# Performance of hi-res GFS-based NOAA models v ECMWF

2013 HFIP summer demo – WPAC

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<table>
<thead>
<tr>
<th>ATCF ID</th>
<th>Model</th>
<th>Resolution (3n+1 rule)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>AVNO</td>
<td>GFS</td>
<td>T574L64</td>
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<tr>
<td>FIM9</td>
<td>FIM</td>
<td>G9L64</td>
<td>15 km</td>
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<tr>
<td>HWRF</td>
<td>HWRF</td>
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<td>27:9:3 km</td>
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<tr>
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<td>GFS SL</td>
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<td>11 km</td>
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<tr>
<td>EDET</td>
<td>ECMWF HRES</td>
<td>T1279L137</td>
<td>10 km</td>
</tr>
</tbody>
</table>
Prelims – NBs – ROEs

• verify against *working best track* using NHC/JTWC rules – if it’s a TC – verify
  ‣ option to filter out over-land TC posits
  ‣ more frequent in WPAC than LANT

• EDET comes from ECMWF (tigge or bufr)
  ‣ ECWMF tracker using *full res fields* – has a few issues
  ‣ intensity forecasts have less bias compared to trackers using 1deg fields (e.g., EMX)

• tracking for GFS/FIM9/GFS-SL uses *0.5 deg global fields* – will not completely resolve model TC intensity

• emphasize *model* performance vice performance as a *forecast aid*
  ‣ will not compare to OFCL or other ‘late’ aids such as TVCN

• homogeneous comps – every 12 h vice 06 h because HRES runs *00/12UTC*
  ‣ 12-h run separation ~ e-folding time for run-to-run error correlation

• *USN talk: tau = forecast time (h) ; phonetic alphabet for subbasins*

• all analysis and plots done with python+opengrads using dictionaries of python ‘vdeck’ and ‘mdeck’ objects ([http://sourceforge.net/projects/wxmap2/](http://sourceforge.net/projects/wxmap2/))
review of the WPAC season
http://ruc.noaa.gov/hfip/tcact
slow start but active oct-nov; ACE ~ -7% of normal

33 # storms – 5 STY – 12 RI – 7 ED
15-d sfc wind anomalies

NCEP R1 30-y daily climo (streams) v GFS mean analysis 091400-092900 (color anom WindSpeed; barb anom wind)

15-d mean GFS analyses sfc wind anomaly centered on 12Z21sep2013
period 2013091400 to 2013092900

climo position of monsoon trough

2013 monsoon trough anomalously strong and shifted poleward
WPAC 2013 oddities – 30W
transited three subbasins W—B—A
dissipates in Arabian Sea
JTWC WPAC warnings 110306-110606
JTWC BB warnings 111506 - 111606
WPAC 2013 oddities part 2 – 02B & 05B
started in WPAC (gulf of Thailand)

02B STC Phailin (ED)
100412-101400

05B TC Lehar (RW)
111918-112000
WPAC 2013 – forecast error

- HWRF *fastest* error growth
- FIM9 *slowest* error growth
- FIM9 most competitive with ECMWF
- Errors are ‘off the charts’ compared to CLIPER (C120)

WPAC 2013 HWRF v FIM9 v GFS v ECMWF - forecast error


### tau 72

<table>
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<th>Storm</th>
<th>HWRF</th>
<th>FIM9</th>
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<td>CL20 FE</td>
<td>382 nmi</td>
<td>631 nmi</td>
<td>210 nmi</td>
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<tr>
<td>GFS FE</td>
<td>115 nmi</td>
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### tau 120

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GFS hi-res models v ECMWF – WPAC 2013
Mike Fiorino ESRL HFIP telcon 20131204
WPAC 2013 – intensity error

- HWRF almost NO bias (mean error)!!
- ECMWF has highest initial intensity error; HWRF almost none
- as in the LANT, ECMWF bias decreases in time…
- higher res in FIM9 (15 km) results in smaller bias than the GFS at the later tactuals, but signal is reduced by using 0.5 deg grids
- HWRF has higher abs mean error (‘intensity error’) in WPAC (17 kt) v LANT (~10 kt)
WPAC cases of extremely large ECMWF HRES intensity errors
WPAC cases of extremely large ECMWF HRES intensity errors

ECMWF tracker issue?

HWRF excellent Vmax forecast
ECMWF flat-lined
by storm tau0 & tau72 intensity error

GFS hi-res models v ECMWF – WPAC 2013
Mike Fiorino ESRL HFIP telcon 20131204
WPAC 2013 model (ECMWF) forecast intensity error

storms of shame

2013 07W TY SOULIK: 125 ; 7.2; 9.2; 22.4; 135.6; 070512<->071418; 19.1<->31.7; 116.7<->158.0; 8.3; 11.4; 9; 2; 5; ddED; sg: 54; 9X; 92W; lat: 070718
2013 11W STY UTOR: 130; 9.2; 10.2; 18.3; 120.8; 080712<->081718; 12.0<->25.9; 109.1<->138.6; 8.4; 10.5; 8; 1; 7; ddED; sg: 30; 9X; 96W; lat: 080818
2013 17W STY USAGI: 140; 6.8; 8.2; 19.5; 124.9; 091506<->092312; 17.0<->25.4; 110.2<->132.6; 9.0; 14.4; 6; 4; 6; ddED; sg: 36; 9X; 99W; lat: 091618
2013 23W TY DANAS: 125; 5.2; 7.5; 21.3; 140.6; 100100<->100818; 15.9<->36.0; 126.9<->151.5; 5.9; 7.7; 6; 0; 4; ddRI; sg: 54; 9X; 97W; lat: 100312
2013 28W STY LEKIMA: 140; 6.2; 7.8; 18.8; 155.0; 101818<->102612; 9.3<->39.5; 144.3<->169.0; 8.9; 15.6; 8; 4; 4; ddED; sg: 42; 9X; 95W; lat: 102012
2013 31W STY HAIYAN: 170; 8.8; 10.8; 10.9; 134.5; 11016<->112018; 5.4<->24.7; 107.2<->164.2; 11.3; 21.6; 7; 4; 11; ddED; sg: 48; 9X; 99W; lat: 110306
WPAC 2013 intensity error for BIG ECMWF intensity error storms

- HWRF clear winner with a weak bias (as expected for STYs)
- huge ECMWF initial intensity error – poor inner-core TC analysis
- other global models about the same except initially

GFS hi-res models v ECMWF – WPAC 2013
Mike Fiorino ESRL HFIP telcon 20131204
WPAC 2013 forecast error for BIG ECMWF intensity error storms

07W, 11W, 17W, 22W, 28W, 31W

- superior HWRF intensity errors do NOT translate into better track forecasts
- errors lower than for all storms – well-behaved STYs
WPAC 2013 forecast error for BIG ECMWF intensity error storms

affect of over-land points in the best track designated as TC

- big forecast errors come from over-land points
- relative position of models about the same except ECMWF has higher forecast error growth – the very poor TC analysis did affect the track
WPAC 2013 – forecast error – add GFS-SL

- fewer cases because of GFS-SL – 9 storms before the 1 AUG 13 start of the demo
- GFS-SL has greatest error growth
- GFS-SL in WPAC even worse
<table>
<thead>
<tr>
<th>Storms</th>
<th>COTC</th>
<th>NAVGEM</th>
<th>HWRF</th>
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</tbody>
</table>

- NAVGEM < GFS
- COTC has very high error growth
- GFDN next highest
- Serious issues with the USN limited-area models...
COAMPS-TC with GFS v NAVGEM
WPAC 2013

WPAC 2013 COTC (run with NAVGEM) v CTCX (run with GFS) v NAVGEM v GFS v ECMWF - forecast error

- modest impact of using GFS vice NAVGEM in COTC
- still issues with USN COAMPS-TC
Takeaways

- JTWC over-land TC posits in (working) best track have a significant on forecast error
- ECMWF had dreadful intensity errors in WPAC – they have a serious TC analysis issue – but impact on track was weak (Fiorino and Elsberry 1989)
- as in the LANT/EPAC HWRF has very low initial position and intensity errors
  - vortex initialization recovers almost all of the location and intensity in the TCvitals
- FIM9 had a good year v GFS v ECMWF v HWRF
- as in LANT/EPAC resolution is not a sufficient condition for TC prediction success
- doubling the resolution of the GFS degraded TC performance less severely v LANT/EPAC
  - consistent with experience at ECMWF – need to ‘adapt’ physics to new resolution
- USN limited-area-models have serious issues that go beyond the embedded global model