

Tropical Cyclone diagnostic developments at ESRL – tracking does matter...

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4 May 2009



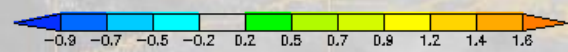
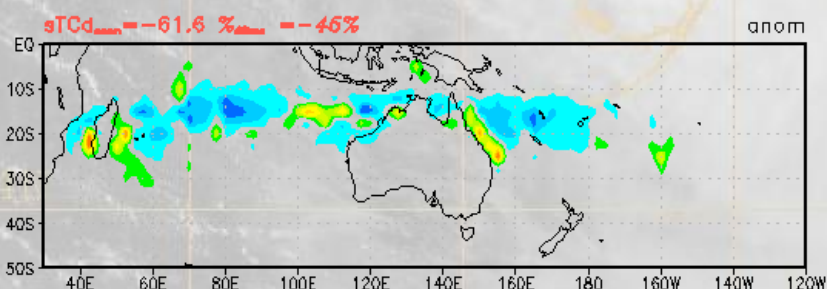
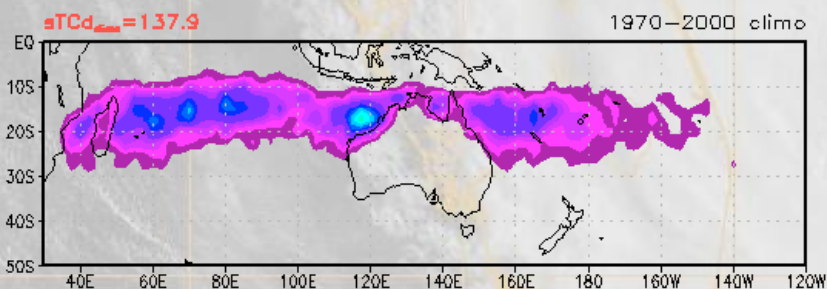
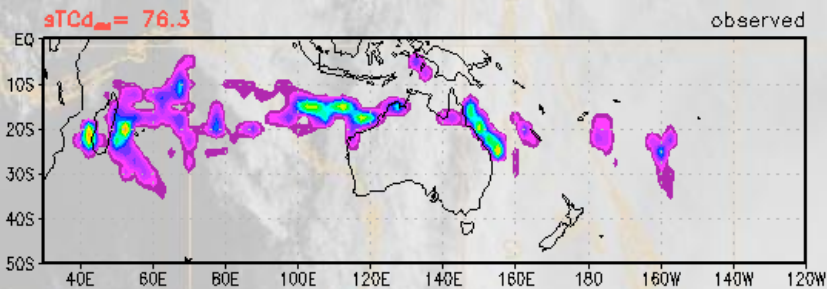
TC diagnostics...

- ***good tropicals = good tropics – good tropics = good models...***
- ***tctrack – where’s the storms?***
- ***tcstruct – sfc wind structure***
- ***tcfilt – kurihara et al ‘vortectomy’***
- ***tromboning & windshield wiper***
- ***run-to-run consistency – model v ofcl***
- ***rehosting of .F diagnostic routines as openGrADS ‘user defined extensions’***

SHEM 2009 – 46% below normal activity

SHEM TC Activity sTCd (scaled TCdays) for: 20080701–20090430

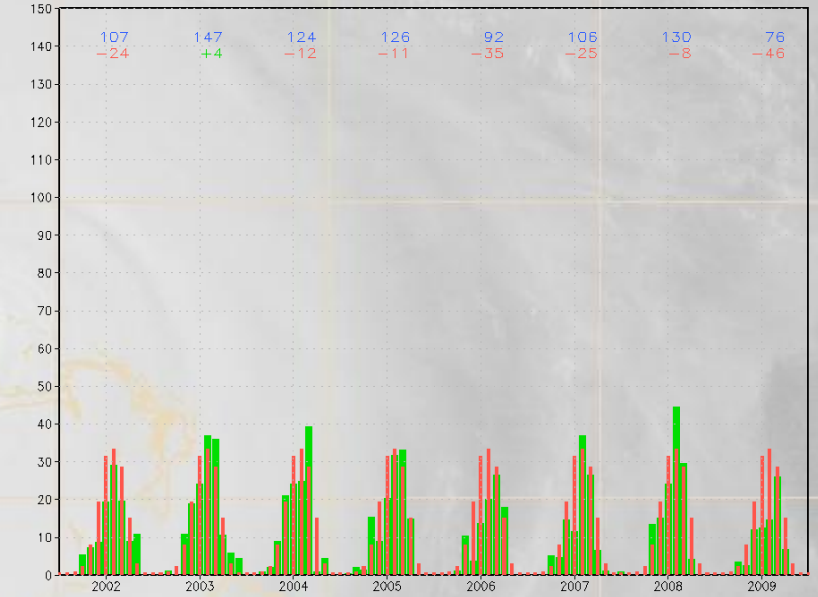
sTCd = sum of TC(scaled Vmax) every 6h * 1[d]/4[6h]
 TC=0.25(TD), 0.50(TS), 1.0(TY), 2.0(STY)



Dr. M. Fiorino, TechDevAppUnit TPC/NHC, Miami FL
 ~/~/to.oct.mots.shem.20080701.20090430.tcstr.eps

2009-04-30-23:45

SHEM TC Activity sTCd (scaled TC days) for: 20010701–20090701
 sTCd = mo sum of TC(scaled Vmax) every 6h * 1[d]/4[6h] ; TC=0.50(TS) ; 1.0(TY) ; 2.0 (STY) Climo: 1970 – 2000
 (B)#: yearly sTCd ; # below: % of yearly climo, (G)>0, (R)<0

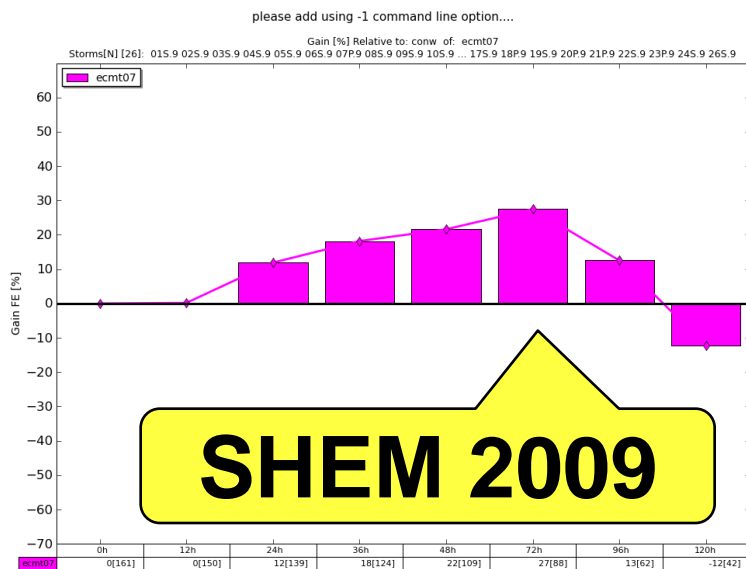
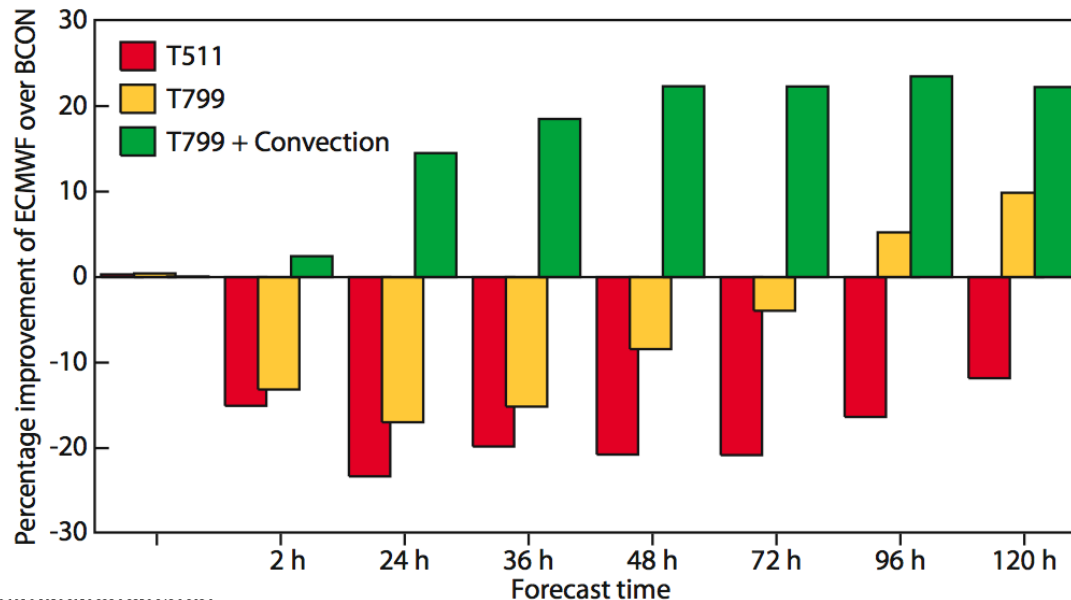


Dr. M. Fiorino, TechDevAppUnit TPC/NHC, Miami FL
 ~/~/to.oct.mots.shem.200107.200907.tcstr.eps

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% improve ECMWF over CON



METEOROLOGY

ECMWF Newsletter No. 118 – Winter 2008/09

reliable model for a given region. It is clear that major atmospheric centres such as the ECMWF will play a crucial role for such developments as they can provide atmospheric and wave forecast data for regions where national centres do not operate.

We also point to the 'new' product for calculating the Stokes drift provided by ECMWF. This is not routinely incorporated into drift models, but we advocate using

the Stokes drift as it is a reliable forecast product that will probably enhance the forecast of drifting objects and substances. At present, the basic spectral data used to calculate the Stokes drift are only available up to day 5 of the forecast. Since all other the global forcing data sets applied in this study extend to at least day 10, it is the availability of wave data that limits the forecast period for global marine drift forecasting to five days.

Record-setting performance of the ECMWF IFS in medium-range tropical cyclone track prediction

MICHAEL FIORINO
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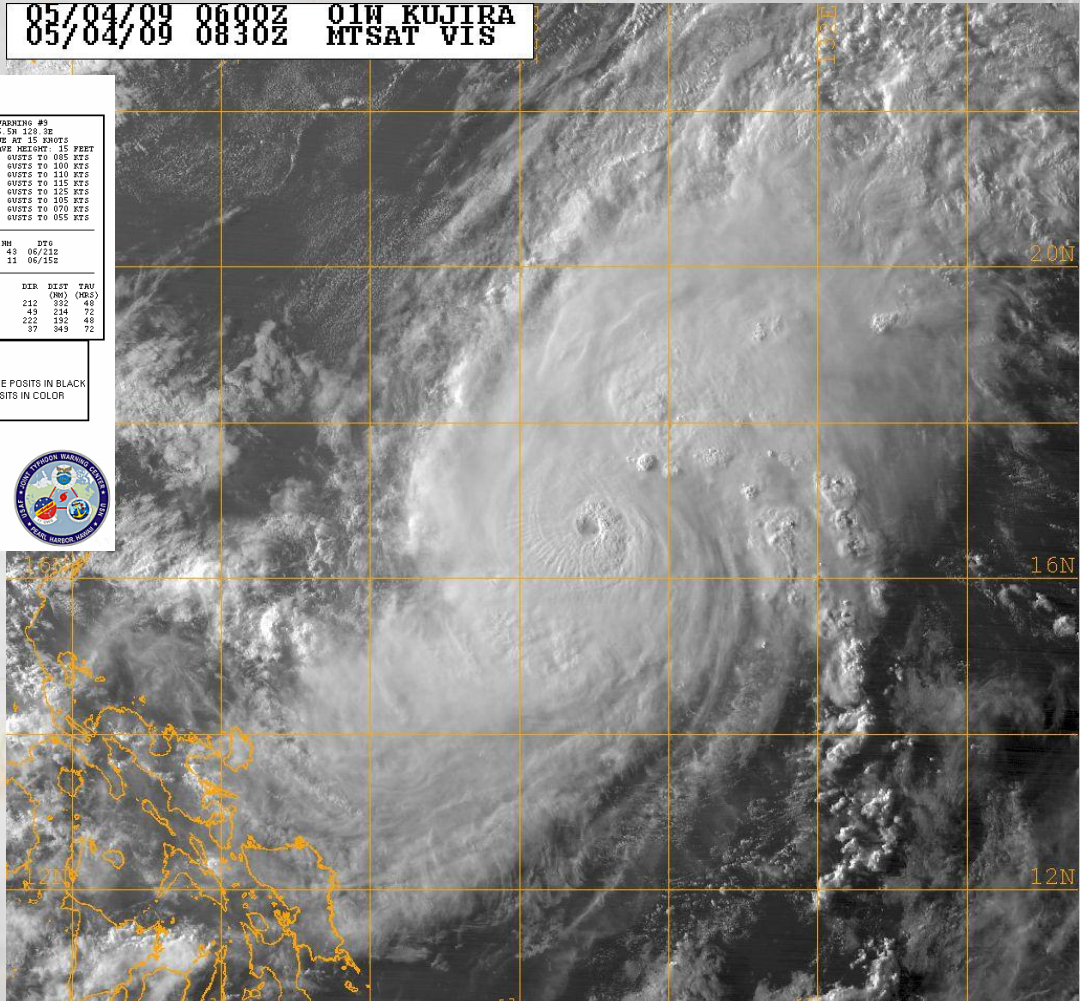
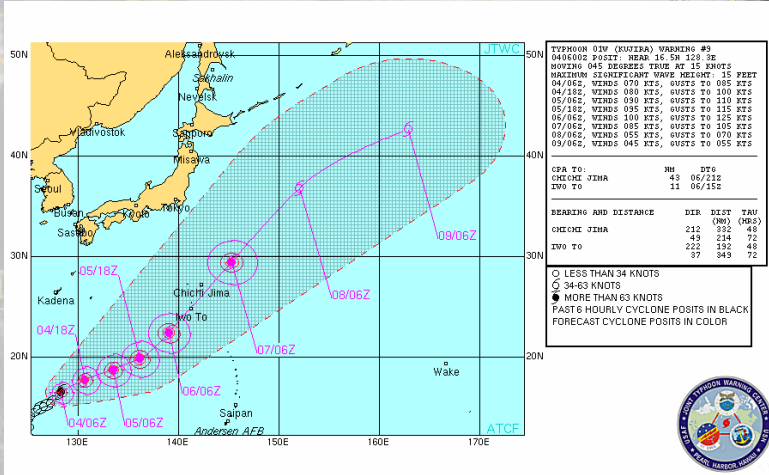
than the 100% improvement in official forecasts from the mid 1990s to 2008 that came from advanced global models.

This article reviews:

- ♦ The relationship between model physics, TC analysis and forecasts and the tropical general circulation.
- ♦ Dynamical medium-range TC track prediction and

01W – kujira – 2009050406

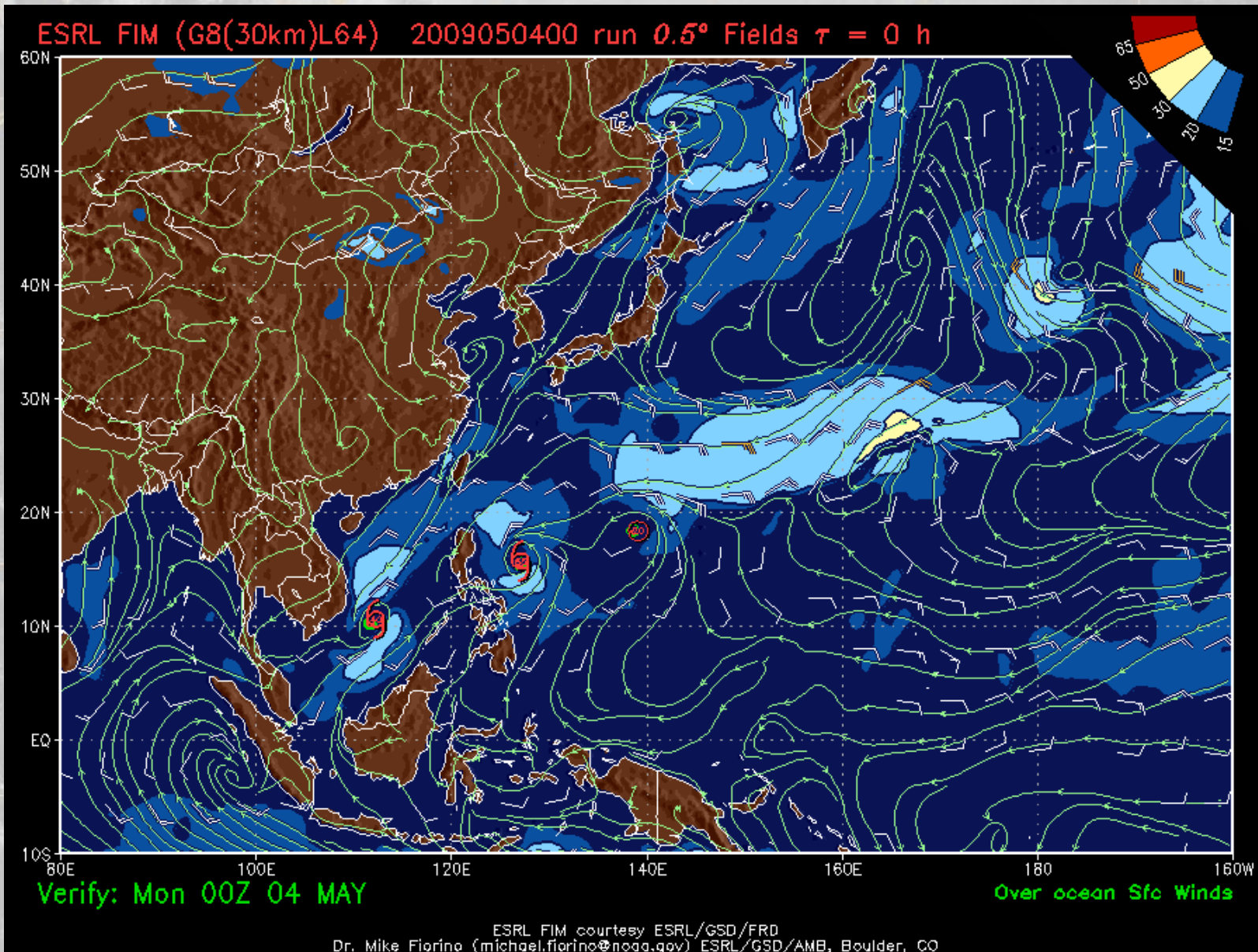
05/04/09 0600Z 01W KIJIRA
05/04/09 0830Z MTSAT VIS



Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
 <-- Visible (Sun elevation at center is 15 degrees) -->

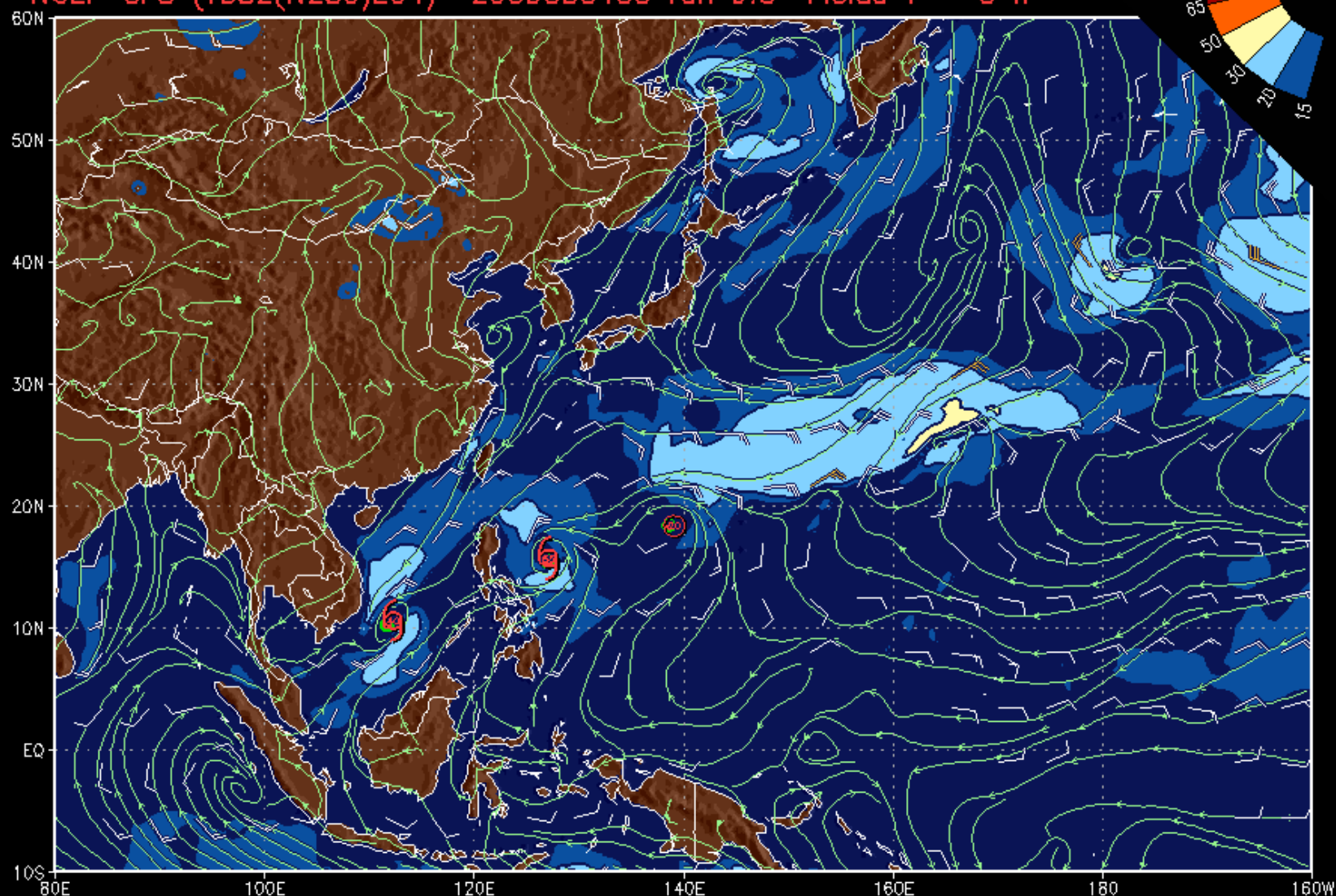


2009050400 – FIM (GFS) sfc wind anal $\tau=0$



verification – 72 h fc v an

NCEP GFS (T382(N286)L64) 2009050400 run 0.5° Fields $\tau = 0$ h



Verify: Mon 00Z 04 MAY

Over ocean Sfc Winds

NCEP GFS courtesy NCEP/NCOS
Dr. Mike Fiorino (michael.fiorino@noaa.gov) ESRL/GSD/AMB, Boulder, CO

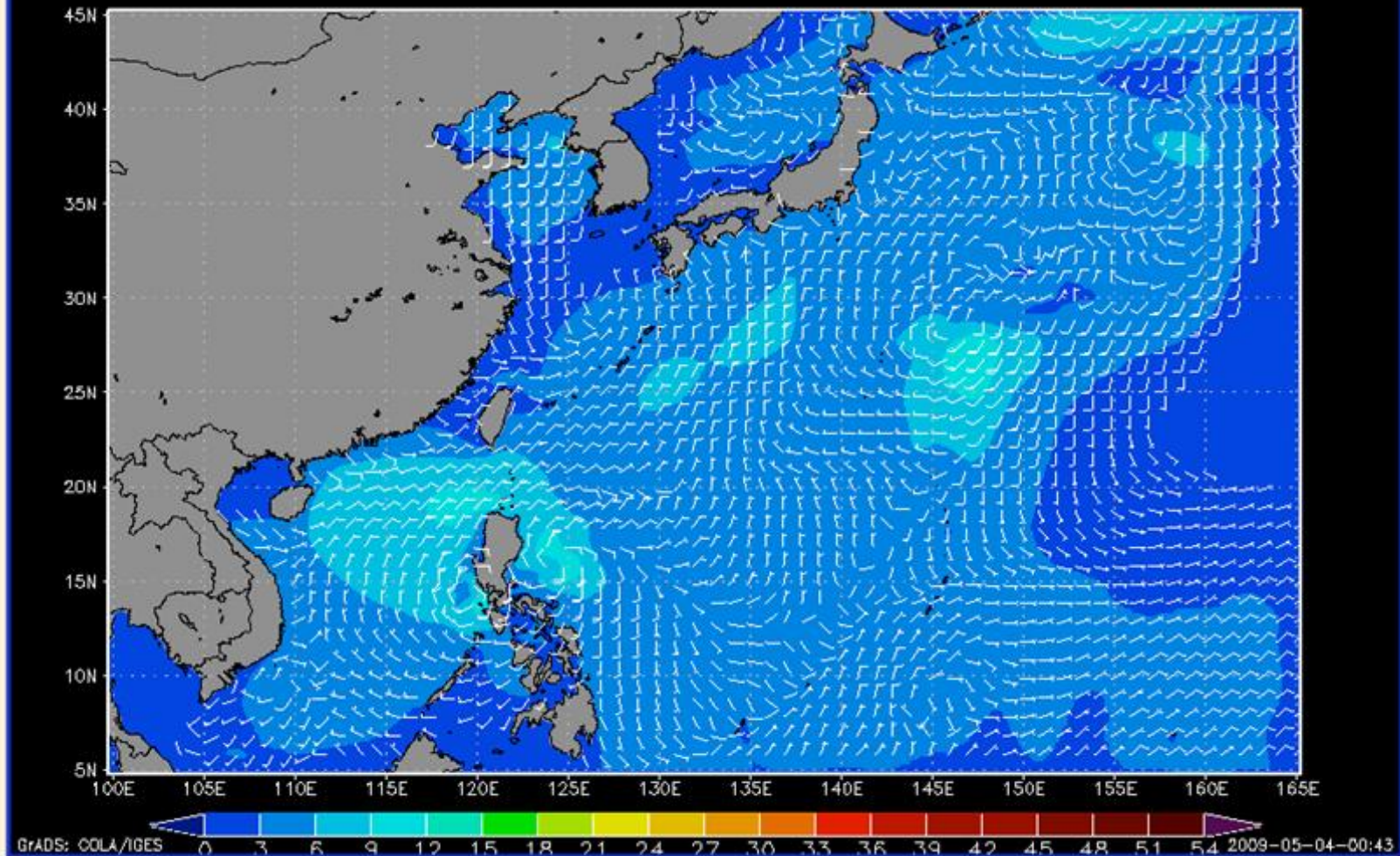


tcww3 – php interface to NRL graphics

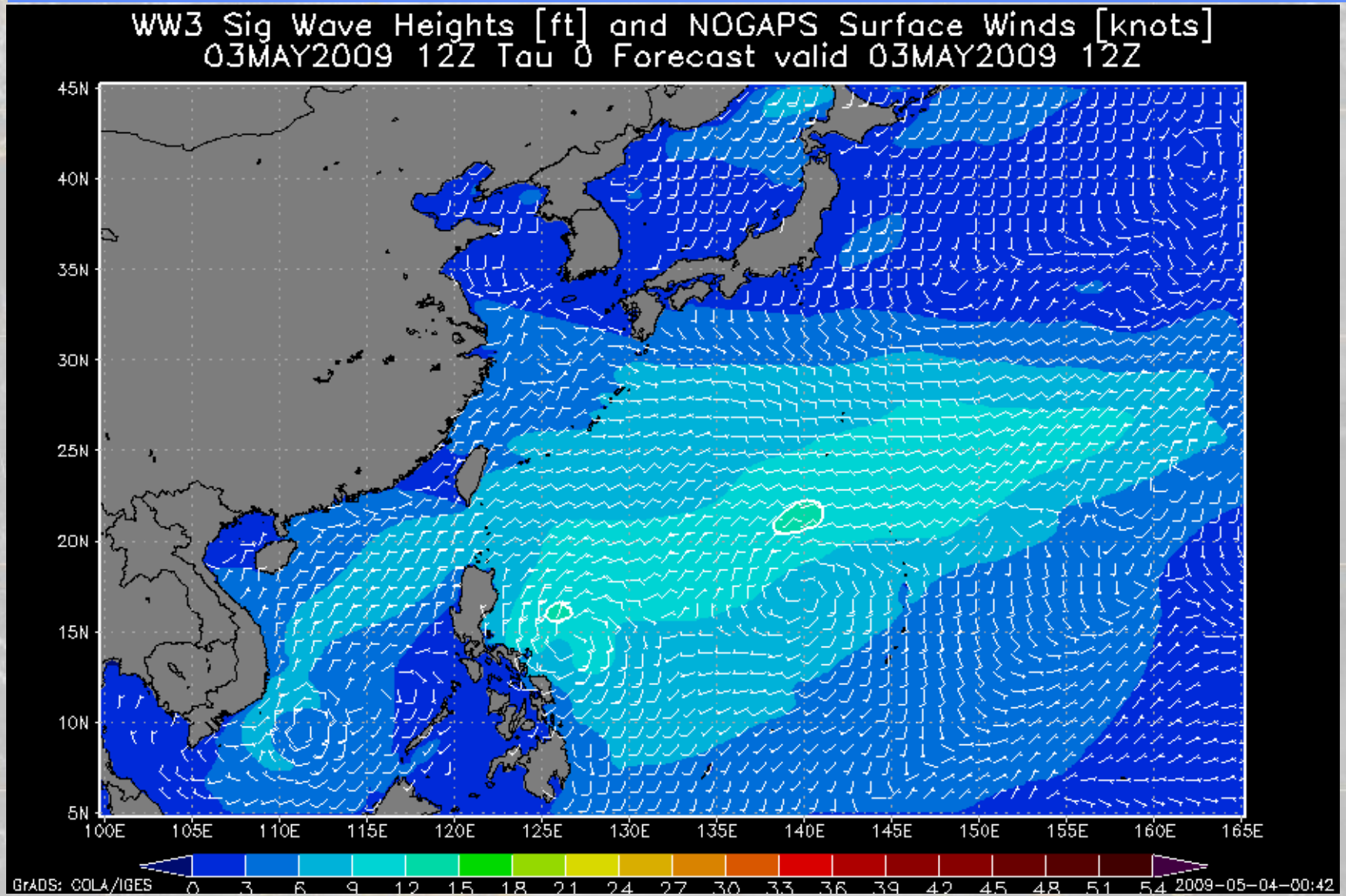
NRL TC WW3 for: 2009050312 Current TC: WP012009

wp012009	wp022009	wp952009	wp972009										
NRL TCww3	2009050312	2009050300	2009050212	2009050200	2009050112								
per.anim	uv.anim	ww3.anim	000	012	024	036	048	060	072	084	096	108	120

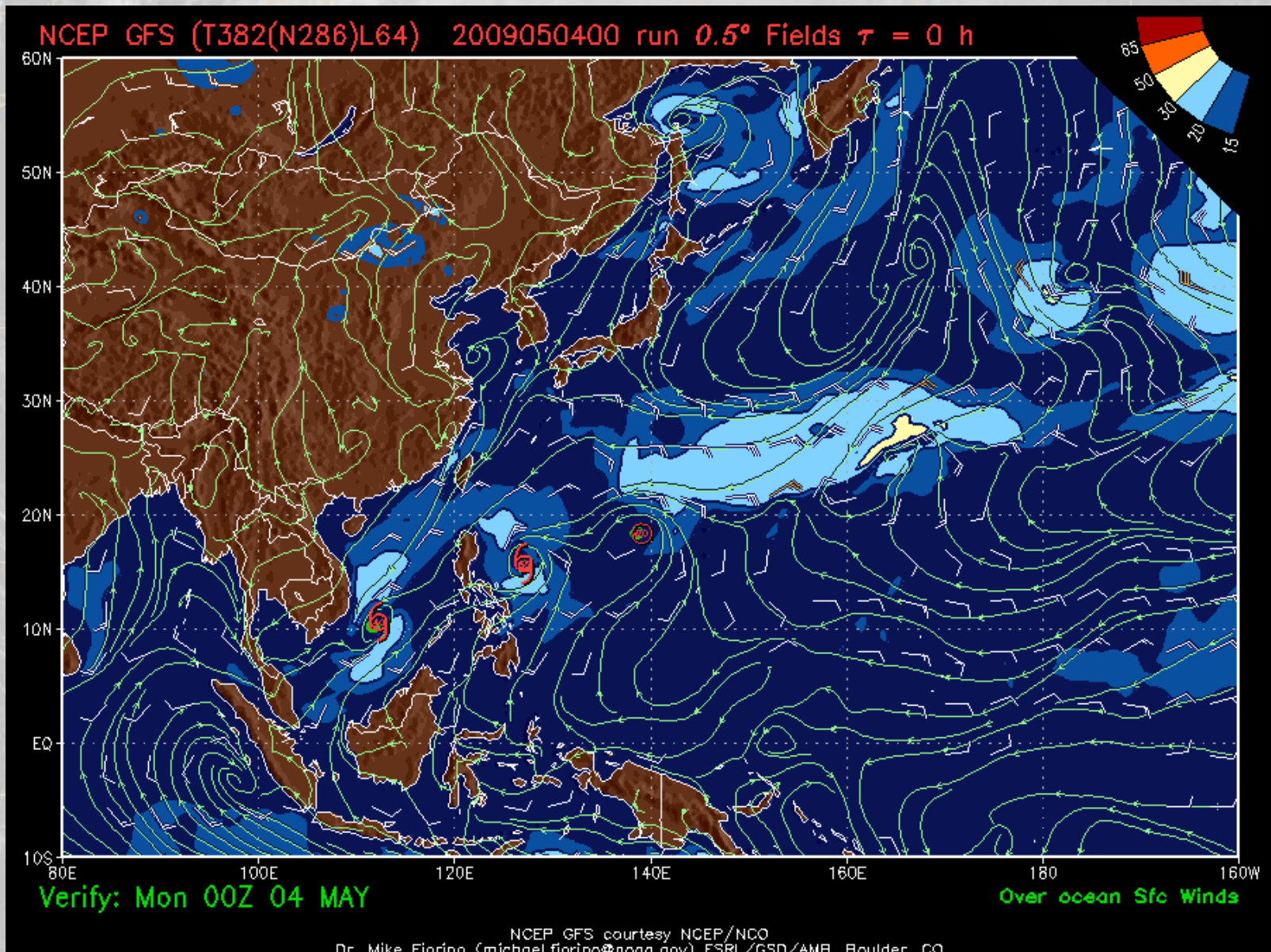
WW3 Sig Wave Heights [ft] and NOGAPS Surface Winds [knots]
03MAY2009 12Z Tau 116 Forecast valid 08MAY2009 08Z



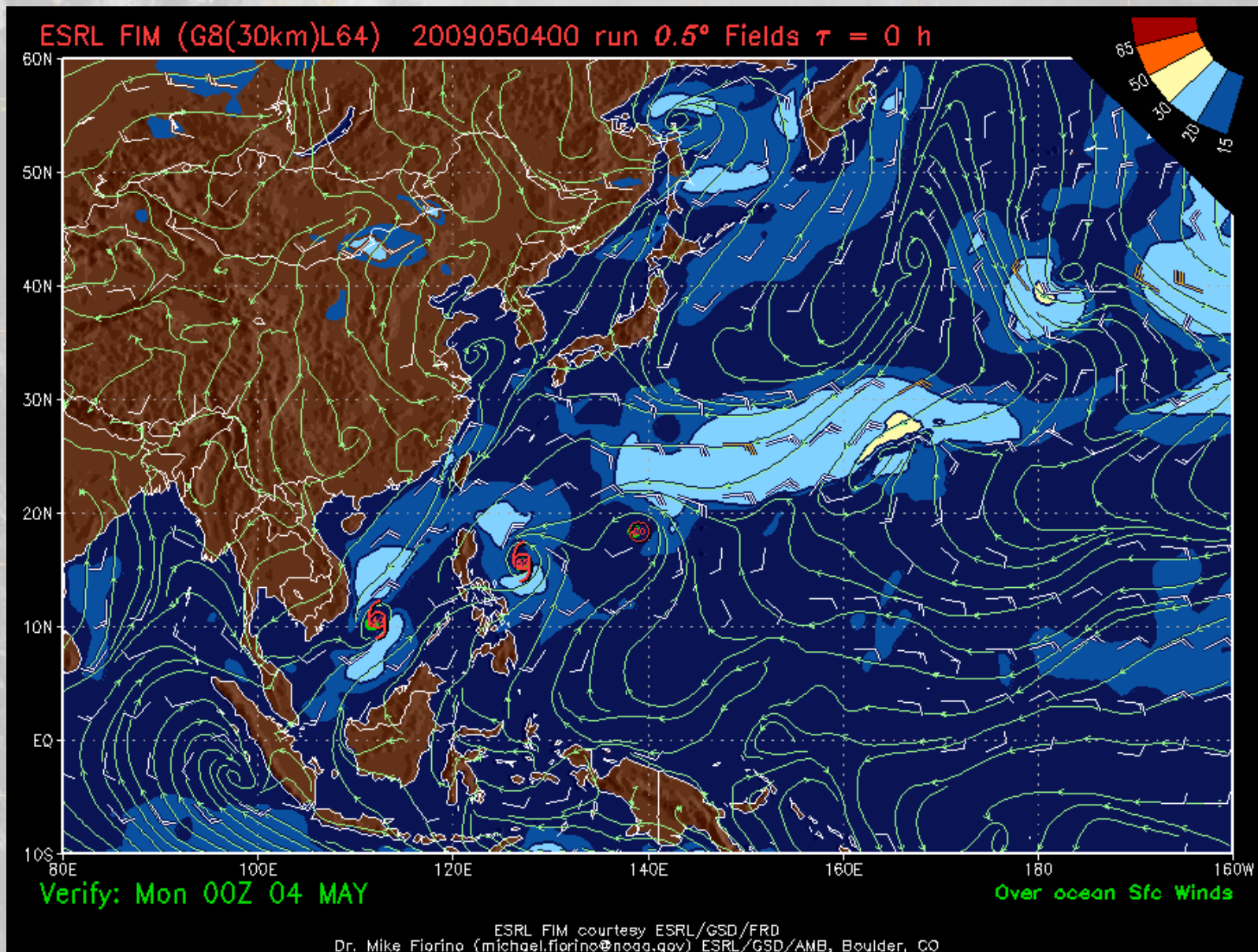
Sig Wave z – NOGAPS + JTWC TC



GFS 2009050400 72-h fc v an – formation

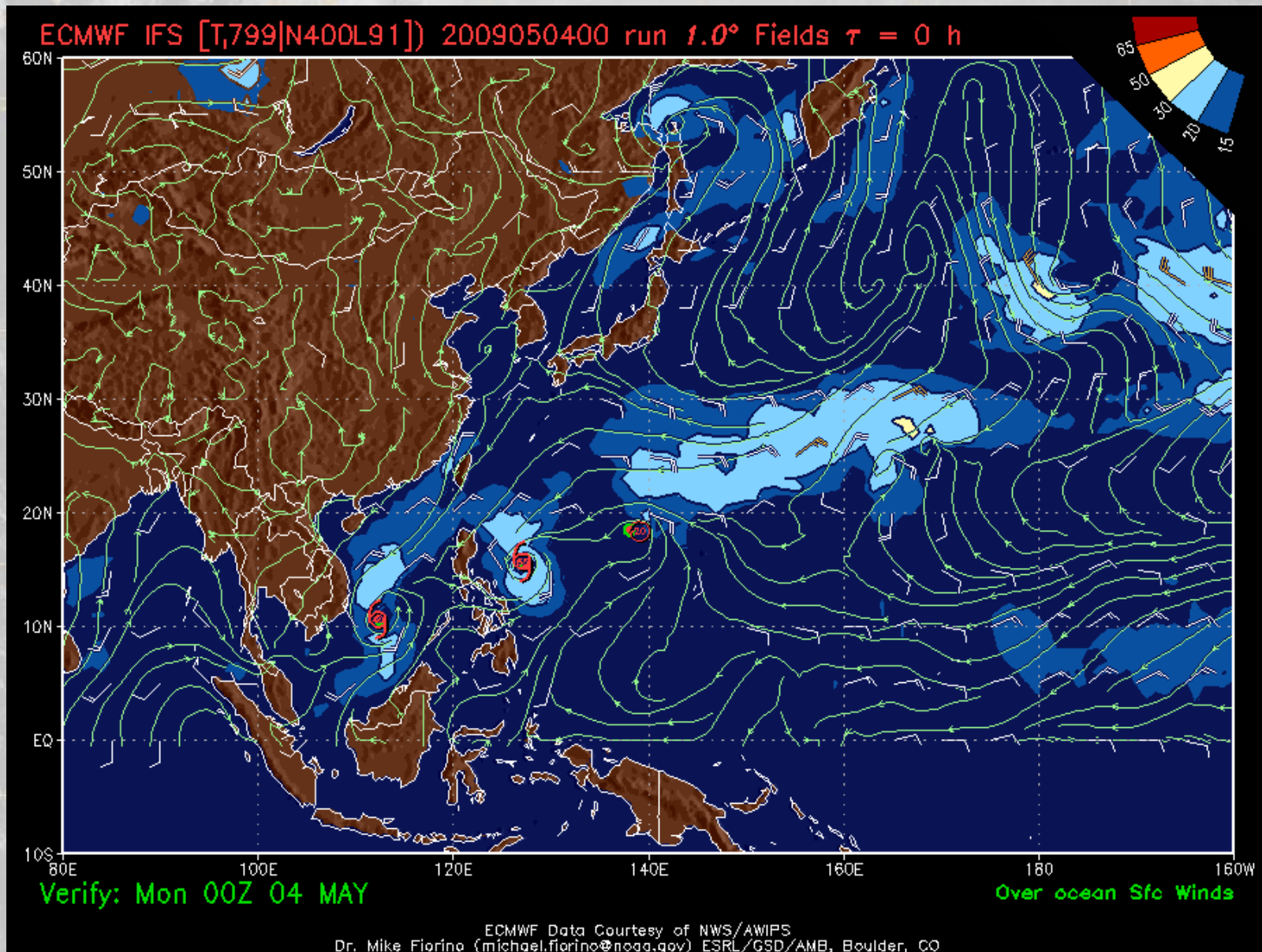


FIM8 (dx~30km) fc v an -- formation



M. Fiorino :: HFIP TC diag wkshp. Miami, FL 20090504

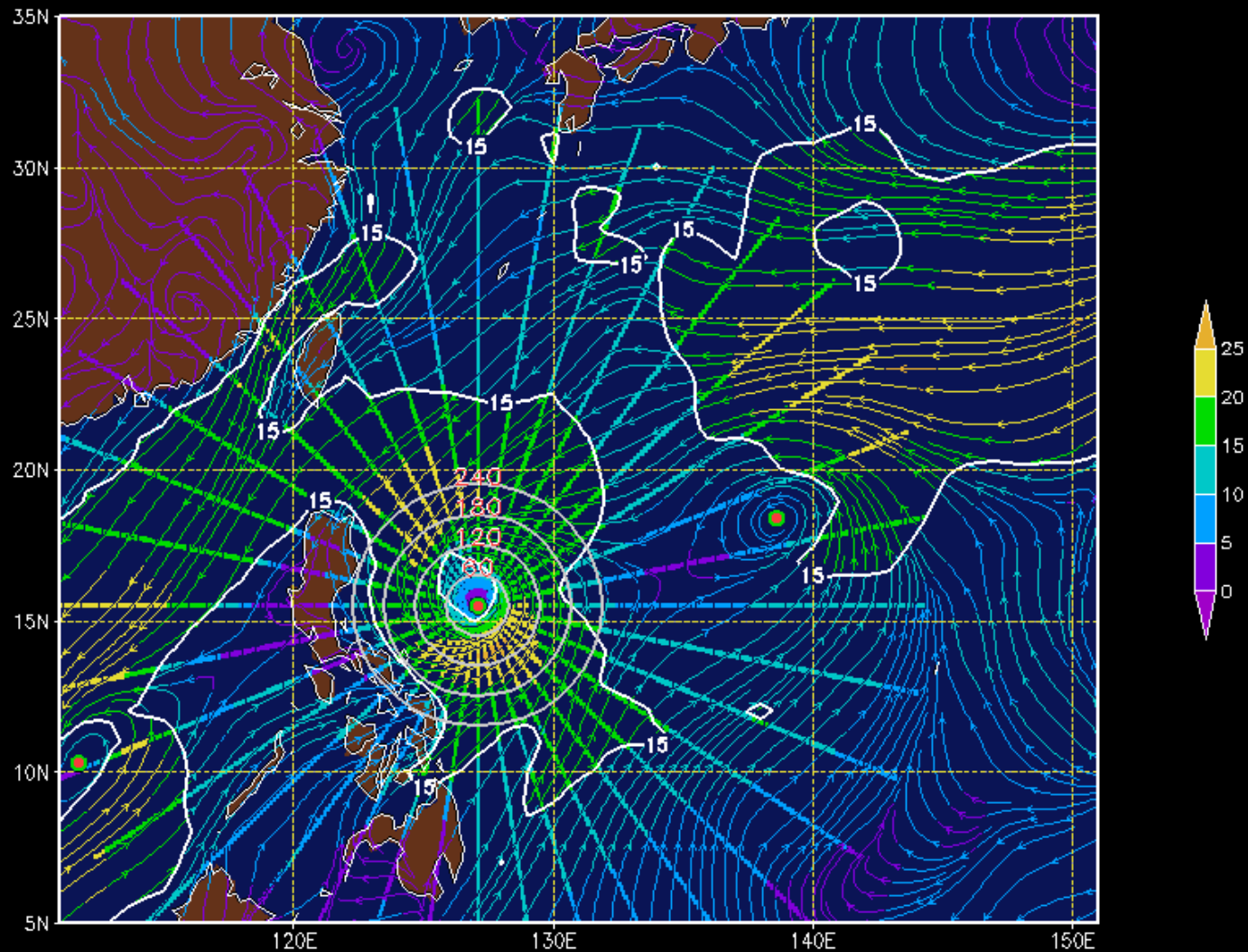
ECMWF (awips) fc v an – formation



M. Fiorino :: HFIP TC diag wkshp. Miami, FL 20090504

tcstruct – GFS sfc forecast

GFS2 V_{surf} for: 01W.2009 at: 2009050400 tau = 000
CARQ: V_{max}=55 kt R_{max}=15 nm R34=50 nm R50=15 nm

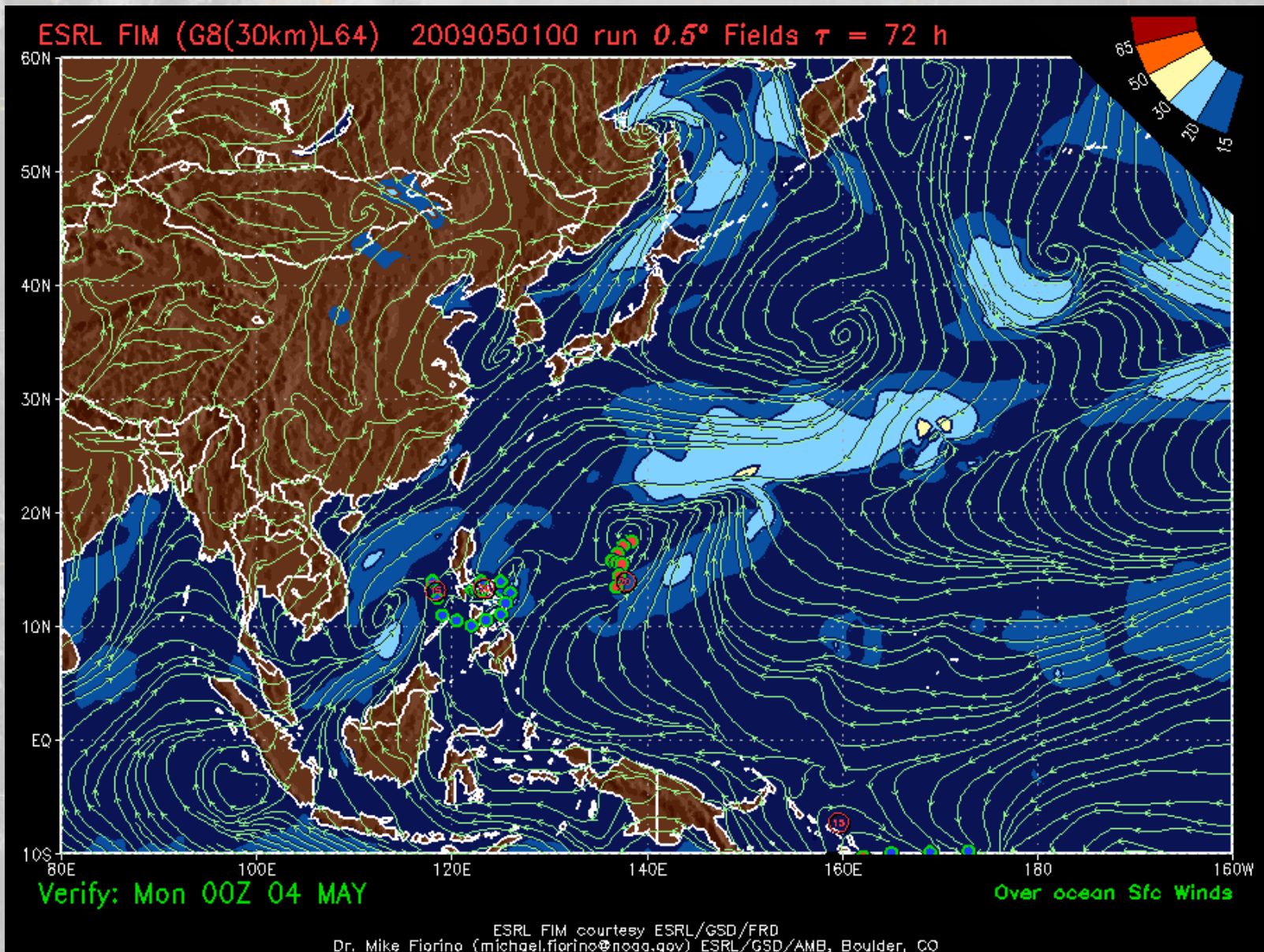


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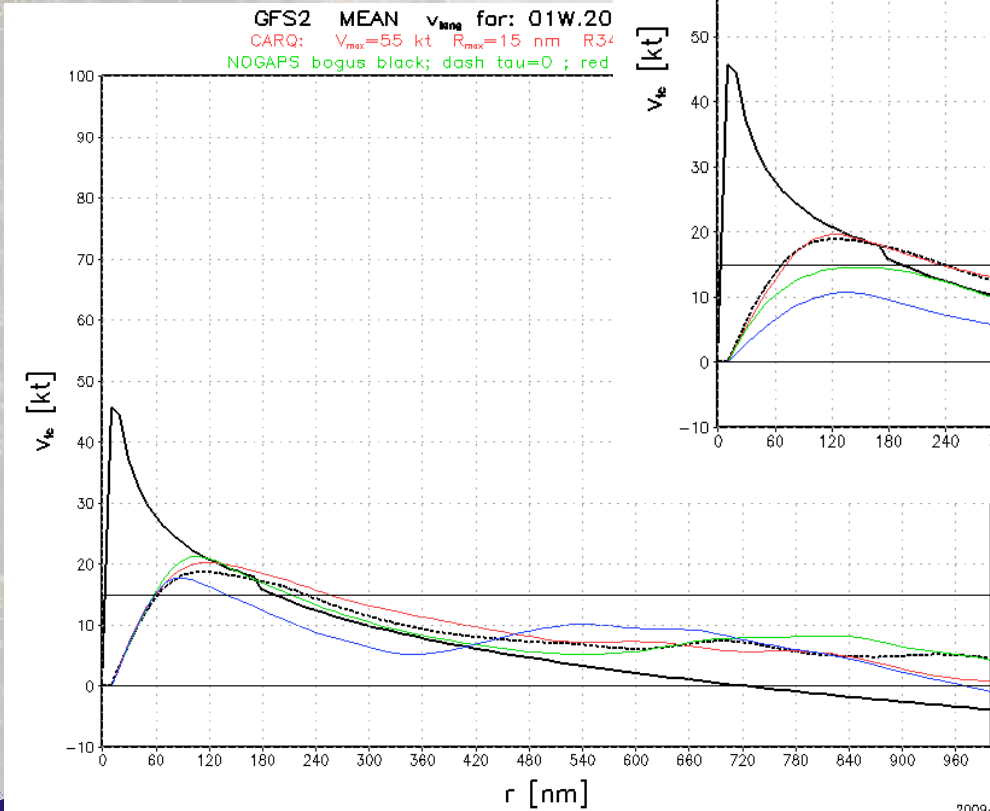
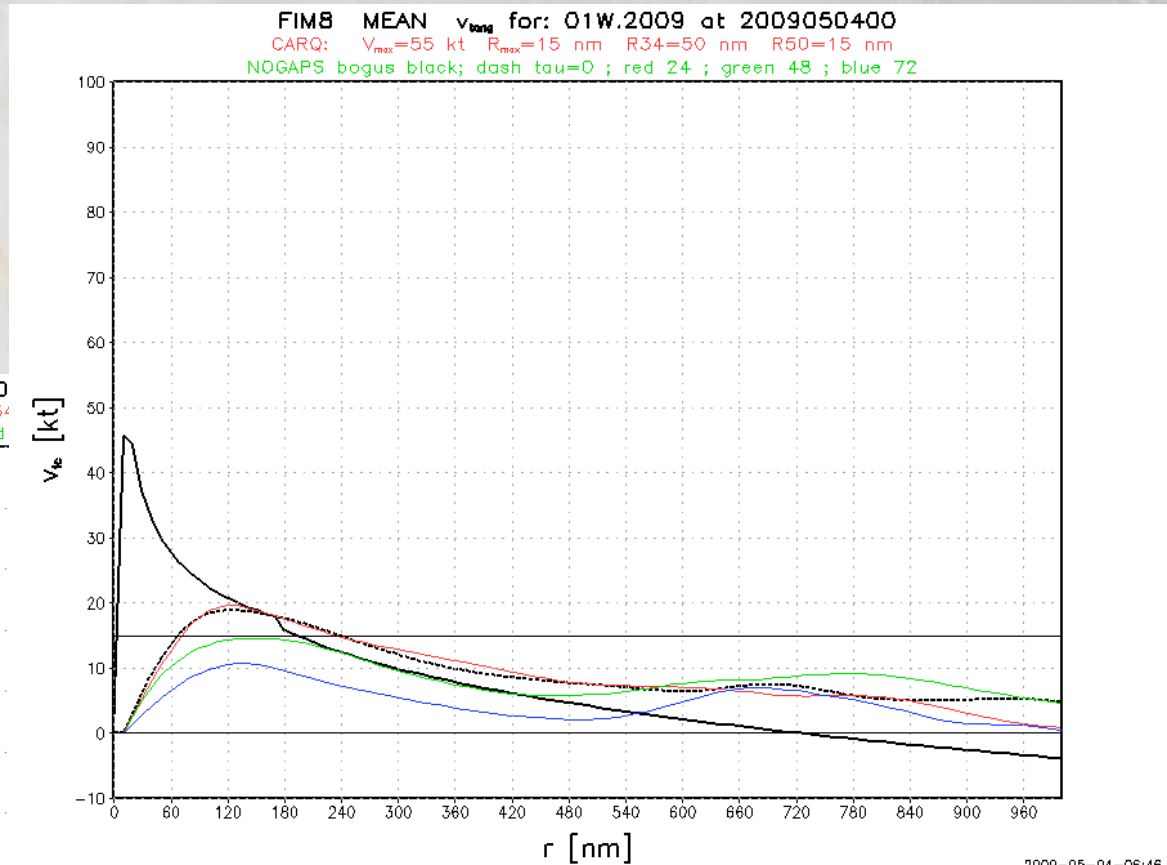


run-to-run consistency



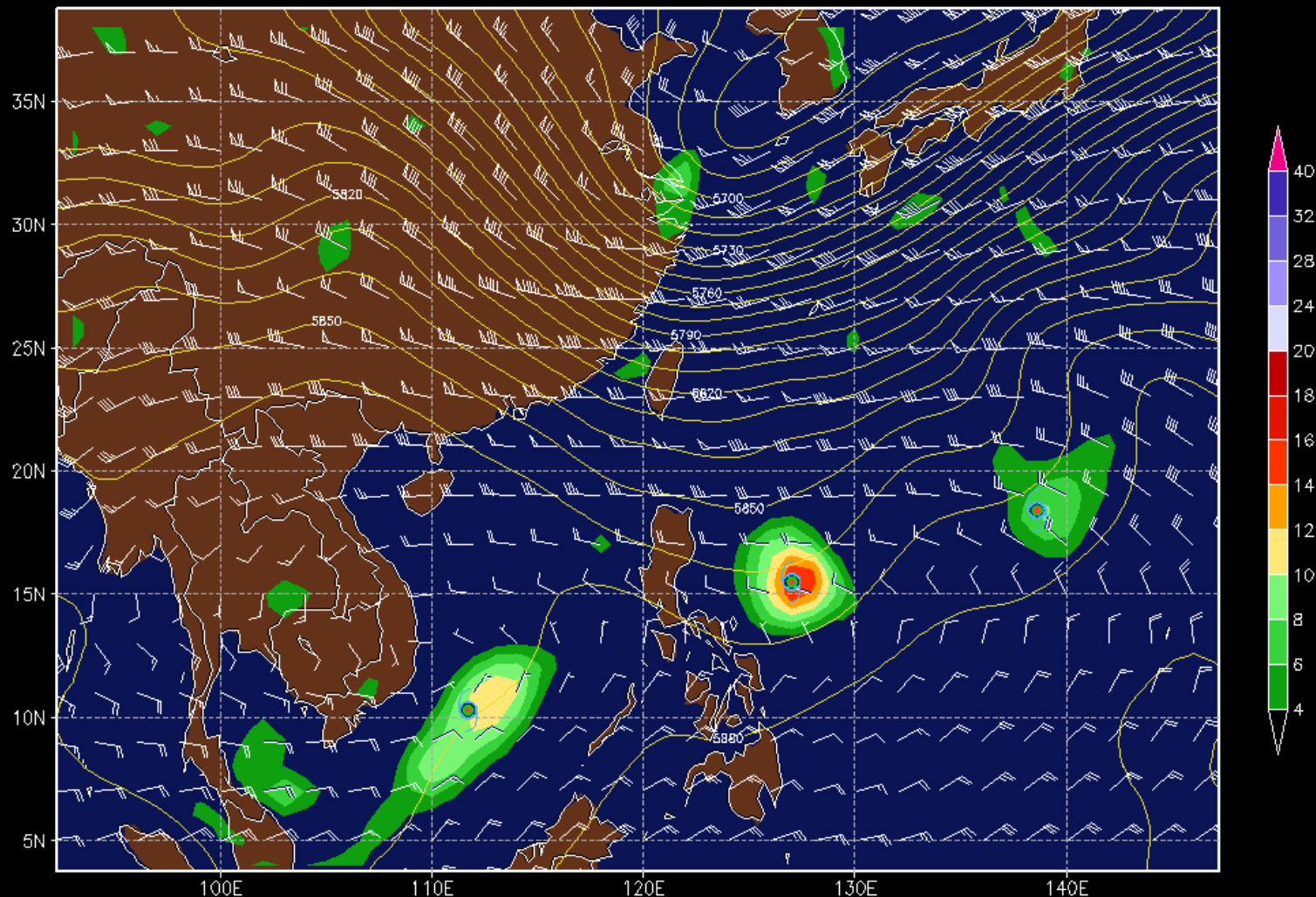
M. Fiorino :: HFIP TC diag wkshp. Miami, FL 20090504

tcstuct – radial wind profiles



tcfilt – “vortectomy”

FIM8: 2009050400 $\tau = +0$ h for: 01W.2009 *vortectomised* 850 vort + 500 z + 200 wind
Verify: Mon 04 May 00Z

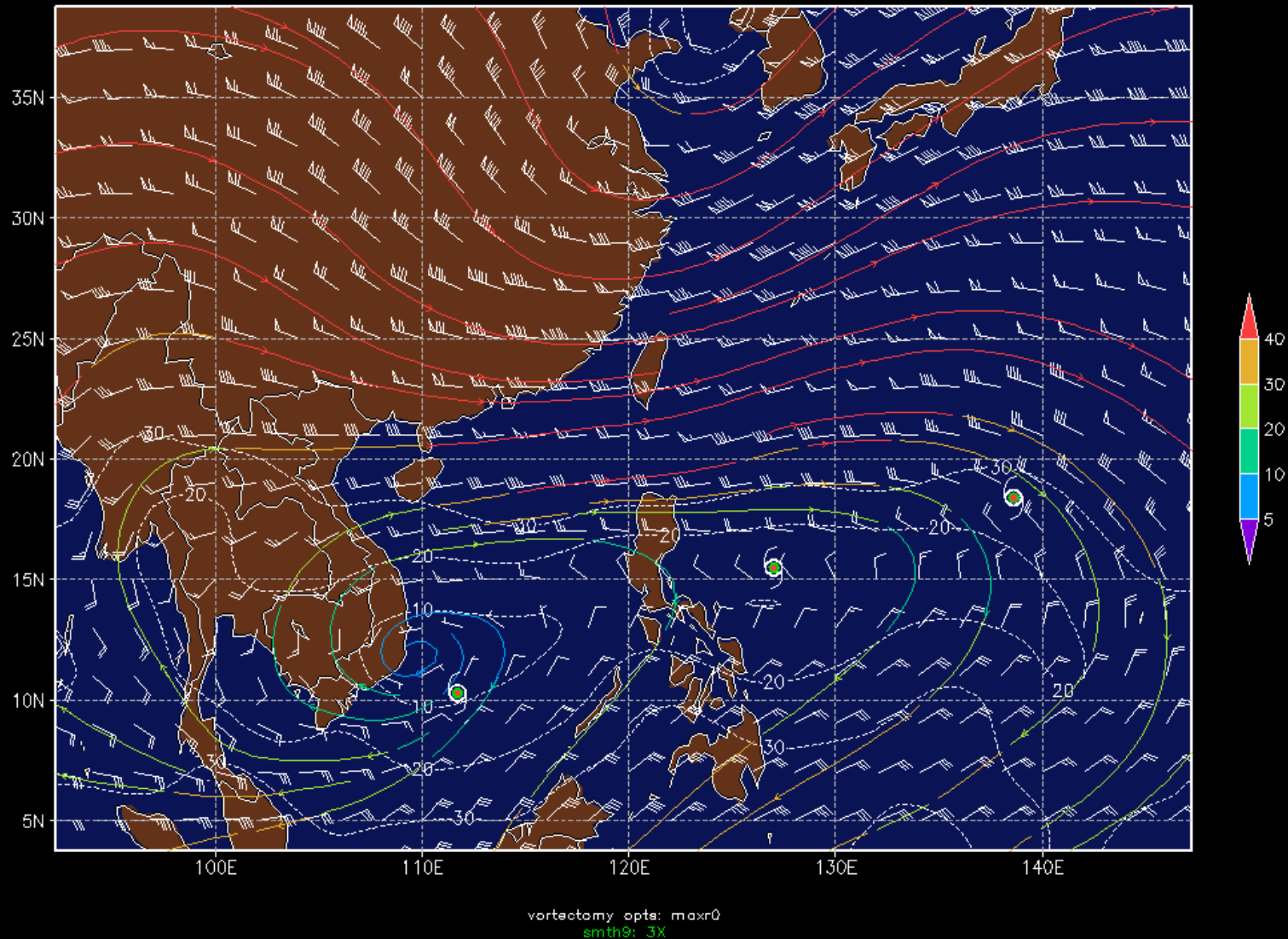


vortectomy opts: maxr0
smth9: 3X



tcfilt – kurihara et al 1993

FIM8: 2009050400 $\tau = +0$ h for: 01W.2009 *vortectomised* 200–850 shear
Verify: Mon 04 May 00Z



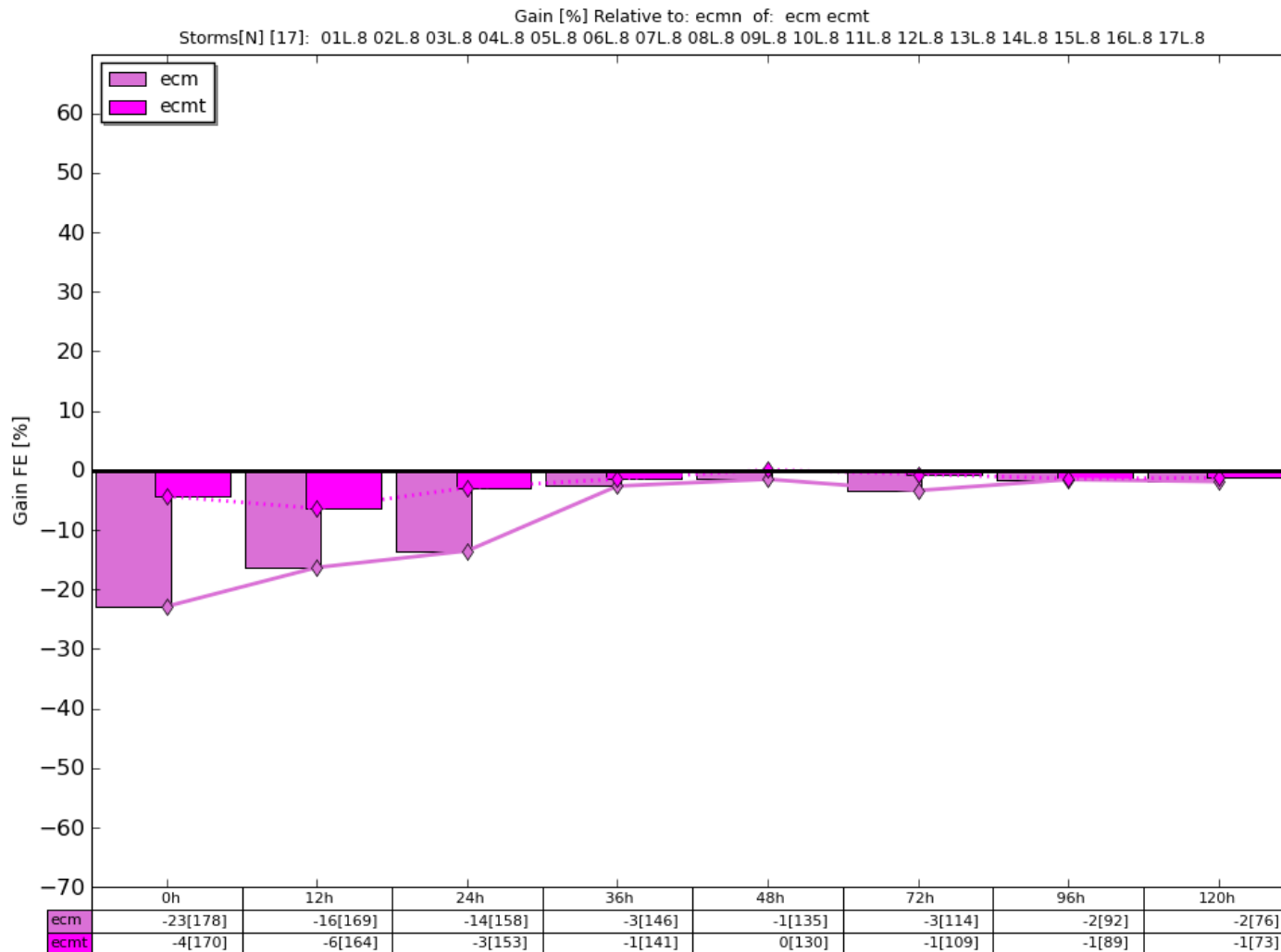
M. Fiorino :: HFIP TC diag wkshp. Miami, FL 20090504

TC tracking – constraints

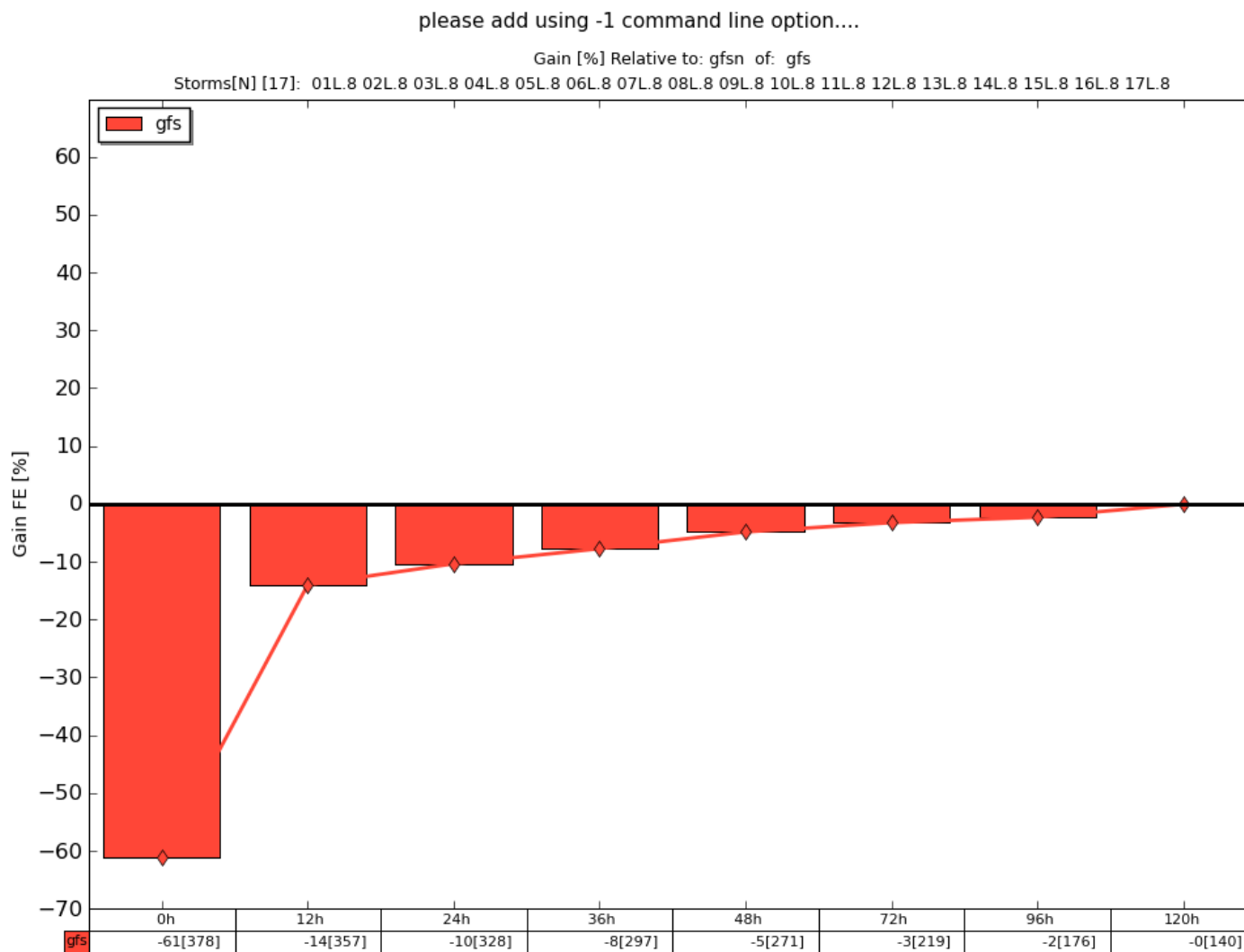
- *make a forecast*
- *track the tropical (low failure rate)*
- *represent the operational definition of the center...*
 - multiple centers
 - wind v mass
 - mid v low

ECMWF 2008 LANT mf v ec v tm trackers

please add using -1 command line option....



% gain(loss) mf v tm tracker – GFS 2008 LANT

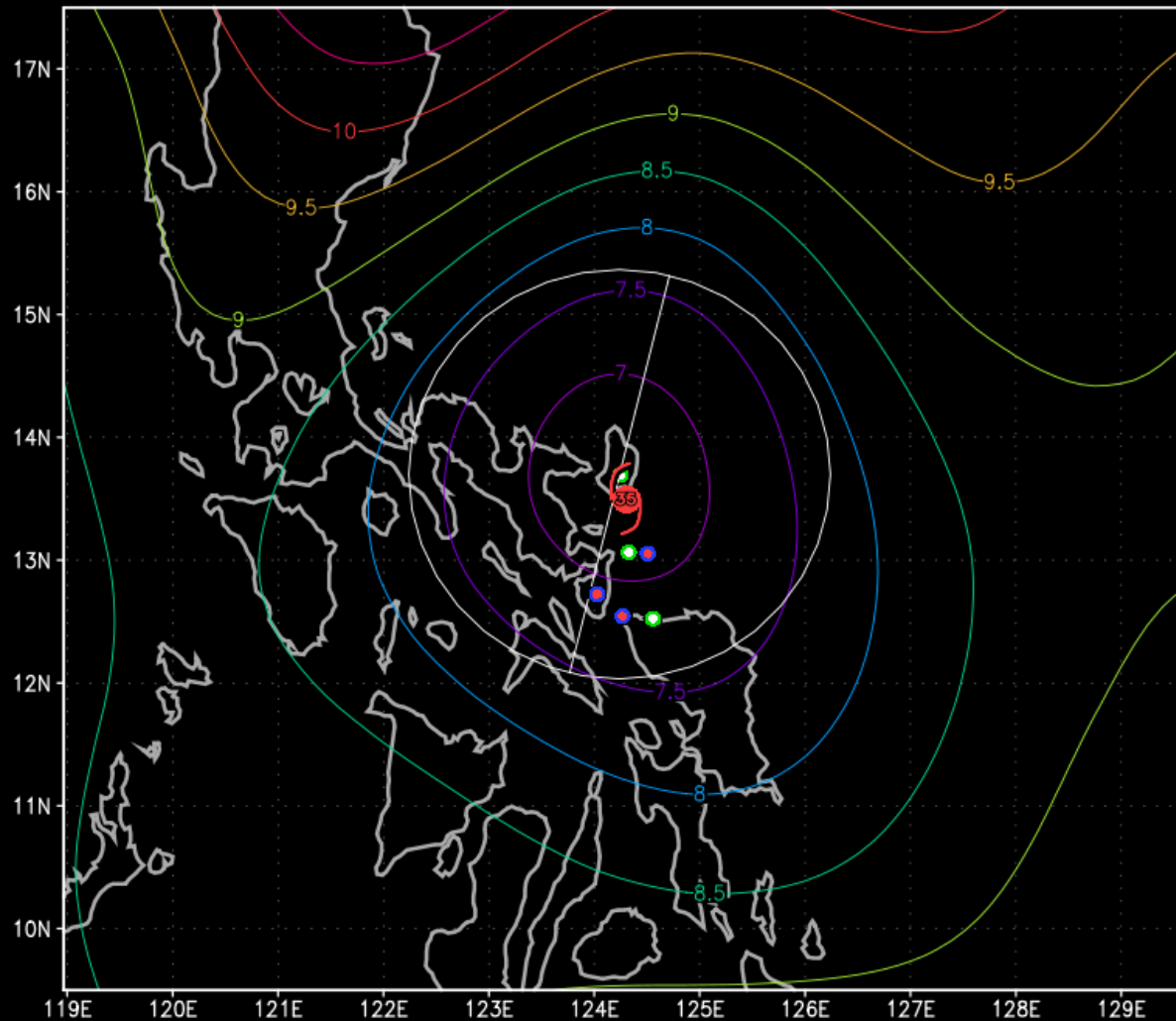


implementation of .F TC diag

- **openGrADS2.0 and 1.10 user-defined extensions in the form of a library → write separate application or run in grads**
- **user-defined commands:**
 - mfhilo – find max/min using three methods
 - tcprop -- averaging in annulus
- **user-defined functions**
 - smth2d – Shuman 2-D smoother-desmooter
 - fish – Ψ / X
 - uv2vt – u,v (cart) → u,v (cylindrical)

mfhilo/tcprop for 01W 2009050212

stmid: 01W.2009 dtg: 2009050212 vmax: 35 model: gfs2 var: psl
m: 8.1 mRH: 8.0 mLH: 8.1 R: 200 [nm] B: 14 deg



GrADS: COLA/IGES

2009-05-04-15:42



Future directions...

- ***why ECMWF doing so well vis-à-vis CON***
 - diagnostics of conv precip – comp to CPC QMORPH satellite precip
 - FIM model experiments with conv physics (Grell)
- ***tracking diagnostics***
 - sfc center
 - upper trop lows – wv imagery
- ***rehost other .F...***

upper-level flow 2009050400

