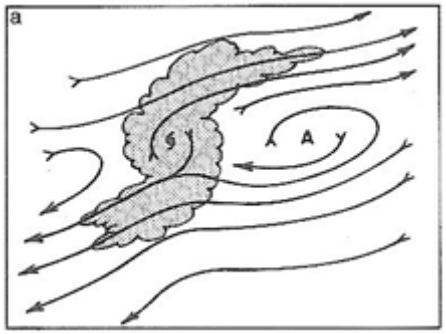
SH072014 RI Events

Influence From Patterns
Of Different Scale

RI Explanation*

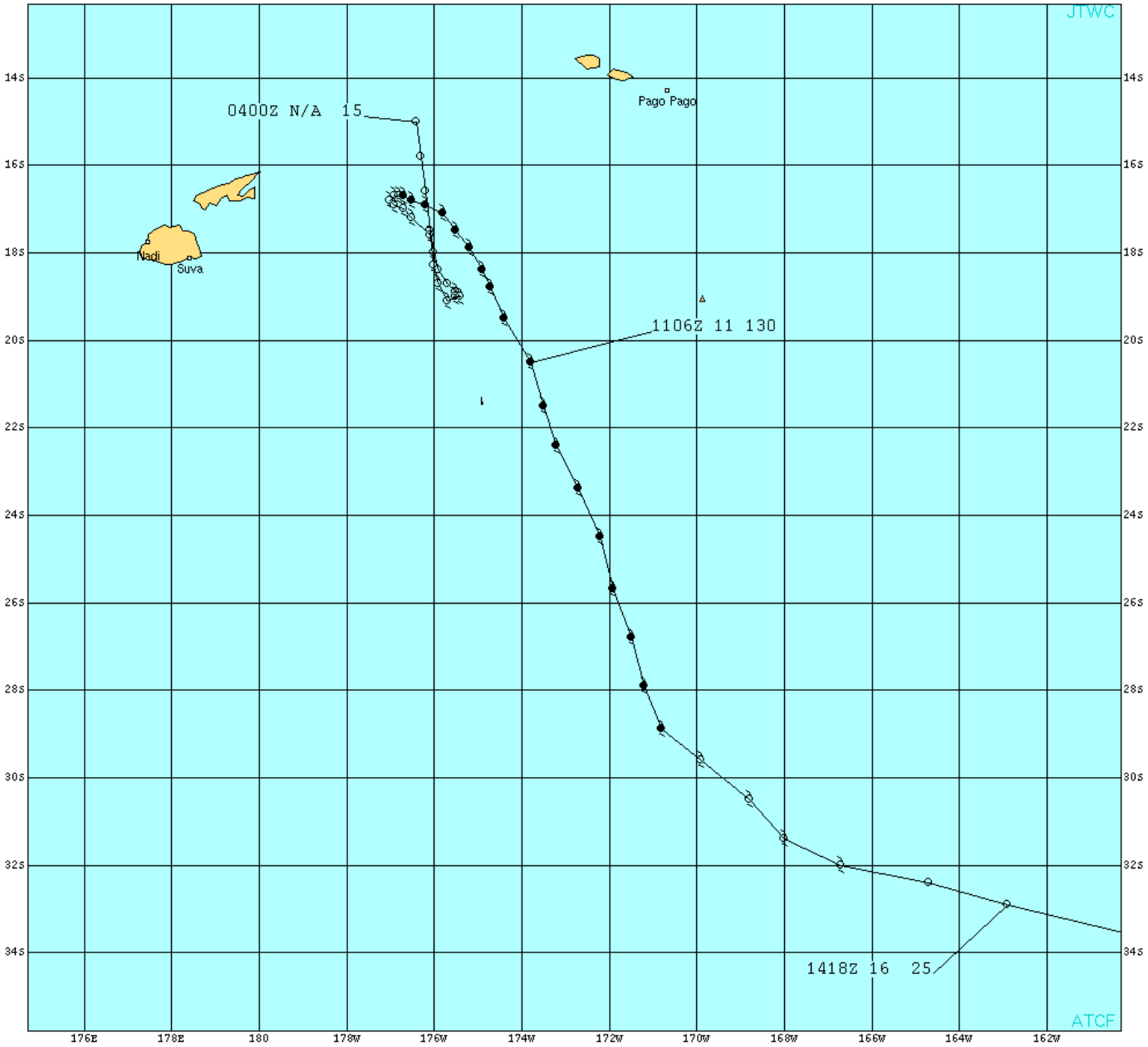
- Rapid intensification, approximately an increase of 2 Dvorak T-numbers or 30 knots in 24 hours, frequently occurs in JTWC forecast basins.
- In general, rapid intensification is likely if dual outflow channels develop.
- *TUTT cell are associated w/RI*
- *Mid-latitude trough also*



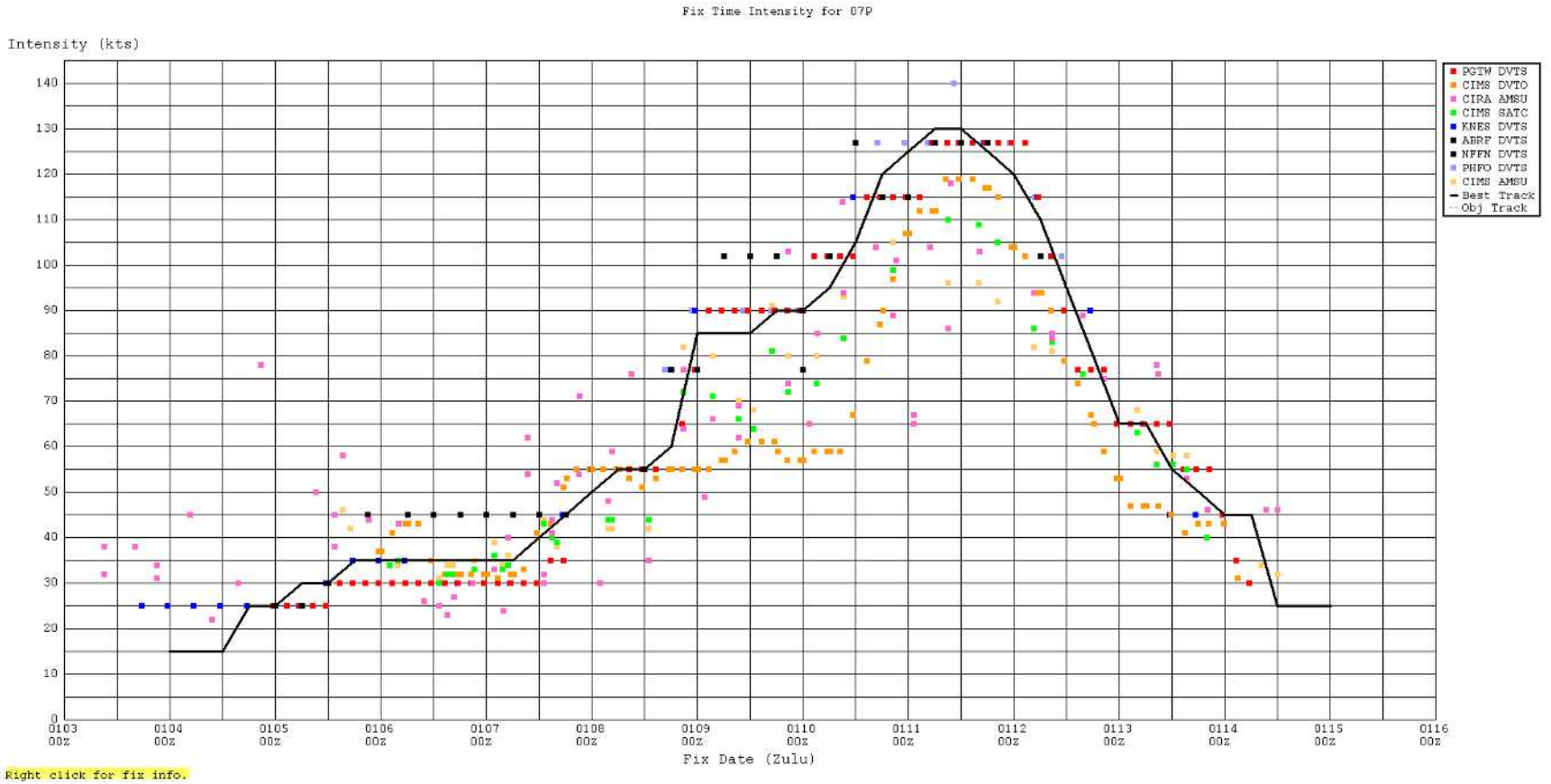
* http://ohana.nmci.navy.mil/mediawiki-1.5.4/index.php/Tropical_cyclone_intensity#Rapid_Intensification

SH072014 Observations and Prelim Conclusion

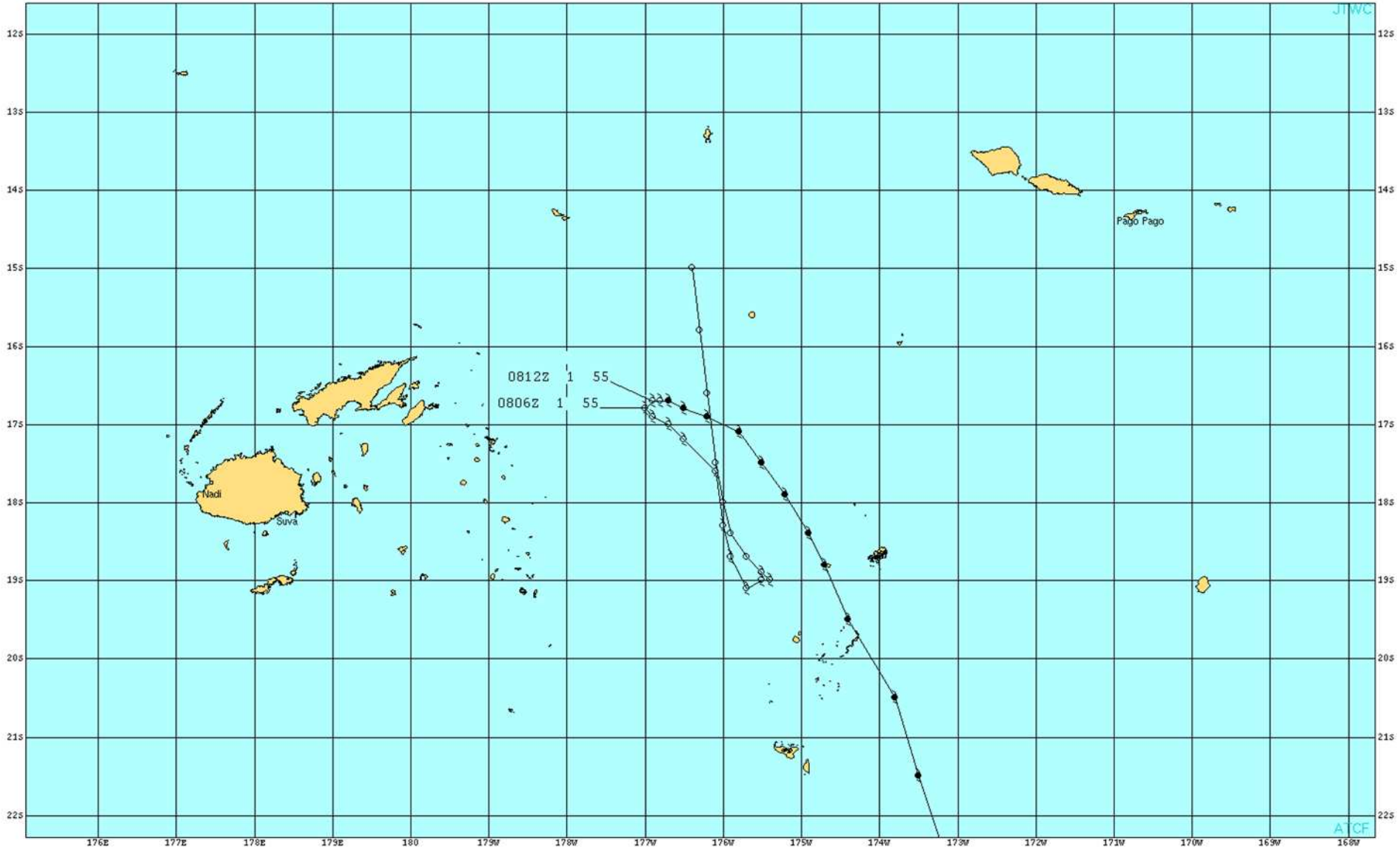
- JTWC warned @ 06Z & 18Z
- Two RI events
  - 08/12Z to 09/00Z
  - 10/00Z to 11/06Z Jan
- RI #1 resulted by increased outflow aided by small TUTT cell (UL cyc)
- RI #2 resulted from mid-latitude trough and TUTT enhancement
- Both events mis-initialized & mis-forecast by models & JTWC
- CHIPS as an RI tool?


JTWC
0400Z N/A 15
Pago Pago
Nadi
Suva
1106Z 11 130
1418Z 16 25
ATCF
14S
16S
18S
20S
22S
24S
26S
28S
30S
32S
34S
176E
178E
180
178W
176W
174W
172W
170W
168W
166W
164W
162W

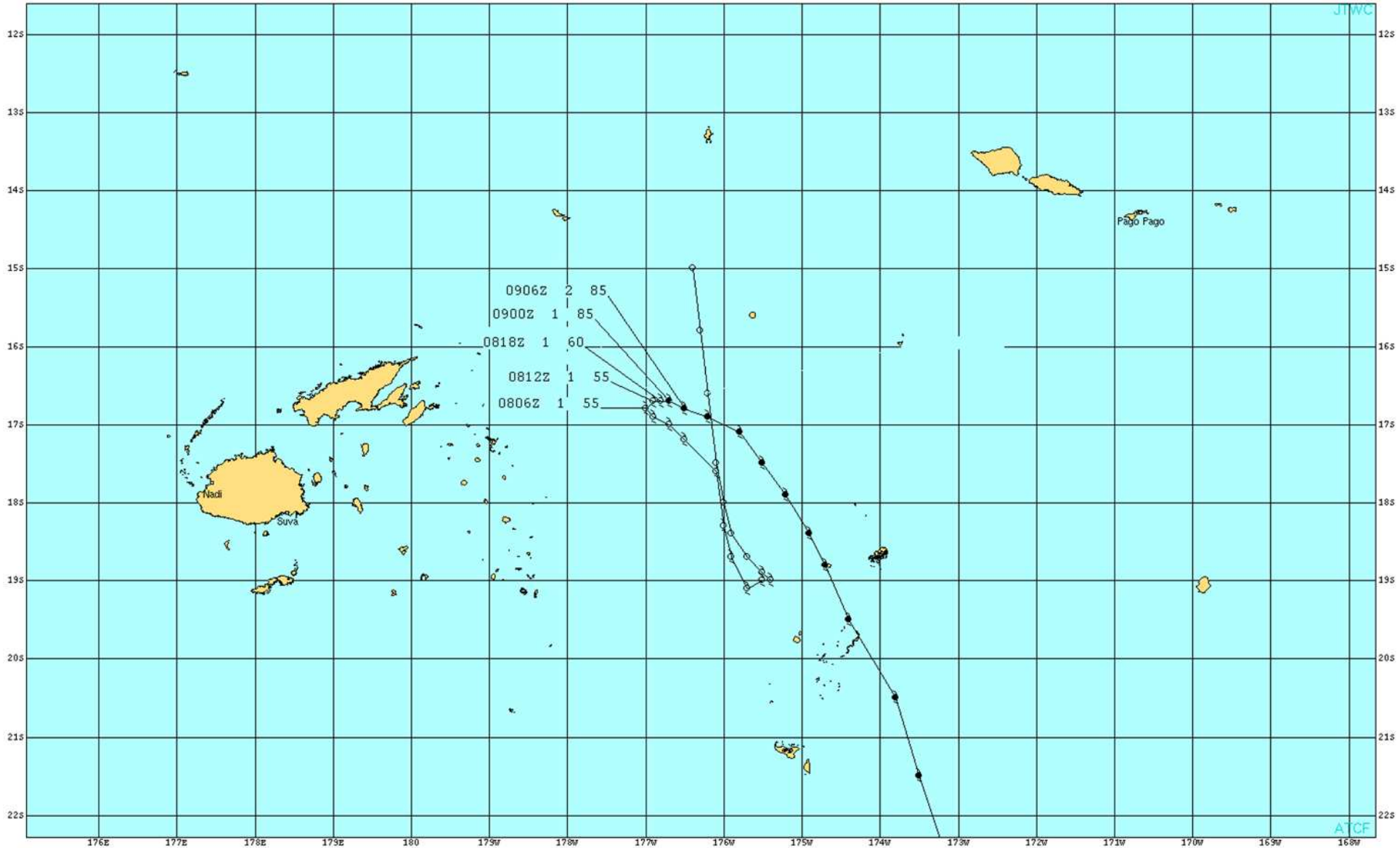
TC 07P (Ian) Working Intensity Plot
Max intensity 130kts



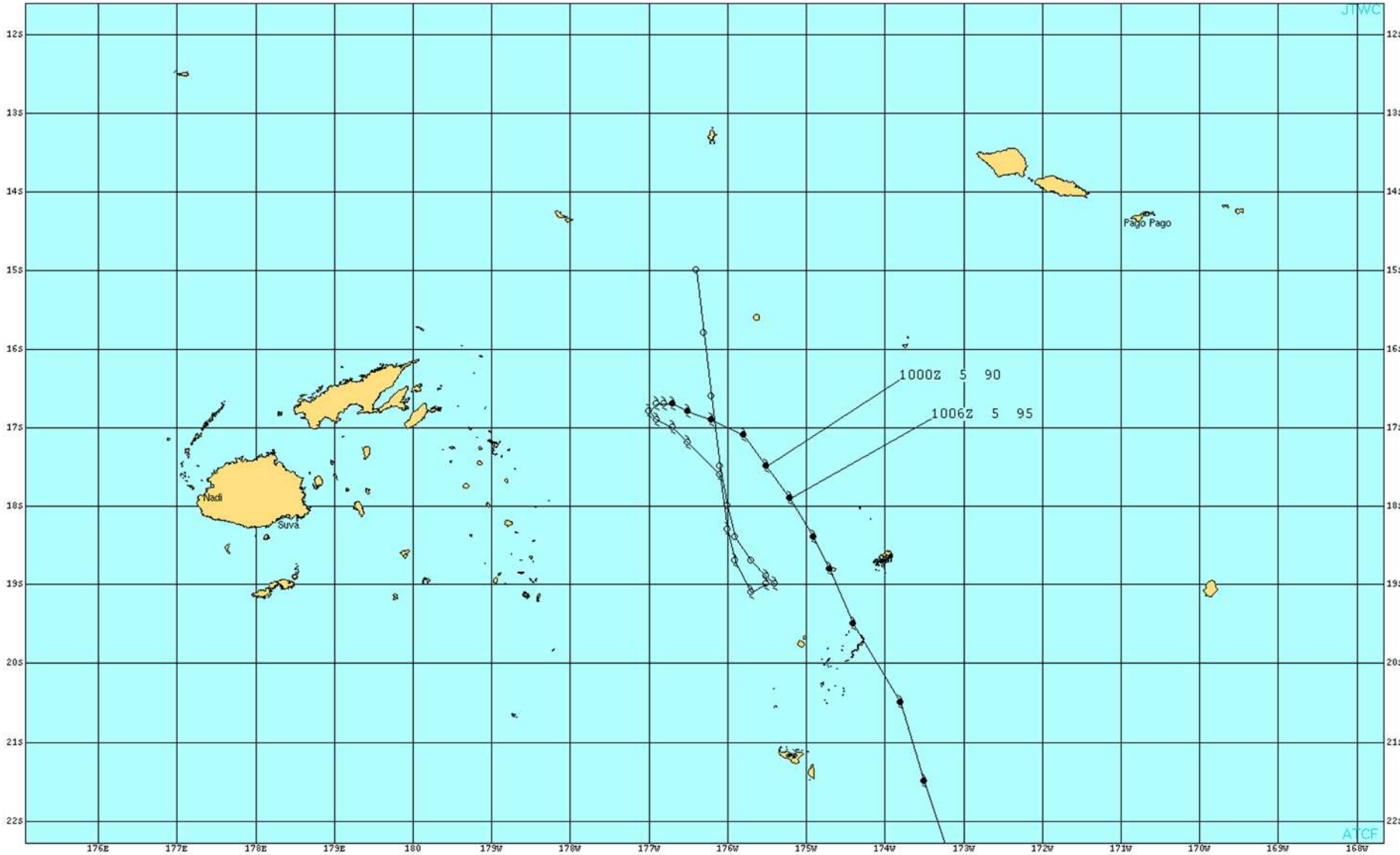
First RI Event Location: Between Fiji and Samoa Islands



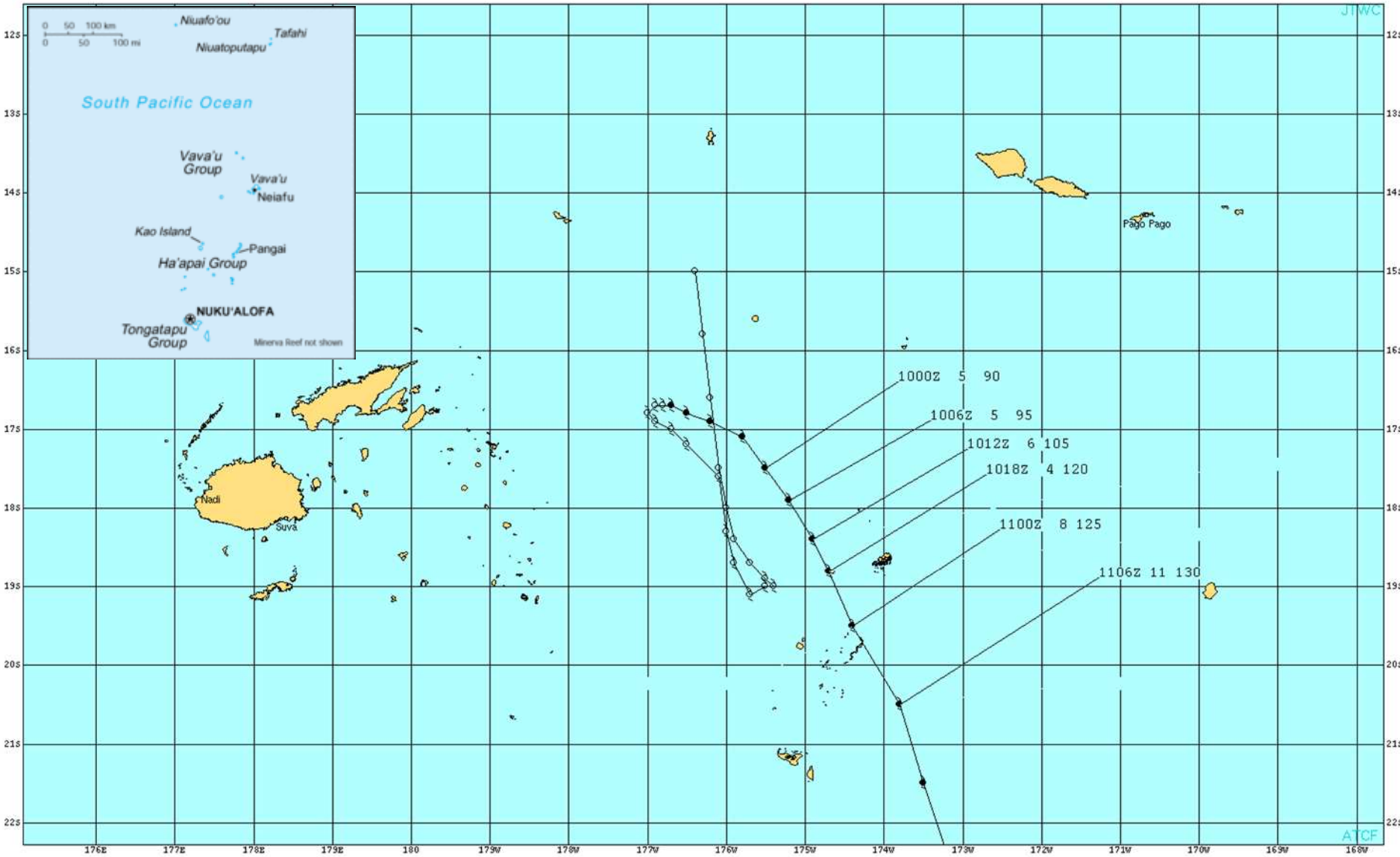
First RI Event: 30kt increase in 12 hours
08/12Z – 09/00Z



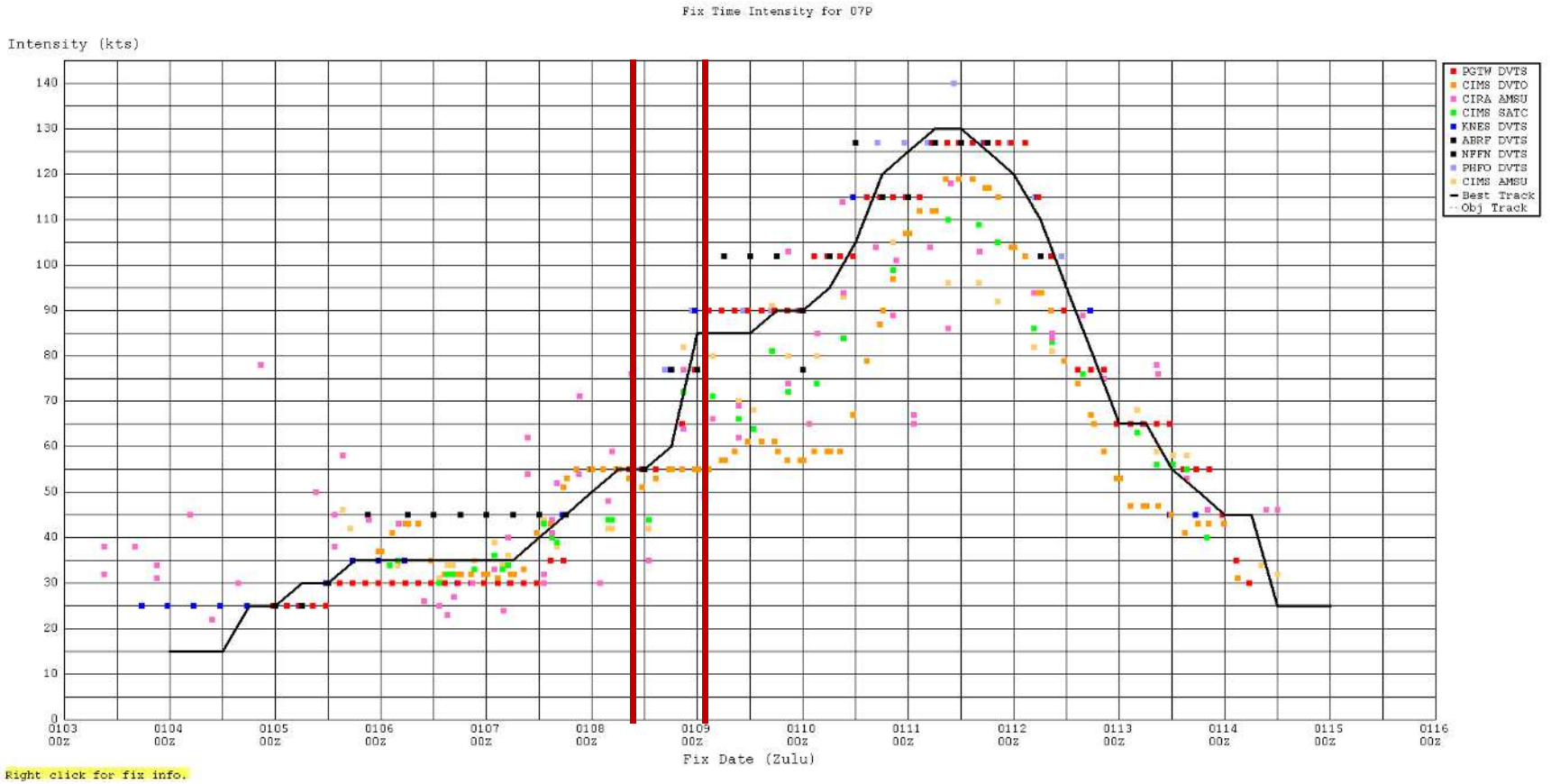
2nd RI Event Began @ 10/06Z
35kt Increase/24hrs



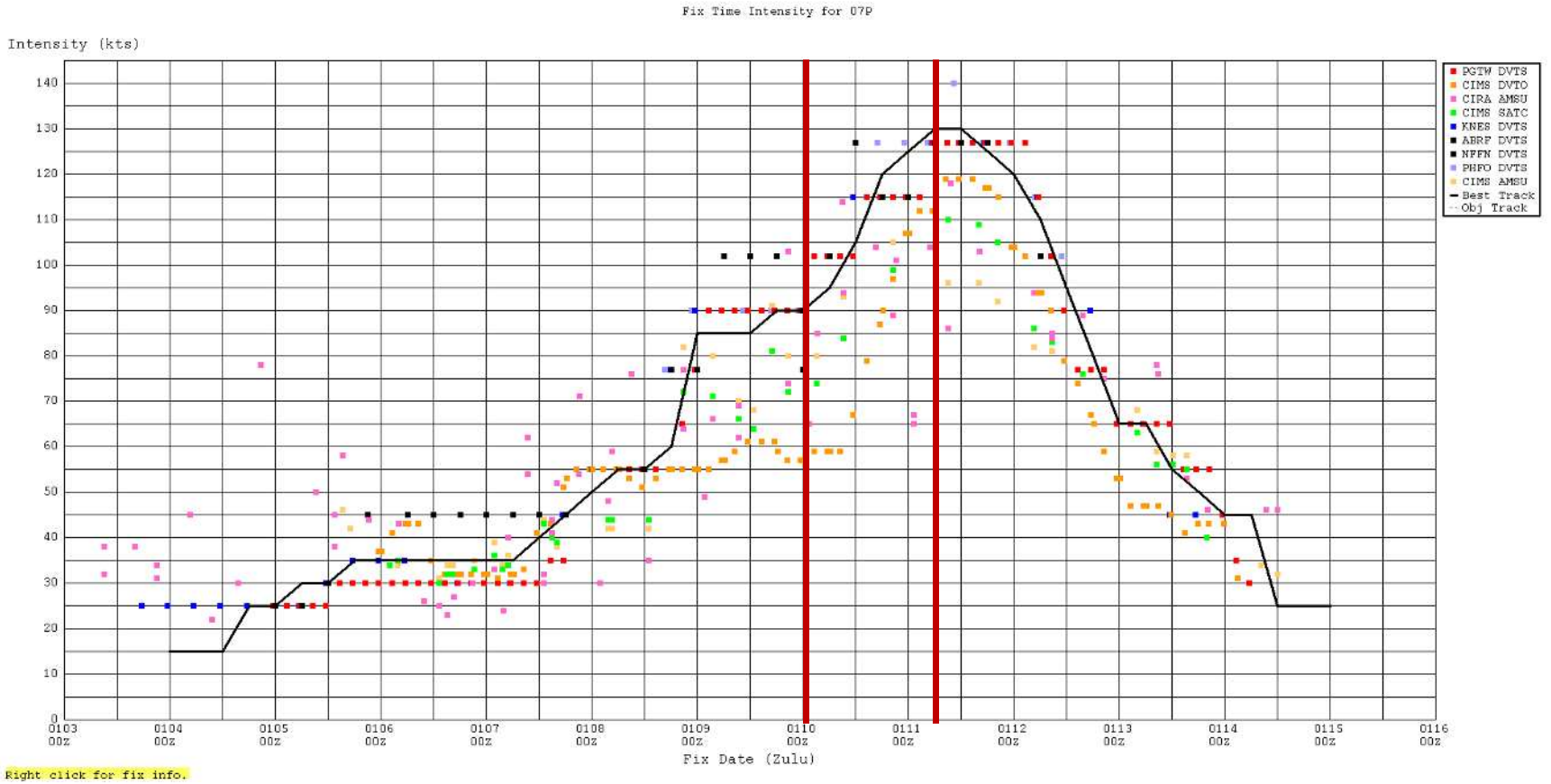
2nd RI Occurred Near and in Tonga (Vava'u and Ha'apai Island Groups)



#1 08/12Z (55kts) – 09/00Z (85kts)



#2 10/06Z (95kts) – 11/06Z (130kts)

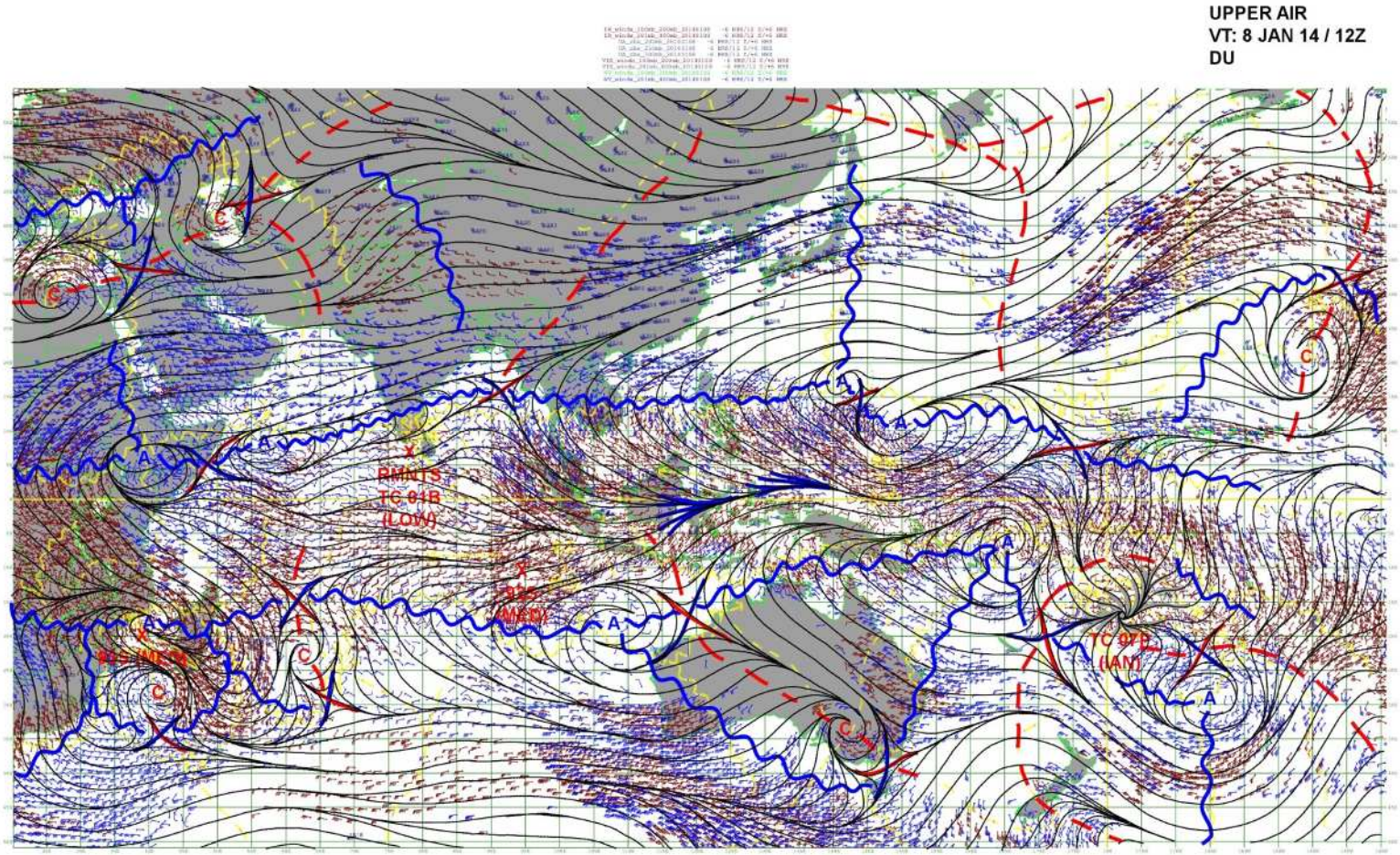


FMQ -17 WV loop SH072014

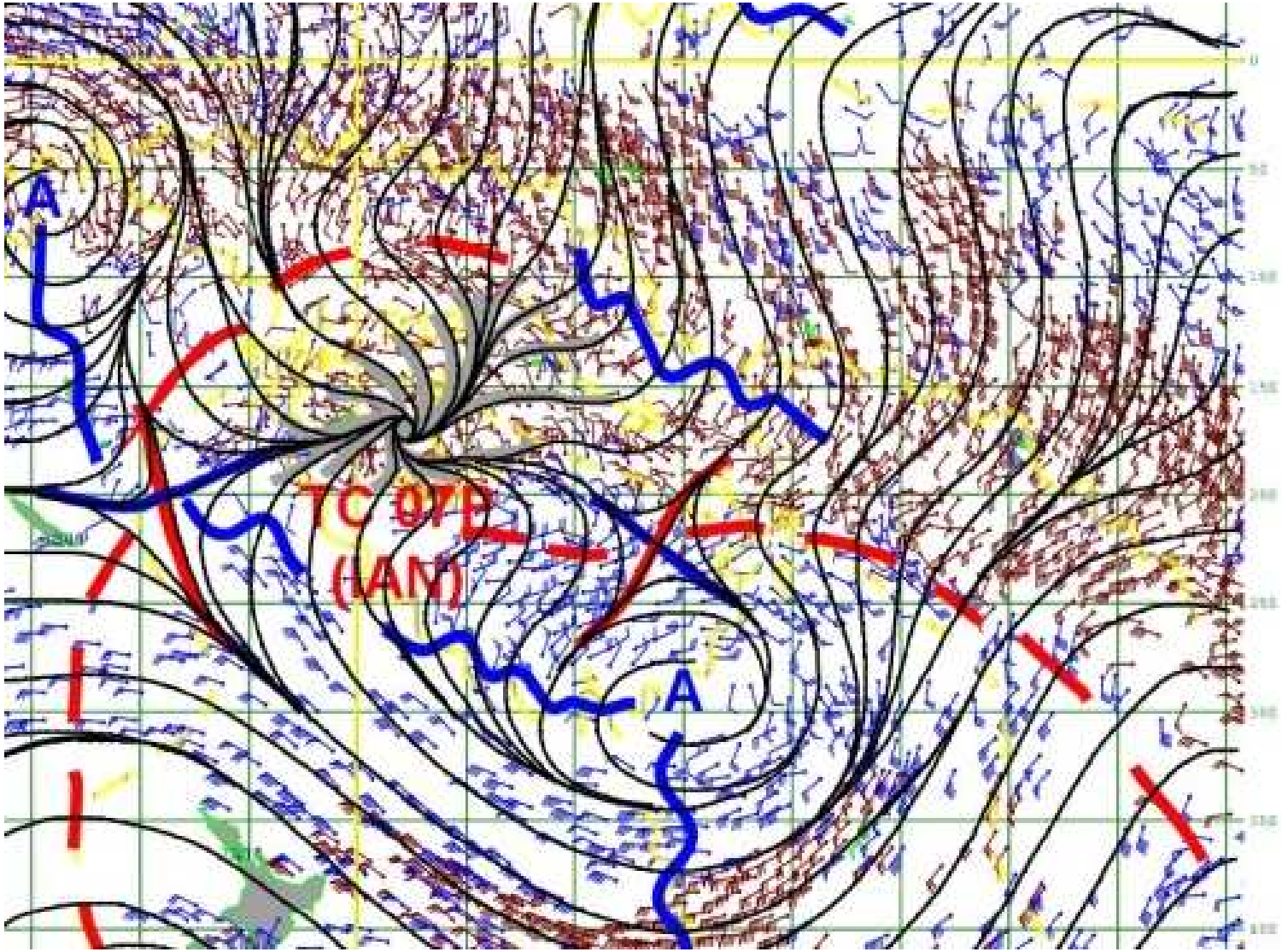
- https://ohana.nmci.navy.mil/products/sat/animator_archive.php

1st RI Presentation

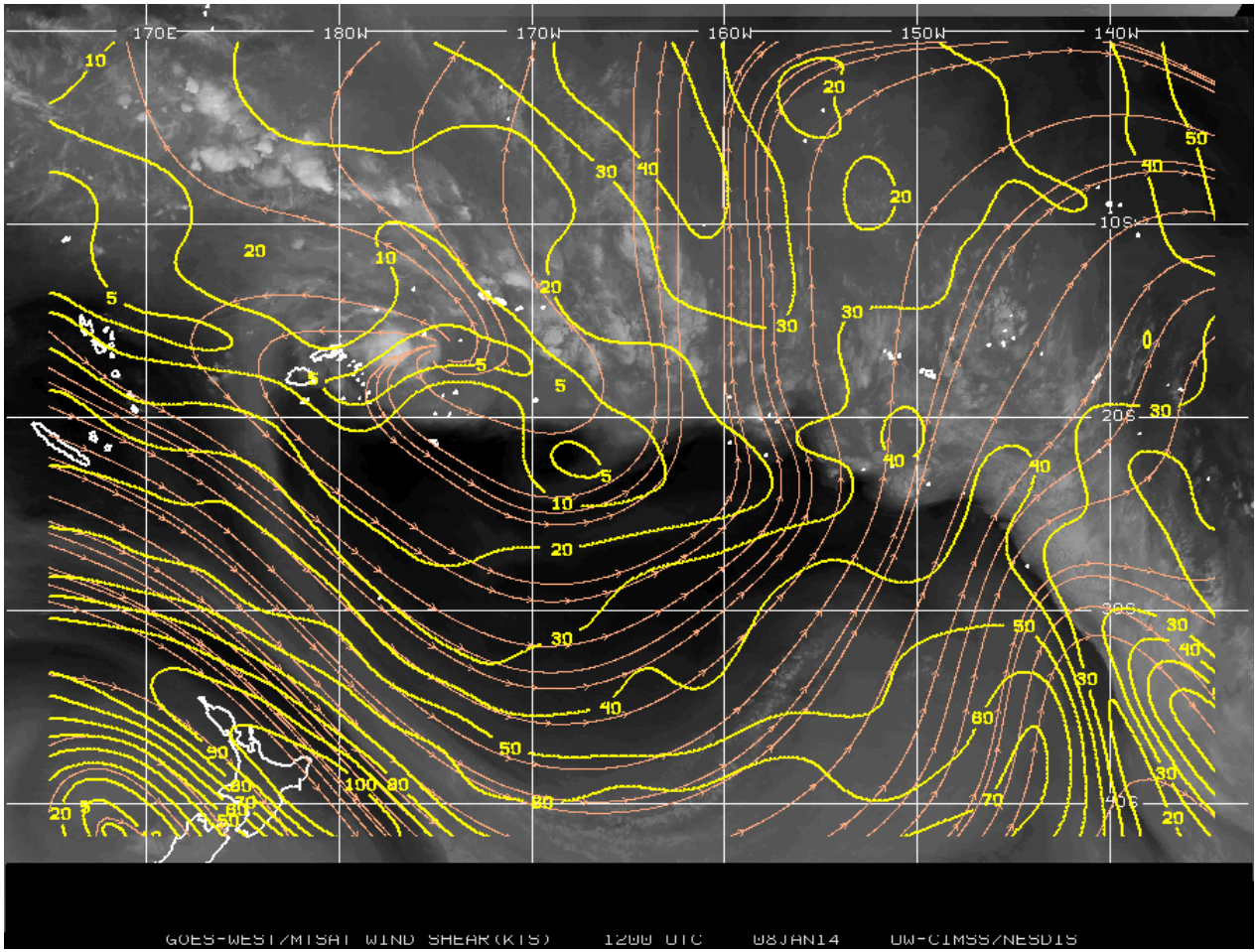
08/12Z JTWC 200mb Streamline Anal



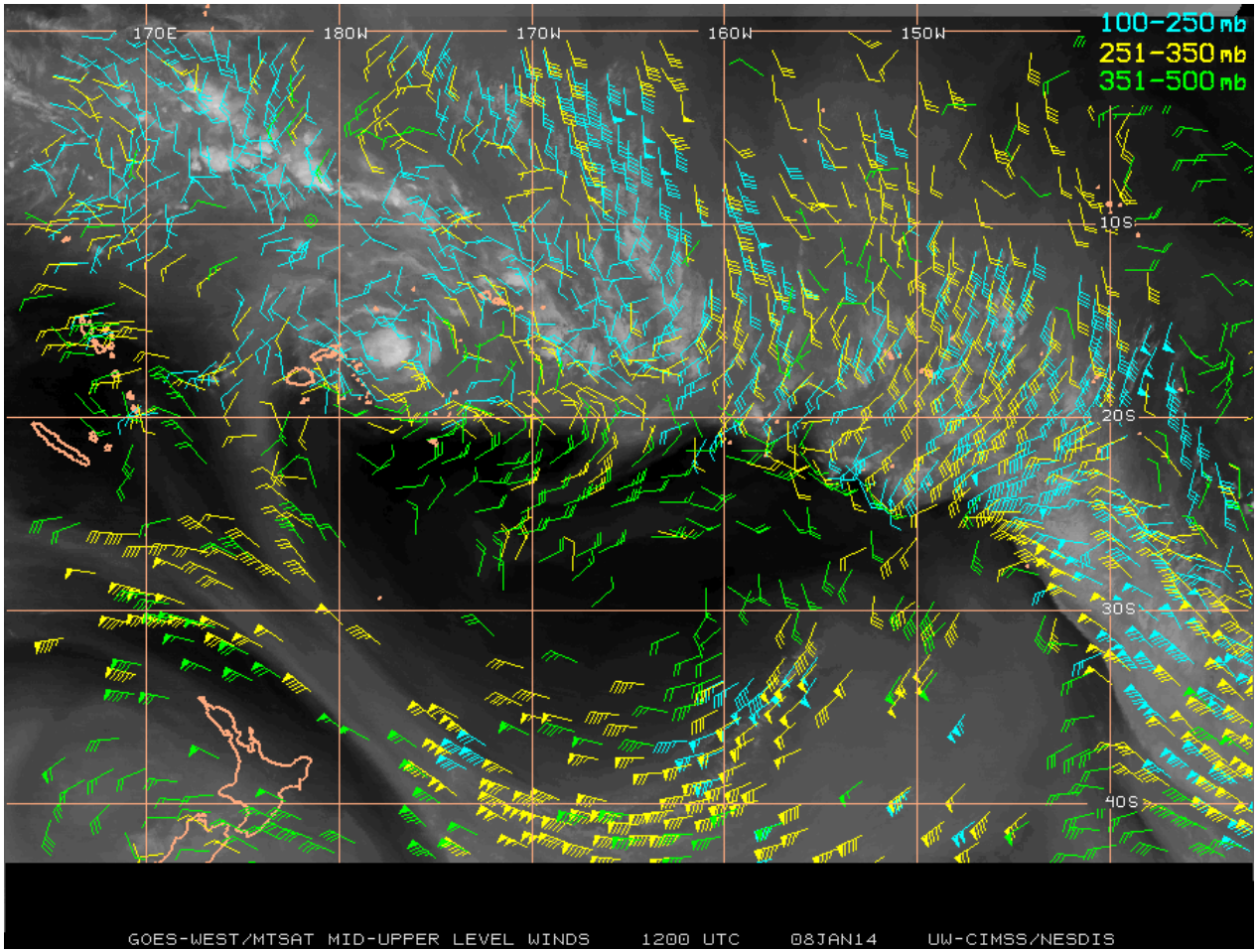
08/12Z JTWC 200mb Streamline Anal



20140108.12.SEPacificDeepShearLarge.png



20140108.12.SEPacificMidUpperWindsLarge.png

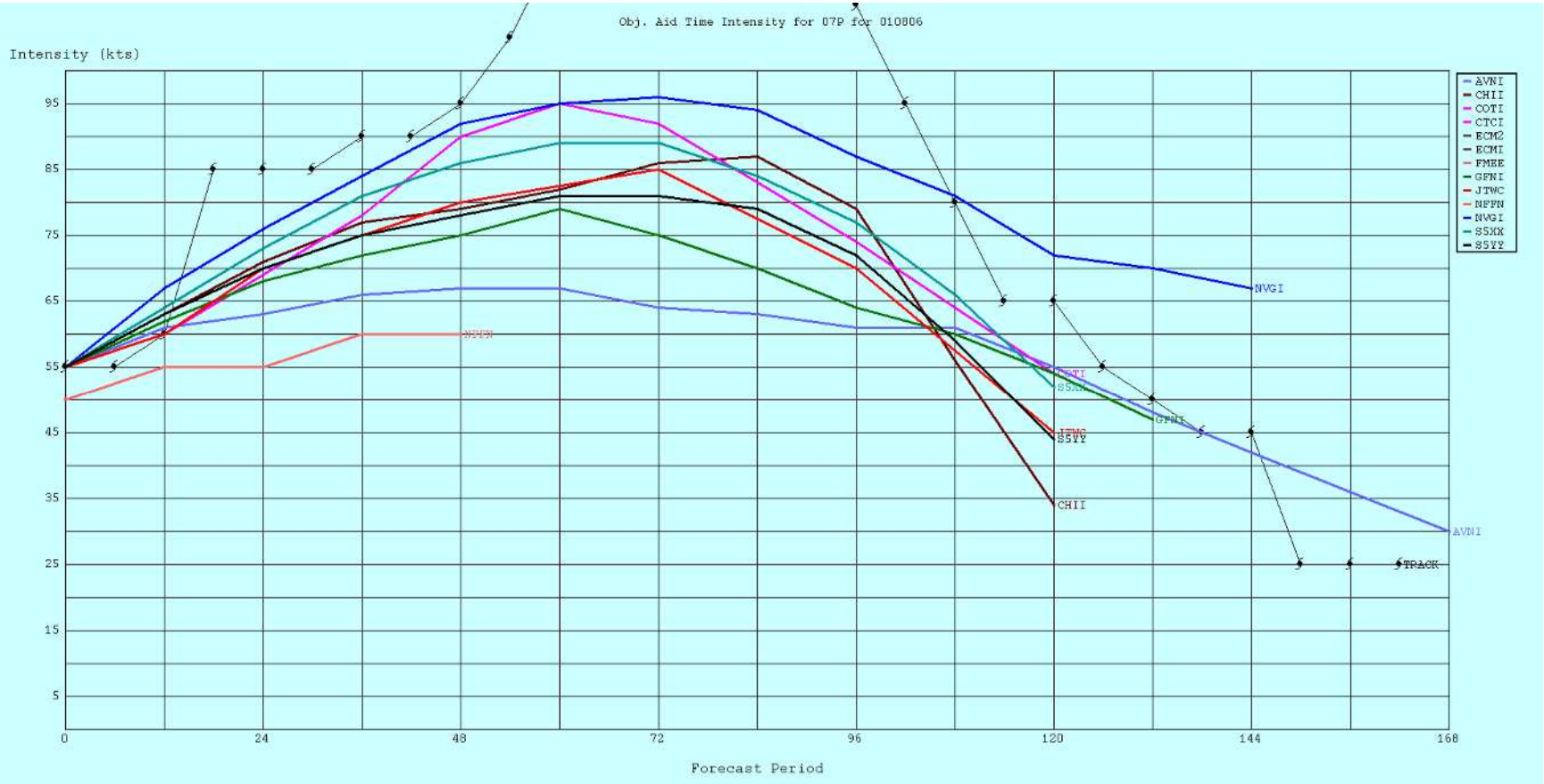


08/18Z Warning REMARKS

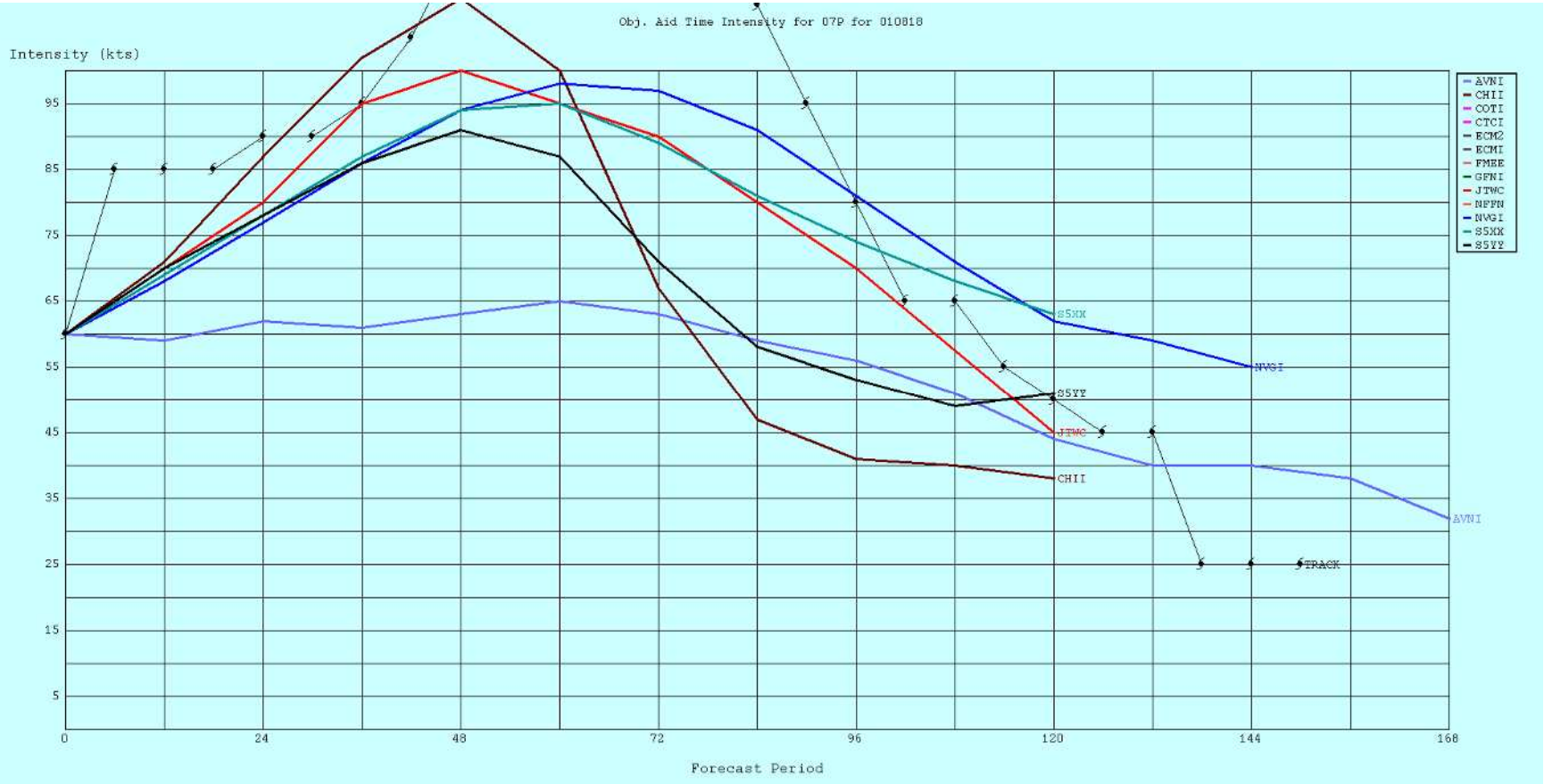
```
TROPICAL CYCLONE 07P (IAN) WARNING #7
WTPS31 PGTW 082100
081800Z POSIT: NEAR 16.7S 176.8W
MOVING 090 DEGREES TRUE AT 01 KNOTS
MAXIMUM SIGNIFICANT WAVE HEIGHT: 15 FEET
08/18Z, WINDS 060 KTS, GUSTS TO 075 KTS
09/06Z, WINDS 070 KTS, GUSTS TO 085 KTS
09/18Z, WINDS 080 KTS, GUSTS TO 100 KTS
10/06Z, WINDS 095 KTS, GUSTS TO 115 KTS
10/18Z, WINDS 100 KTS, GUSTS TO 125 KTS
11/18Z, WINDS 090 KTS, GUSTS TO 110 KTS
12/18Z, WINDS 070 KTS, GUSTS TO 085 KTS
13/18Z, WINDS 045 KTS, GUSTS TO 055 KTS
---------------------------------------------

CPA TO:                  NM      DTG
AVATA_SAMOA              283   09/14Z
SAFOTULAFAI              308   09/16Z
APIA                     312   09/17Z
PAGO_PAGO                334   09/23Z
MANUA_ISLANDS            383   10/02Z
---------------------------------------------

BEARING AND DISTANCE       DIR   DIST   TAU
                                 (NM)  (HRS)
APIA                       223    313    24
AVATA_SAMOA                213    286    24
MANUA_ISLANDS              240    391    24
PAGO_PAGO                  235    337    24
SAFOTULAFAI                220    309    24
SUVA                       085    350    24
```

- 082100Z POSITION NEAR 16.7S 176.7W. TROPICAL CYCLONE (TC) 07P (IAN), LOCATED APPROXIMATELY 287 NM EAST- NORTHEAST OF SUVA, FIJI, HAS TRACKED EASTWARD AT 01 KNOTS OVER THE PAST SIX HOURS. ANIMATED INFRARED SATELLITE IMAGERY DEPICTS A CONSOLIDATING LOW-LEVEL CIRCULATION CENTER (LLCC) WITH CURVED BANDING WRAPPING INTO A CENTRAL DENSE OVERCAST FEATURE. A 081717Z SSMIS 91 GHZ MICROWAVE IMAGE REVEALS DEEP CONVECTIVE BANDING TIGHTLY WRAPPED INTO AN APPARENT MICROWAVE EYE, THEREFORE, THERE IS HIGH CONFIDENCE IN THE CURRENT POSITION. THE INITIAL INTENSITY OF 60 KNOTS IS BASED ON DVORAK ESTIMATES RANGING FROM 55 TO 77 KNOTS FROM PGTW AND KNES. TC 07P IS CURRENTLY LOCATED IN A WEAK STEERING ENVIRONMENT, BETWEEN A NEAR-EQUATORIAL RIDGE (NER) TO THE NORTH AND A SUB-TROPICAL RIDGE (STR) TO THE SOUTH, RESULTING IN THE QUASI- STATIONARY MOVEMENT. AFTER TAU 24, A MID-LATITUDE TROUGH WILL MOVE OVER THE AREA, DOMINATING THE STEERING PATTERN AND ALLOWING THE SYSTEM TO ACCELERATE SOUTHEASTWARD THROUGH THE END OF THE FORECAST PERIOD. UPPER-LEVEL ANALYSIS INDICATES FAVORABLE VERTICAL WIND SHEAR (VWS) AND INCREASING POLEWARD OUTFLOW EVIDENT IN THE WATER VAPOR IMAGERY. IN ADDITION TO THE FAVORABLE UPPER-LEVEL CONDITIONS, THE WARM SEA SURFACE TEMPERATURE (SST) WILL FURTHER SUPPORT A PEAK INTENSITY OF 100 KNOTS IN 48 HOURS. BY TAU 72, TC 07P IS EXPECTED TO WEAKEN AS THE SYSTEM REMAINS ON A SOUTHEASTWARD TRACK, ENCOUNTERING STRONGER VWS AND COOLER SST. TC 07P IS FORECAST TO BEGIN EXTRA- TROPICAL TRANSITION (ETT) BY TAU 96 AND COMPLETE ETT BY TAU 120. DUE TO THE CURRENTLY WEAK STEERING ENVIRONMENT, THERE IS LOW CONFIDENCE IN FORECAST TRACK IN THE NEAR TERM. DYNAMIC MODEL GUIDANCE INDICATES BETTER AGREEMENT IN THE LATER TAUS, LENDING A HIGH CONFIDENCE IN THE OFFICIAL FORECAST TRACK. MAXIMUM SIGNIFICANT WAVE HEIGHT AT 081800Z IS 15 FEET. NEXT WARNINGS AT 090900Z AND 092100Z.//

08/06Z Intensity Plot



08/18Z Intensity Plot



RAMMB
Regional and Mesoscale Meteorology Branch

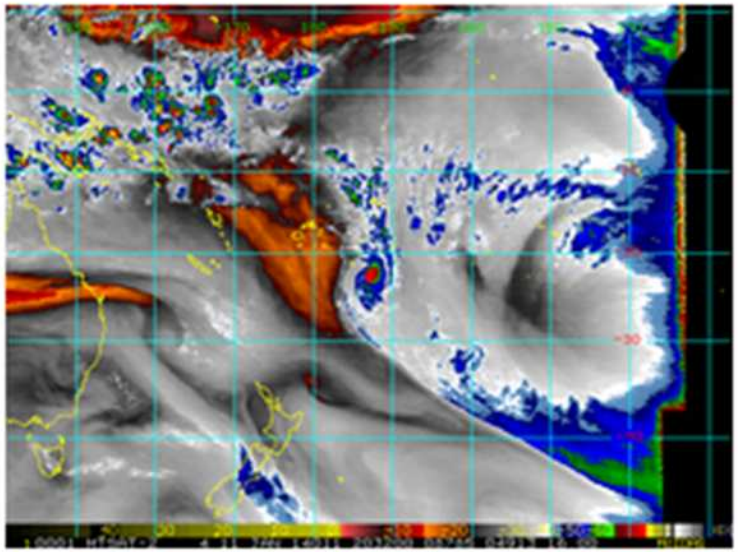
NOAA Satellites and Information
National Environmental Satellite, Data, and Information Service

Cooperative Research Program | Office of Research and Applications/Center for Satellite Applications and Research

CIRA
Cooperative Institute for Research in the Atmosphere

SH072014 - Tropical Cyclone (>=96 kt) IAN

Storm Relative 16 km Geostationary Water Vapor Imagery



Loop | Latest Image | Archive | About

Time of This Image: 201401112032

RAMMB 07P Loop 08/00Z – 0906Z

- http://rammb.cira.colostate.edu/products/tc_realtime/loop.asp?product=16kmgwvp&storm_identifier=SH072014&starting_image=2014SH07_16KMGWVP_201401072332.GIF&ending_image=2014SH07_16KMGWVP_201401090532.GIF

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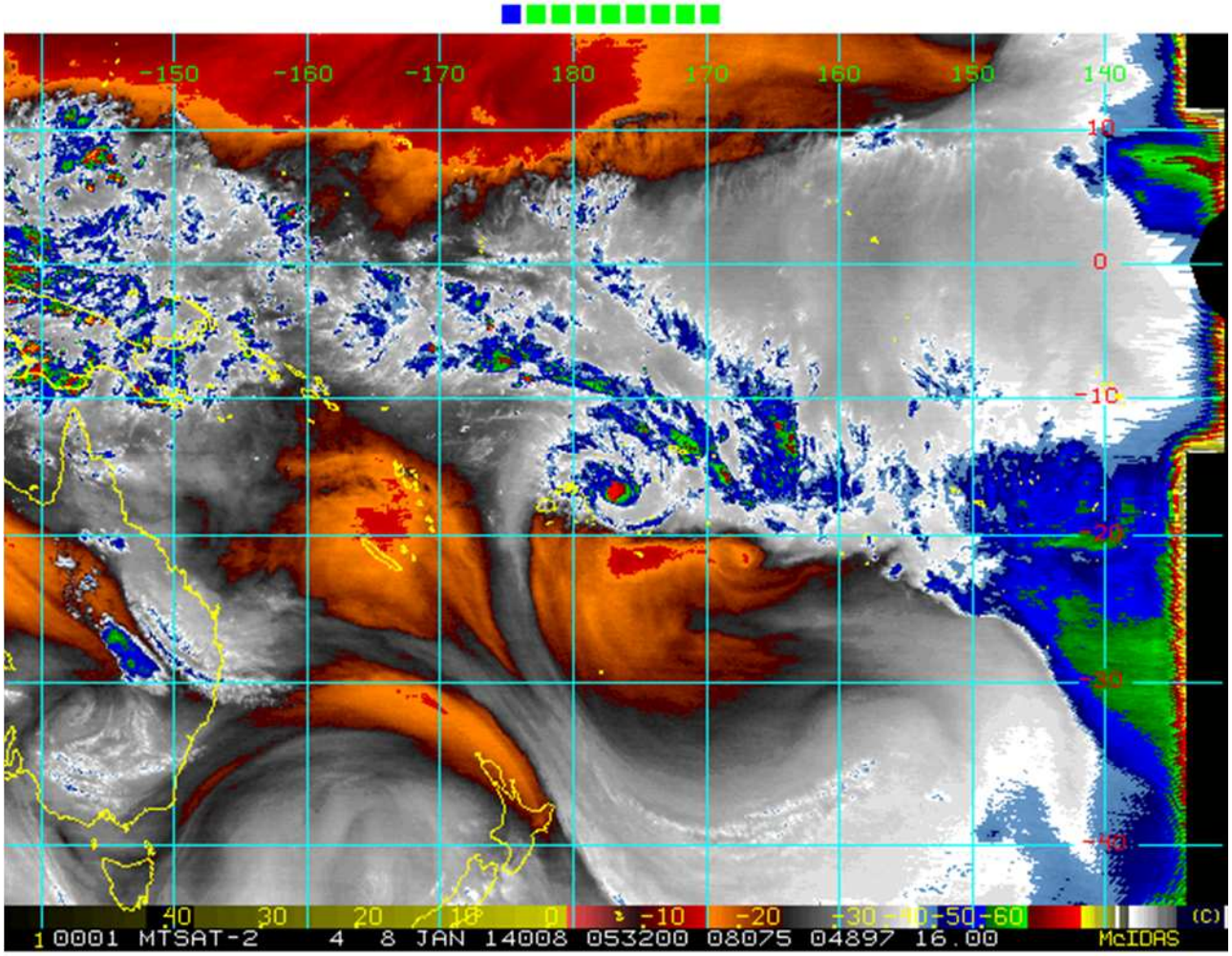

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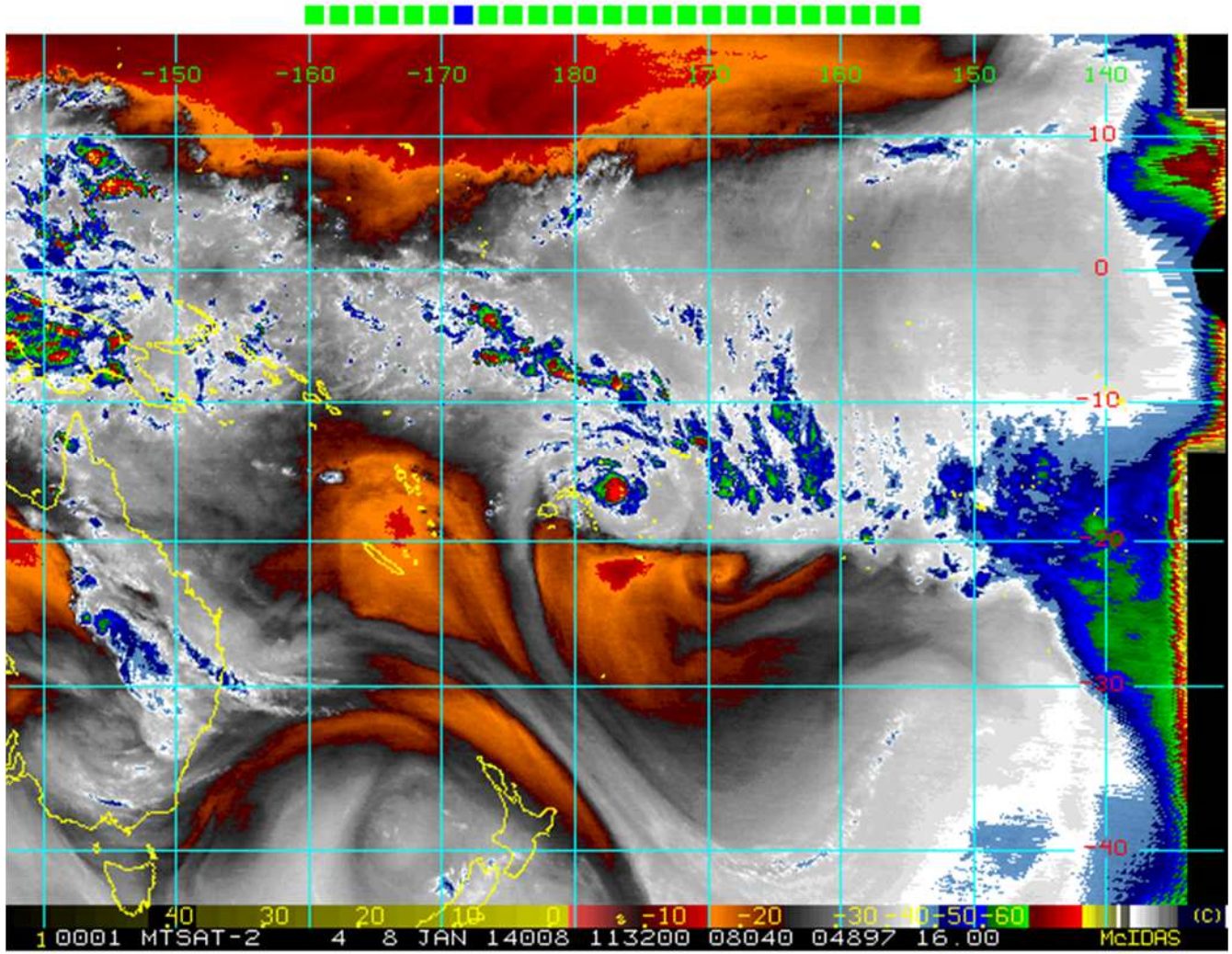

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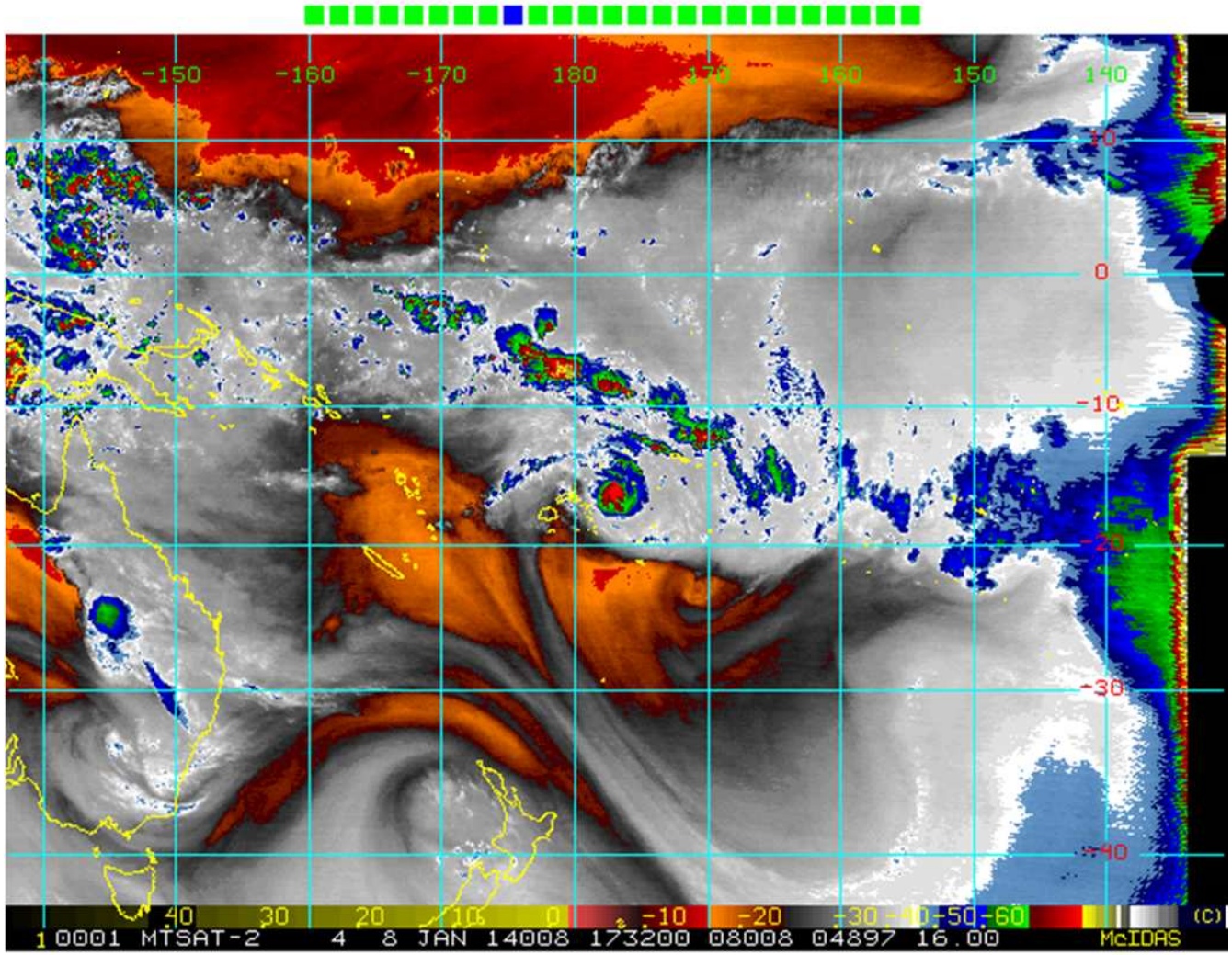
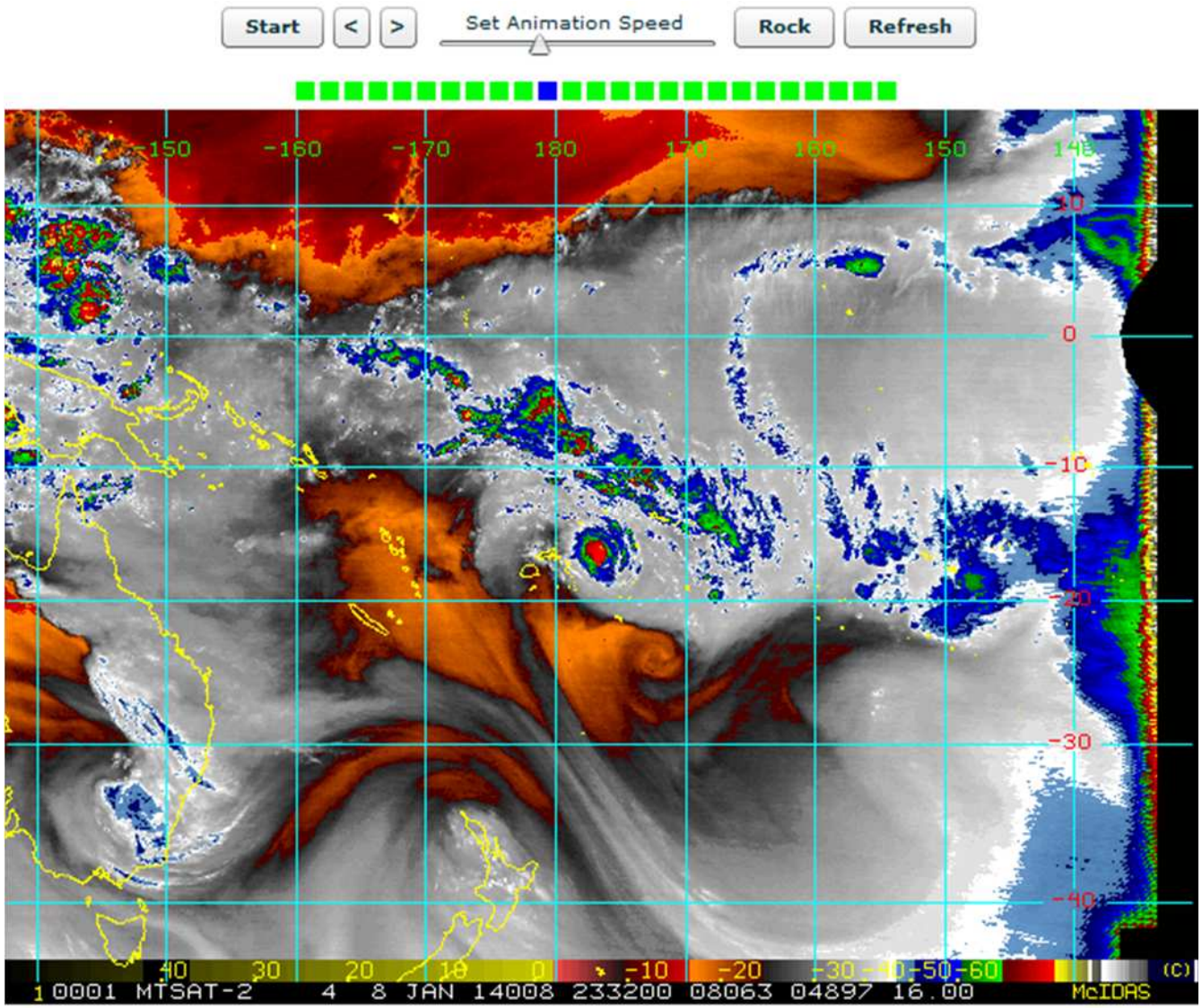
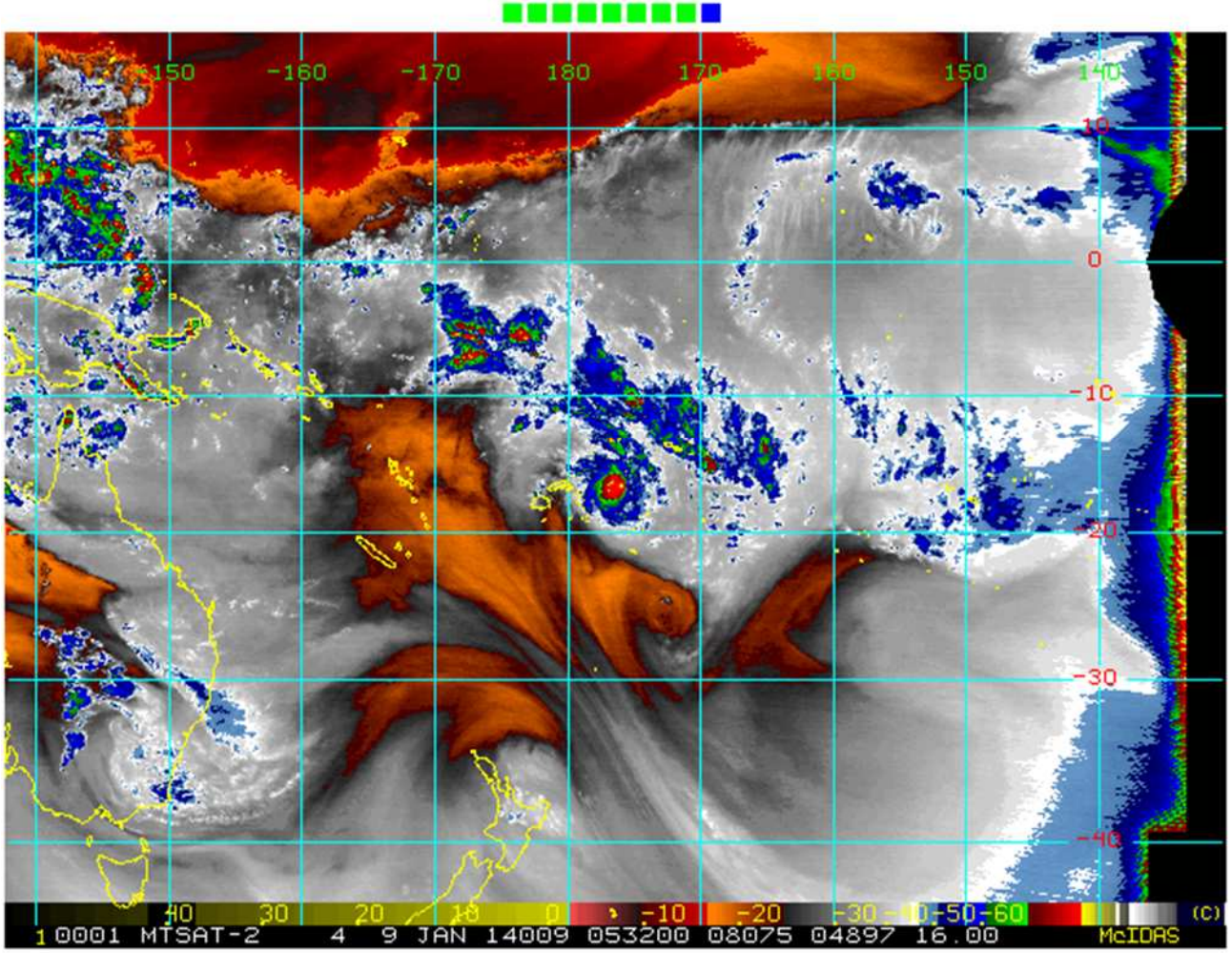


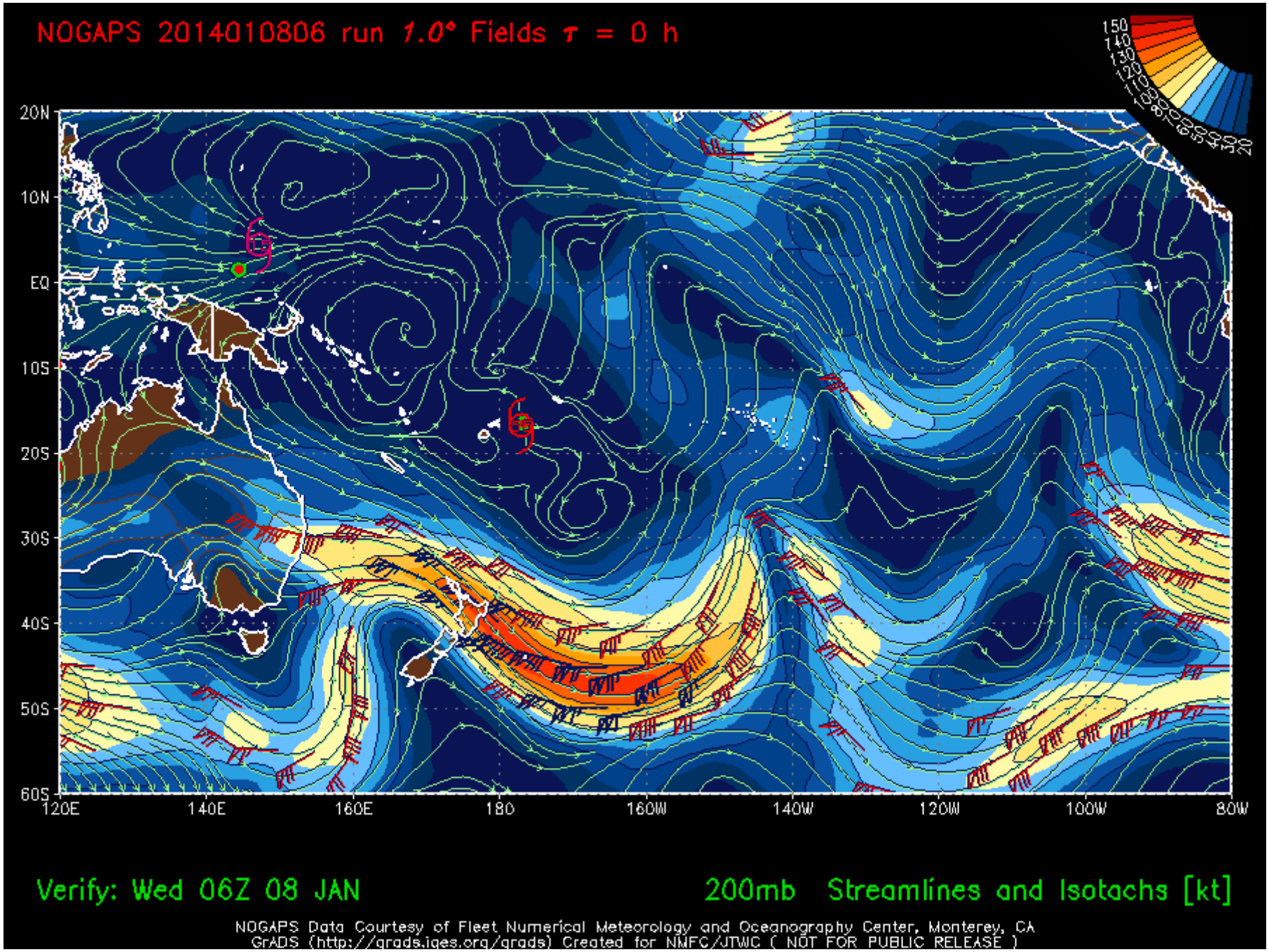

Start
<
>
Set Animation Speed
Rock
Refresh
-150
-160
-170
180
170
160
150
140
10
0
-10
-20
-30
-40
40
30
20
10
0
-10
-20
-30
-40
-50
-60
(C)
1 0001 MTSAT-2 4 8 JAN 14008 233200 08063 04897 16.00
McIDAS

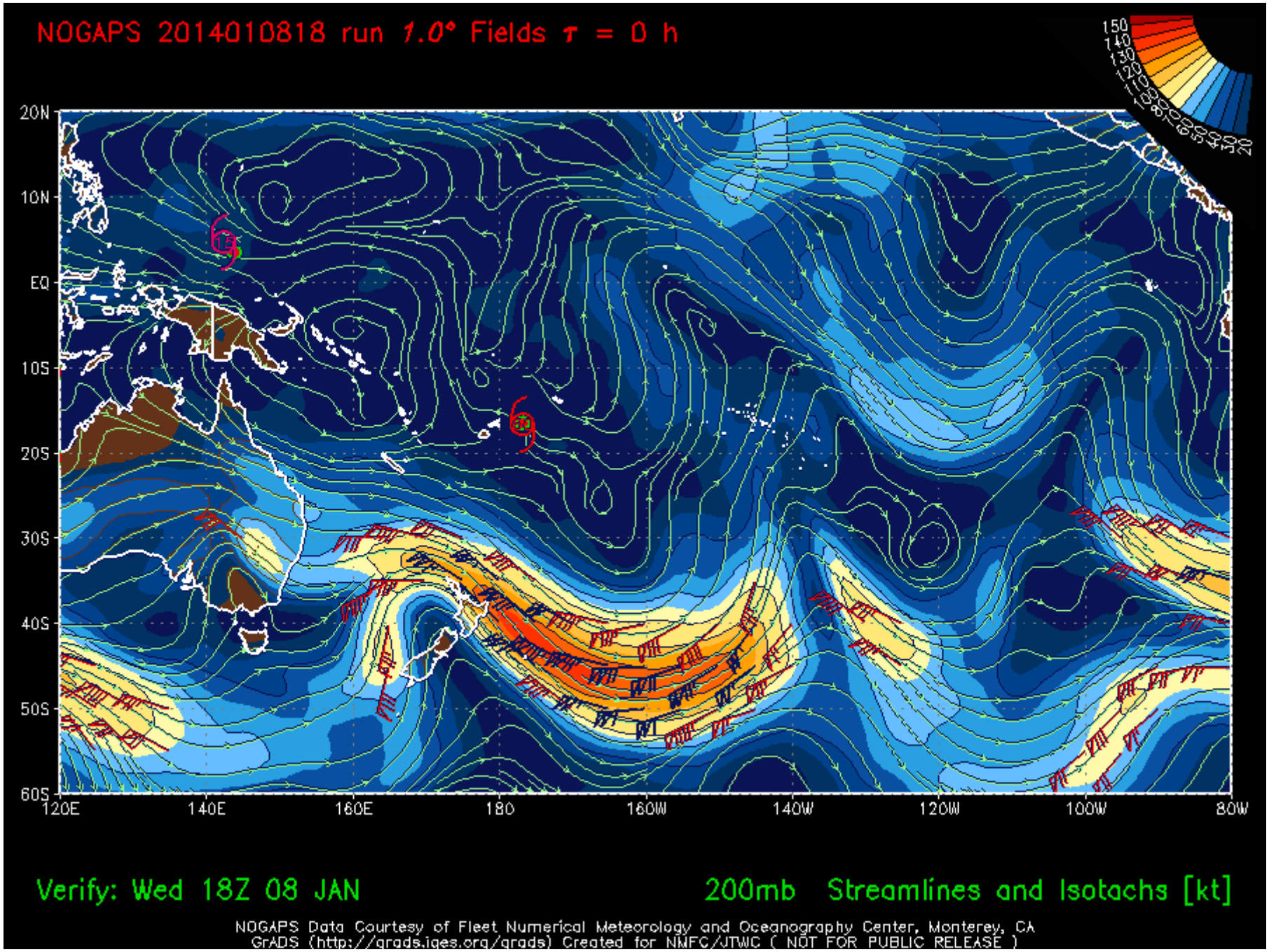
Start < > Set Animation Speed Rock Refresh



WXMAP Data Follows

- 08 Jan 0600Z and 1800Z NAVGEM
  - 081200Z not in WXMAP archives
- Analyses
- 081800Z Anal weaker troughing depicted
  - Working BT indicates RI period
  - CIRA WV indicates well-defined TUTT cell


NOGAPS 2014010806 run 1.0° Fields τ = 0 h
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
20N
10N
EQ
10S
20S
30S
40S
50S
60S
120E
140E
160E
180
160W
140W
120W
100W
80W
Verify: Wed 06Z 08 JAN
200mb Streamlines and Isotachs [kt]
NOGAPS Data Courtesy of Fleet Numerical Meteorology and Oceanography Center, Monterey, CA
GrADS (http://grads.iges.org/grads) Created for NMFC/JTWC (NOT FOR PUBLIC RELEASE)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140
130
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10N
EQ
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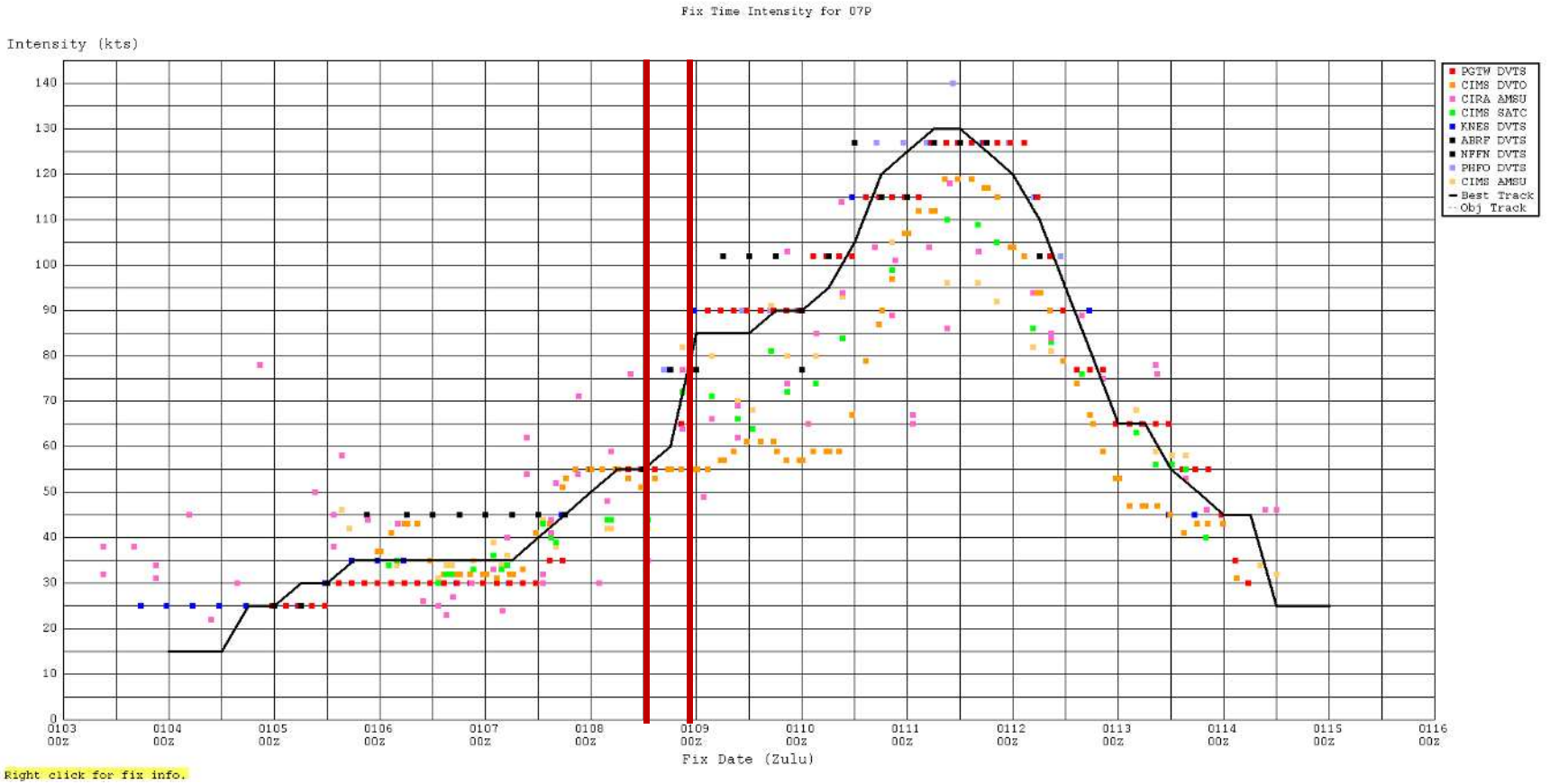
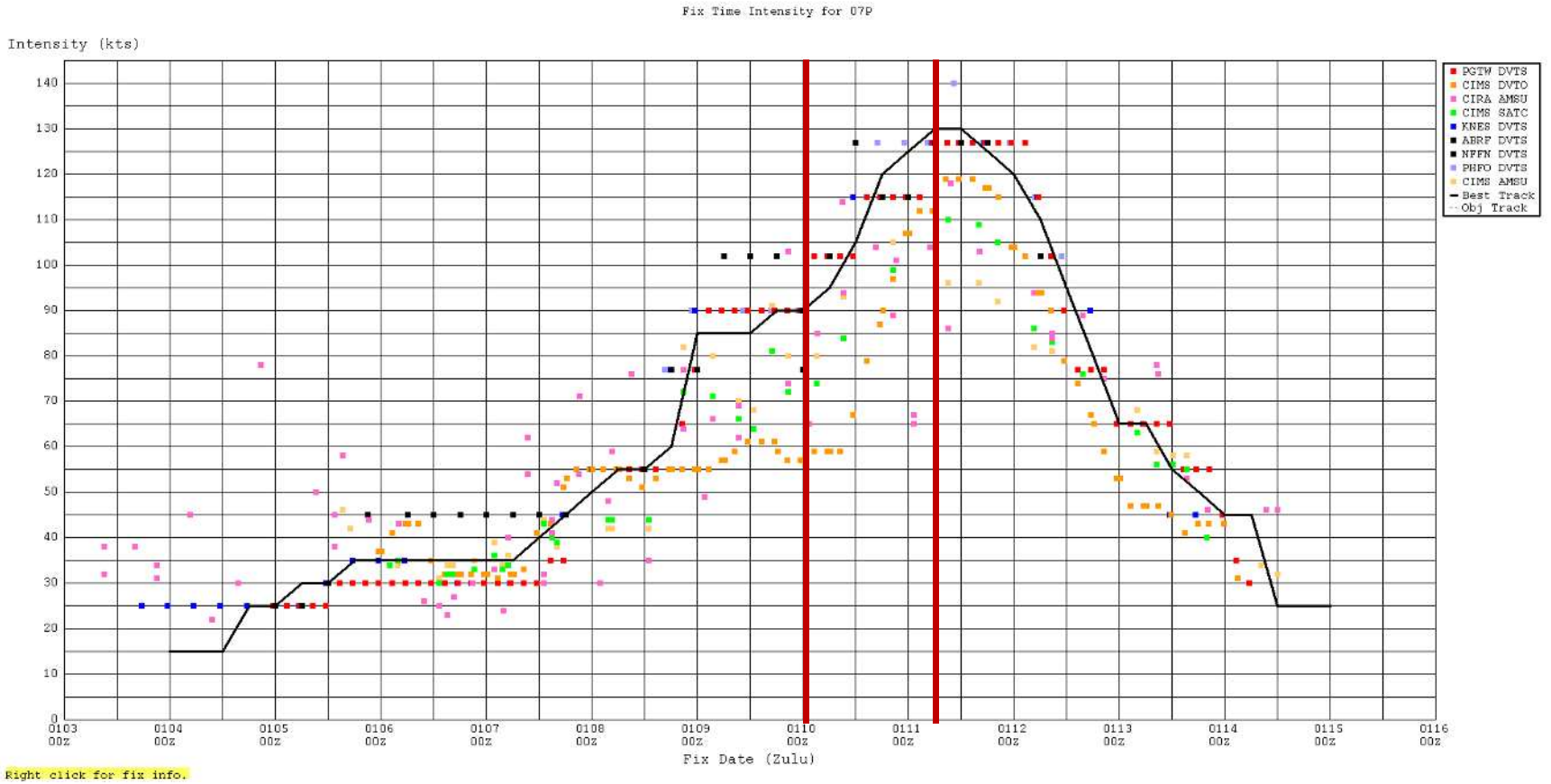
60S
120E
140E
160E
180
160W
140W
120W
100W
80W
Verify: Wed 18Z 08 JAN
200mb Streamlines and Isotachs [kt]
NOGAPS Data Courtesy of Fleet Numerical Meteorology and Oceanography Center, Monterey, CA
GrADS (http://grads.iges.org/grads) Created for NMFC/JTWC (NOT FOR PUBLIC RELEASE)

Two RI /steep slope regions
#1 08/12Z (55kts) – 09/00Z (85kts)



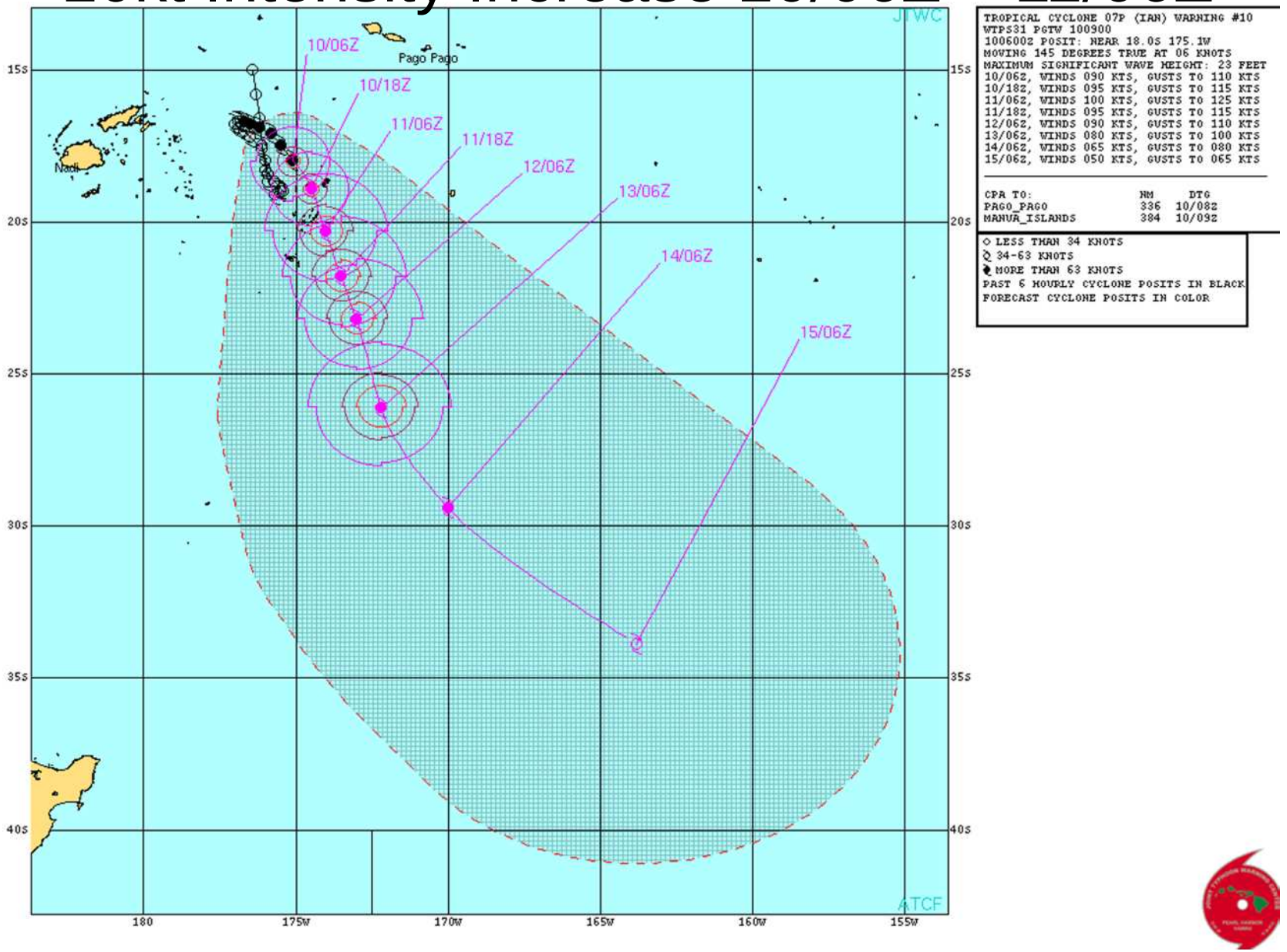
Two RI /steep slope regions
#2 10/00Z (90kts) – 11/06Z (130kts)



2nd RI

- No clear “smoking gun”
- CIRA WV data suggests:
  - Narrow TUTT to west and southwest
  - UL northwest flow associated w/mid-latitude trough moving from Australia eastward
  - TUTT cell to SE????

10/06Z JTWC Warning
10kt Intensity Increase 10/06Z – 11/06Z

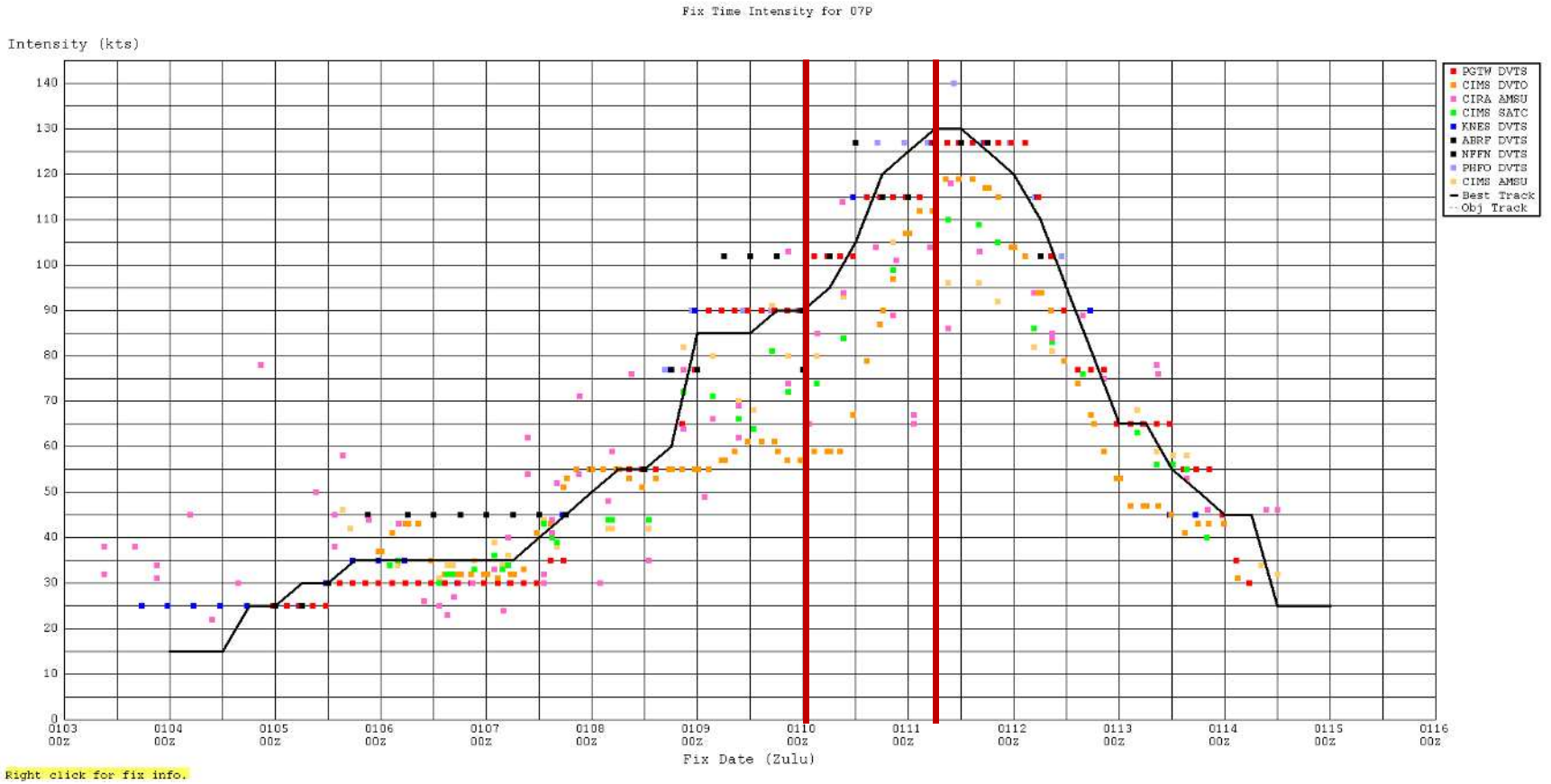


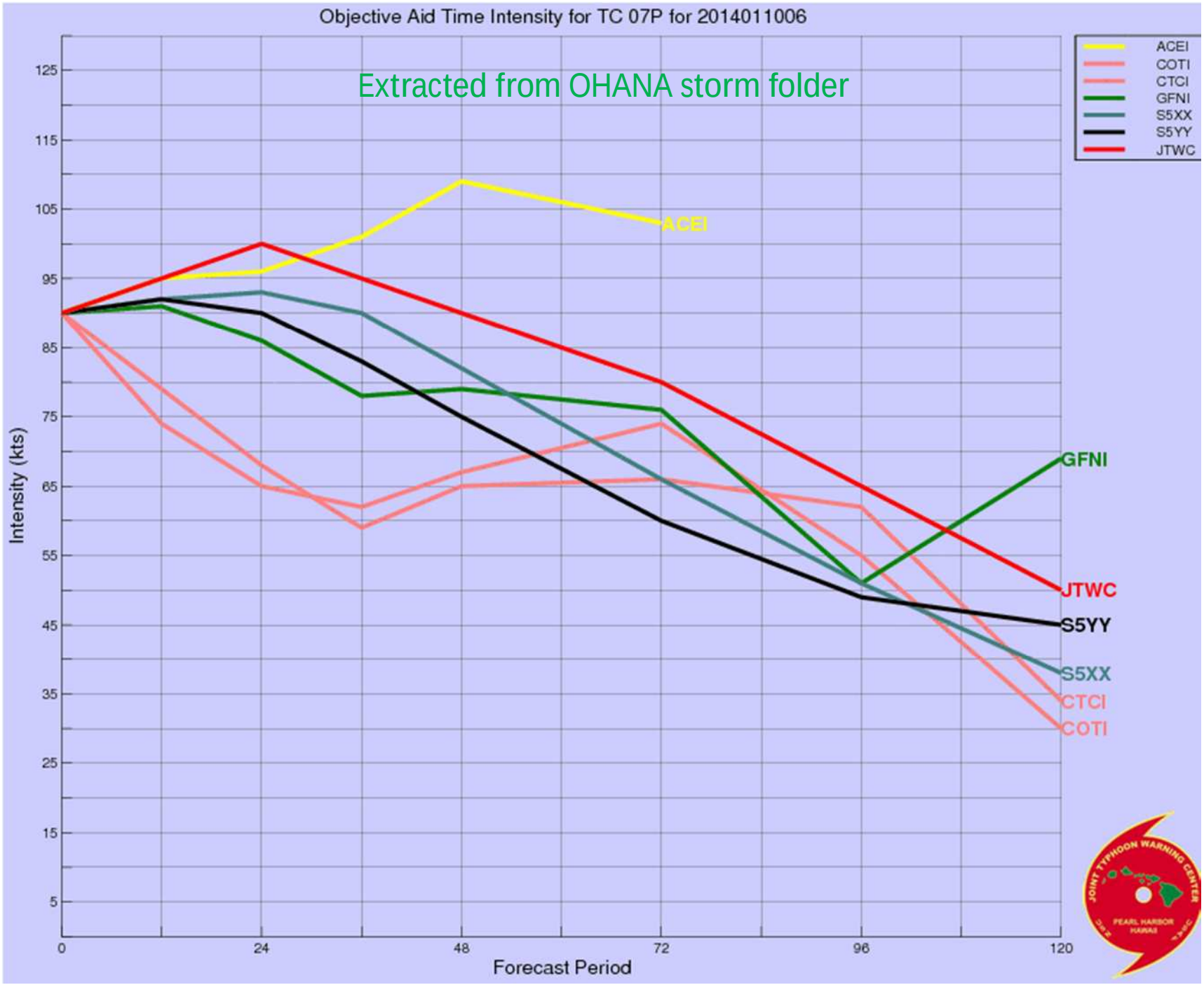
TROPICAL CYCLONE 07P (IAN) WARNING #10
WTPS31 PGTW 100900
1006002 POSIT: NEAR 18.0S 175.1W
MOVING 145 DEGREES TRUE AT 06 KNOTS
MAXIMUM SIGNIFICANT WAVE HEIGHT: 23 FEET
10/06Z, WINDS 090 KTS, GUSTS TO 110 KTS
10/18Z, WINDS 095 KTS, GUSTS TO 115 KTS
11/06Z, WINDS 100 KTS, GUSTS TO 125 KTS
11/18Z, WINDS 095 KTS, GUSTS TO 115 KTS
12/06Z, WINDS 090 KTS, GUSTS TO 110 KTS
13/06Z, WINDS 080 KTS, GUSTS TO 100 KTS
14/06Z, WINDS 065 KTS, GUSTS TO 080 KTS
15/06Z, WINDS 050 KTS, GUSTS TO 065 KTS

CPA TO:	NM	DTG
PAGO_PAGO	336	10/08Z
MANUA_ISLANDS	384	10/09Z

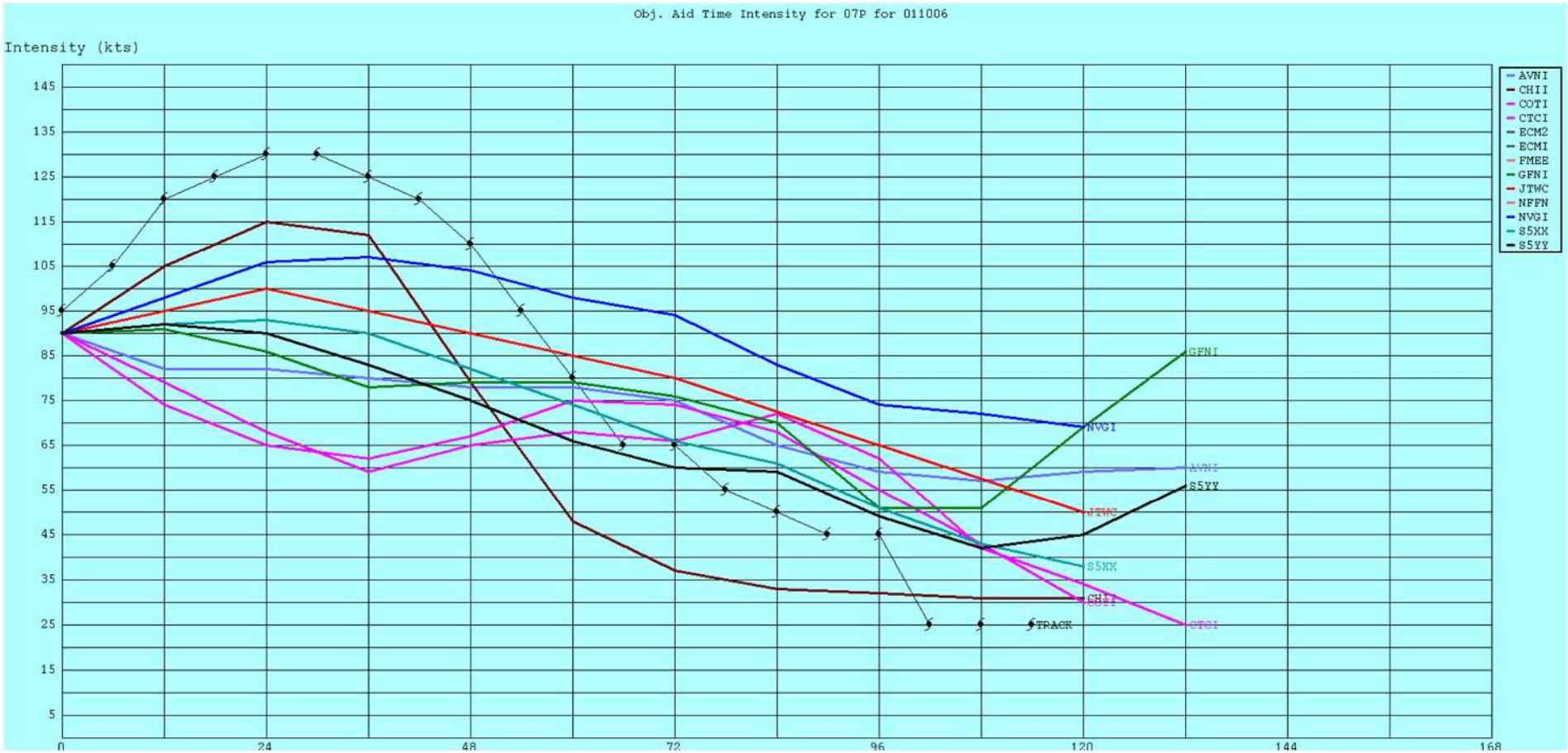
◇ LESS THAN 34 KNOTS
◔ 34-63 KNOTS
◆ MORE THAN 63 KNOTS
PAST 6 HOURLY CYCLONE POSITS IN BLACK
FORECAST CYCLONE POSITS IN COLOR

Two RI /steep slope regions
#2 10/00Z (90kts) – 11/06Z (130kts)




Objective Aid Time Intensity for TC 07P for 2014011006
Extracted from OHANA storm folder
ACEI
COTI
CTCI
GFNI
S5XX
S5YY
JTWC
Intensity (kts)
Forecast Period
125
115
105
95
85
75
65
55
45
35
25
15
5
0
24
48
72
96
120
JOINT TYPHOON WARNING CENTER
PEARL HARBOR
HAWAII

Extracted fm ATCF (default setting)



10/06Z & 10/18Z Remarks: Nearly Similar w/30kt Intensity Change

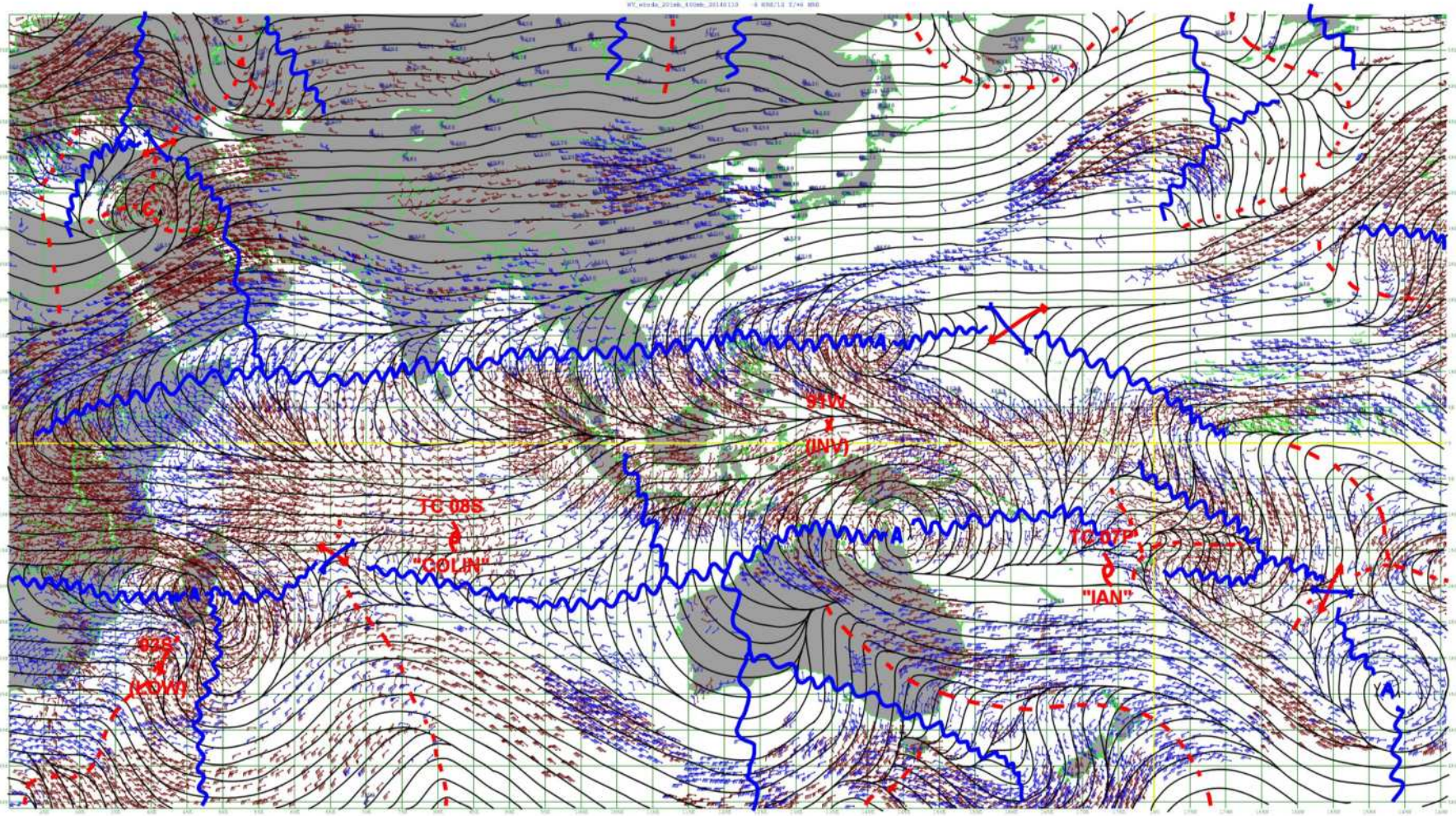
- TAU 0 = 90kts
- 100900Z POSITION NEAR 18.2S 174.9W. TROPICAL CYCLONE 07P (IAN), LOCATED APPROXIMATELY 371 NM EAST OF SUVA, FIJI, HAS TRACKED SOUTHEASTWARD AT 06 KNOTS OVER THE PAST SIX HOURS. ANIMATED MULTISPECTRAL SATELLITE IMAGERY (MSI) SHOWS TC 07P HAS STARTED TO STEADILY TRACK ALONG THE WESTERN PERIPHERY OF THE NEAR EQUATORIAL RIDGE (NER) AS IT EXTENDS FROM THE NORTHEASTERN QUADRANT OF THE SYSTEM TO THE SUB-TROPICAL RIDGE LOCATED TO THE SOUTHEAST OF TC 07P. MSI ALSO SHOWS THE EYE HAS EXPANDED SLIGHTLY AND CLEARED OVER THE PAST FEW HOURS. UPPER LEVEL ANALYSIS INDICATES THE TRANSITORY MID-LATITUDE TROUGH TO THE SOUTH OF TC 07P HAS ENHANCED THE THE POLEWARD OUTFLOW AND HAS ALLOWED THE SYSTEM TO MAINTAIN AS AN INTENSE TROPICAL CYCLONE WITH FAVORABLE VERTICAL WIND SHEAR (VWS). IN ADDITION TO THE FAVORABLE UPPER-LEVEL CONDITIONS, WARM SEA SURFACE TEMPERATURES (SSTS) WILL FURTHER SUPPORT A PEAK INTENSITY OF 100 KNOTS WITHIN THE NEXT 24 HOURS. BY TAU 72, TC 07P IS EXPECTED TO WEAKEN AS THE SYSTEM REMAINS ON A SOUTHEASTWARD TRACK, ENCOUNTERING STRONGER VWS AND COOLER SSTS. TC 07P IS FORECAST TO BEGIN EXTRA-TROPICAL TRANSITION (ETT) BY TAU 72 AND COMPLETE ETT BY TAU 120. IMPROVEMENTS IN THE STEERING ENVIRONMENT AND MODEL GUIDANCE LEADS TO HIGH CONFIDENCE IN THE FORECAST TRACK. MAXIMUM SIGNIFICANT WAVE HEIGHT AT 100600Z IS 23 FEET. NEXT WARNINGS AT 102100Z AND 110900Z.//

- TAU 0 = 120kts
- 102100Z POSITION NEAR 19.3S 174.6W. TROPICAL CYCLONE 07P (IAN), LOCATED APPROXIMATELY 363 NM SOUTHWEST OF PAGO PAGO, HAS TRACKED SOUTHWARD AT 05 KNOTS OVER THE PAST SIX HOURS. ANIMATED INFRARED (IR) SATELLITE IMAGERY SHOWS TC 07P TRACKING ALONG THE WESTERN PERIPHERY OF THE NEAR EQUATORIAL RIDGE (NER) EXTENDING FROM THE NORTHEASTERN QUADRANT OF THE SYSTEM TO THE SUB-TROPICAL RIDGE LOCATED TO THE SOUTHEAST OF TC 07P. THE IR ANIMATION DEPICTS AN INTENSE, TIGHTLY WRAPPED SYSTEM WITH AN 18 NM EYE FEATURE. A 101652Z SSMIS MICROWAVE IMAGE REVEALS A SHARPLY DEFINED EYEWALL WITH SEVERAL DEEP CONVECTIVE BANDS SPIRALING OUT FROM THE SYSTEM CENTER. THE INITIAL POSITION IS BASED ON THE EYE FEATURE IN THE IR ANIMATION WITH HIGH CONFIDENCE. THE INITIAL INTENSITY HAS BEEN ASSESSED AT 120 KNOTS BASED ON AN AVERAGE OF DVORAK INTENSITY ESTIMATES RANGING FROM 115-127 KNOTS. UPPER LEVEL ANALYSIS INDICATES THE TRANSITORY MID-LATITUDE TROUGH TO THE SOUTH OF TC 07P HAS CONTINUED TO ENHANCE THE POLEWARD OUTFLOW AND ALLOWED THE SYSTEM TO CONTINUE TO INTENSIFY. IN ADDITION TO THE FAVORABLE UPPER-LEVEL CONDITIONS, WARM SEA SURFACE TEMPERATURES (SSTS) WILL FURTHER SUPPORT A PEAK INTENSITY OF 125 KNOTS WITHIN THE NEXT 12 HOURS. A GRADUAL WEAKENING TREND IS EXPECTED THEREAFTER. BY TAU 72, TC 07P WILL BEGIN ENCOUNTERING STRONGER VWS AND COOLER SSTS, BEGINNING EXTRA-TROPICAL TRANSITION. TC 07P IS FORECAST TO COMPLETE ETT BY TAU 96. IMPROVEMENTS IN THE STEERING ENVIRONMENT AND MODEL GUIDANCE LEADS TO HIGH CONFIDENCE IN THE FORECAST TRACK. MAXIMUM SIGNIFICANT WAVE HEIGHT AT 101800Z IS 25 FEET. NEXT WARNINGS AT 110900Z AND 112100Z.//

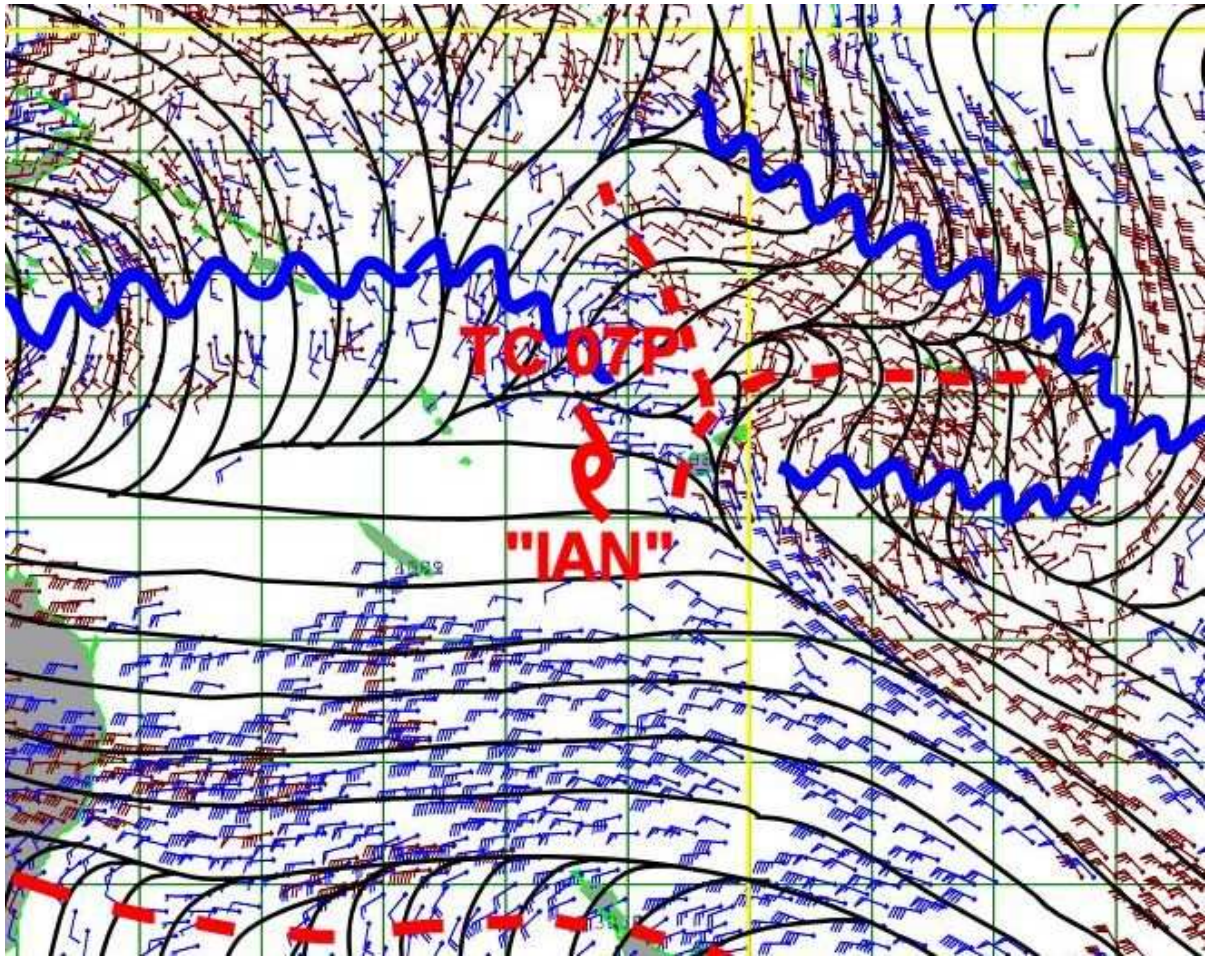
- WTPS31 PGTW 100900 MSGID/GENADMIN/JOINT TYPHOON WRNCEN PEARL HARBOR HI// SUBJ/TROPICAL CYCLONE 07P (IAN) WARNING NR 010// RMKS/ 1. TROPICAL CYCLONE 07P (IAN) WARNING NR 010 01 ACTIVE TROPICAL CYCLONE IN SOUTHPAC MAX SUSTAINED WINDS BASED ON ONE-MINUTE AVERAGE WIND RADII VALID OVER OPEN WATER ONLY --- WARNING POSITION: 100600Z --- NEAR 18.0S 175.1W MOVEMENT PAST SIX HOURS - 145 DEGREES AT 06 KTS POSITION ACCURATE TO WITHIN 020 NM POSITION BASED ON EYE FIXED BY SATELLITE PRESENT WIND DISTRIBUTION: MAX SUSTAINED WINDS - 090 KT, GUSTS 110 KT WIND RADII VALID OVER OPEN WATER ONLY RADIUS OF 064 KT WINDS - 015 NM NORTHEAST QUADRANT 015 NM SOUTHEAST QUADRANT 015 NM SOUTHWEST QUADRANT 015 NM NORTHWEST QUADRANT RADIUS OF 050 KT WINDS - 030 NM NORTHEAST QUADRANT 030 NM SOUTHEAST QUADRANT 030 NM SOUTHWEST QUADRANT 030 NM NORTHWEST QUADRANT RADIUS OF 034 KT WINDS - 070 NM NORTHEAST QUADRANT 070 NM SOUTHEAST QUADRANT 080 NM SOUTHWEST QUADRANT 070 NM NORTHWEST QUADRANT REPEAT POSIT: 18.0S 175.1W

- WTPS31 PGTW 102100 MSGID/GENADMIN/JOINT TYPHOON WRNCEN PEARL HARBOR HI// SUBJ/TROPICAL CYCLONE 07P (IAN) WARNING NR 011// RMKS/ 1. TROPICAL CYCLONE 07P (IAN) WARNING NR 011 01 ACTIVE TROPICAL CYCLONE IN SOUTHPAC MAX SUSTAINED WINDS BASED ON ONE-MINUTE AVERAGE WIND RADII VALID OVER OPEN WATER ONLY --- WARNING POSITION: 101800Z --- NEAR 18.9S 174.8W MOVEMENT PAST SIX HOURS - 170 DEGREES AT 05 KTS POSITION ACCURATE TO WITHIN 020 NM POSITION BASED ON EYE FIXED BY SATELLITE PRESENT WIND DISTRIBUTION: MAX SUSTAINED WINDS - 120 KT, GUSTS 145 KT WIND RADII VALID OVER OPEN WATER ONLY RADIUS OF 064 KT WINDS - 015 NM NORTHEAST QUADRANT 015 NM SOUTHEAST QUADRANT 015 NM SOUTHWEST QUADRANT 015 NM NORTHWEST QUADRANT RADIUS OF 050 KT WINDS - 030 NM NORTHEAST QUADRANT 030 NM SOUTHEAST QUADRANT 030 NM SOUTHWEST QUADRANT 030 NM NORTHWEST QUADRANT RADIUS OF 034 KT WINDS - 070 NM NORTHEAST QUADRANT 070 NM SOUTHEAST QUADRANT 080 NM SOUTHWEST QUADRANT 070 NM NORTHWEST QUADRANT REPEAT POSIT: 18.9S 174.8W

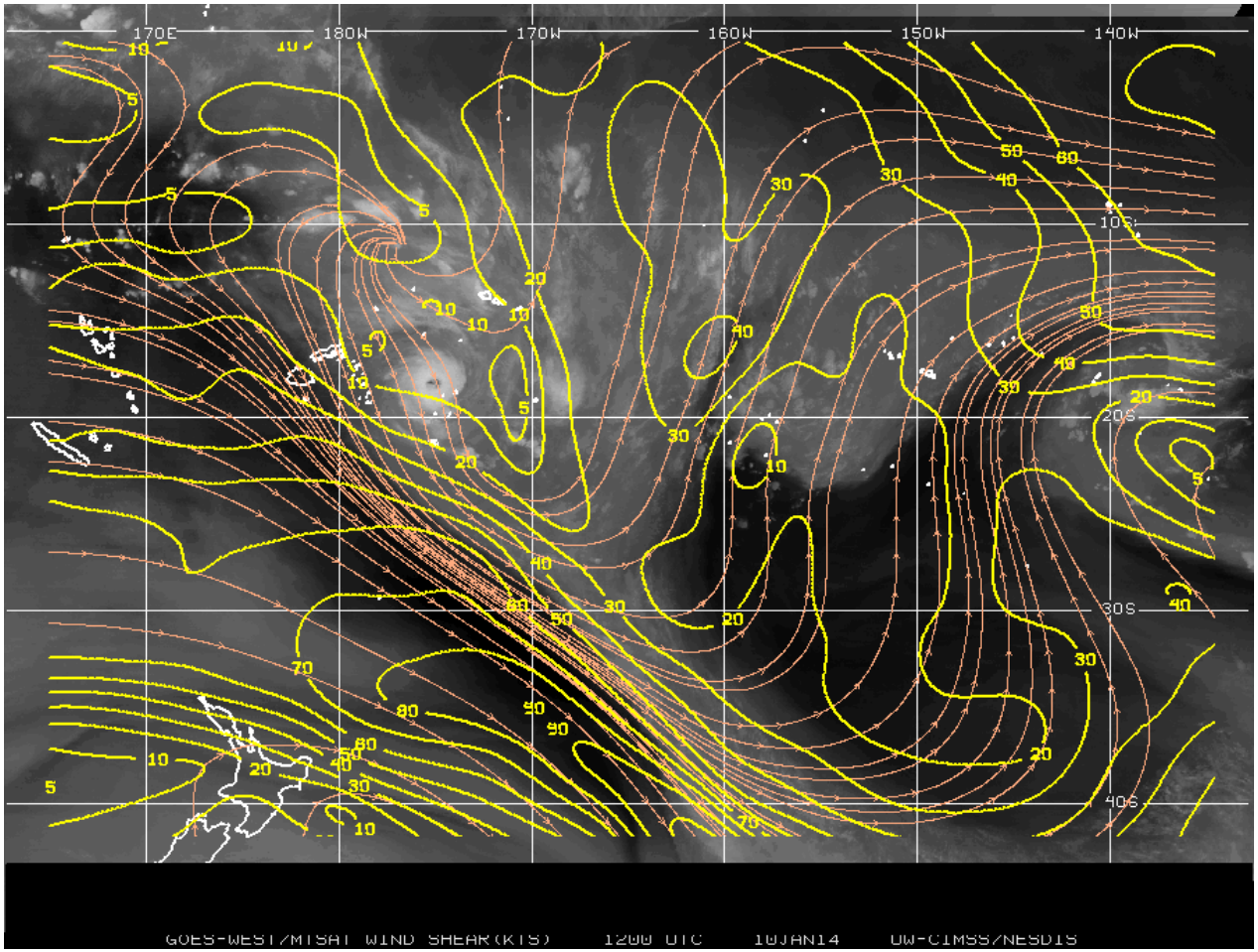
UPPER AIR
VT: 10 JAN 2014 / 12Z
BGB

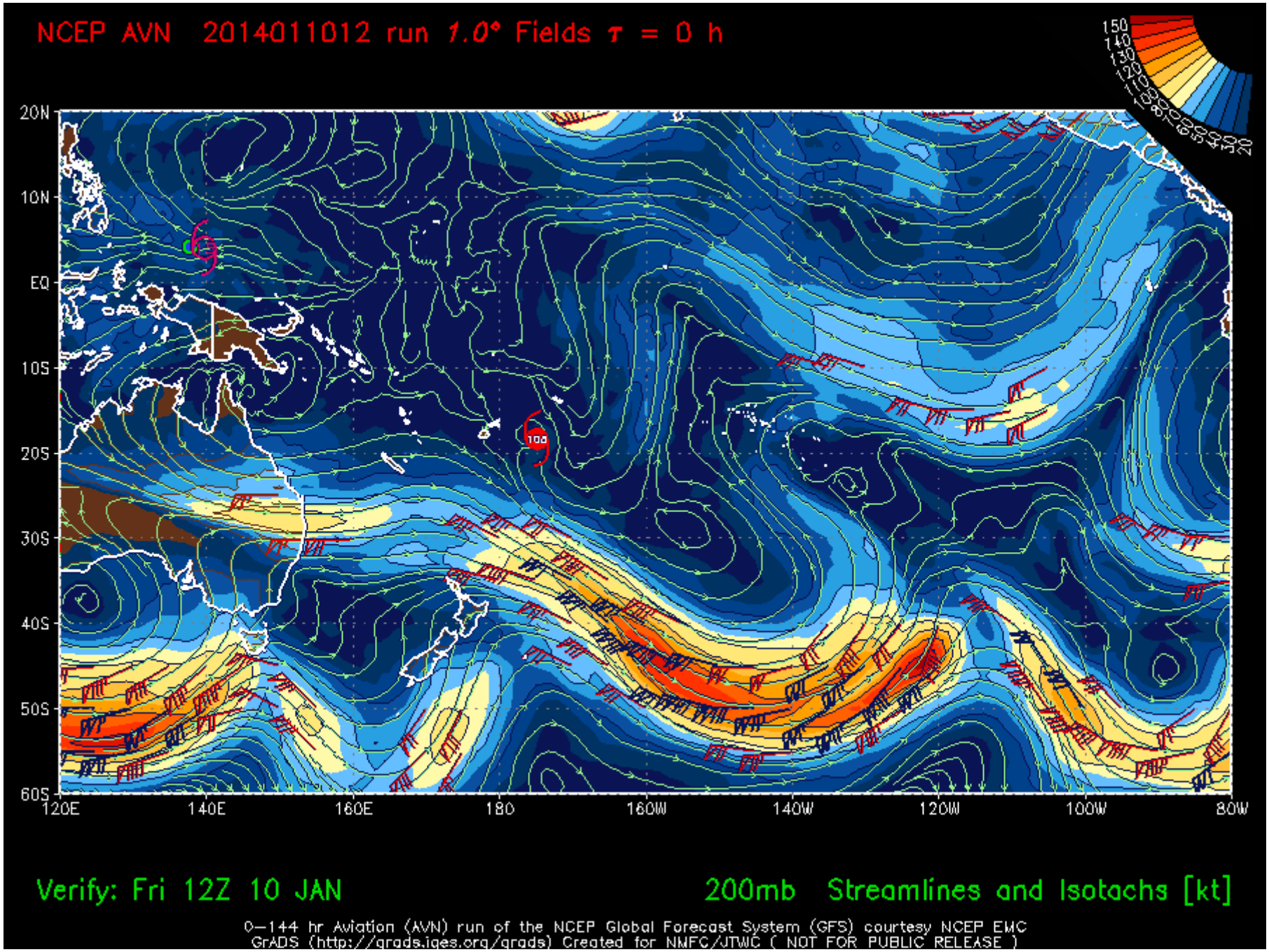


10/12Z JTWC 200mb Streamline Analysis Zoomed



CIMSS 12Z – No Anti over Eye???




NCEP AVN 2014011012 run 1.0° Fields τ = 0 h
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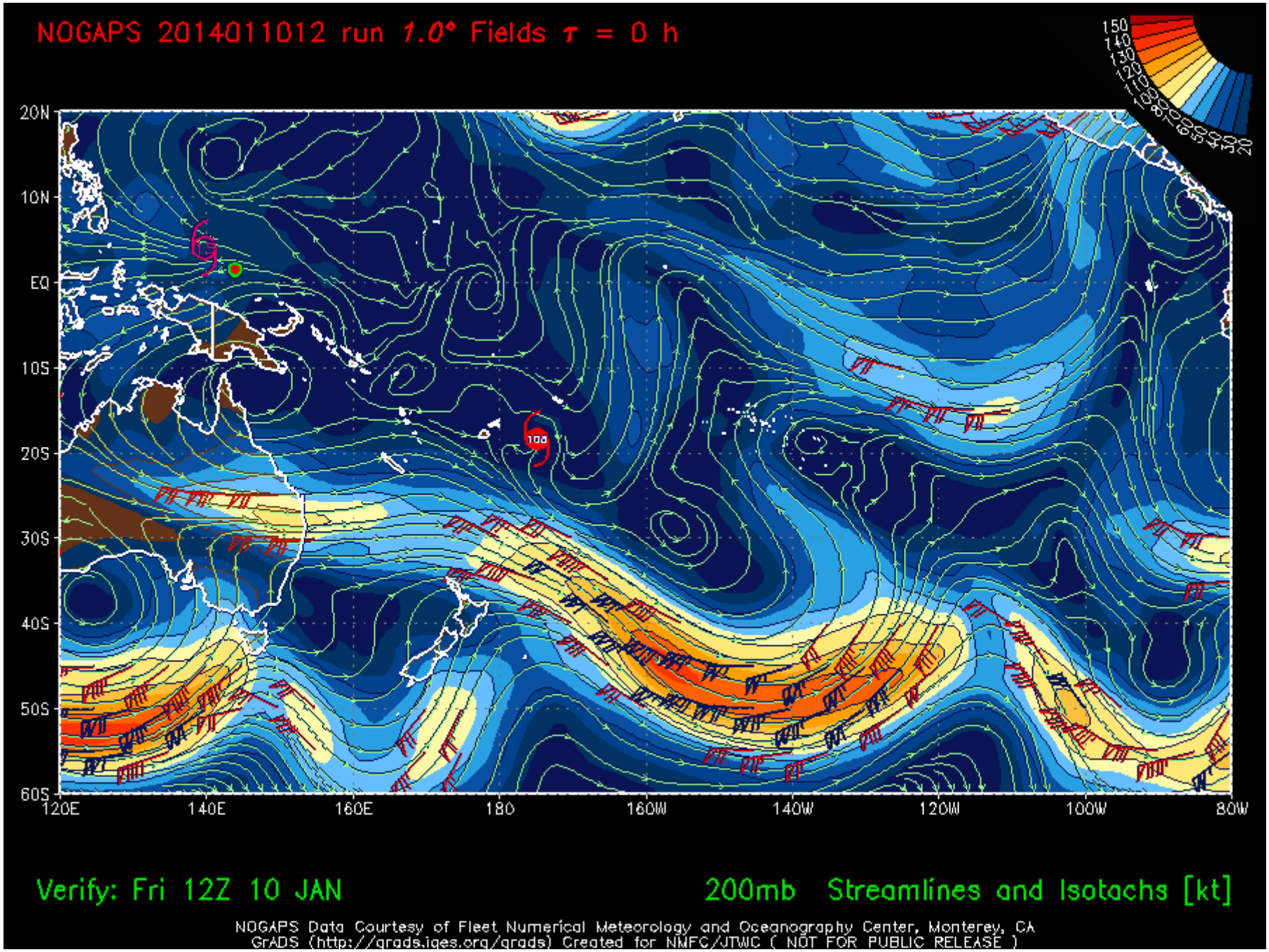
Verify: Fri 12Z 10 JAN
200mb Streamlines and Isotachs [kt]
0-144 hr Aviation (AVN) run of the NCEP Global Forecast System (GFS) courtesy NCEP EMC
GrADS (http://grads.iges.org/grads) Created for NMFC/JTWC (NOT FOR PUBLIC RELEASE)


NOGAPS 2014011012 run 1.0° Fields τ = 0 h
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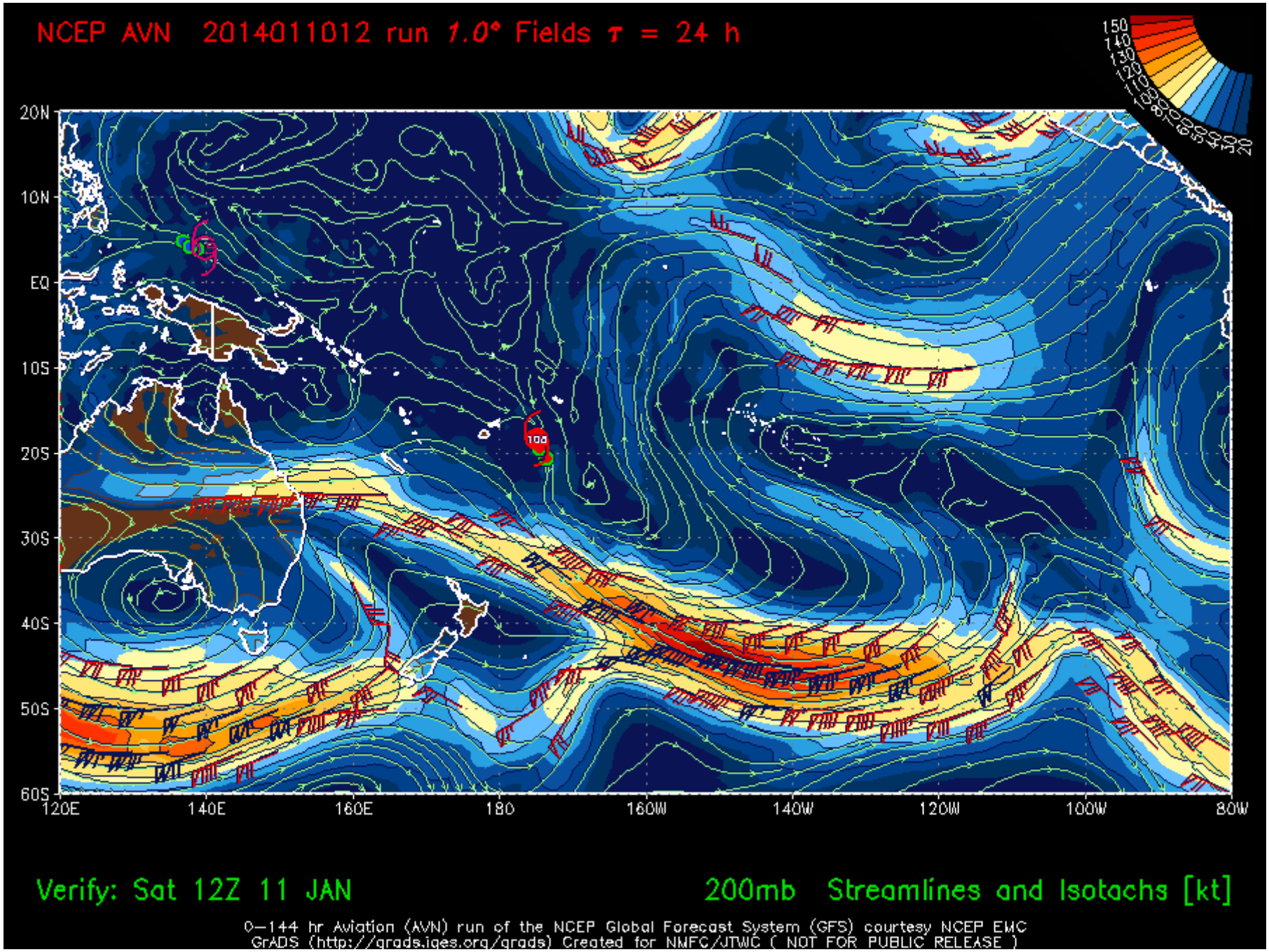
Verify: Fri 12Z 10 JAN
200mb Streamlines and Isotachs [kt]
NOGAPS Data Courtesy of Fleet Numerical Meteorology and Oceanography Center, Monterey, CA
GrADS (http://grads.iges.org/grads) Created for NMFC/JTWC (NOT FOR PUBLIC RELEASE)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200mb Streamlines and Isotachs [kt]
0-144 hr Aviation (AVN) run of the NCEP Global Forecast System (GFS) courtesy NCEP EMC
GrADS (http://grads.iges.org/grads) Created for NWFC/JTWC (NOT FOR PUBLIC RELEASE)

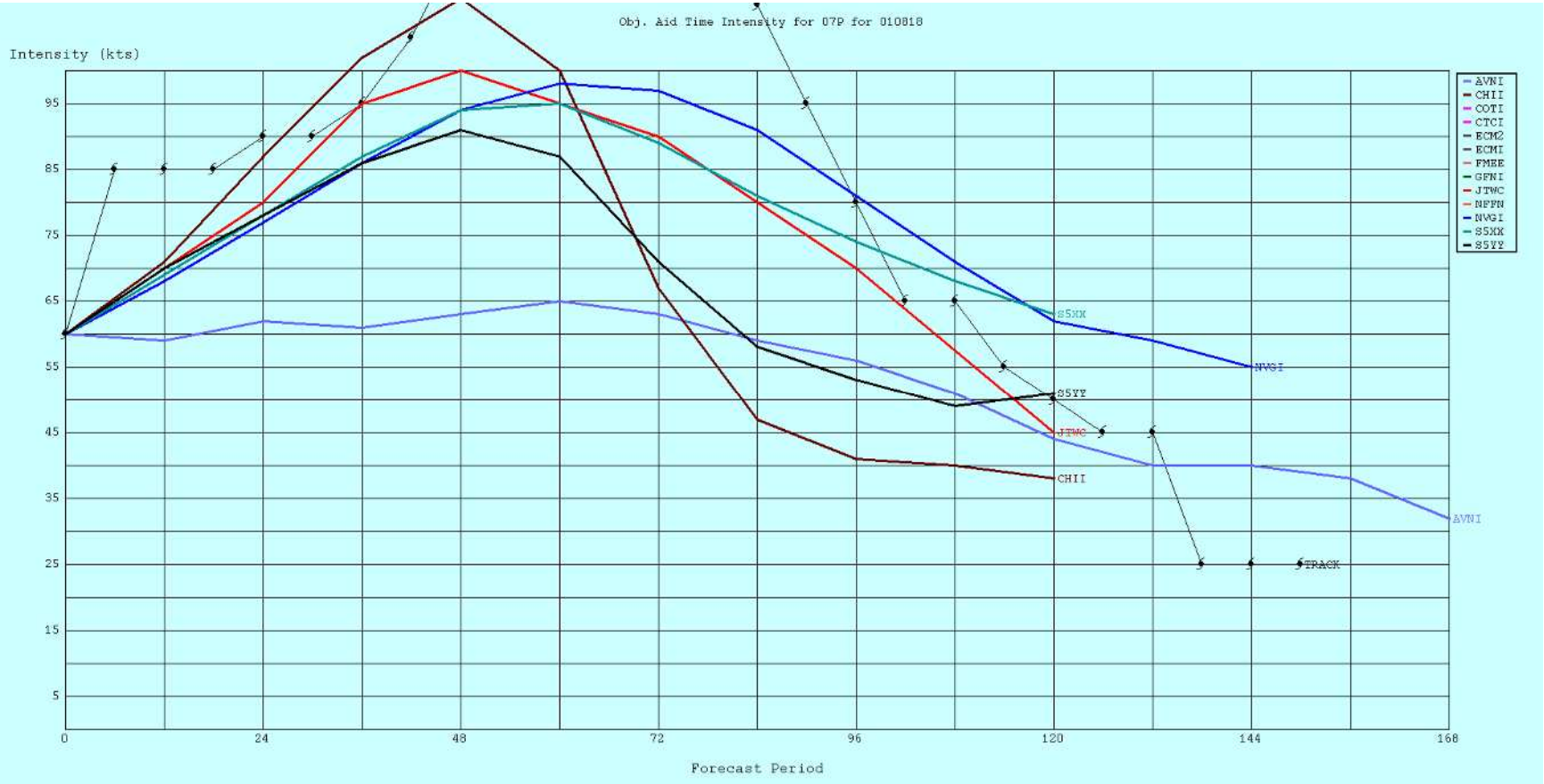
RAMMB WV Loop
09/21Z – 11/09Z

- http://rammb.cira.colostate.edu/products/tc_realtime/loop.asp?product=16kmgwvp&storm_identifier=SH072014&starting_image=2014SH07_16KMGWVP_201401092032.GIF&ending_image=2014SH07_16KMGWVP_201401110832.GIF

Summary

- Apparent small features (e.g. Tutt Cell) not readily apparent in “Large-scale” data/analyses
  - “analyses”, both numerical and manual
- Small features appear to enhance outflow already aided by synoptic or large scale features
- Need for forecaster to consider and factor into forecast for intensity and track.
- CHIPS depicted the RI

08/18Z Intensity Plot



Extracted fm ATCF (default setting)