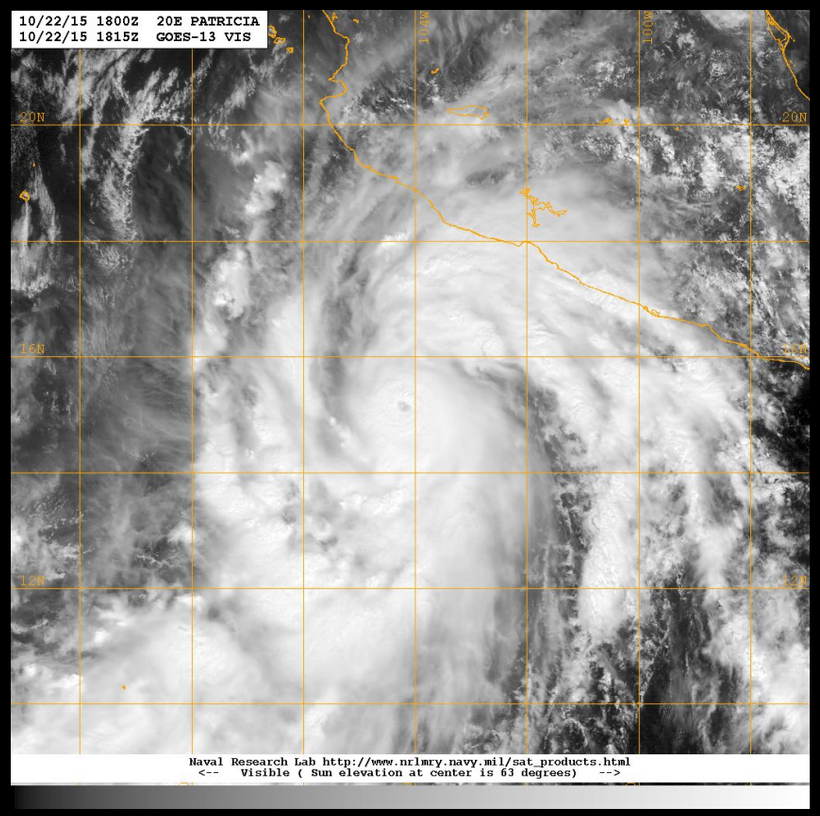
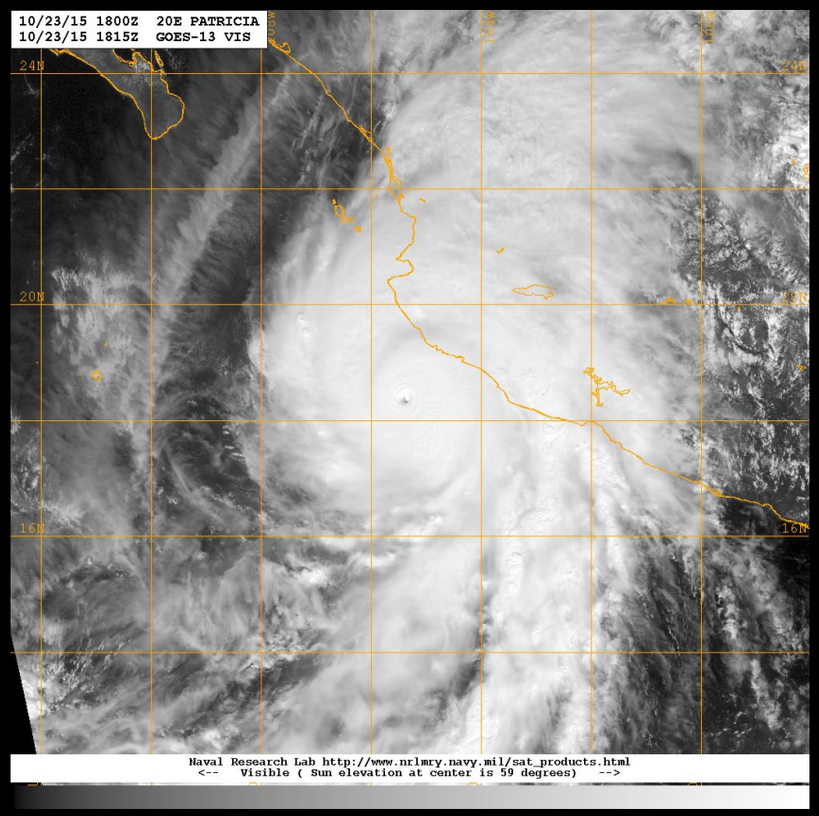
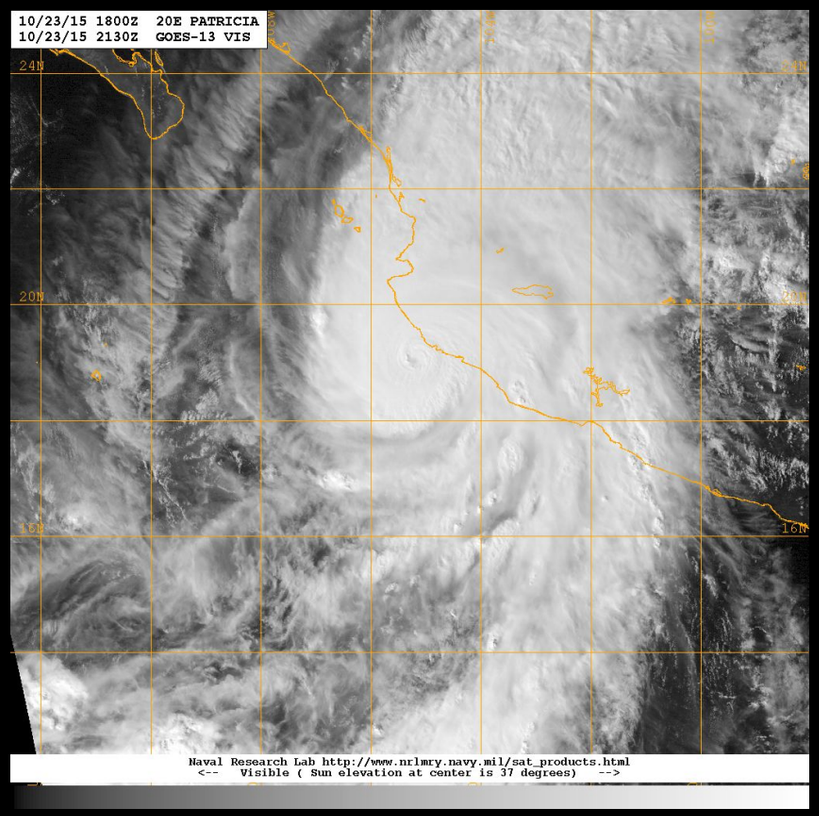
A comparison of SAMURAI, HEDAS, and radar analyses for Hurricane Patricia (and a sneak peek into Dorian)







SAMURAI analyses: Michael Bell and Jonathan Martinez, Colorado State University
HEDAS analyses: Sim Aberson **Radar analyses: John Gamache**

HRD Science Meeting
10 October, 2019

SAMURAI - Spline Analysis at Mesoscale Utilizing Radar and Aircraft Instrumentation

Variational analysis based on Ooyama's SAFER technique using cubic B-splines. Analyses are 1-km/33 height levels. Analyses have motion subtracted out; I have added it back in here.

Bell, M. M., M. T. Montgomery, and K. A. Emanuel, 2012: Air–sea enthalpy and momentum exchange at major hurricane wind speeds observed during CBLAST. J. Atmos. Sci., 69, 3197–3222, https://doi.org/10.1175/JAS-D-11-0276.1.

HEDAS - HWRF Ensemble Data Assimilation System

EnKF data assimilation system incorporating all available data. Analyses are 1-km/ 75 eta levels converted to pressure levels by UPP.

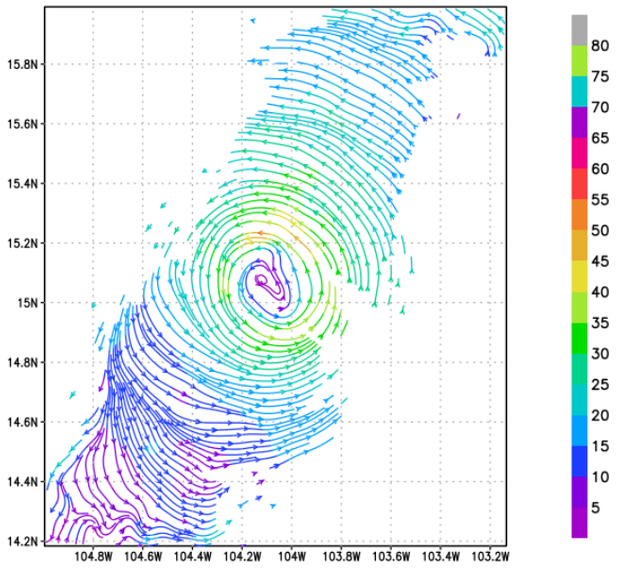
Aksoy, A., S. Lorsolo, T. Vukicevic, K. J. Sellwood, S. D. Aberson, and F. Zhang, 2012: The HWRF Hurricane Ensemble Data Assimilation System (HEDAS) for high-resolution data: The impact of airborne Doppler radar observations in an OSSE. Mon. Wea. Rev., 140, 1843–1862, https://doi.org/10.1175/MWR-D-11-00212.1.

RADAR analyses

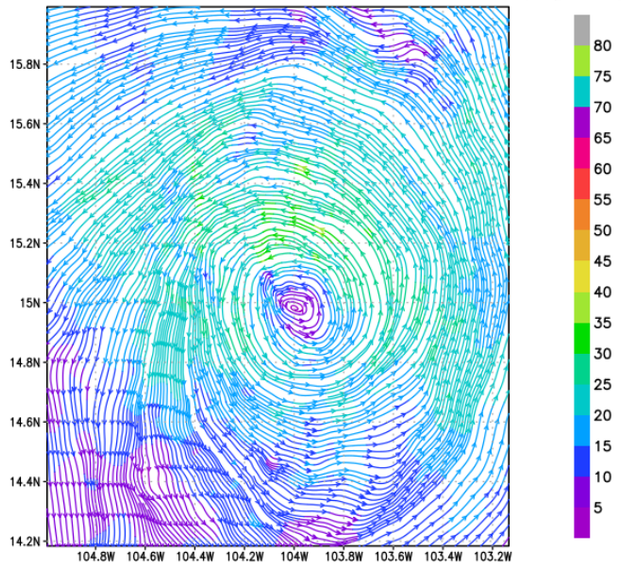
The same as real-time analyses, but these were done after-the-fact. Analyses are 1.5 km/37 height levels, only radar data included.

[Direct comparison difficult because of different grids and vertical coordinates.]

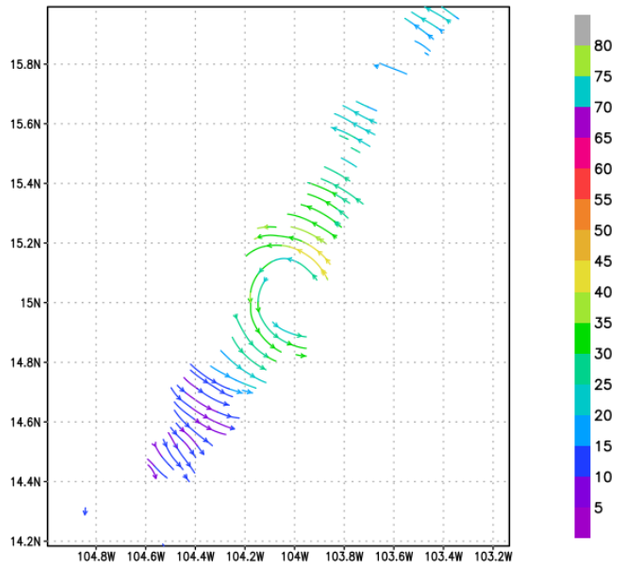
AMURAI Patricia 20151022 1800Z pass 1 11.5 km Wind Velocity [m/



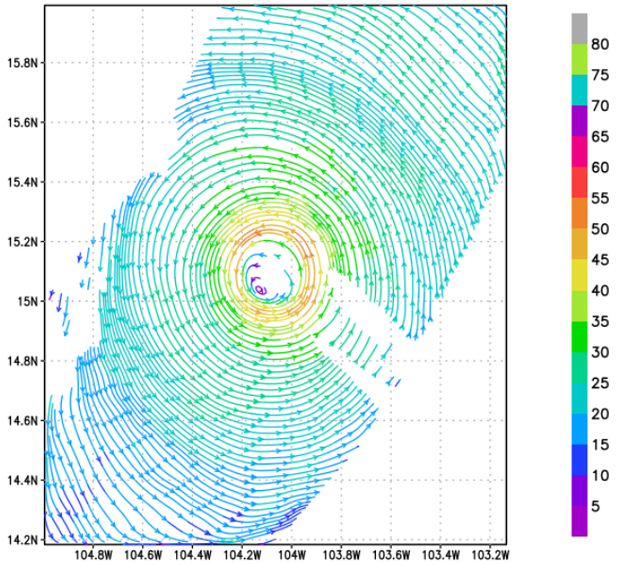
Patricia 20151022 1730Z 200 hPa Wind Velocity [m/s]



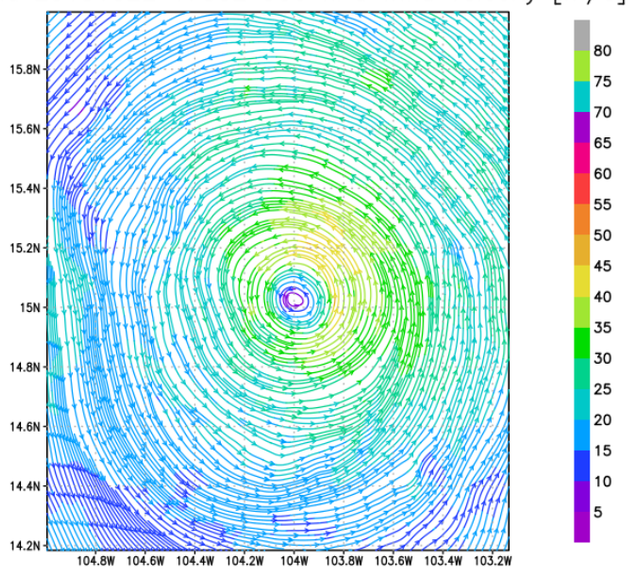
151022I1 PATRICIA at 12 km (m/s) Valid 20151022 1739Z



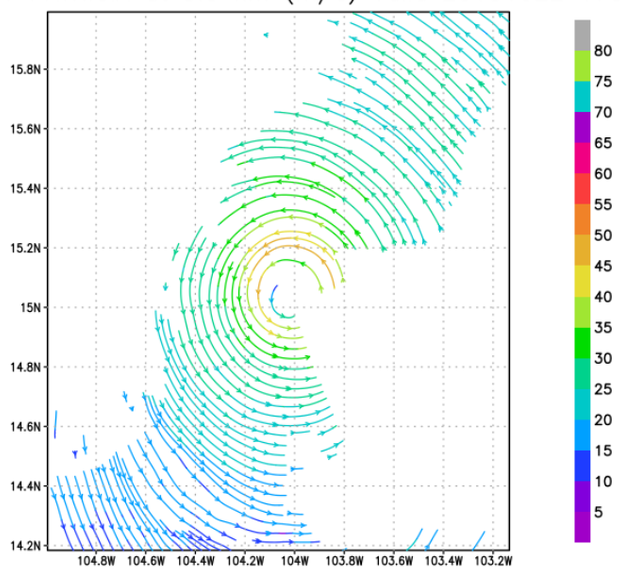
AMURAI Patricia 20151022 1800Z pass 1 5.5 km Wind Velocity [m/



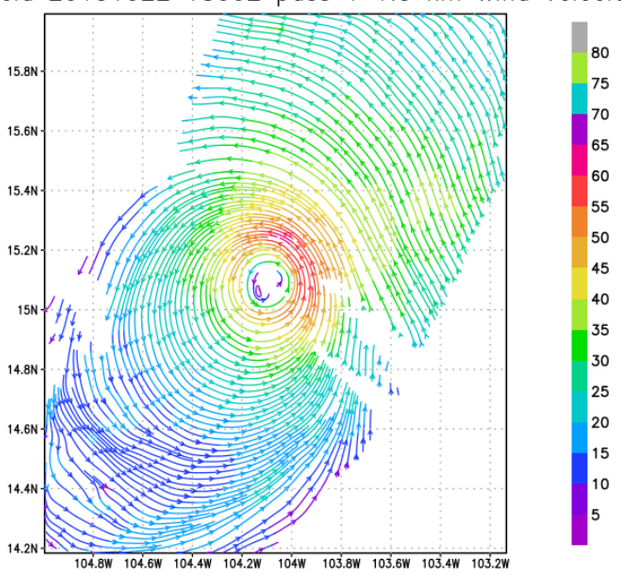
Patricia 20151022 1730Z 500 hPa Wind Velocity [m/s]



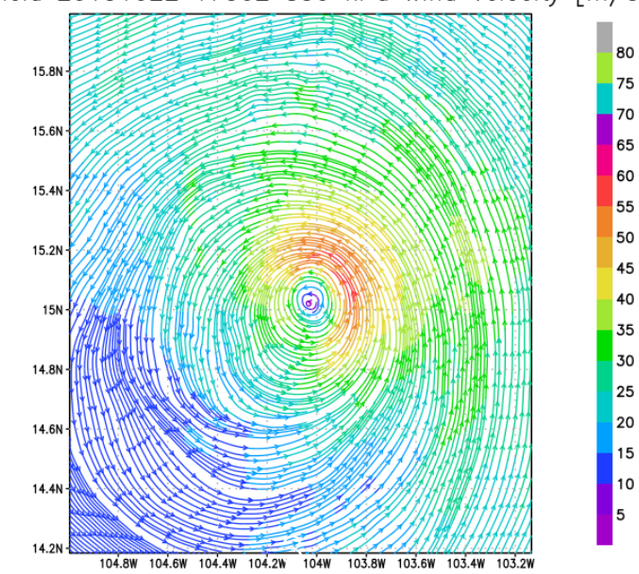
151022I1 PATRICIA at 5.5 km (m/s) Valid 20151022 1739Z



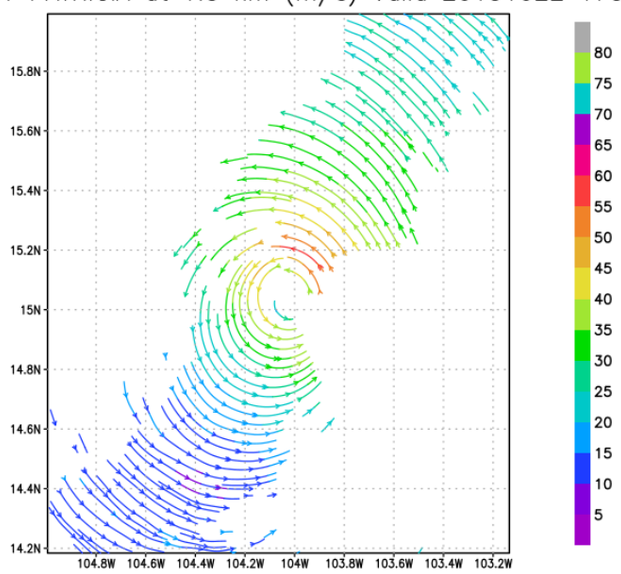
AMURAI Patricia 20151022 1800Z pass 1 1.5 km Wind Velocity [m/



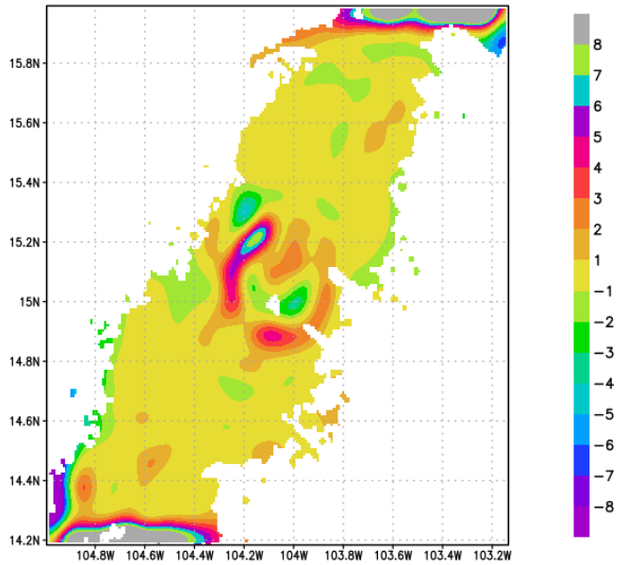
Patricia 20151022 1730Z 850 hPa Wind Velocity [m/s]



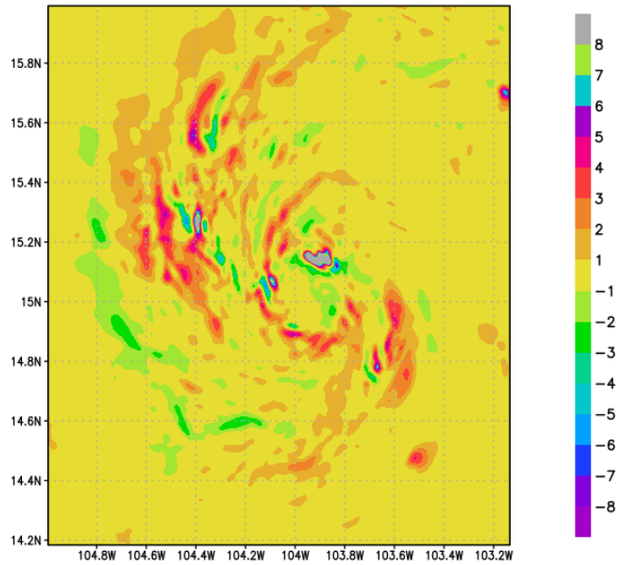
151022I1 PATRICIA at 1.5 km (m/s) Valid 20151022 1739Z



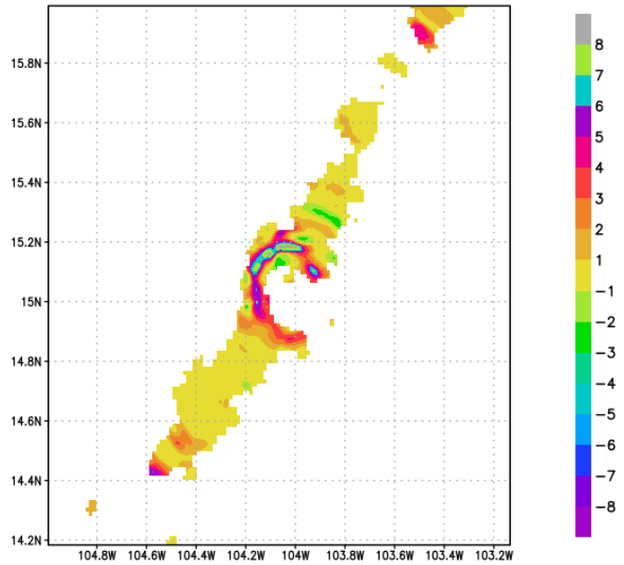
URAI Patricia 20151022 1800Z pass 1 12.0 km Vertical Velocity [r



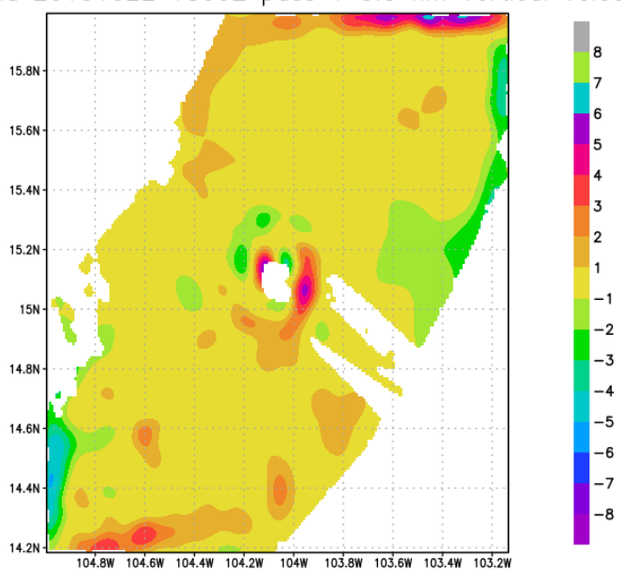
Patricia 20151022 1730Z 200 hPa Vertical Velocity [m/s]



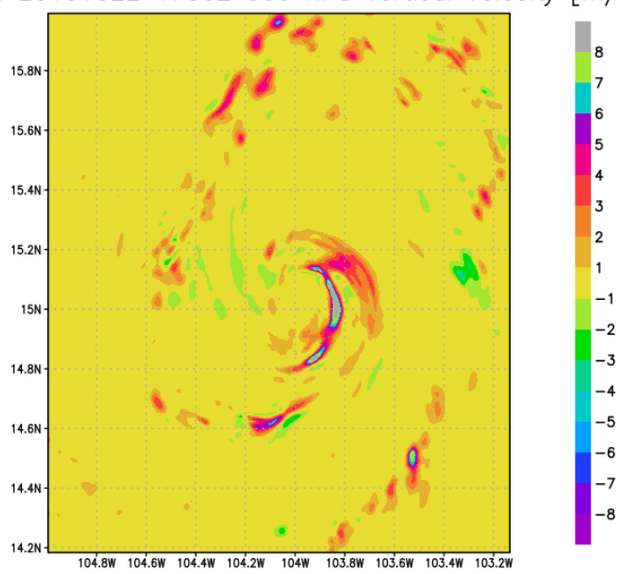
151022I1 PATRICIA at 120 km (m/s) Valid 20151023 1739Z



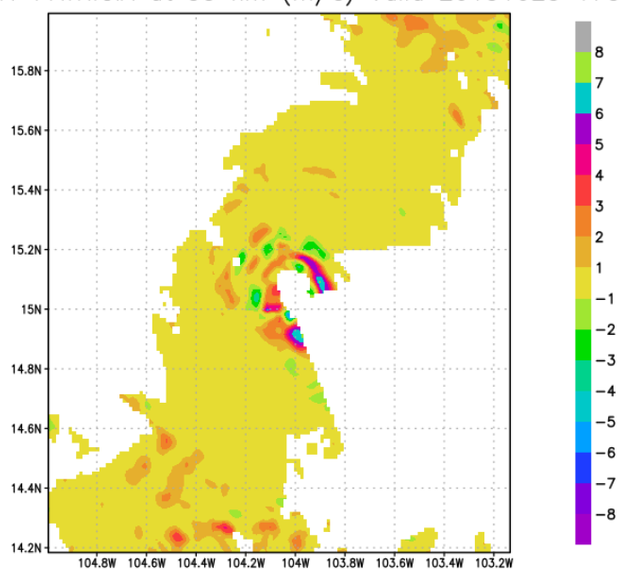
MURAI Patricia 20151022 1800Z pass 1 5.5 km Vertical Velocity [m



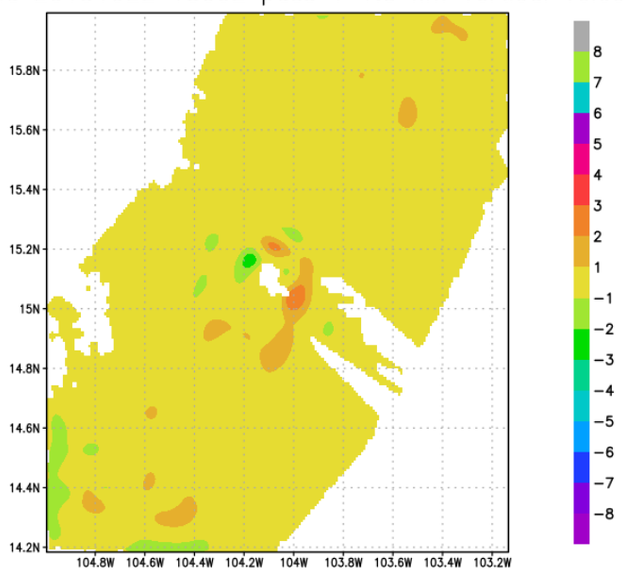
Patricia 20151022 1730Z 500 hPa Vertical Velocity [m/s]



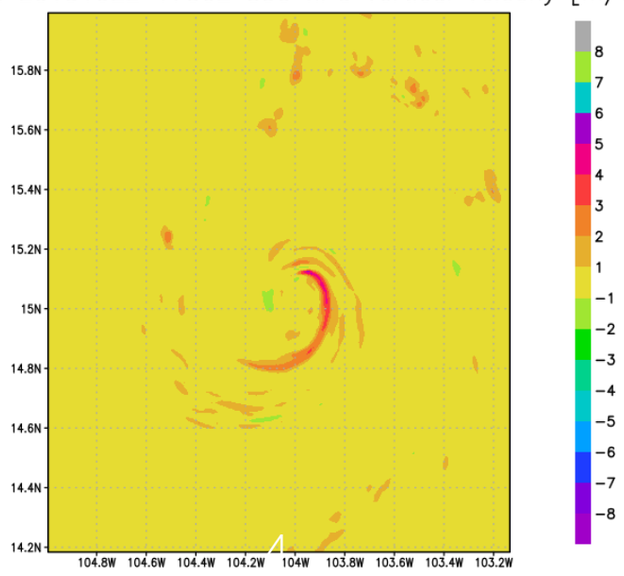
151022I1 PATRICIA at 55 km (m/s) Valid 20151023 1739Z



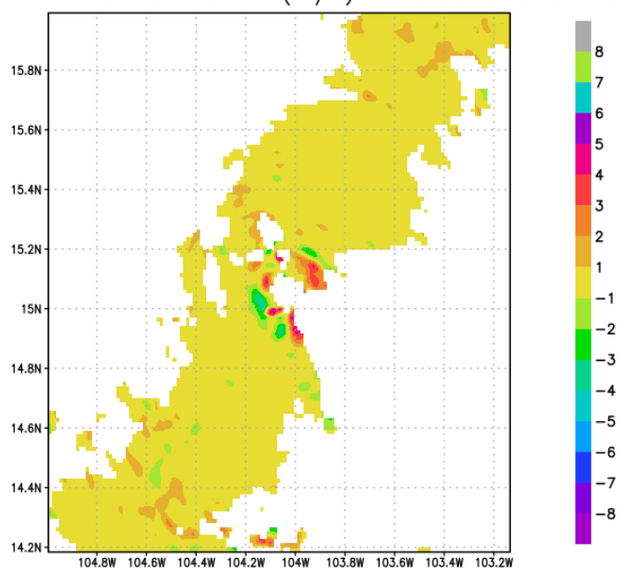
MURAI Patricia 20151022 1800Z pass 1 1.5 km Vertical Velocity [m



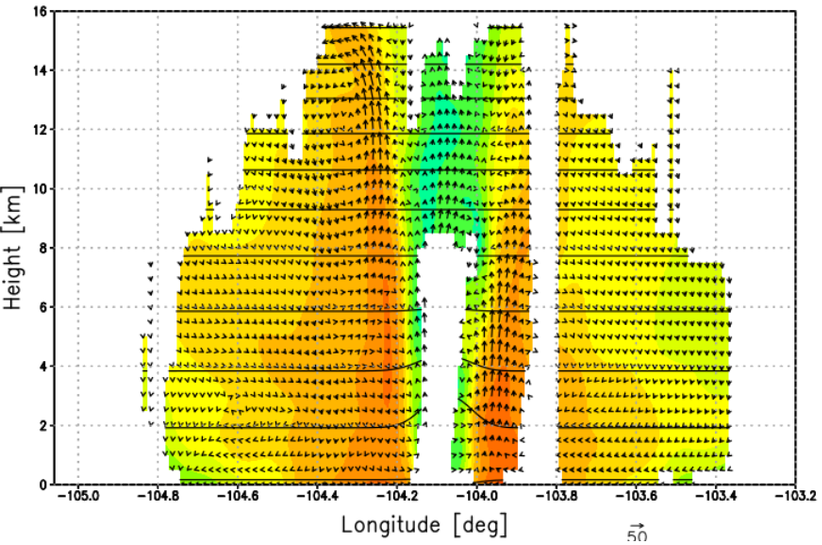
Patricia 20151022 1730Z 850 hPa Vertical Velocity [m/s]



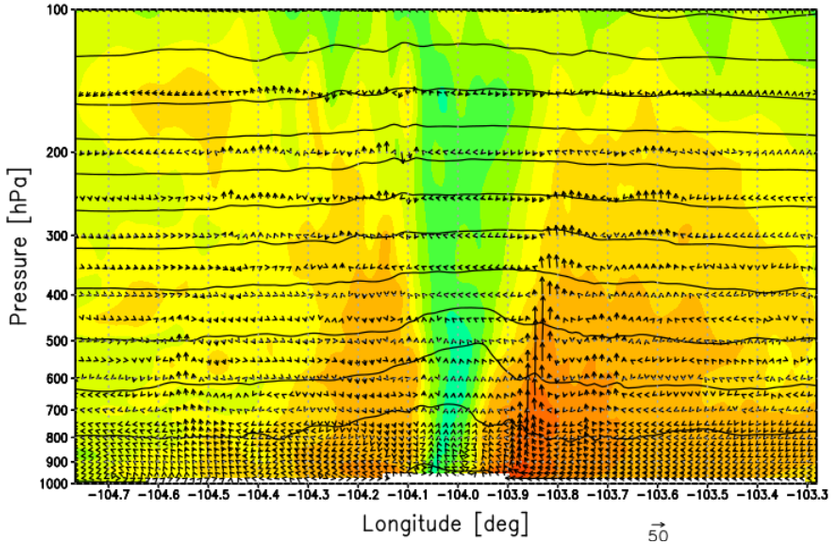
151022I1 PATRICIA at 15 km (m/s) Valid 20151023 1739Z



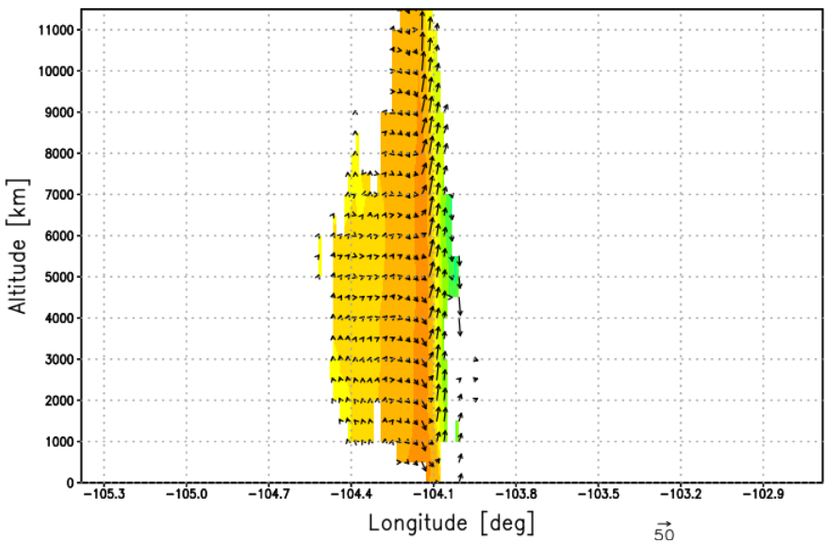
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231800



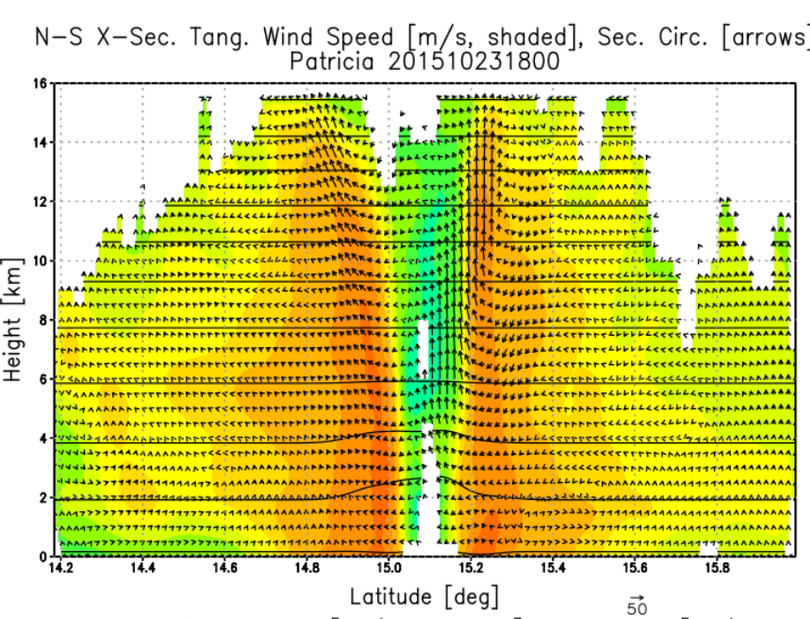
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221730



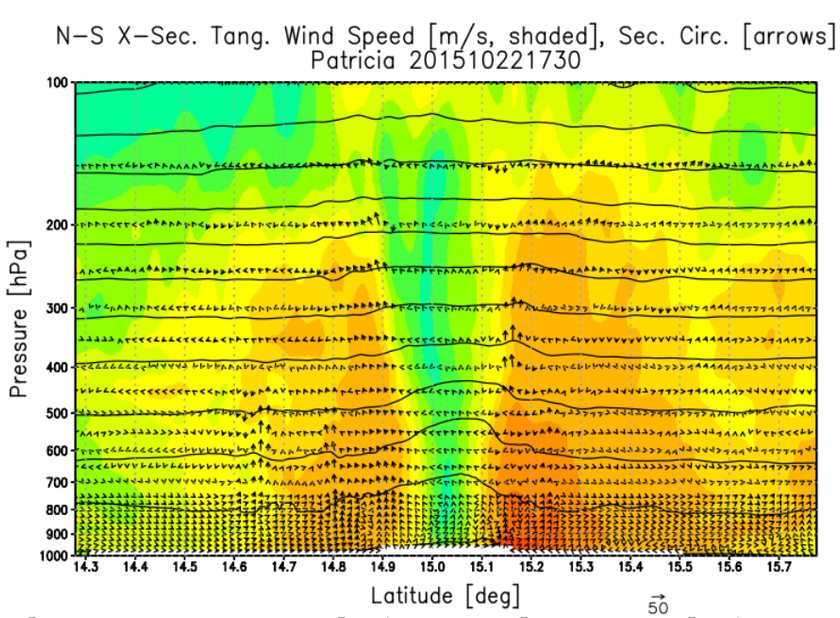
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221739



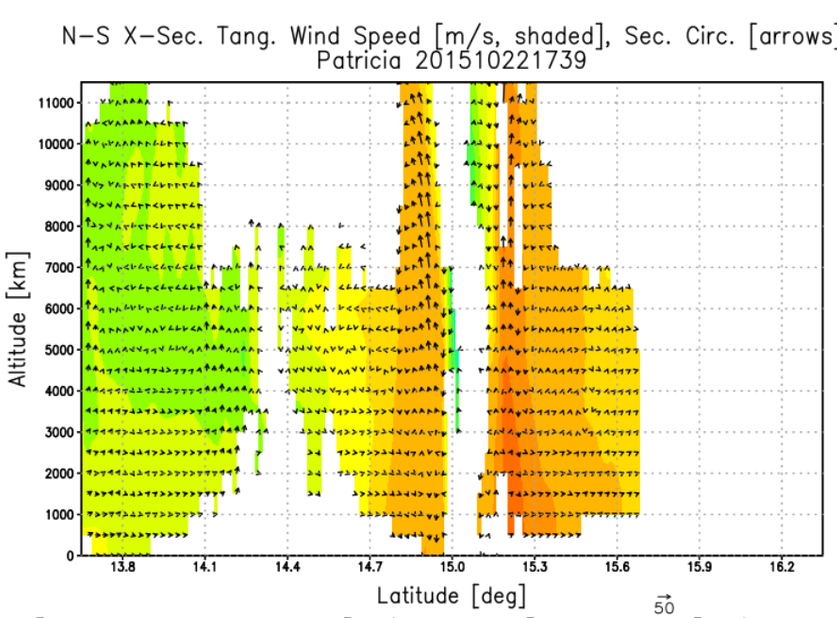
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231800



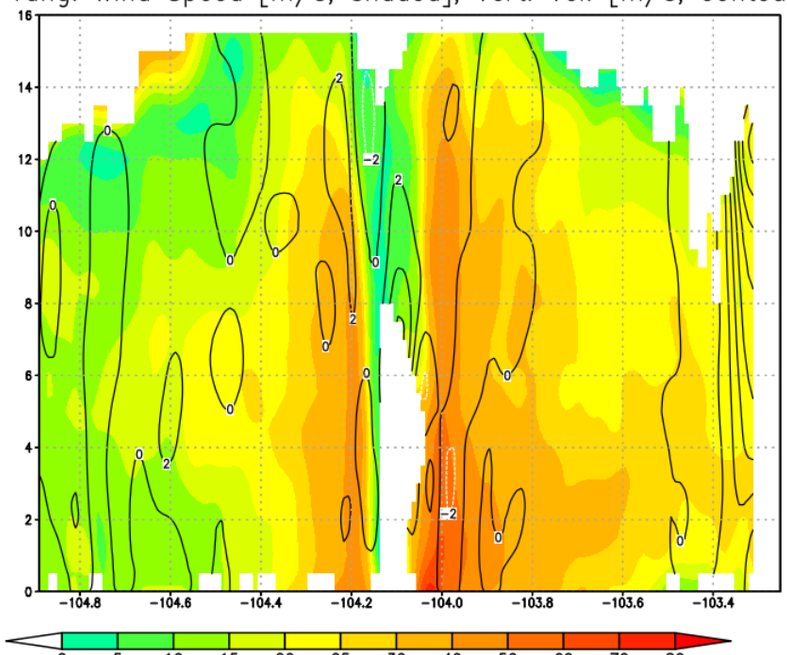
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221730



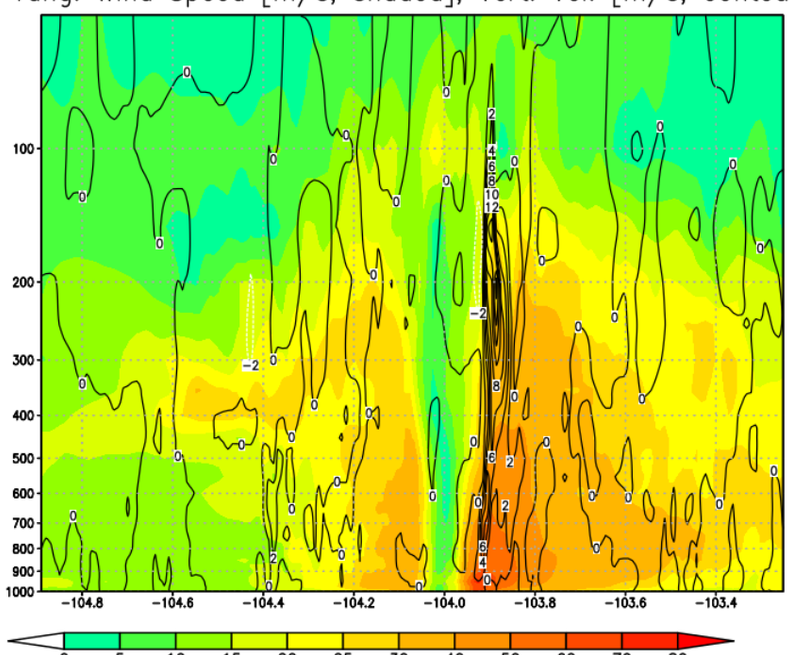
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221739



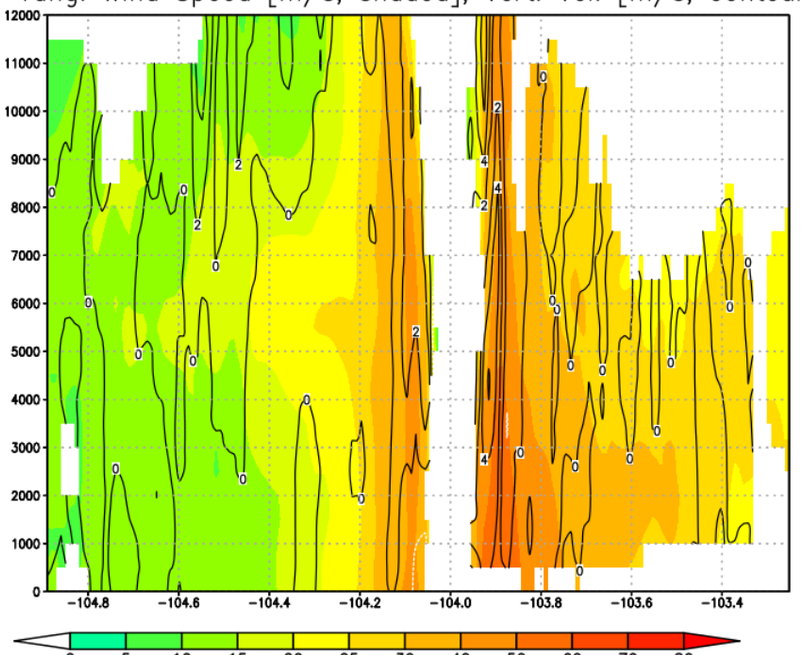
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



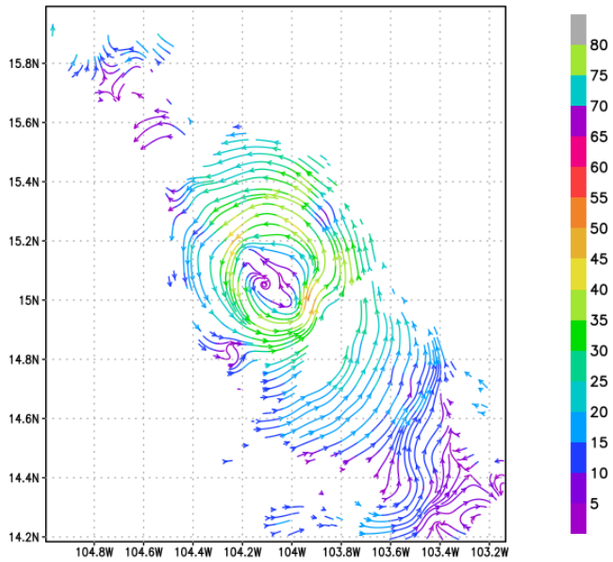
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



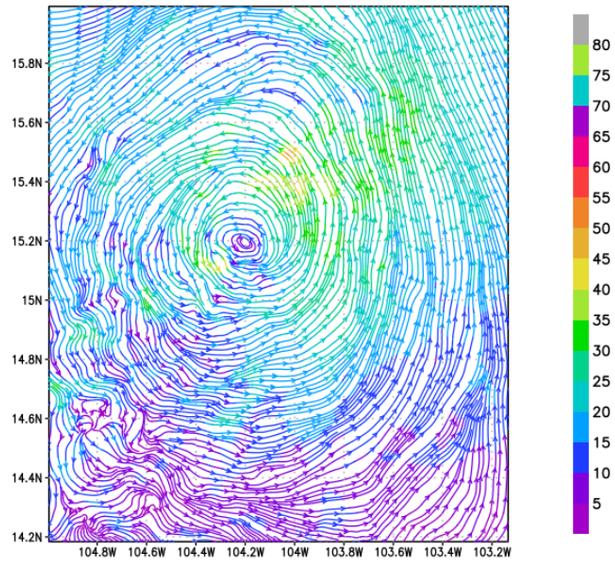
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



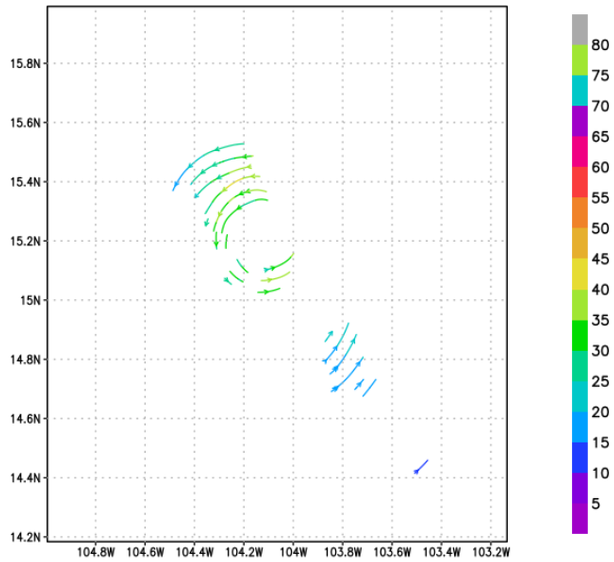
MURAI Patricia 20151022 1800Z pass 2 12.0 km Wind Velocity [m/



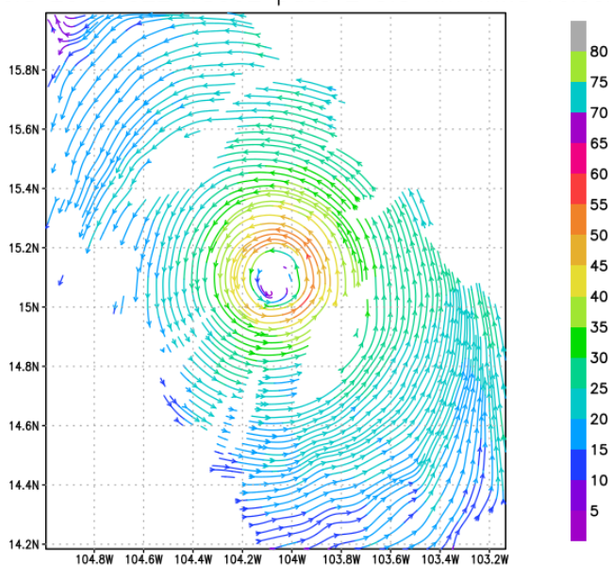
Patricia 20151022 1900Z 200 hPa Wind Velocity [m/s]



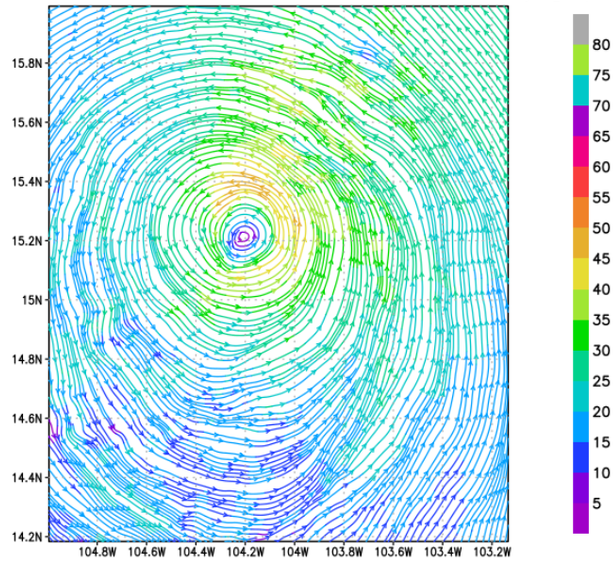
151022I1 PATRICIA at 12 km (m/s) Valid 20151022 1855Z



AMURAI Patricia 20151022 1800Z pass 2 5.5 km Wind Velocity [m/



Patricia 20151022 1900Z 500 hPa Wind Velocity [m/s]



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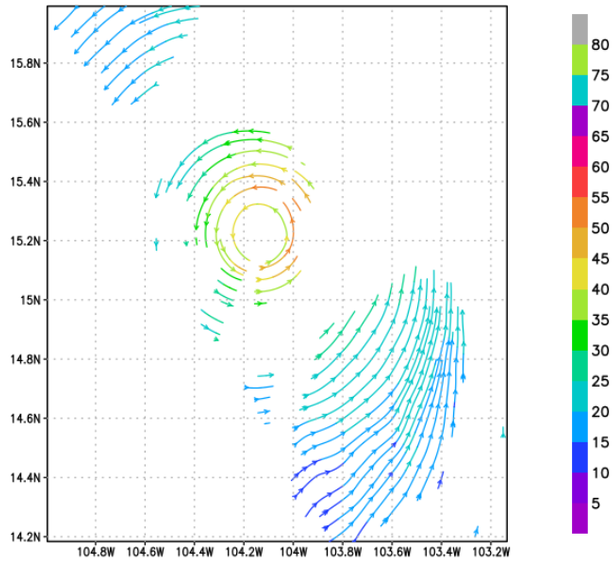
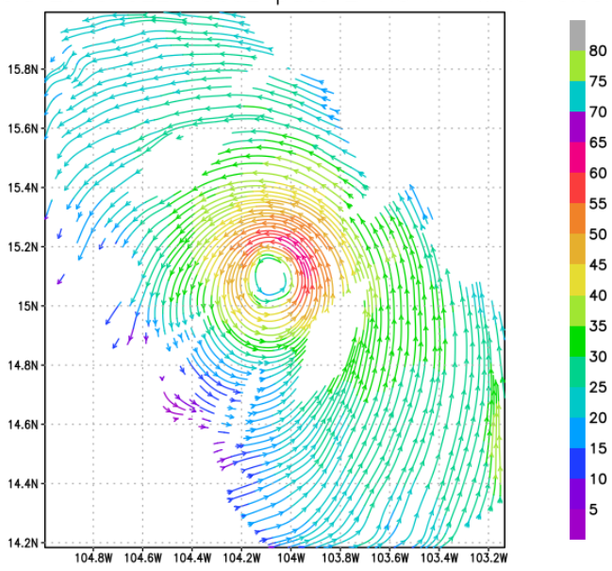
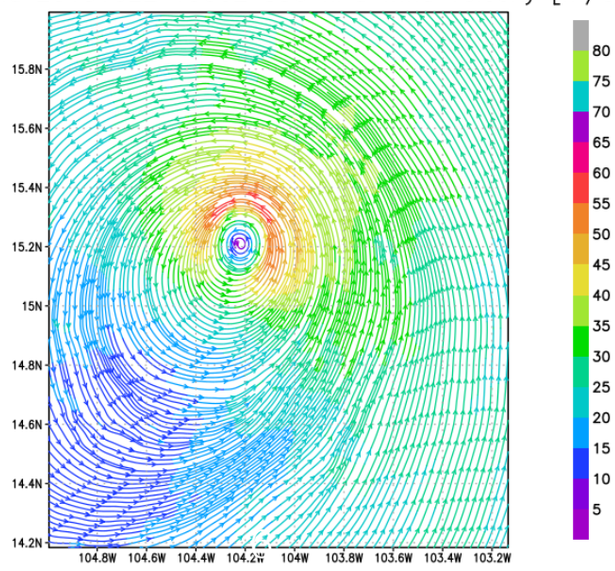


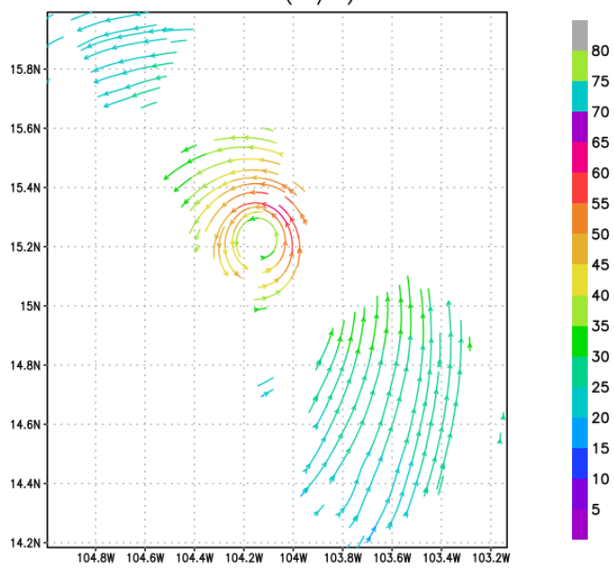
AMURAI Patricia 20151022 1800Z pass 2 1.5 km Wind Velocity [m/



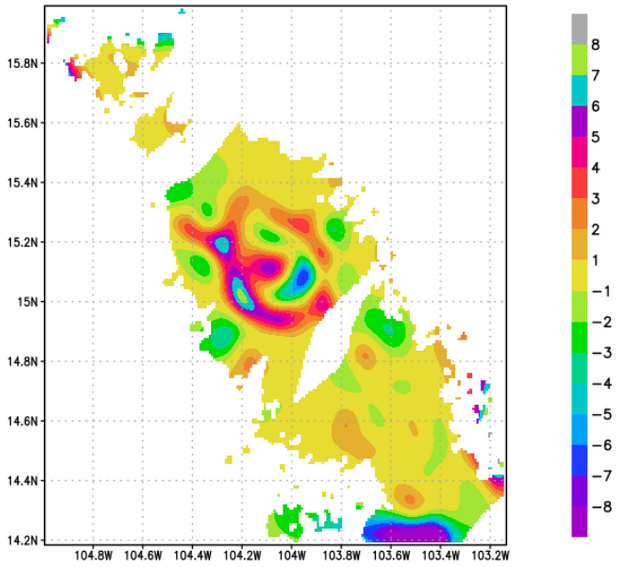
Patricia 20151022 1900Z 850 hPa Wind Velocity [m/s]



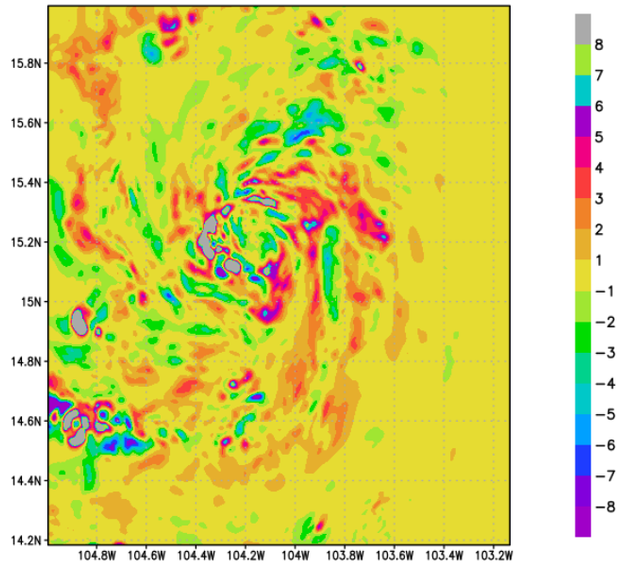
151022I1 PATRICIA at 1.5 km (m/s) Valid 20151022 1855Z



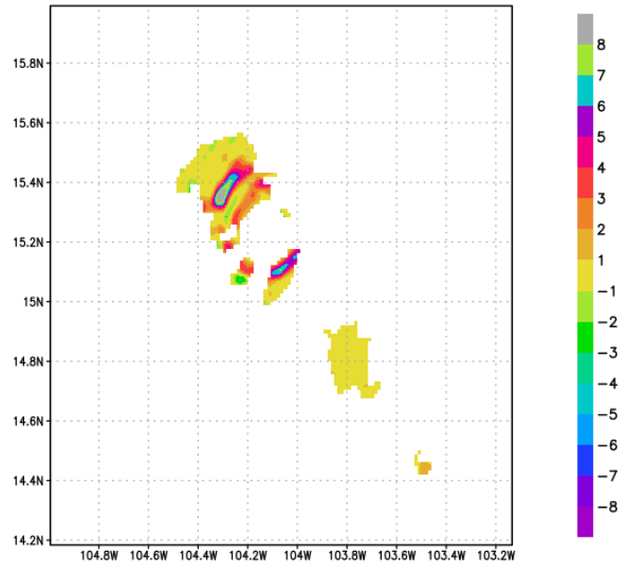
URAI Patricia 20151022 1800Z pass 2 12.0 km Vertical Velocity



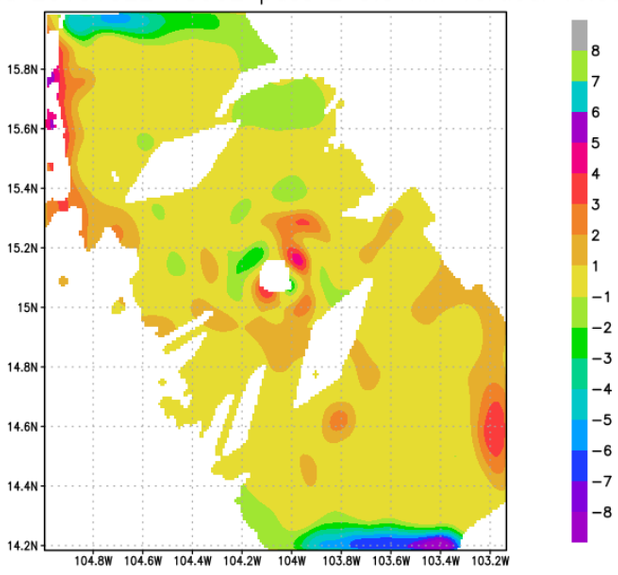
Patricia 20151022 1900Z 200 hPa Vertical Velocity [m/s]



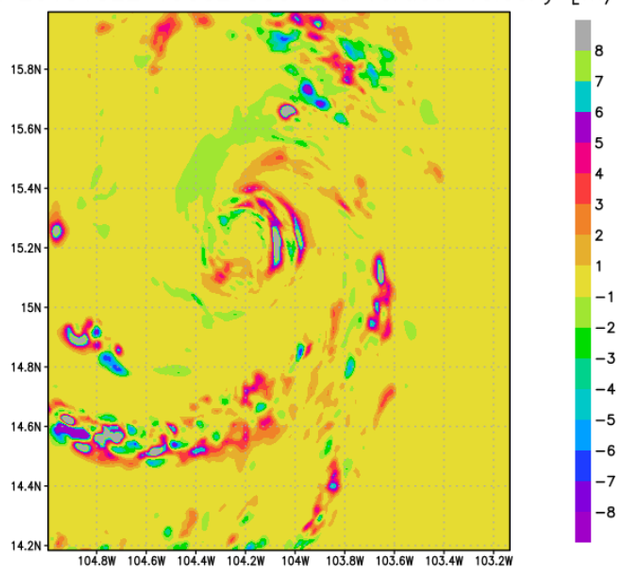
151022I1 PATRICIA at 120 km (m/s) Valid 20151023 1855Z



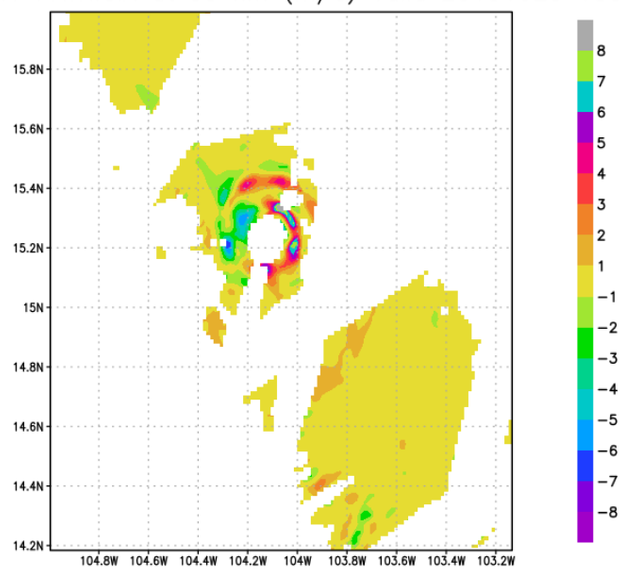
MURAI Patricia 20151022 1800Z pass 2 5.5 km Vertical Velocity



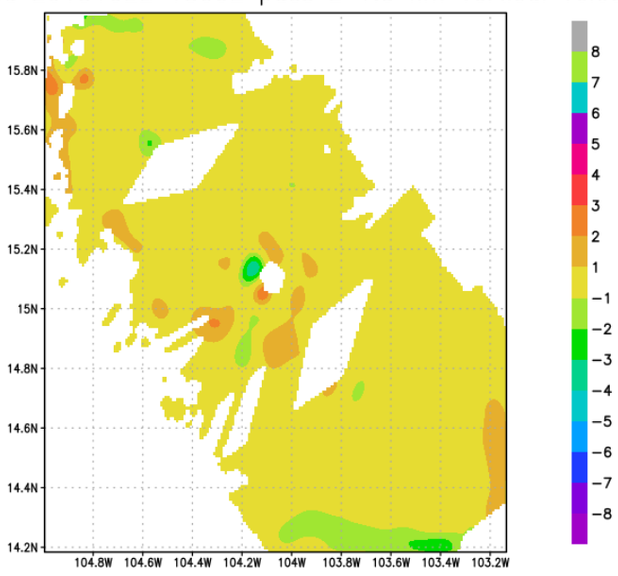
Patricia 20151022 1900Z 500 hPa Vertical Velocity [m/s]



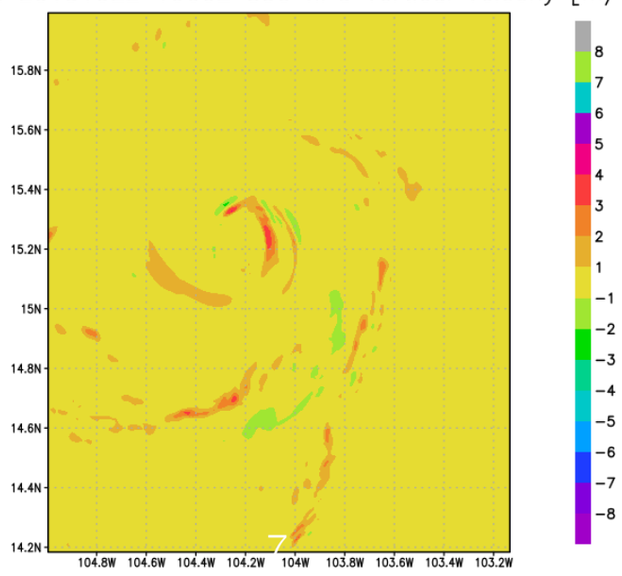
151022I1 PATRICIA at 55 km (m/s) Valid 20151023 1855Z



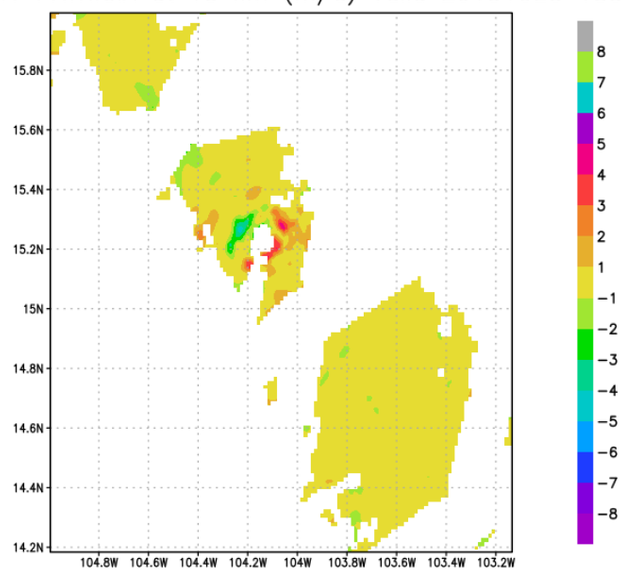
MURAI Patricia 20151022 1800Z pass 2 1.5 km Vertical Velocity



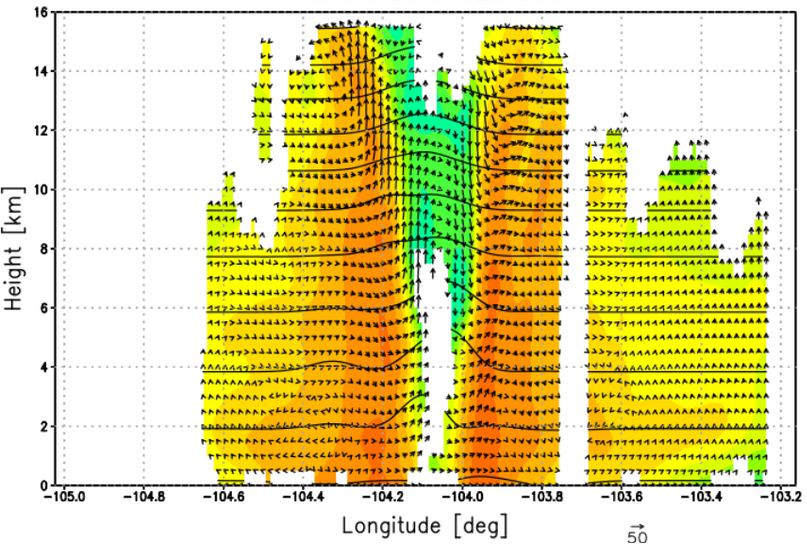
Patricia 20151022 1900Z 850 hPa Vertical Velocity [m/s]



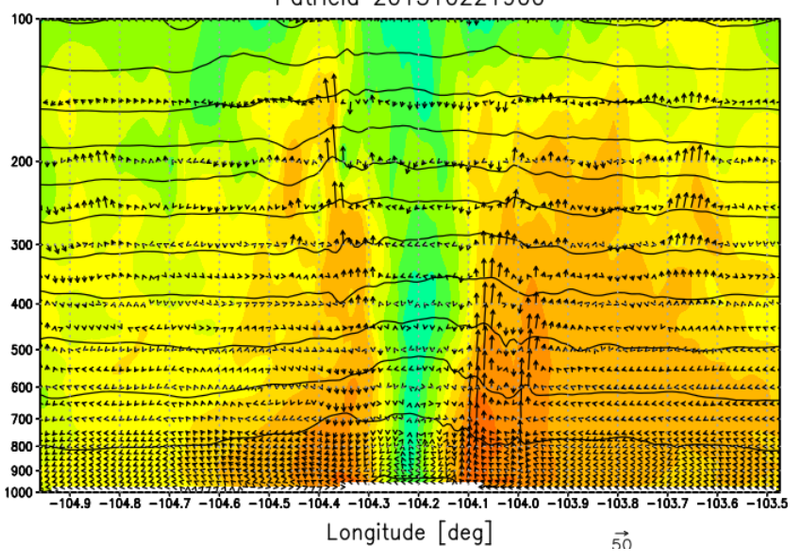
151022I1 PATRICIA at 15 km (m/s) Valid 20151023 1855Z



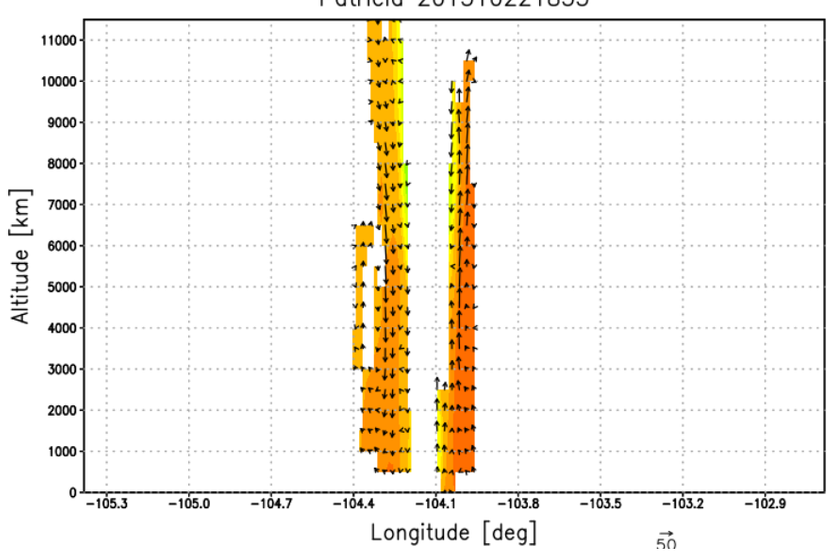
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221800



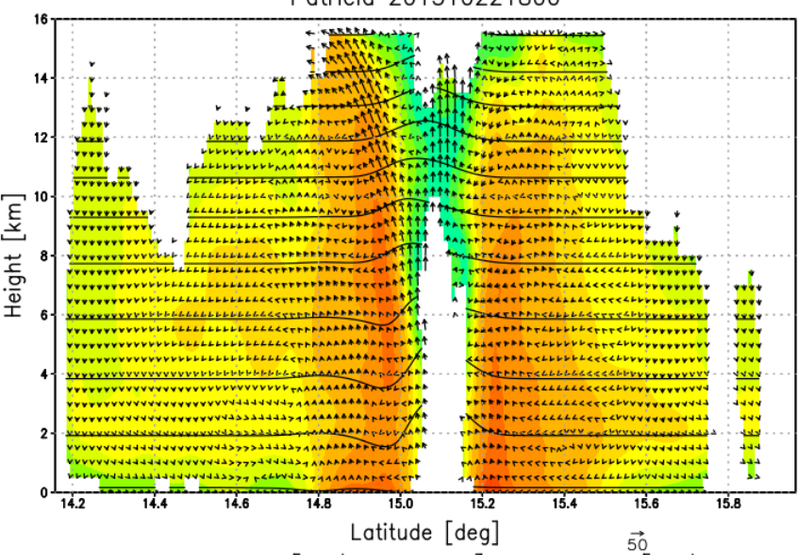
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221900



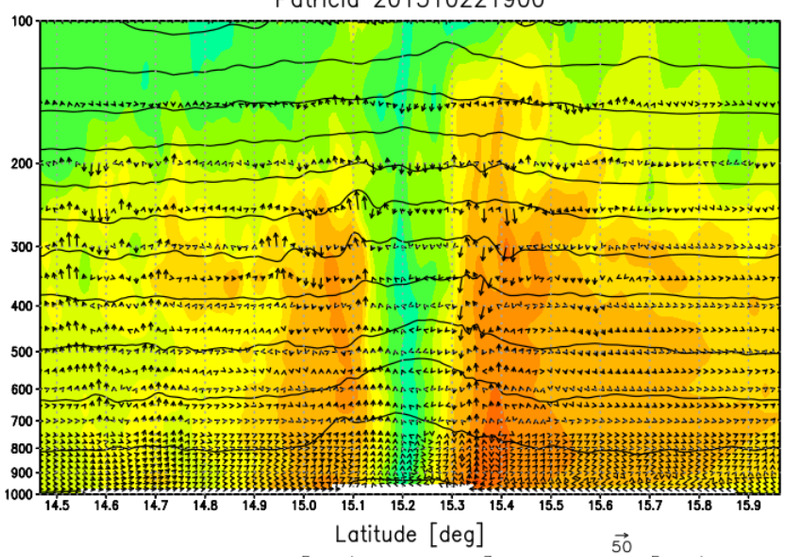
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221855



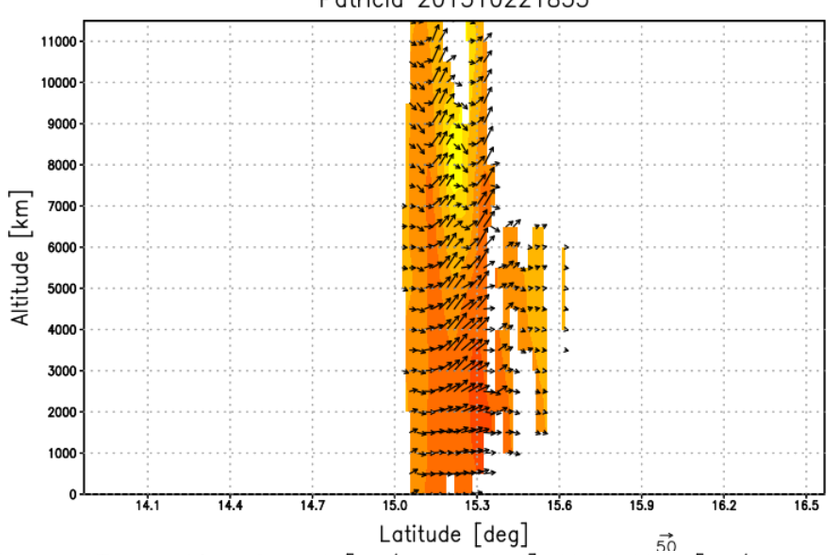
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221800



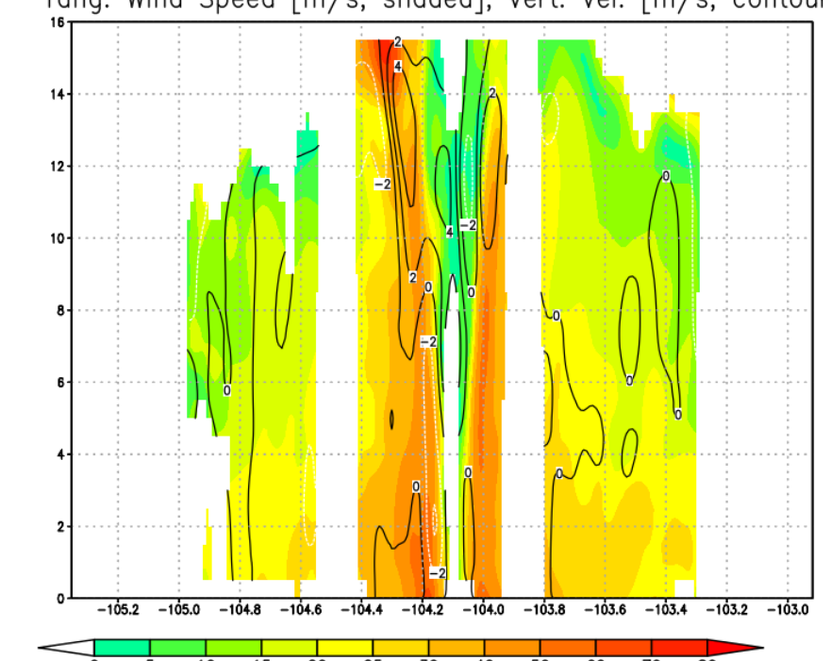
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221900



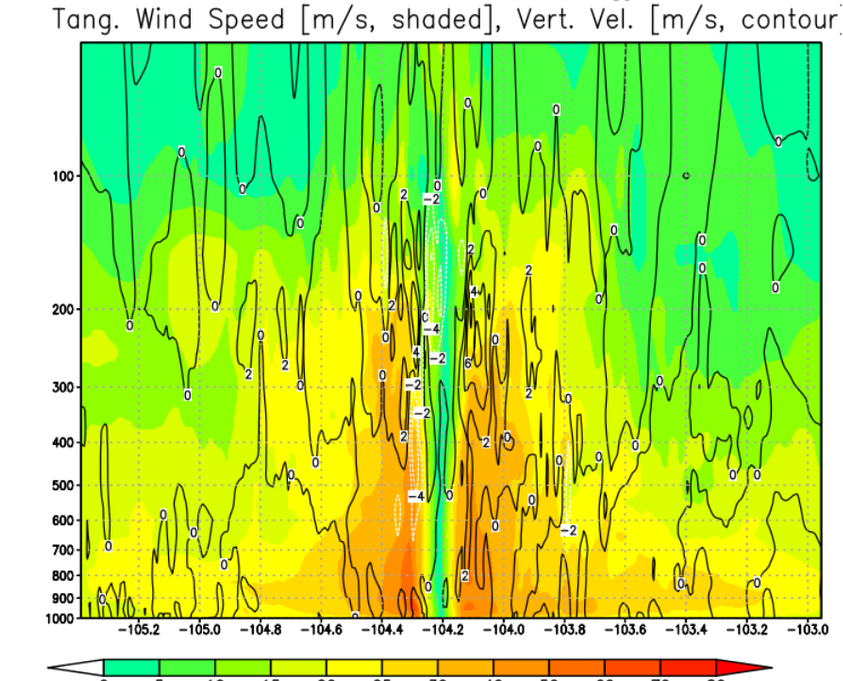
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510221855



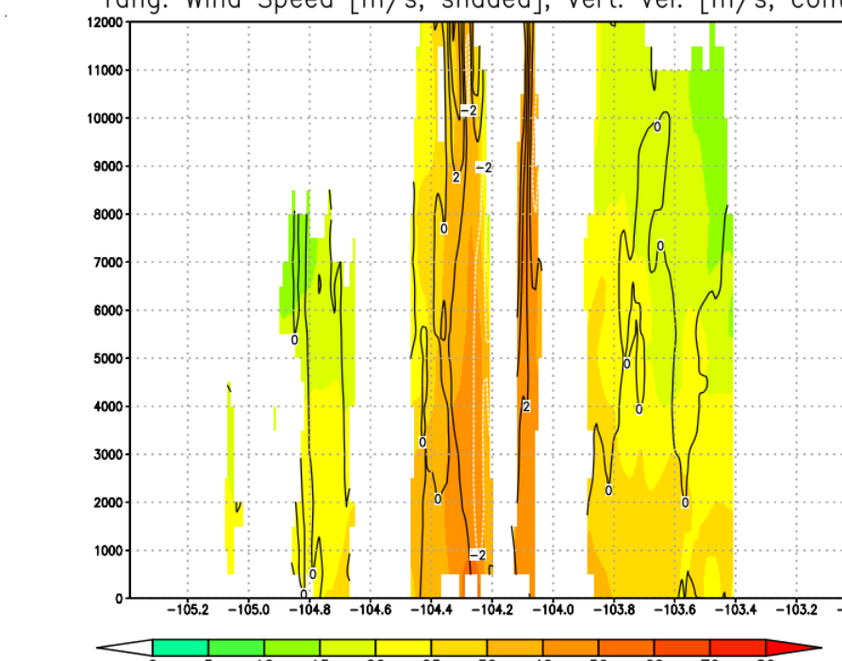
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



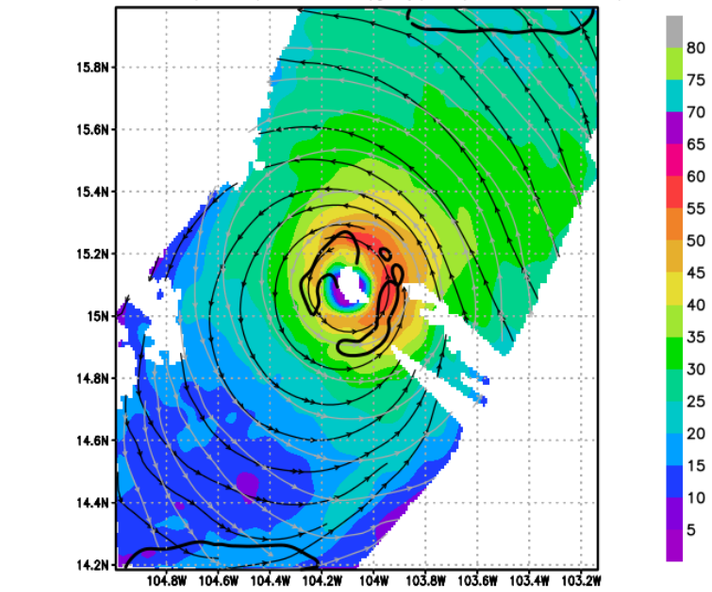
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour



Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, conto

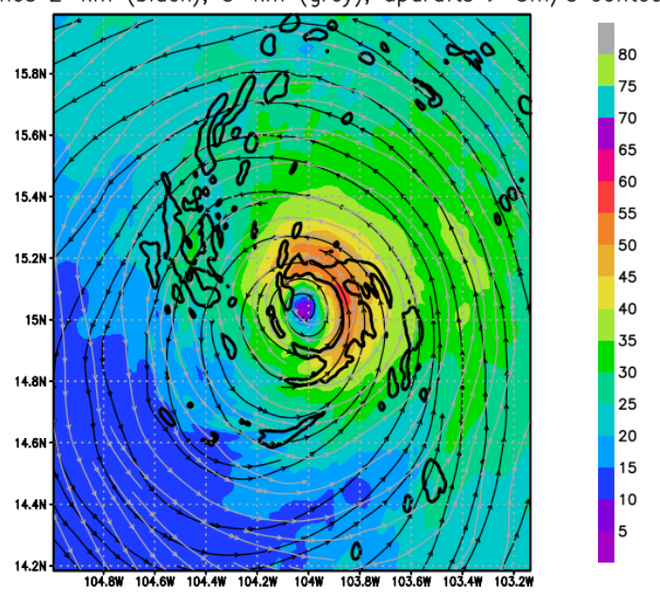


SAMURAI Patricia 20151022 1800Z pass 1 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



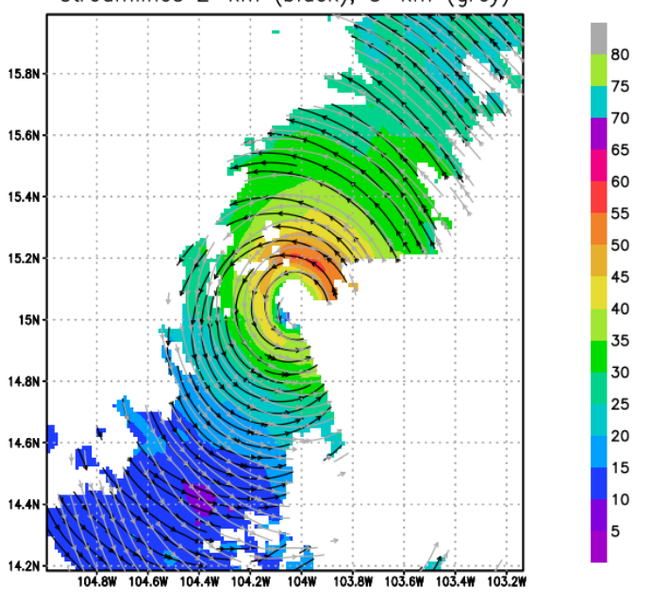
2-km center: Lon = -104.13 Lat = 15.088 5-km center: Lon = -104.121 Lat = 15.0338

Patricia 20151022 1730Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



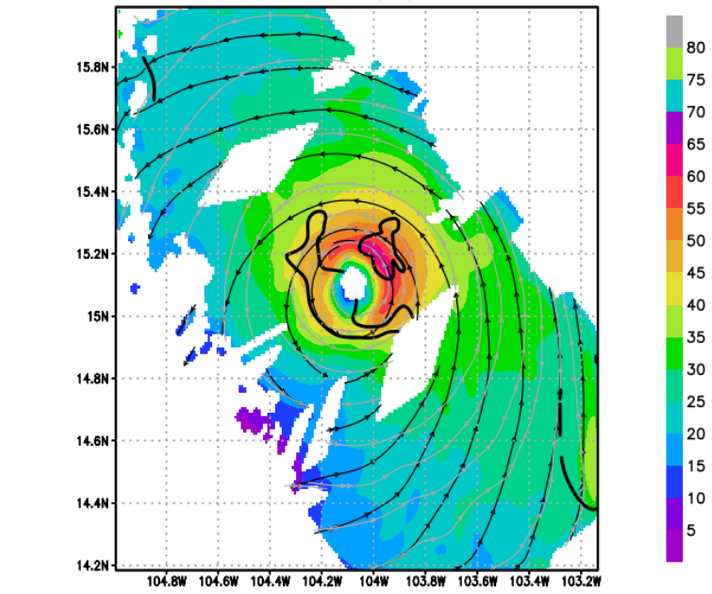
2-km center: Lon = -104.024 Lat = 15.0276 5-km center: Lon = -104.002 Lat = 15.0276

Patricia 20151022 1739Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey)



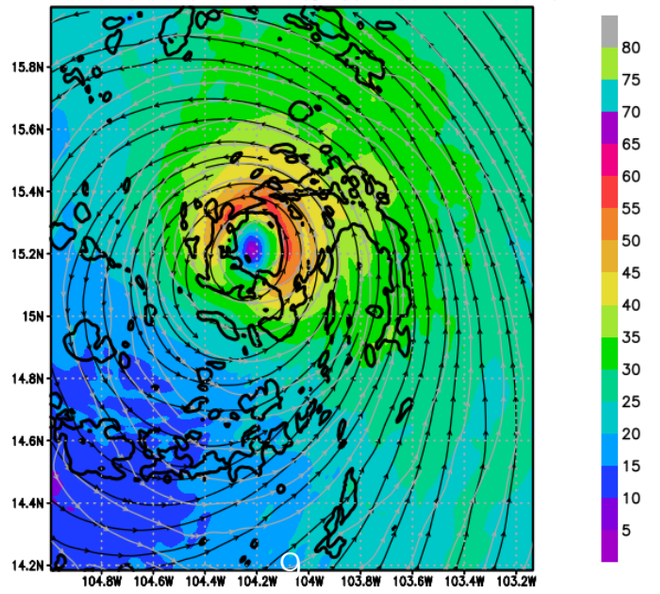
2-km center: Lon = -104.034 Lat = 15.0106 5-km center: Lon = -104.021 Lat = 15.0106

SAMURAI Patricia 20151022 1800Z pass 2 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



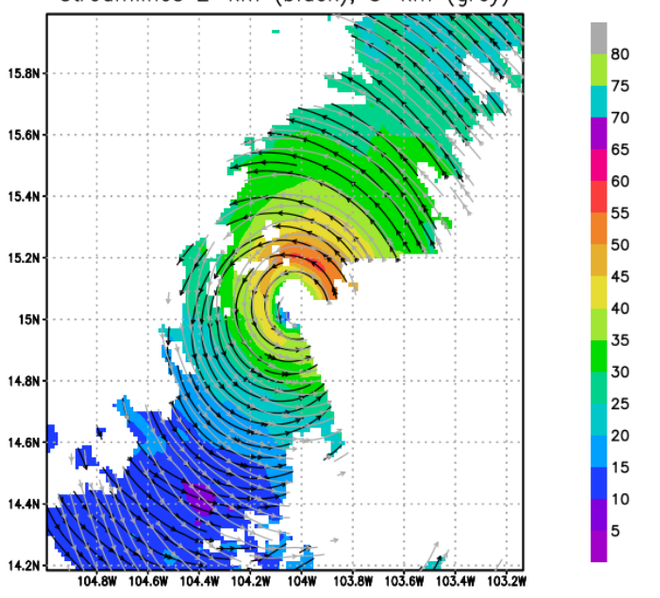
2-km center: Lon = -104.502 Lat = 14.6269 5-km center: Lon = -104.084 Lat = 15.0518

Patricia 20151022 1900Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



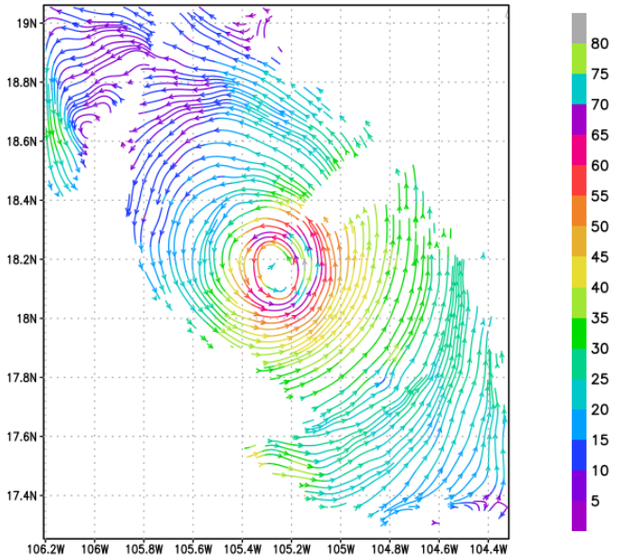
2-km center: Lon = -104.217 Lat = 15.2149 5-km center: Lon = -104.842 Lat = 14.1065

Patricia 20151022 1855Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey)

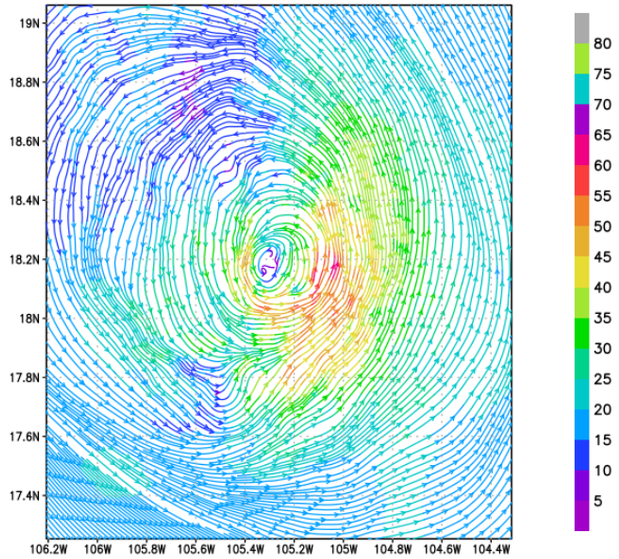


2-km center: Lon = -104.034 Lat = 15.0106 5-km center: Lon = -104.021 Lat = 15.0106

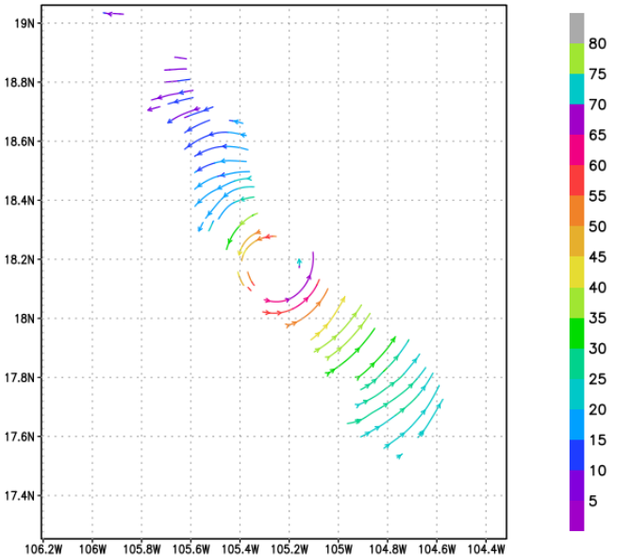
SAMURAI Patricia 20151023 1730Z 11.5 km Wind Velocity [m/s]



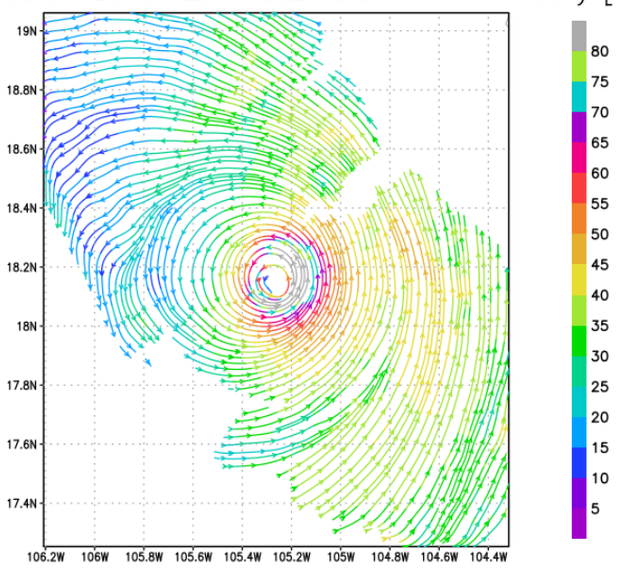
HEDAS Patricia 20151023 1730Z 200 hPa Wind Velocity [m/s]



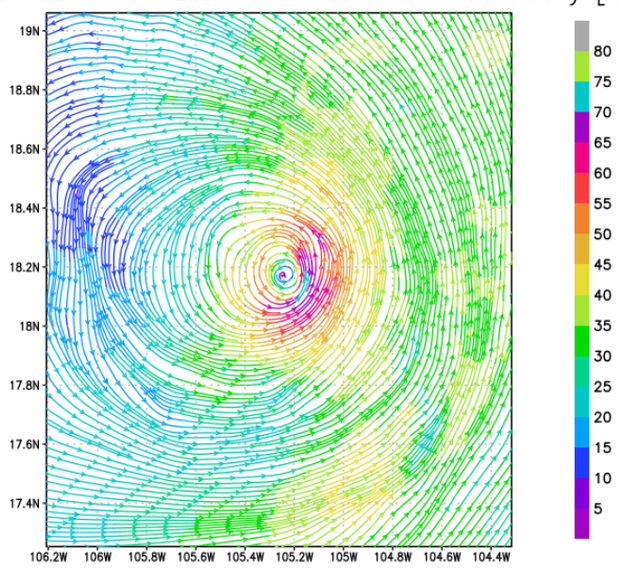
151023I1 PATRICIA at 12 km (m/s) Valid 20151023 1733Z



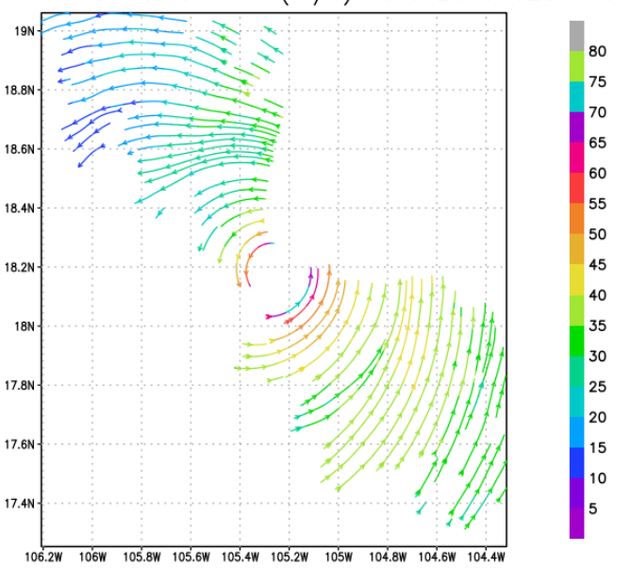
SAMURAI Patricia 20151023 1730Z 5.5 km Wind Velocity [m/s]



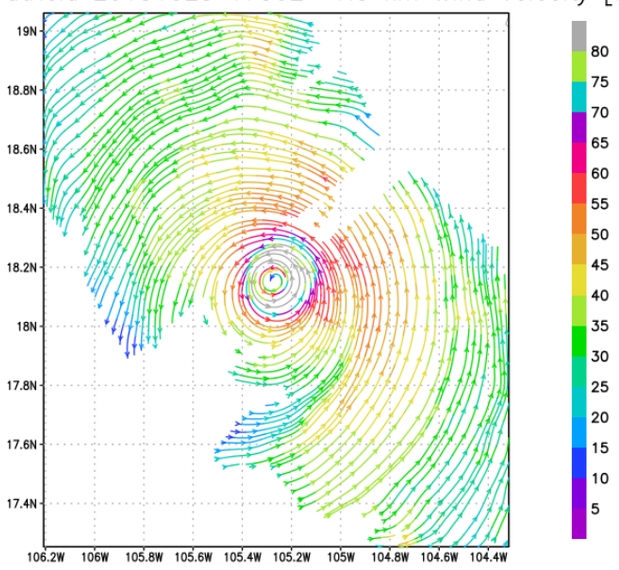
HEDAS Patricia 20151023 1730Z 500 hPa Wind Velocity [m/s]



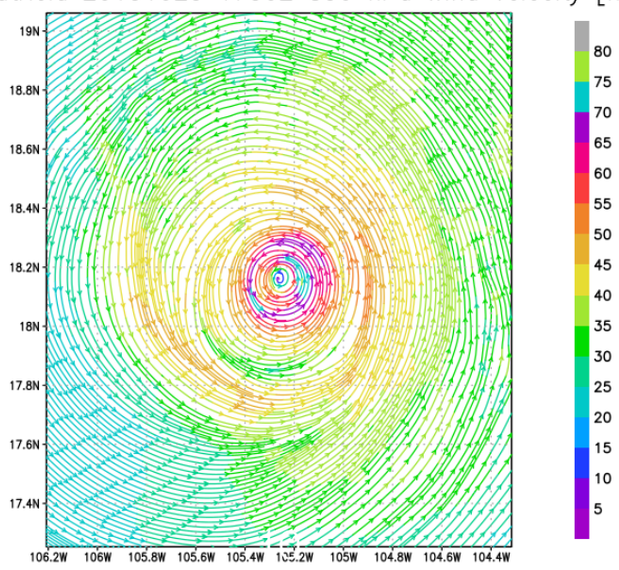
151023I1 PATRICIA at 5.5 km (m/s) Valid 20151023 1733Z



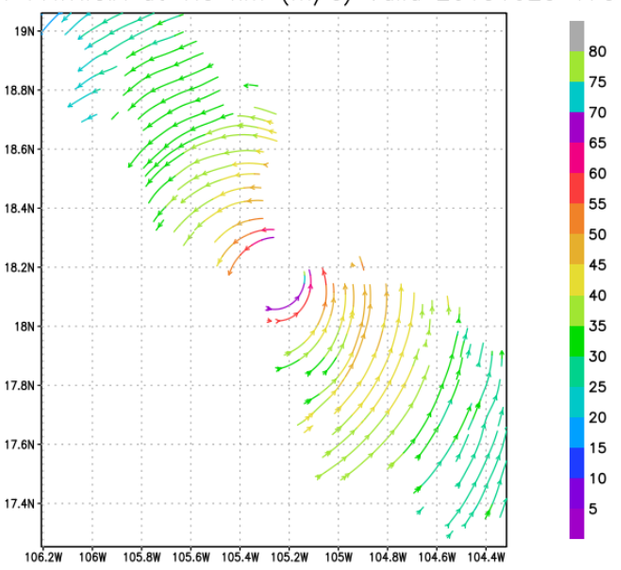
SAMURAI Patricia 20151023 1730Z 1.5 km Wind Velocity [m/s]



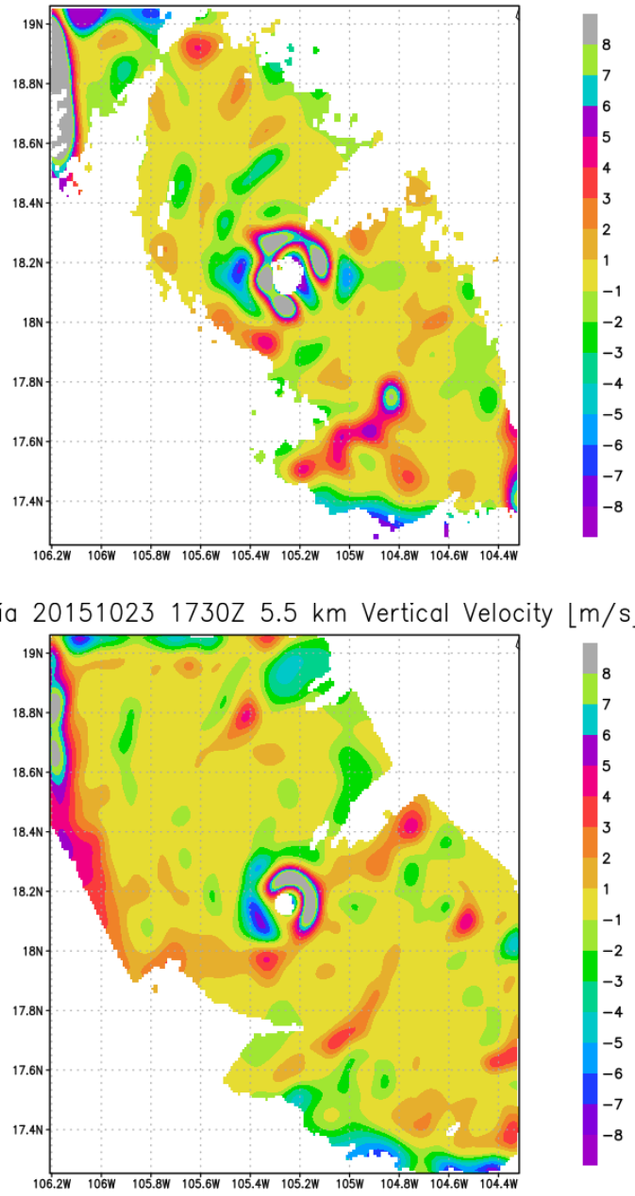
HEDAS Patricia 20151023 1730Z 850 hPa Wind Velocity [m/s]



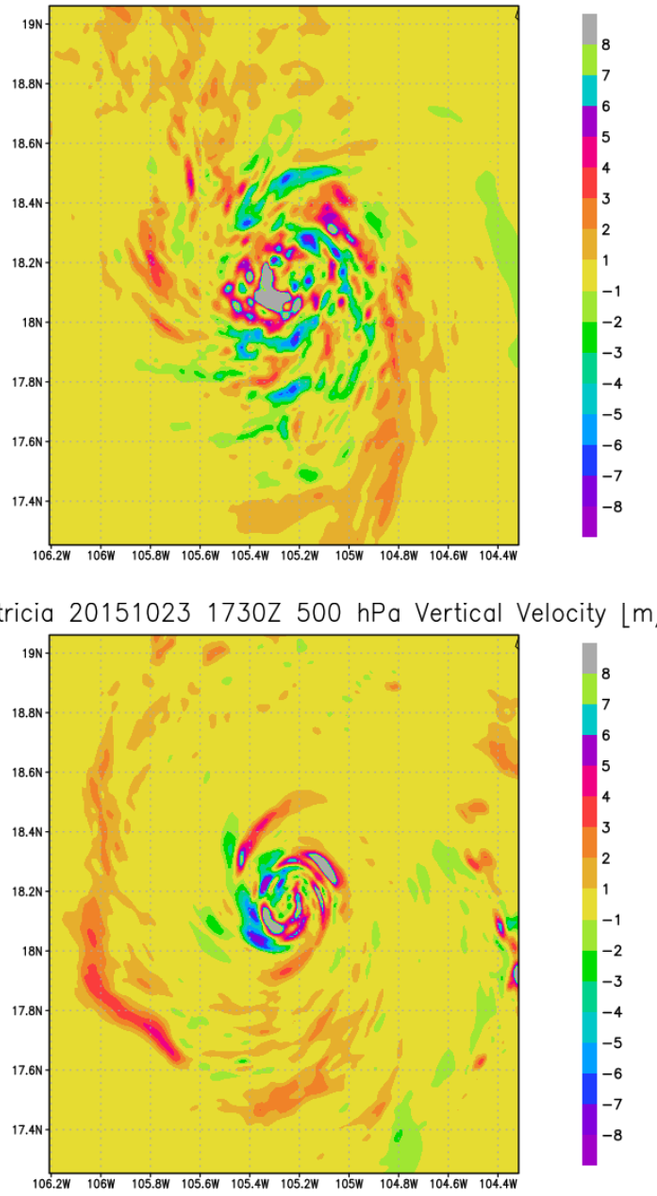
151023I1 PATRICIA at 1.5 km (m/s) Valid 20151023 1733Z



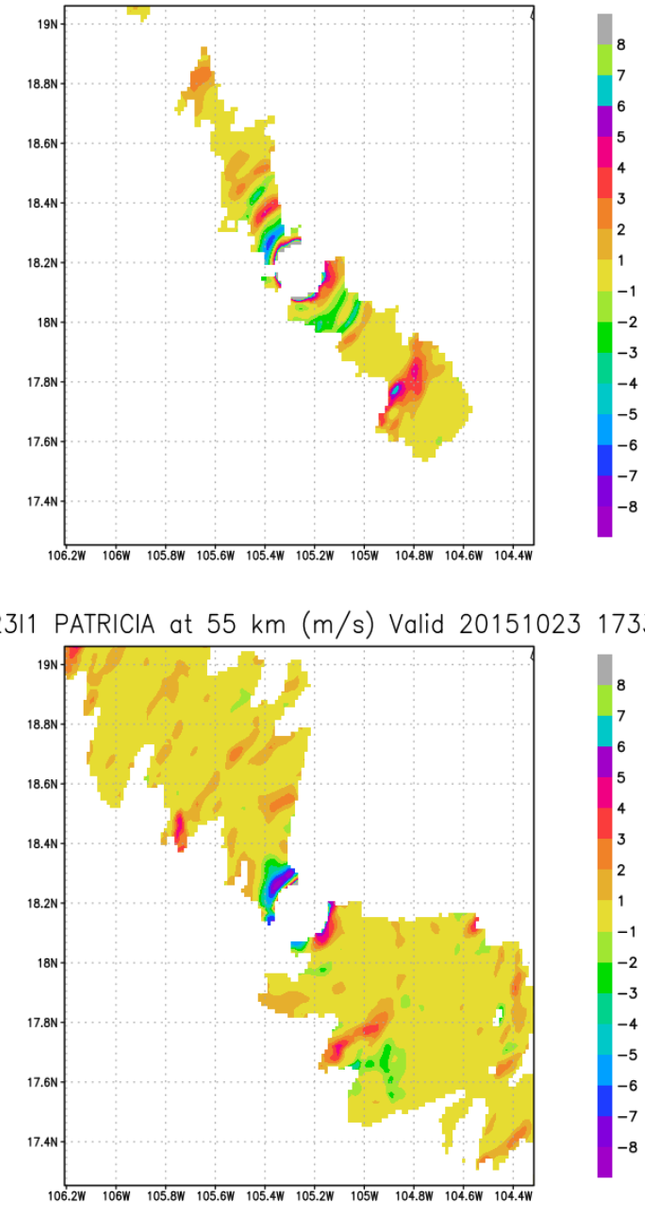
Patricia 20151023 1730Z 12.0 km Vertical Velocity [m/s]



HEDAS Patricia 20151023 1730Z 200 hPa Vertical Velocity [m/s]



151023I1 PATRICIA at 120 km (m/s) Valid 20151023 1733Z

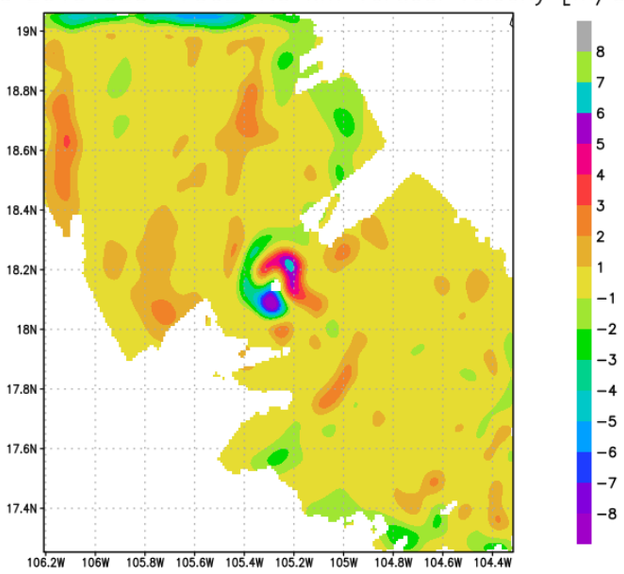


Patricia 20151023 1730Z 5.5 km Vertical Velocity [m/s]

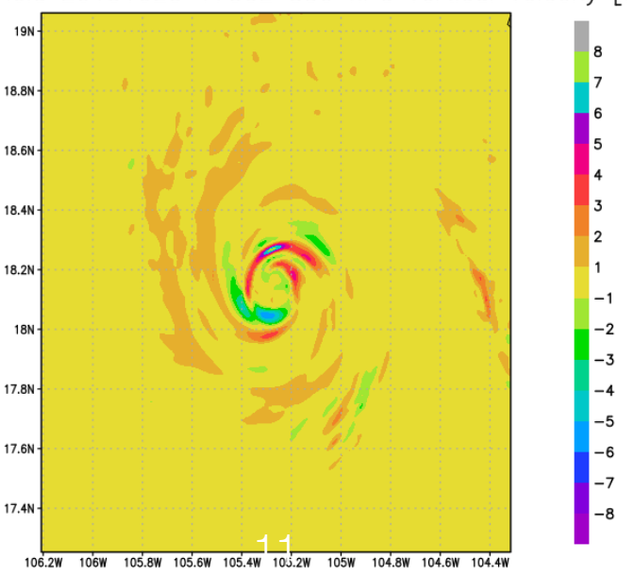
HEDAS Patricia 20151023 1730Z 500 hPa Vertical Velocity [m/s]

151023I1 PATRICIA at 55 km (m/s) Valid 20151023 1733Z

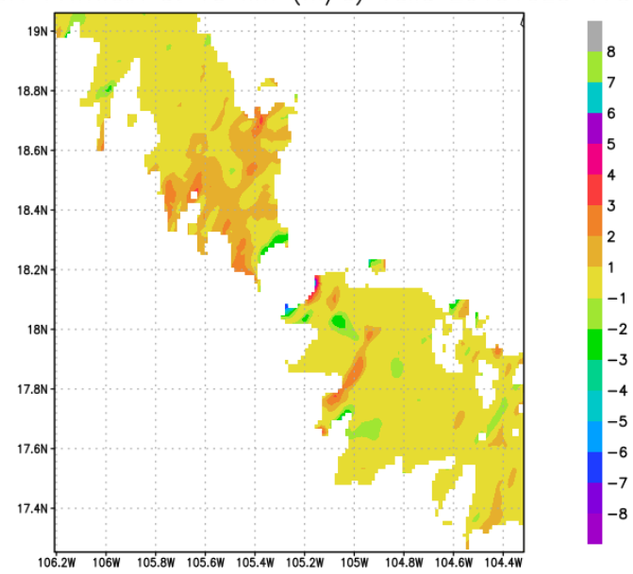
Patricia 20151023 1730Z 1.5 km Vertical Velocity [m/s]



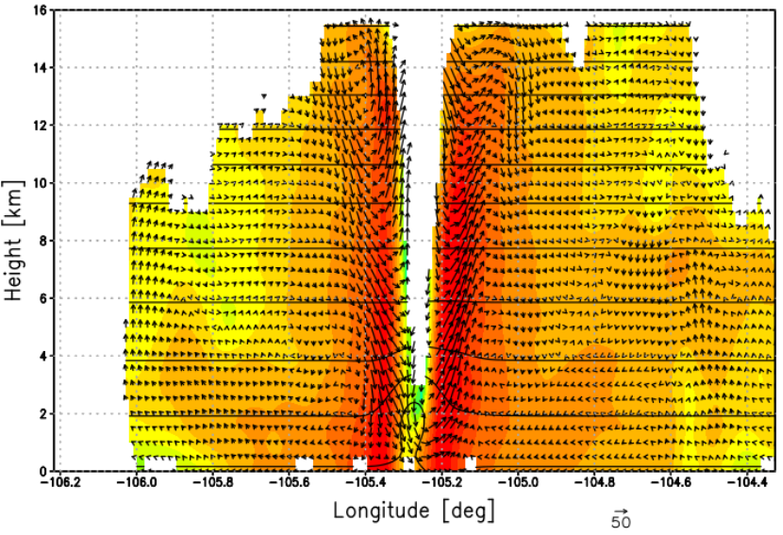
HEDAS Patricia 20151023 1730Z 850 hPa Vertical Velocity [m/s]



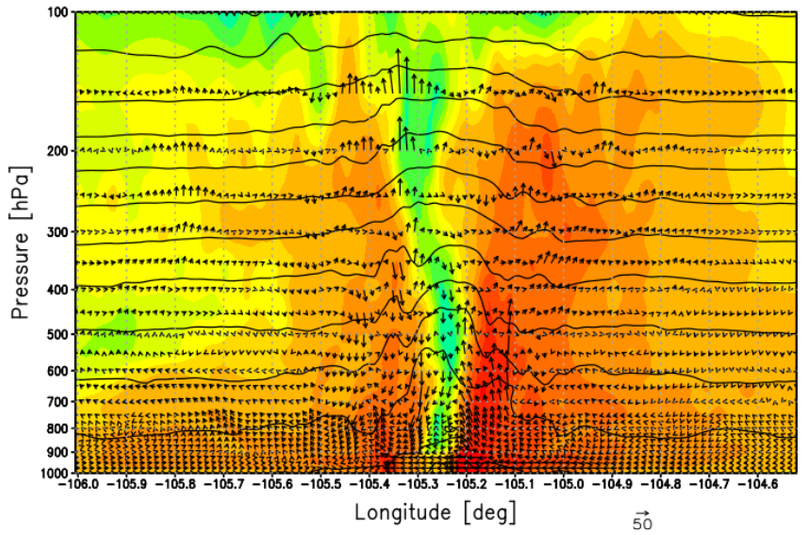
151023I1 PATRICIA at 15 km (m/s) Valid 20151023 1733Z



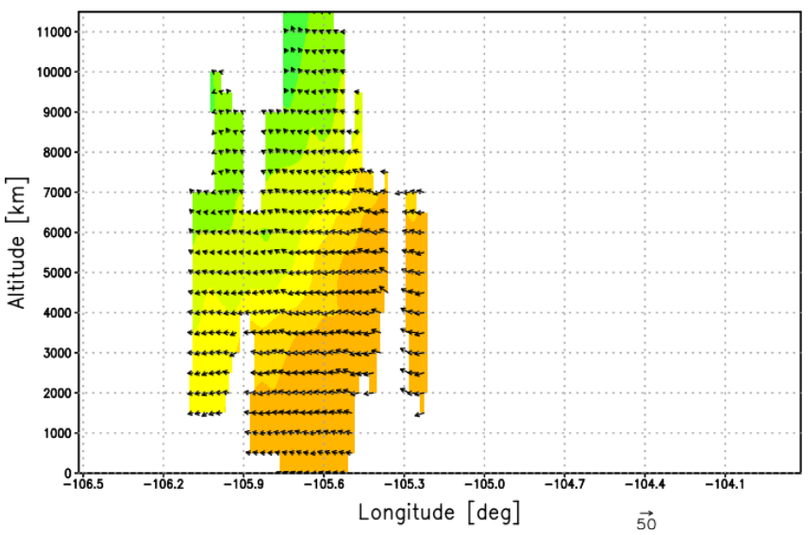
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231730



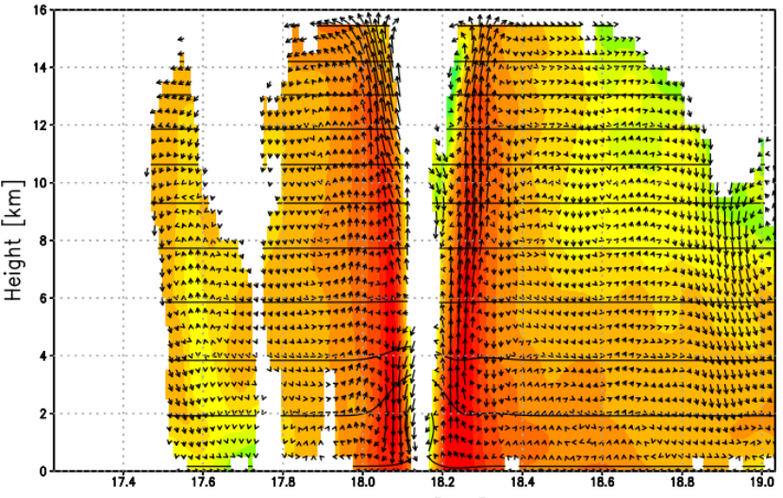
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231730



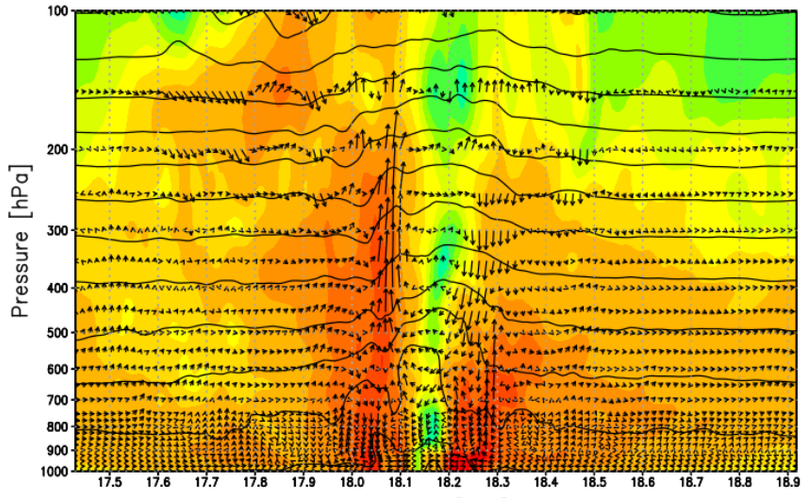
E–W X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231733



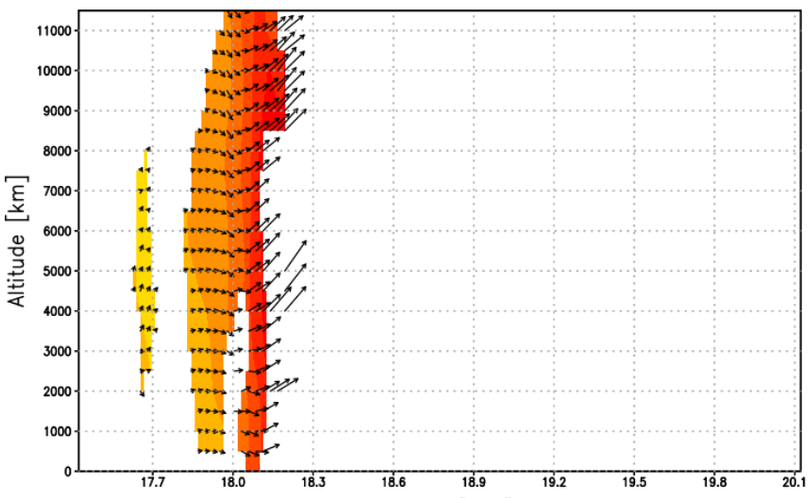
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231730



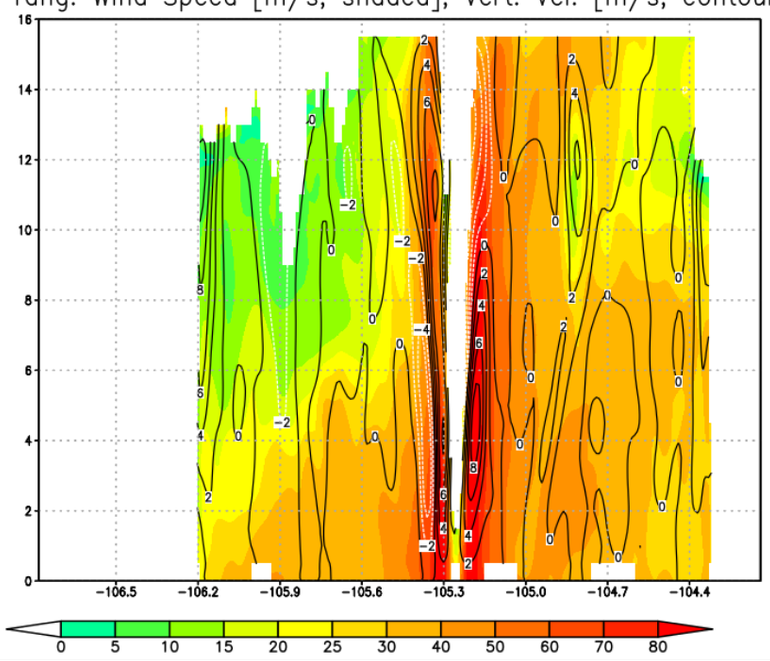
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231730



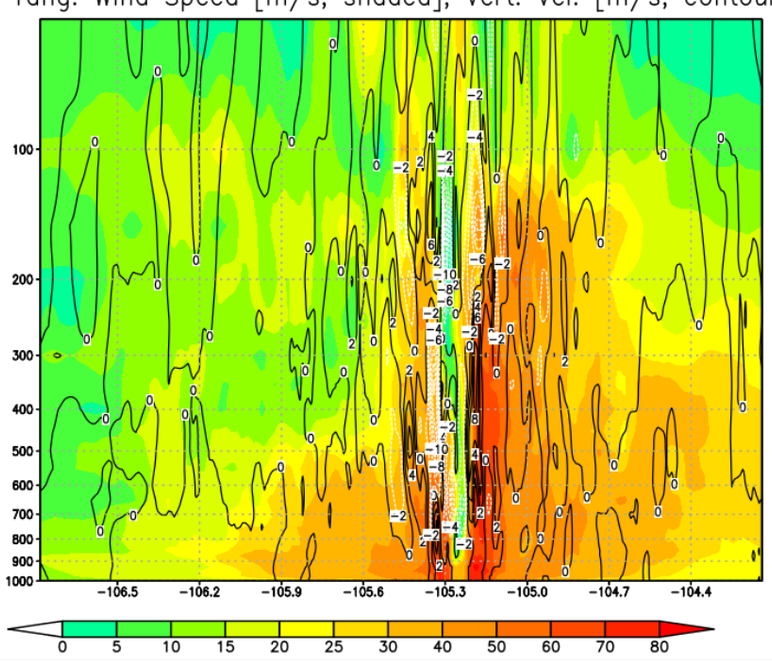
N–S X–Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510231733



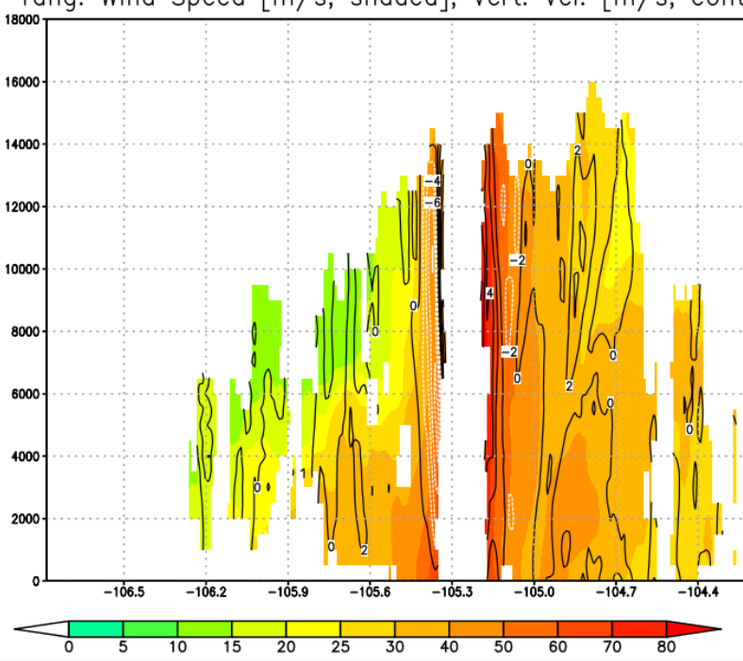
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



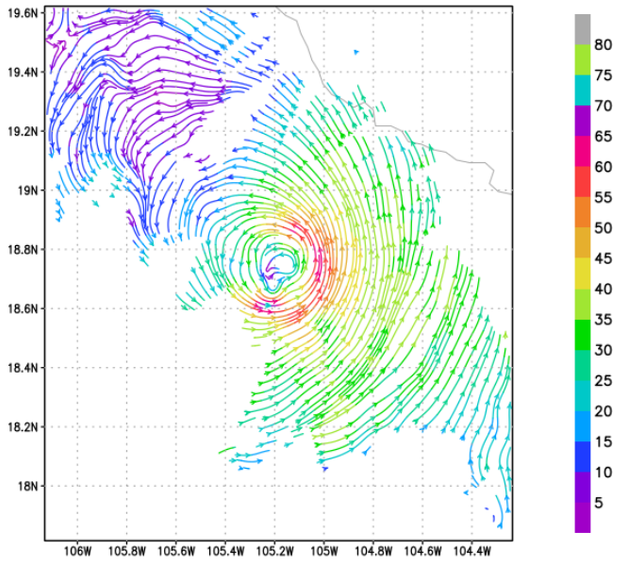
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



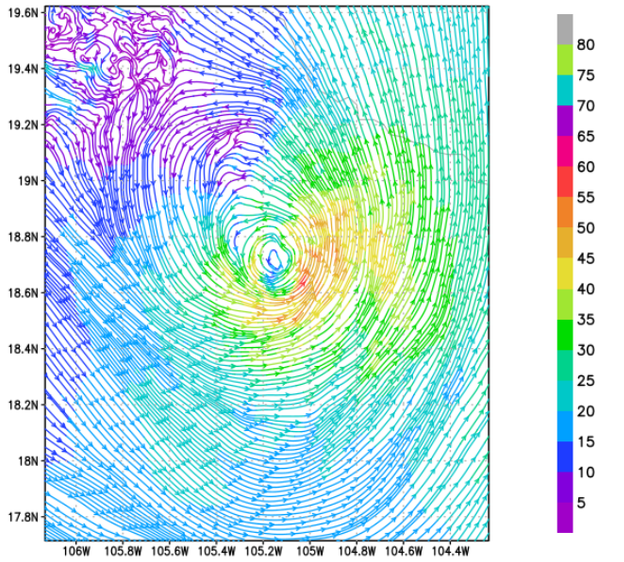
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



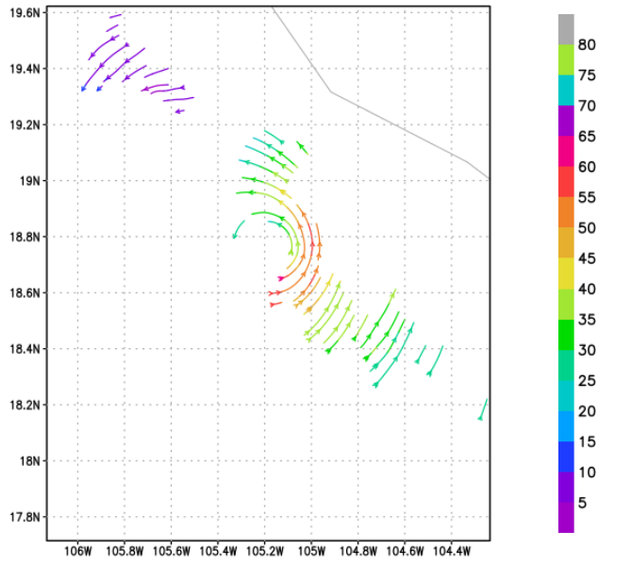
SAMURAI Patricia 20151023 2030Z 11.5 km Wind Velocity [m/s]



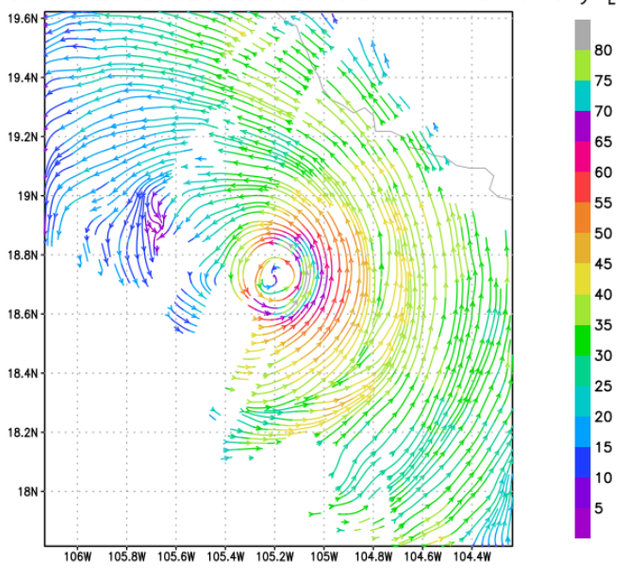
HEDAS Patricia 20151023 2030Z 200 hPa Wind Velocity [m/s]



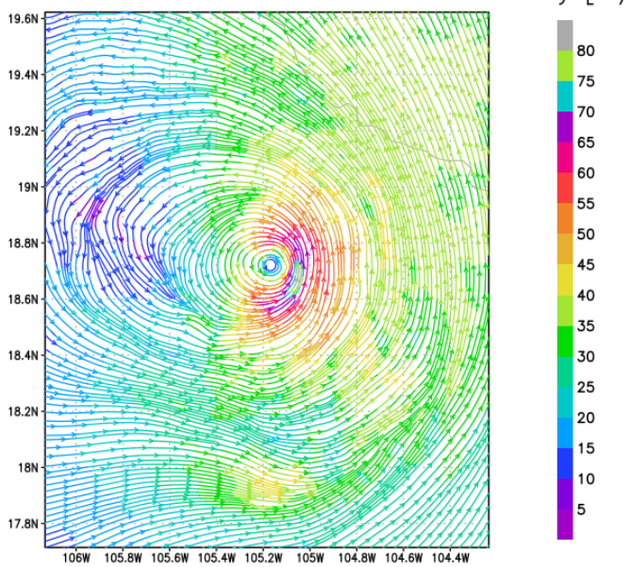
151023I1 PATRICIA at 12 km (m/s) Valid 20151023 2033Z



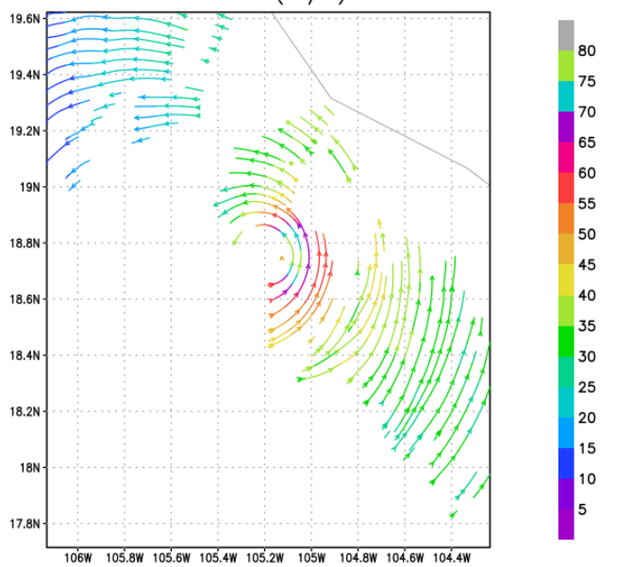
SAMURAI Patricia 20151023 2030Z 5.5 km Wind Velocity [m/s]



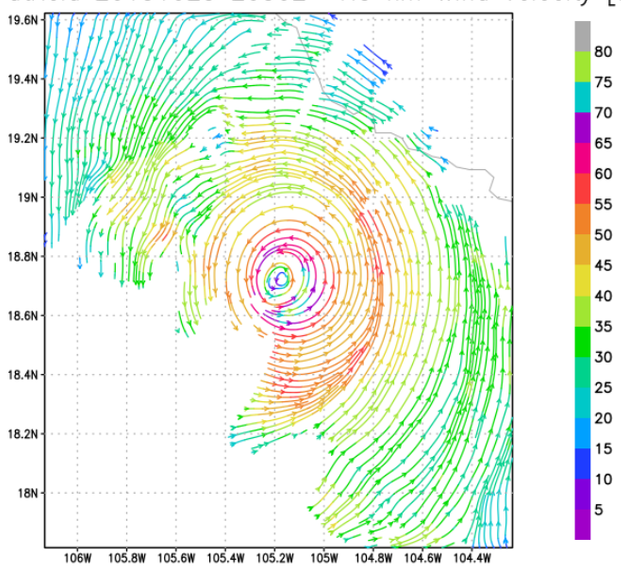
HEDAS Patricia 20151023 2030Z 500 hPa Wind Velocity [m/s]



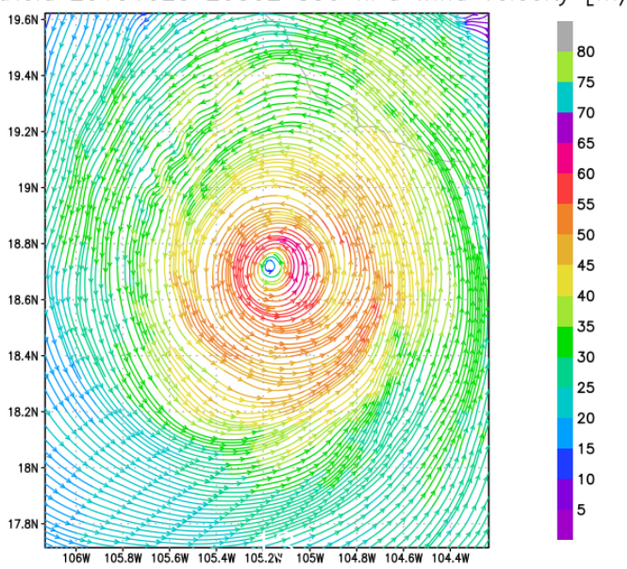
151023I1 PATRICIA at 5.5 km (m/s) Valid 20151023 2033Z



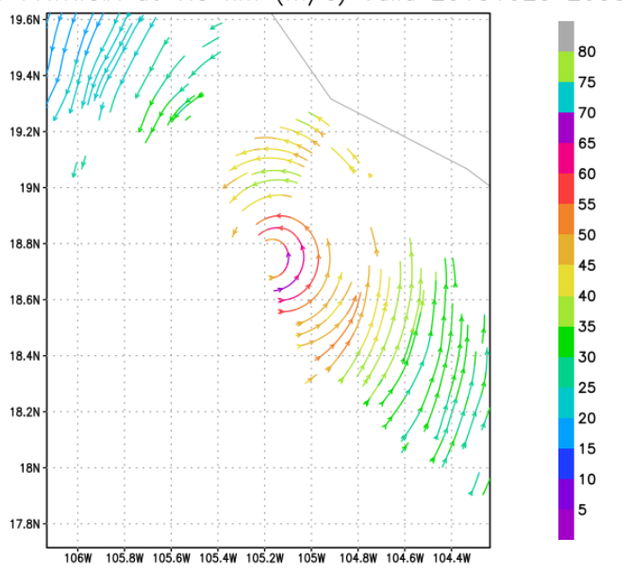
SAMURAI Patricia 20151023 2030Z 1.5 km Wind Velocity [m/s]



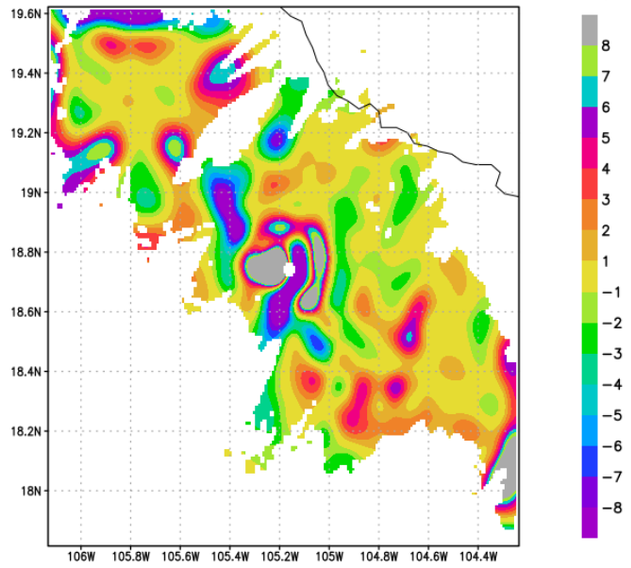
HEDAS Patricia 20151023 2030Z 850 hPa Wind Velocity [m/s]



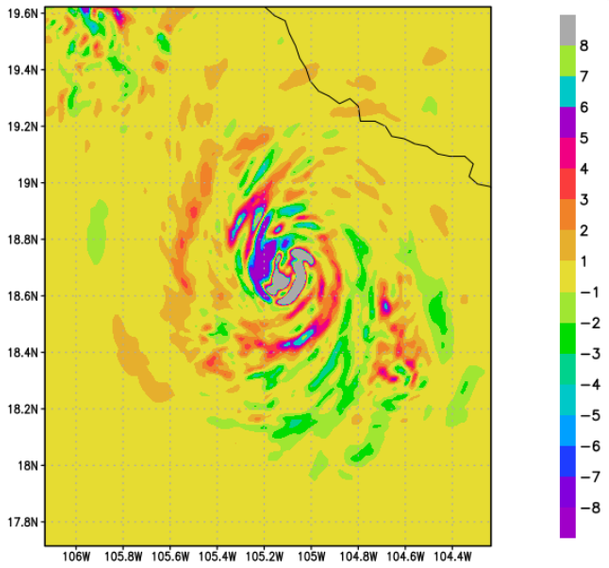
151023I1 PATRICIA at 1.5 km (m/s) Valid 20151023 2033Z



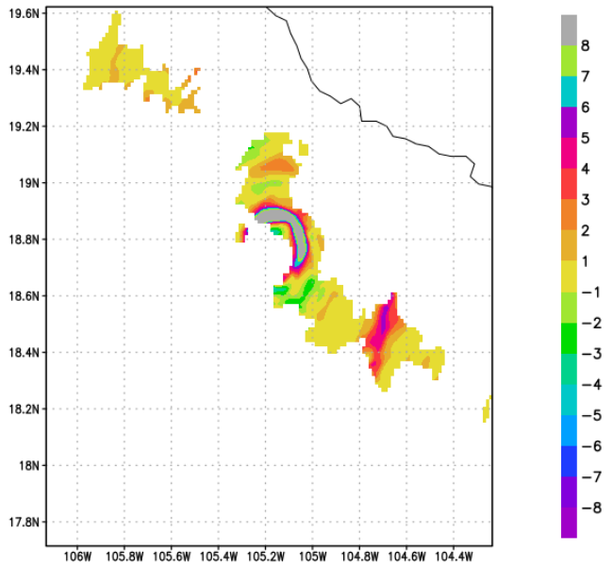
SAMURAI Patricia 20151023 2030Z 12.0 km Vertical Velocity [r



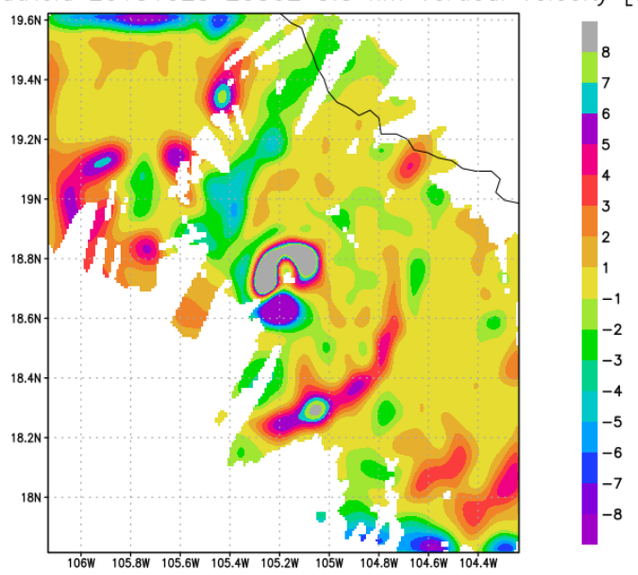
HEDAS Patricia 20151023 2030Z 200 hPa Vertical Velocity [m/s]



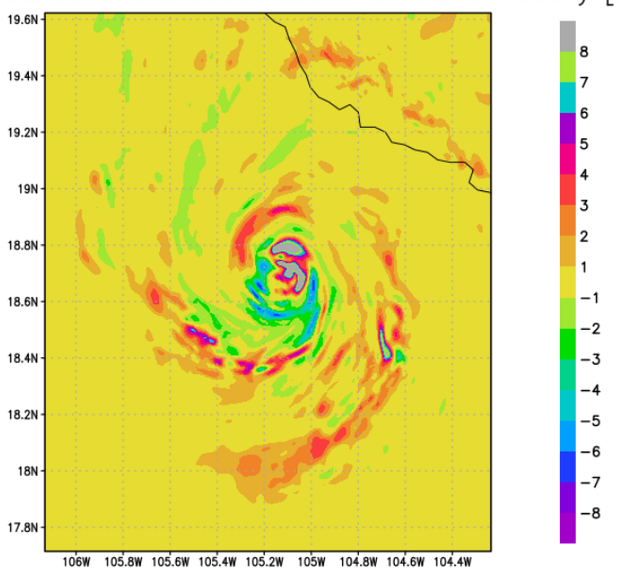
151023I1 PATRICIA at 120 km (m/s) Valid 20151023 2033Z



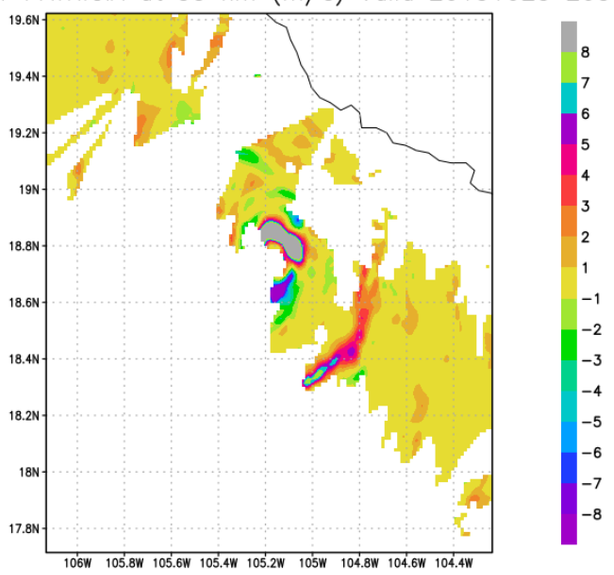
SAMURAI Patricia 20151023 2030Z 5.5 km Vertical Velocity [m



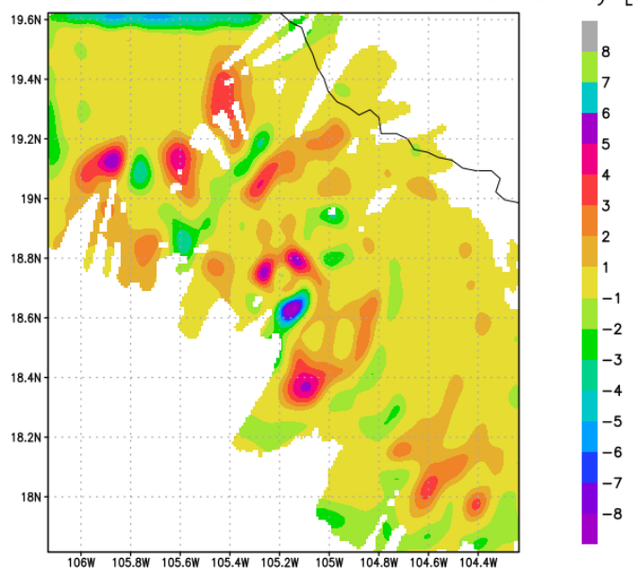
HEDAS Patricia 20151023 2030Z 500 hPa Vertical Velocity [m/s]



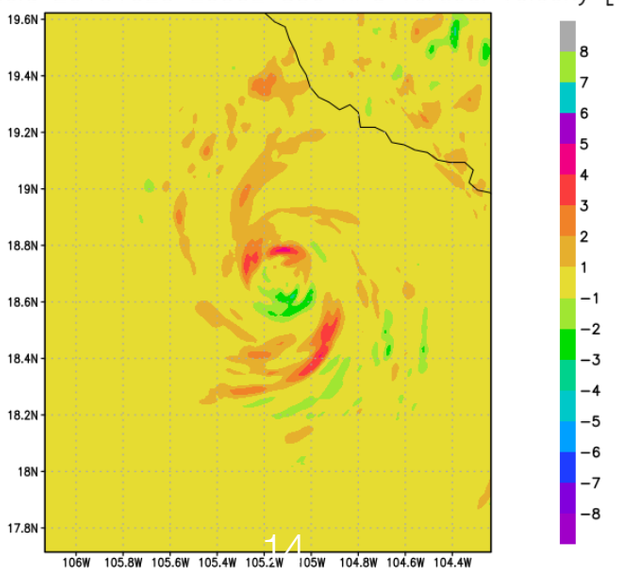
151023I1 PATRICIA at 55 km (m/s) Valid 20151023 2033Z



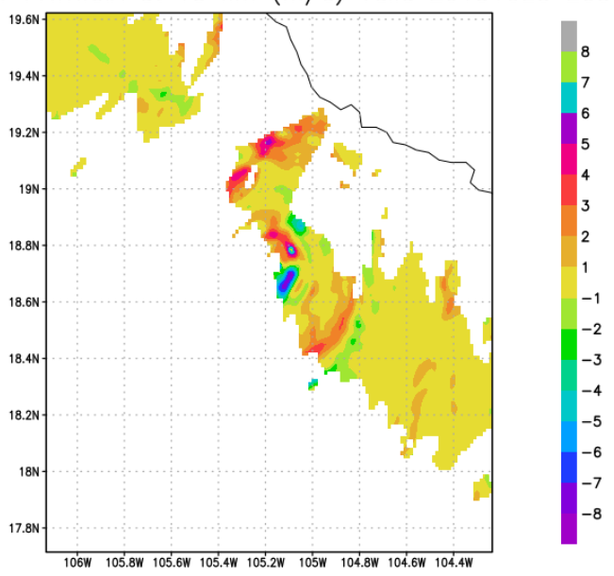
SAMURAI Patricia 20151023 2030Z 1.5 km Vertical Velocity [m



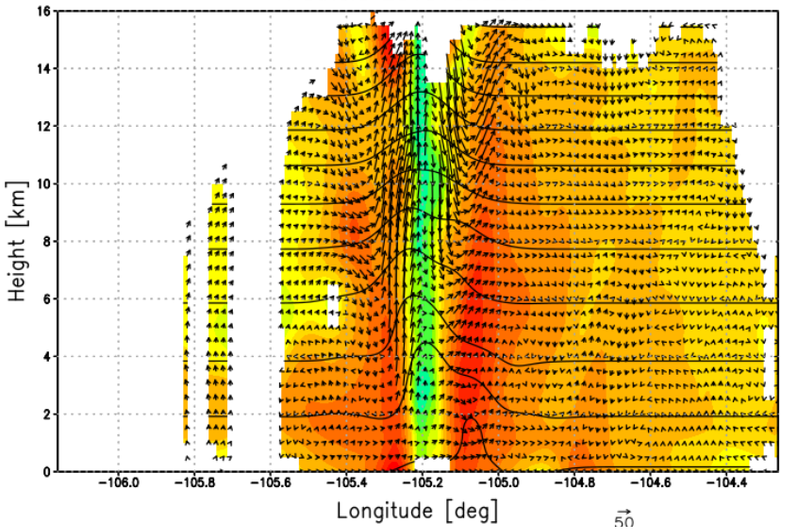
HEDAS Patricia 20151023 2030Z 850 hPa Vertical Velocity [m/s]



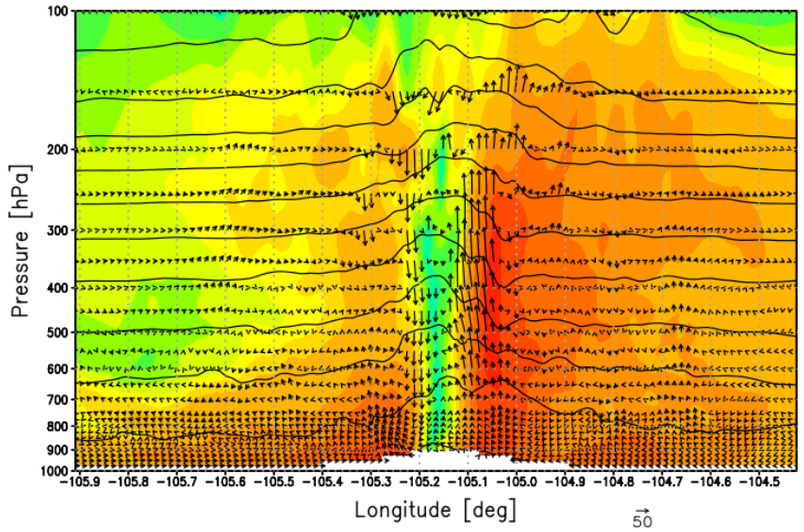
151023I1 PATRICIA at 15 km (m/s) Valid 20151023 2033Z



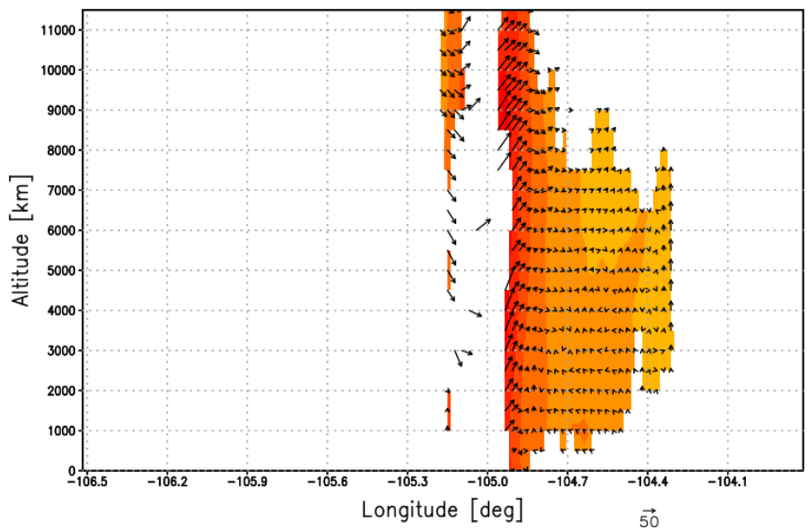
E-W X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232030



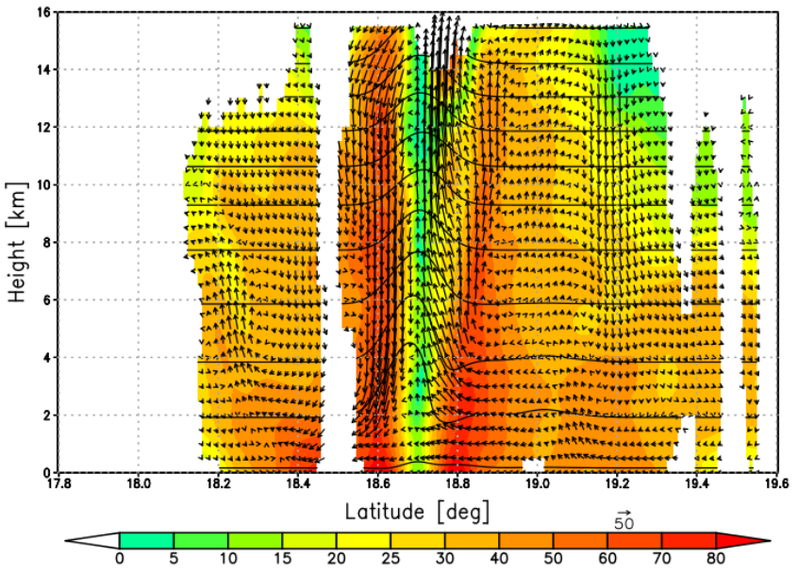
E-W X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232030



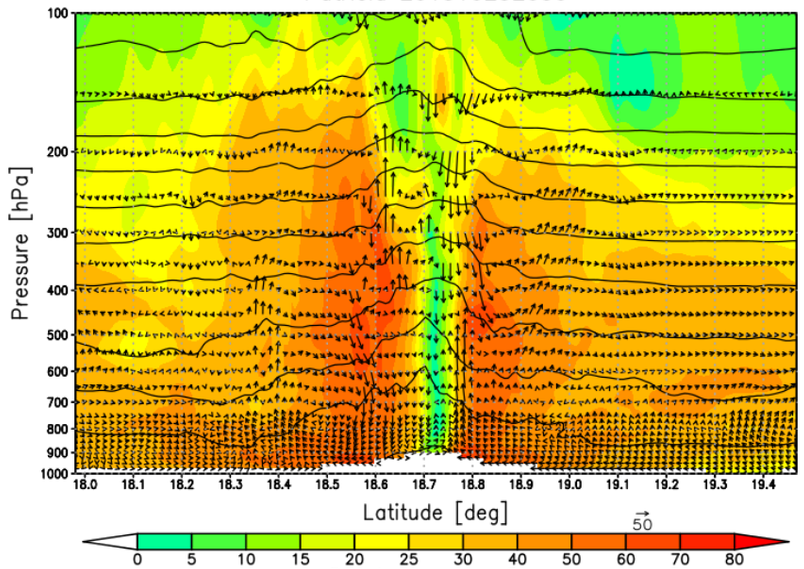
E-W X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232033



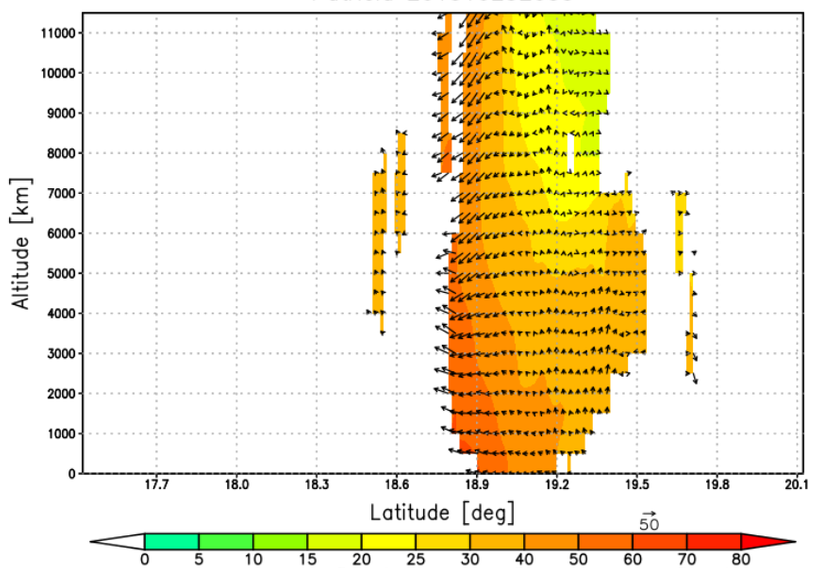
N-S X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232030



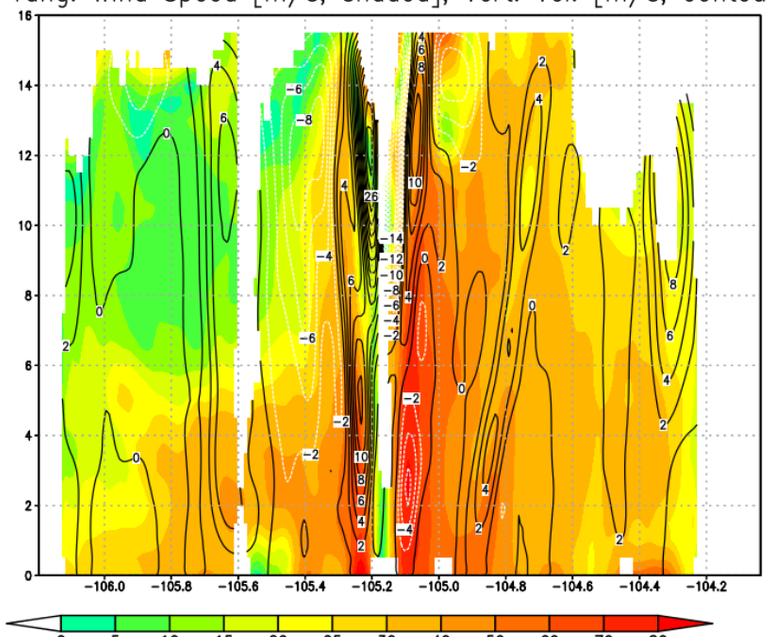
N-S X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232030



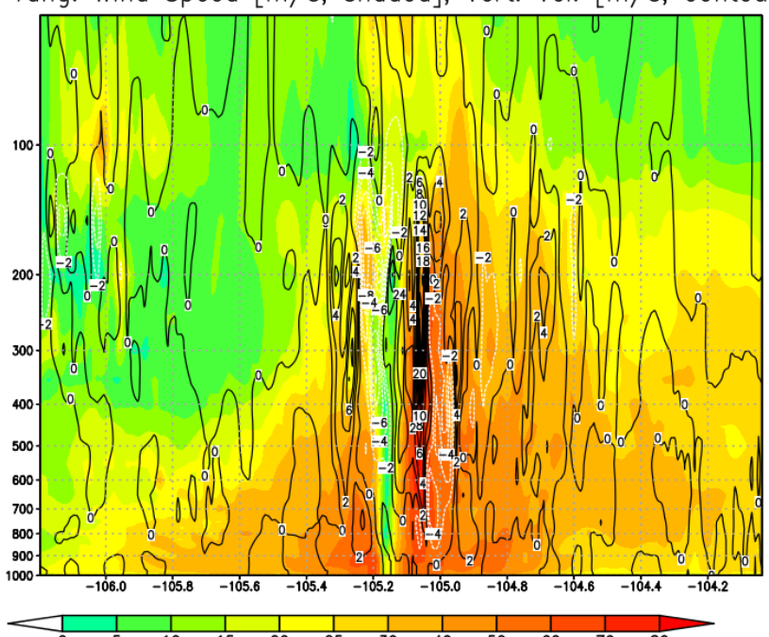
N-S X-Sec. Tang. Wind Speed [m/s, shaded], Sec. Circ. [arrows]
Patricia 201510232033



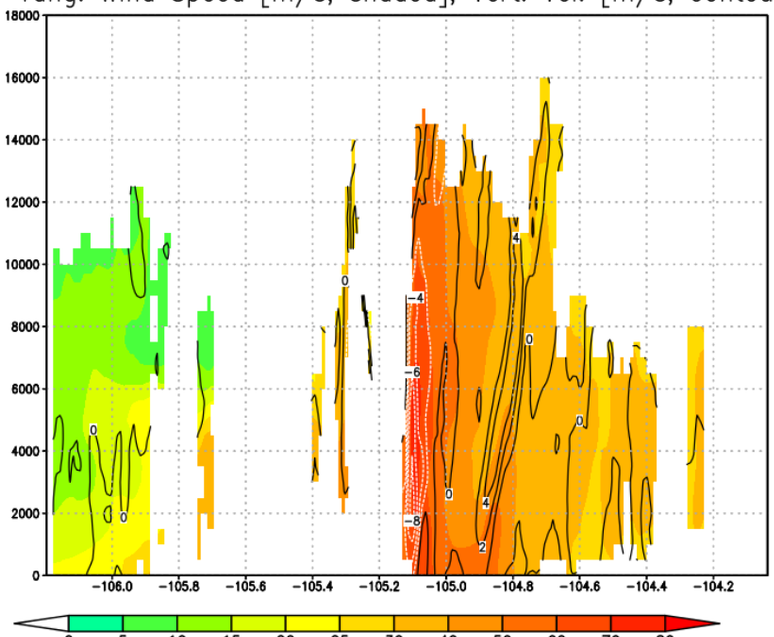
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



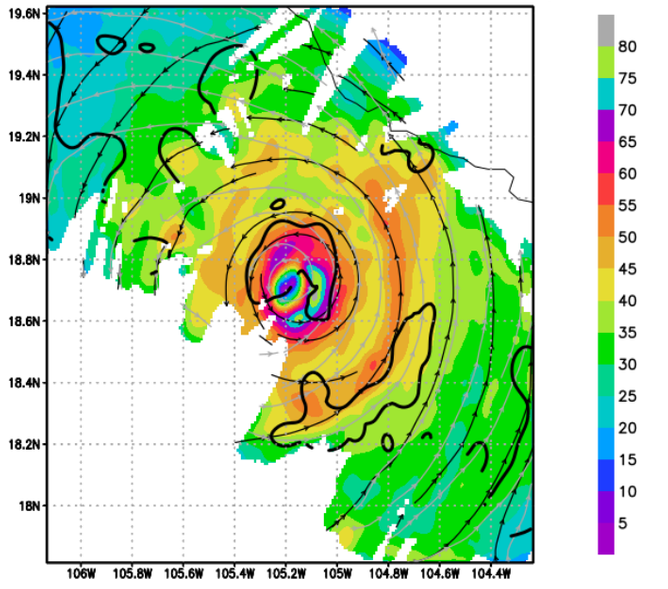
Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]



Tang. Wind Speed [m/s, shaded], Vert. Vel. [m/s, contour]

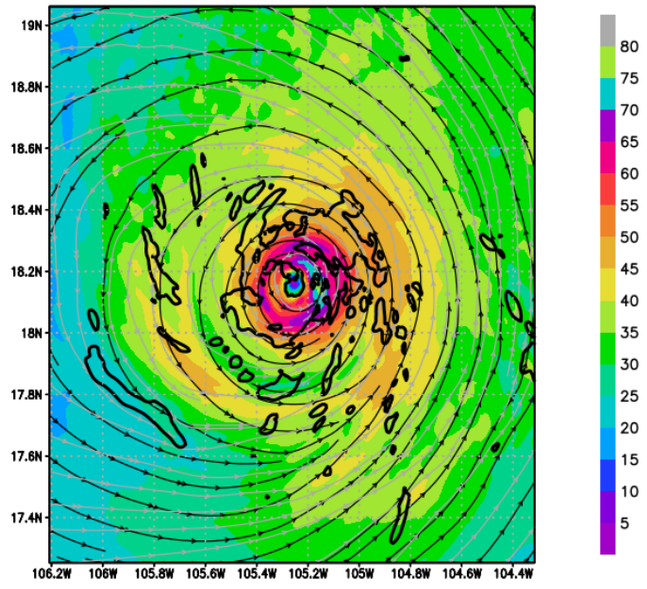


SAMURAI Patricia 20151023 2030Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



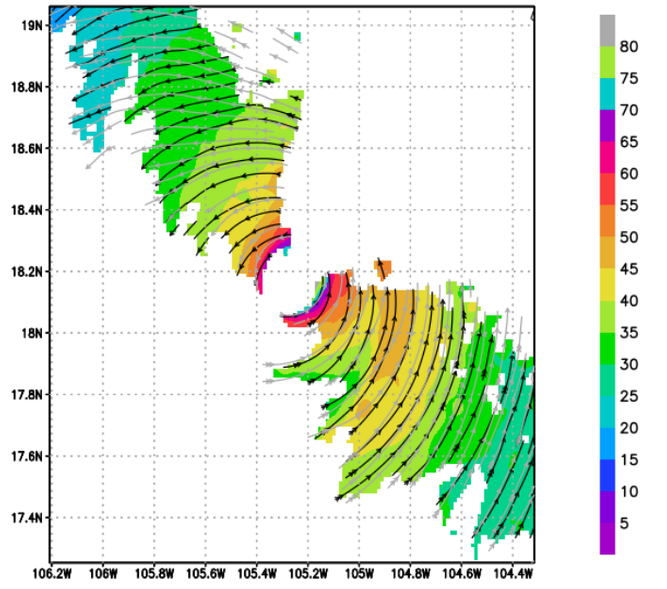
2-km center: Lon = -105.212 Lat = 18.7004 5-km center: Lon = -105.687 Lat = 18.9354

HEDAS Patricia 20151023 1730Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



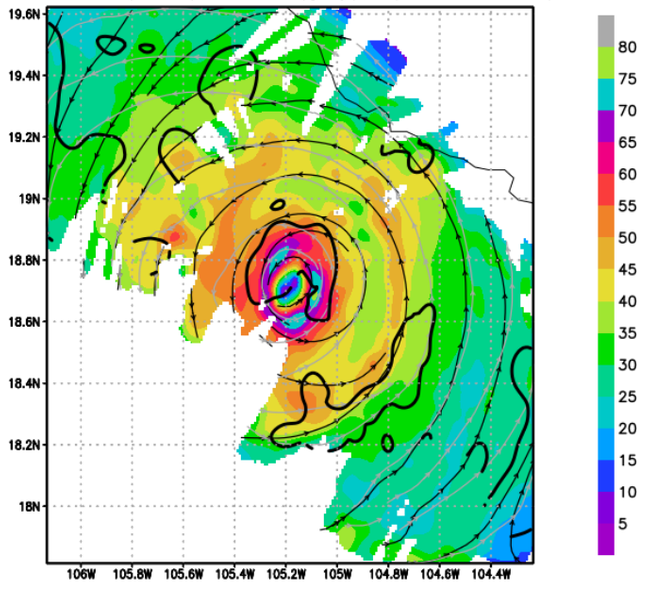
2-km center: Lon = -105.263 Lat = 18.1736 5-km center: Lon = -105.233 Lat = 18.1736

Patricia 20151023 1733Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey)



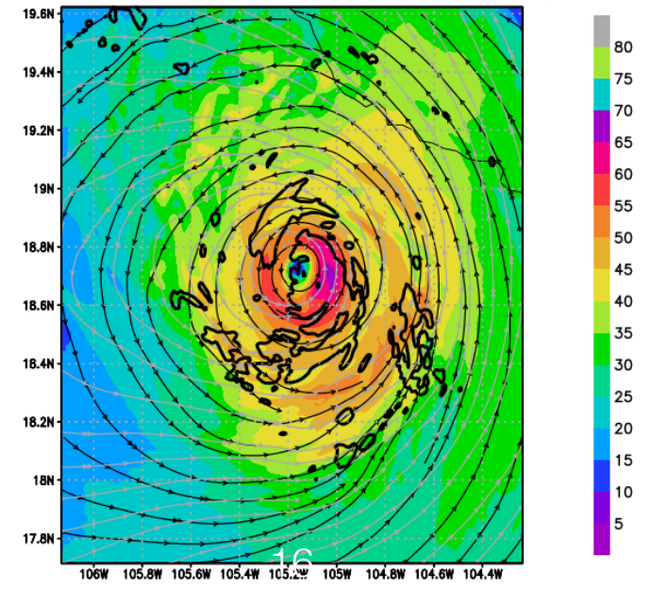
2-km center: Lon = -106.185 Lat = 19.0716 5-km center: Lon = -106.32 Lat = 19.0041

SAMURAI Patricia 20151023 2030Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



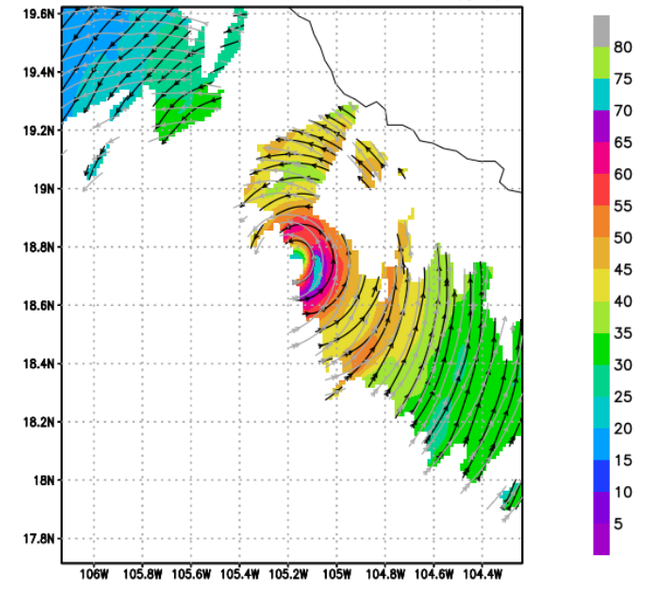
2-km center: Lon = -105.165 Lat = 18.7275 5-km center: Lon = -105.687 Lat = 18.9173

HEDAS Patricia 20151023 2030Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey), updrafts > 3m/s contour



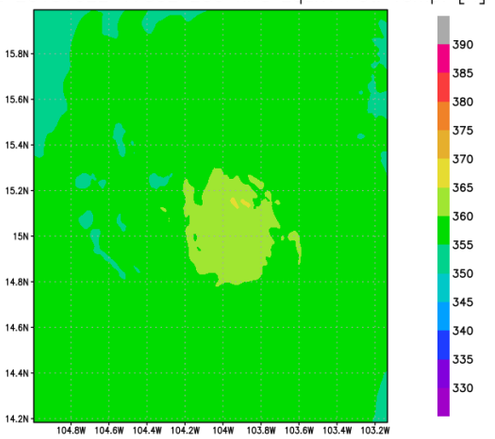
2-km center: Lon = -105.166 Lat = 18.7244 5-km center: Lon = -105.166 Lat = 18.717

Patricia 20151023 2033Z 2-km wind speed (shaded)
streamlines 2-km (black), 5-km (grey)

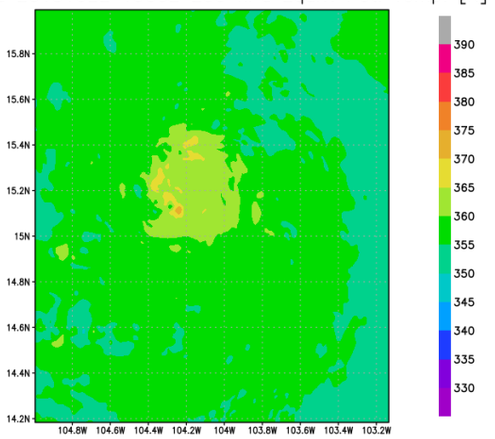


2-km center: Lon = -106.301 Lat = 19.4486 5-km center: Lon = -106.234 Lat = 19.4486

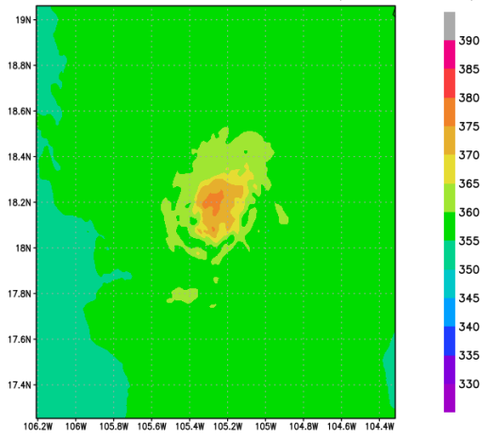
Patricia 20151022 1730Z 200 hPa Equiv. Pot. Temp. [K]



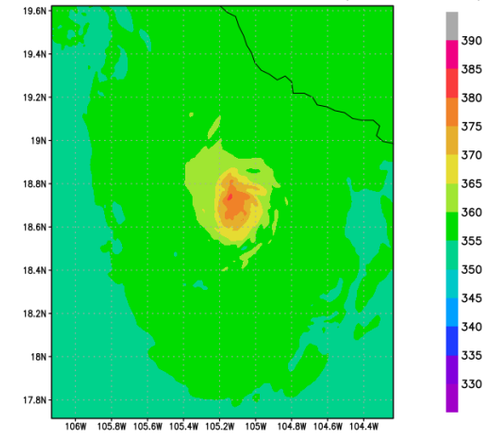
Patricia 20151022 1900Z 200 hPa Equiv. Pot. Temp. [K]



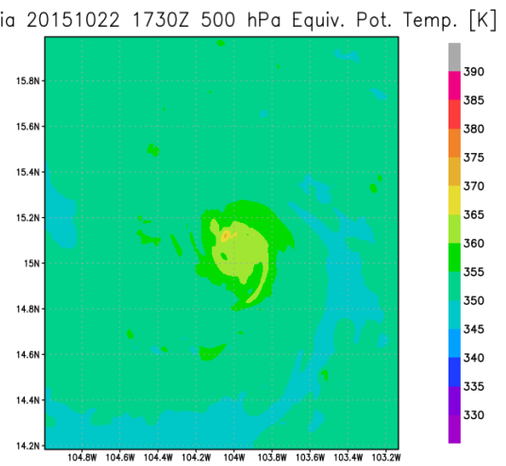
HEDAS Patricia 20151023 1730Z 200 hPa Equiv. Pot. Temp. [K]



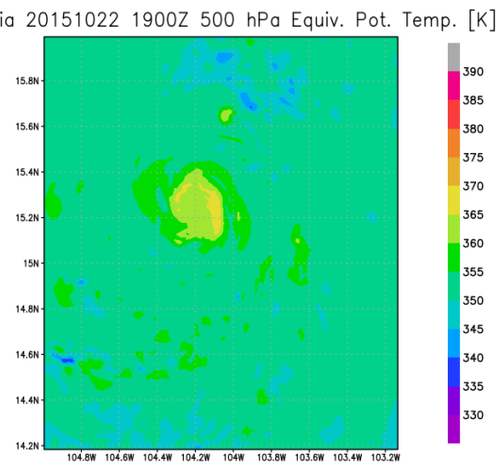
HEDAS Patricia 20151023 2030Z 200 hPa Equiv. Pot. Temp. [K]



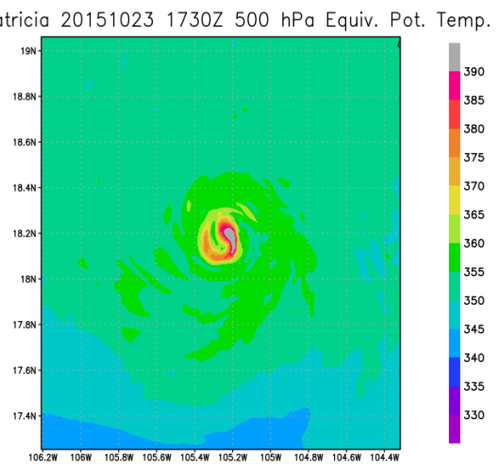
Patricia 20151022 1730Z 500 hPa Equiv. Pot. Temp. [K]



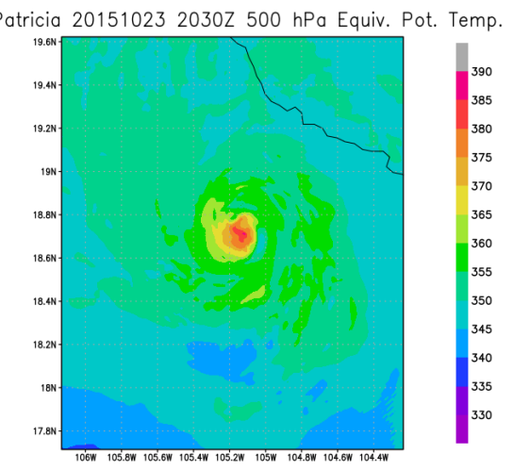
Patricia 20151022 1900Z 500 hPa Equiv. Pot. Temp. [K]



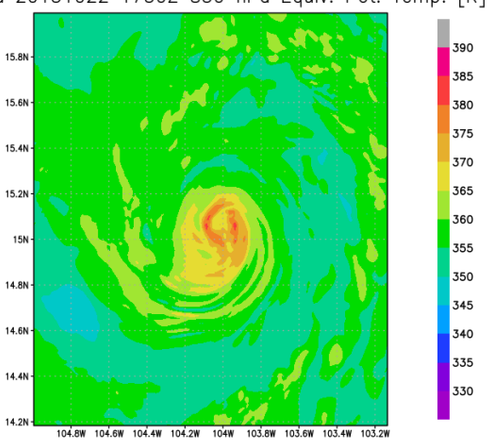
HEDAS Patricia 20151023 1730Z 500 hPa Equiv. Pot. Temp. [K]



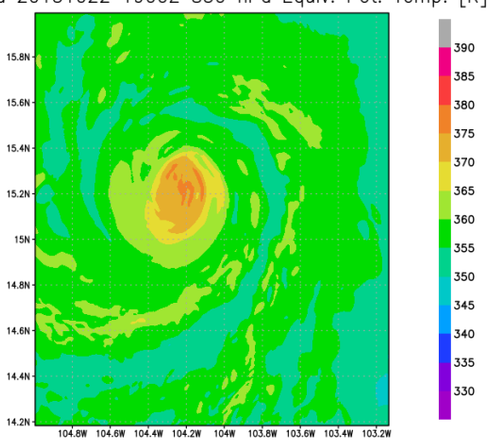
HEDAS Patricia 20151023 2030Z 500 hPa Equiv. Pot. Temp. [K]



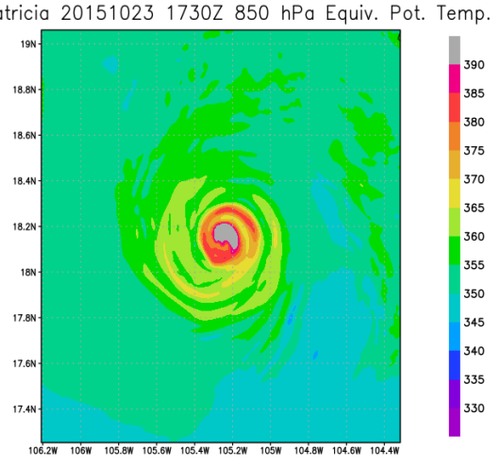
Patricia 20151022 1730Z 850 hPa Equiv. Pot. Temp. [K]



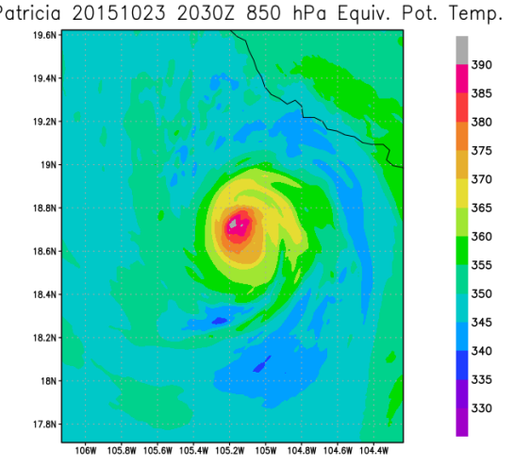
Patricia 20151022 1900Z 850 hPa Equiv. Pot. Temp. [K]



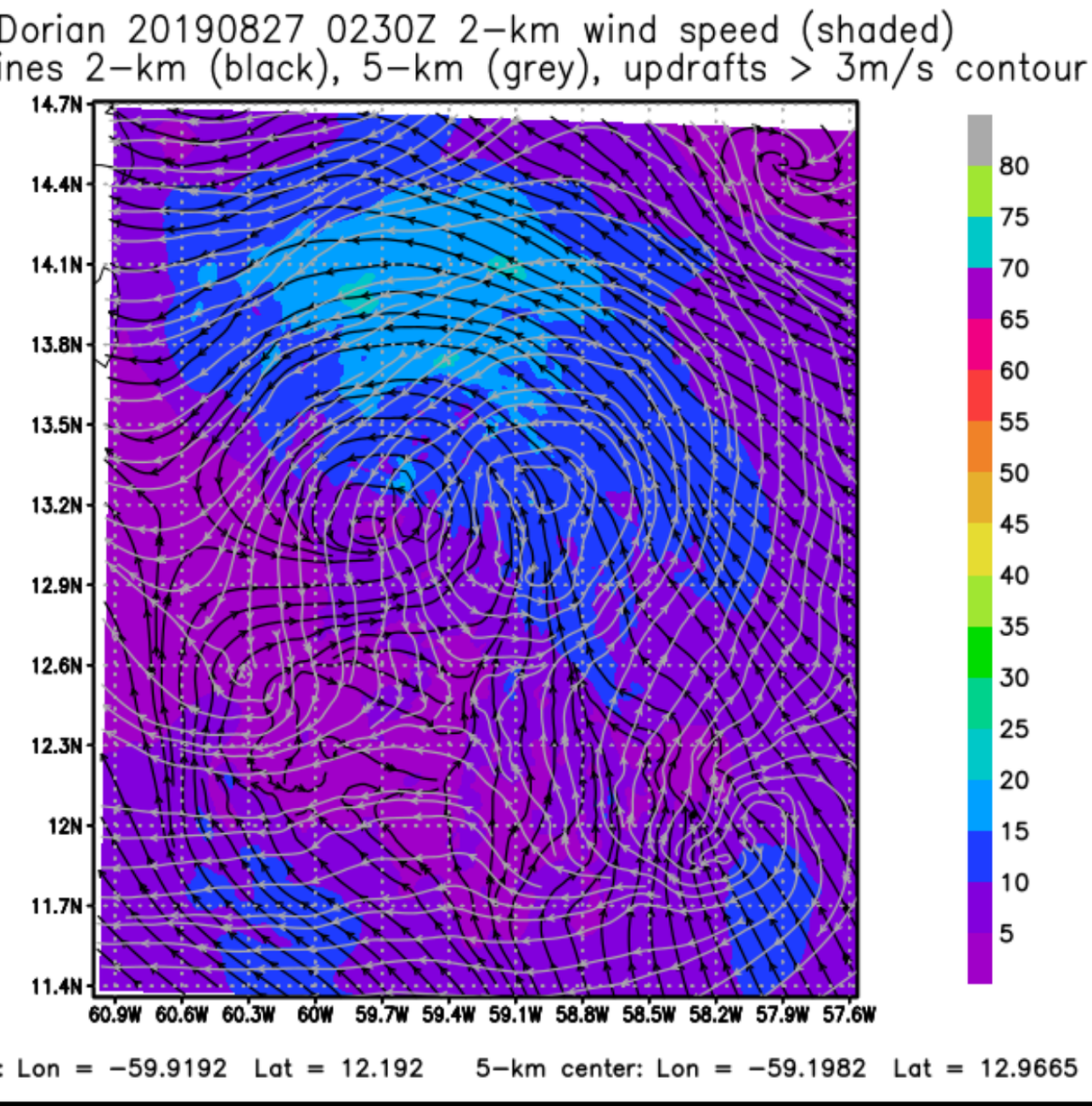
HEDAS Patricia 20151023 1730Z 850 hPa Equiv. Pot. Temp. [K]

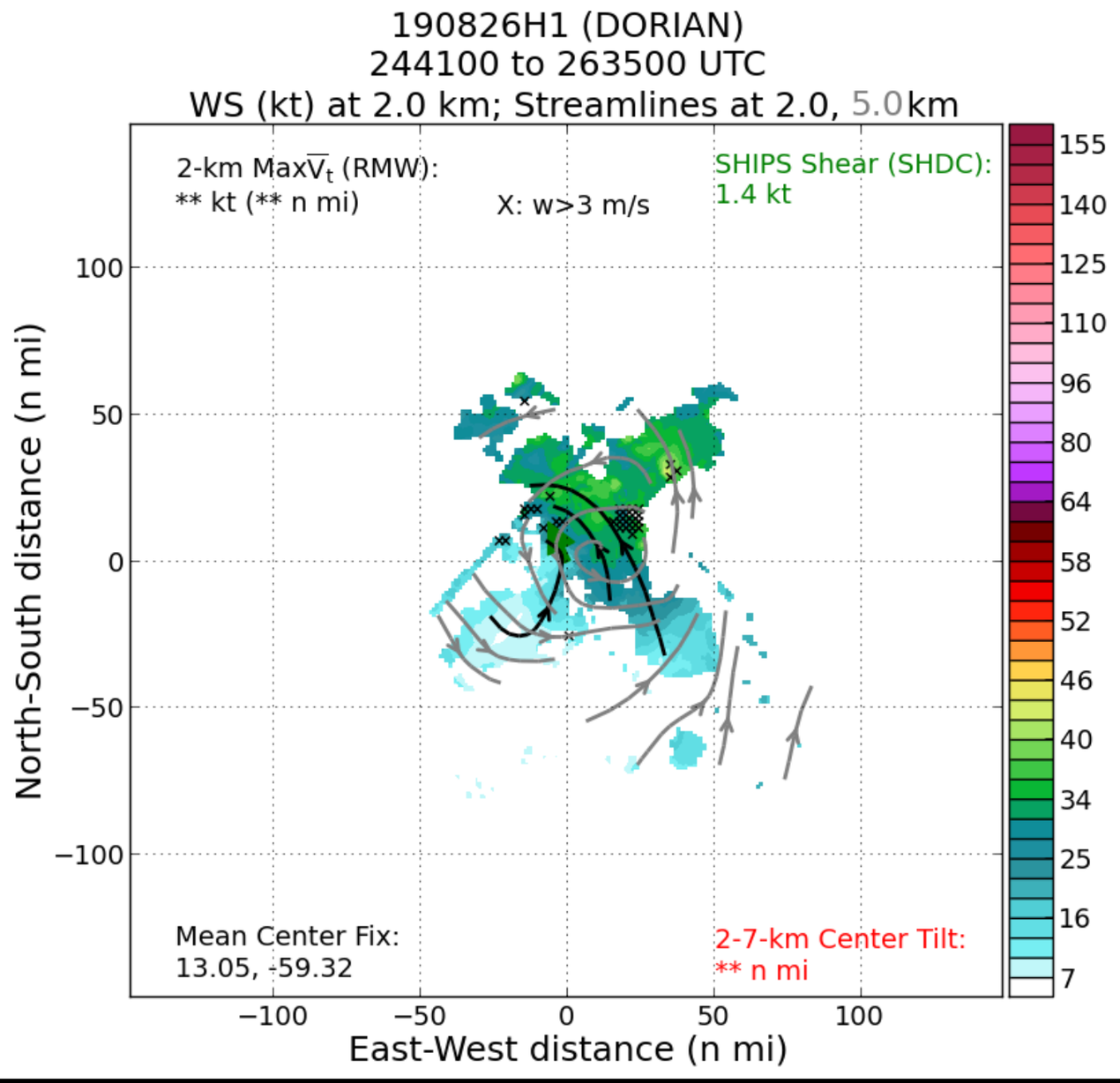


HEDAS Patricia 20151023 2030Z 850 hPa Equiv. Pot. Temp. [K]

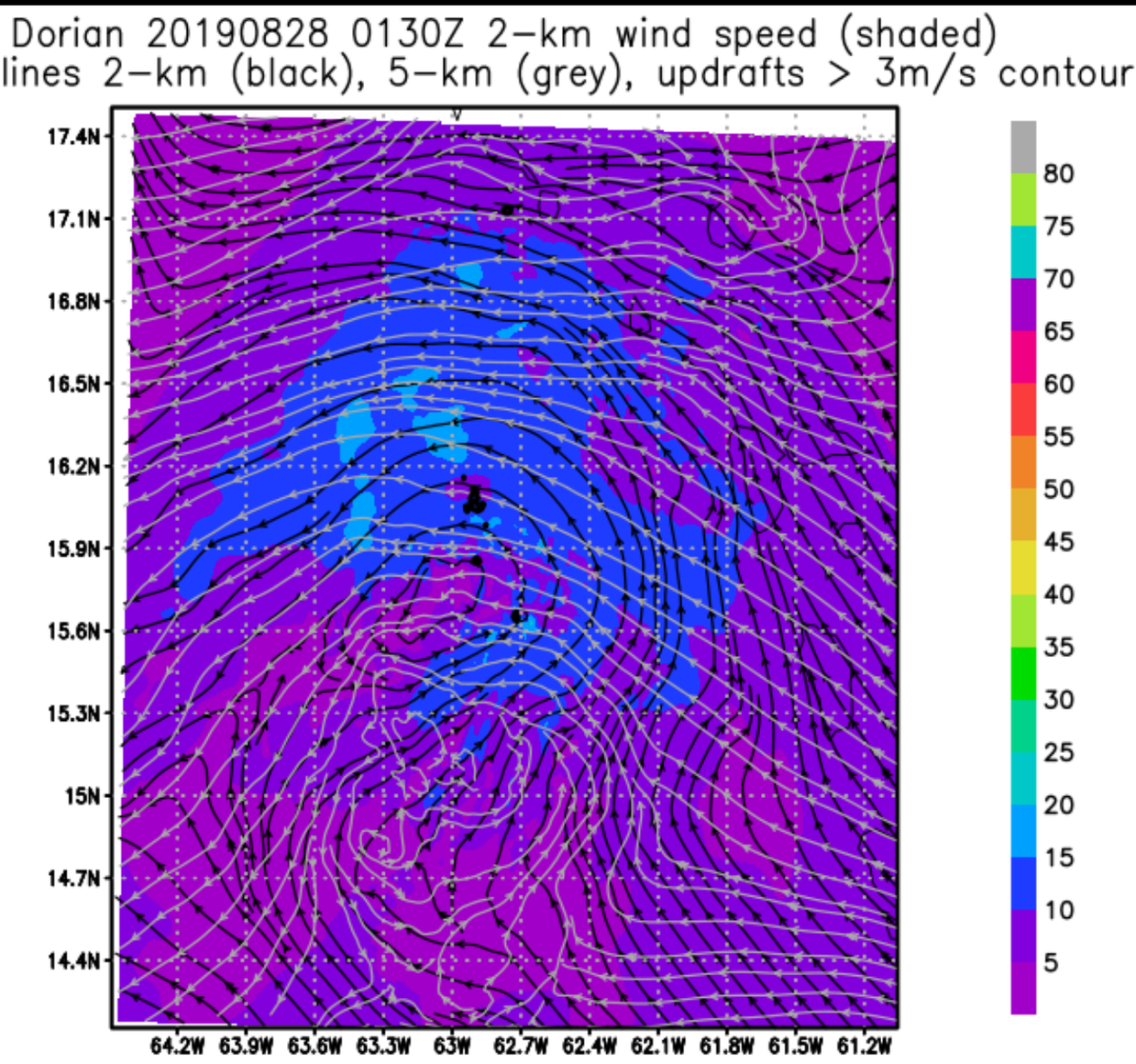


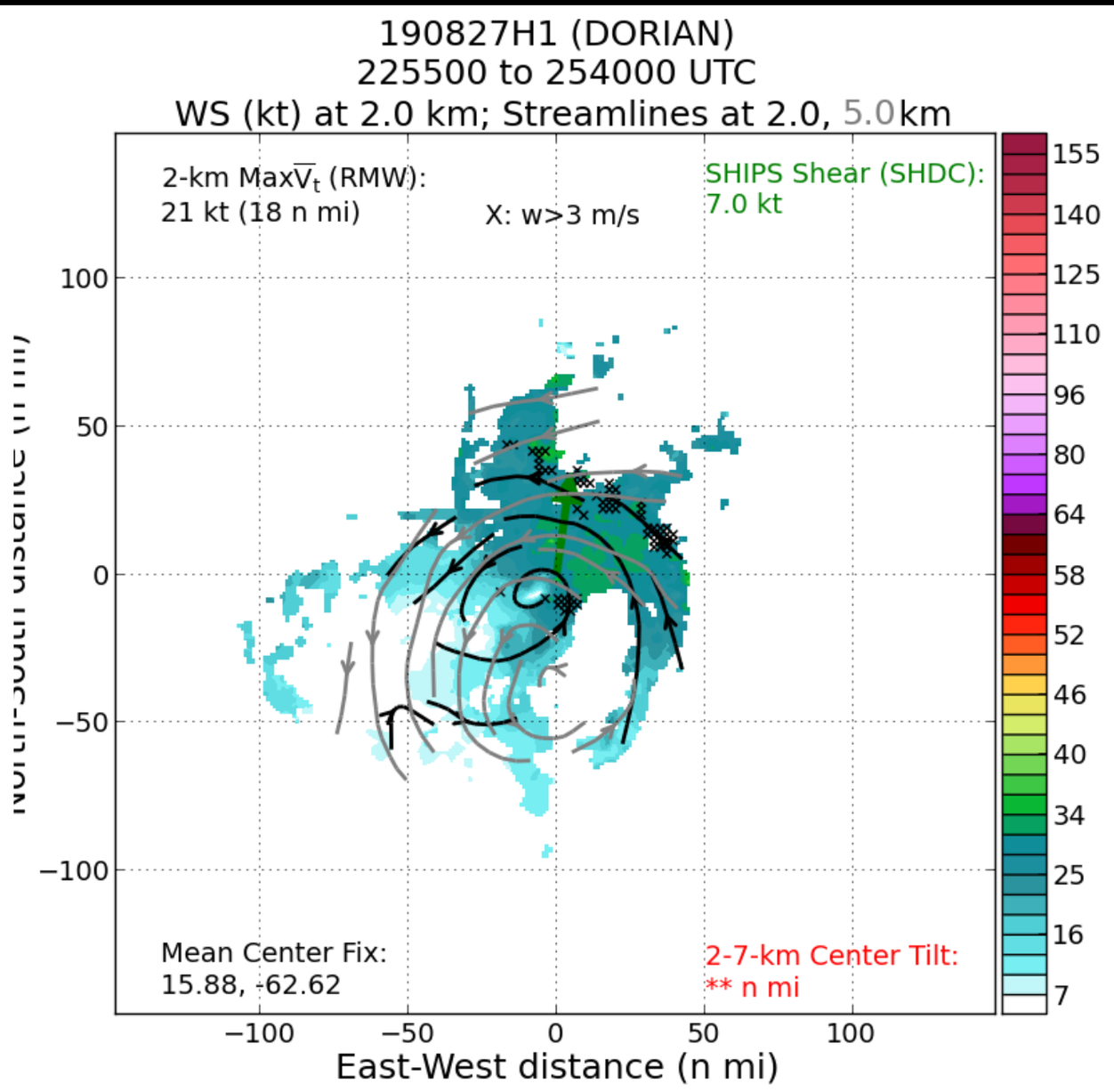
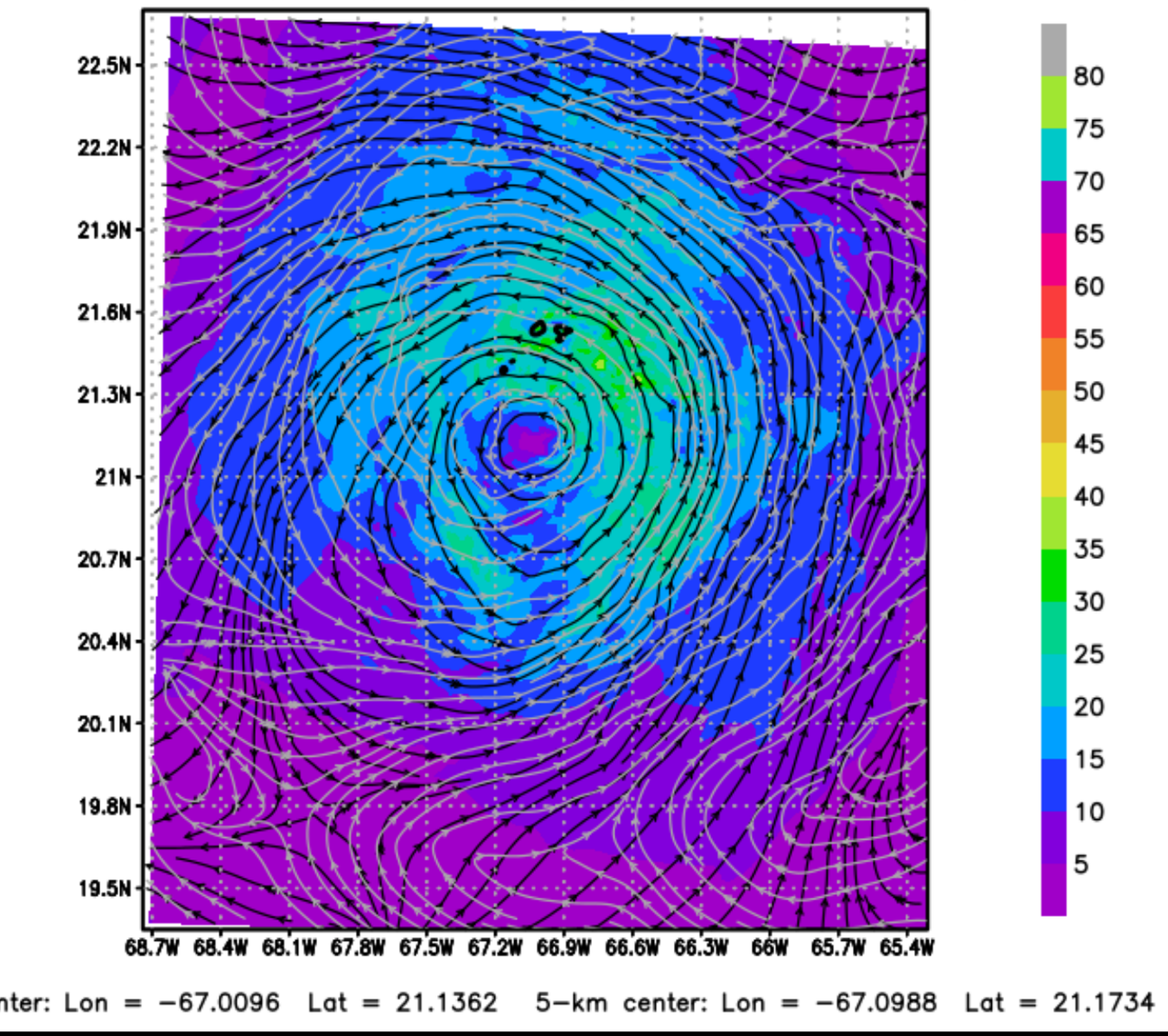
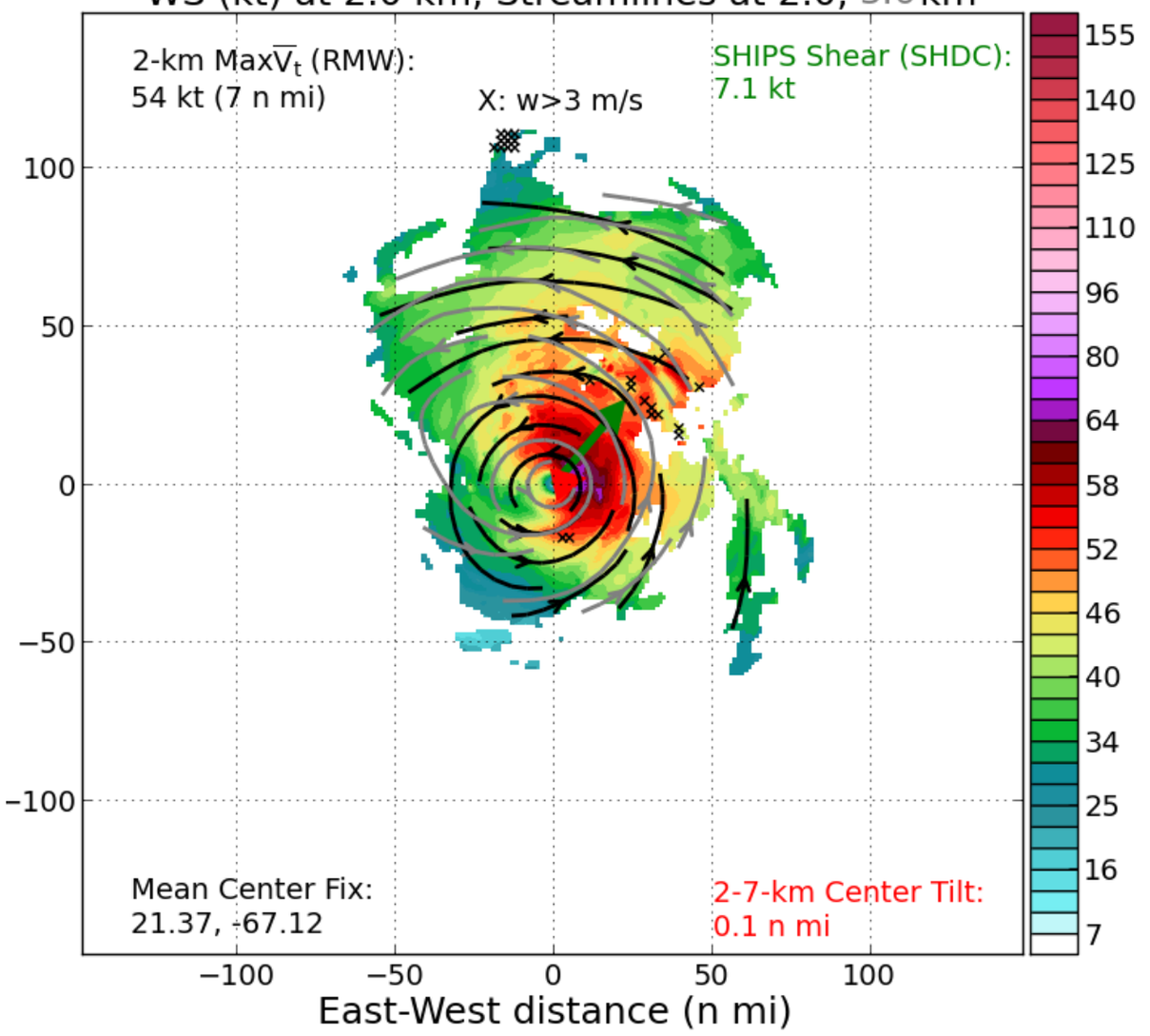
Hurricane Dorian
190826H1





Hurricane Dorian
190827H1





Hurricane Dorian
190829H1