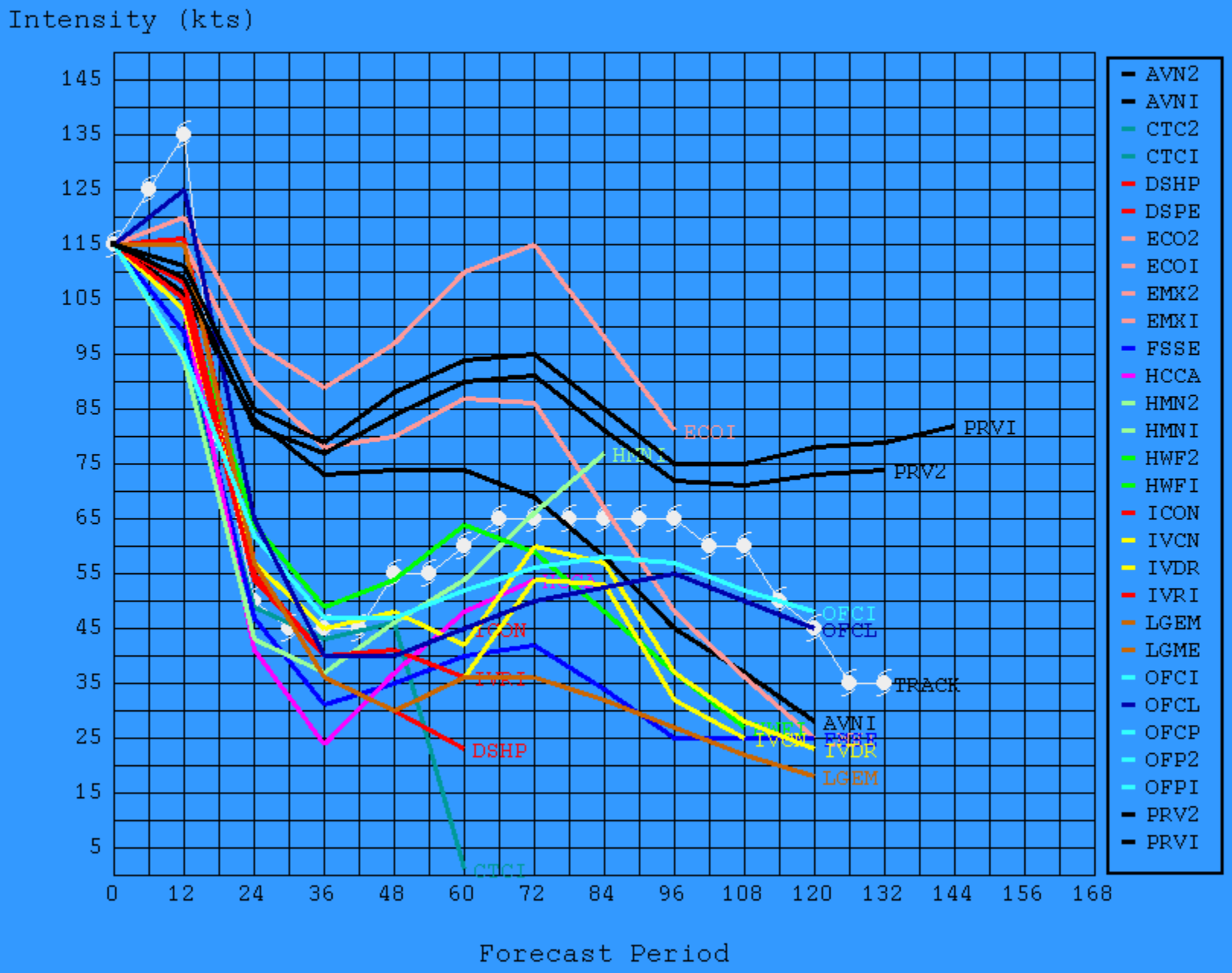
Woefully underdone at landfall

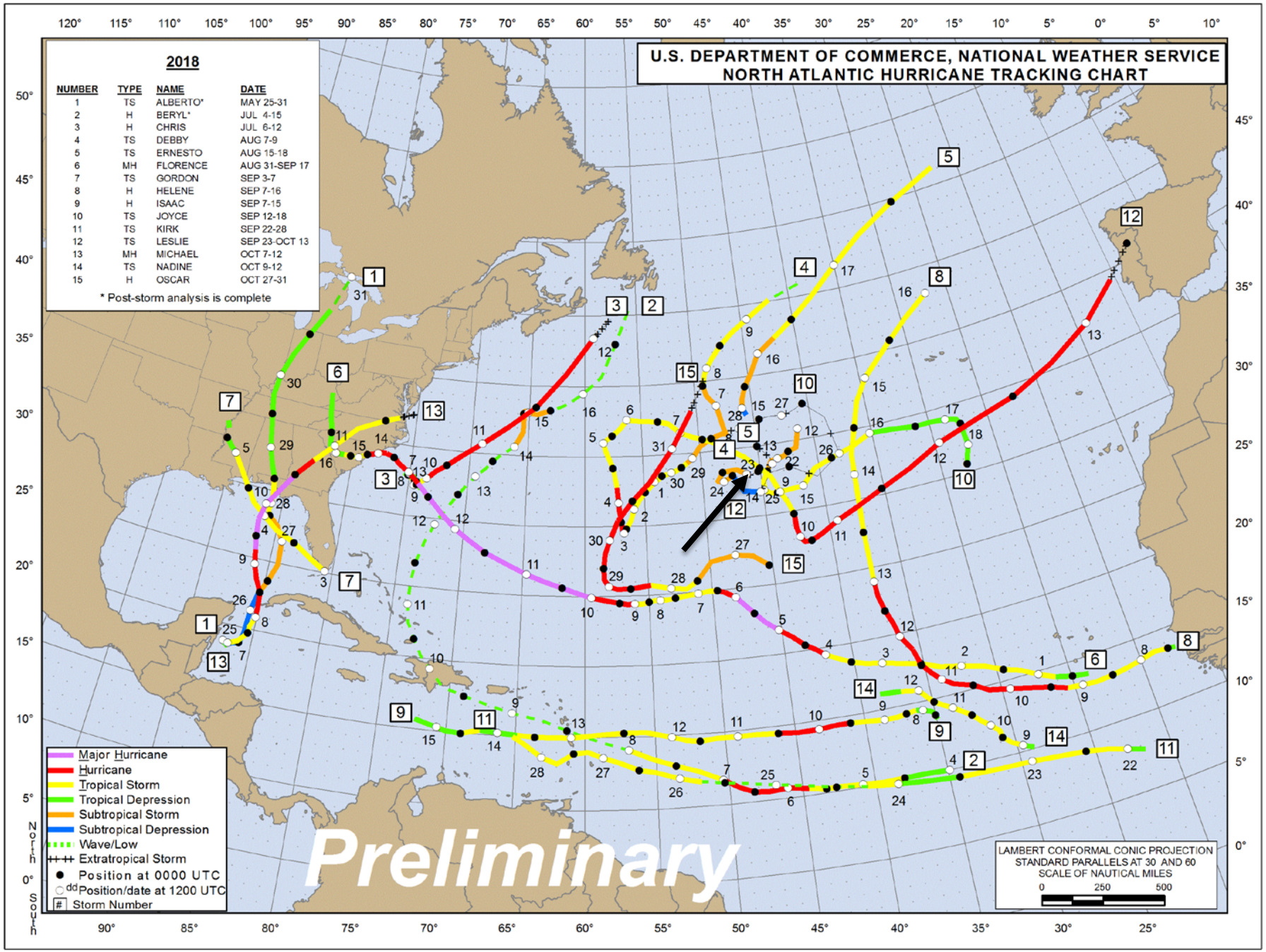


Michael intensity guidance 10/9/18z



Michael intensity guidance 10/10/06z

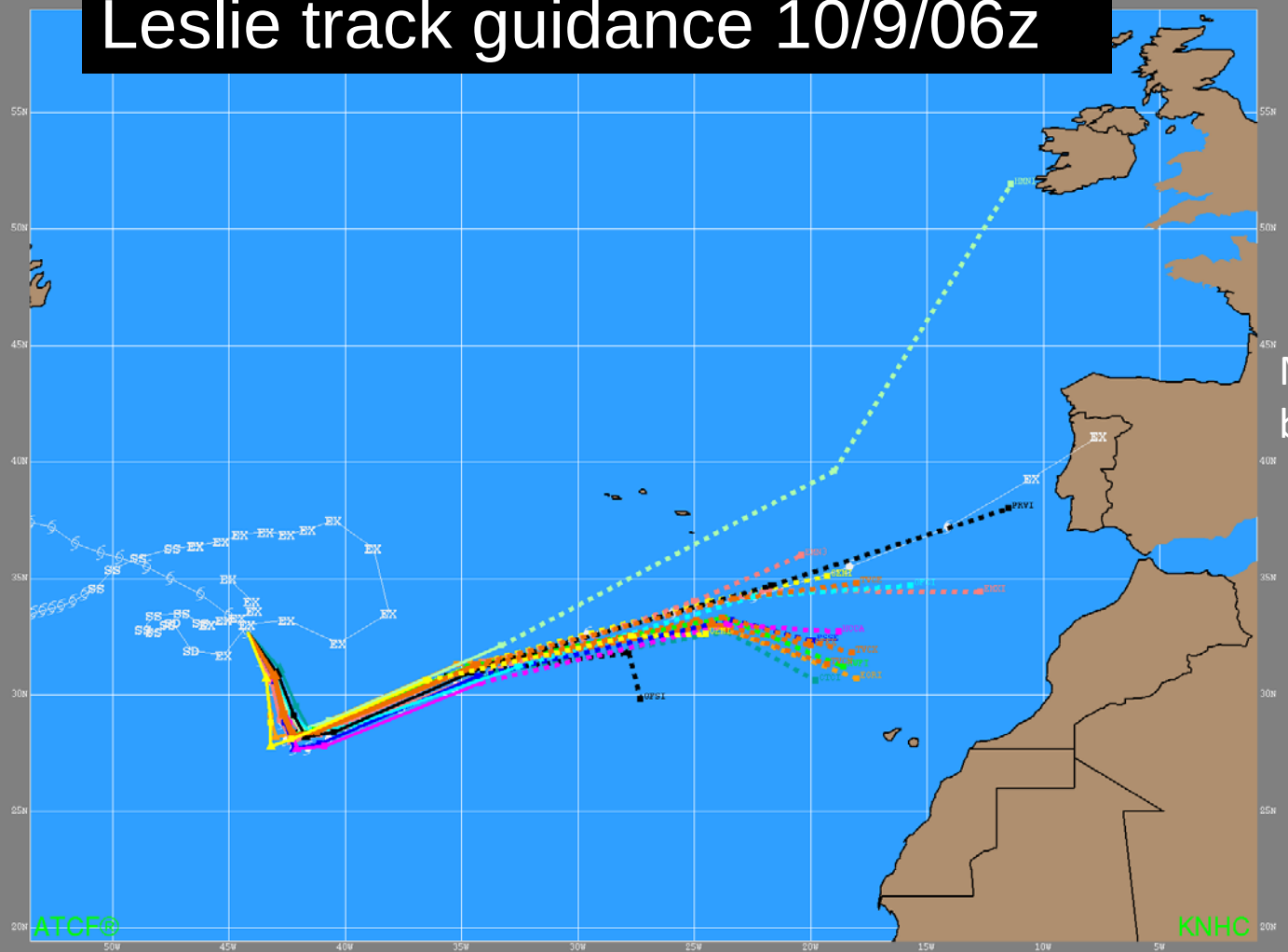




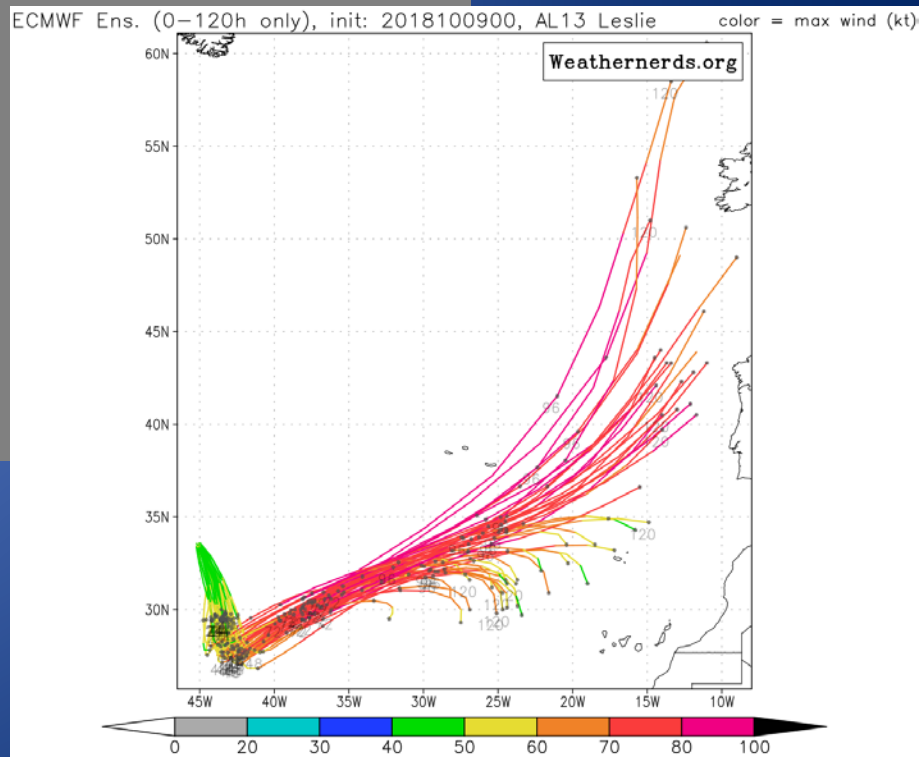
Hurricane Leslie

Long lasting and highly annoying

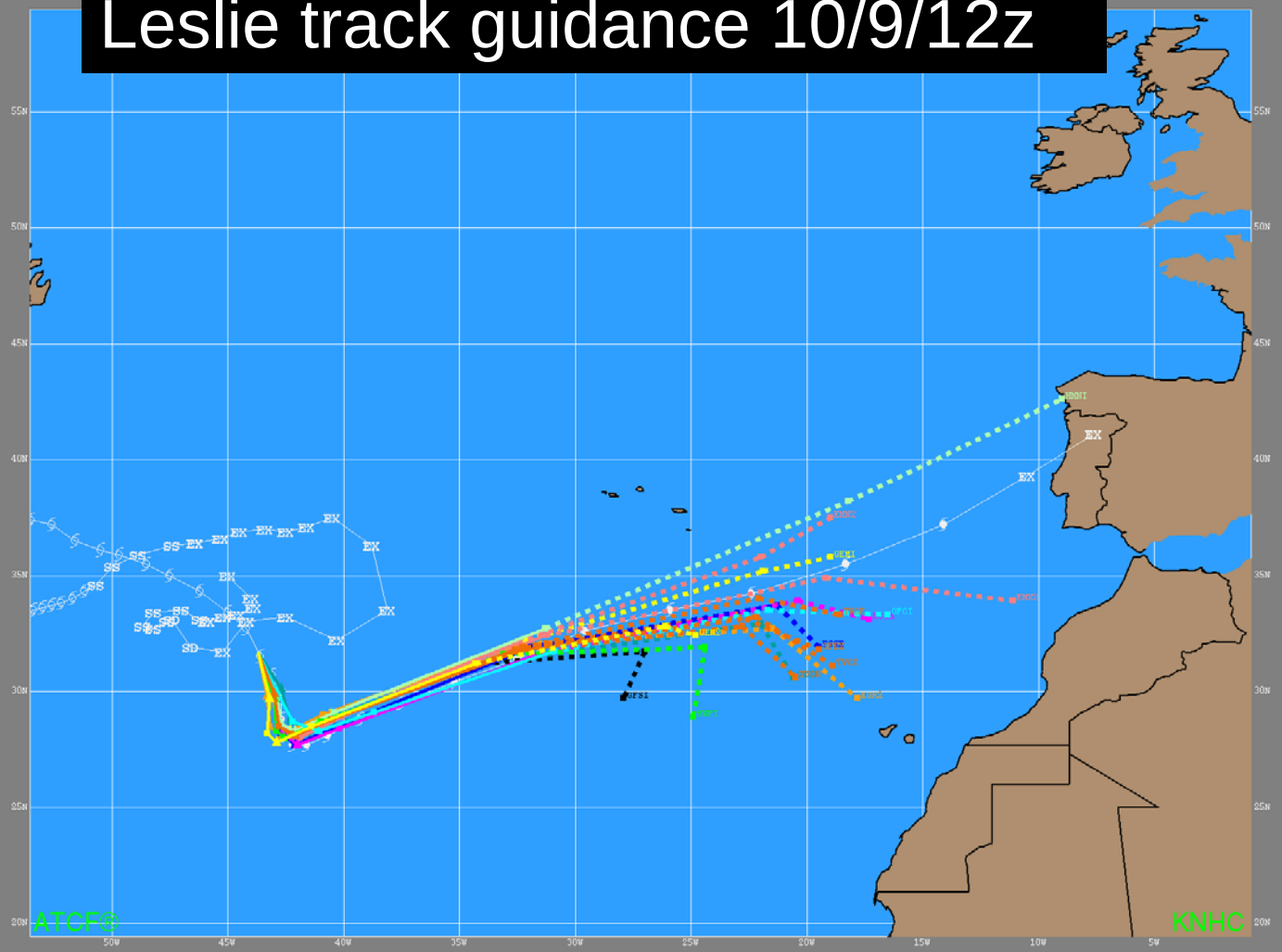
Leslie track guidance 10/9/06z



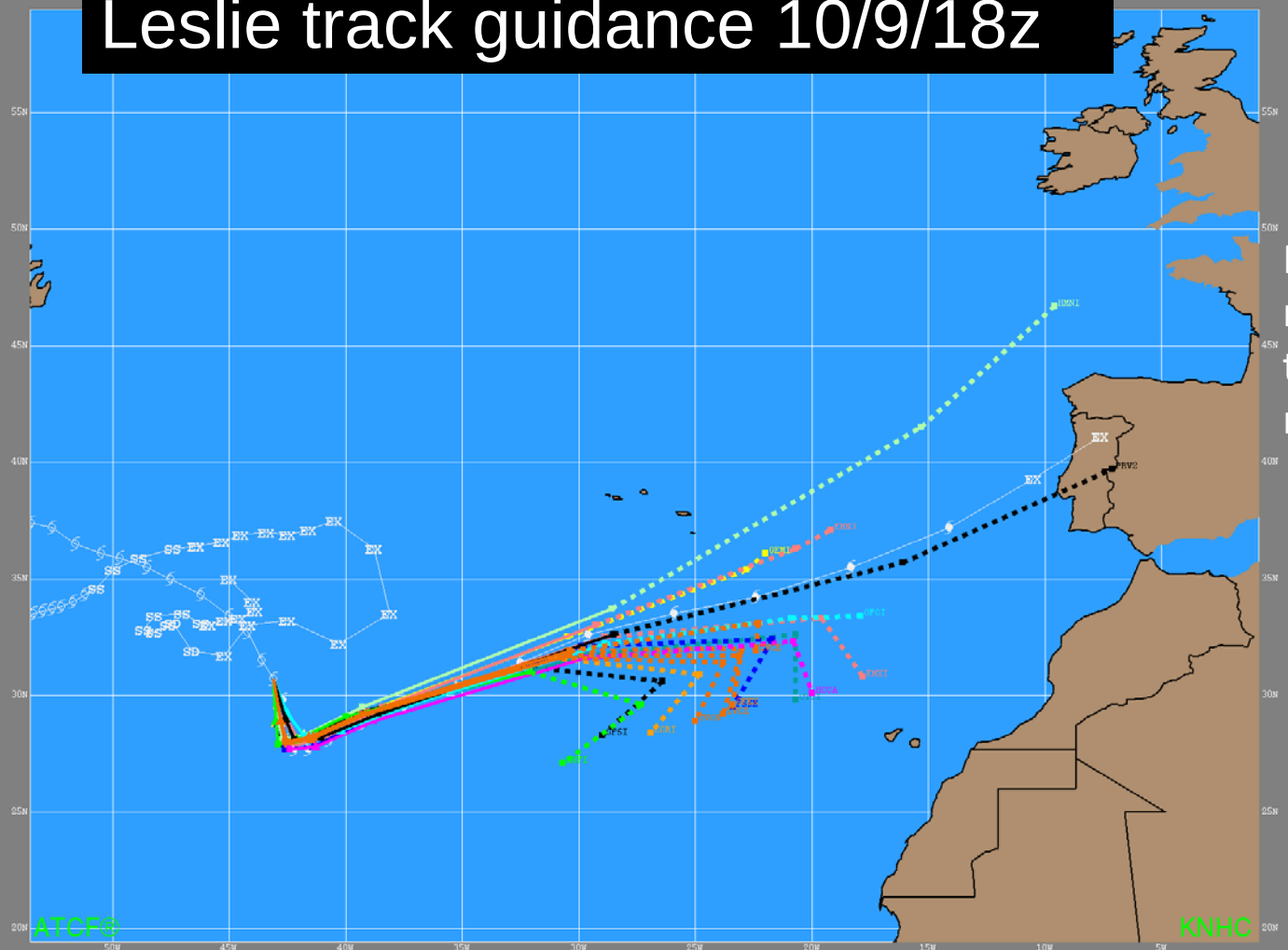
Major model spread, but best models farthest south



Leslie track guidance 10/9/12z

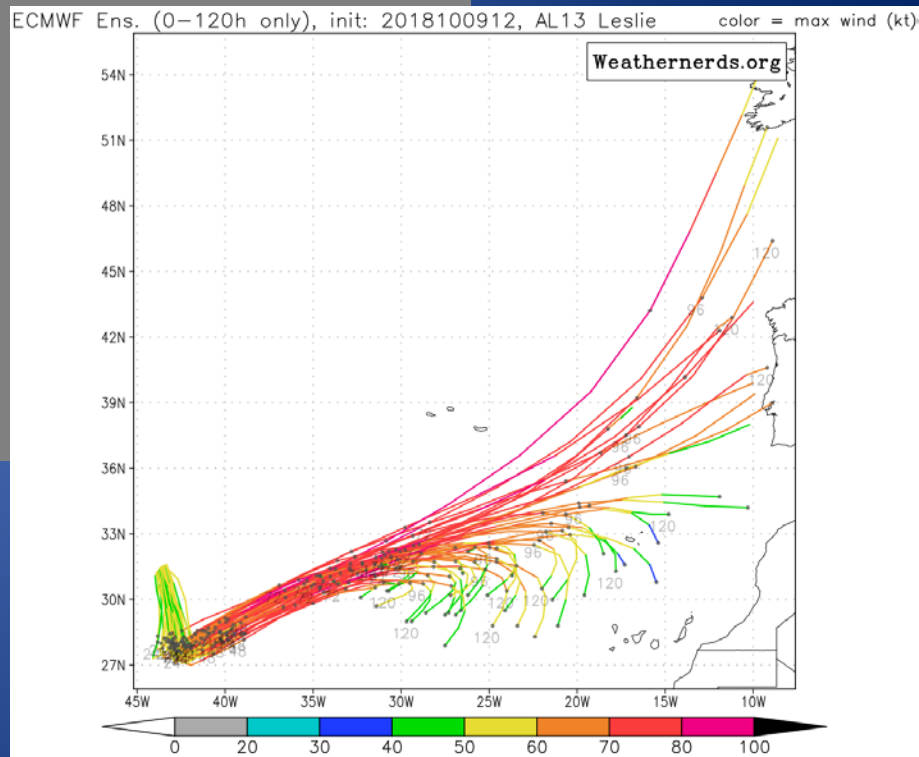


Leslie track guidance 10/9/18z

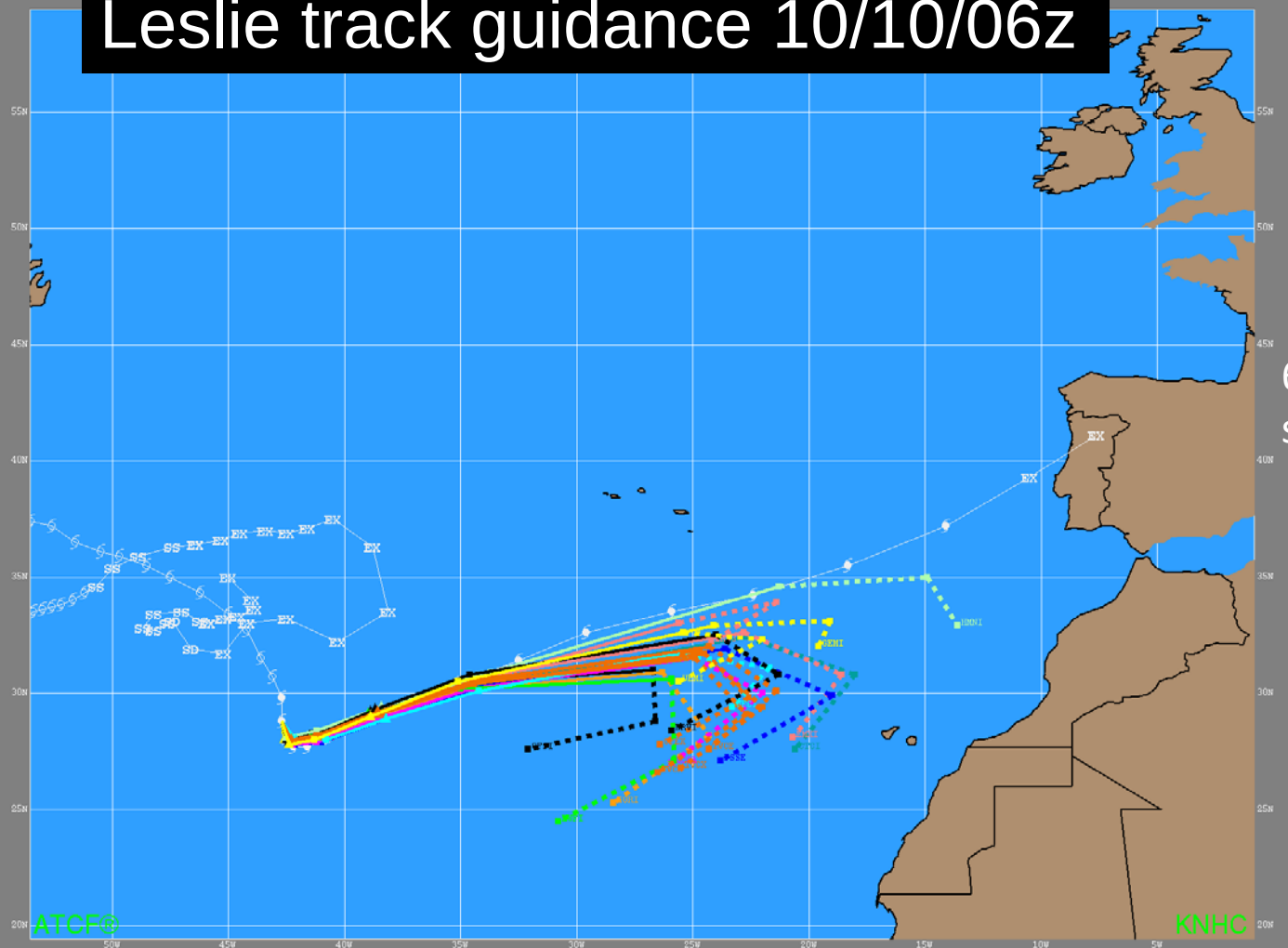


Major model shift- all reliable guidance except the HMON indicate Leslie misses the trough

Massive EC Ensemble spread

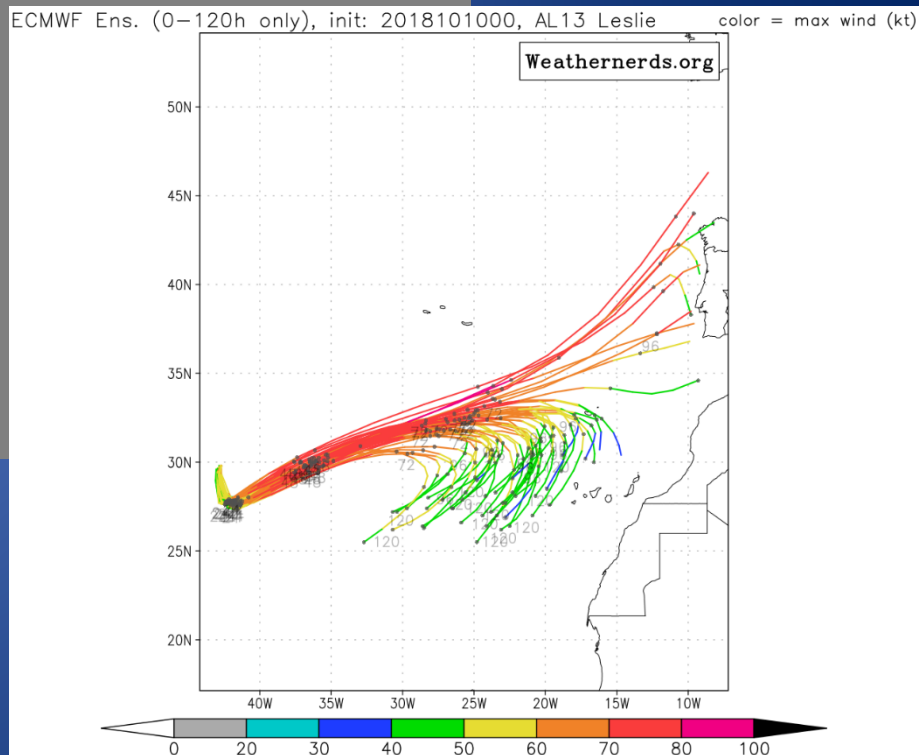


Leslie track guidance 10/10/06z

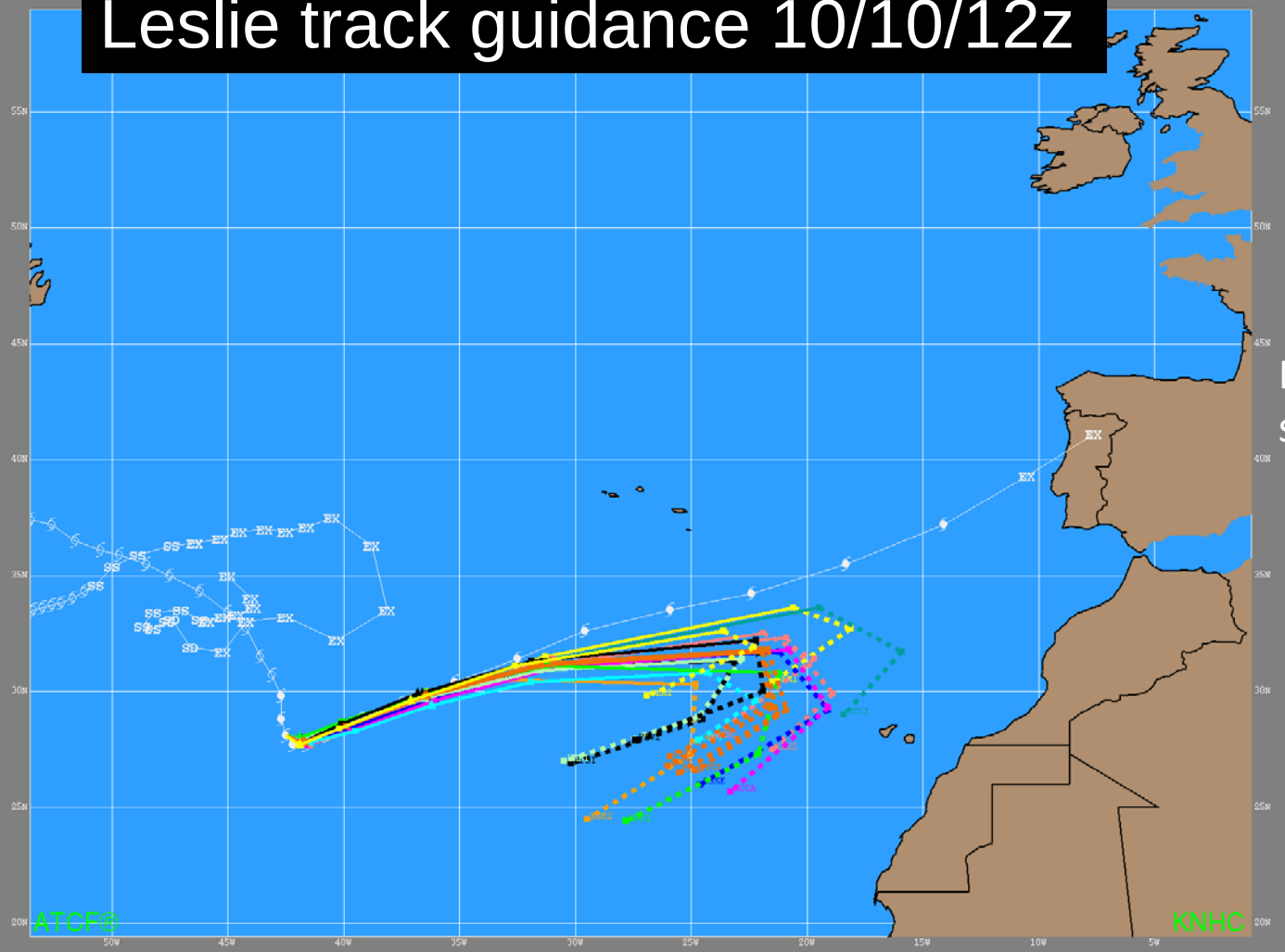


6 hours later, all models shift southward.

EC ensemble not as definitive

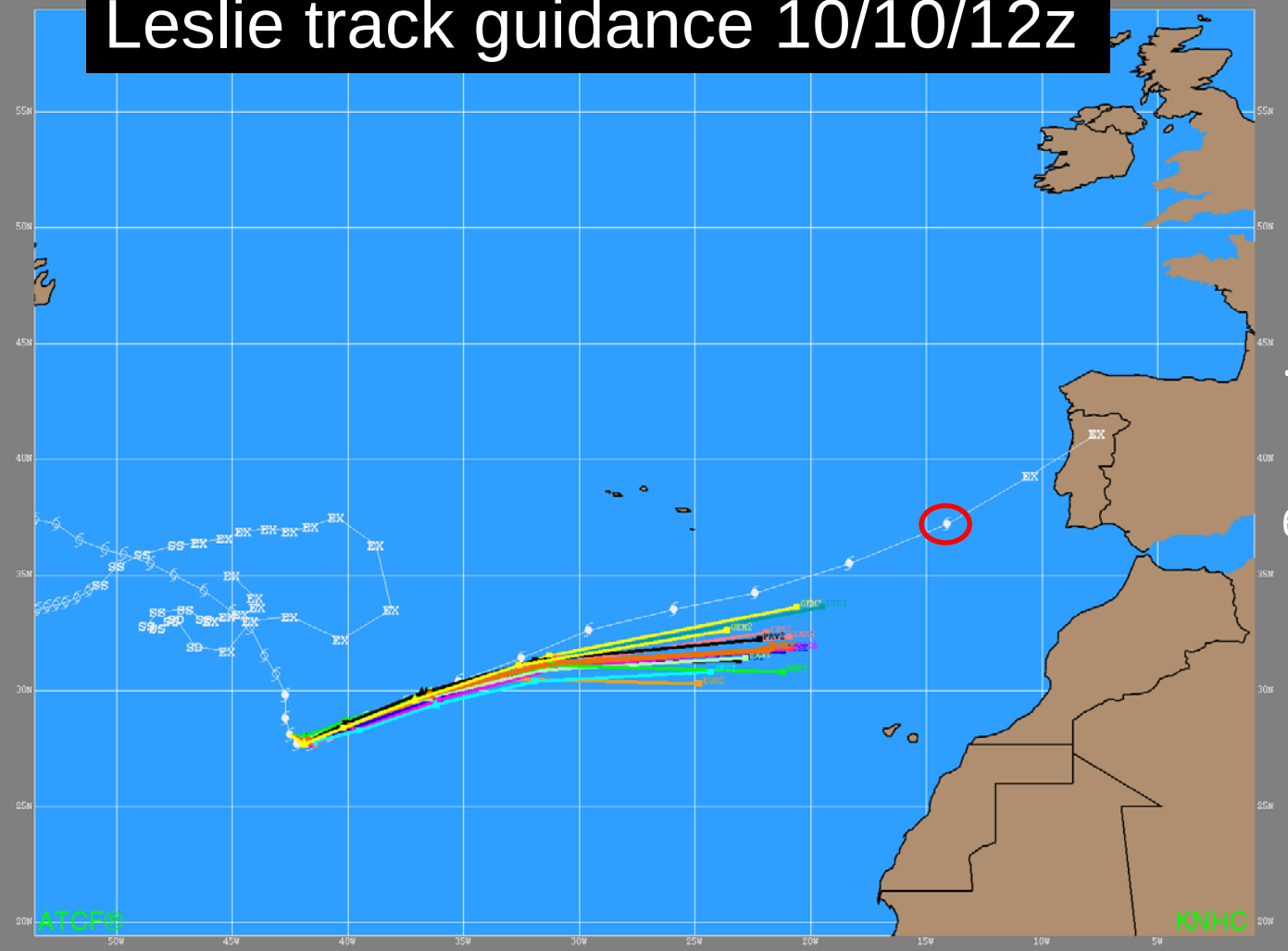


Leslie track guidance 10/10/12z



Models keep shifting southward

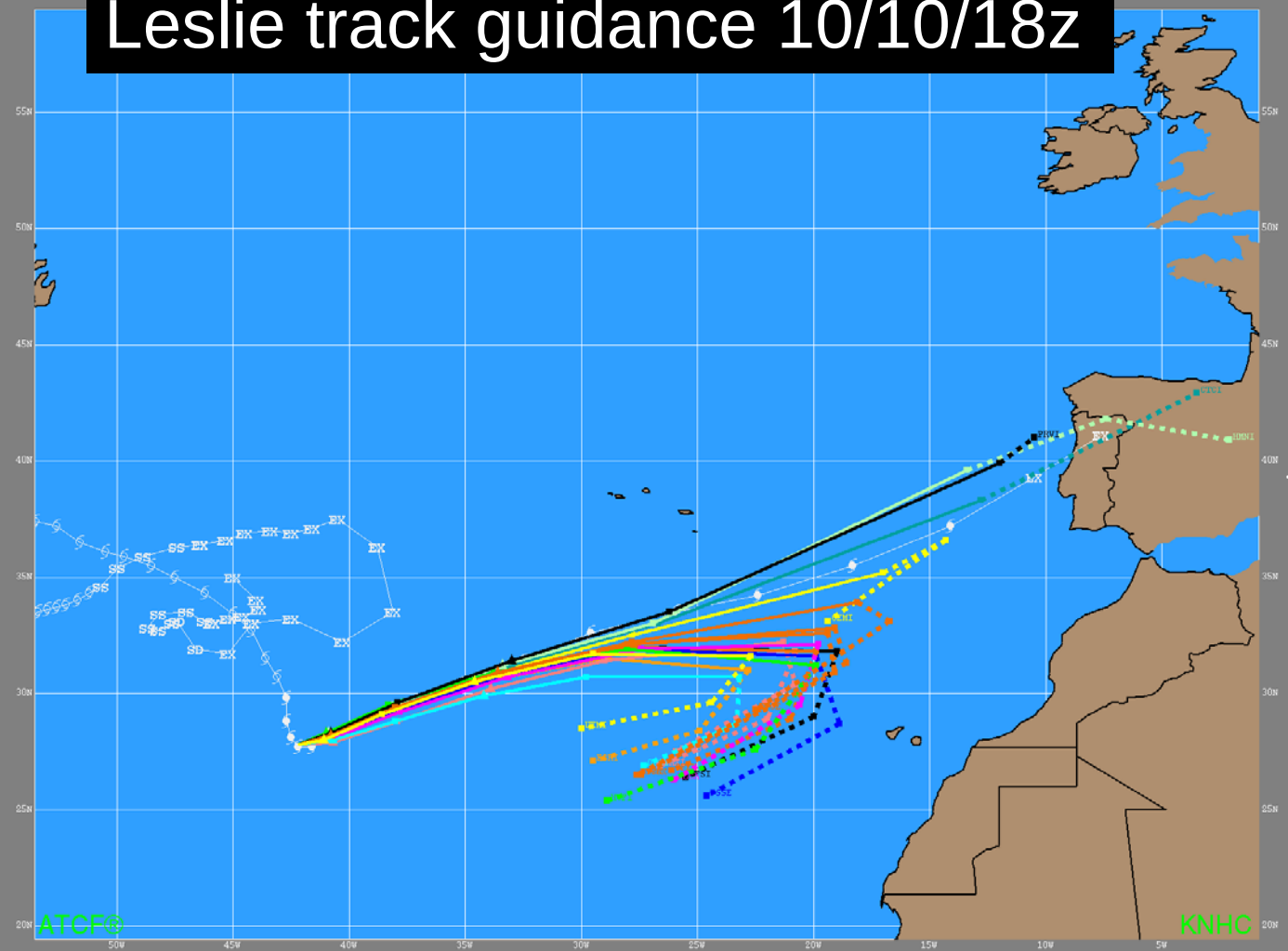
Leslie track guidance 10/10/12z



72 hour zoom –

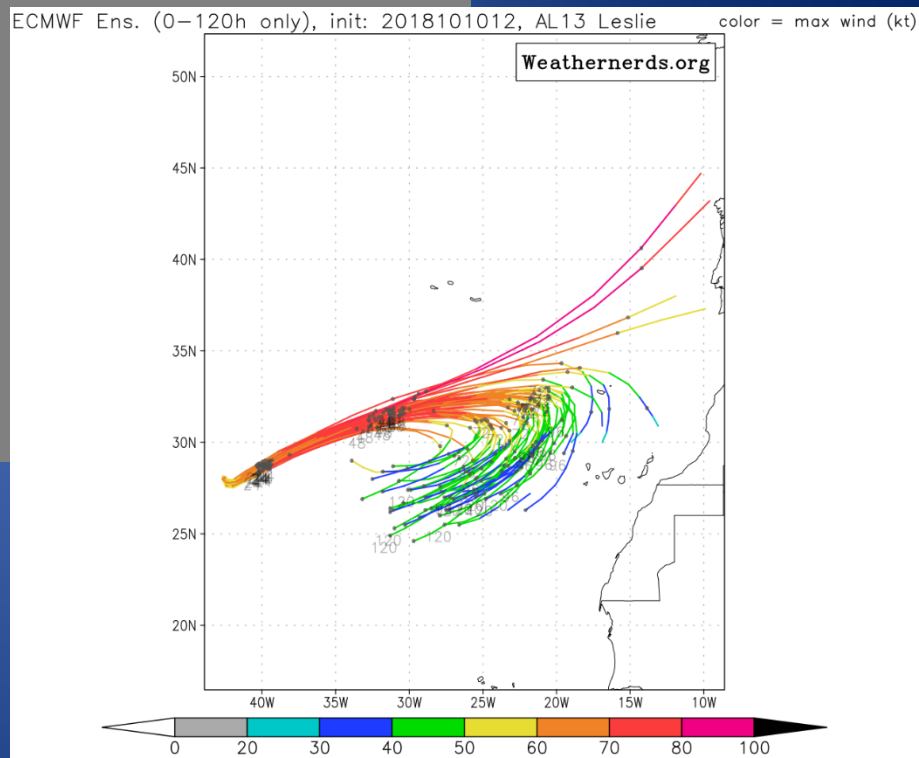
All models have a 400-600 n mi error

Leslie track guidance 10/10/18z

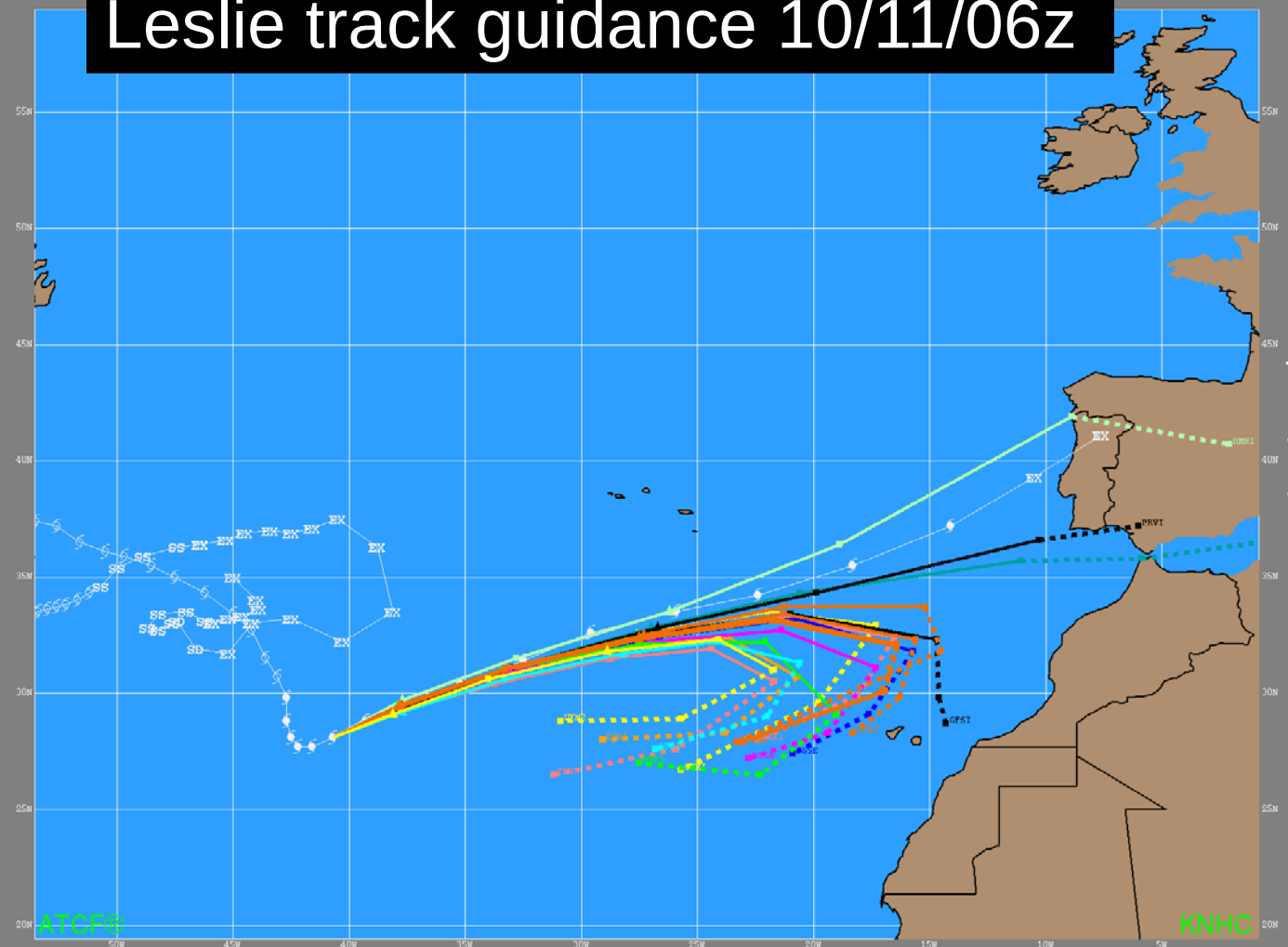


Few more models shift north, but most still miss the trough

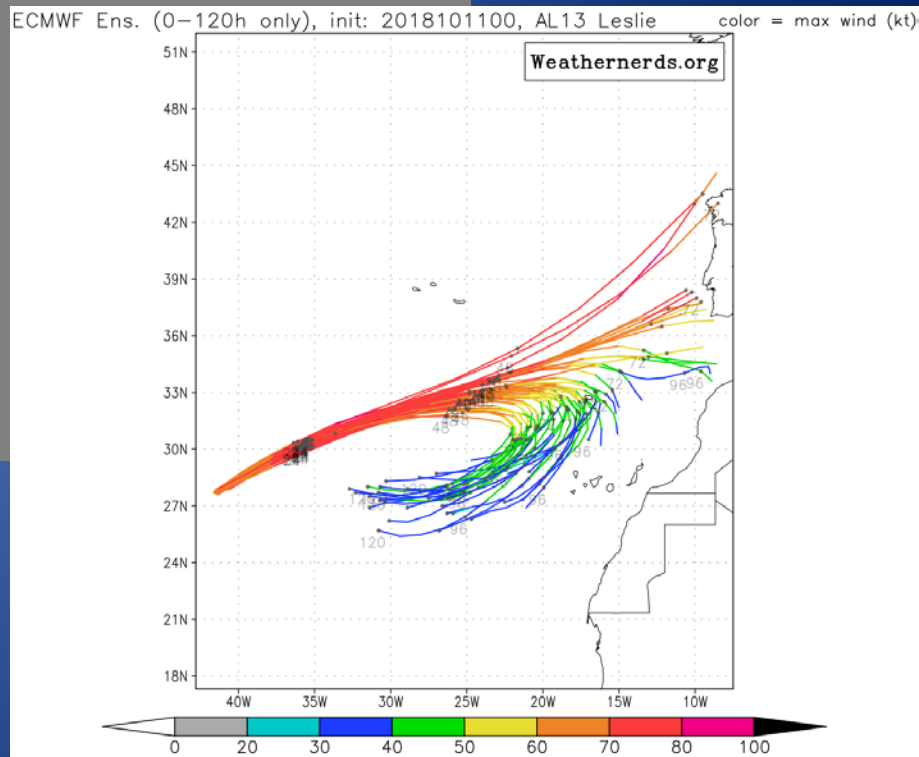
EC ensemble continues to shift south



Leslie track guidance 10/11/06z

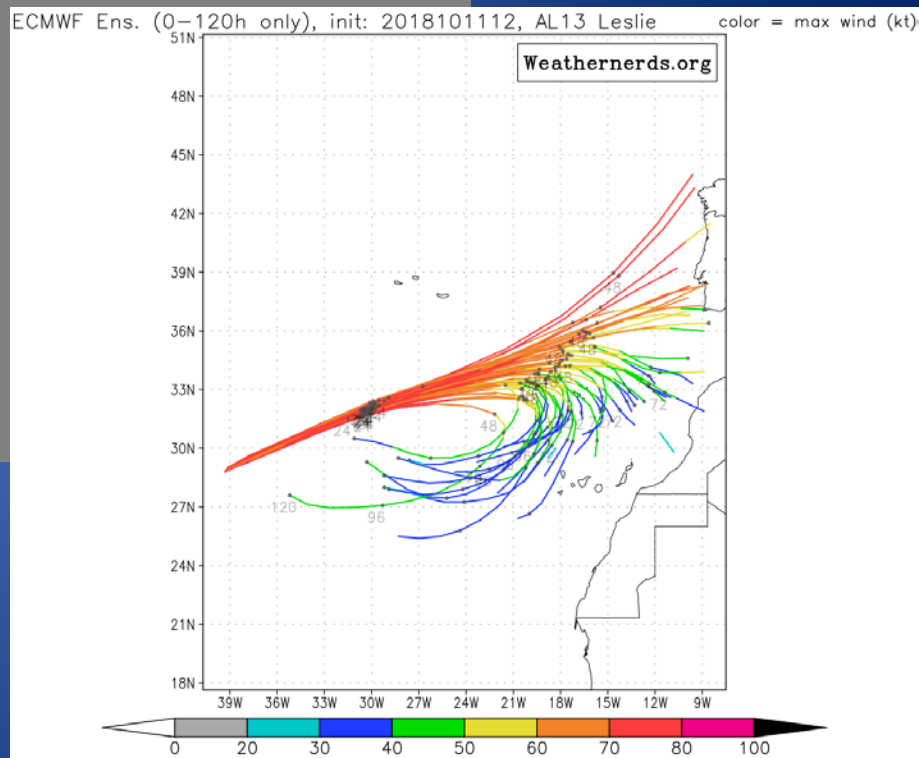


The most reliable guidance stay south, though some shift north



Leslie track guidance 10/11/18z

Deterministic models shift south, but little change in EC ensemble

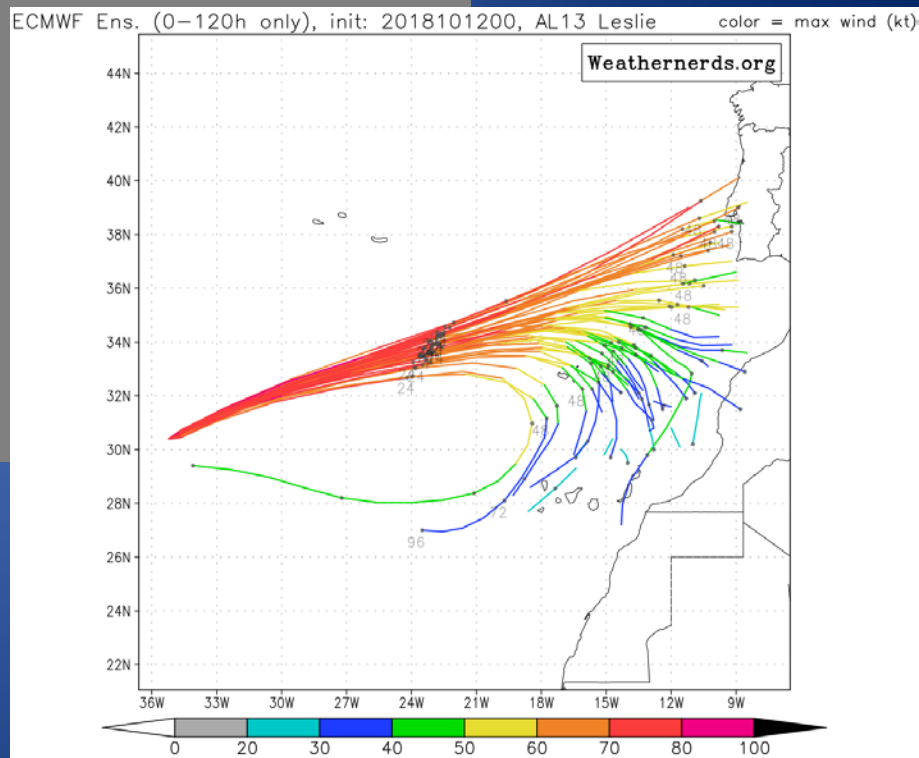


FV3 shifts over 1500 n mi

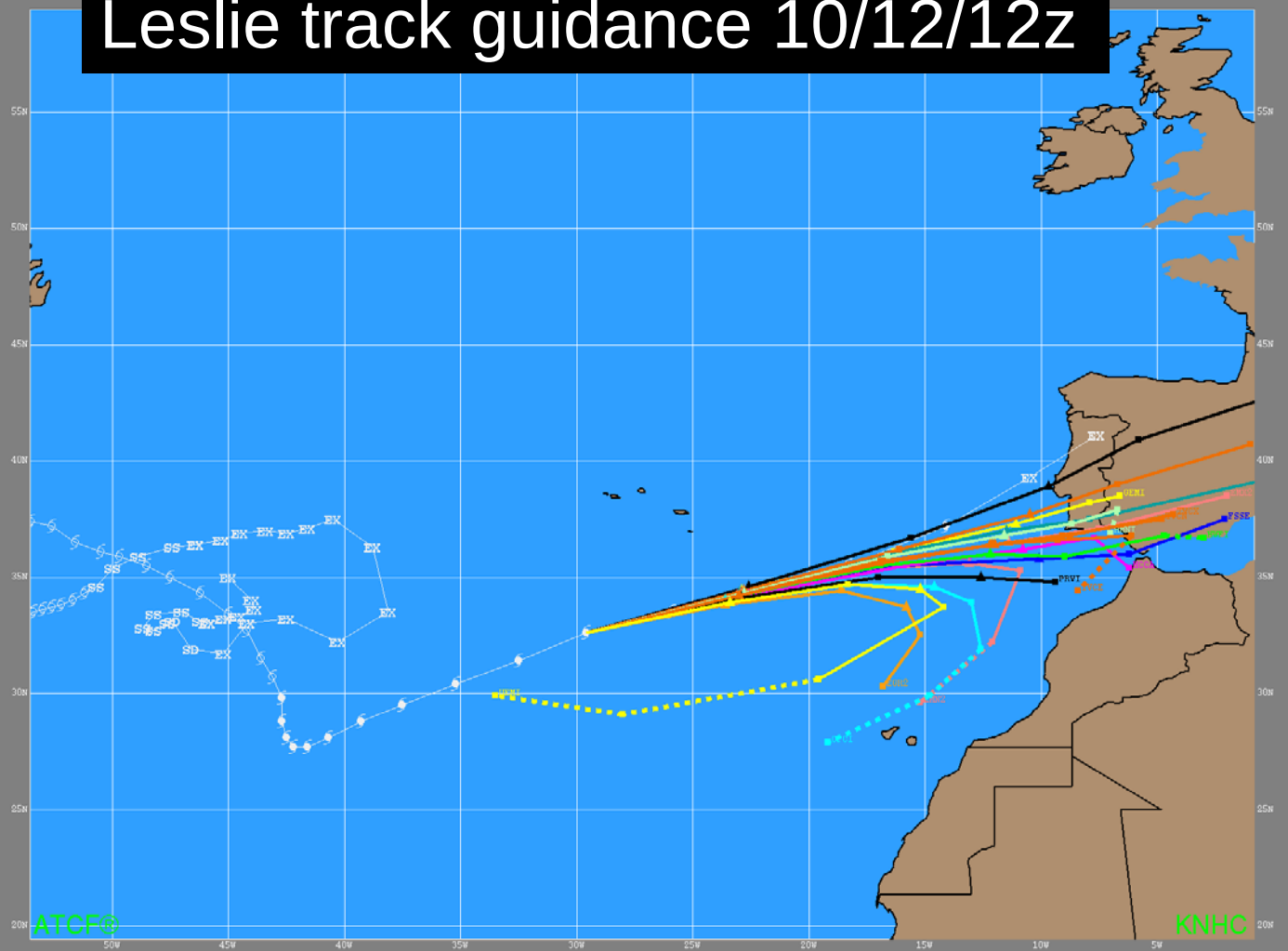
~400 n mi errors in < 48 h

Leslie track guidance 10/12/06z

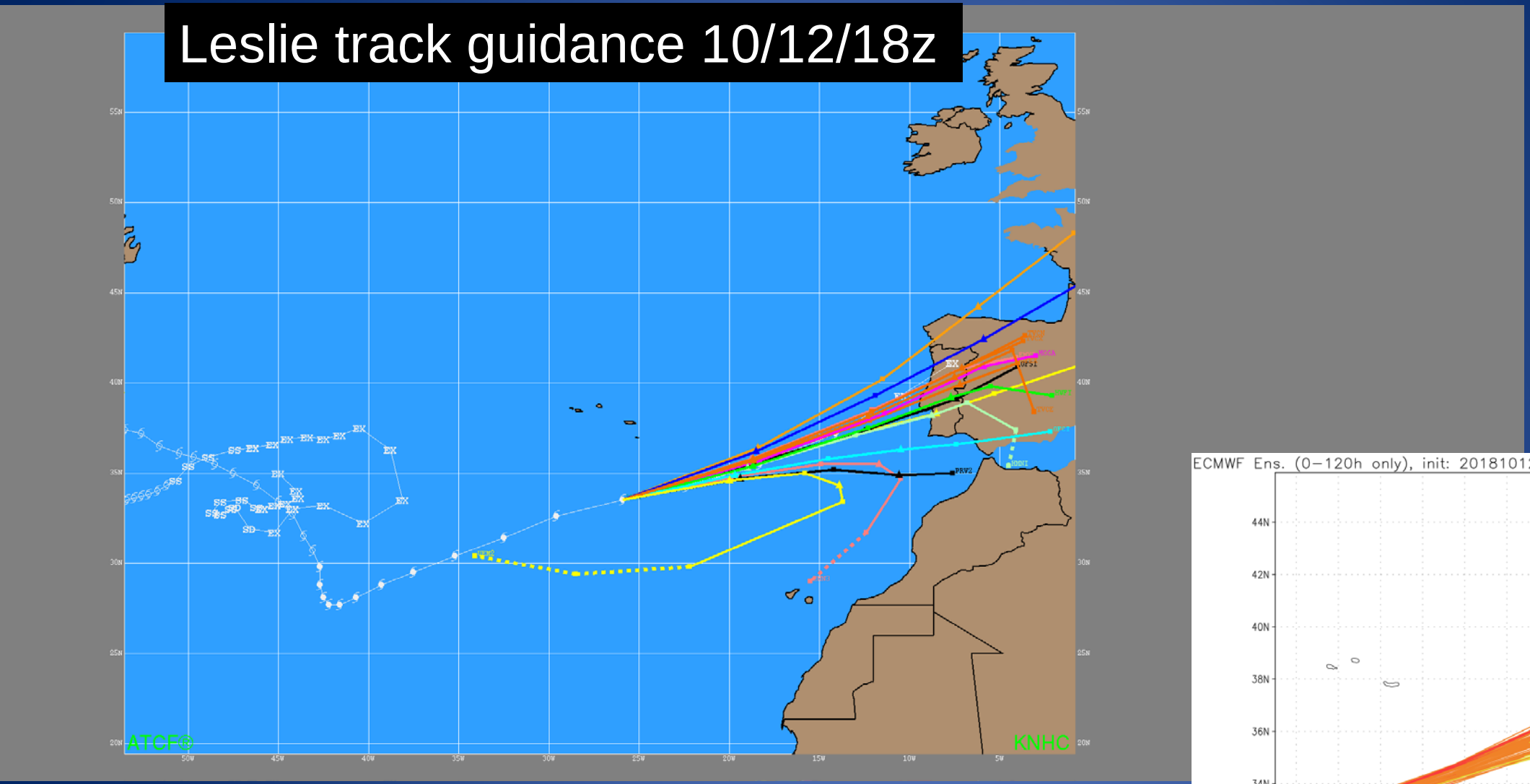
Models mostly jump northward

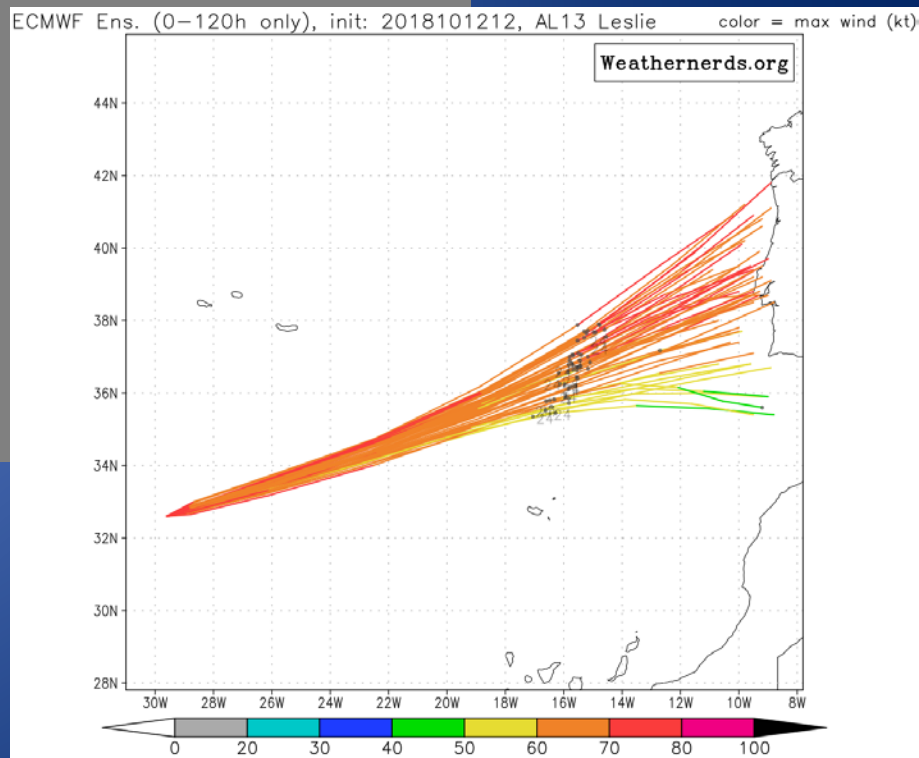


Leslie track guidance 10/12/12z

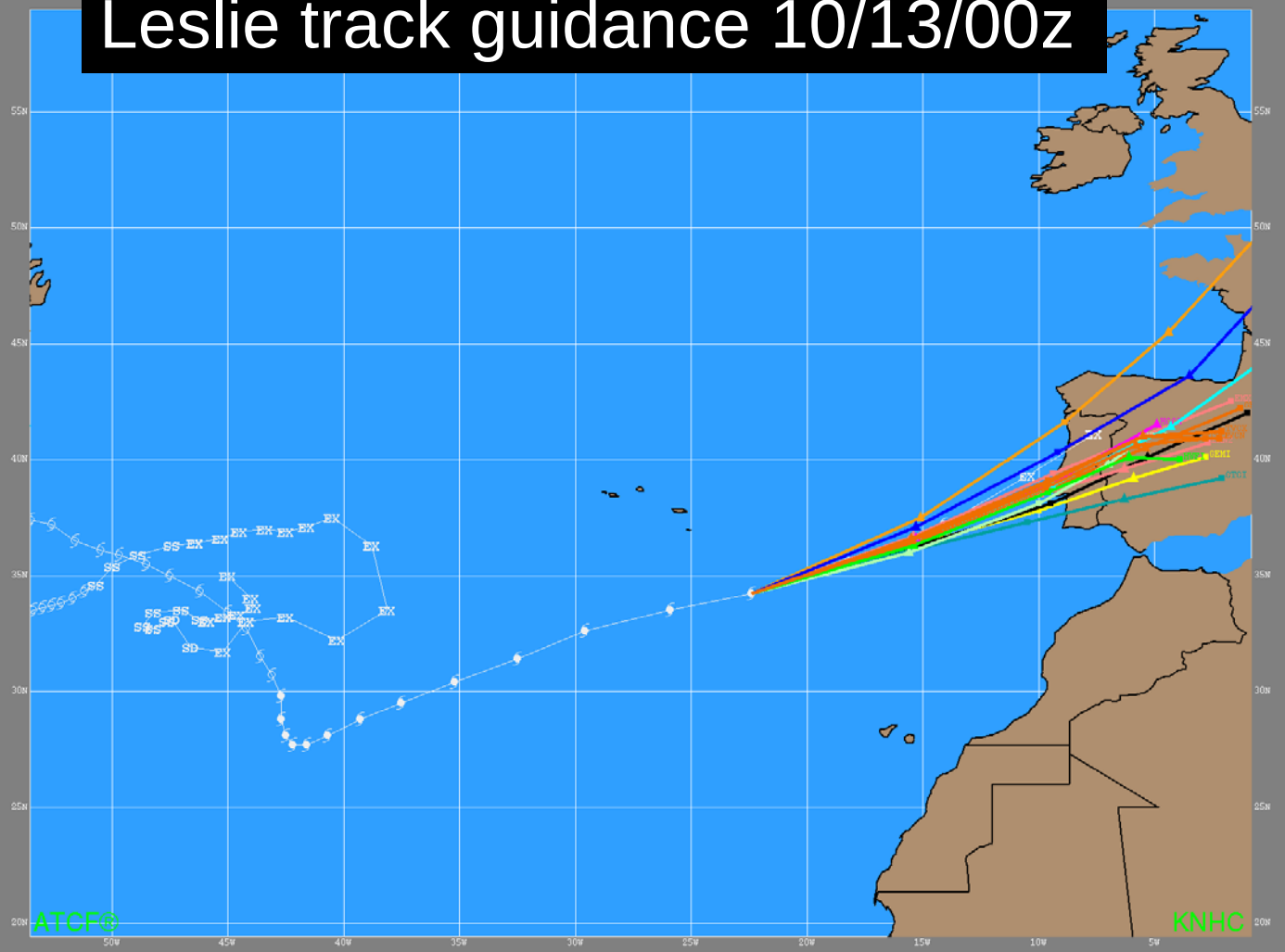


Leslie track guidance 10/12/18z





Leslie track guidance 10/13/00z

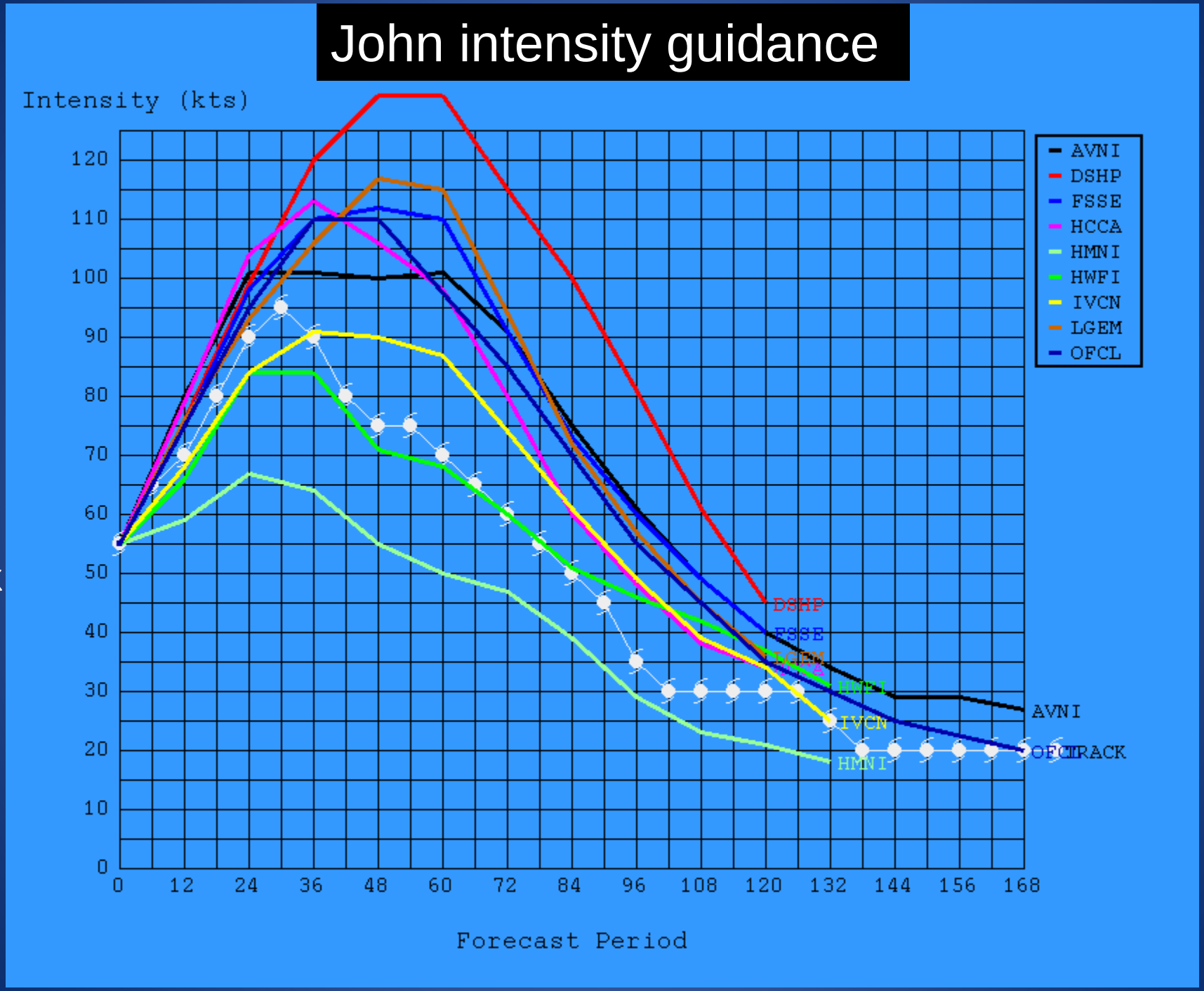


Finally!

John intensity guidance

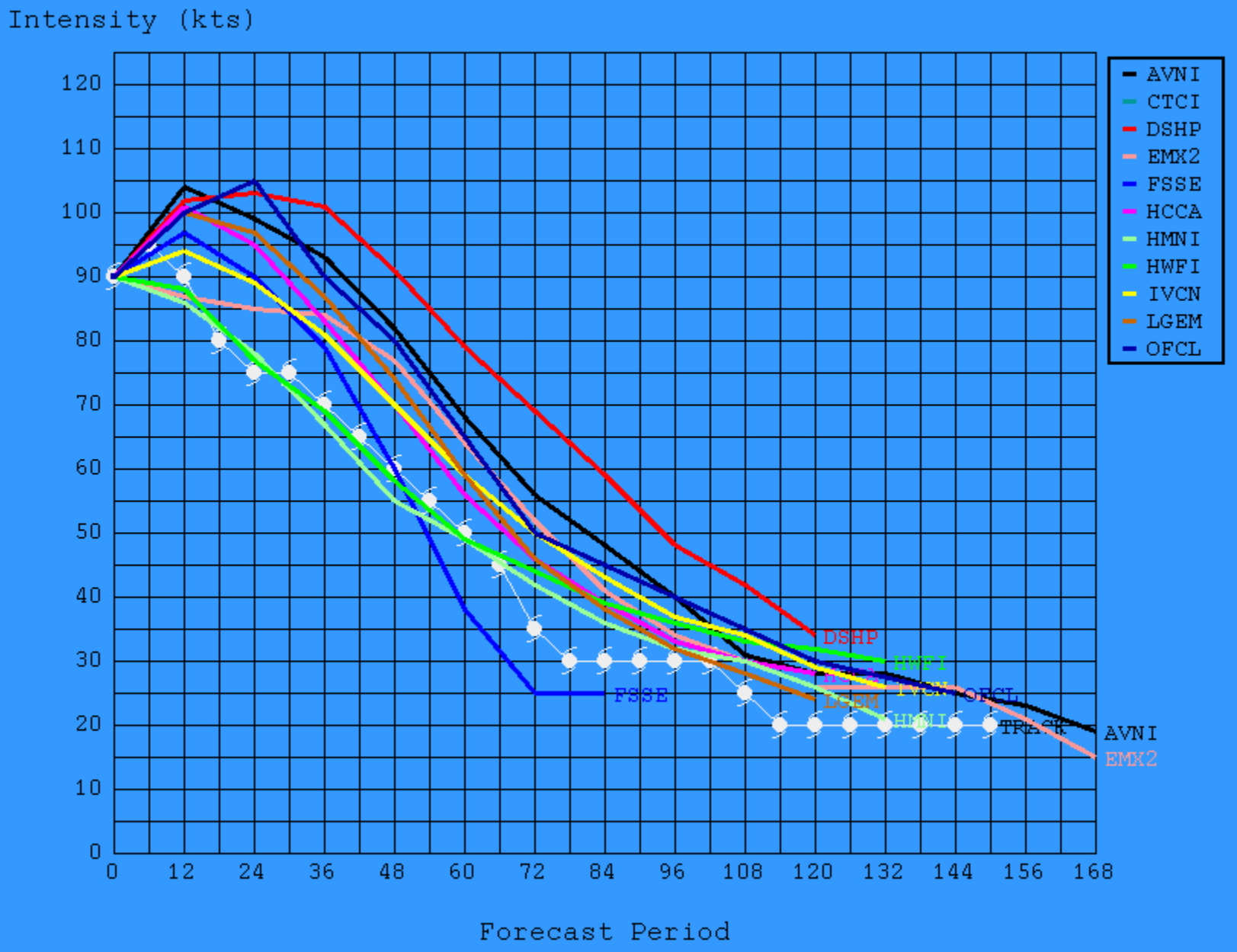
Successful RI forecast by most of the guidance!

However peak intensity timing and magnitude was off, leading to large errors

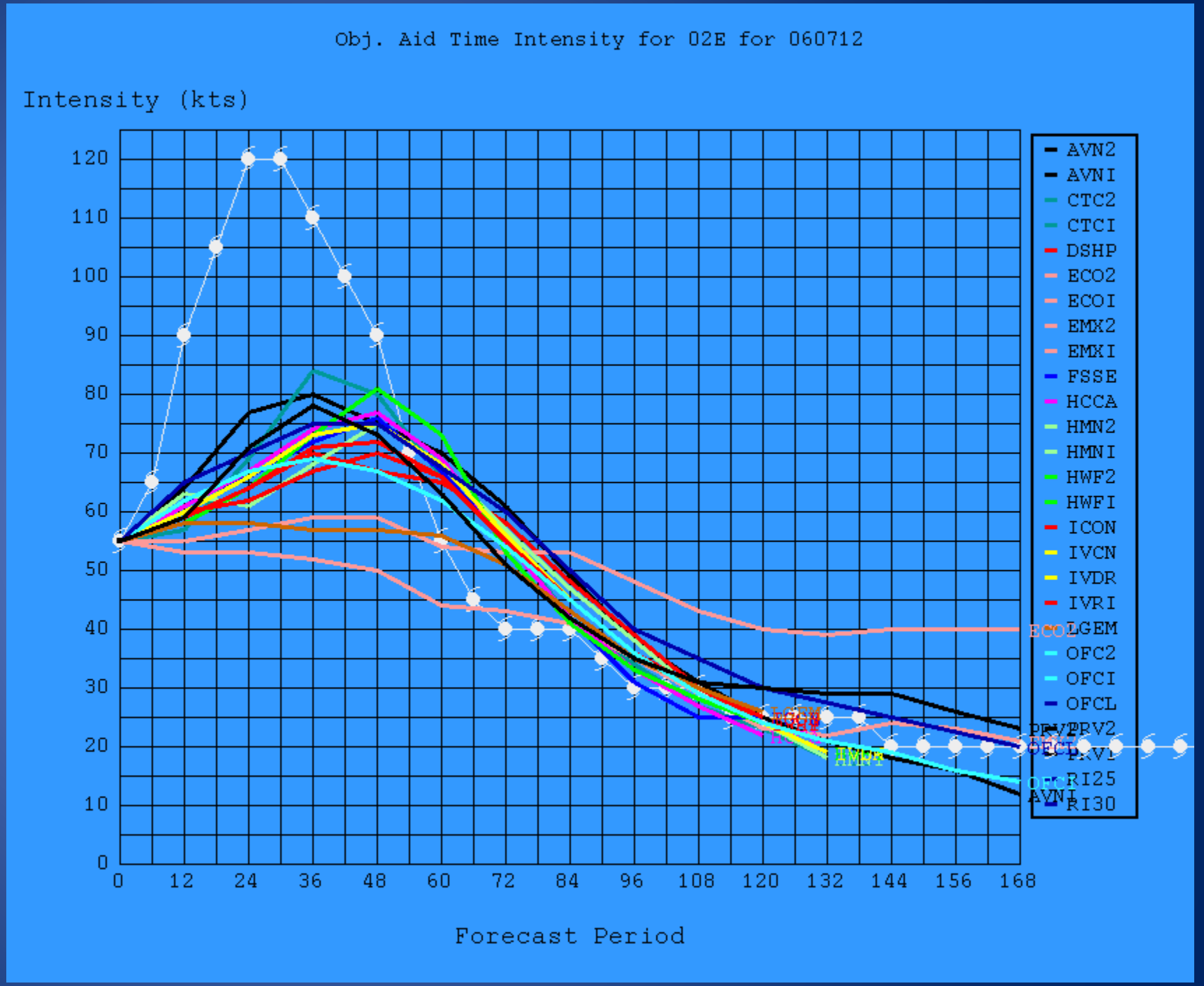


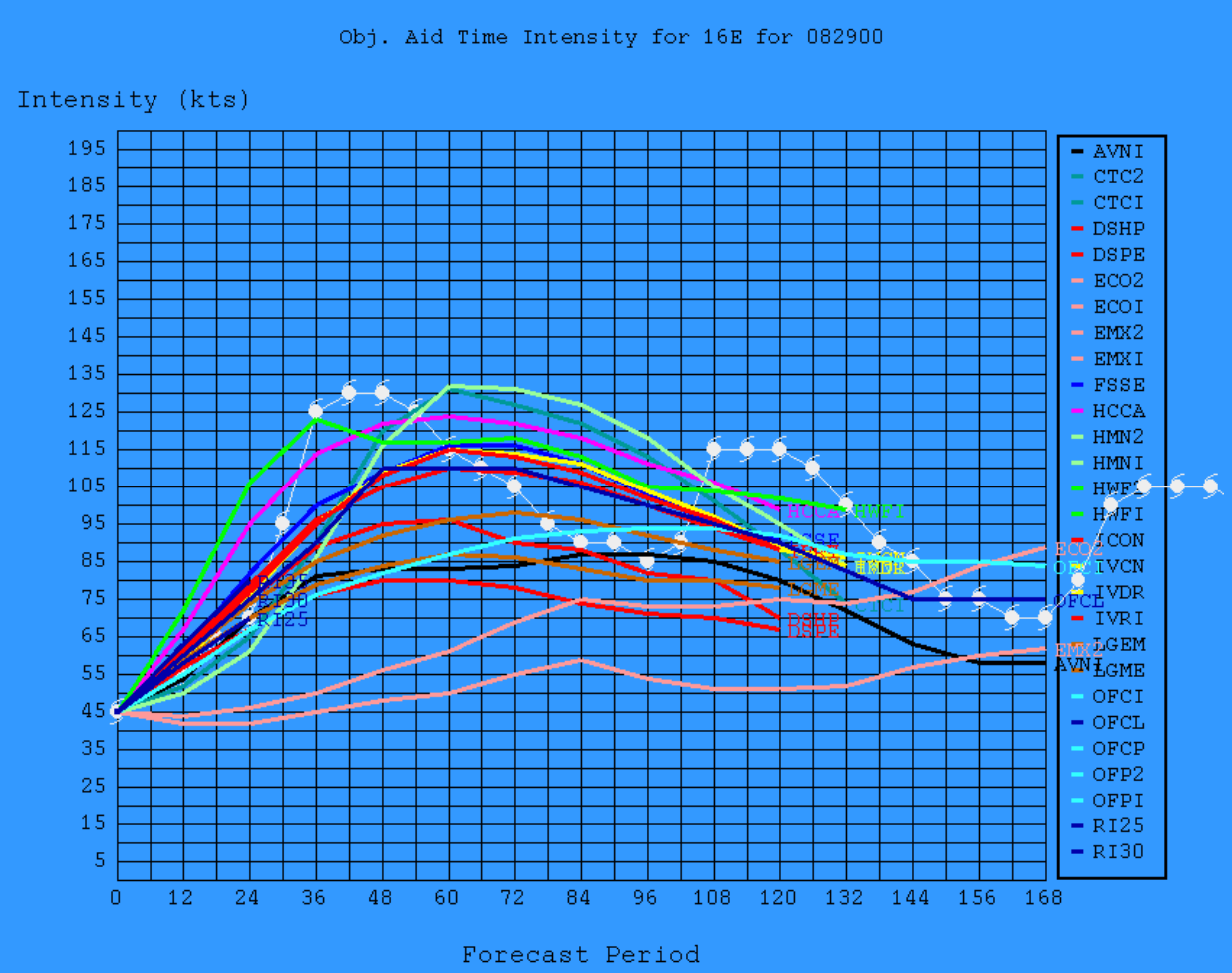
John intensity guidance

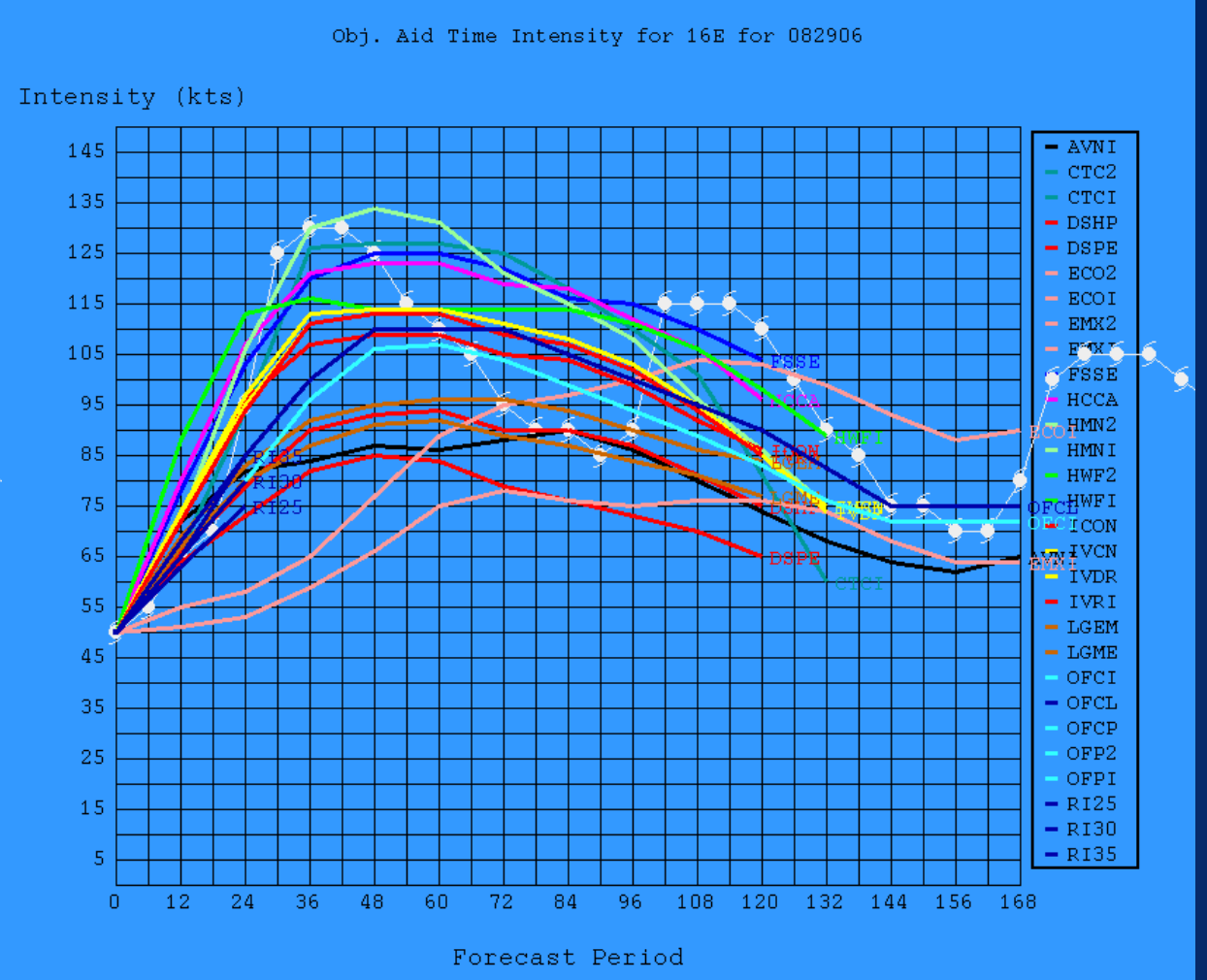
24 h later:
Led to large overforecast errors at peak intensity



Biggest RI miss of the year: Aletta – 70 kt in 24 hours

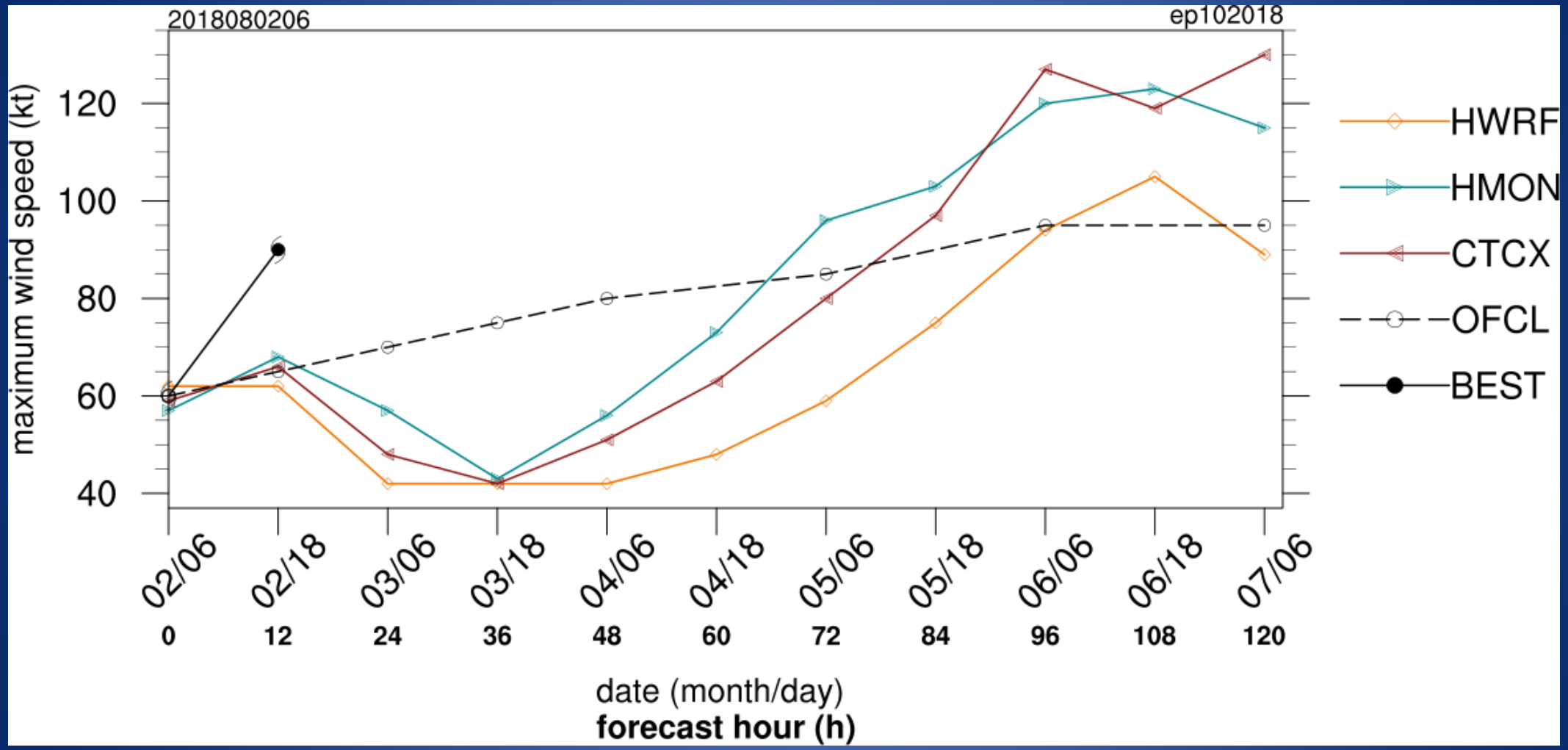




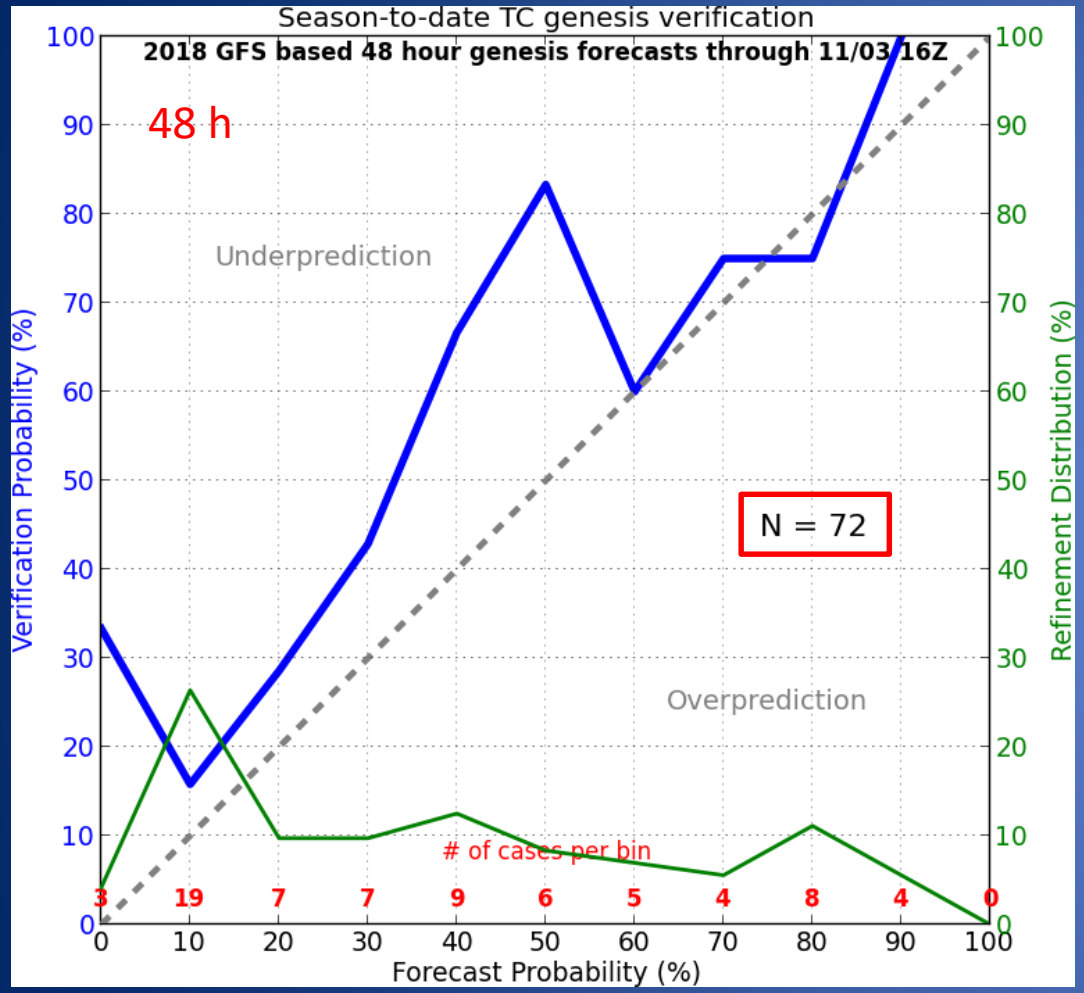


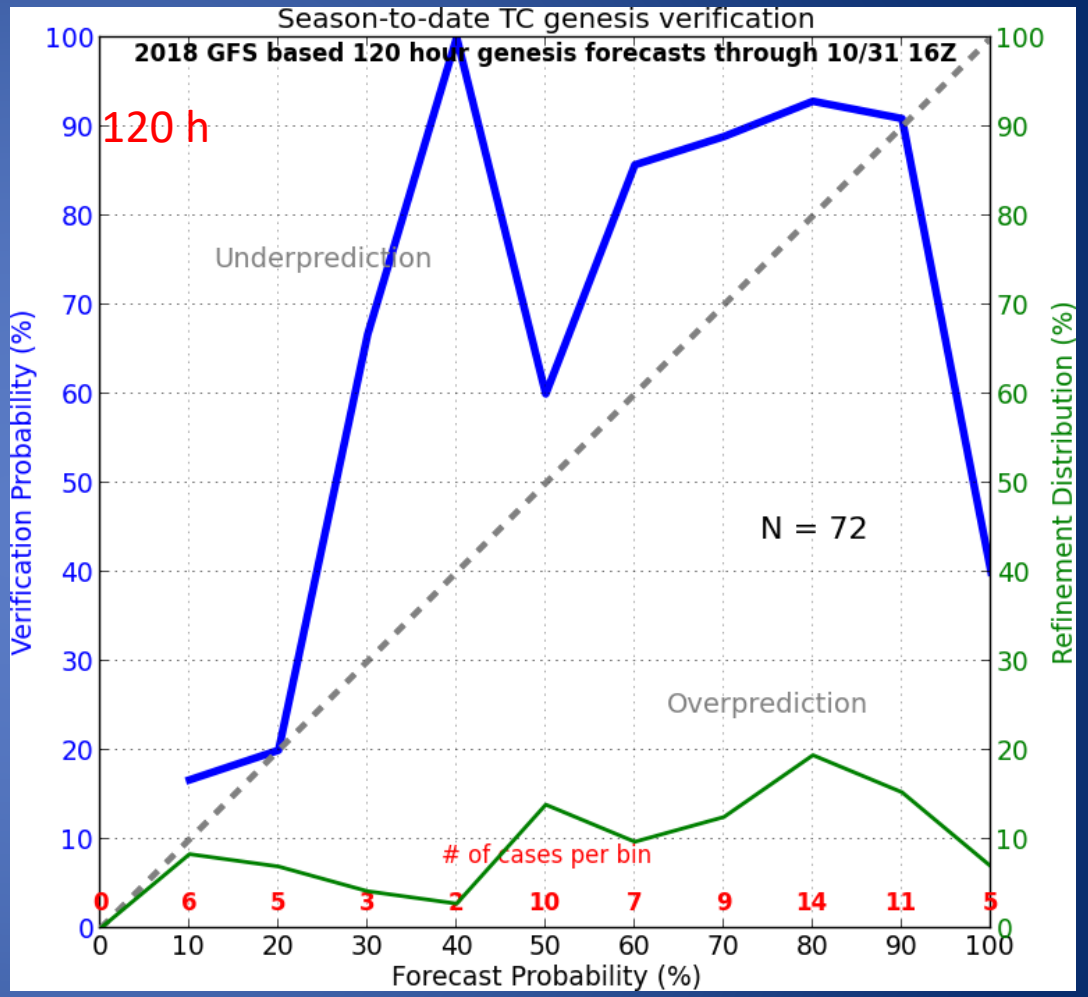
Norman RI forecasts were successful even 48 hours out

Unrealistic spindown during rapid intensification of Hector



GFS Atlantic basin genesis guidance





- Calibration is ok, but not many cases (lots of missed events), NHC issued 510 non-zero outlooks
- This methodology struggles with subtropical cyclones - the Atlantic had 7 this year at some point

Beryl genesis forecasts

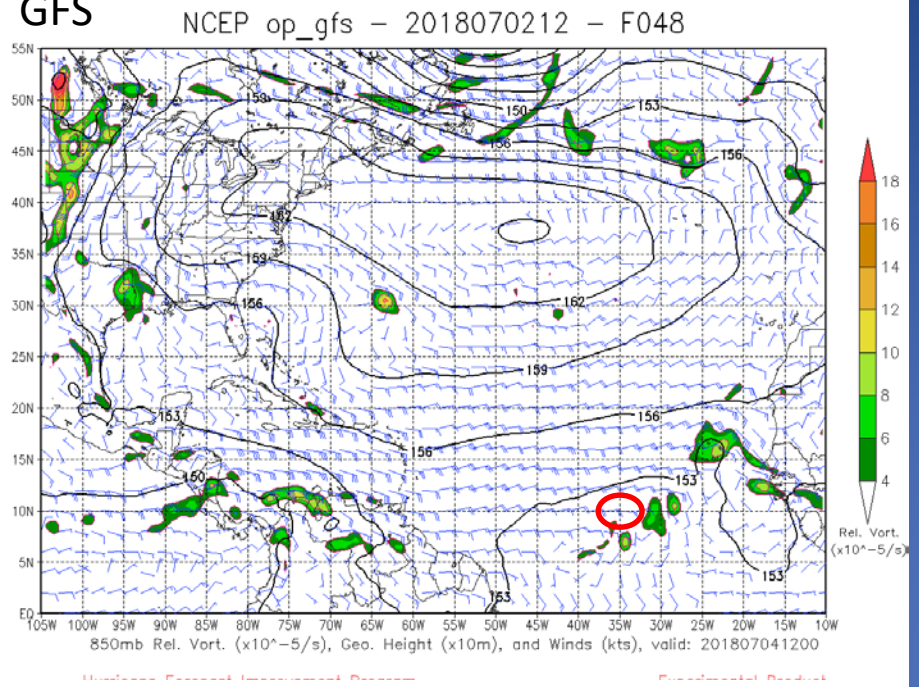
Almost nothing in GFS, EC at best shows a strong wave

2 day

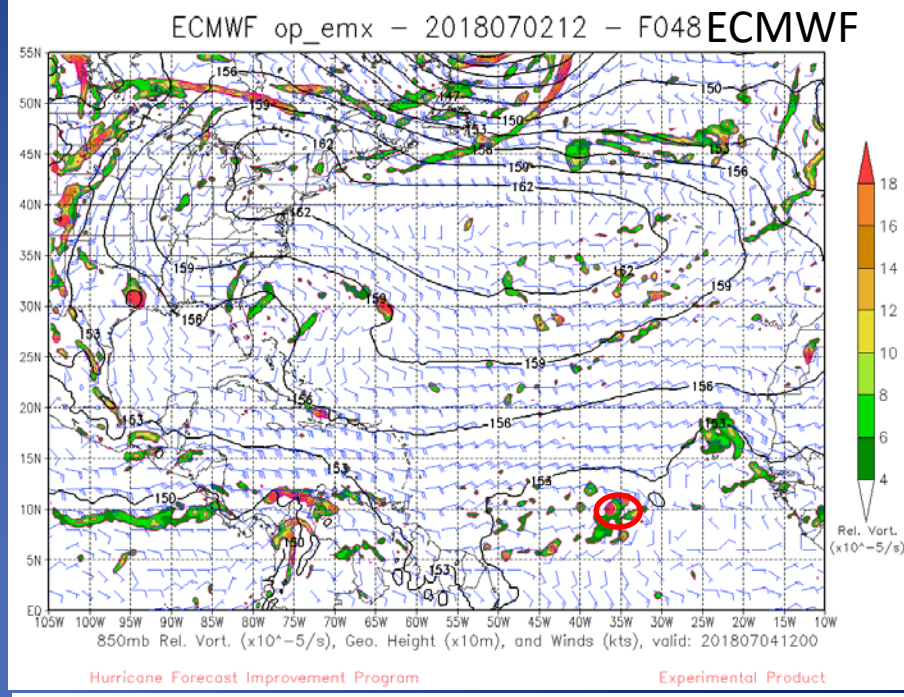
No useful signal in either model

5 day

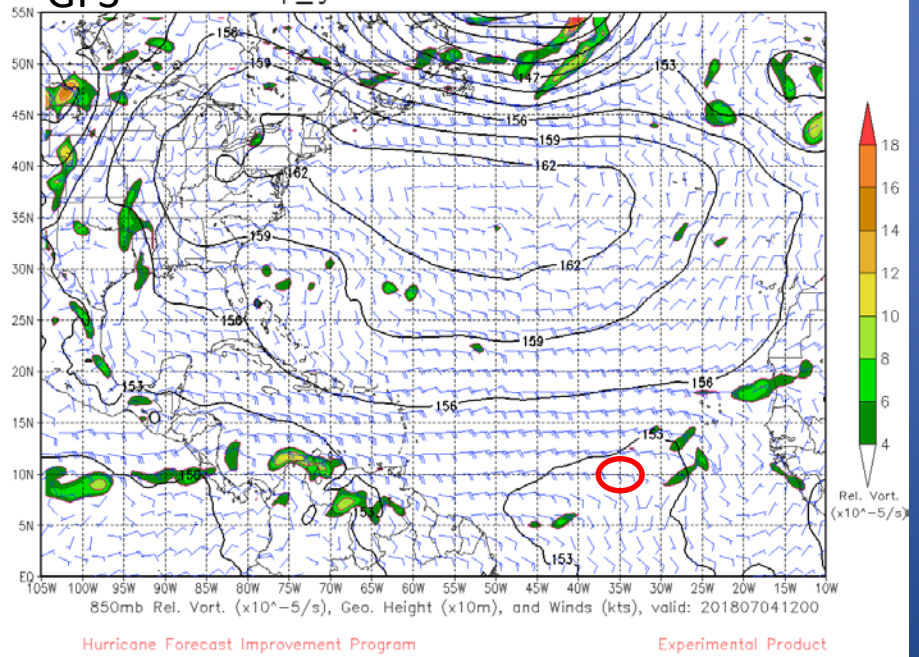
GFS



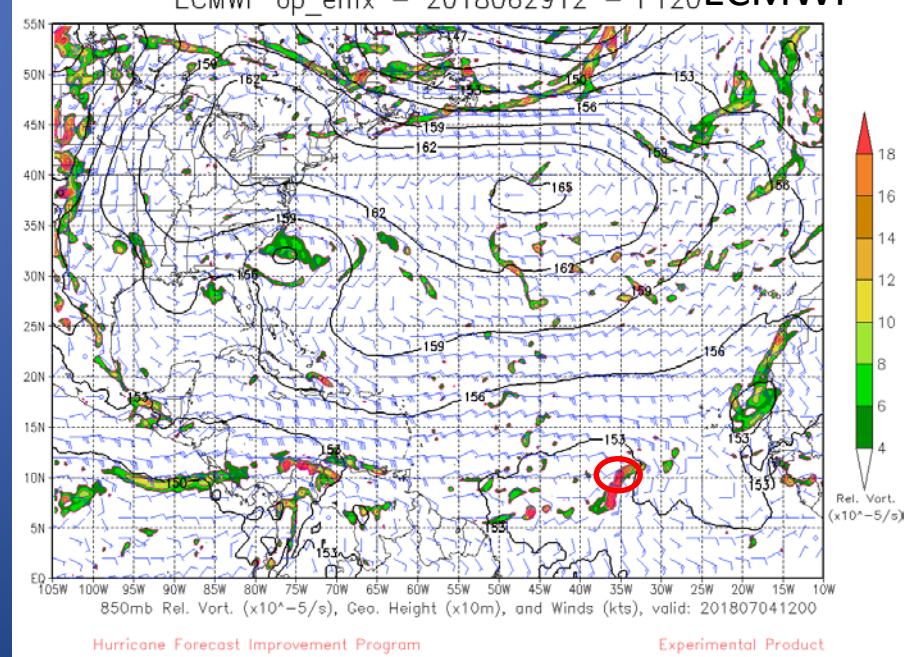
ECMWF



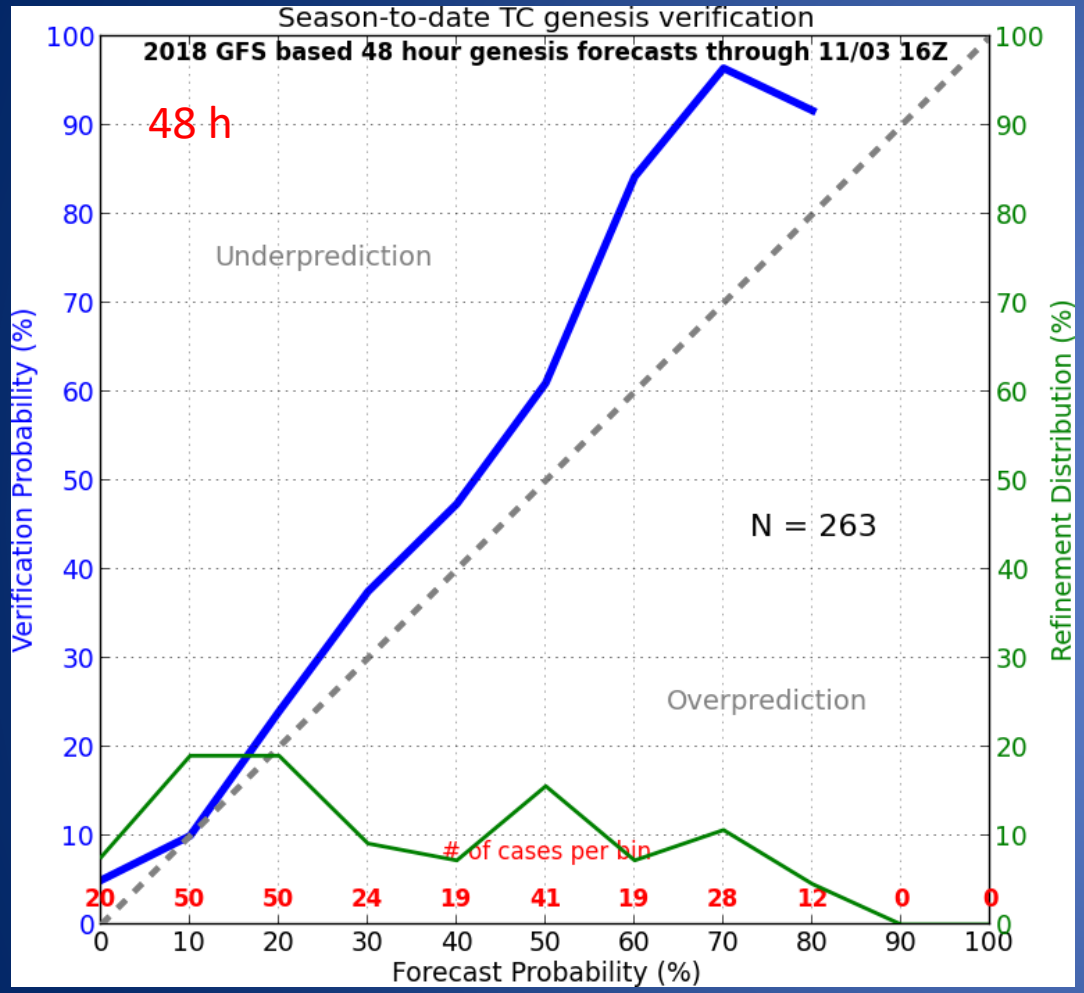
GFS

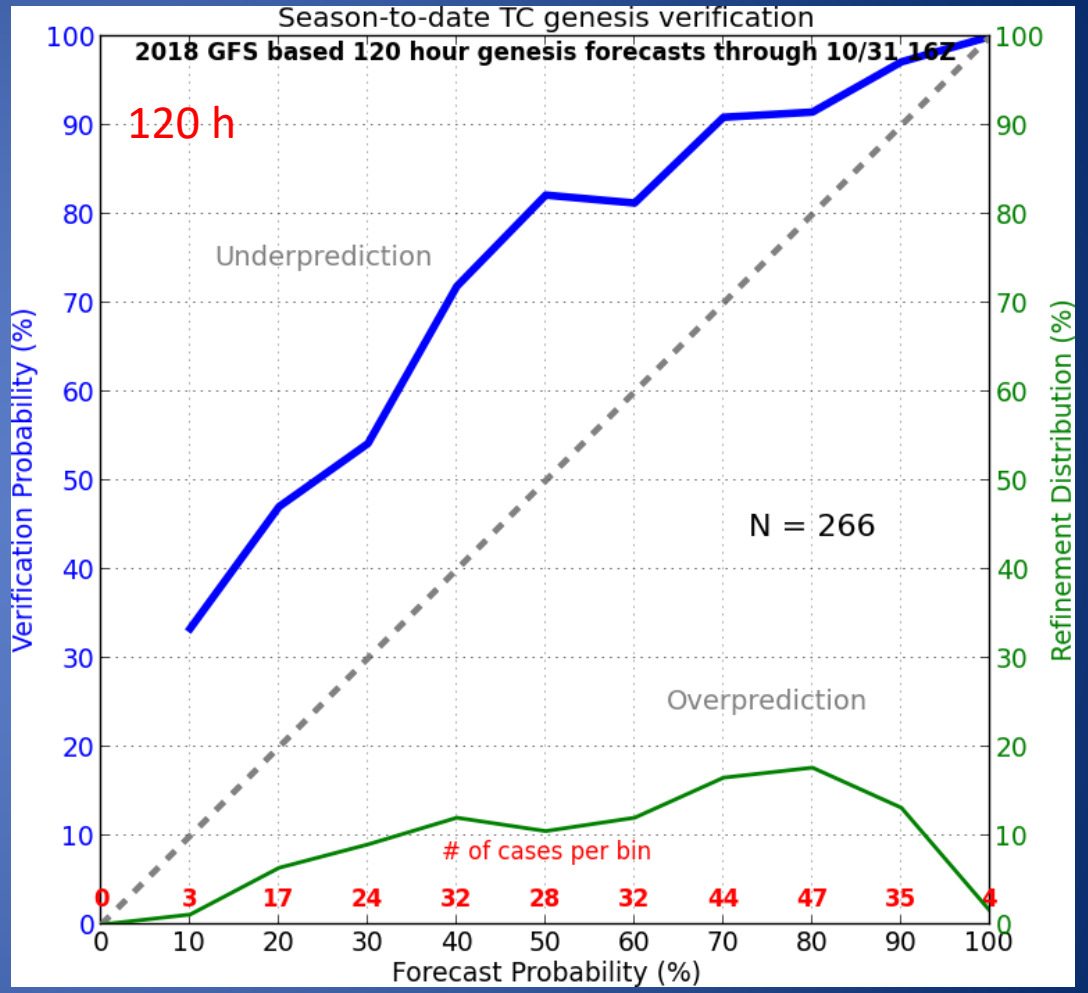


ECMWF



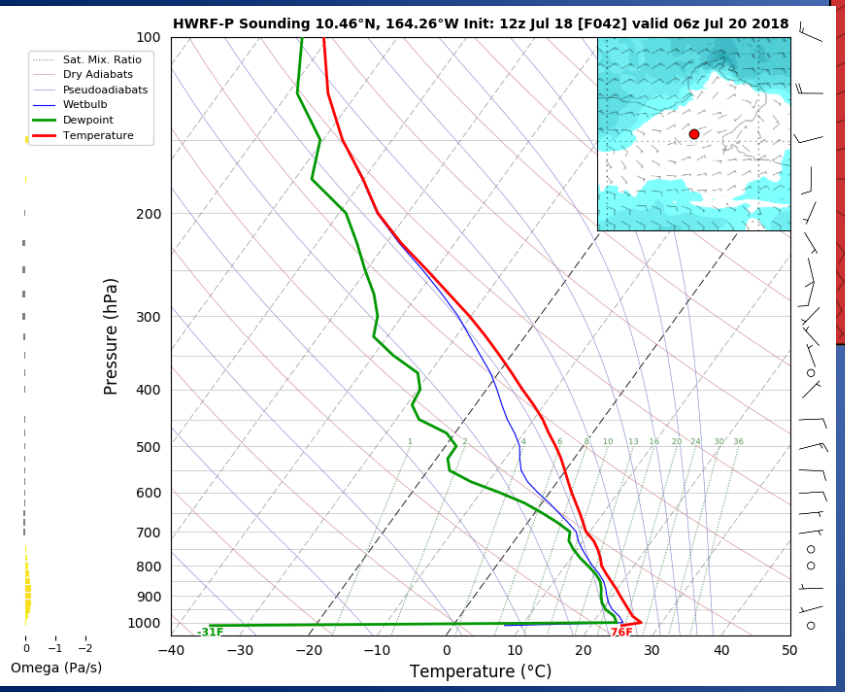
GFS eastern Pacific genesis guidance



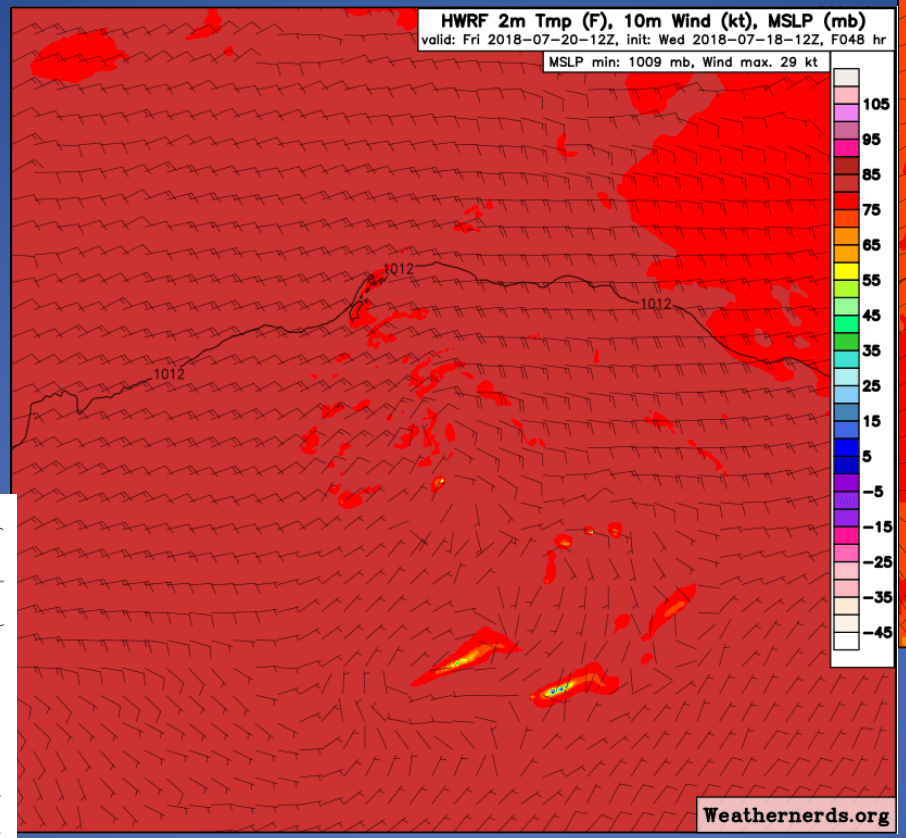


Fairly well calibrated, but a low bias overall, and not a lot of cases (NHC issued 678 non-zero outlooks)

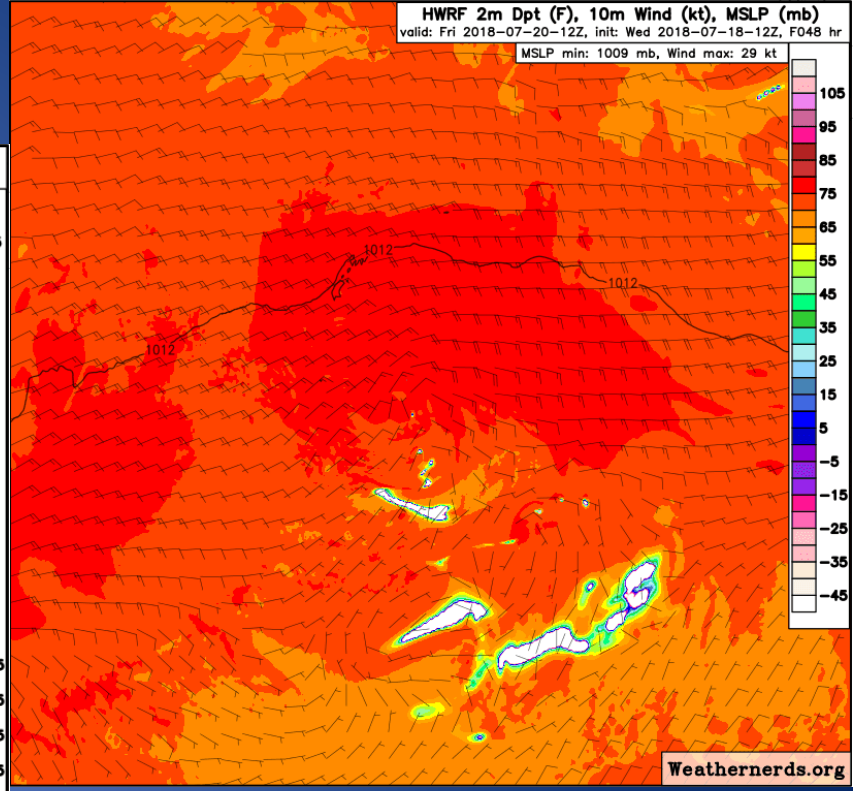
Strange Initializations/Forecasts



Very dry low-levels forecast



48 h forecasts with sub 50F sfc temps



48 h forecasts with subzero dewpoints

Questions/Comments?