

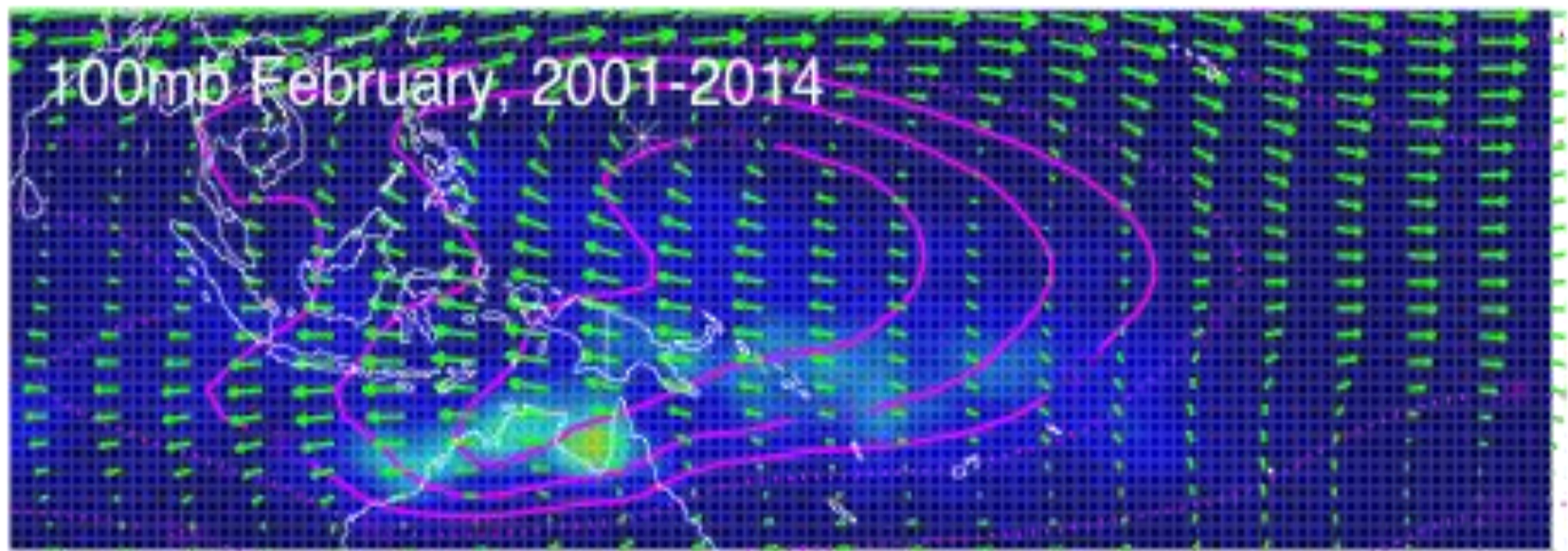
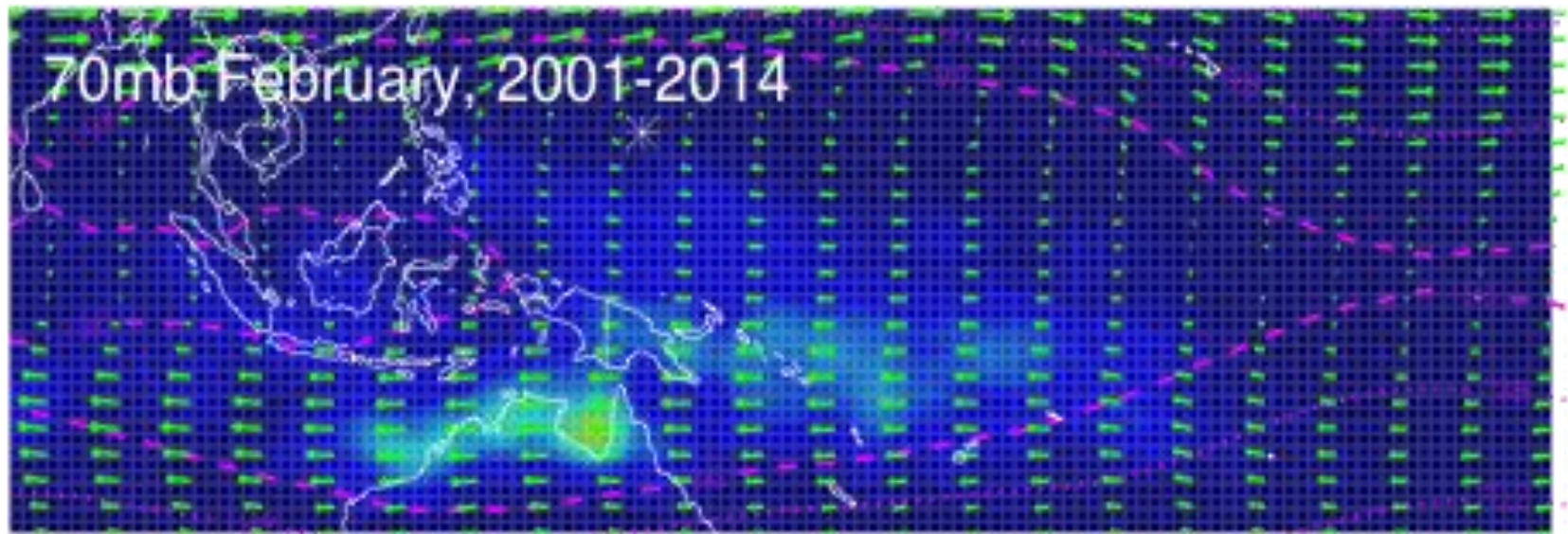
# Meteorological Overview of the ATTREX 3 mission

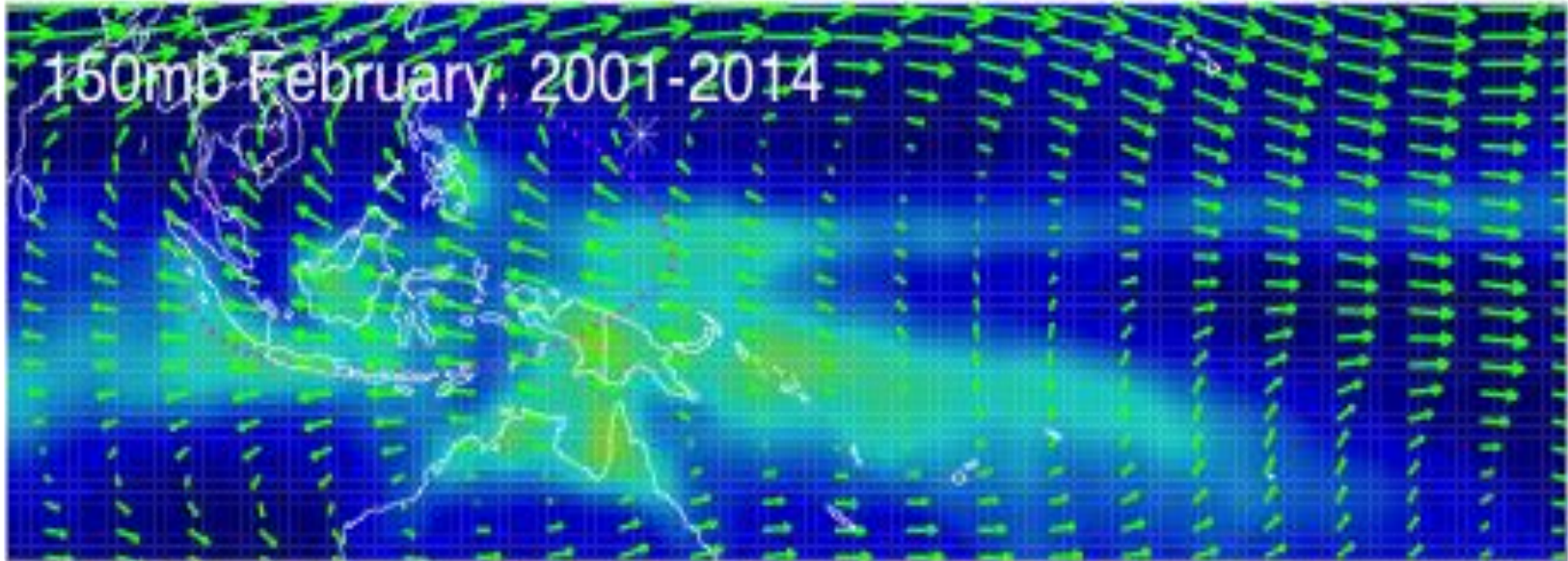
Leonhard Pfister (NASA/ARC) and  
Pat Hillyard (BAERI)

[http://bocachica.arc.nasa.gov/attrex\\_2014/attrex\\_2014.html](http://bocachica.arc.nasa.gov/attrex_2014/attrex_2014.html)

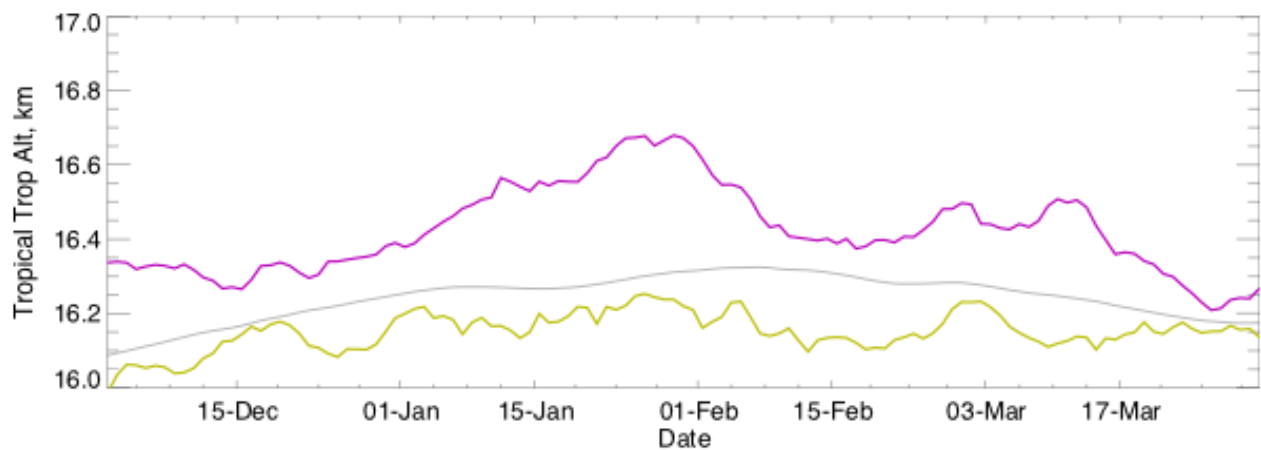
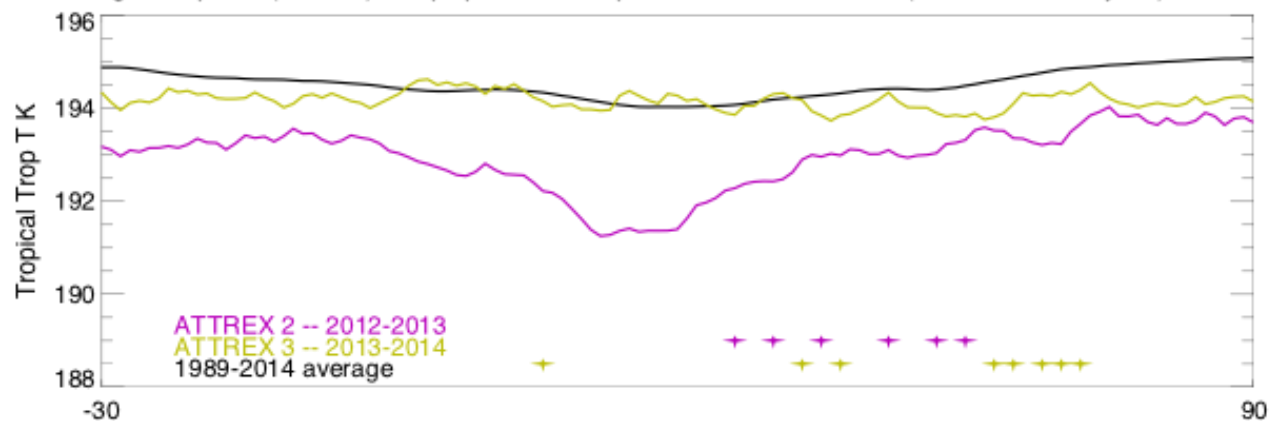
# Outline

- Seasonal Temperature evolution in TTL during ATTREX3 – comparison with previous years.
- Monthly mean Convection, Clouds, Temperature and Circulation in the TTL
- Time evolution of the relationship of temperature to convection and the nature of TTL temperature changes (waves).
- Meteorological situation for individual flights (movie).
- Convective influence in the TTL – evolution of air origins and the relationship of convective influence to temperature.

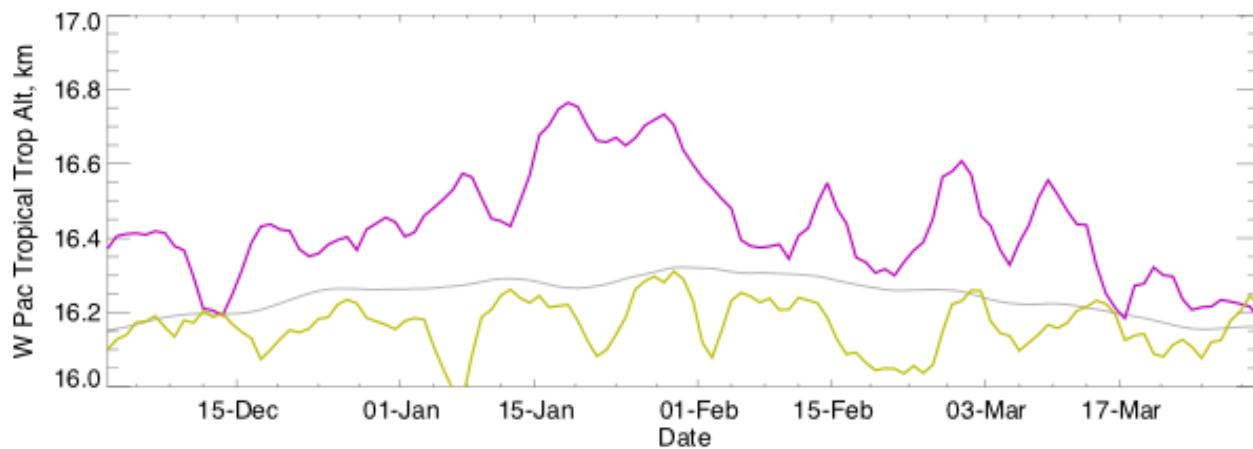
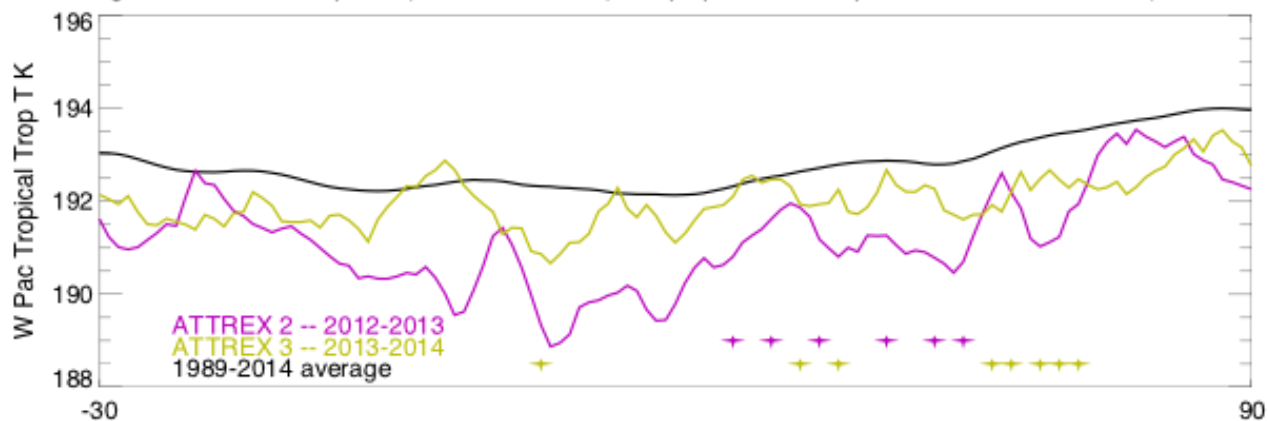




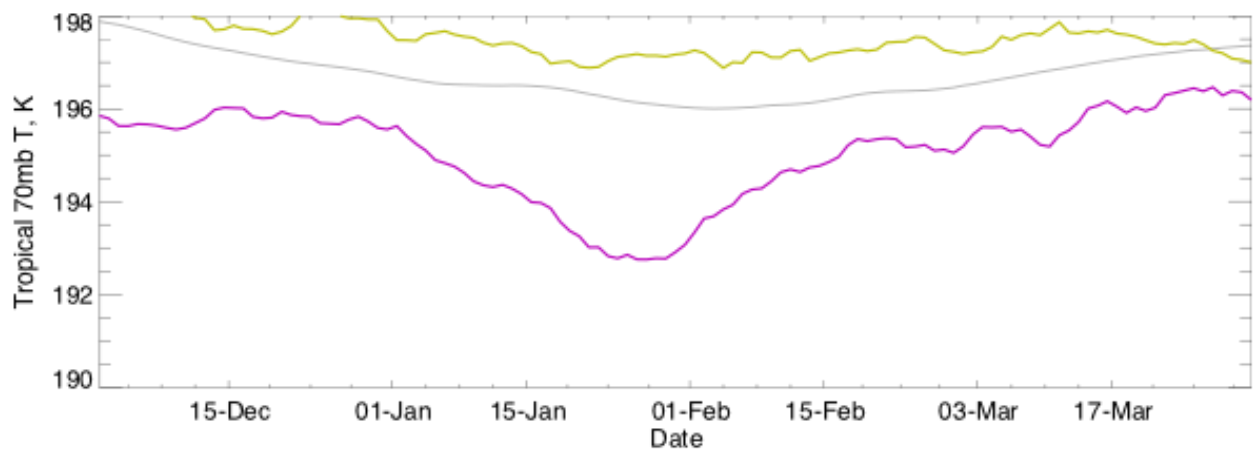
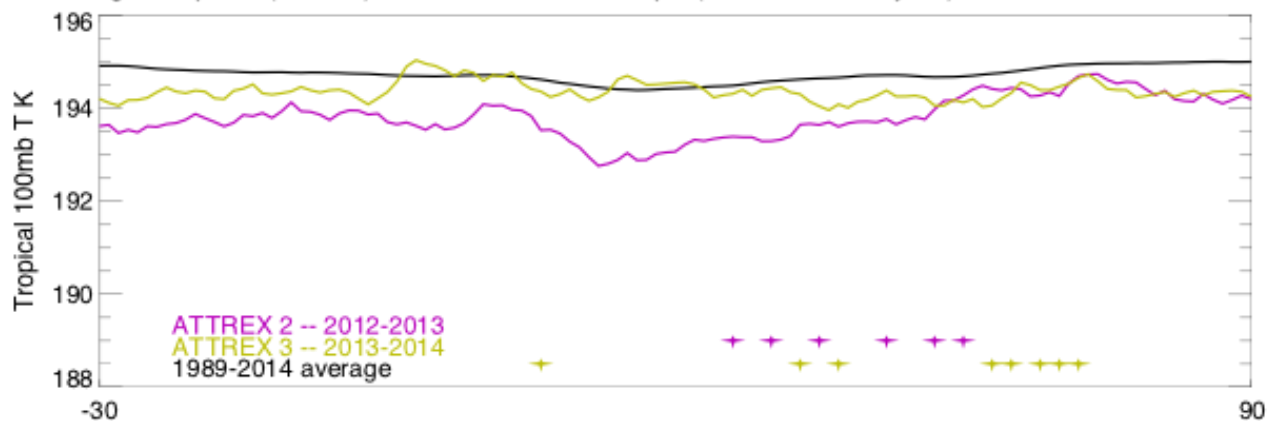
Average Tropical (-20-20) Tropopause Temperature and Altitude (NCAR Reanalysis)

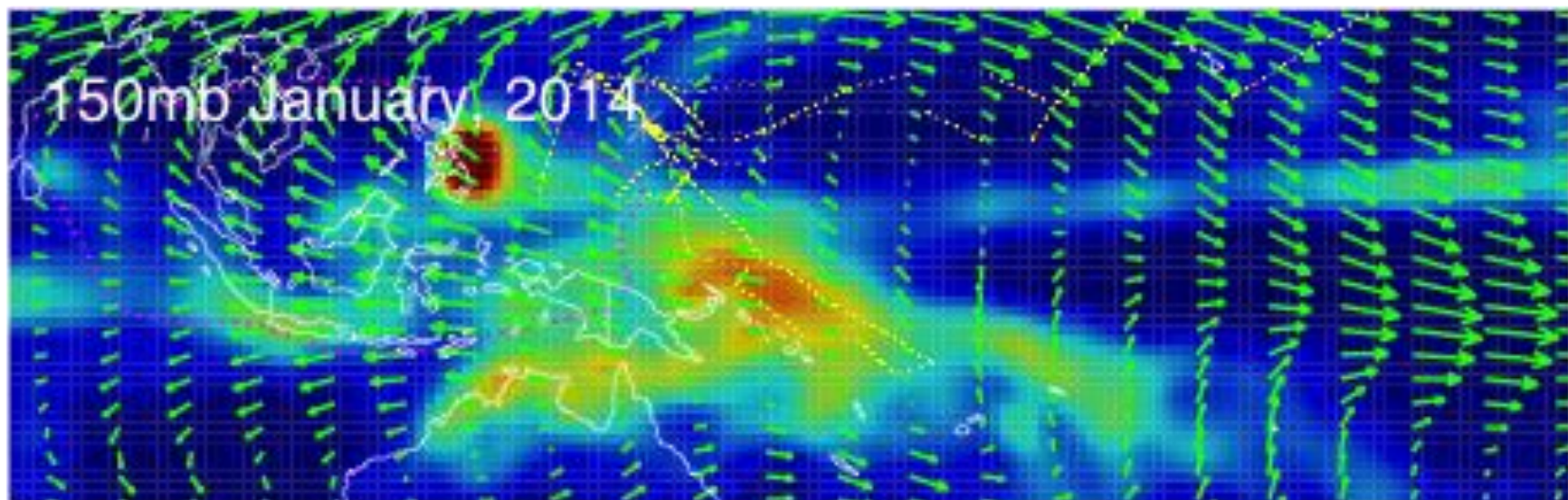
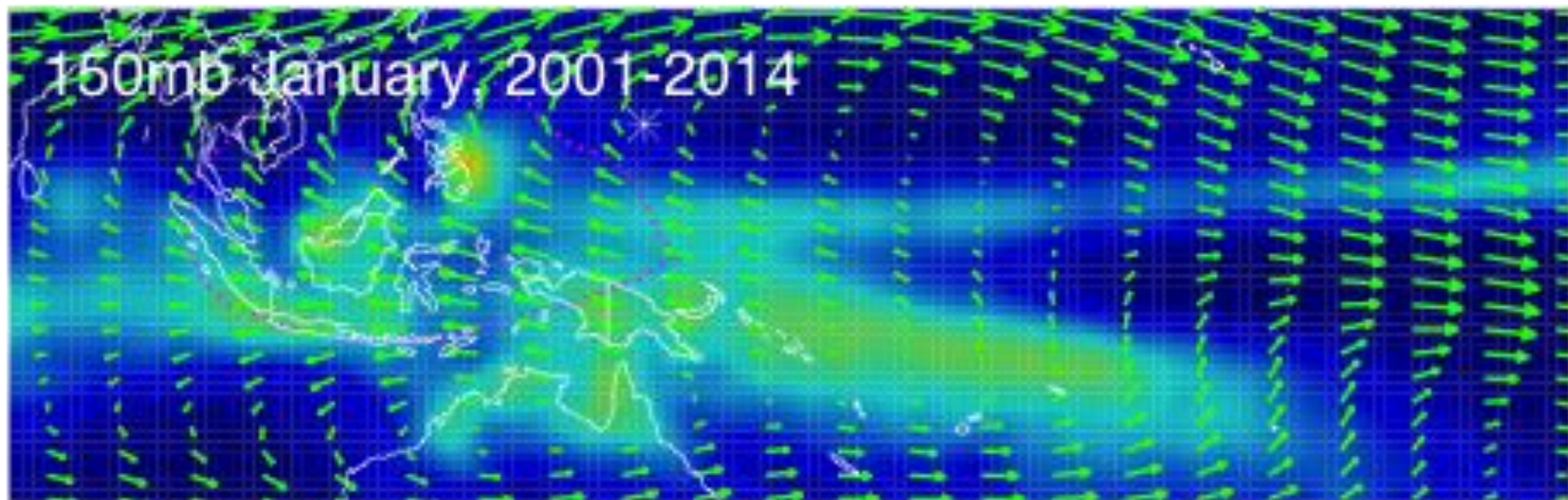


Average West Pac Tropical (-20-20;90-210) Tropopause Temperature and Altitude (NCAR Reanalysis)



Average Tropical (-20-20) 100 and 70 mb Temps (NCAR Reanalysis)





0.0

0.2

0.4

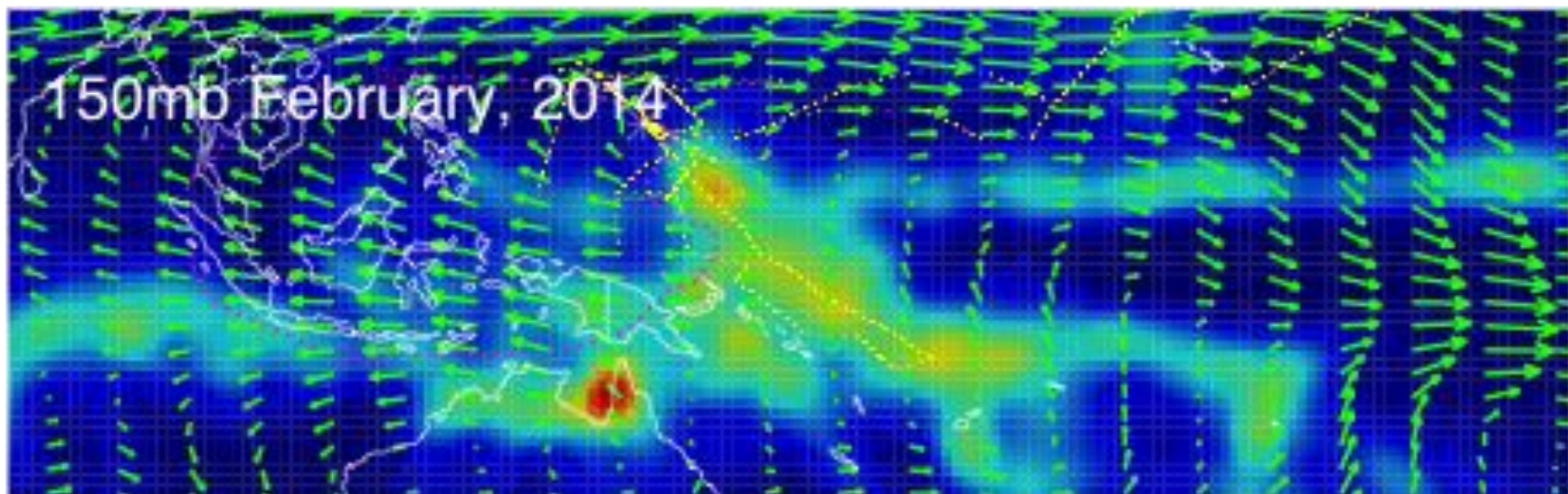
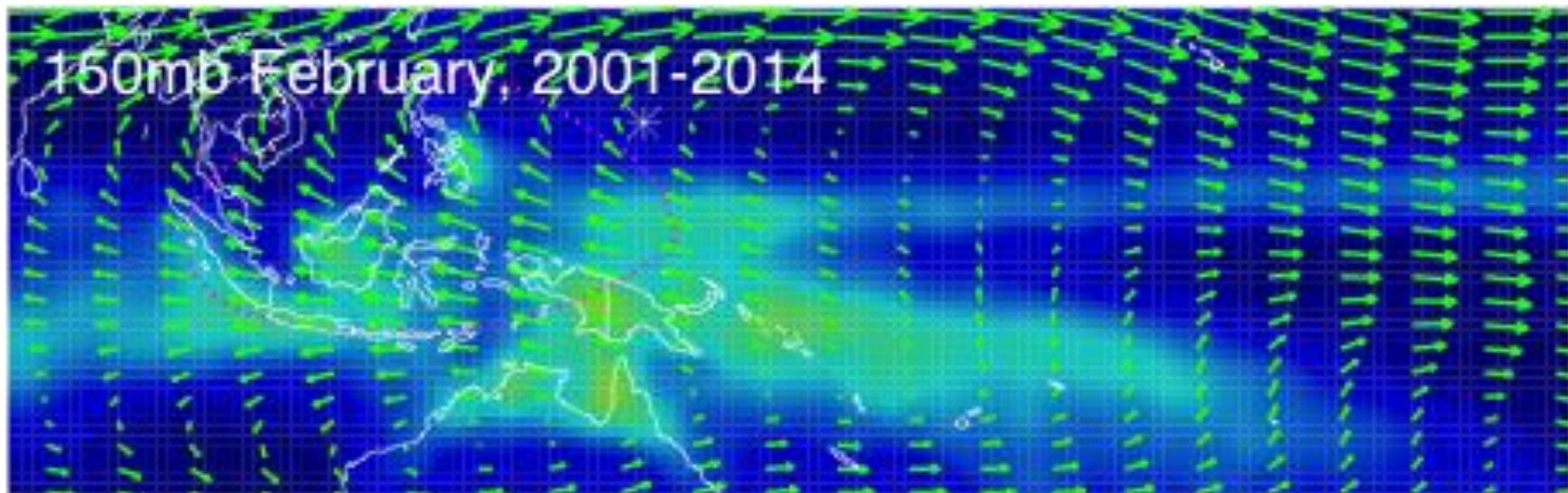
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0.8

1.0

Average Rain Rate, mm/hour





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0.2

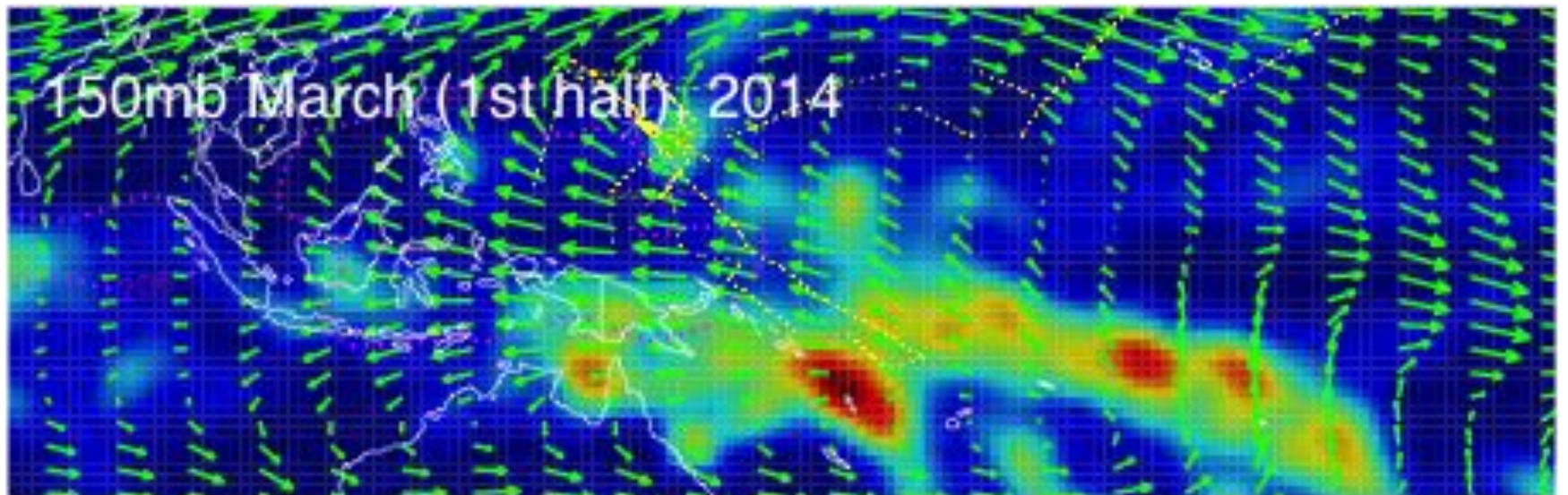
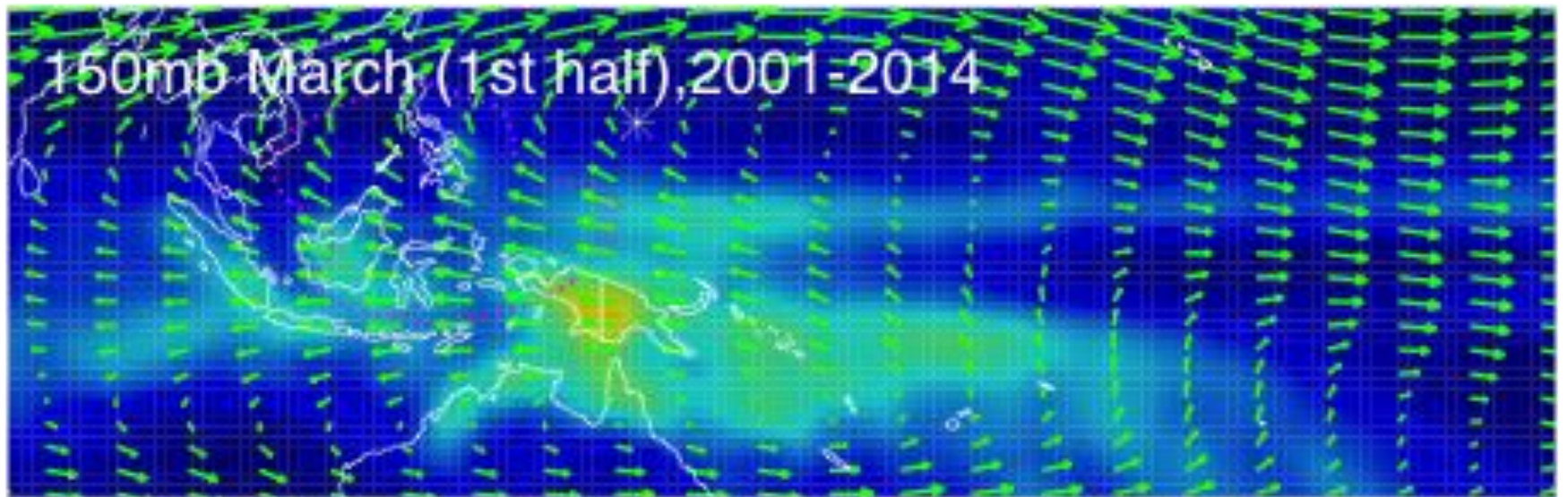
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Average Rain Rate, mm/hour



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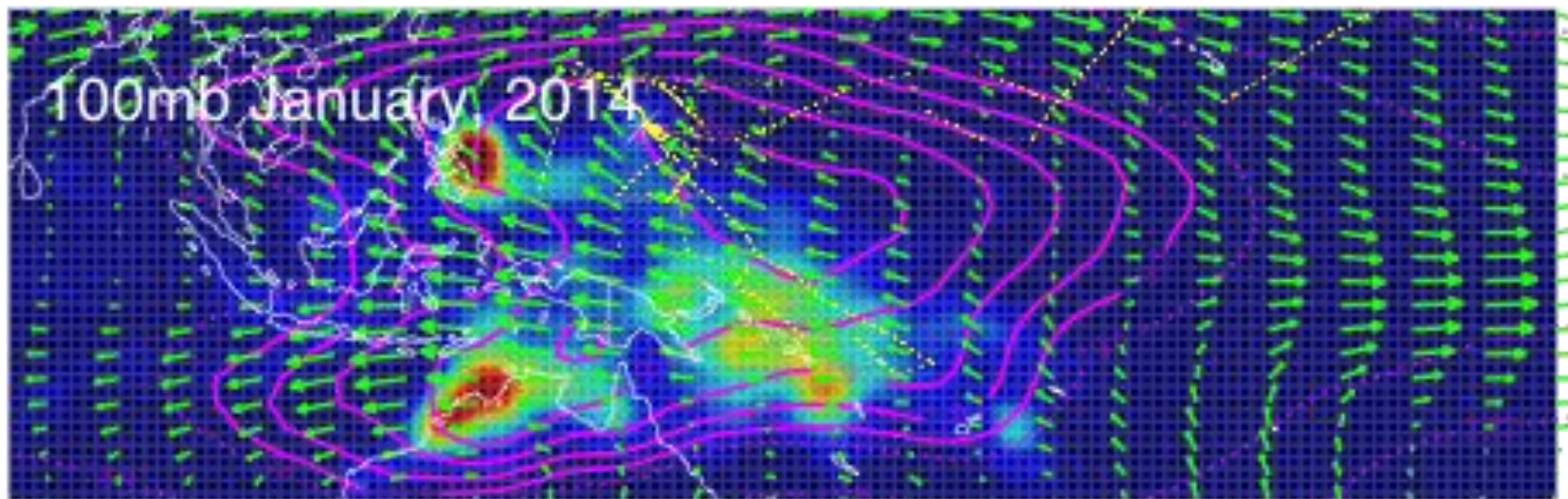
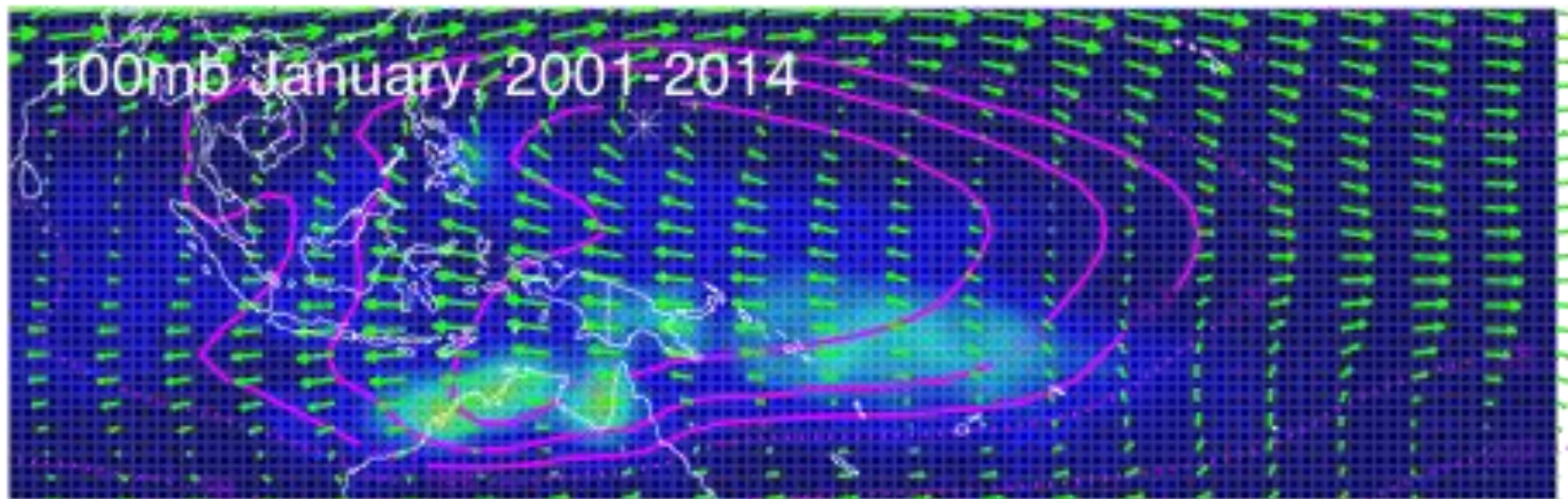
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Average Rain Rate, mm/hour



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0.01

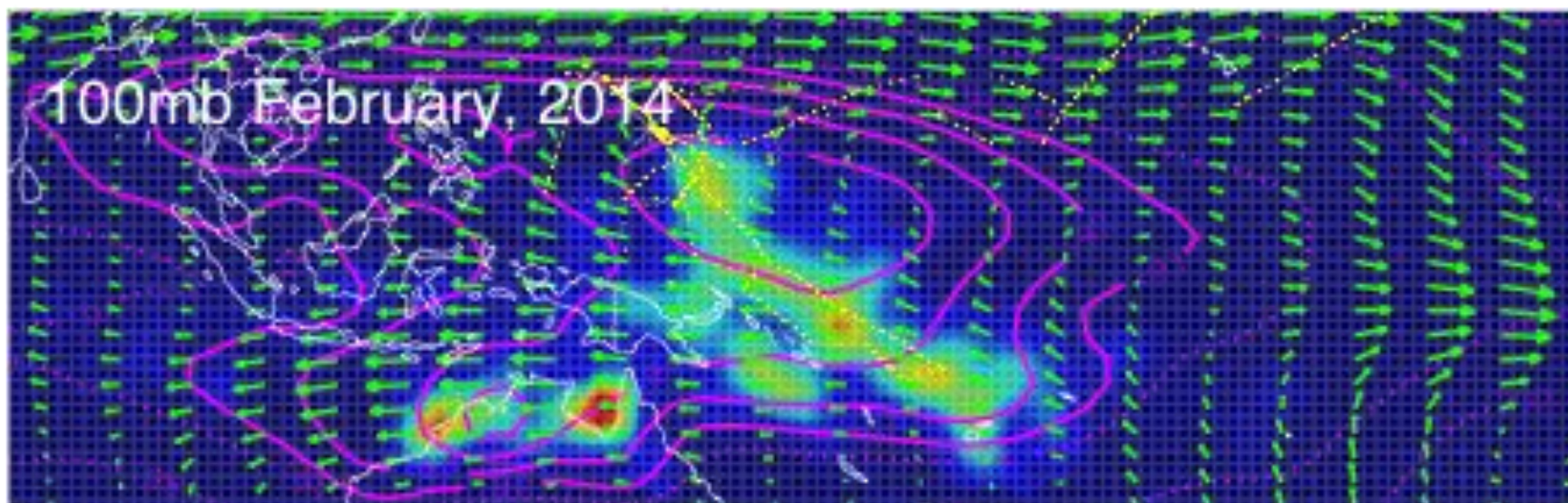
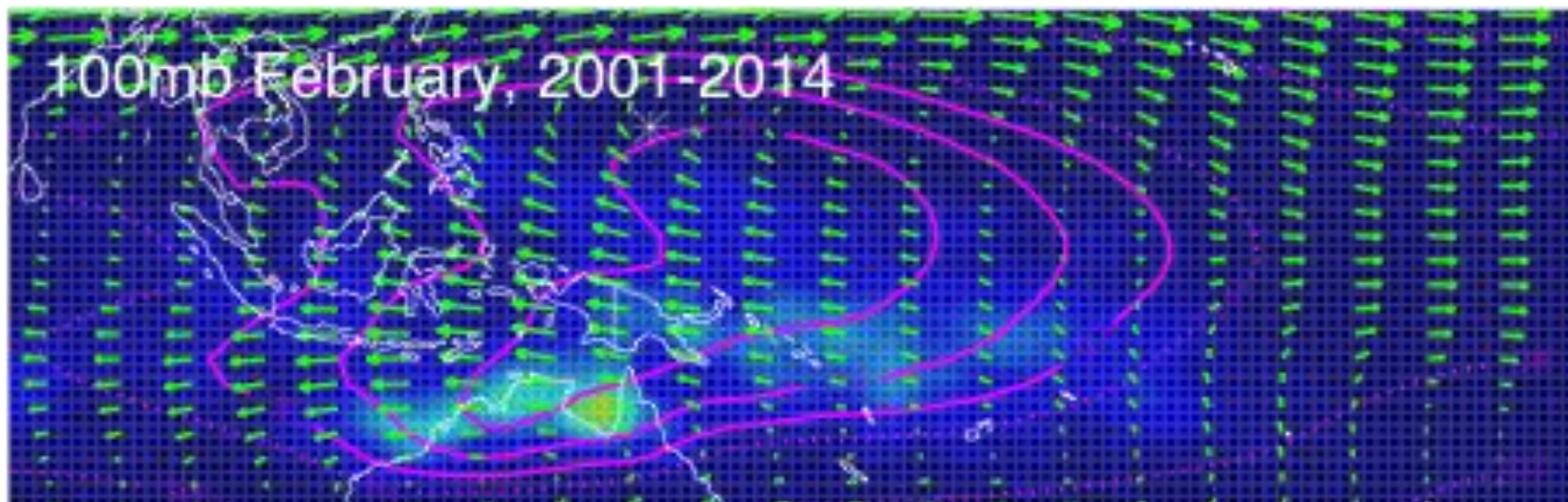
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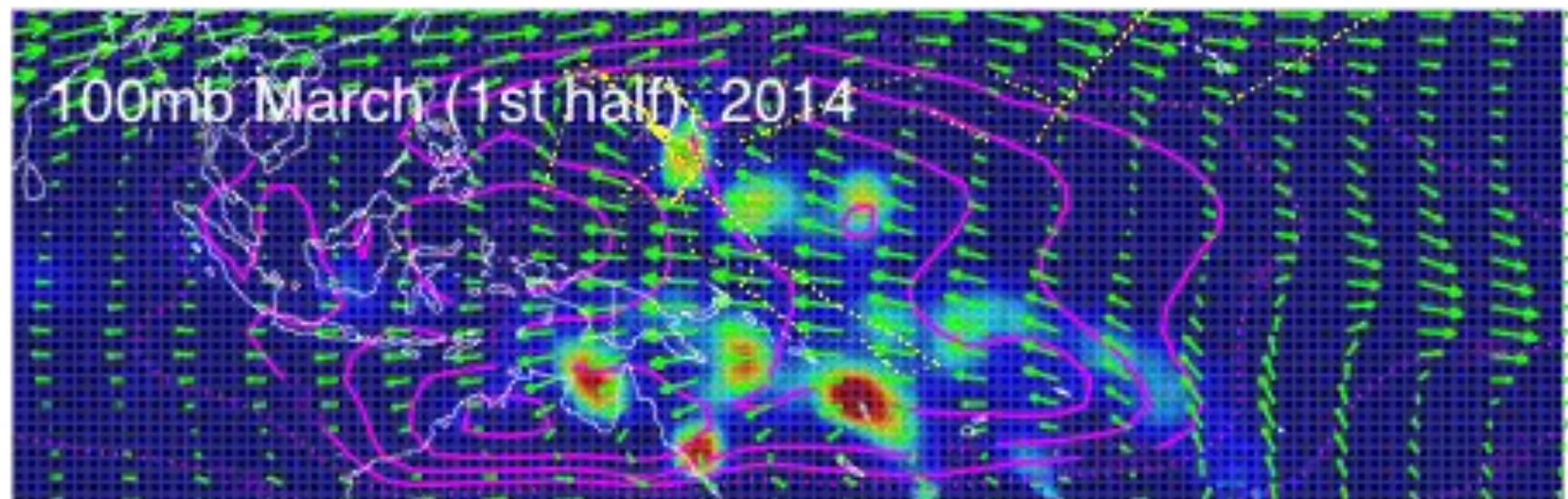
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0.04

0.05

Frac Incidence, Brightness  $T < 200$  K





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0.01

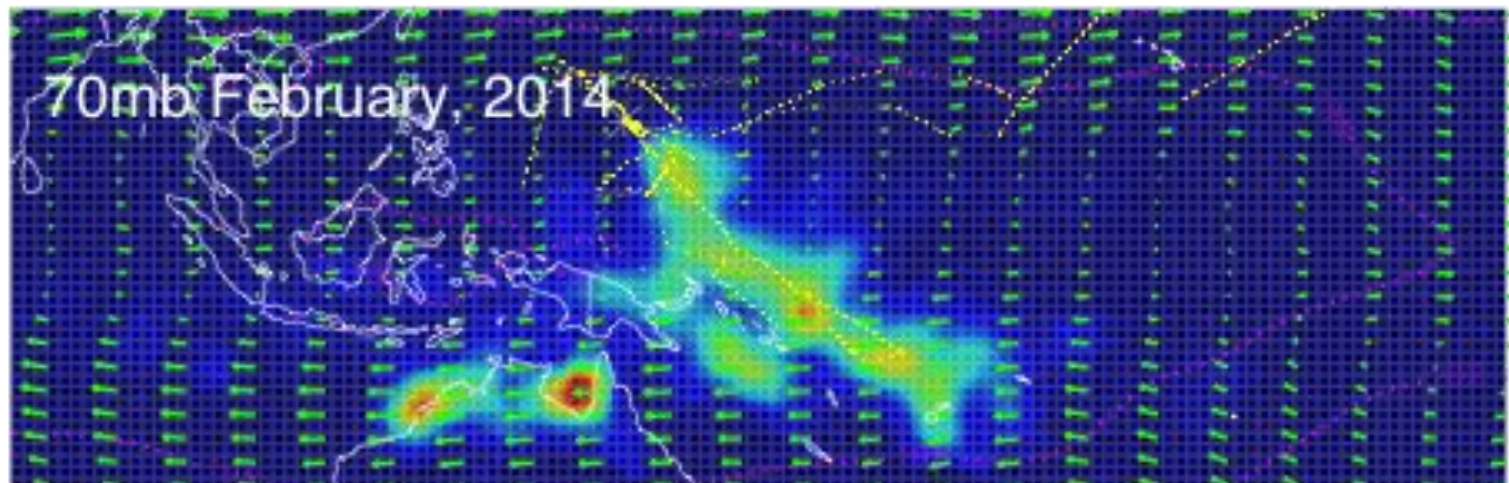
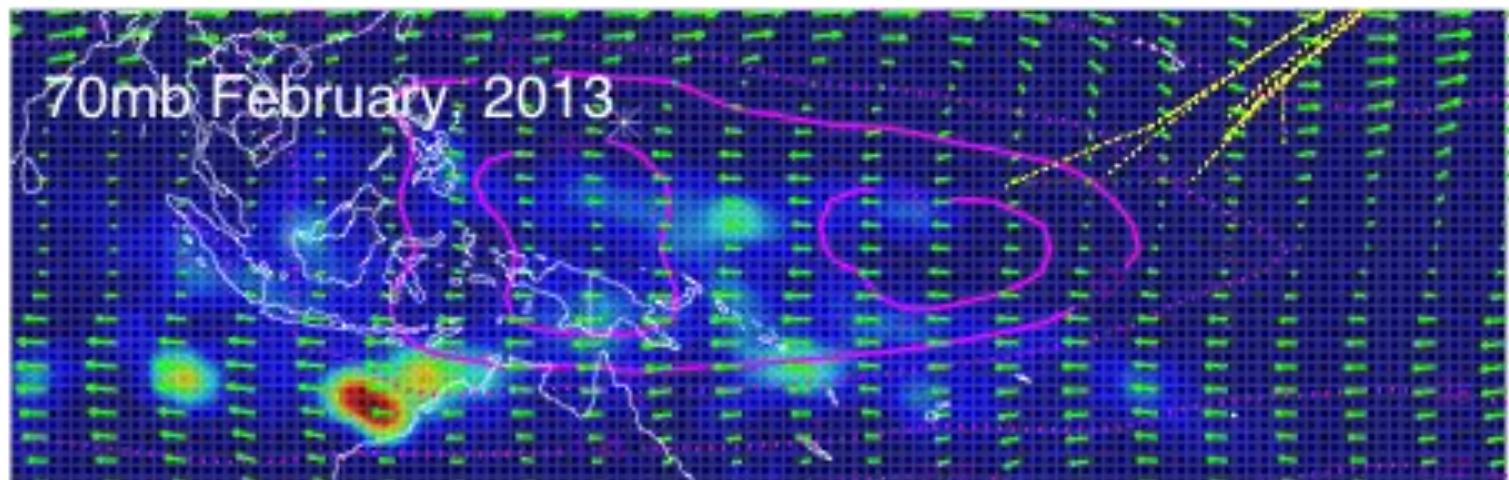
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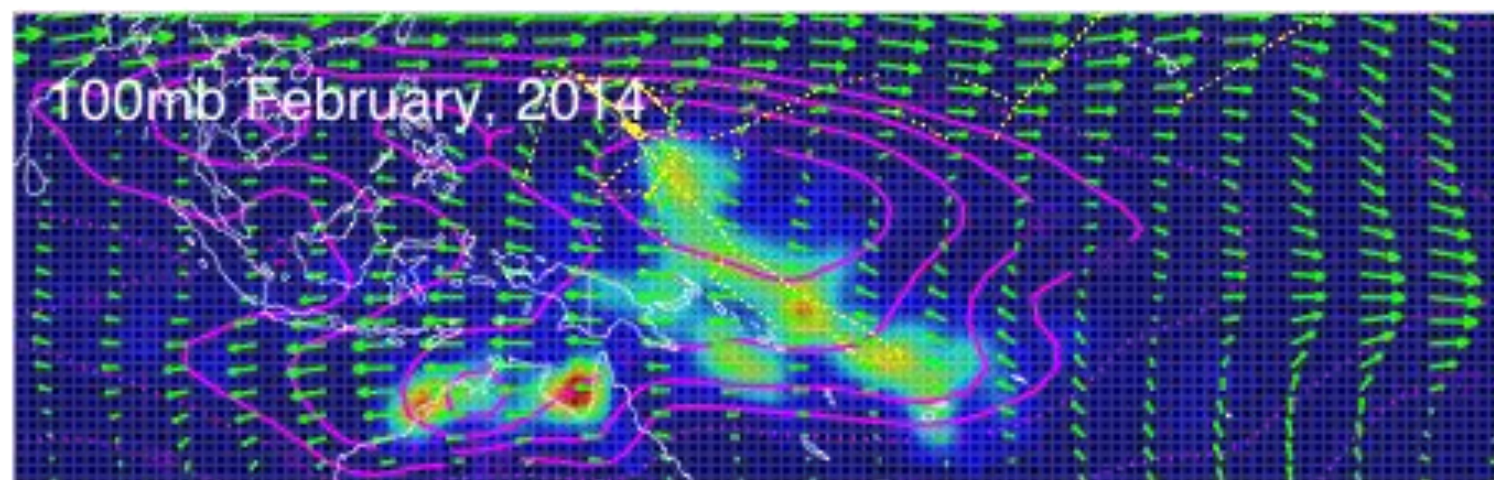
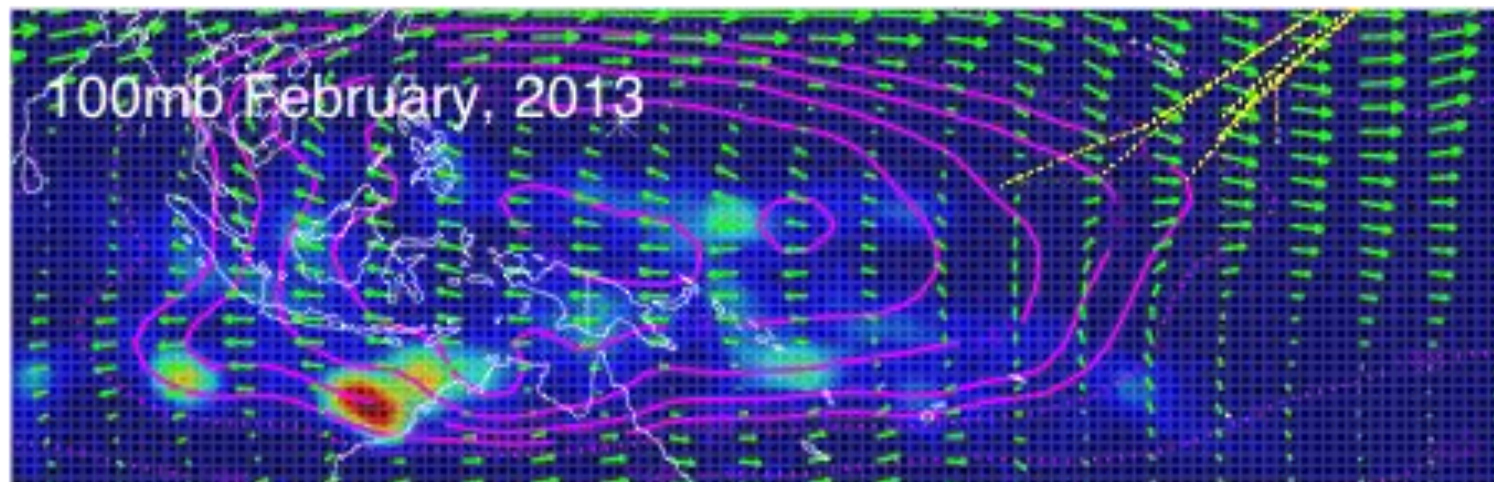
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Frac Incidence, Brightness  $T < 200$  K





0.00

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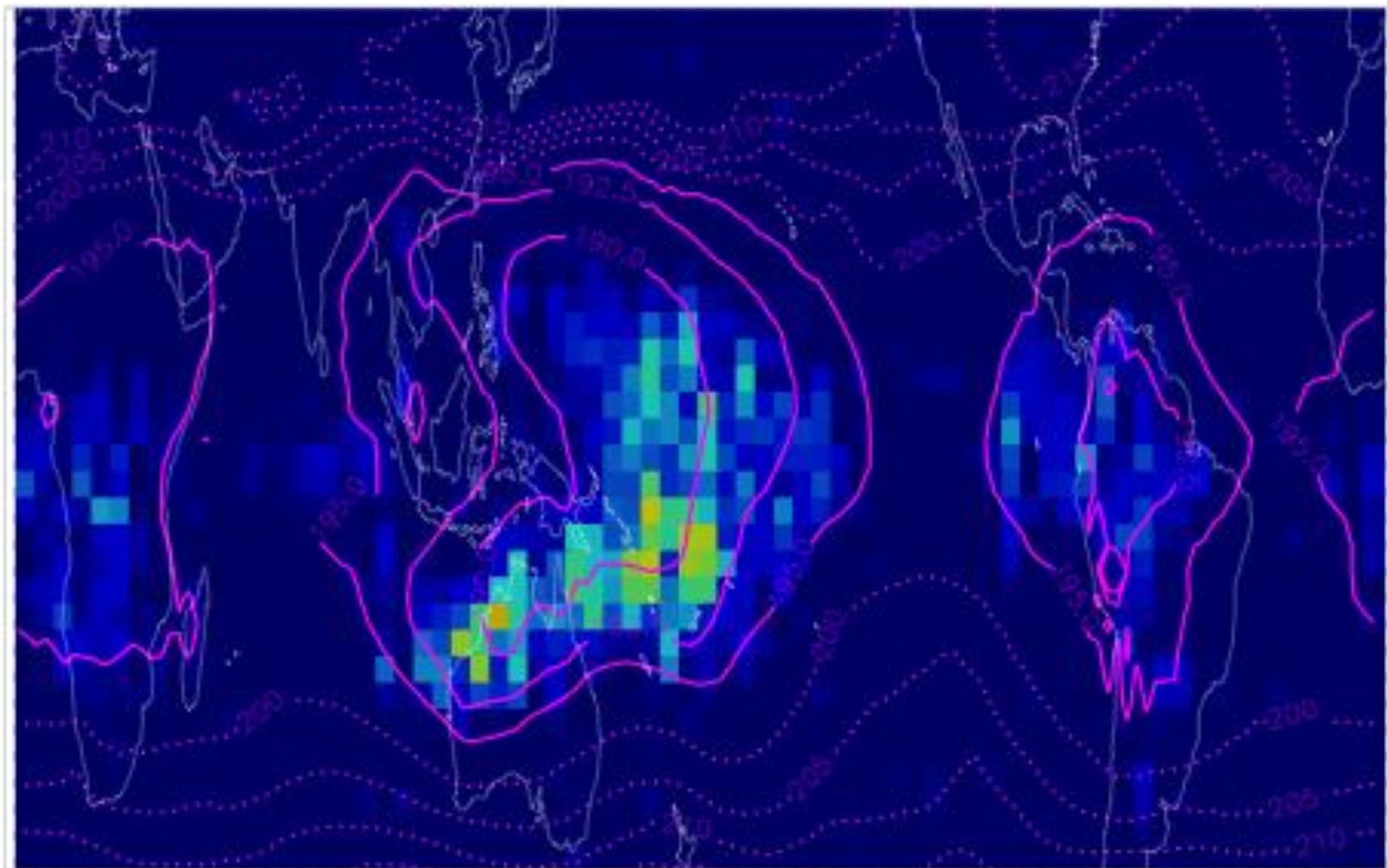
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Frac Incidence, Brightness T < 200 K

# Summary for monthly mean circulation and temperature

- Convection forces a cold pattern somewhat east of the convective heating. Mean anticyclone is still further east.
- Pattern slopes eastward with altitude.
- QBO indicates a warm year for 2014, and it was so for 70mb. Tropopause and 100mb temperatures were near normal.
- Convection, moreso than in 2013 and “normal”, was concentrated near Guam longitudes (Duh). Also, more NH convection than typical





0.00

0.05

0.10

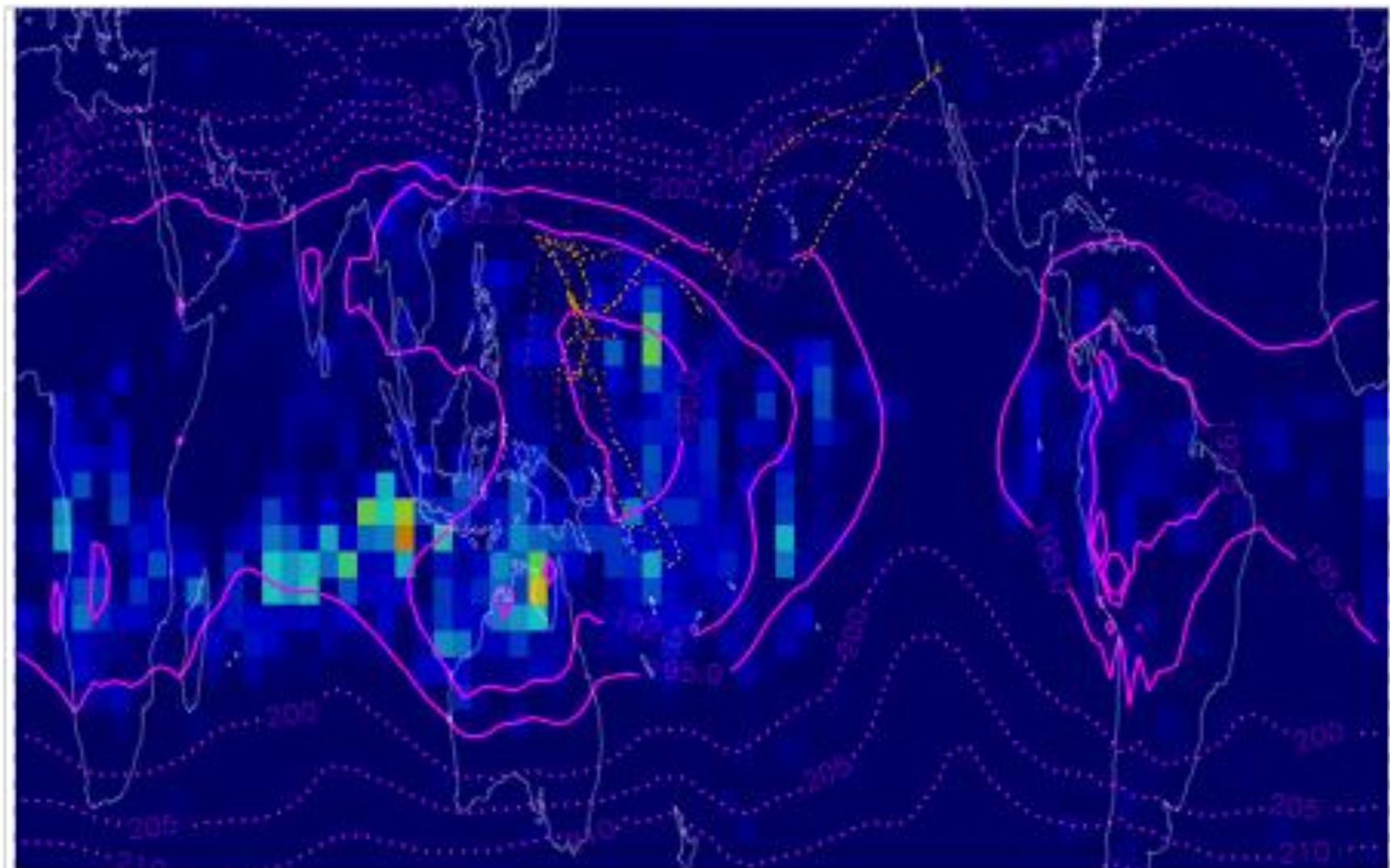
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0.25

0.30

Cloud Incidence, Jan 2014, 16.5-19.0 km (Trop T)



0.00

0.05

0.10

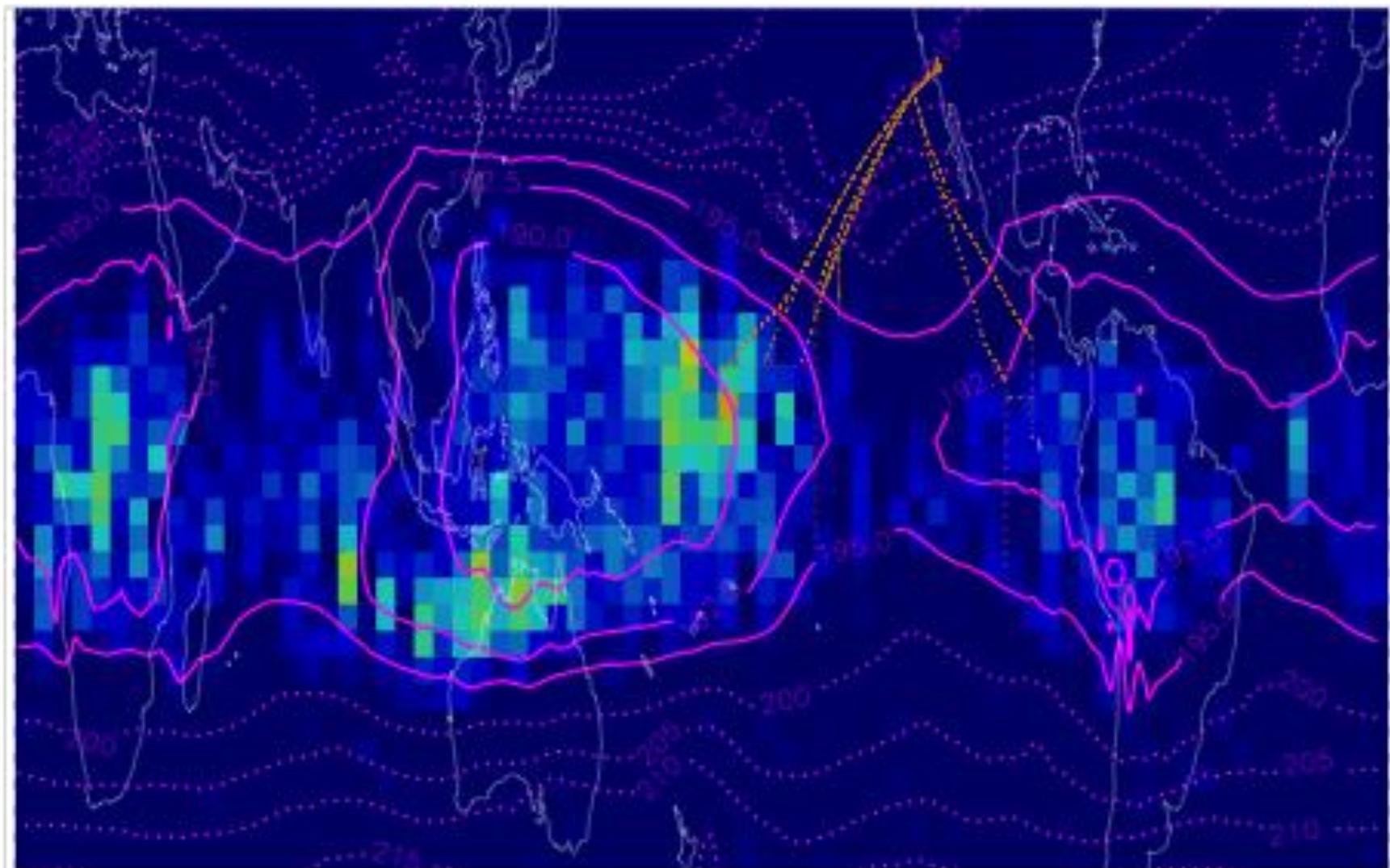
0.15

0.20

0.25

0.30

Cloud Incidence, Feb 2014, 16.5-19.0 km (Trop T)



0.00

0.05

0.10

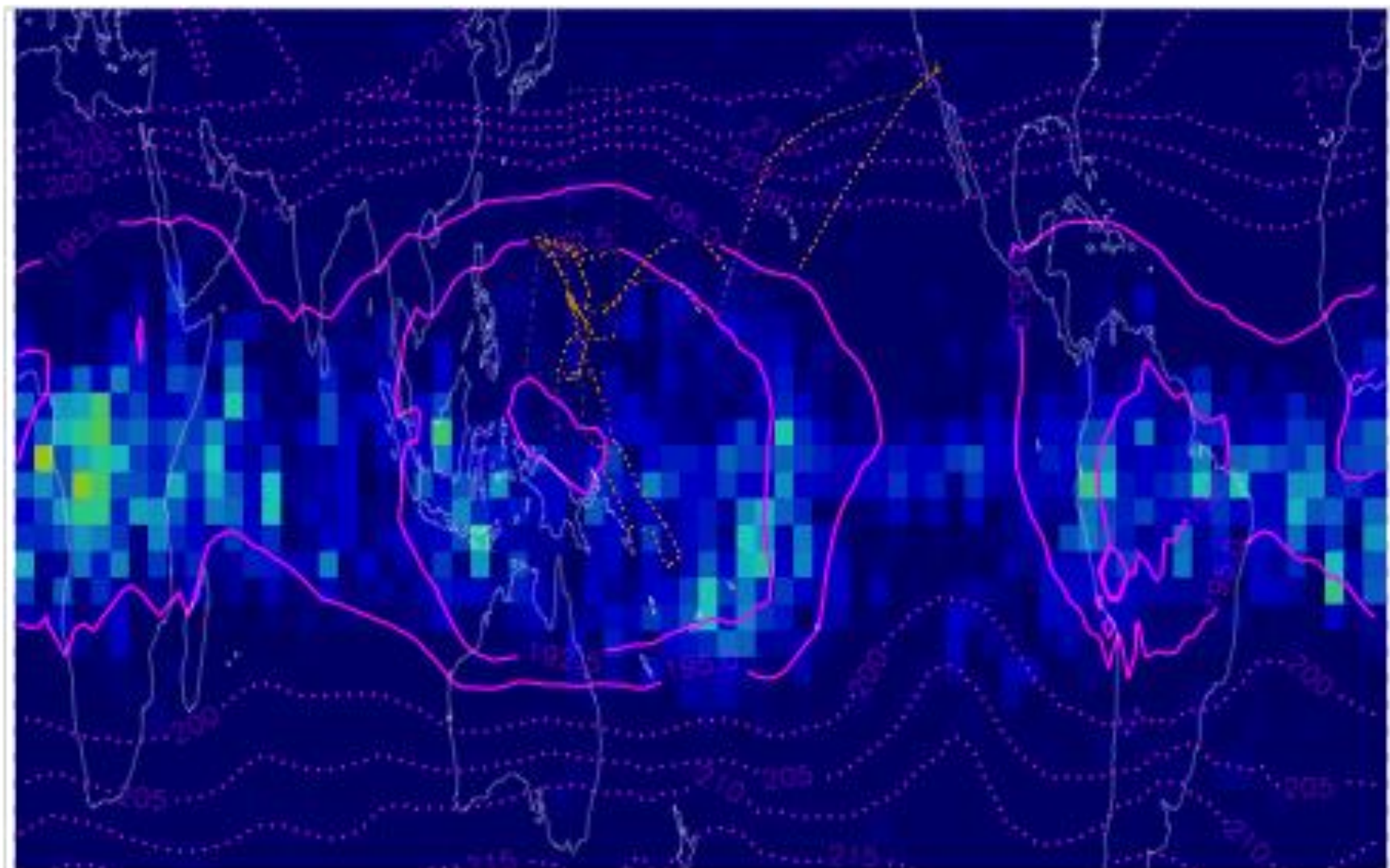
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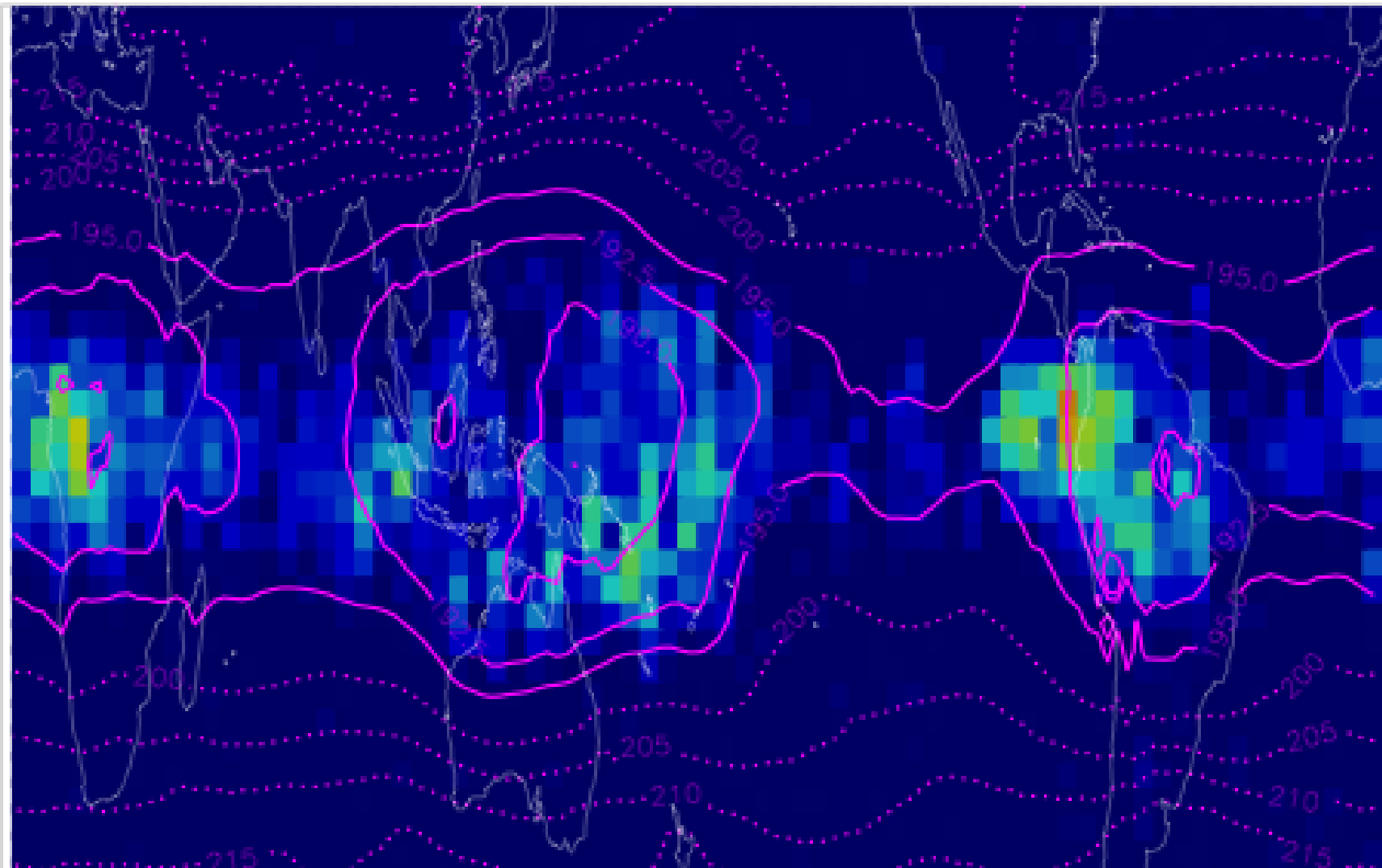
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0.30

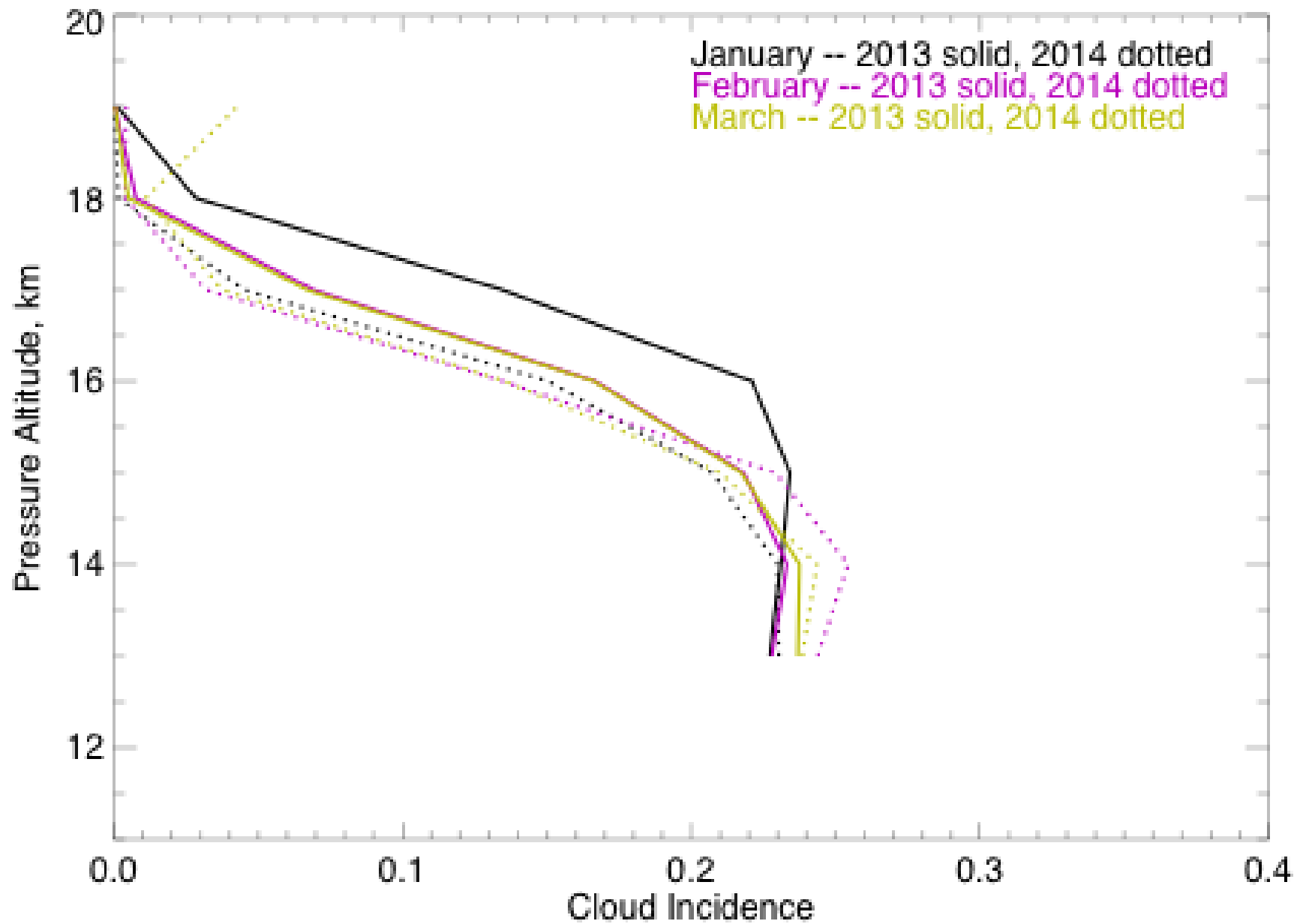
Cloud Incidence, Feb 2013, 16.5-19.0 km (Trop T)



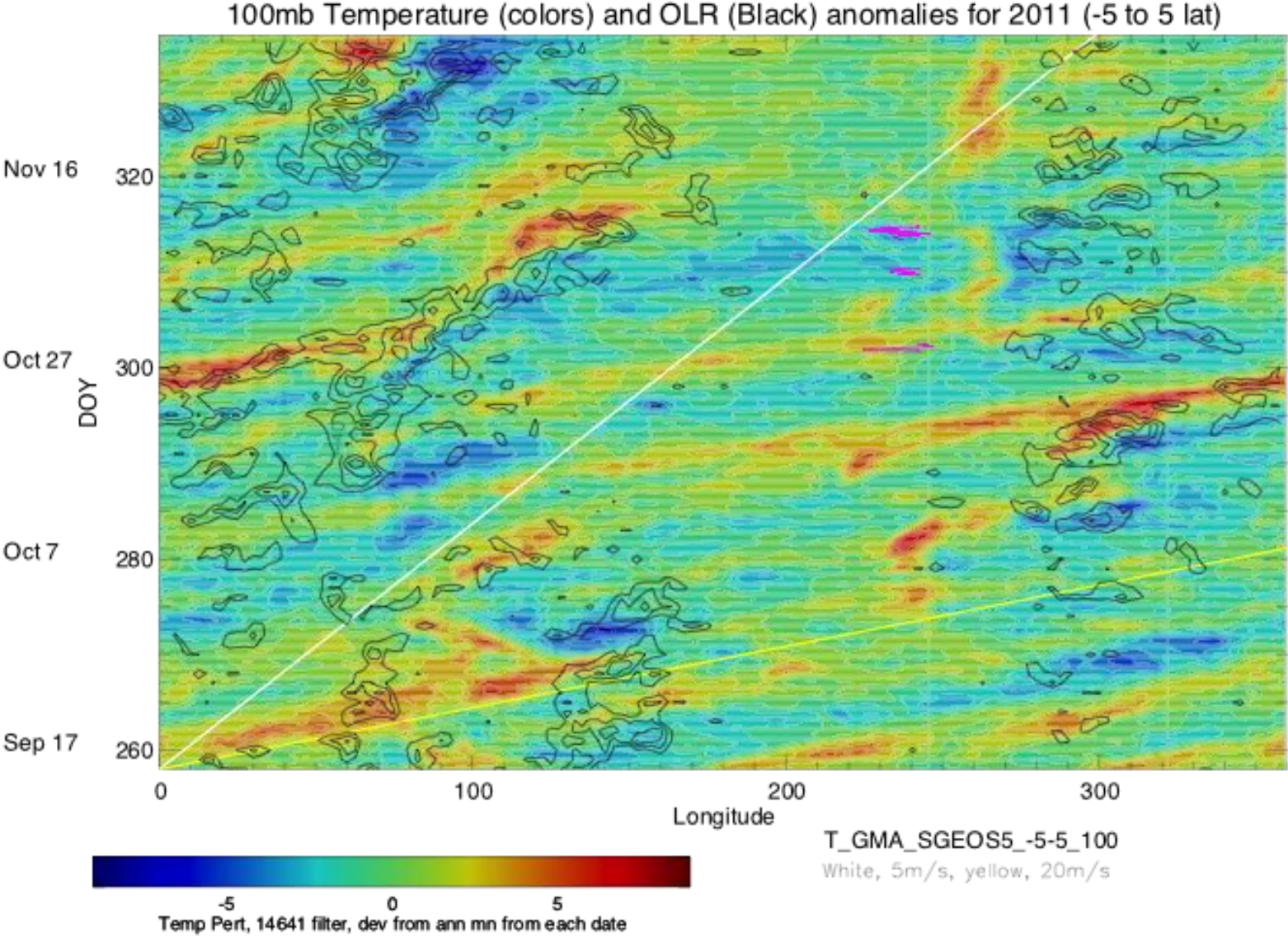
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Cloud Incidence, Mar 2014, 16.5-19.0 km (Trop T)



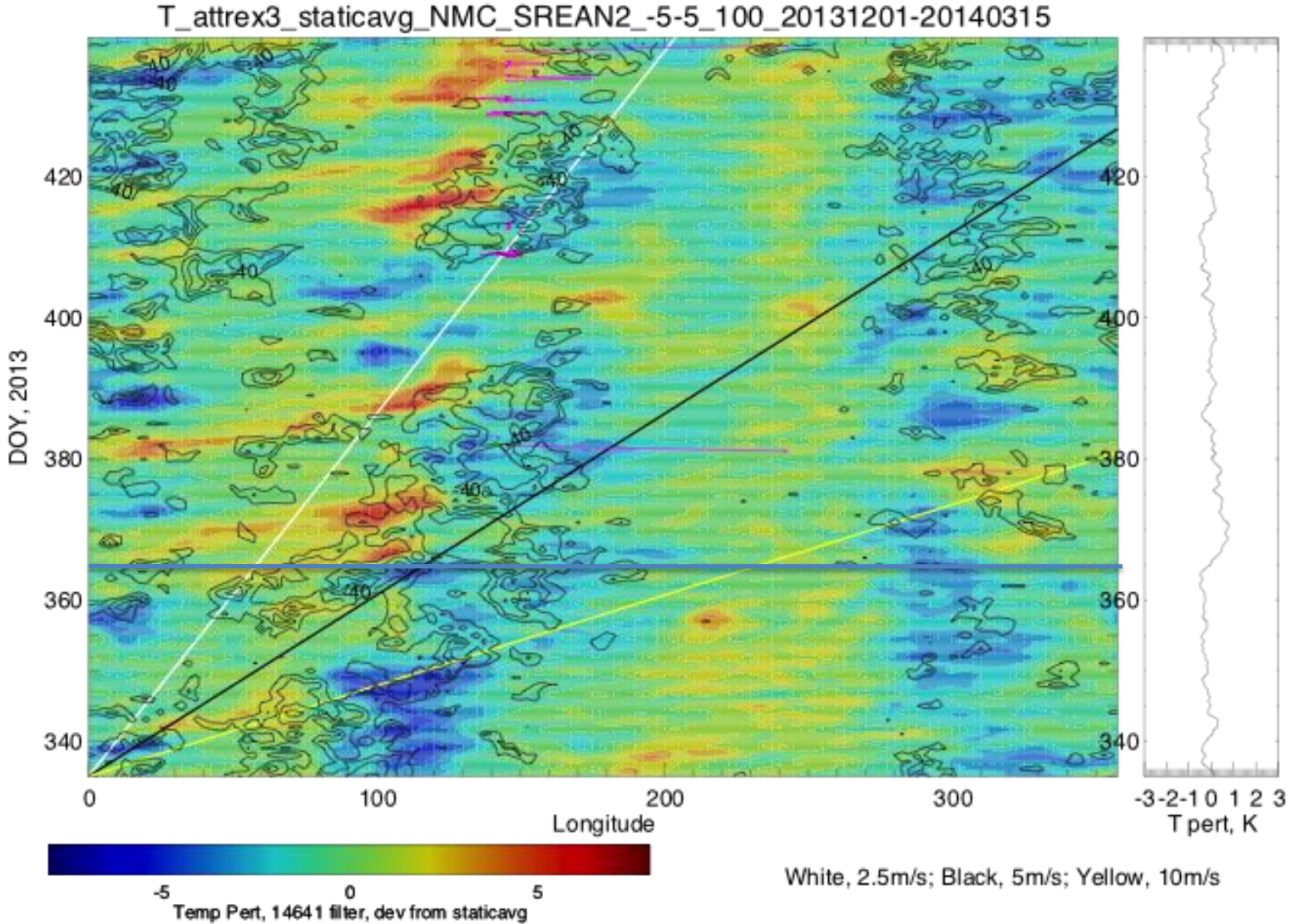
0.00 0.05 0.10 0.15 0.20 0.25 0.30  
Cloud Incidence, Mar 2013, 16.5-19.0 km (Trop T)



Hovmuller, 100mb at equator. Black lines are negative OLR deviations

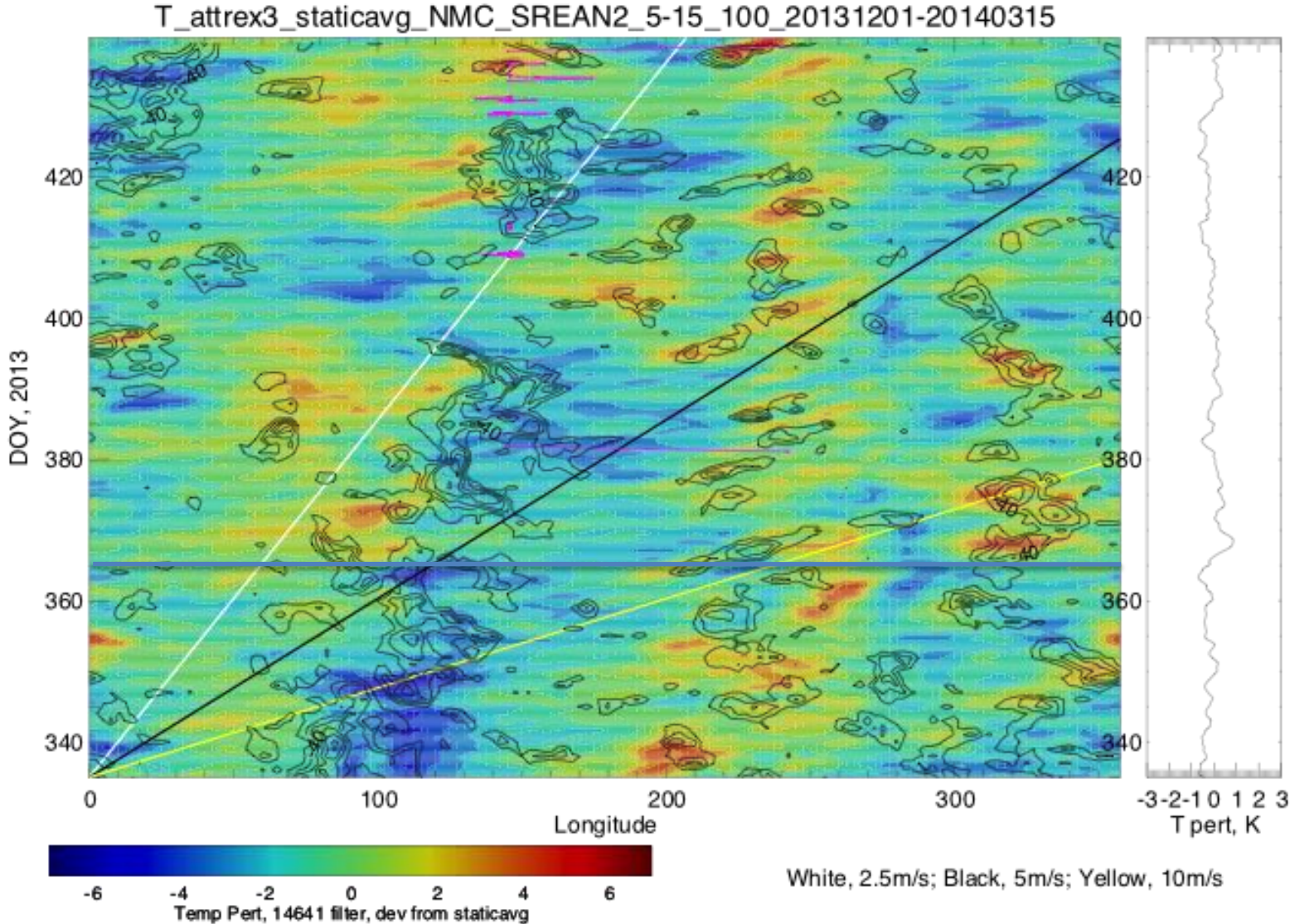


Hovmuller, 100mb at equator. Black lines are negative OLR deviations

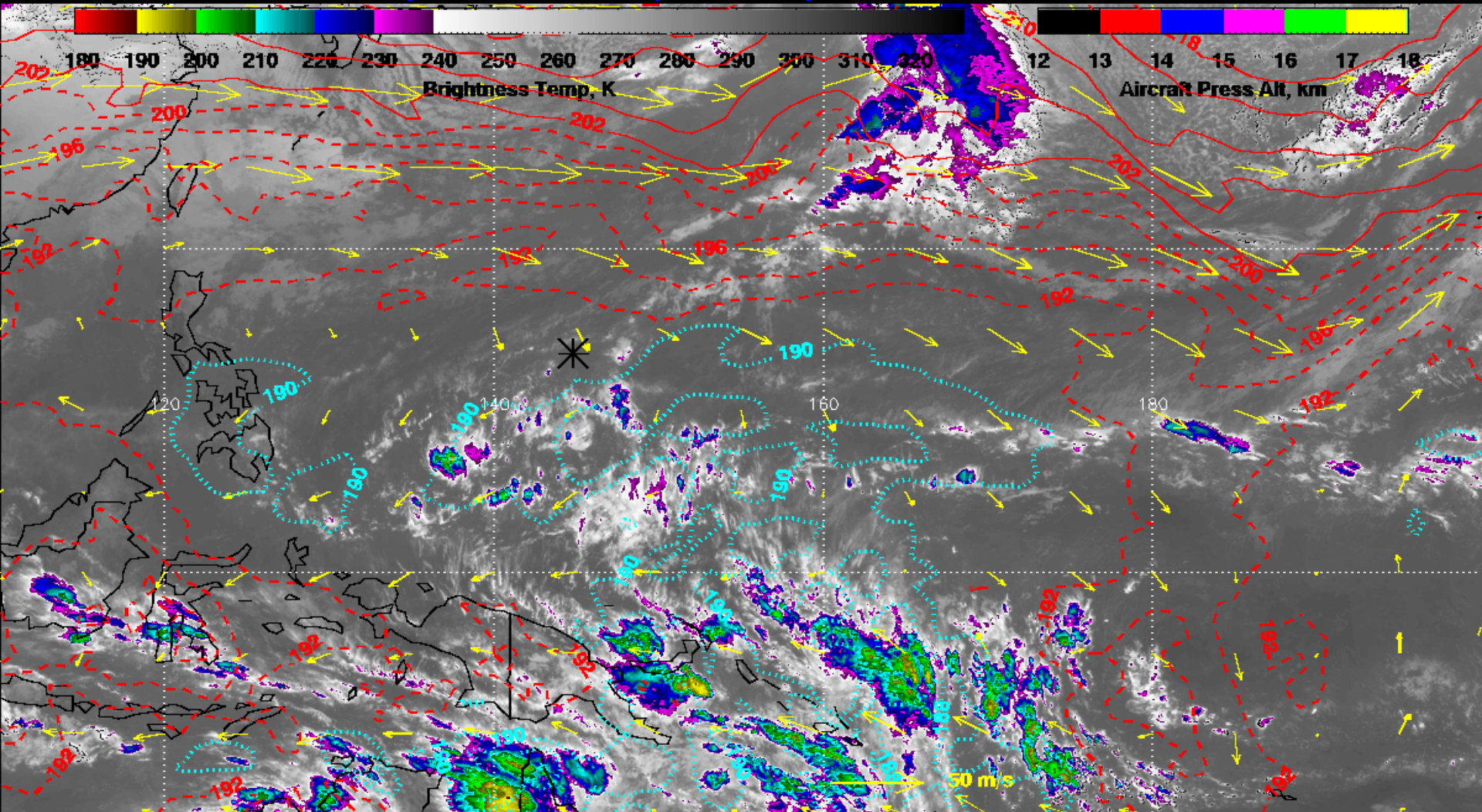




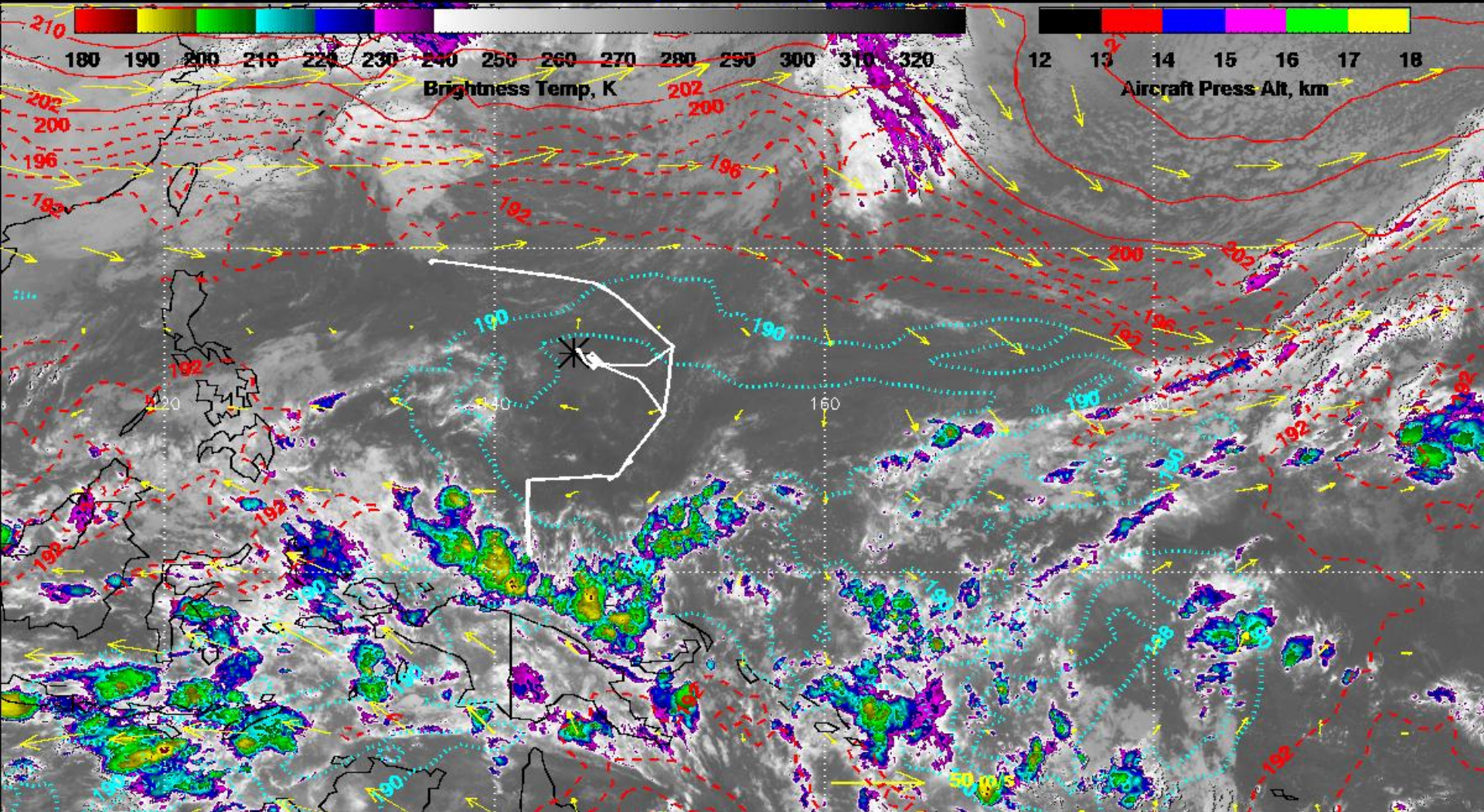
Hovmuller, 100mb 5-15N. Black lines are negative OLR deviations



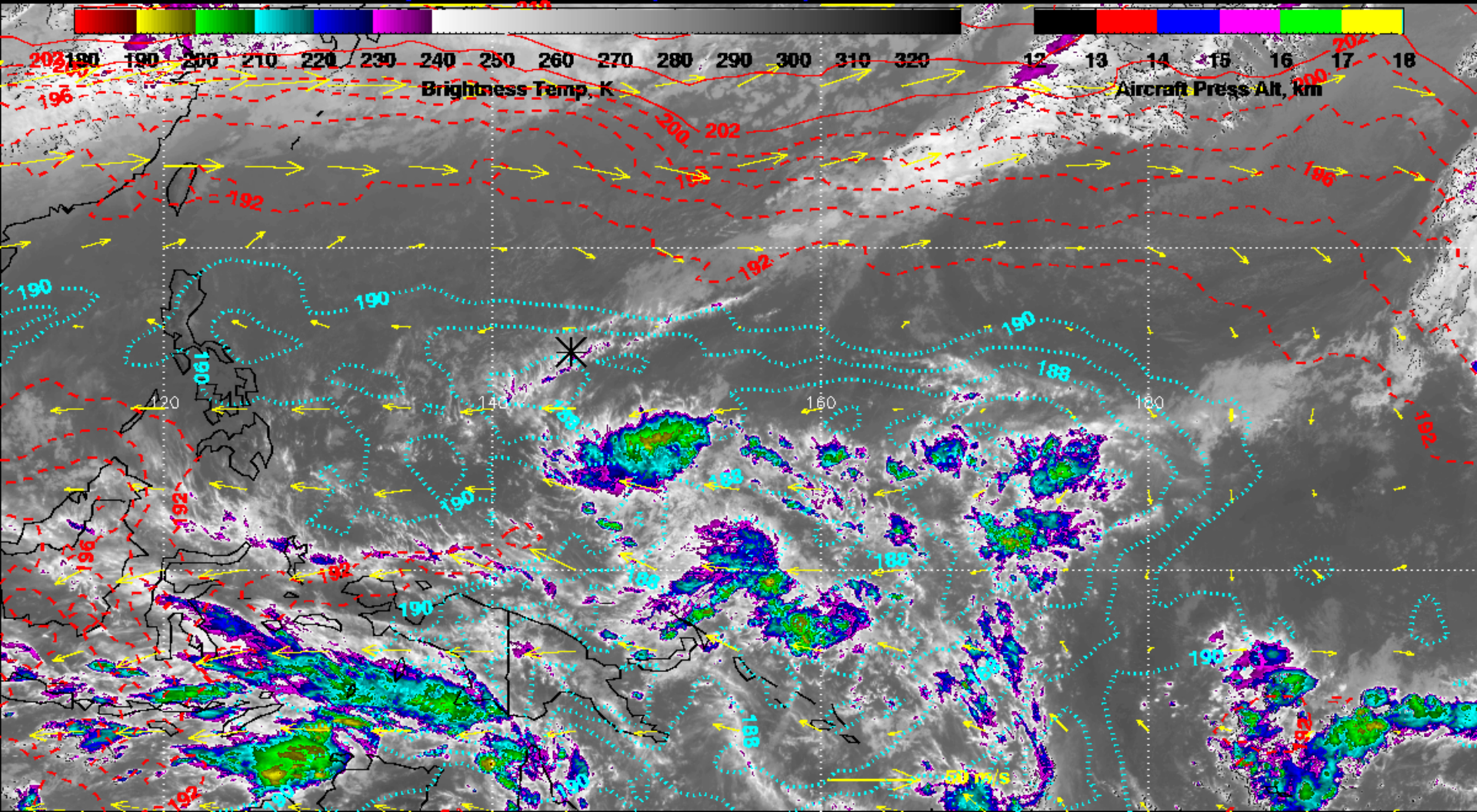
IR Window Channel with Trop T and 100mb wind (NCEP GDAS) for 201402050000



IR Window Channel with Trop T and 100mb wind (NCEP GDAS) for 201402131900



**IR Window Channel with Trop T and 100mb wind (NCEP GDAS) for 201402180100**

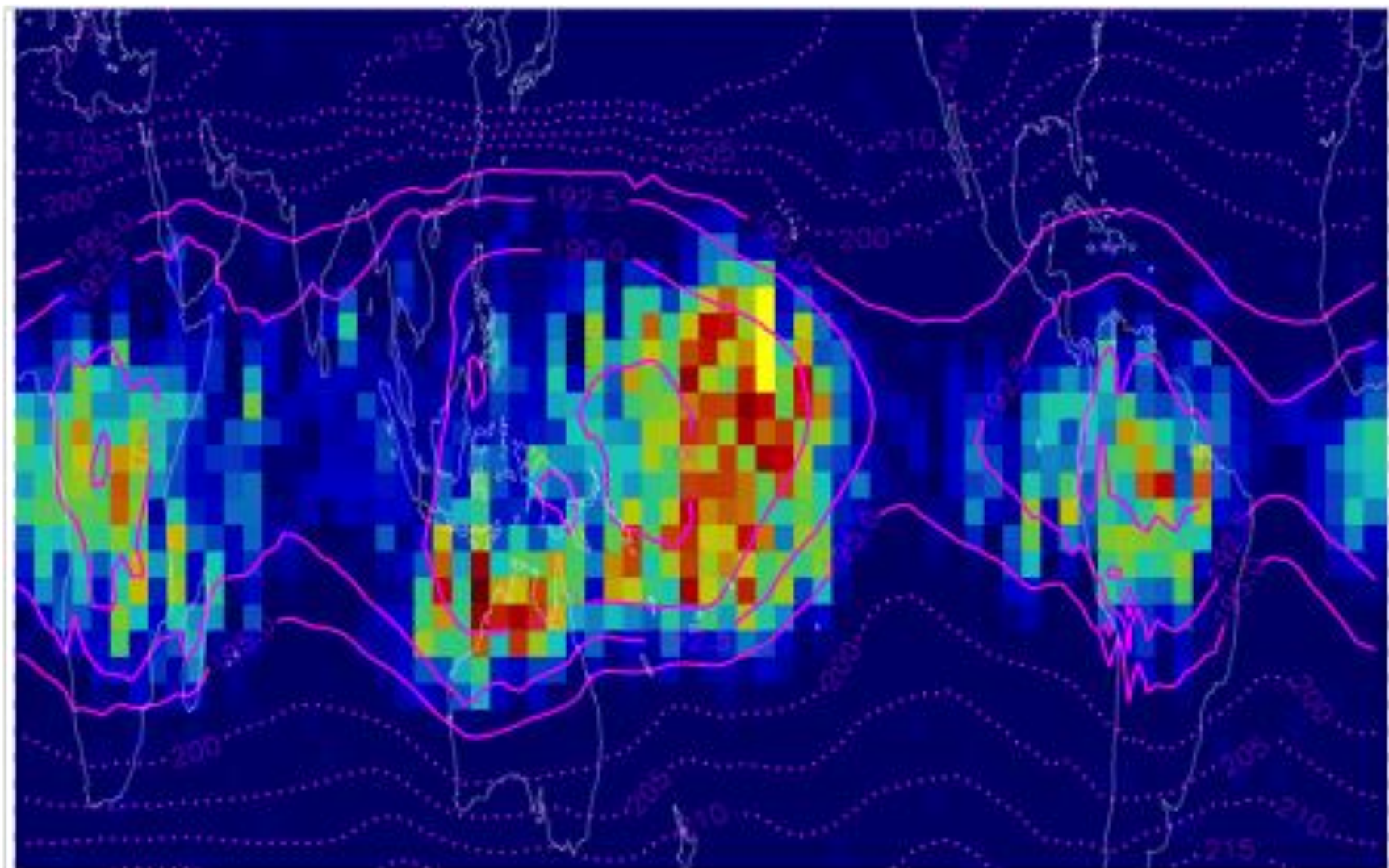


Air mass pdf file

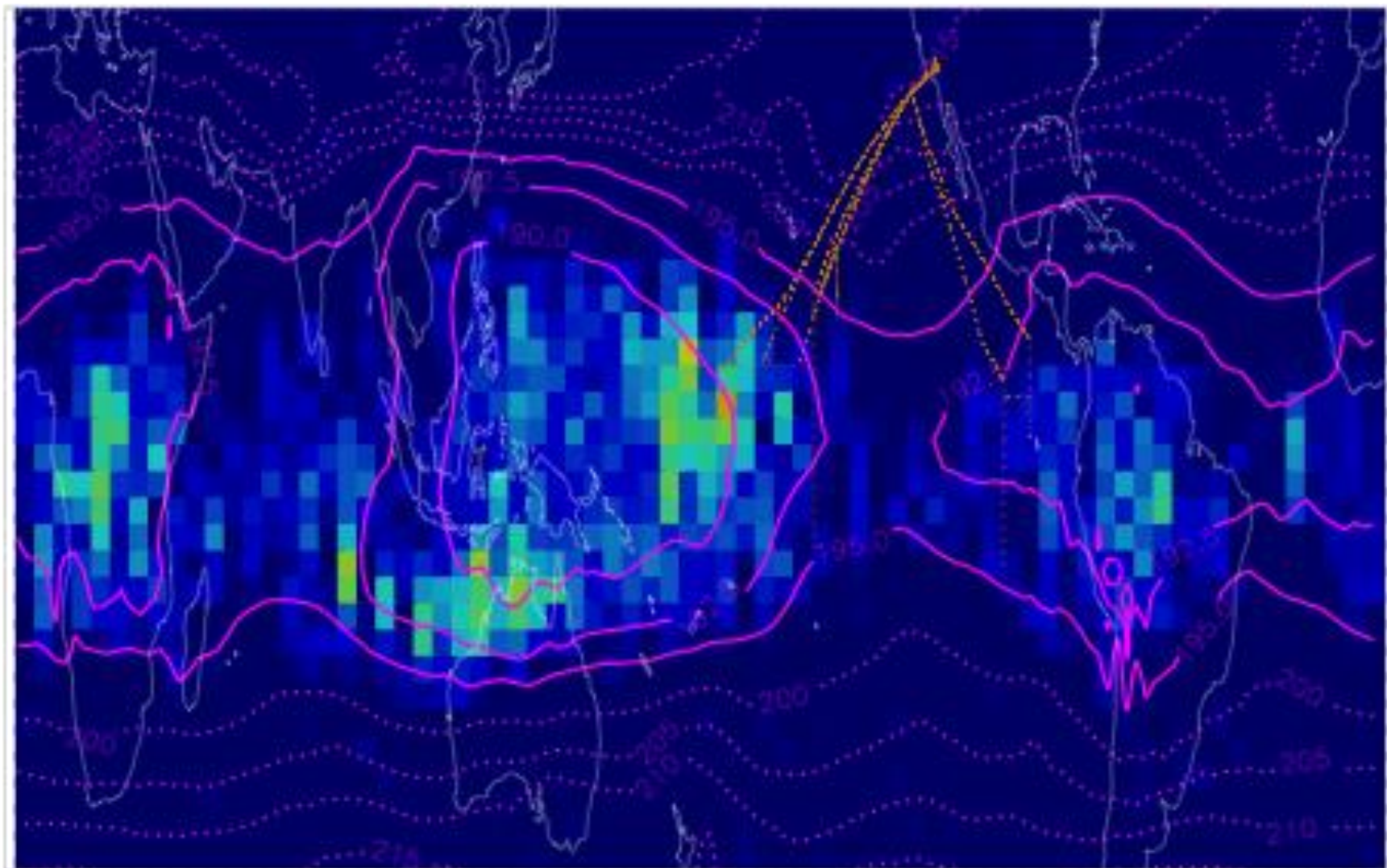
# Summary

- 2014 a “normal” year for tropopause temps – March colder than “normal”.
- More convection than typical in the northern hemisphere in Jan-Feb-early March.
- Absence of classic MJO, with very slow movement of convective activity from west to east during experimental period.
- Upper TTL (16.5-19km) cloud distributions roughly consistent with temperature pattern, but slightly upstream.
- Early flights exhibited an anomalous anticyclone pattern (anticyclone to the west of Guam). Anticyclone moved east of Guam for March flights.
- More to be done on air mass analysis. Early flights had more air nearby from Africa, later flights dominated by MC and SP convection.
- Can see convectively influenced air moving into cold temperatures, taking advantage of phase shift of anticyclone and T pattern.

# Backup







0.00

0.05

0.10

0.15

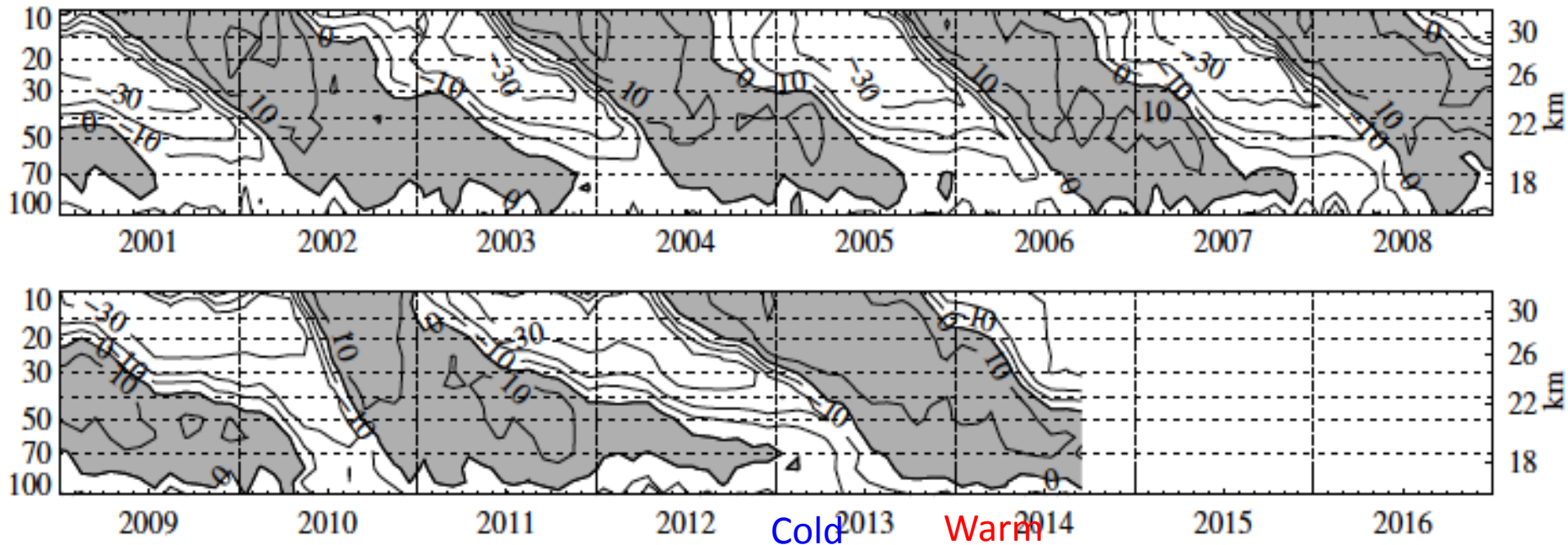
0.20

0.25

0.30

Cloud Incidence, Feb 2013, 16.5-19.0 km (Trop T)

QBO has strongest effect (in TTL) on 70mb T. Overlying easterlies (white) yield cold anomalies; overlying westerlies yield warm anomalies. Effect is to raise and lower the tropopause.



(From Freie Universitaet Berlin)

Average West Pac Tropical (-20-20;90-210) 100 and 70 mb Temps (NCAR Reanalysis)

