Tropical Cyclone diagnostic developments at ESRL – tracking does matter…

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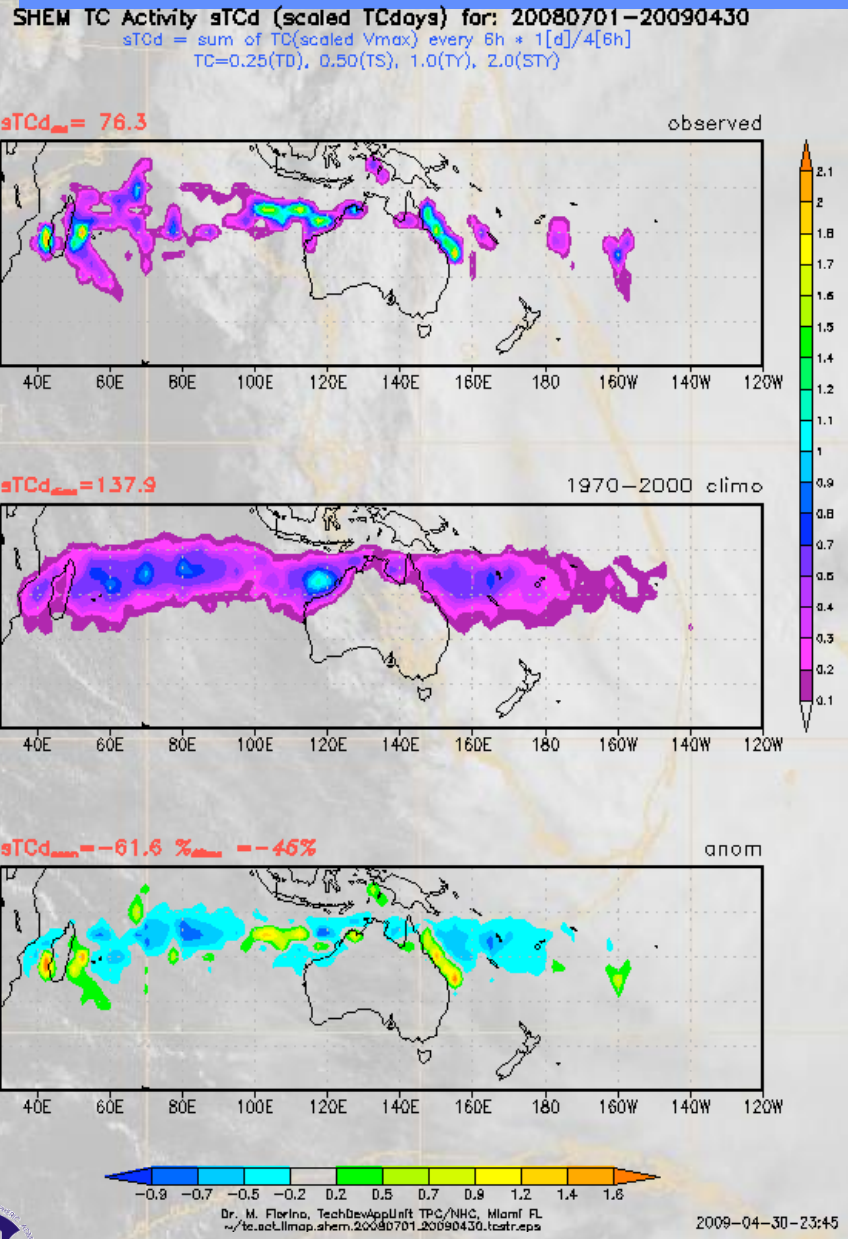
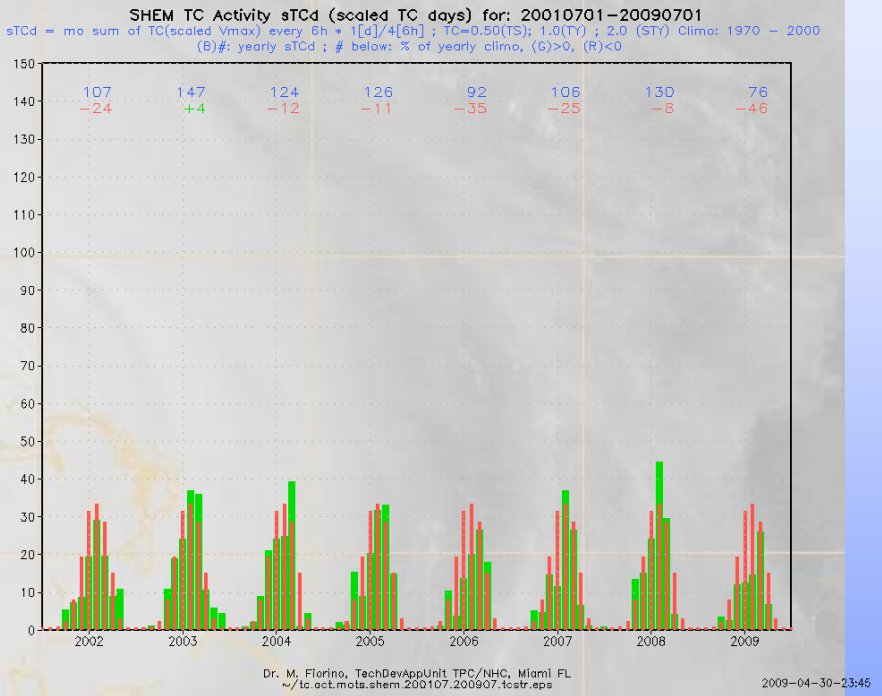
TC diagnostics…

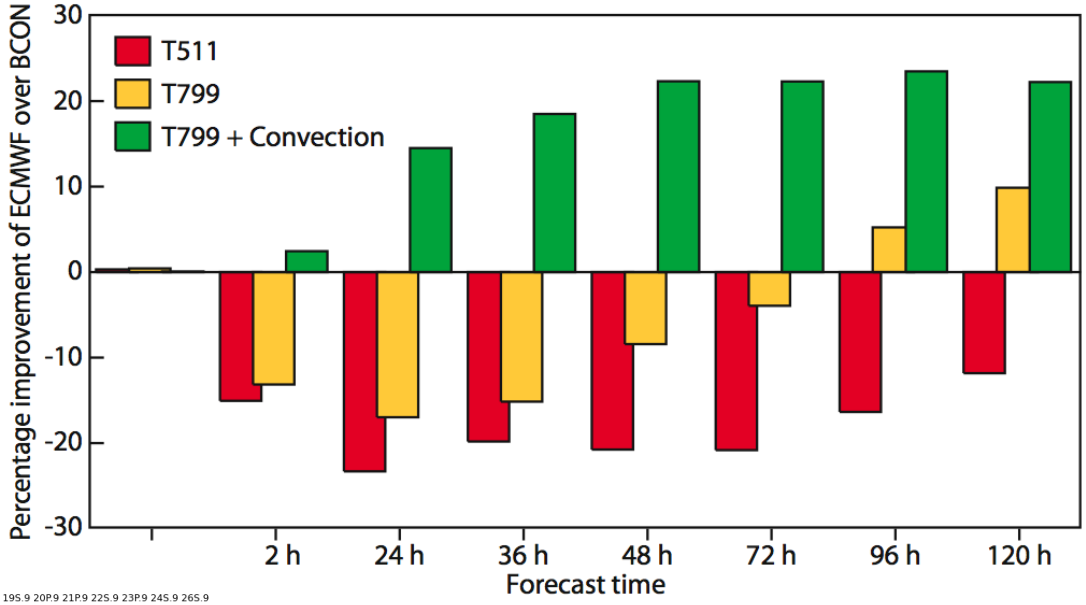
- good tropicals = good tropics – good tropics = good models…
- tctrack – where's the storms?
- tcstruct – sfc wind structure
- tcfilt – kurihara et al 'vortectomy'
- tromboning & windshield wipering
- run-to-run consistency – model v ofcl
- rehosting of .F diagnostic routines as openGrADS 'user defined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

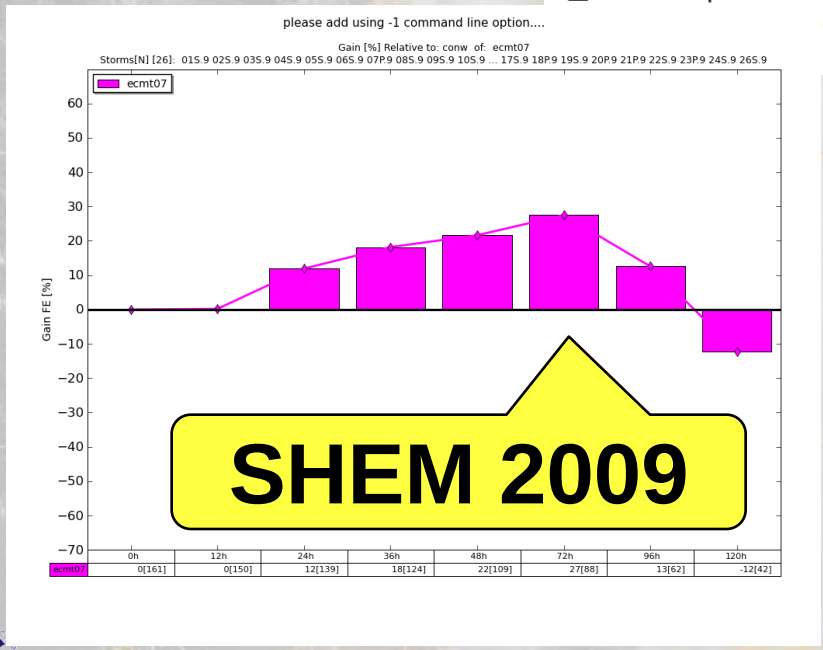
SHEM 2009 – 46% below normal activity

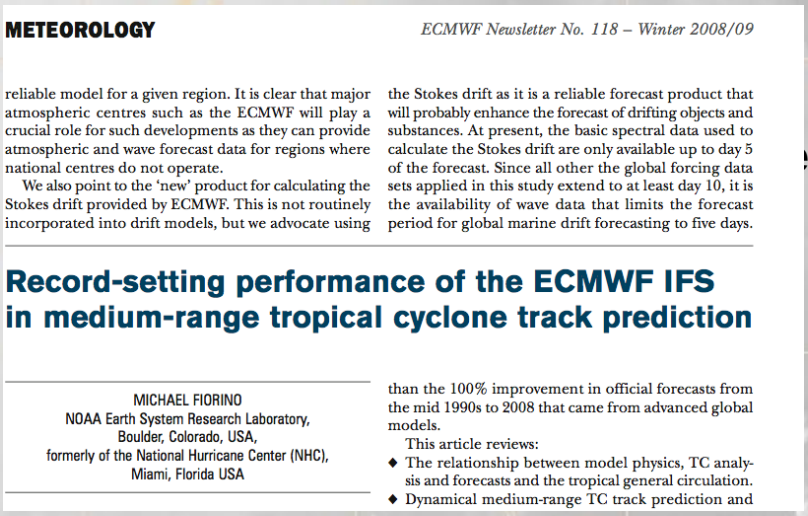




% improve ECMWF over CON







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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

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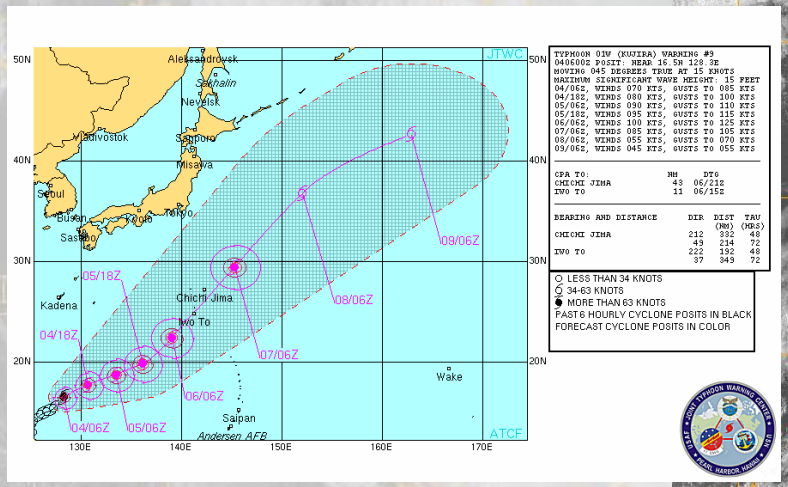
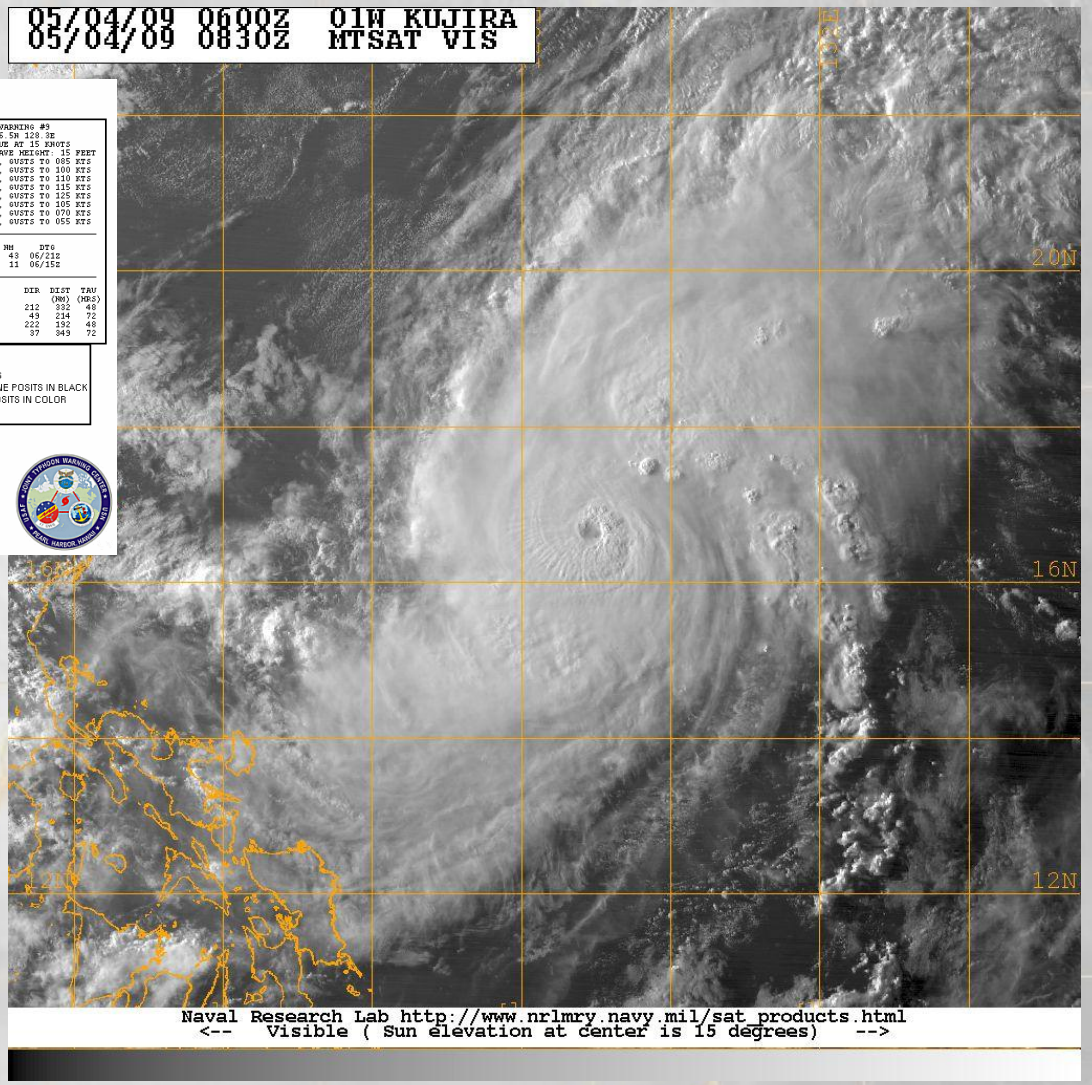
than the 100% improvement in official forecasts from the mid 1990s to 2008 that came from advanced global models.

This article reviews:

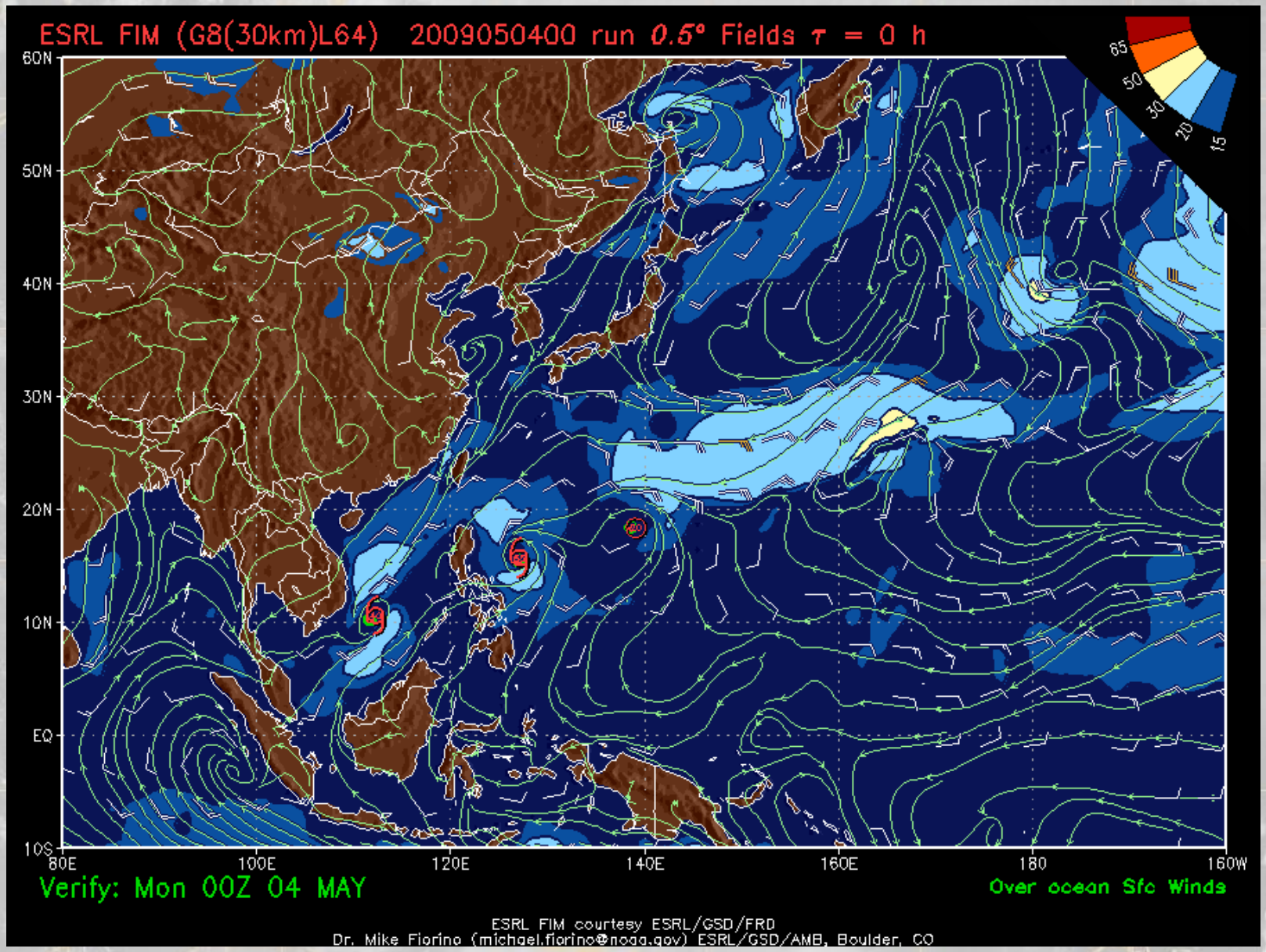
- The relationship between model physics, TC analysis and forecasts and the tropical general circulation.
- Dynamical medium-range TC track prediction and

01W – kujira – 2009050406

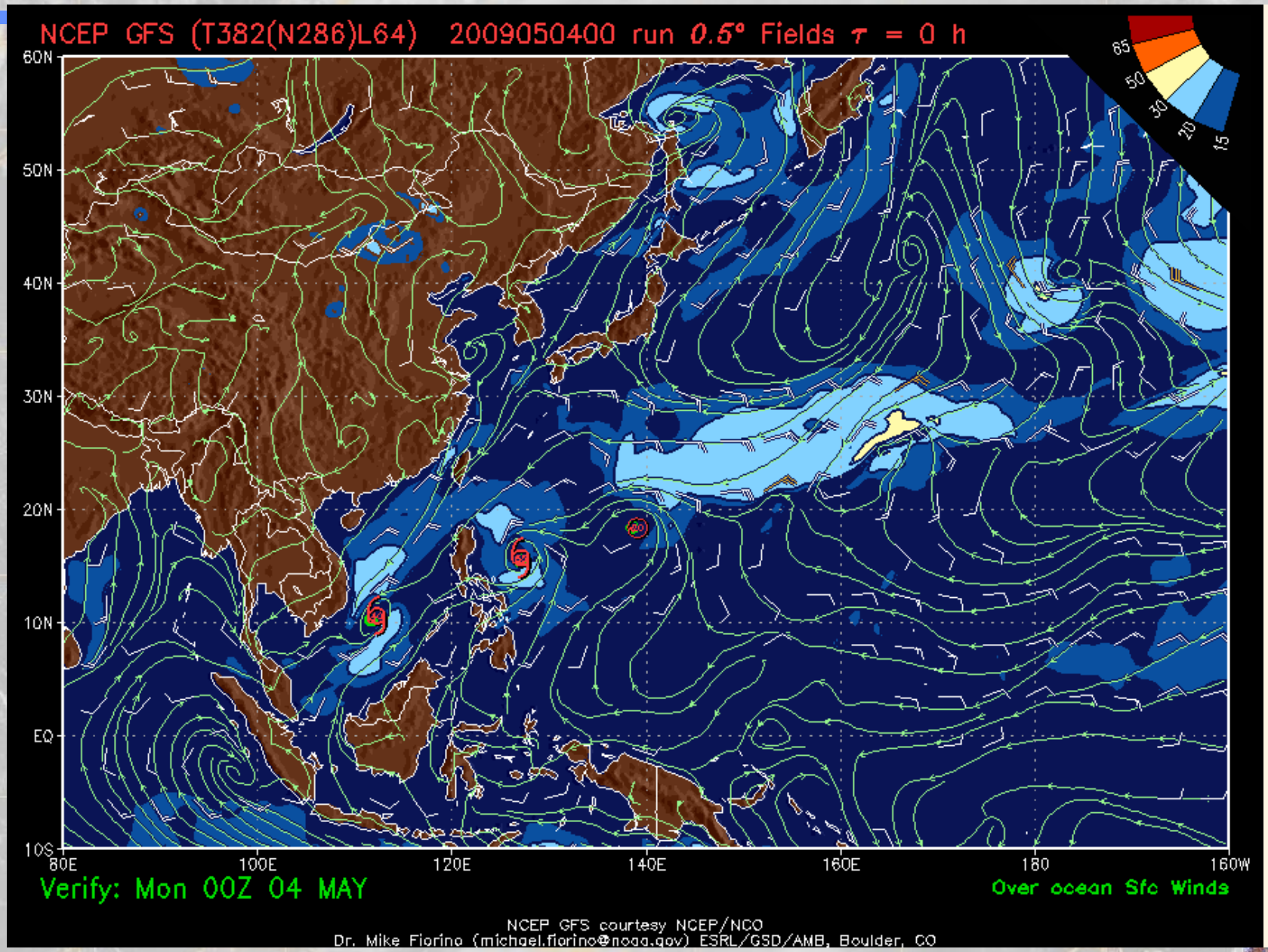




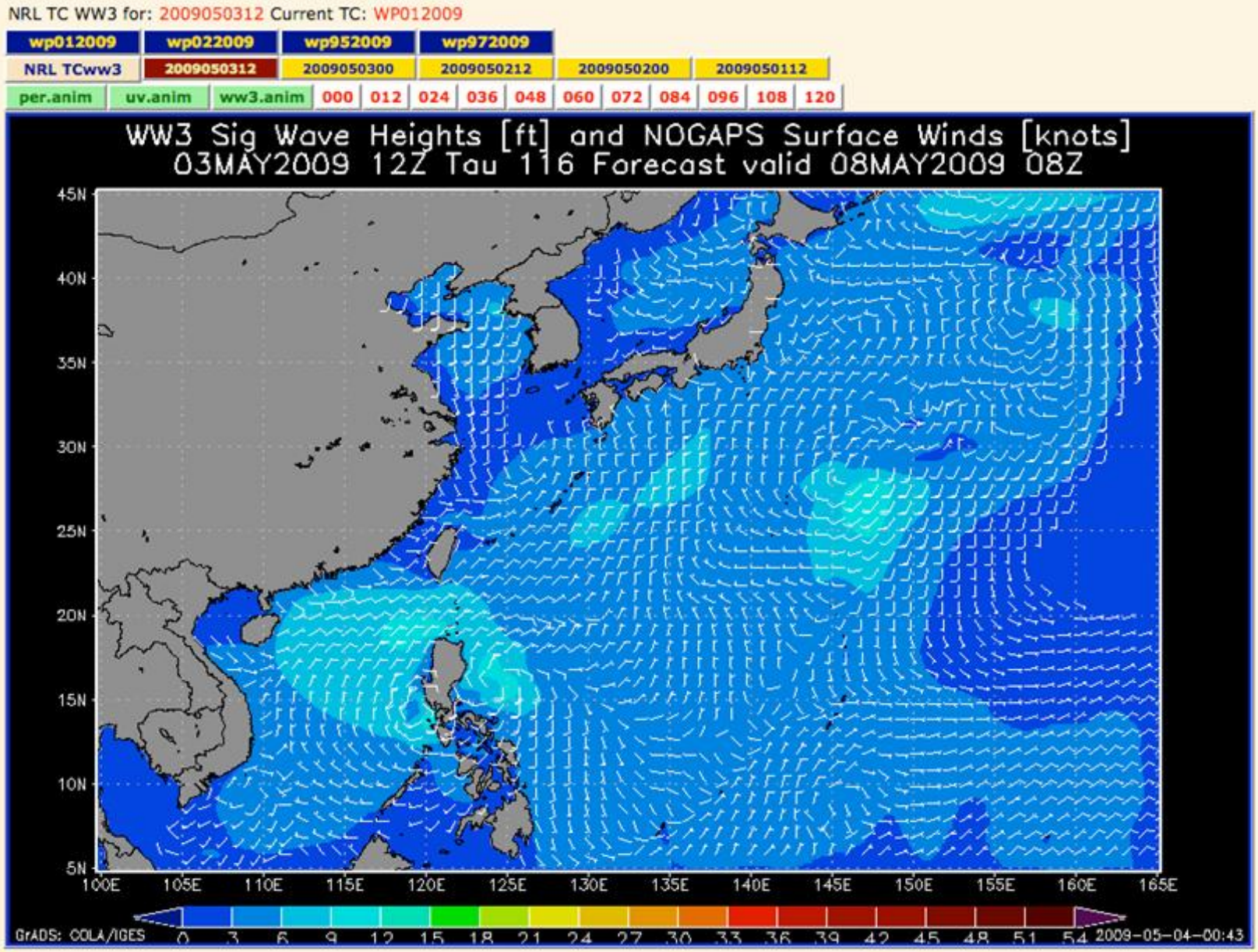
2009050400 – FIM (GFS) sfc wind anal τ=0



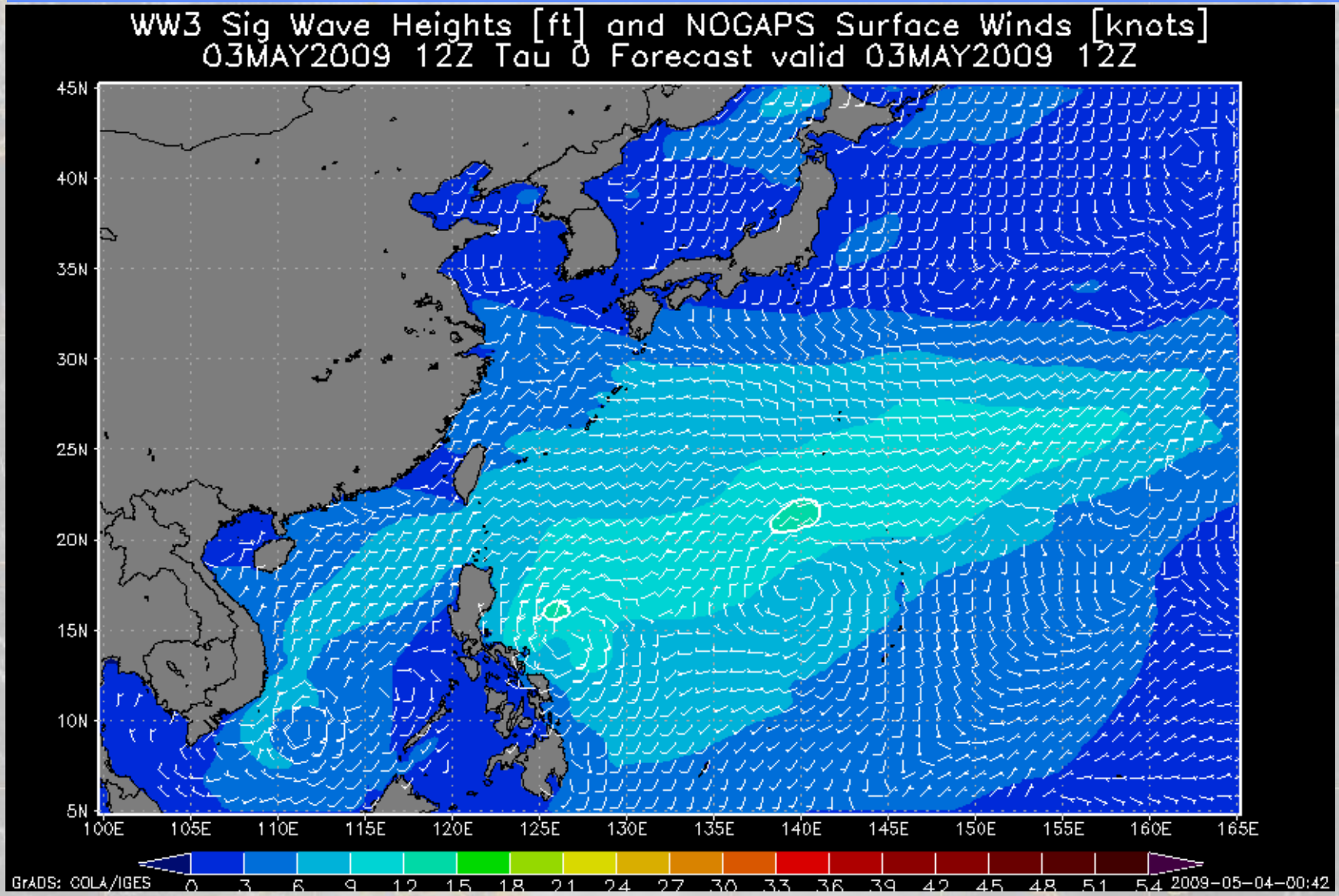
verification – 72 h fc v an



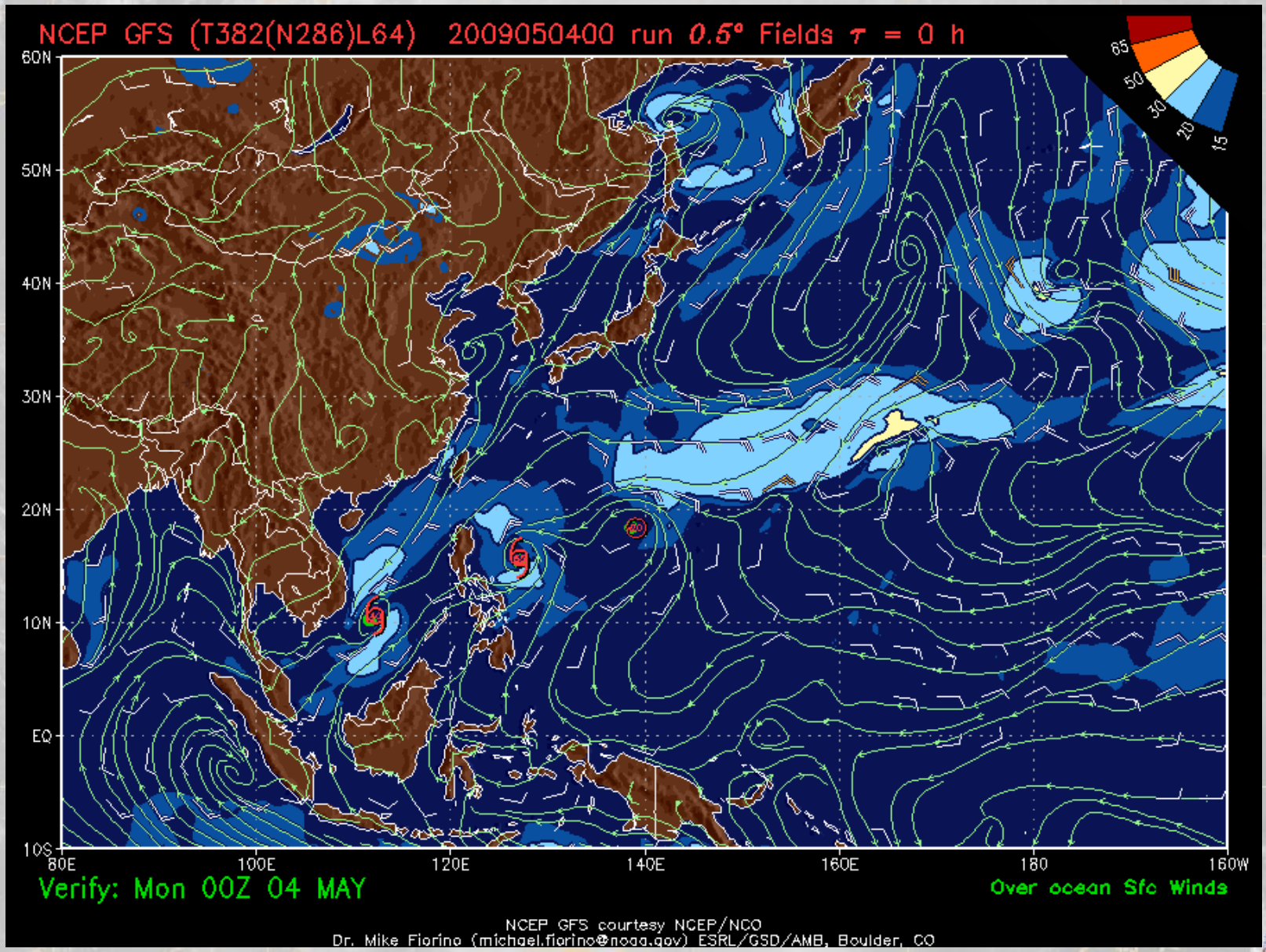
tcww3 – php interface to NRL graphics



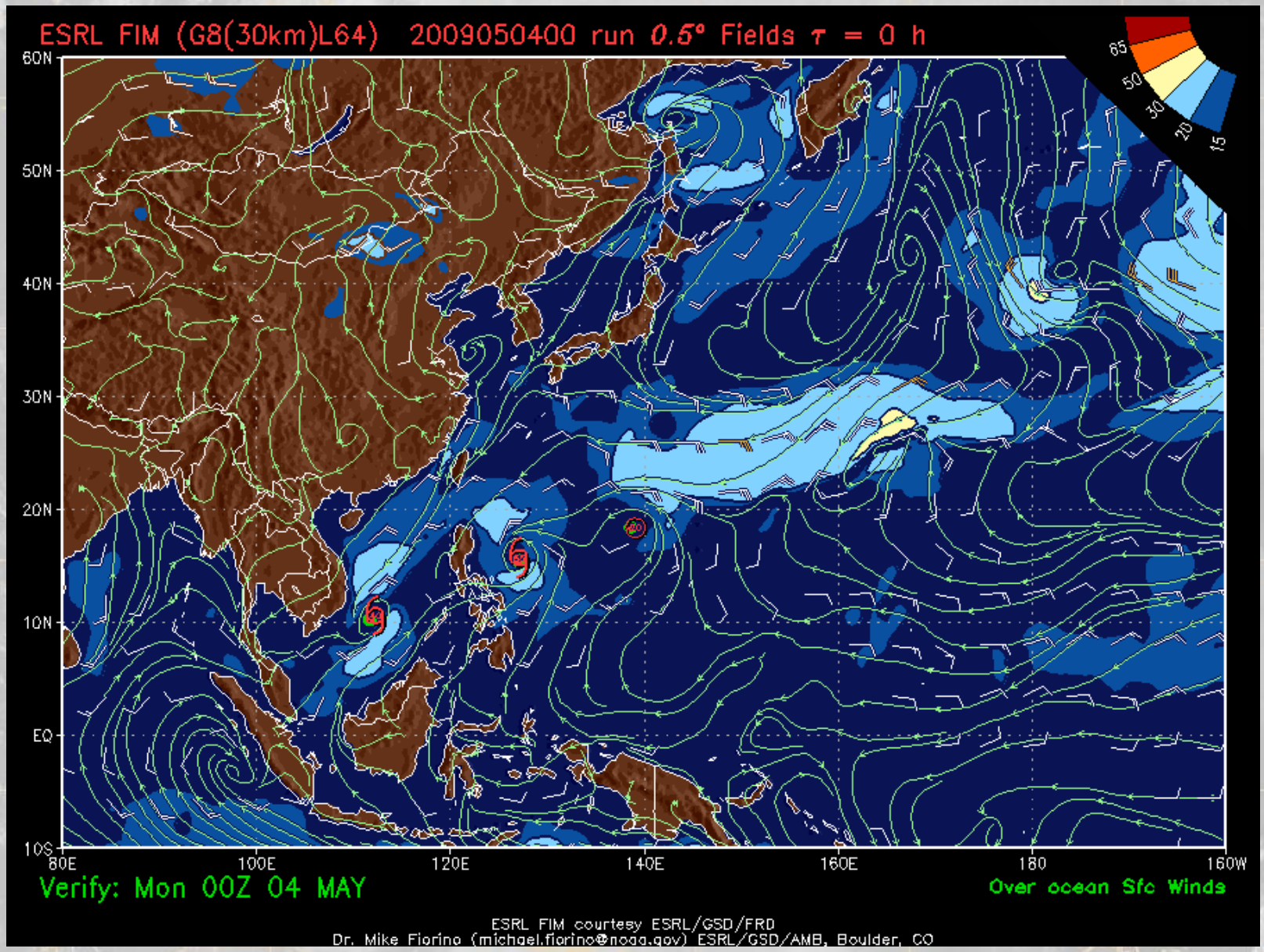
Sig Wave z – NOGAPS + JTWC TC



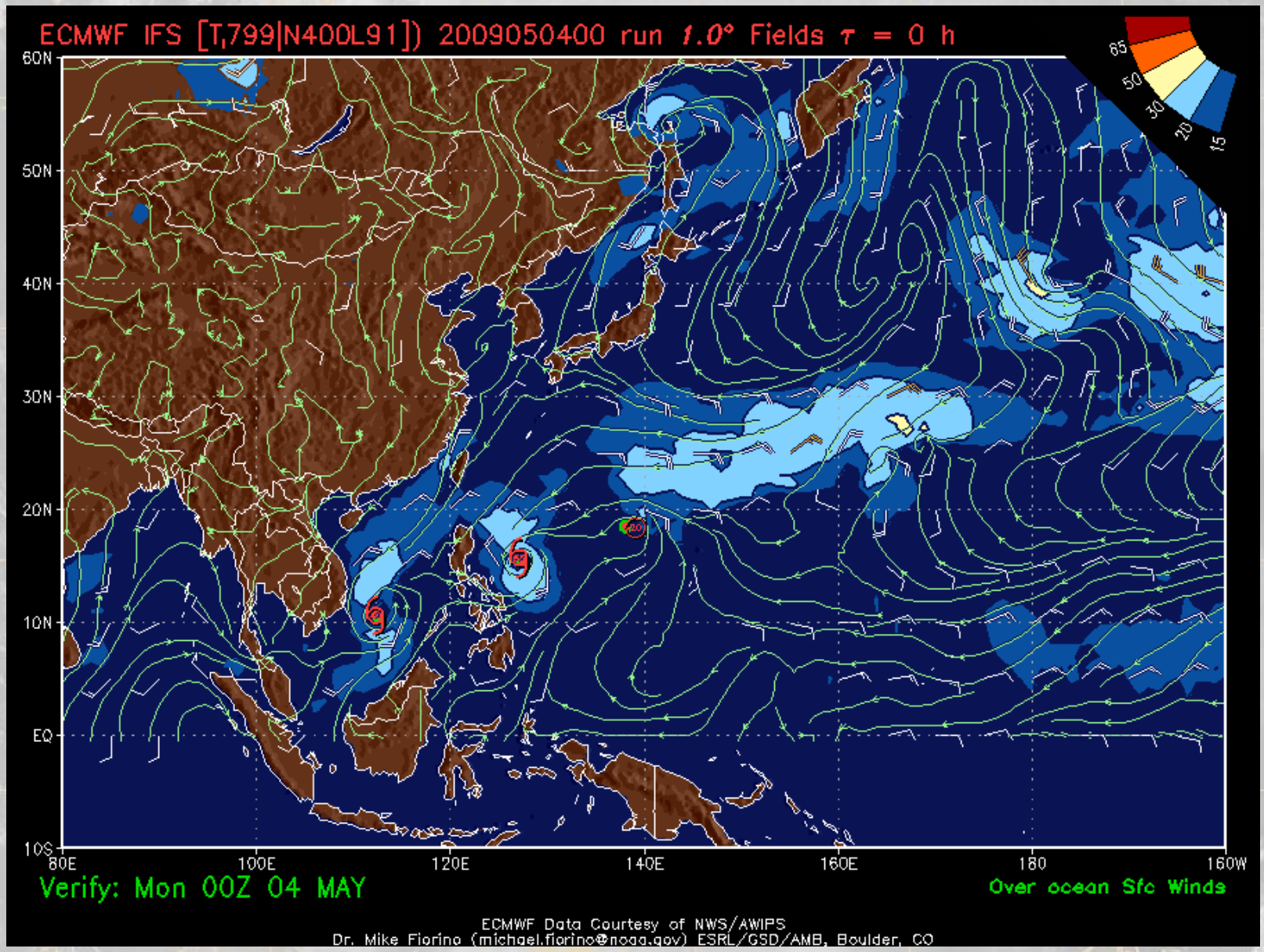
GFS 2009050400 72-h fc v an – formation



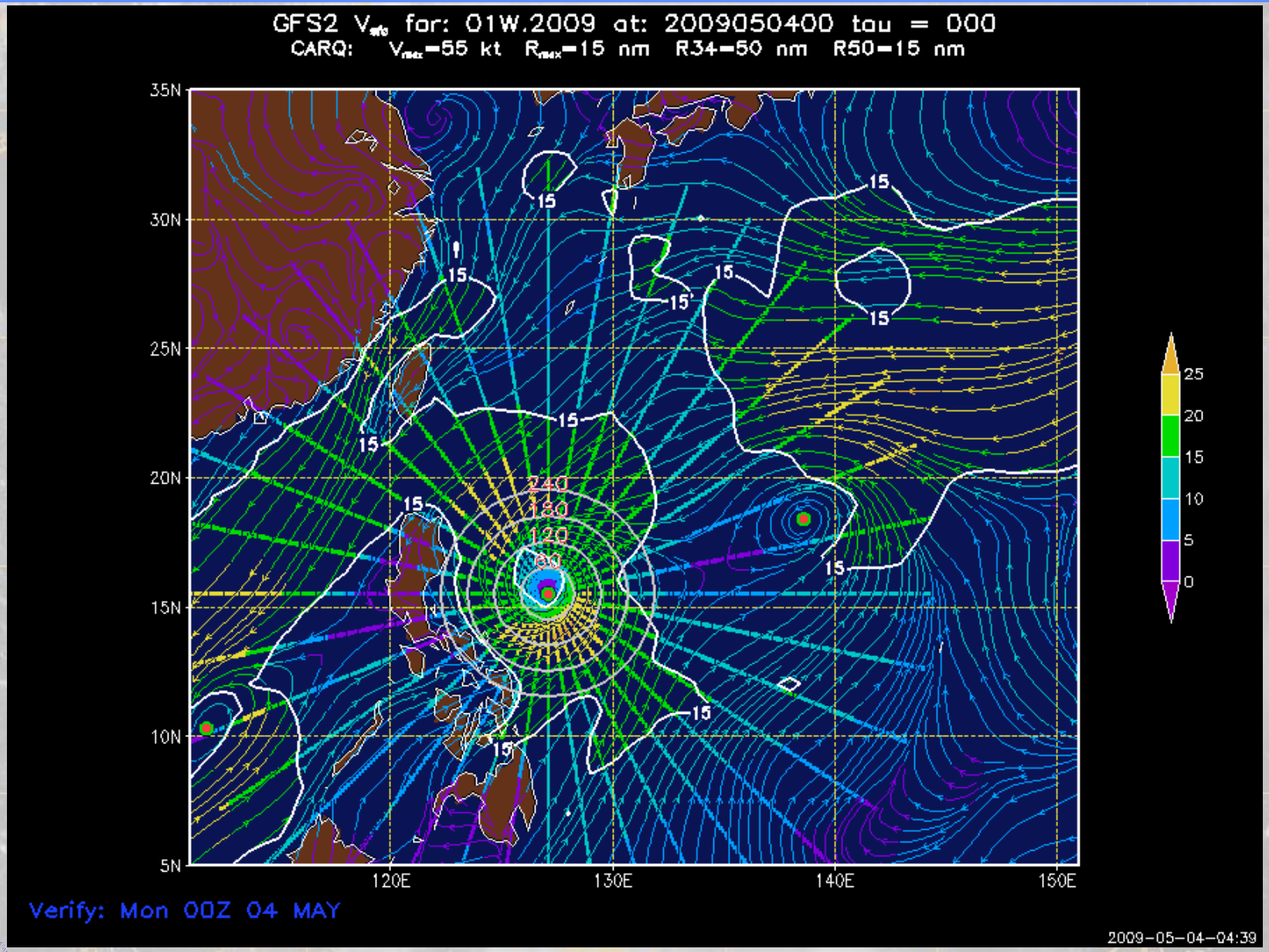
FIM8 (dx~30km) fc v an -- formation



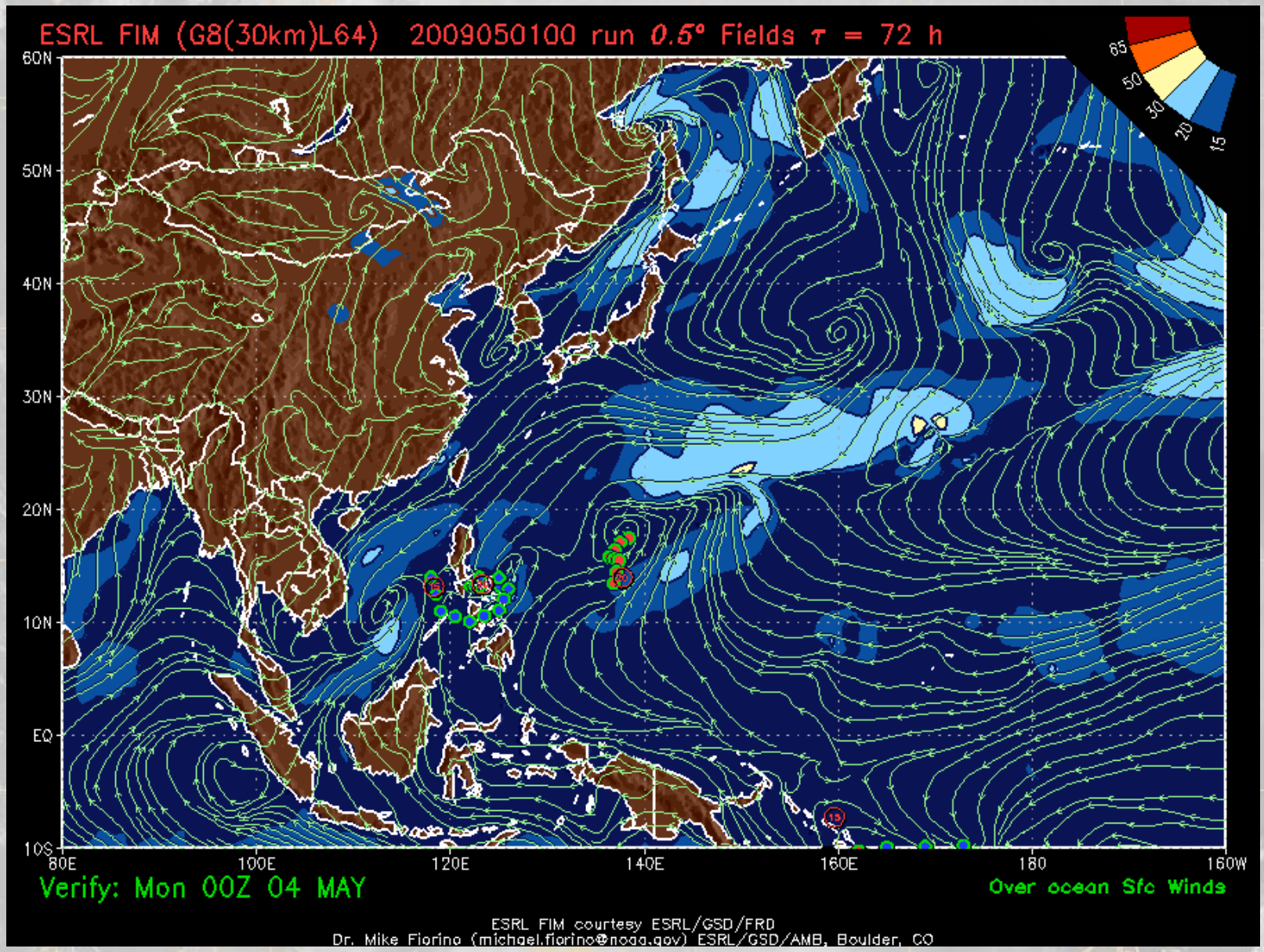
ECMWF (awips) fc v an – formation



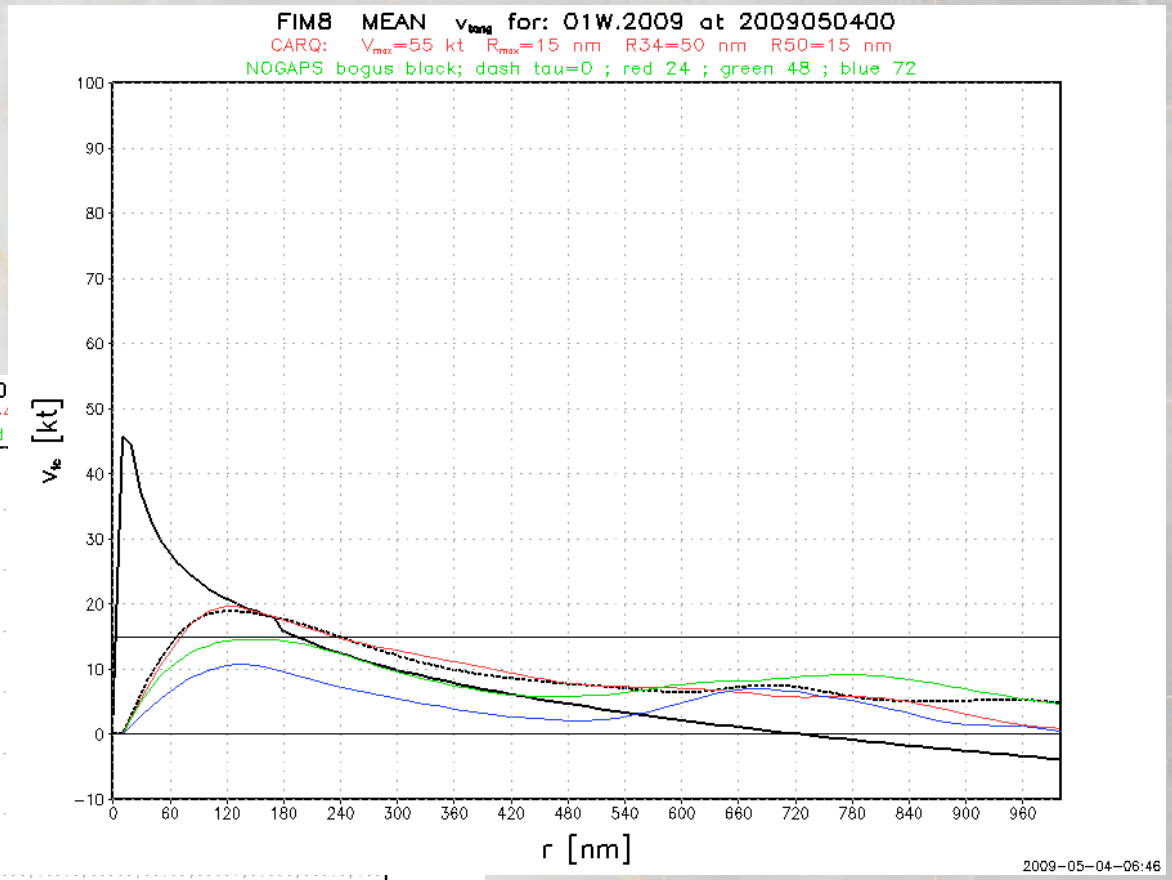
tcstruct – GFS sfc forecast

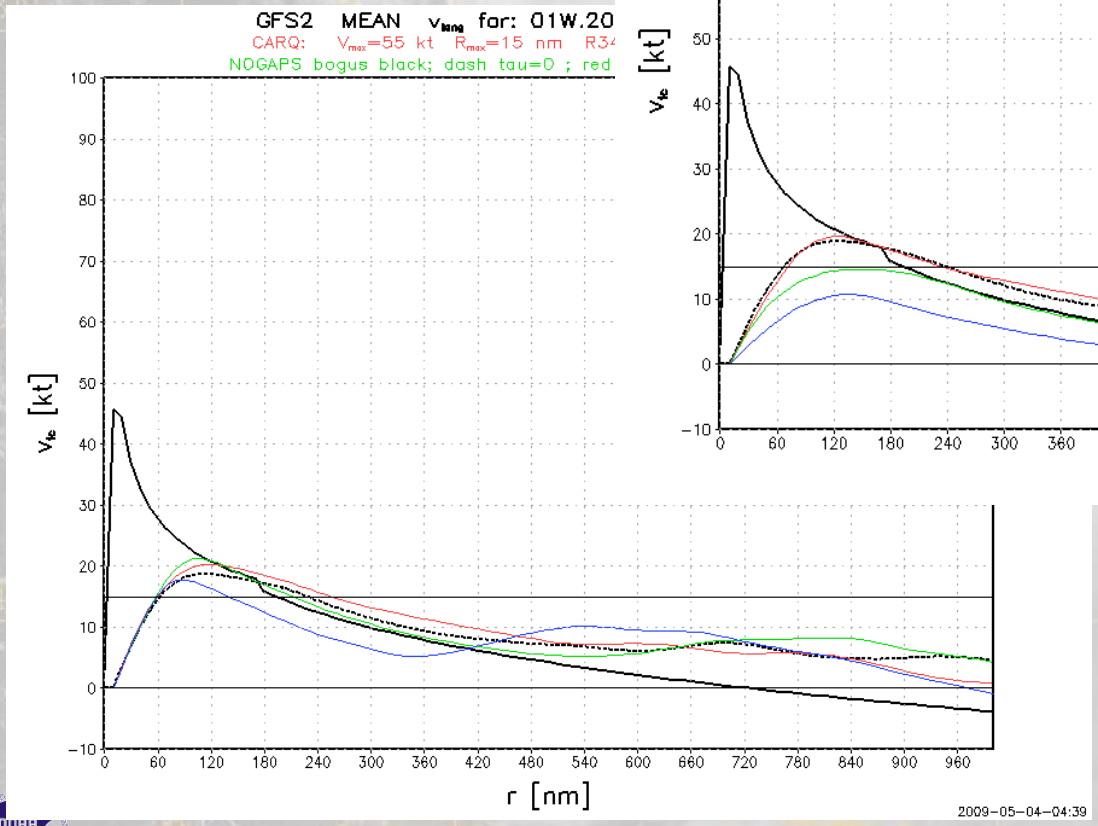


run-to-run consistency

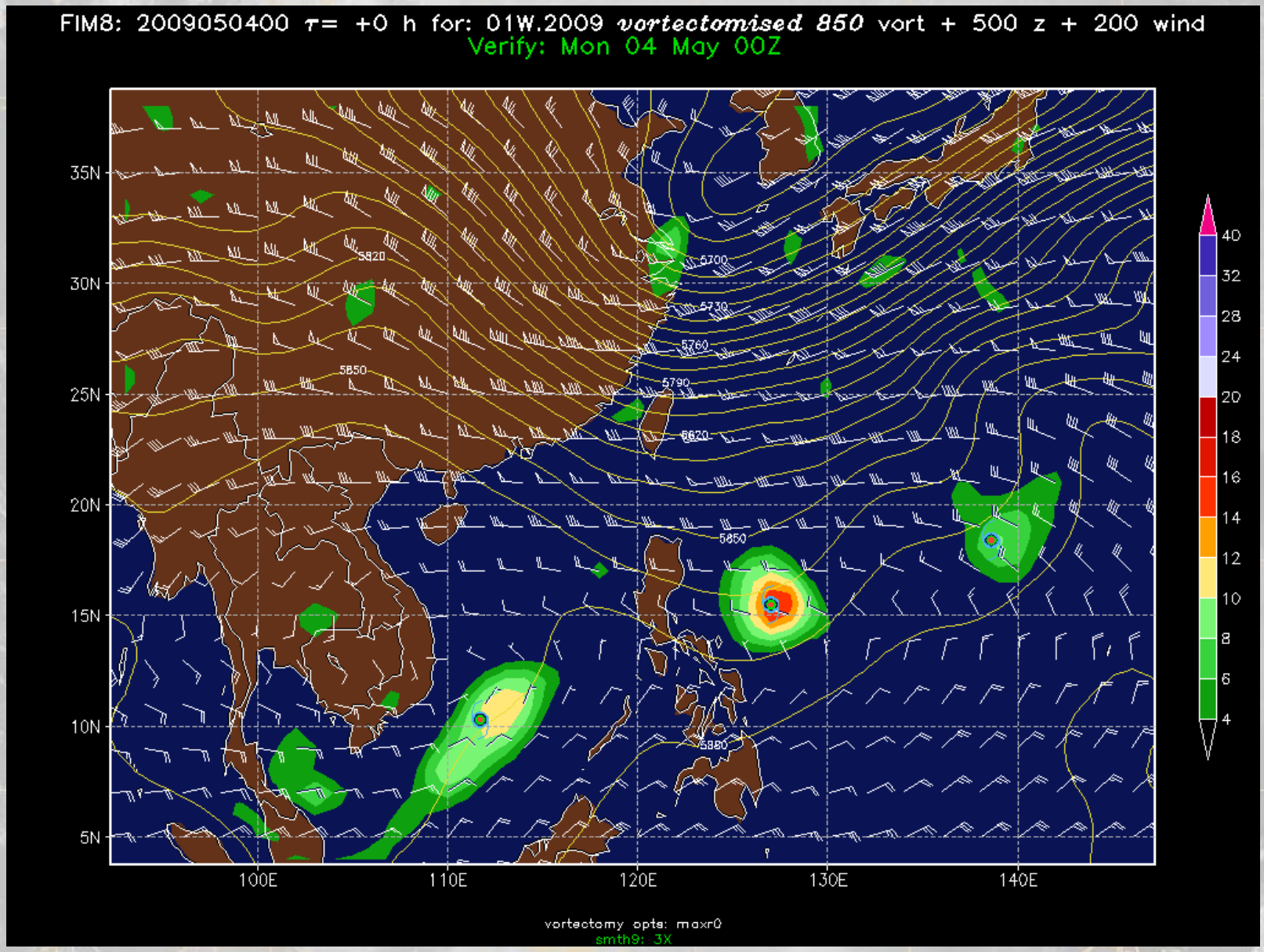


tcstuct – radial wind profiles

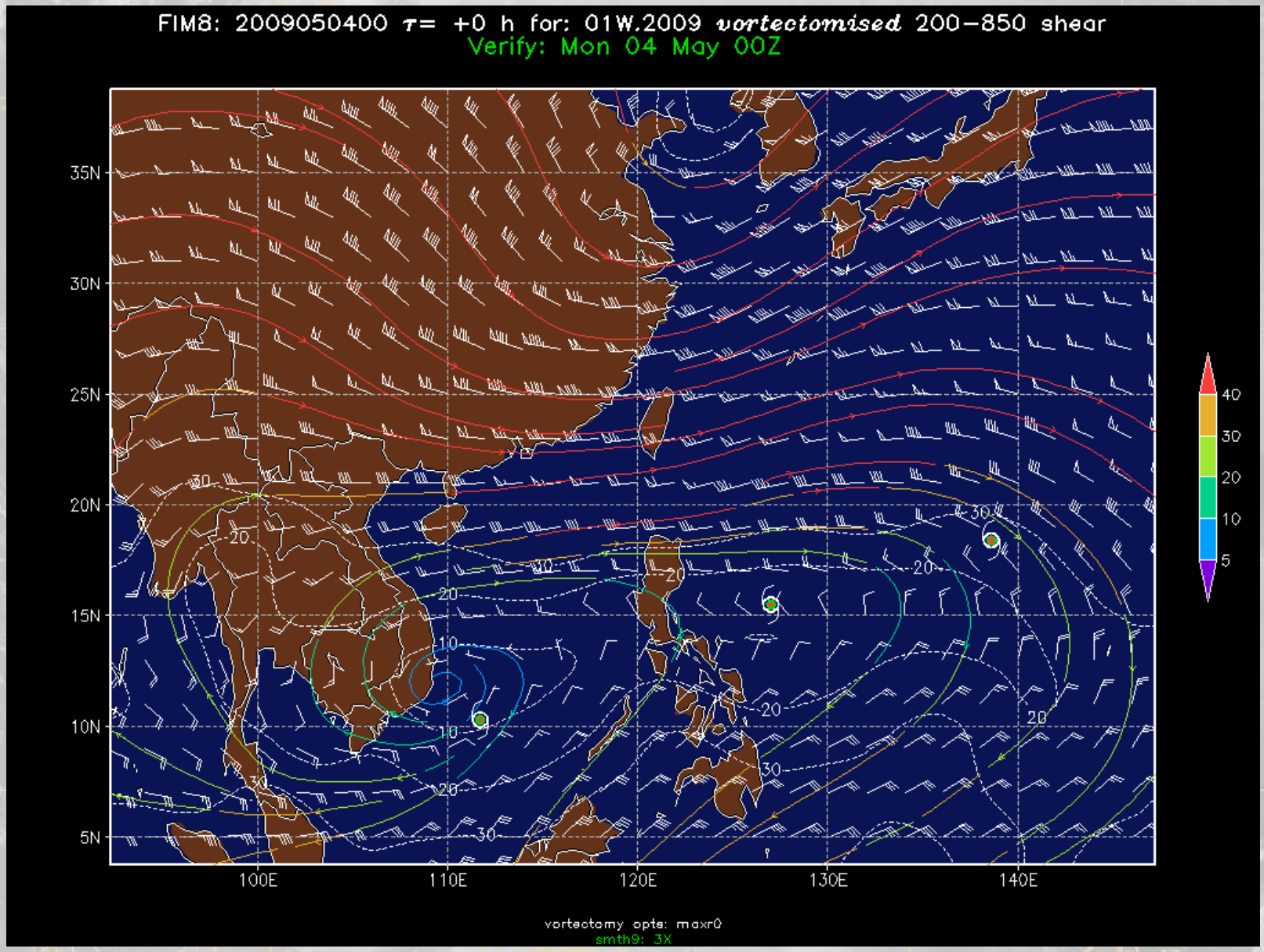




tcfilt – “vortectomy”



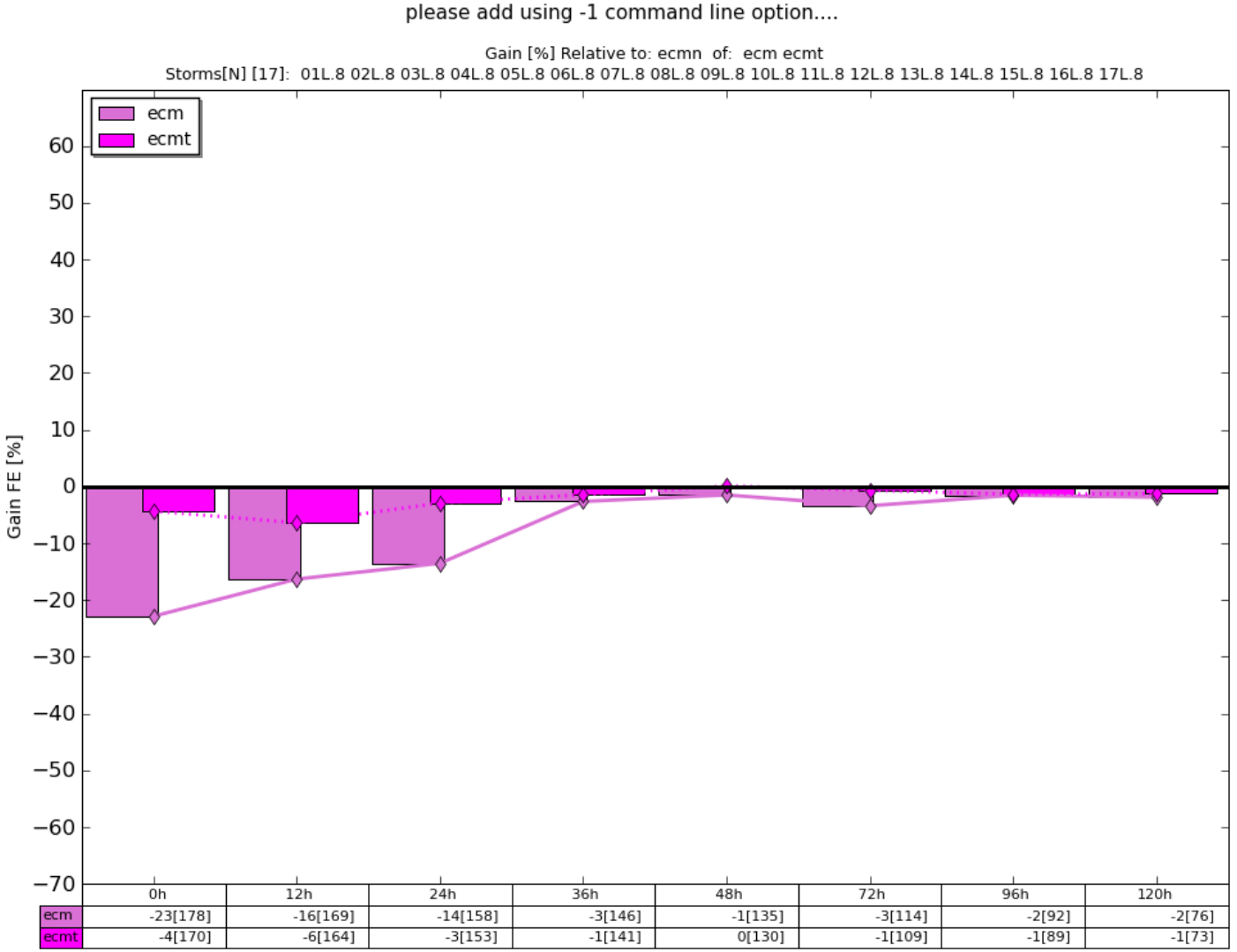
tcfilt – kurihara et al 1993



TC tracking – constraints

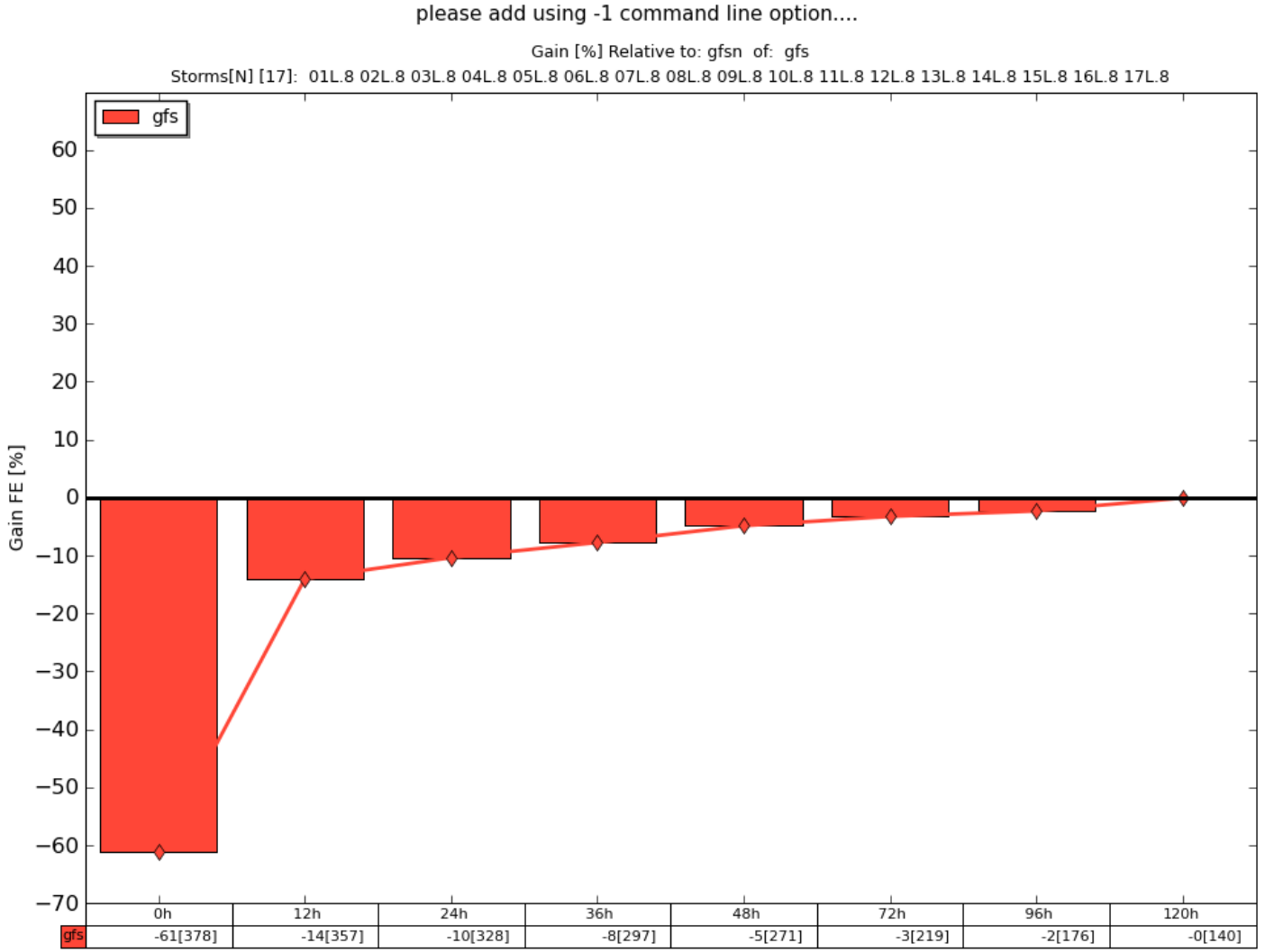
- ***make a forecast***
- ***track the tropical (low failure rate)***
- ***represent the operational definition of the center…***
  - **multiple centers**
  - **wind v mass**
  - **mid v low**

ECMWF 2008 LANT mf v ec v tm trackers



	0h	12h	24h	36h	48h	72h	96h	120h
ecm	-23[178]	-16[169]	-14[158]	-3[146]	-1[135]	-3[114]	-2[92]	-2[76]
ecmt	-4[170]	-6[164]	-3[153]	-1[141]	0[130]	-1[109]	-1[89]	-1[73]

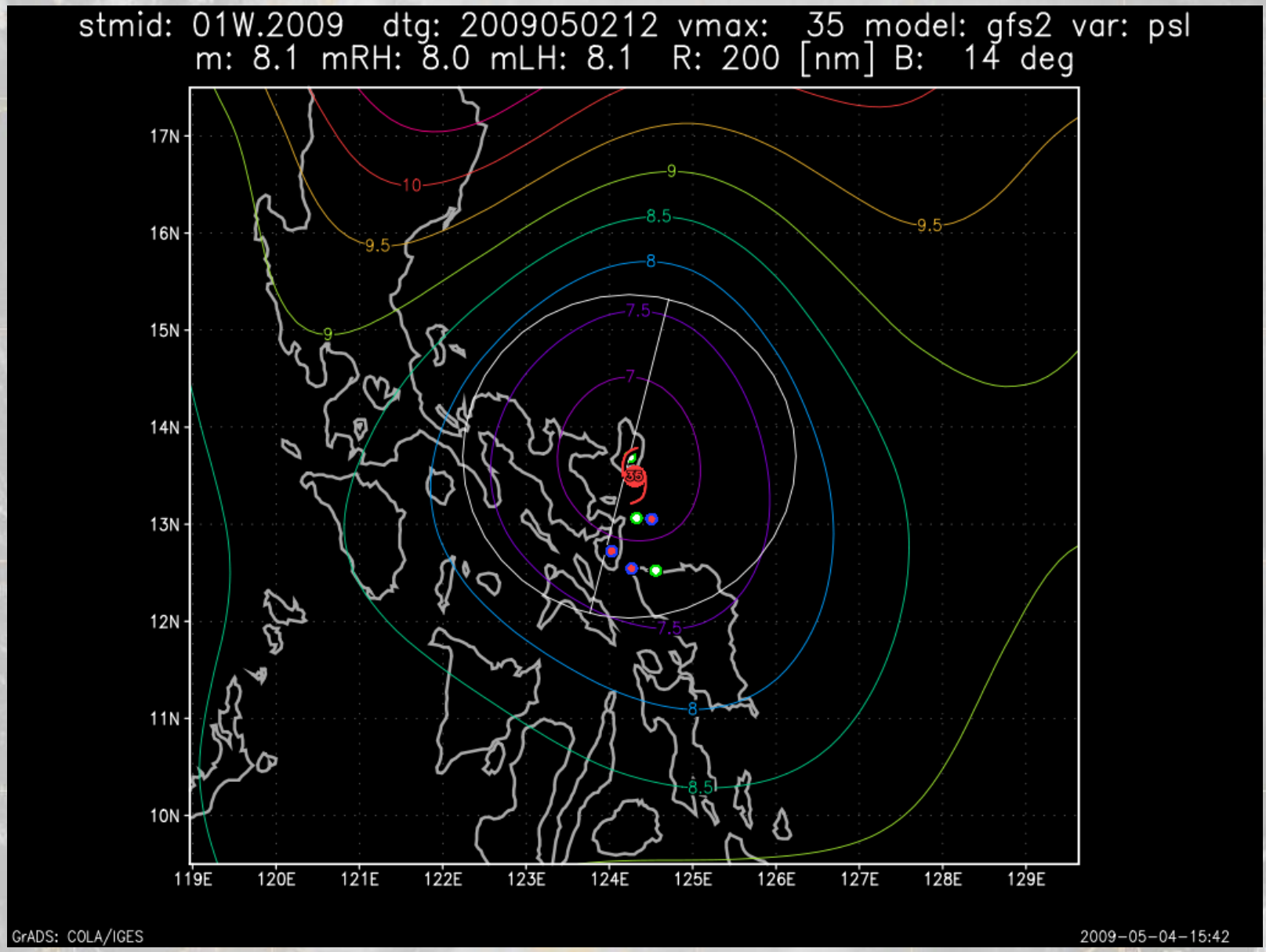
% gain(loss) mf v tm tracker – GFS 2008 LANT



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-desmoother**
  - **fish – Ψ / X**
  - **uv2vt – u,v (cart) → u,v (cylindrical)**

mfhilo/tcprop for 01W 2009050212



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