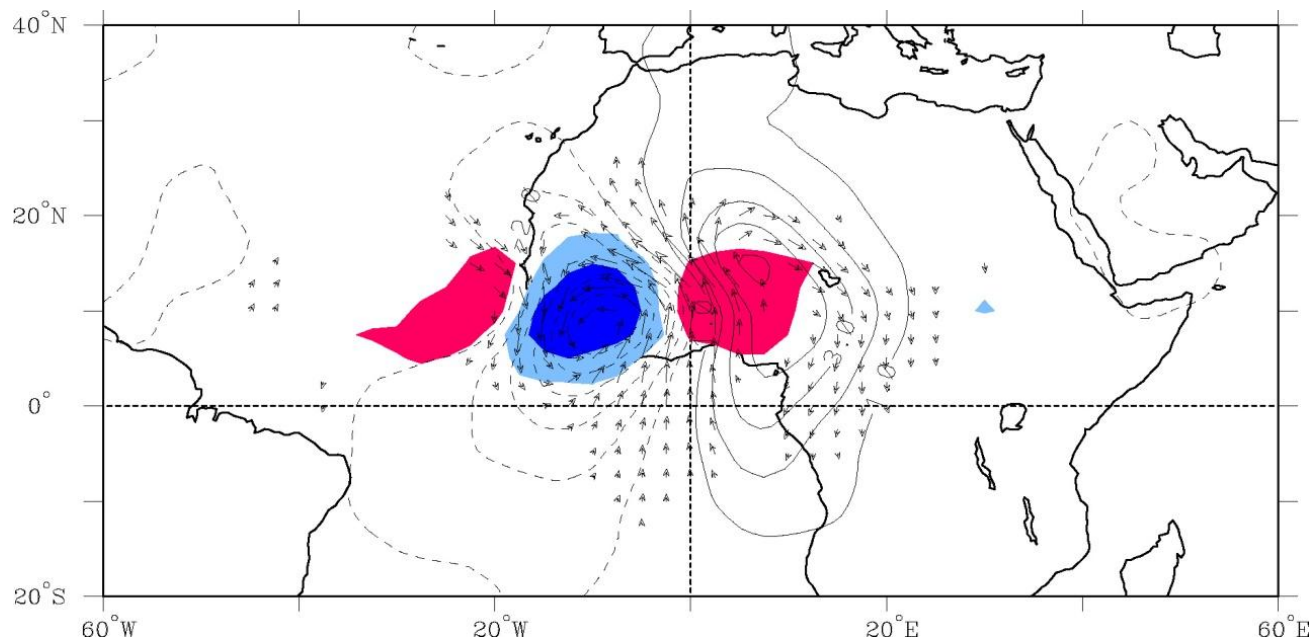
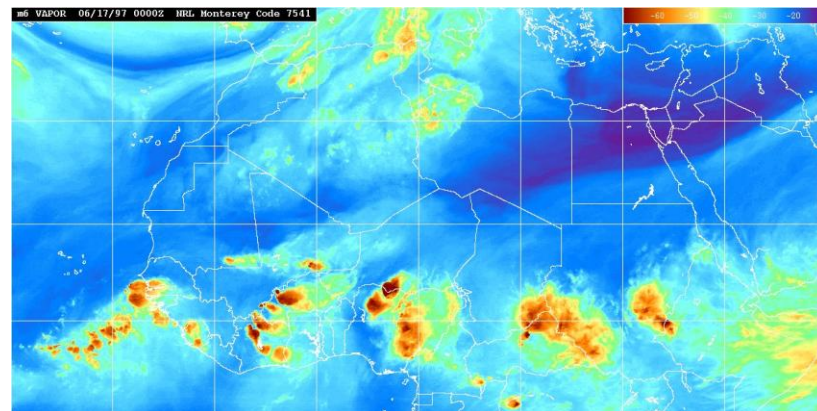


Easterly Waves and the YOTC Period: Chris Thorncroft (SUNY at Albany)

1. Key scientific issues
2. Overview of the 2008 Summer Season
3. Some Interesting Cases
4. Summary



1. Key Scientific Issues

1. Initiation of AEWs:

What is the role of upstream convection?

What is the role of the Easterly jet?

2. Baroclinic Growth and interactions with Convection including MCSs:

How is convection triggered? What are the relative roles of the synoptic structure and topography?

How do MCSs feedback onto AEW structure?

3. Relationship between AEWs and Tropical Cyclones:

How does the AEW/MCS structure impact probability of tropical cyclogenesis?

What is the role of dry air (SAL and Midlatitude)?

1. Key Scientific Issues

4. Intraseasonal Variability of AEWs:

What are the relative roles of variability in “triggers” and the African Easterly Jet?

What are the external (to Africa) causes of intraseasonal variability?

Is there internally generated intraseasonal variability?

5. Interactions between AEWs and Equatorial Waves:

How do Kelvin waves impact the nature of AEWs?

Do other Equatorial waves have a role?

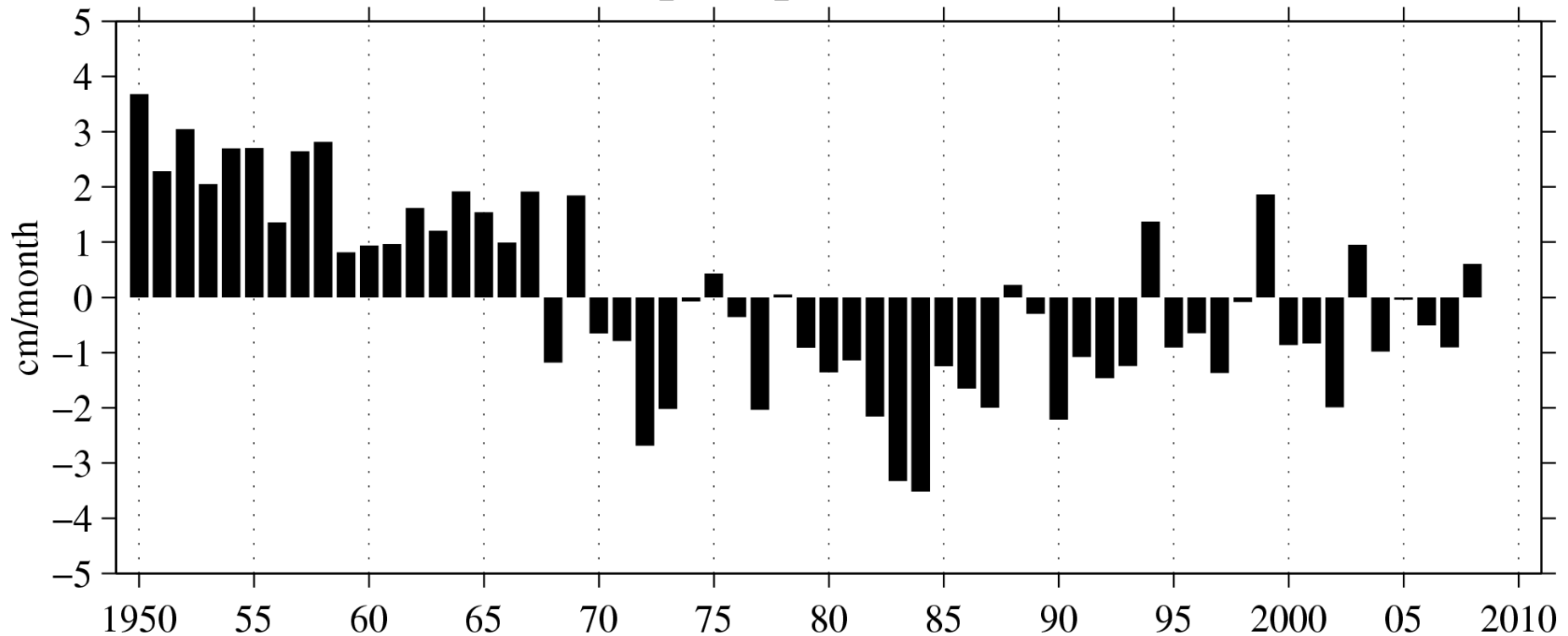
6. Interactions between AEWs and Extratropics:

Do midlatitude troughs impact the nature of AEWs?

Do they impact the tropical cyclogenesis?

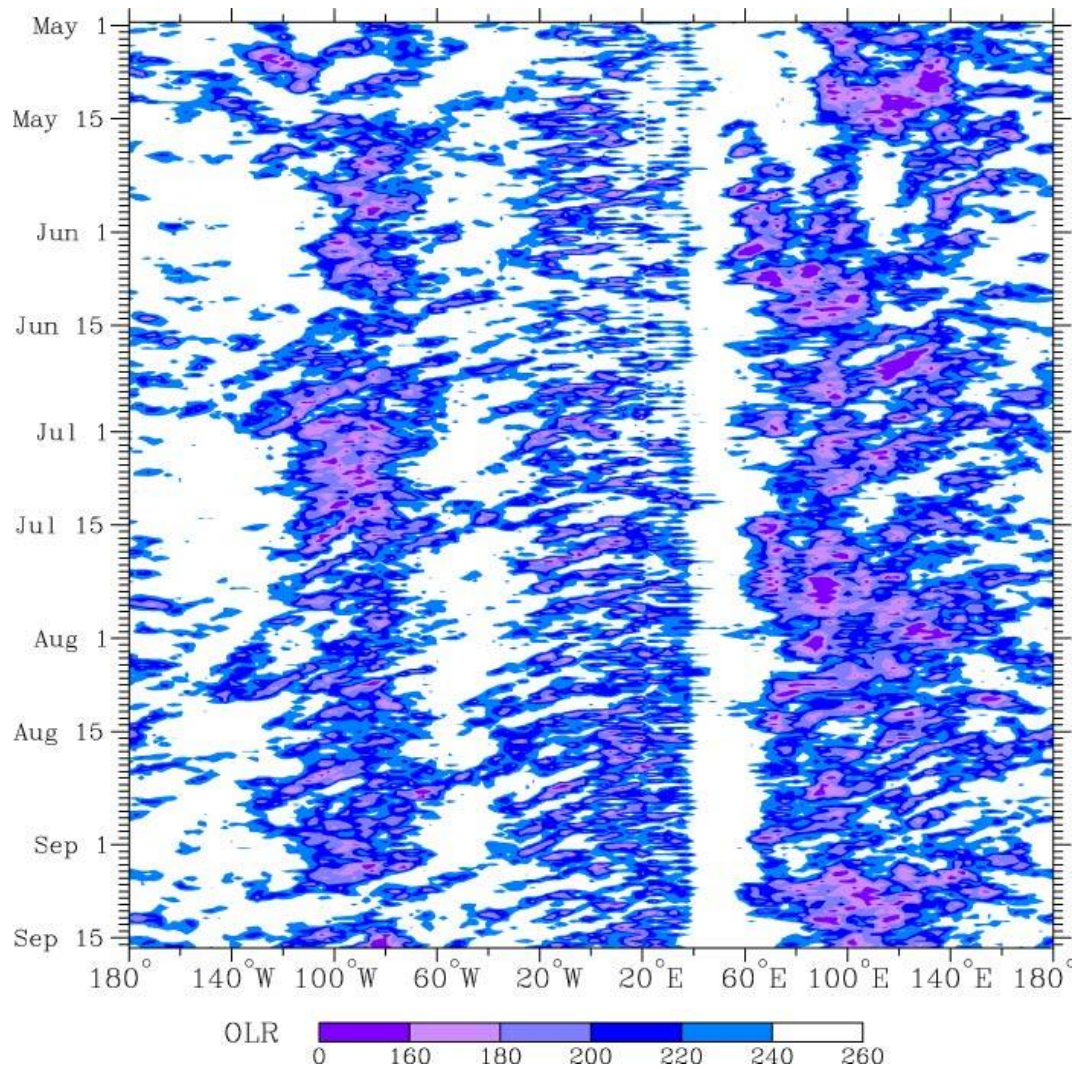
2. Overview of the 2008 Summer Season: A Wet Sahel

JJASO–mean Sahel precipitation anomalies 1950–2008



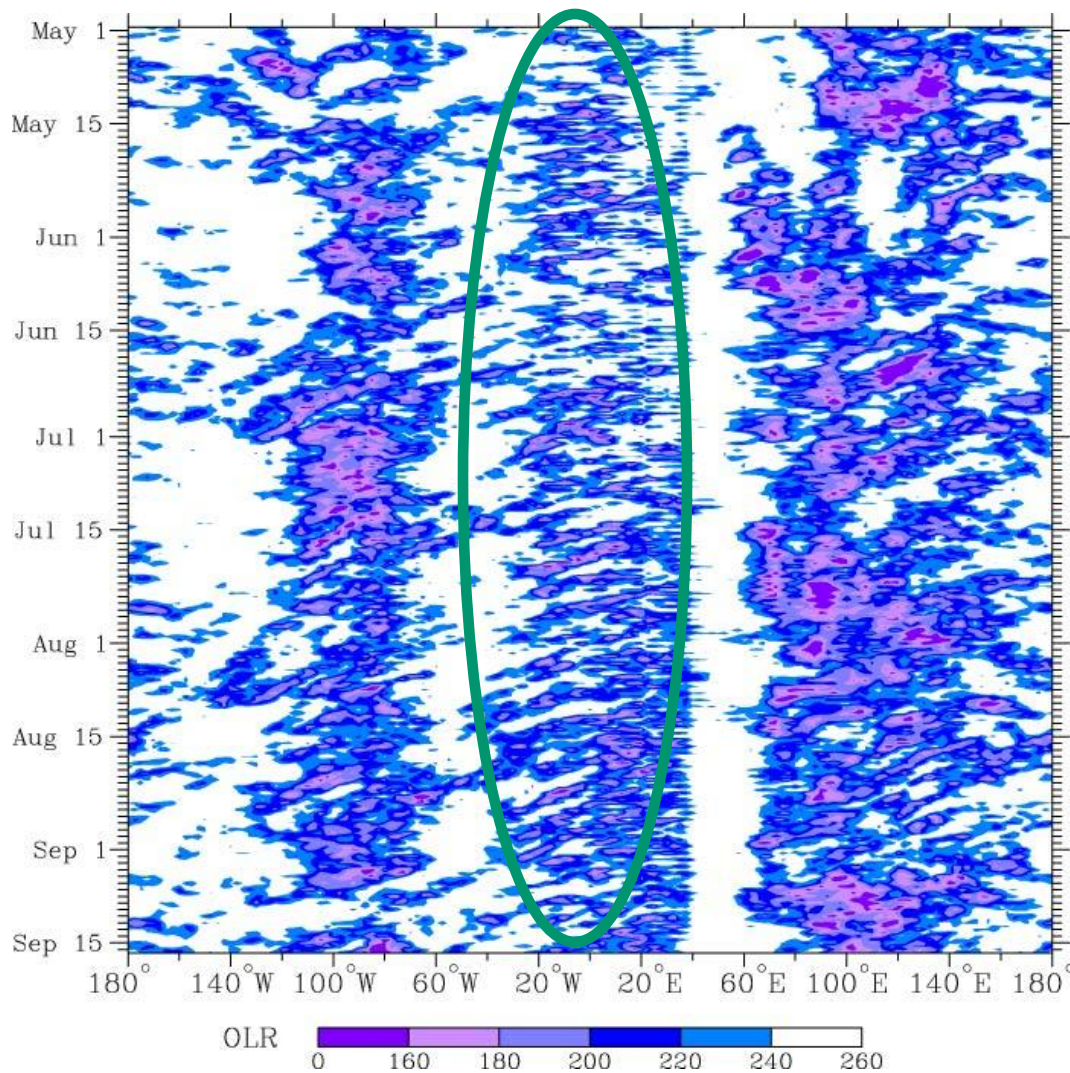
Averages over 20–10N, 20W–10E; 1950–2008 climatology
NOAA NCDC Global Historical Climatology Network data

2. Overview of the 2008 Summer Season: OLR (5N-15N)



Courtesy George Kiladis

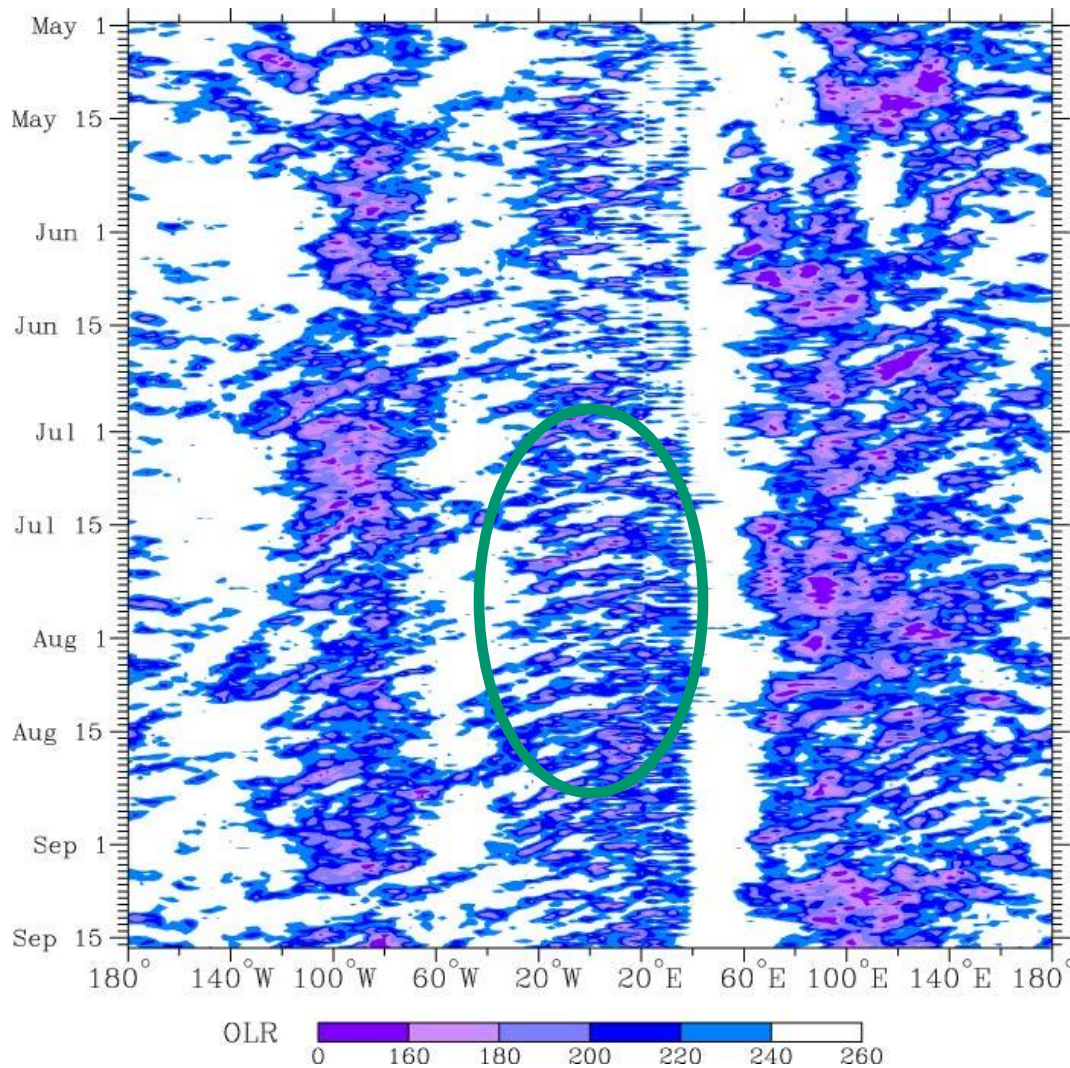
2. Overview of the 2008 Summer Season: OLR (5N-15N)



Only significant
AEW activity is in
the Africa-Atlantic
sector?

Courtesy George Kiladis

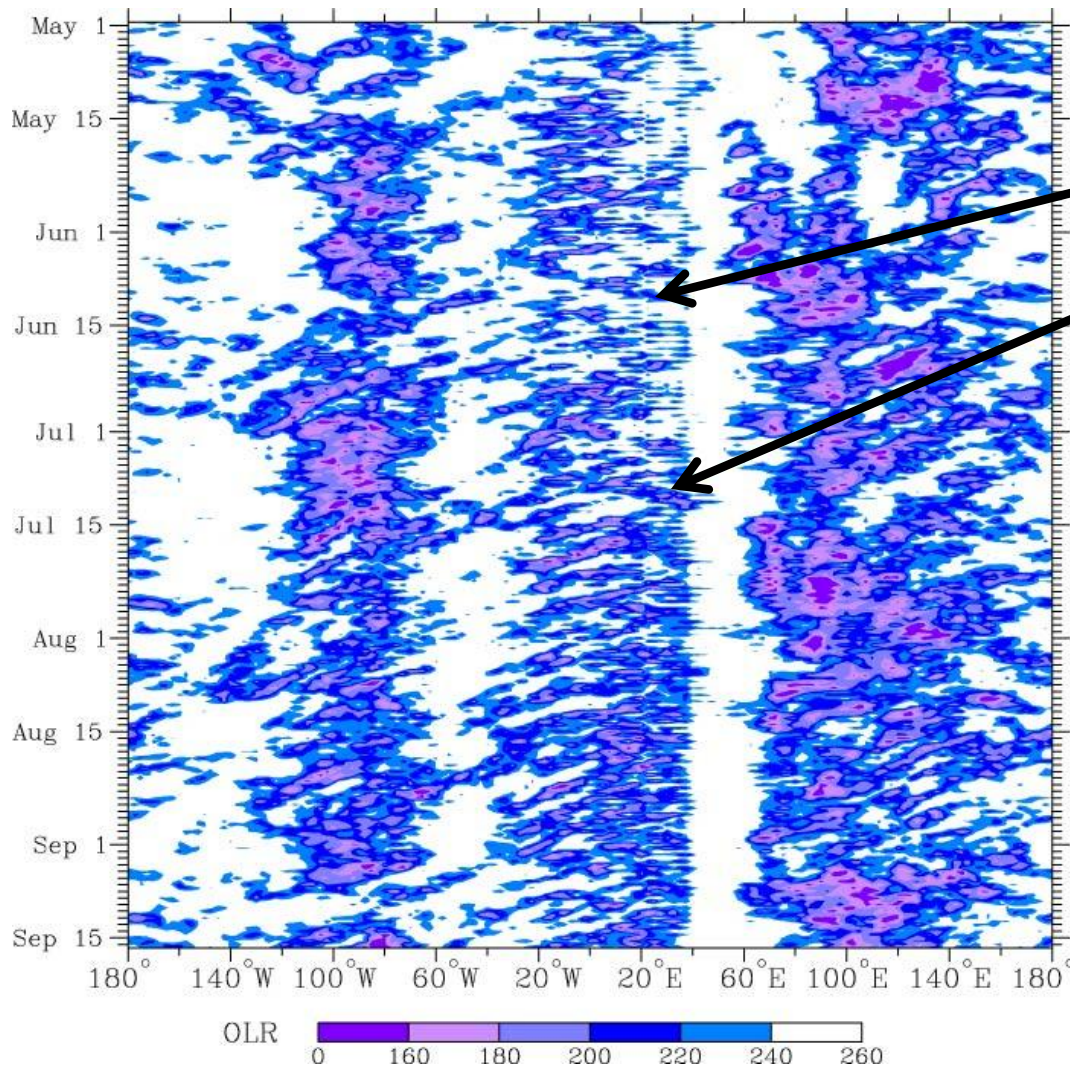
2. Overview of the 2008 Summer Season: OLR (5N-15N)



Season characterised
by significant and
coherent AEW
activity

Courtesy George Kiladis

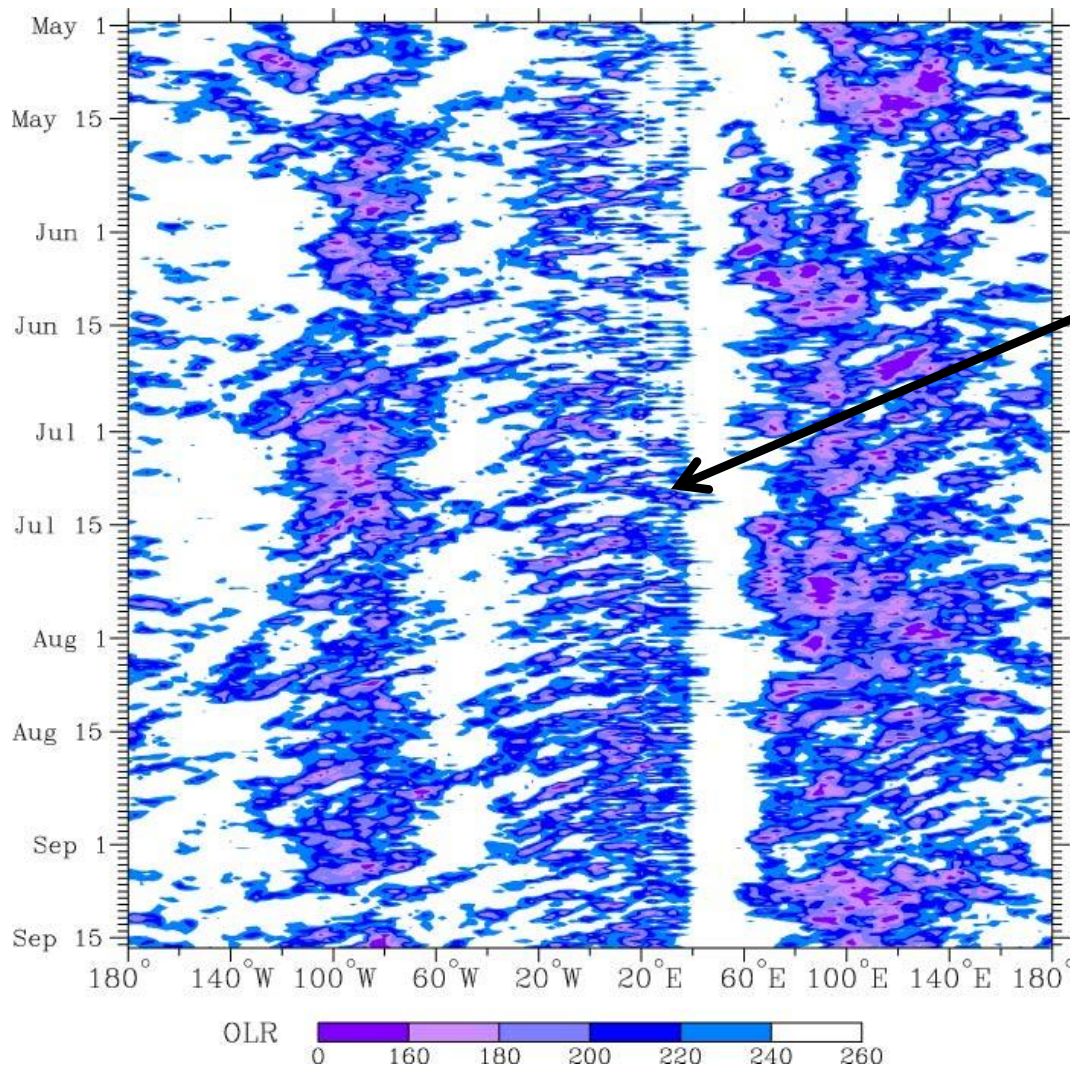
2. Overview of the 2008 Summer Season: OLR (5N-15N)



Evidence for Kelvin waves passing through

Courtesy George Kiladis

2. Overview of the 2008 Summer Season: OLR (5N-15N)

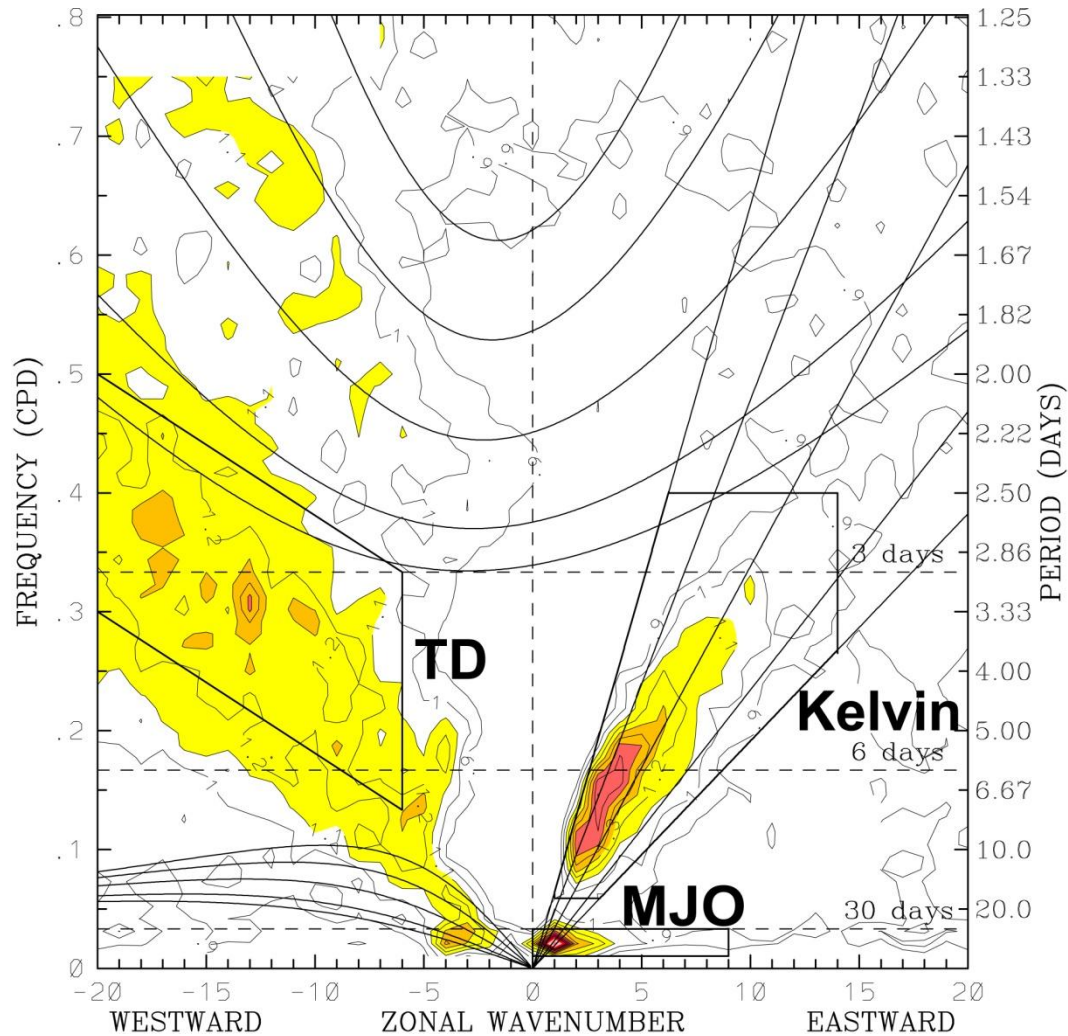


Evidence for Kelvin waves passing through

Link to MJO?

Courtesy George Kiladis

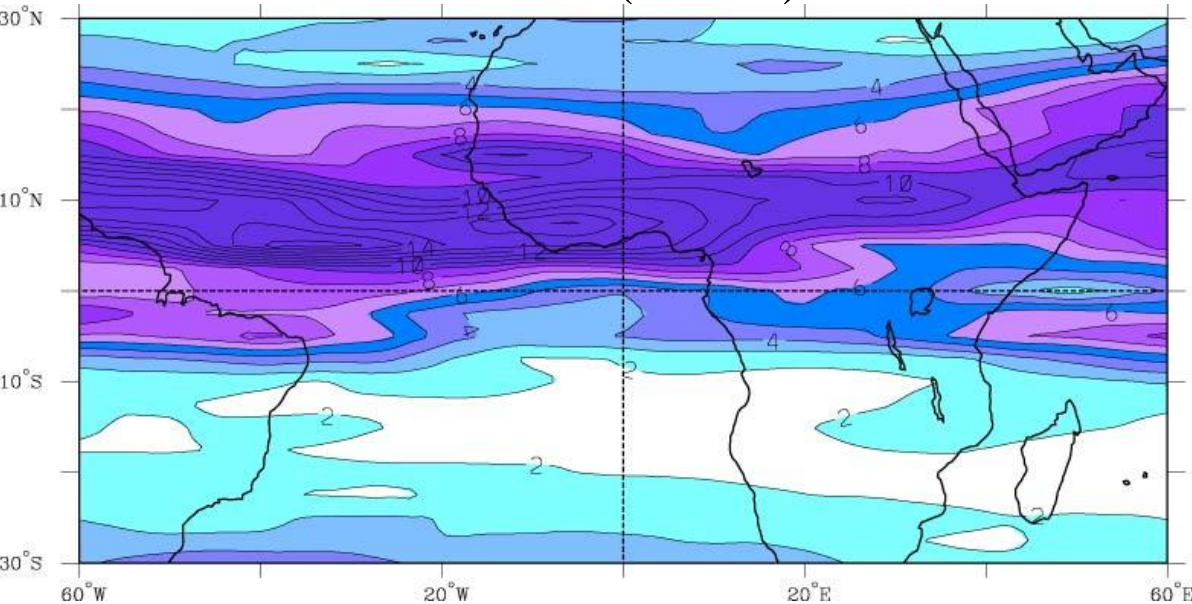
2. Overview of the 2008 Summer Season: TD Filtering



Courtesy George Kiladis

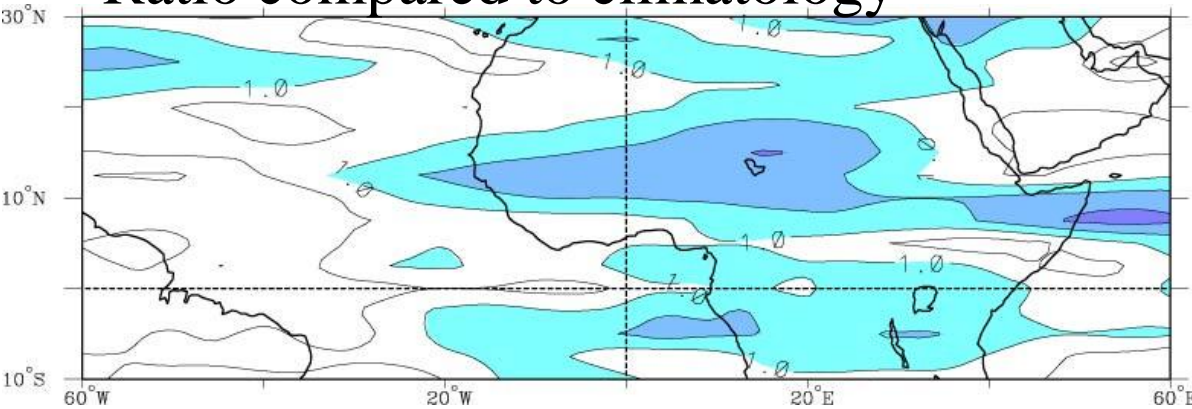
2. Overview of the 2008 Summer Season: TD-Filtering

Standard Deviation (W/m^2)



JUNE

Ratio compared to climatology

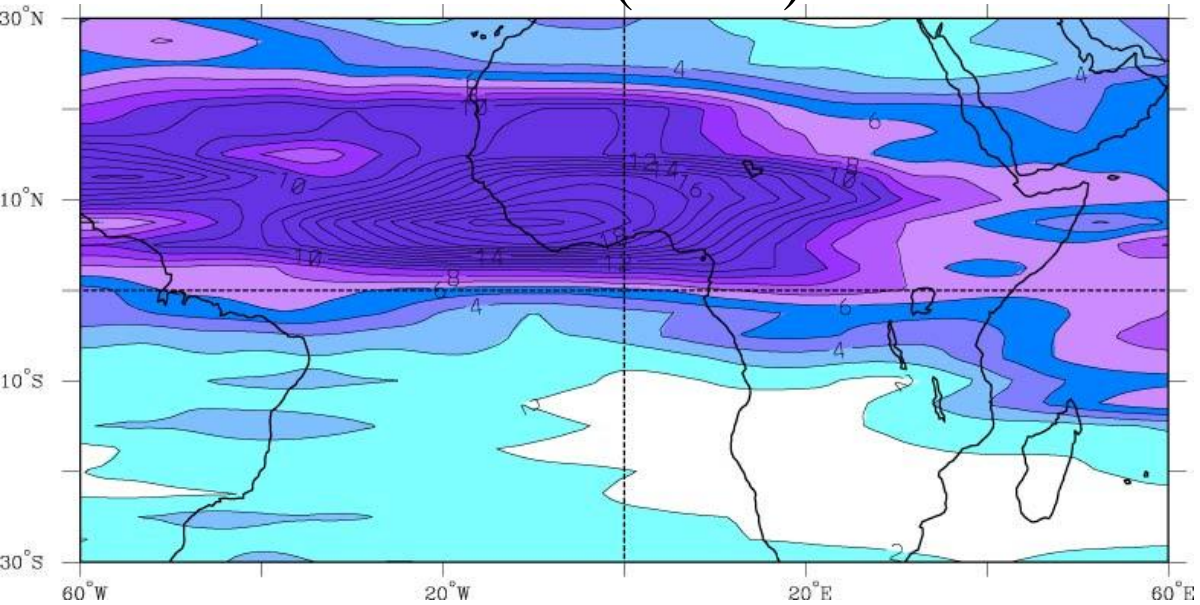


June: 10% more active than climatology over most of tropical North Africa

Courtesy George Kiladis

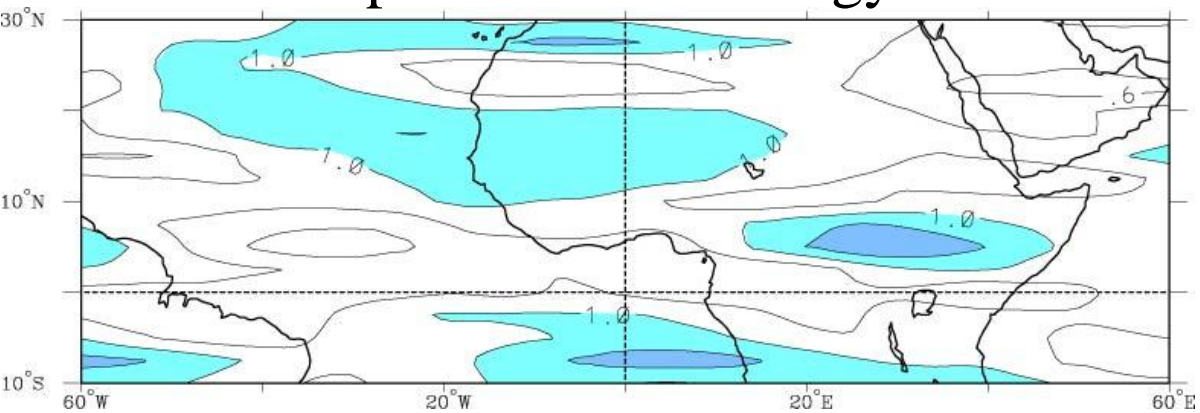
2. Overview of the 2008 Summer Season: TD-Filtering

Standard Deviation (W/m^2)



JULY

Ratio compared to climatology

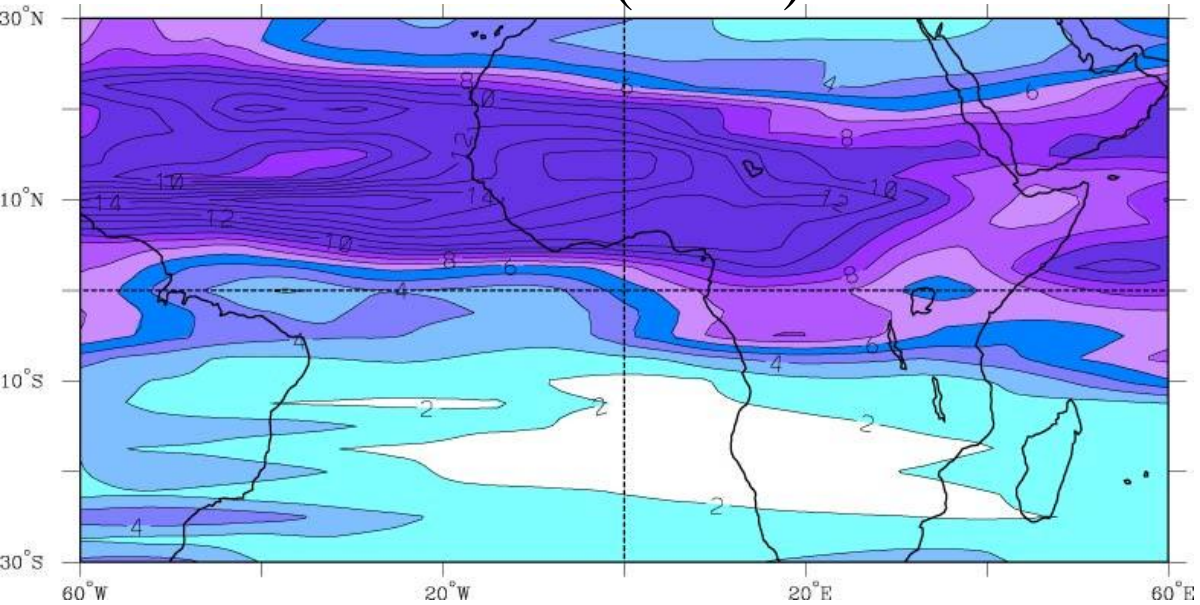


July: Close to average

Courtesy George Kiladis

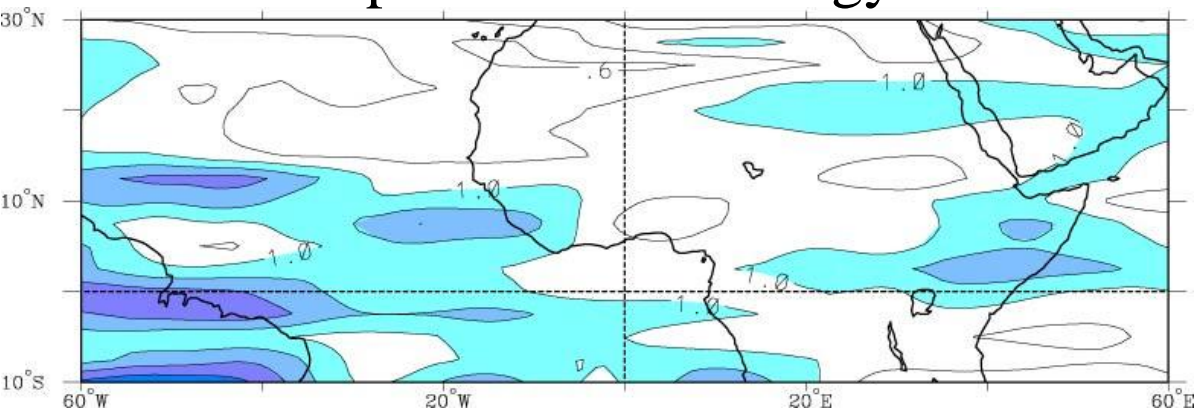
2. Overview of the 2008 Summer Season: TD-Filtering

Standard Deviation (W/m^2)



AUGUST

Ratio compared to climatology

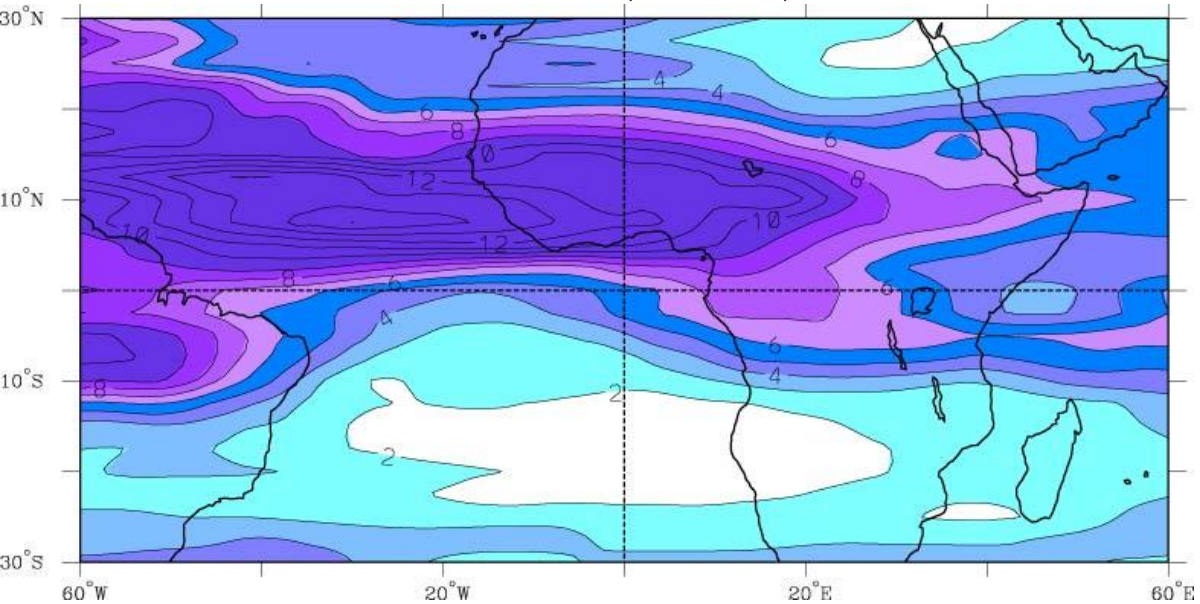


August: Below Average over Africa, more active over ocean compared to climatology

Courtesy George Kiladis

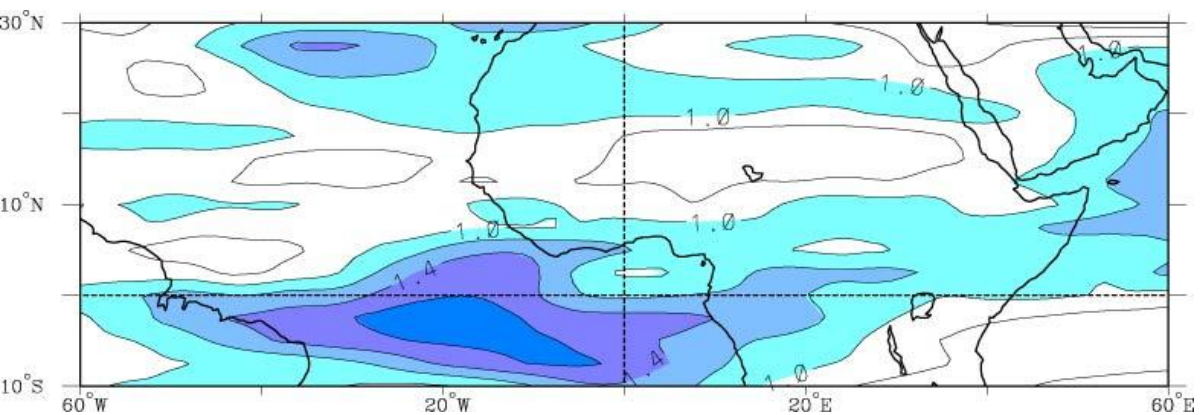
2. Overview of the 2008 Summer Season: TD-Filtering

Standard Deviation (W/m^2)



SEPTEMBER

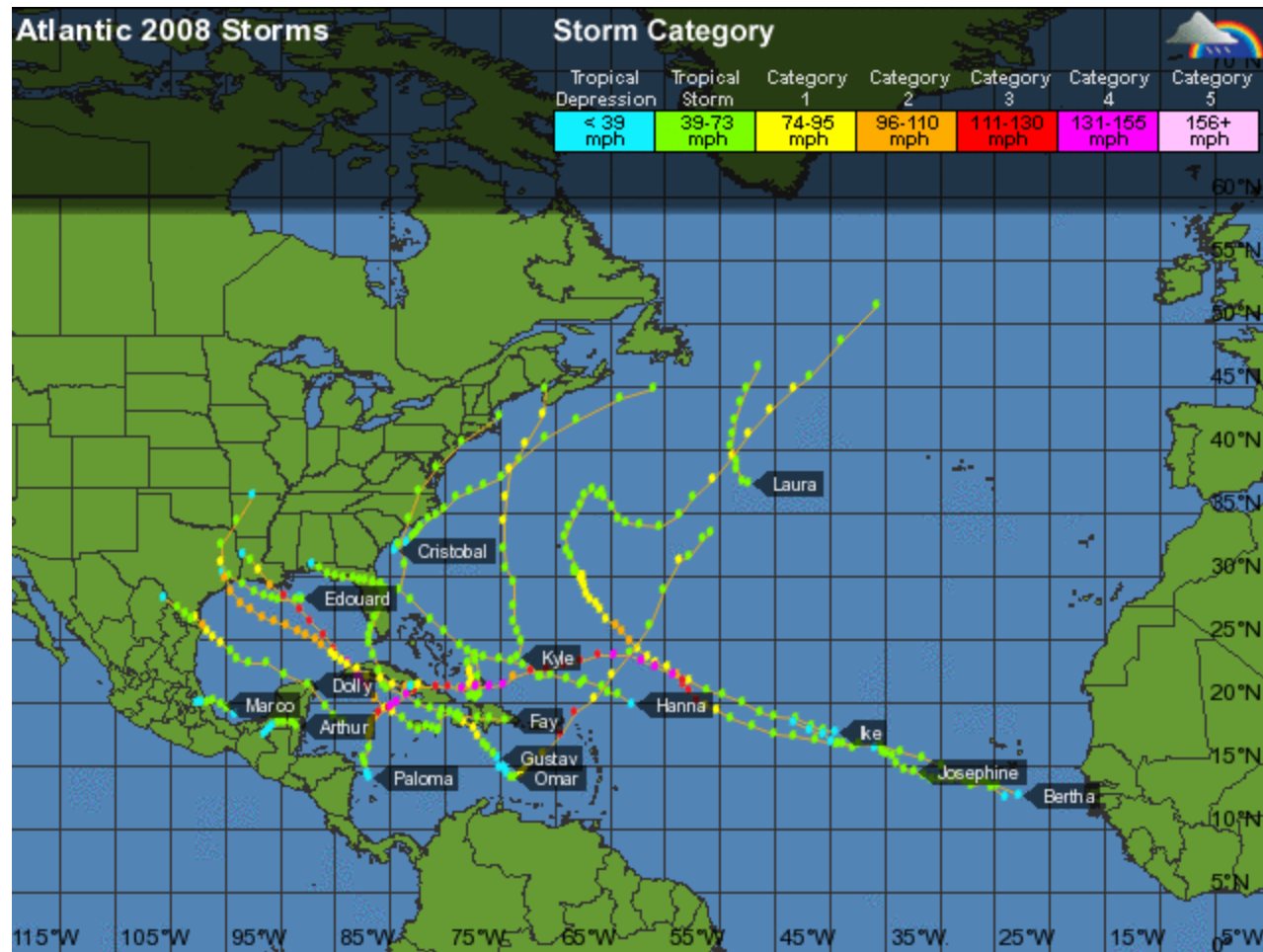
Ratio compared to climatology



September: Below Average over Africa, more active over equatorial region compared to climatology

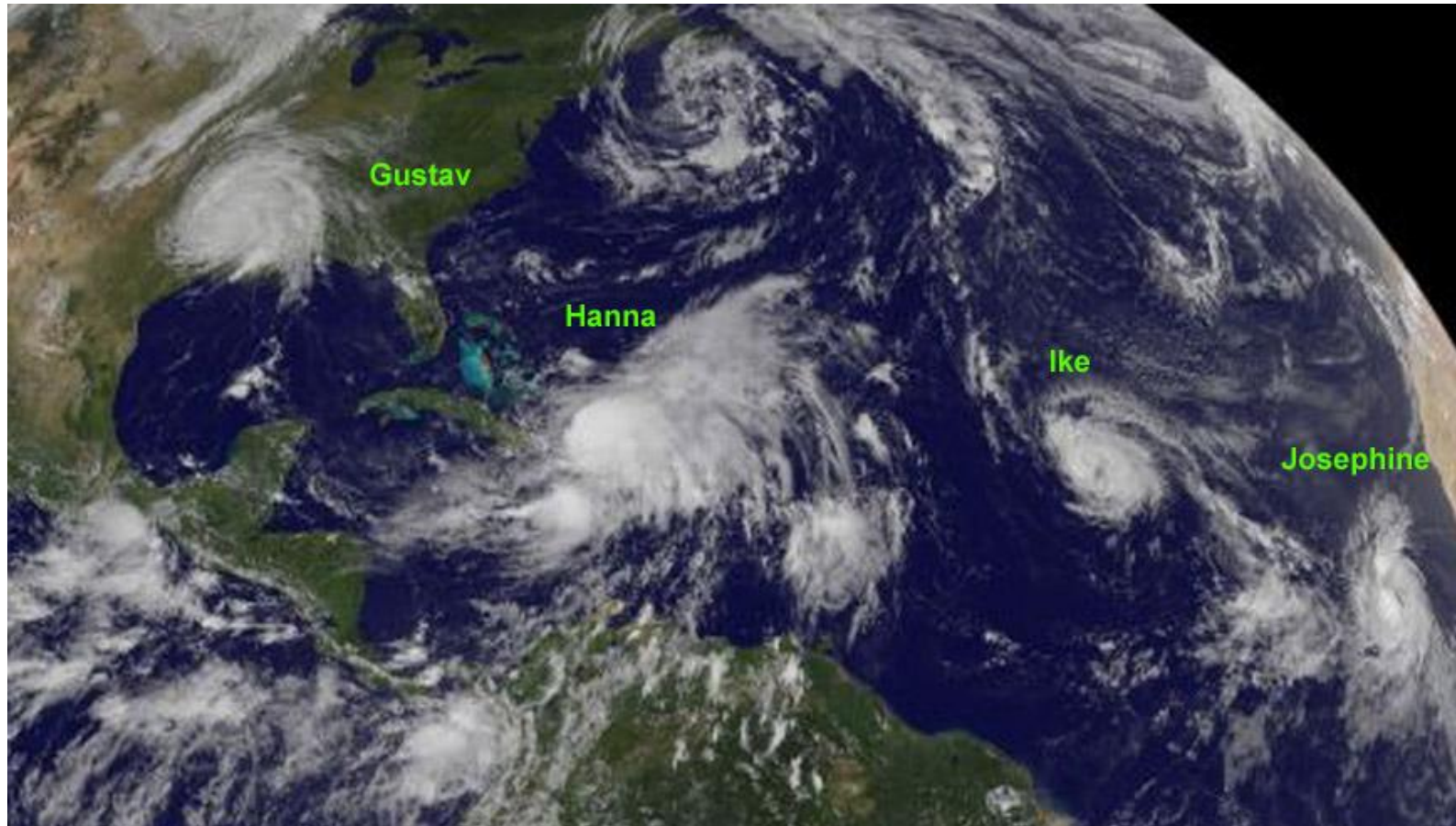
Courtesy George Kiladis

2. Overview of the 2008 Summer Season: Hurricanes



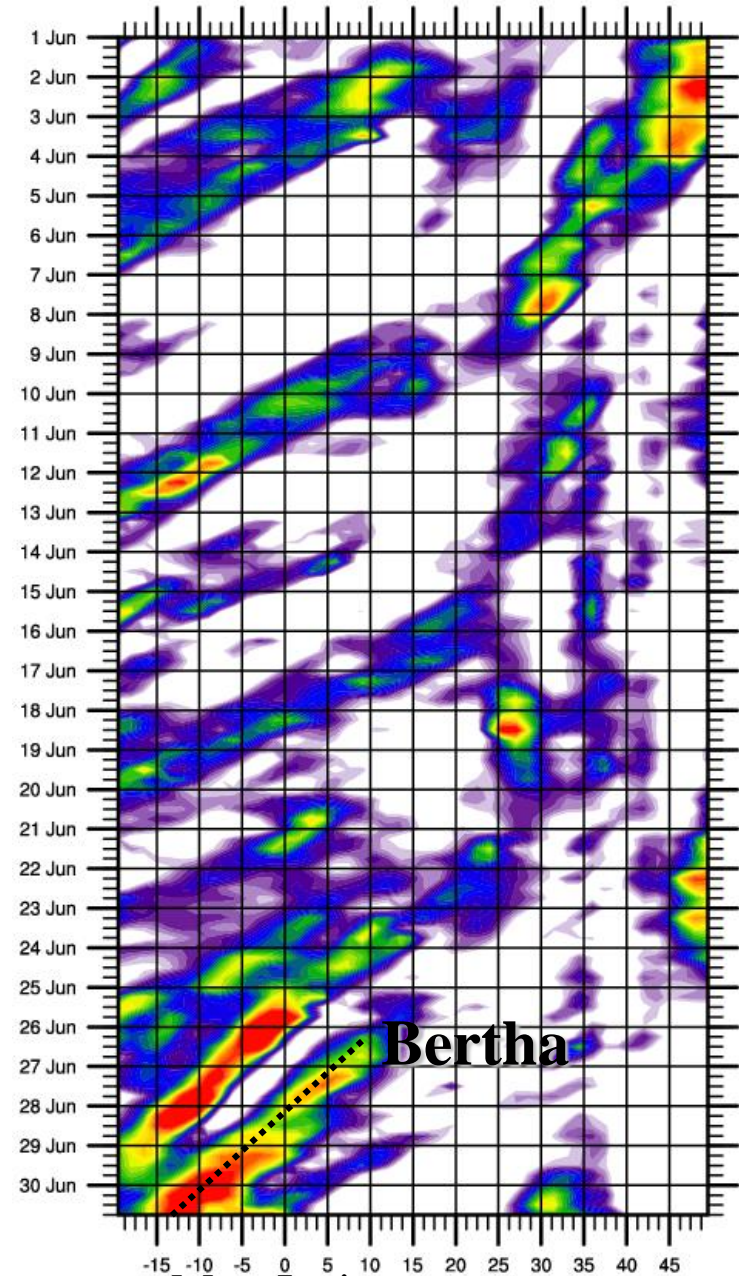
An active hurricane season: 16 named storms (8 hurricanes including 5 major hurricanes)

2. Overview of the 2008 Summer Season: Hurricanes

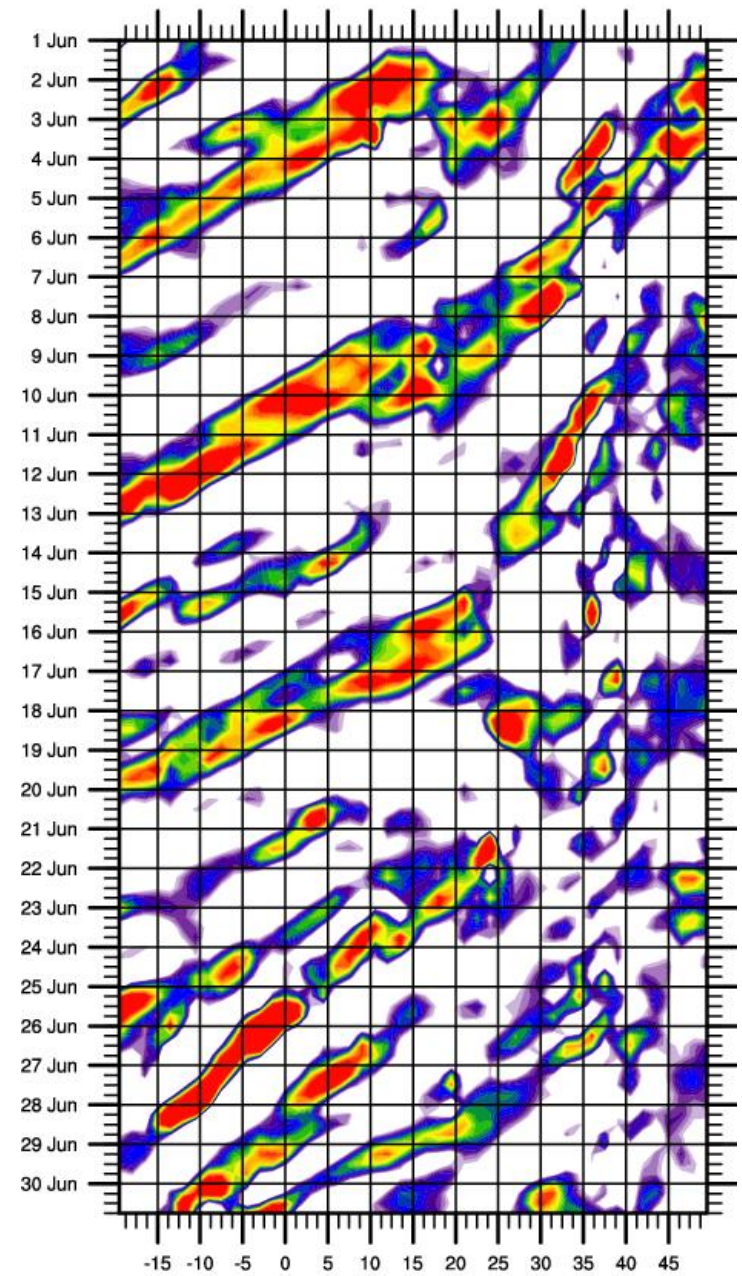


Severn formed from AEWs including all four shown here

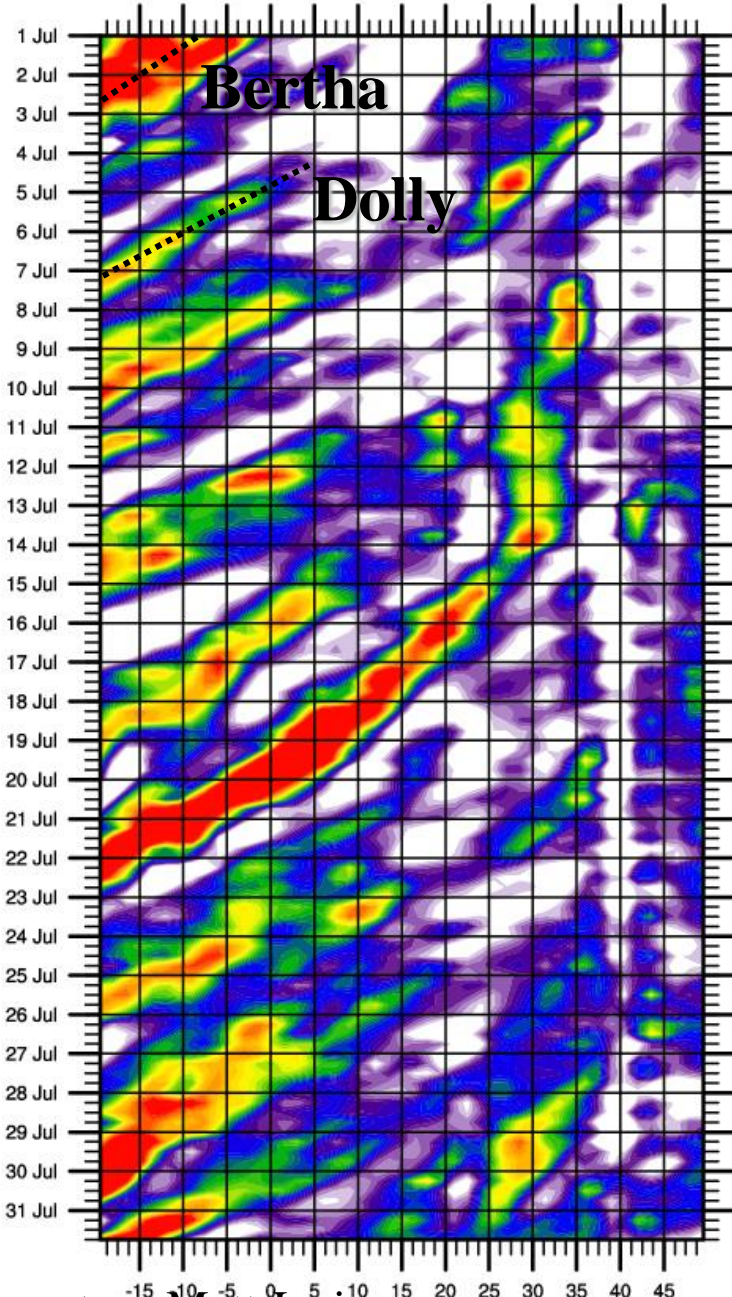
June 2008 650 PV (0.1 PVU) 4.5-16.5N



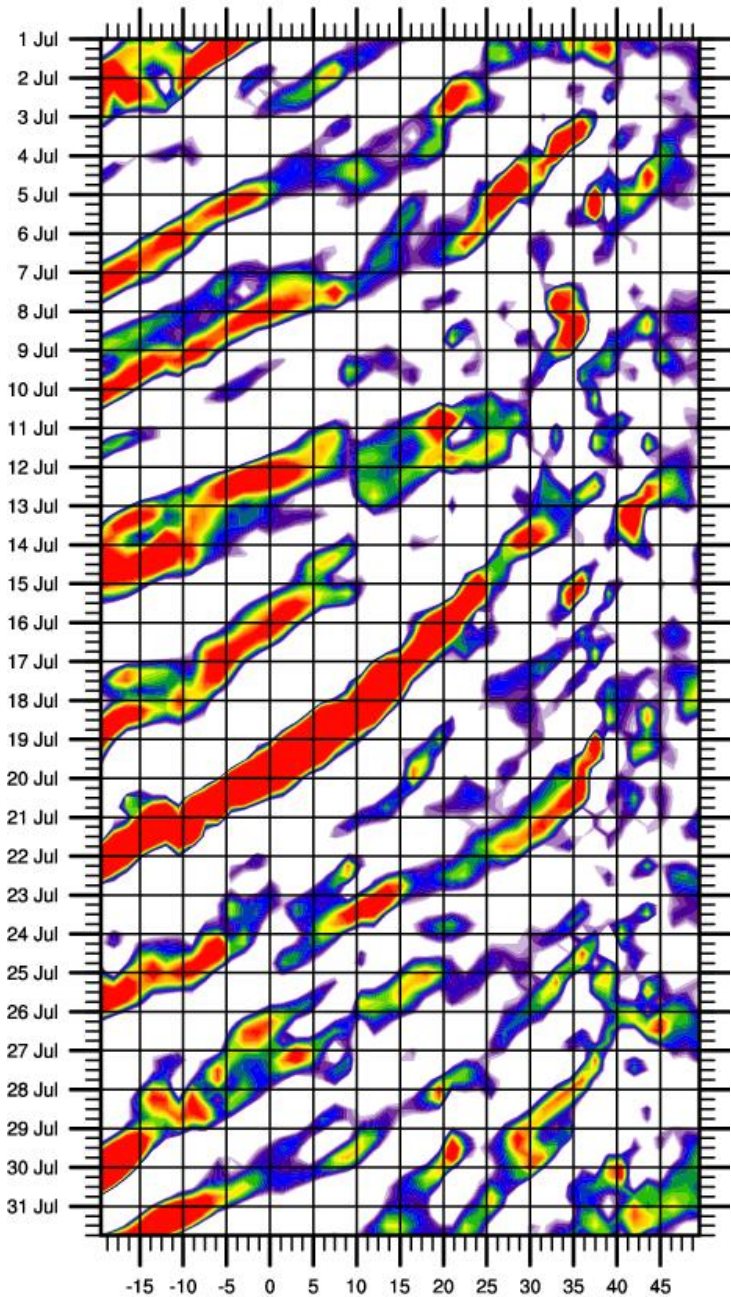
June 2008 1-8d Pv. 4.5-16.5N



July 2008 650 PV (0.1 PVU) 4.5-16.5N

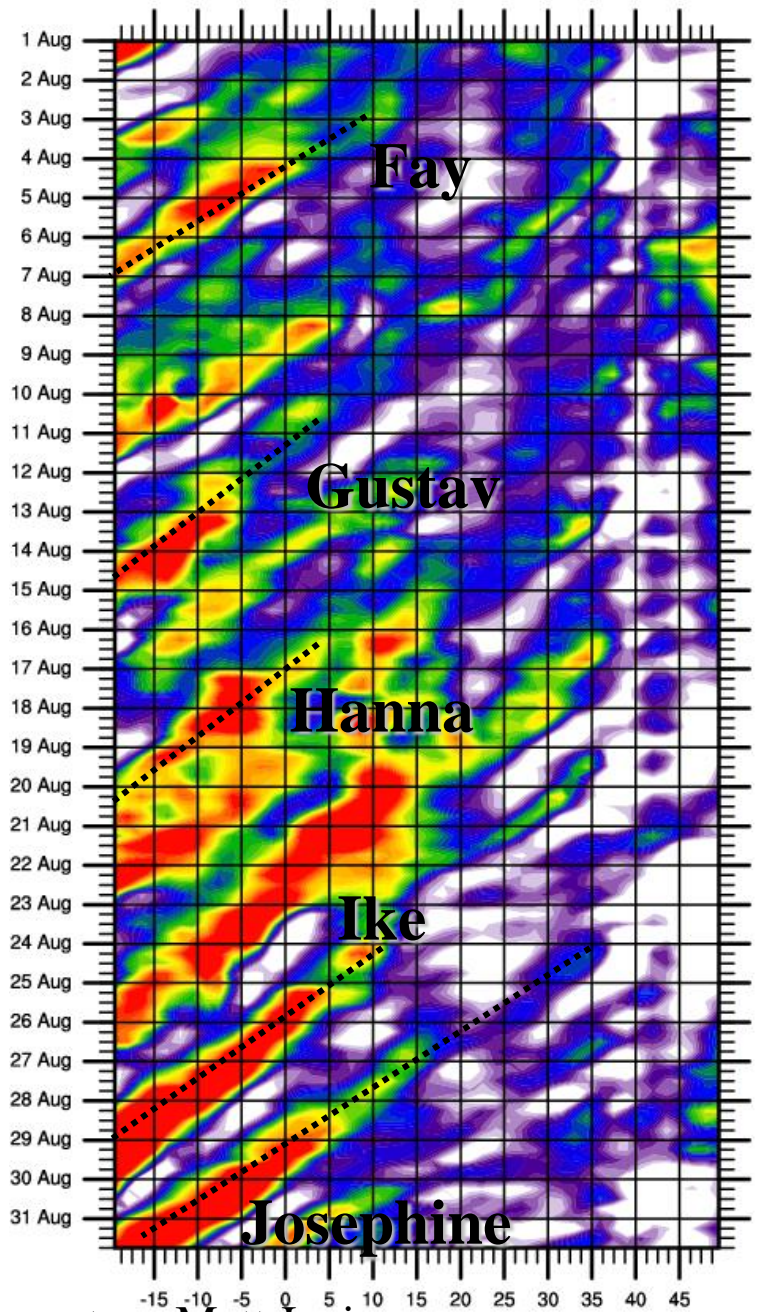


July 2008 1-8d Pv. 4.5-16.5N

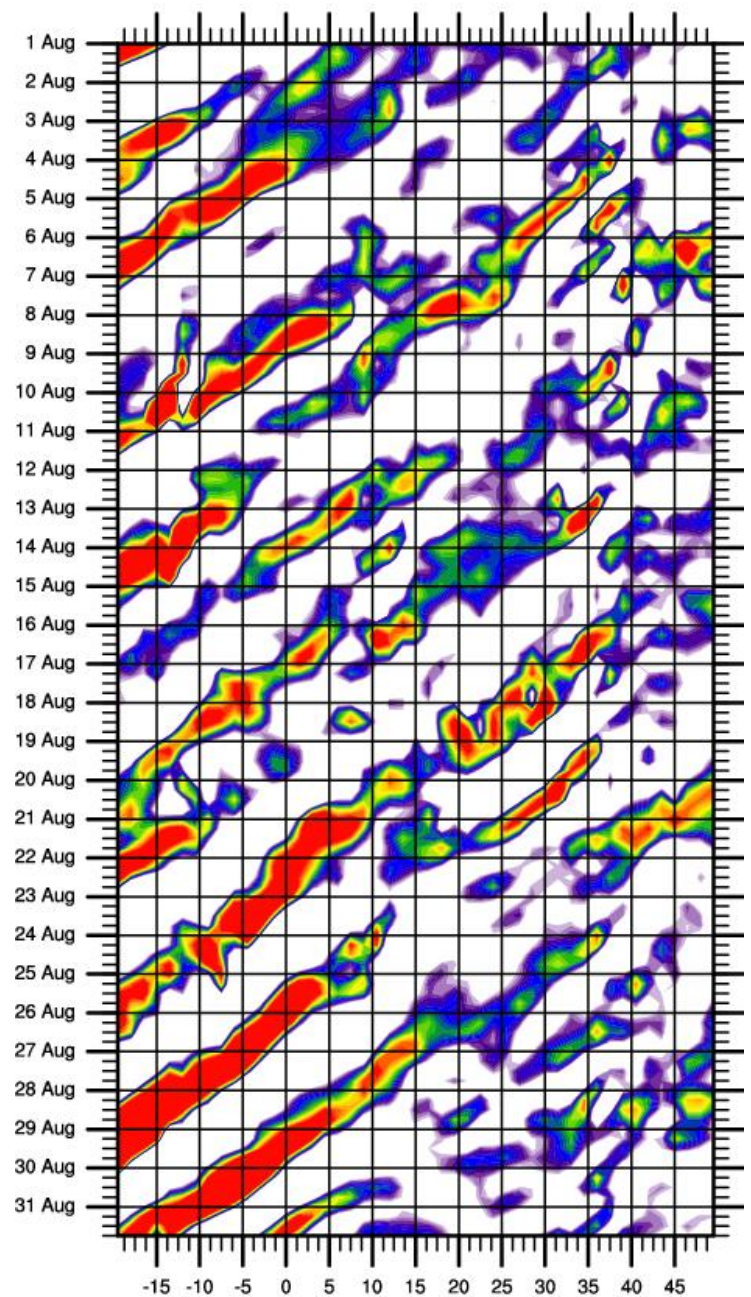


courtesy Matt Janiga

Aug. 2008 650 PV (0.1 PVU) 4.5-16.5N

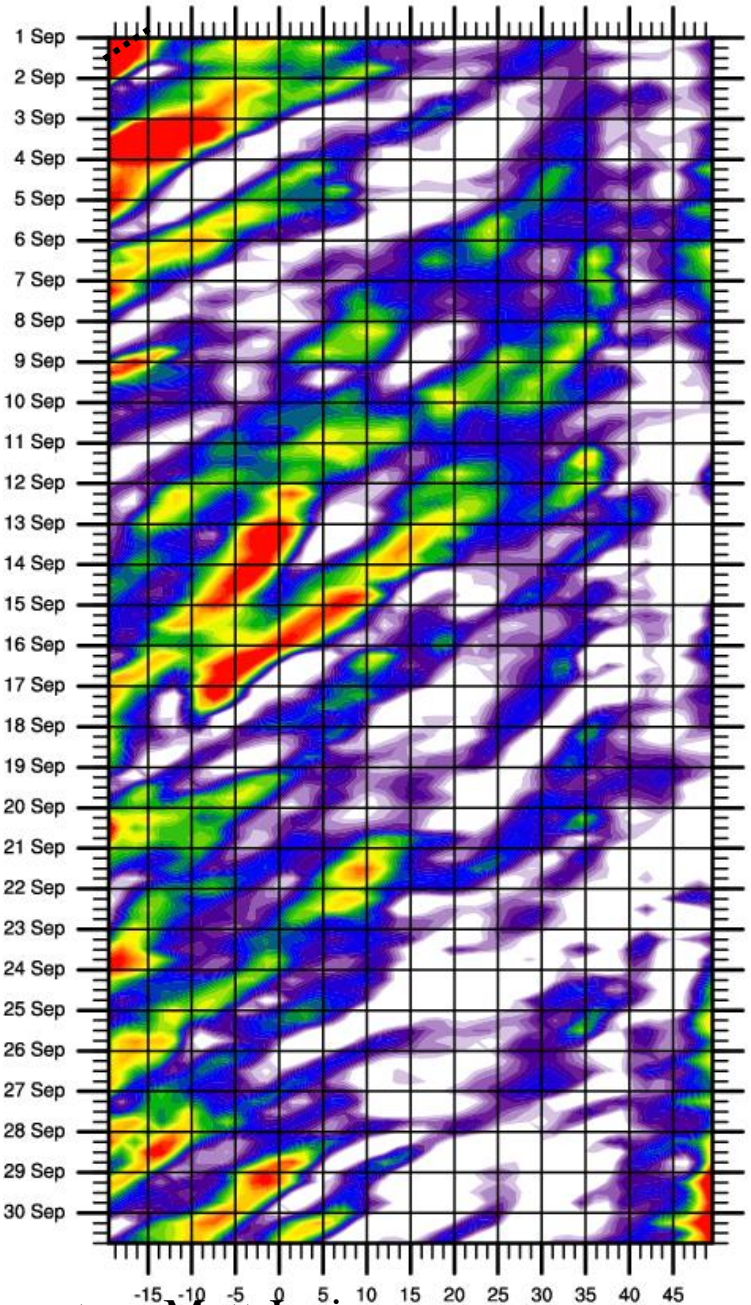


Aug. 2008 1-8d Pv. 4.5-16.5N

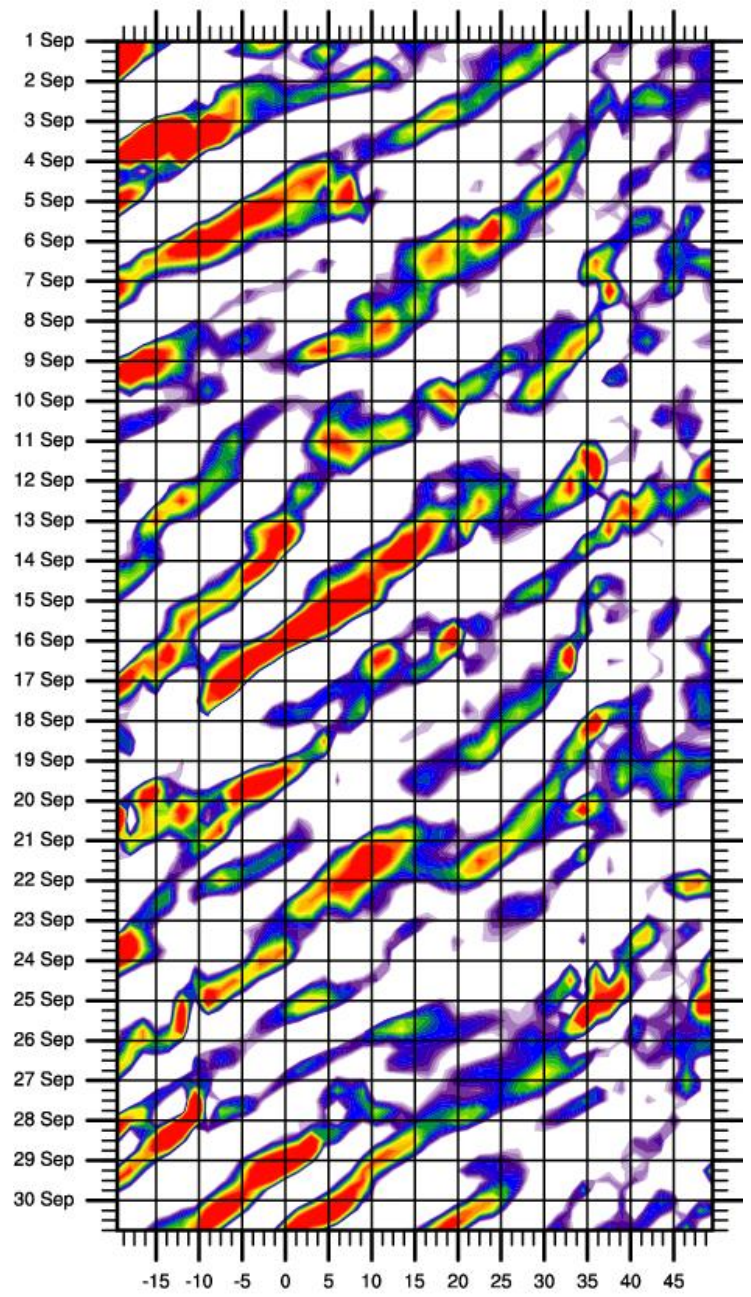


courtesy Matt Janiga

Sep. 2008 650 PV (0.1 PVU) 4.5-16.5N



Sep. 2008 1-8d Pv. 4.5-16.5N



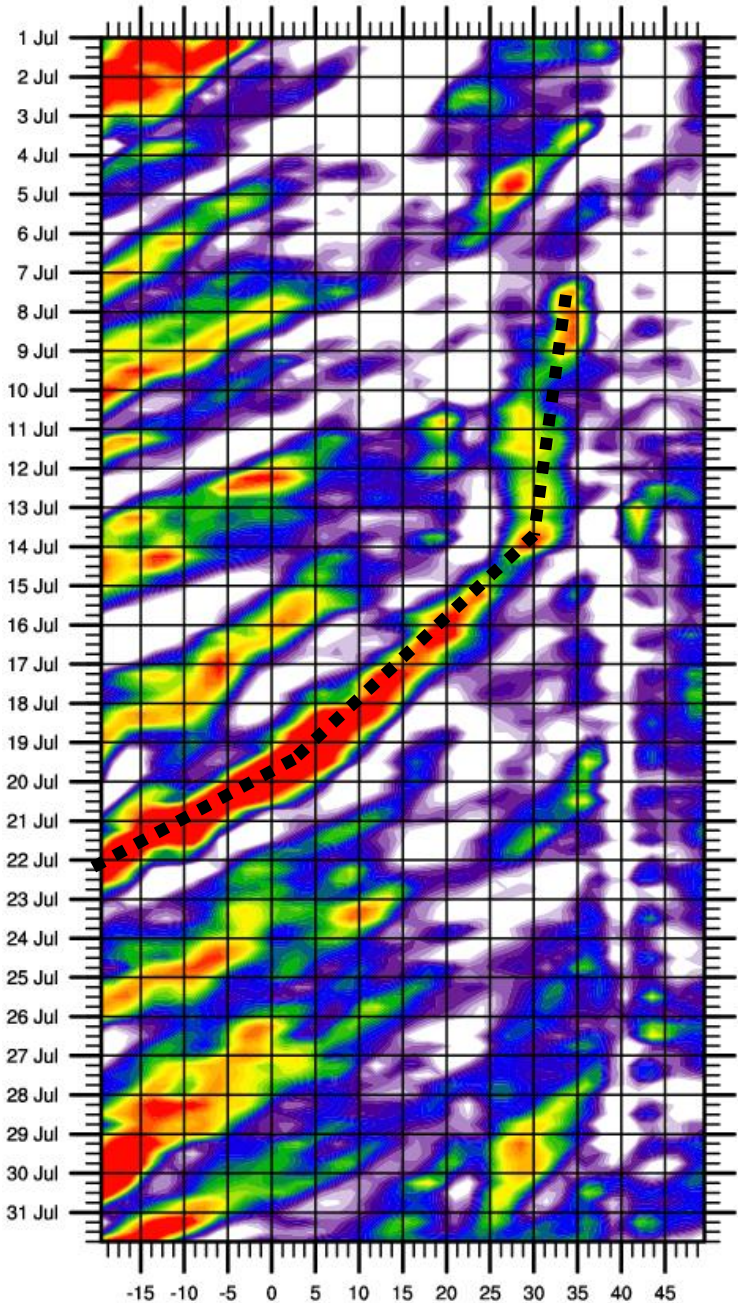
courtesy Matt Janiga

3. Some Interesting Cases

The Late July 2008 Event

Courtesy of following sequence: Matt Janiga
TRMM-Curvature Vorticity Hovmoellers courtesy Gareth Berry

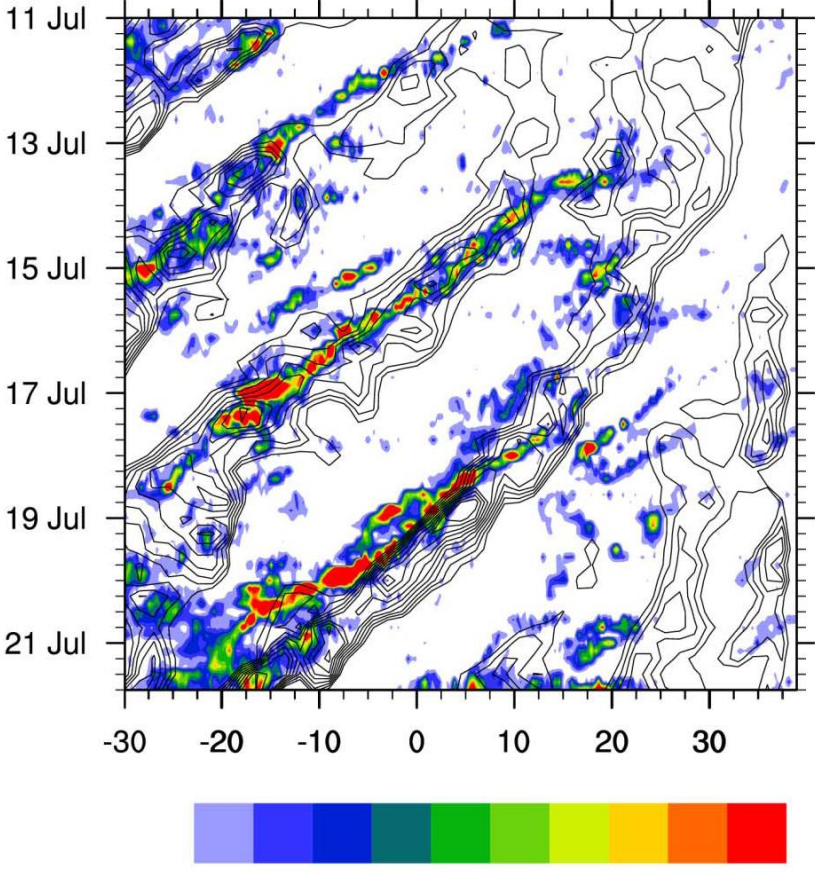
July 2008 650 PV (0.1 PVU) 4.5-16.5N



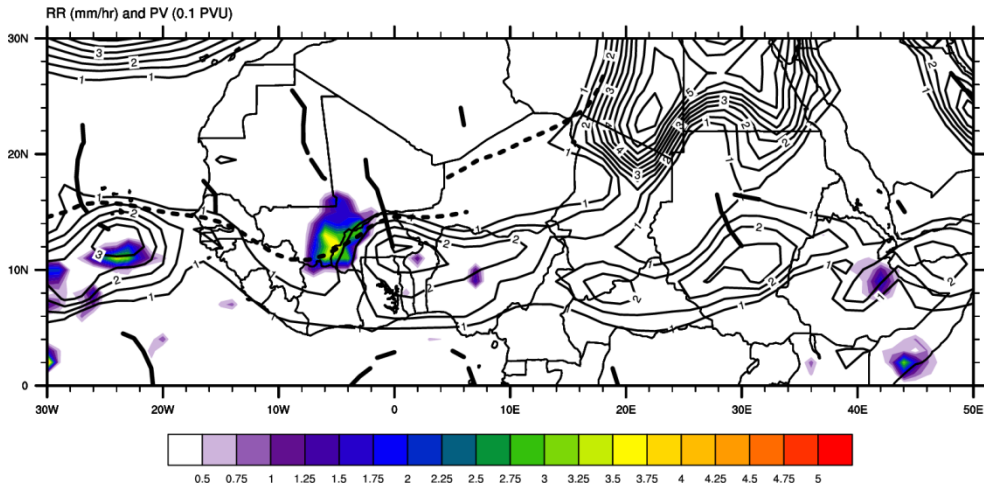
There is a stationary blob of PV that was generated by convection in the lee of the Ethiopian Highlands on the 7th and 8th. The PV max doesn't seem to move until about the 14th-15th. Delay may have been due to a midlatitude trough interaction.

This PV max is quite coherent from the 7th all the way to the 22nd when it moves into the Atlantic – and has a significant convective signature – initiated behind and moves through the wave.

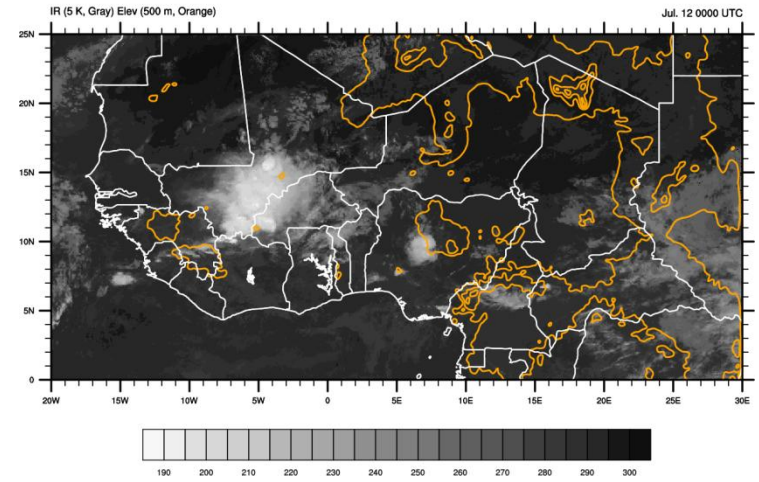
This did NOT develop into a tropical cyclone



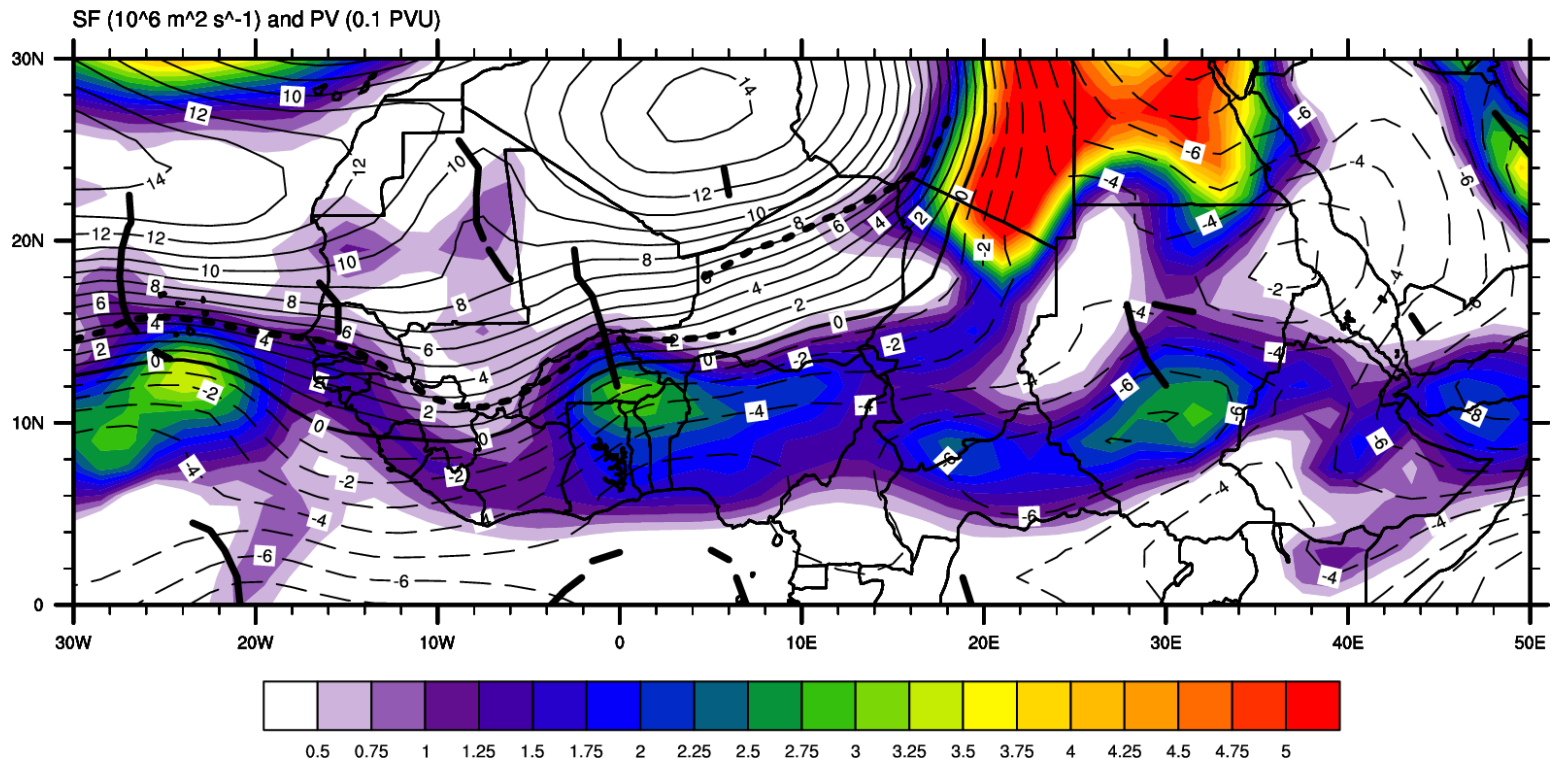
2008/7/12 0 UTC 650 hPa PV and TRMM3B42



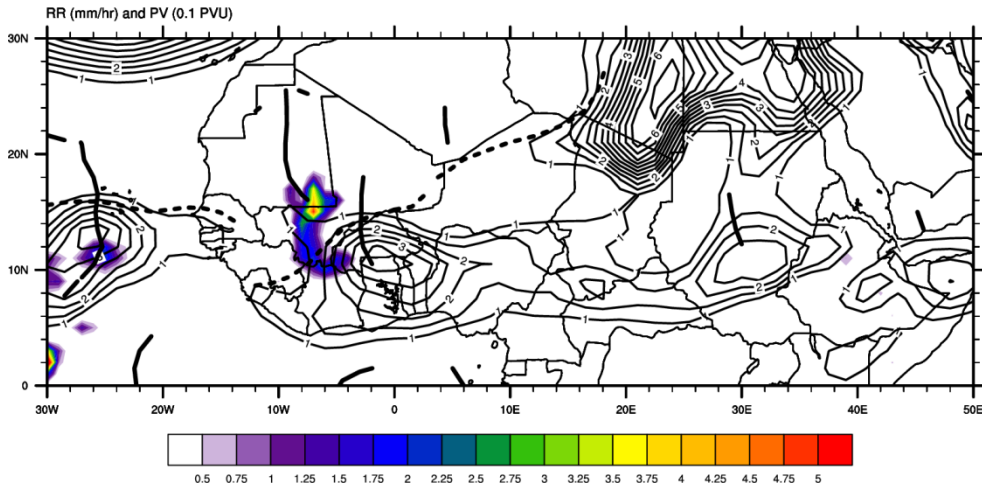
10.9 um IR, Elev.



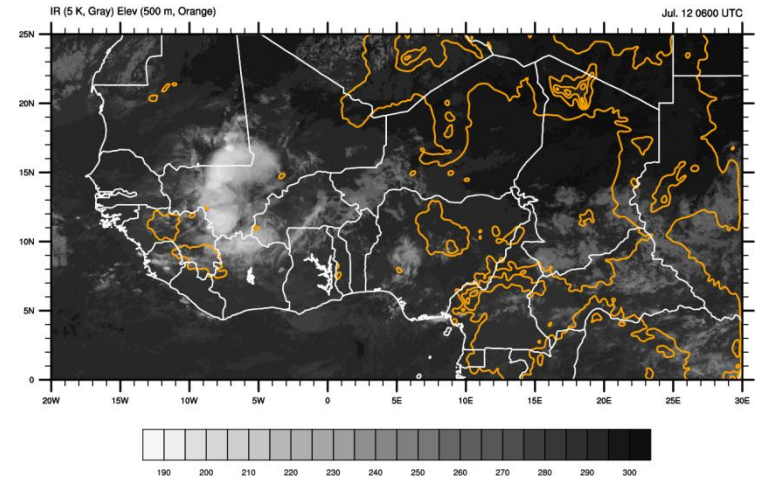
2008/7/12 0 UTC 650 hPa Streamfunction and PV



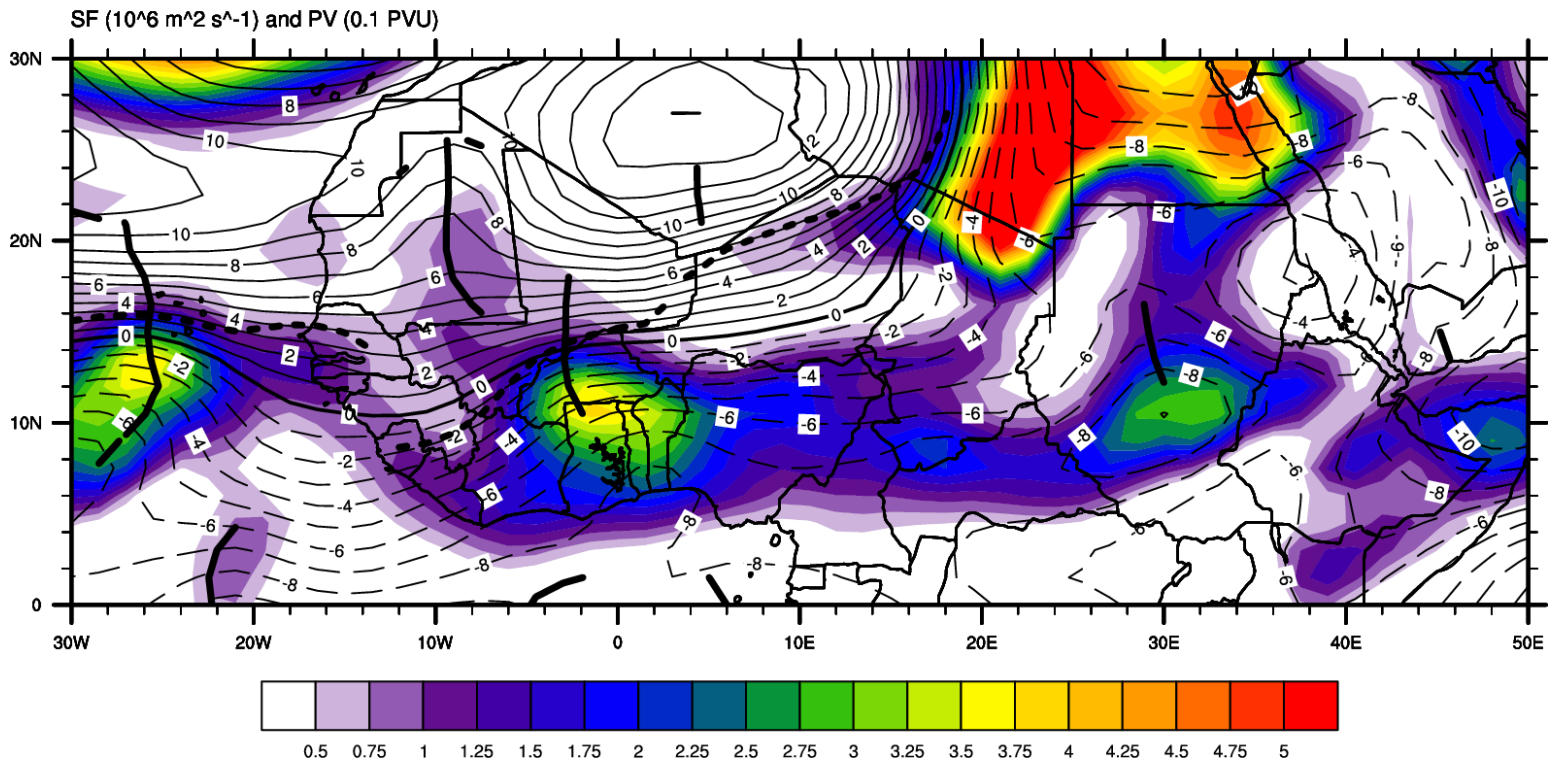
2008/7/12 6 UTC 650 hPa PV and TRMM3B42



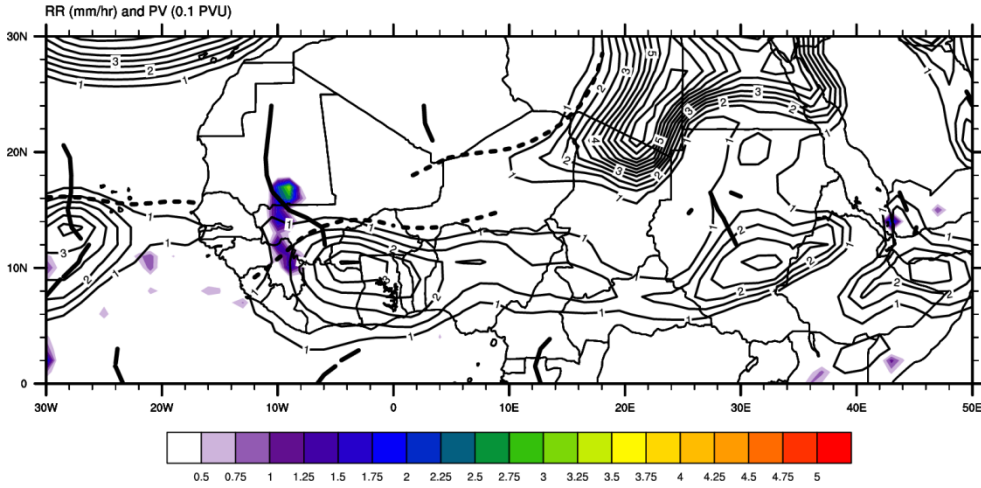
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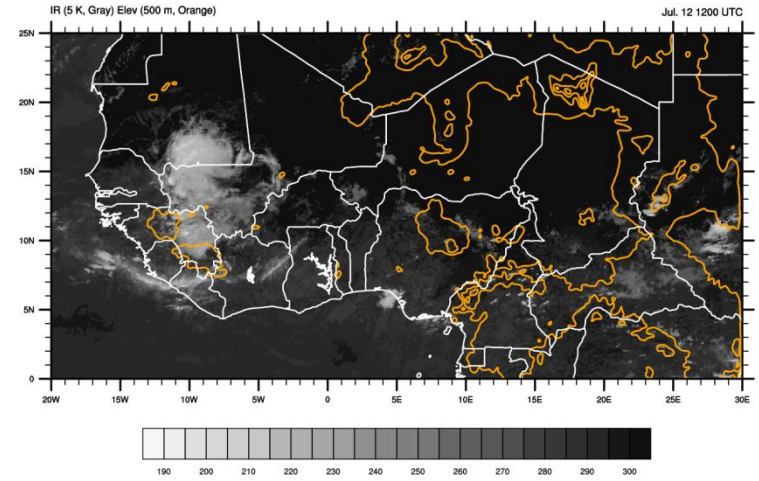
2008/7/12 6 UTC 650 hPa Streamfunction and PV



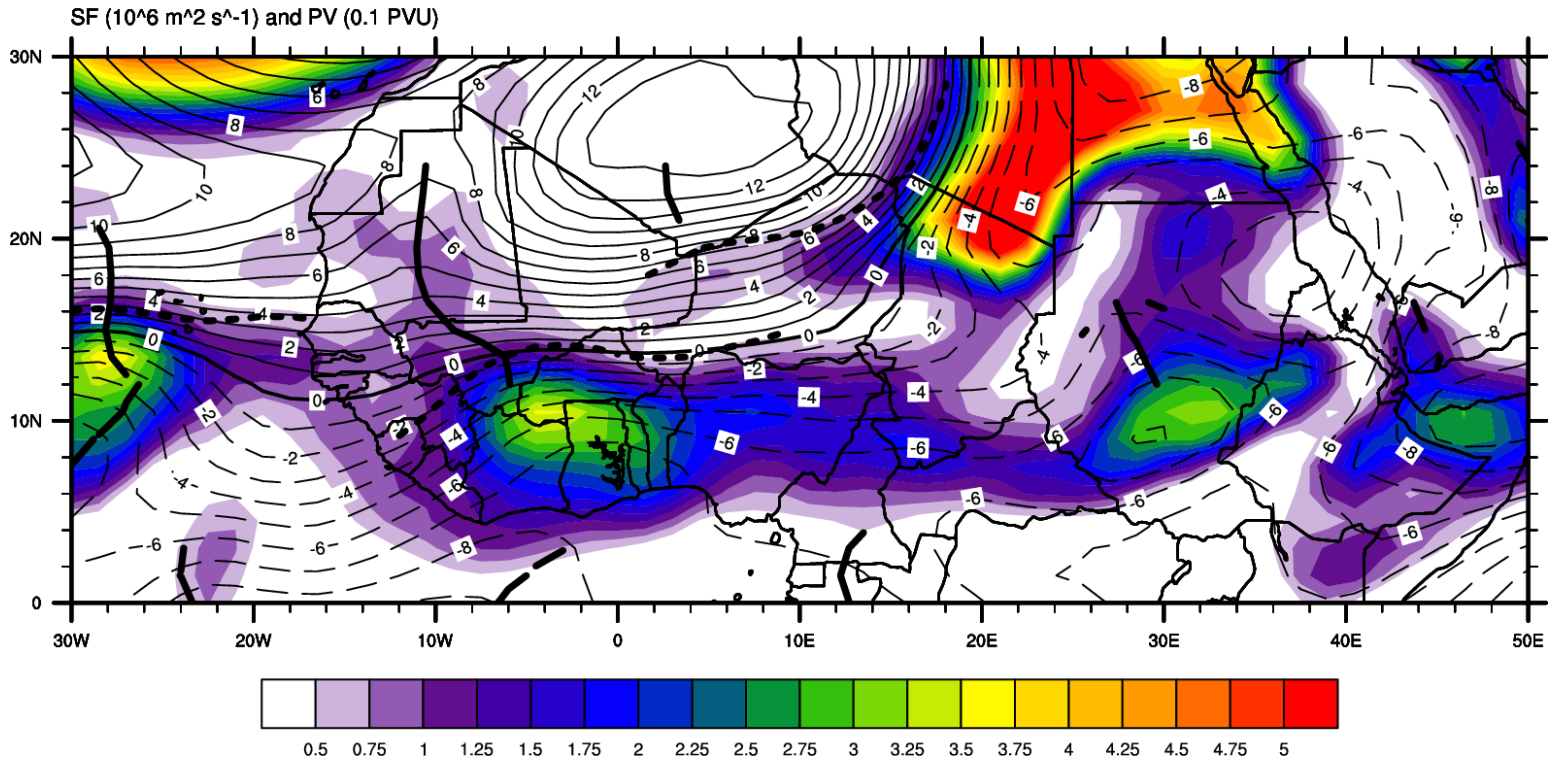
2008/7/12 12 UTC 650 hPa PV and TRMM3B42



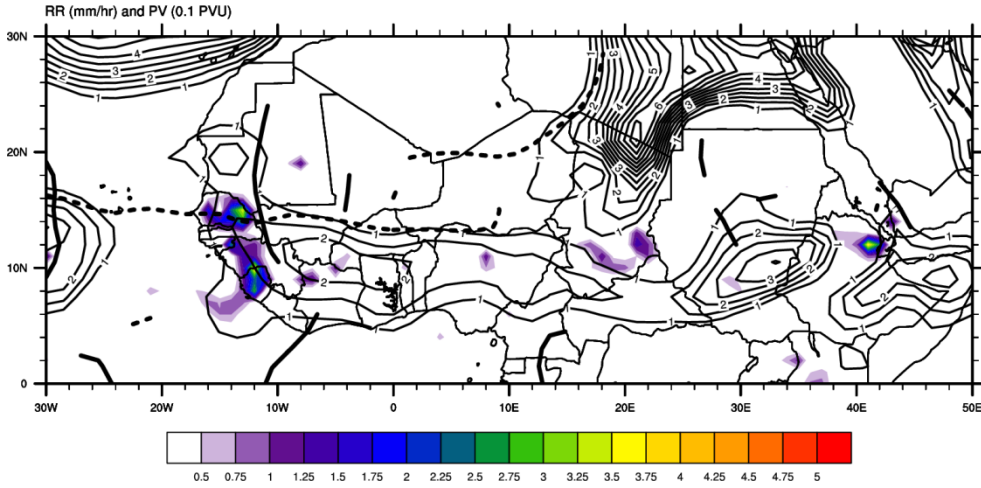
10.9 um IR, Elev.



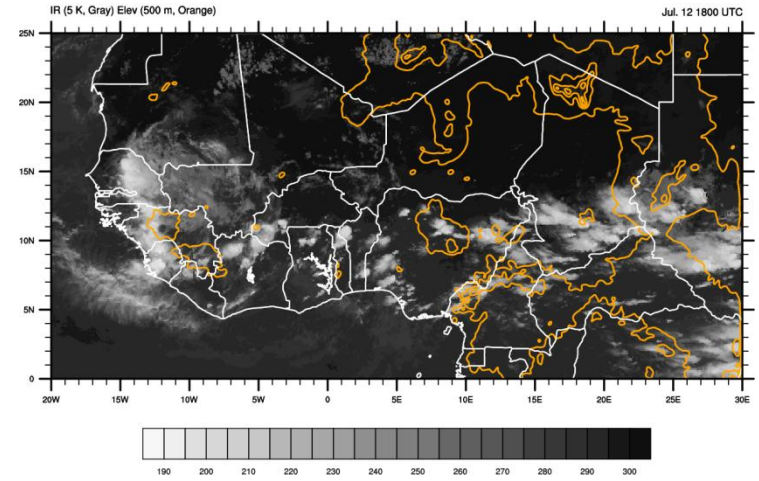
2008/7/12 12 UTC 650 hPa Streamfunction and PV



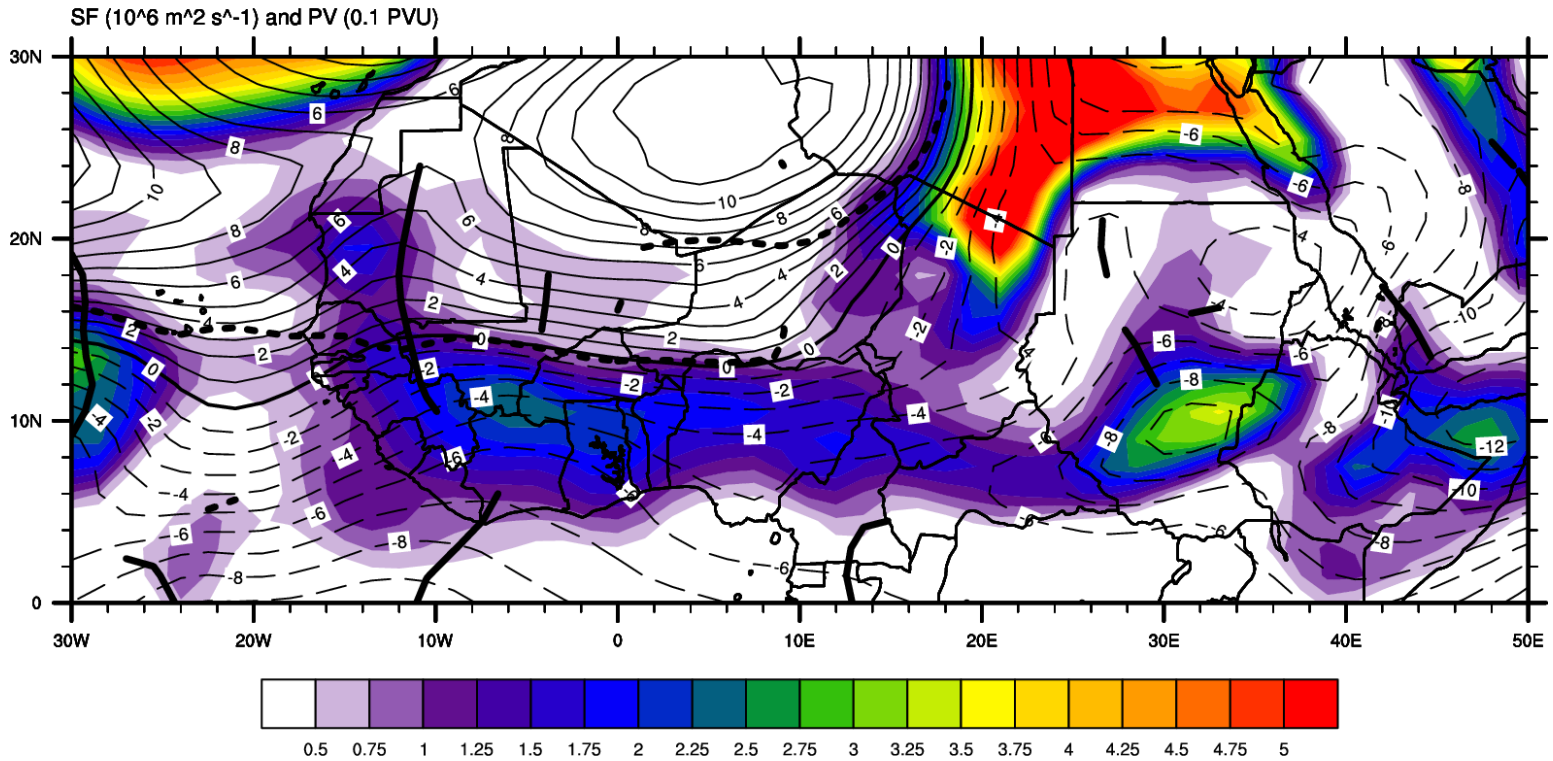
2008/7/12 18 UTC 650 hPa PV and TRMM3B42



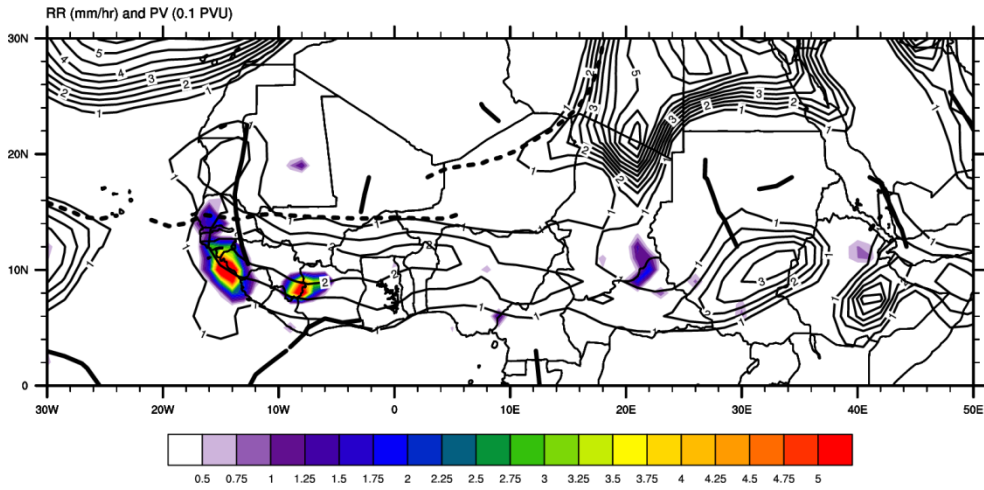
10.9 um IR, Elev.



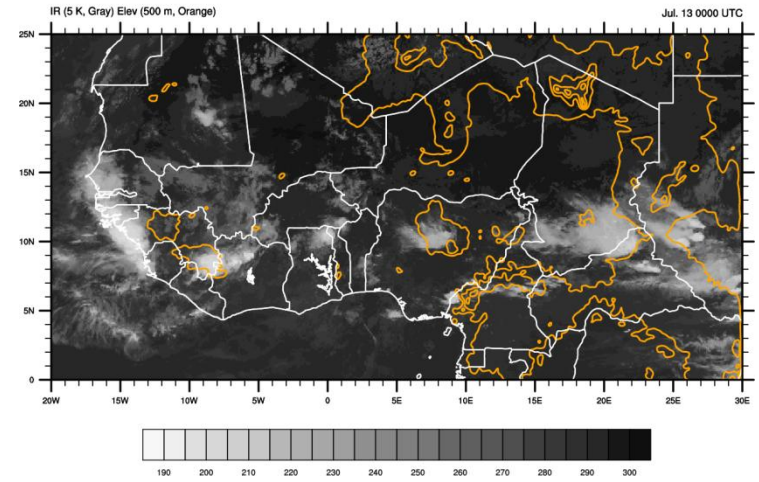
2008/7/12 18 UTC 650 hPa Streamfunction and PV



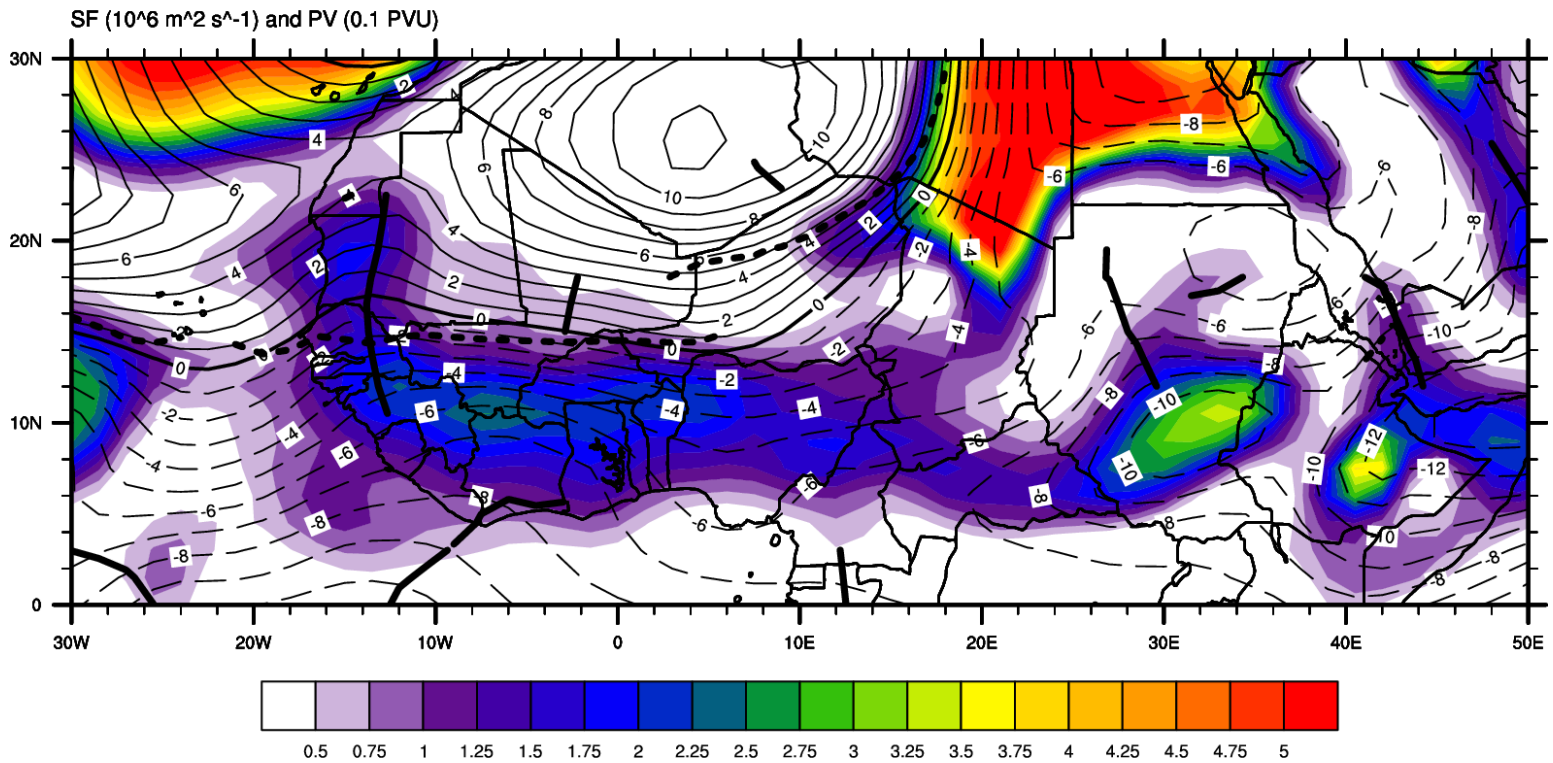
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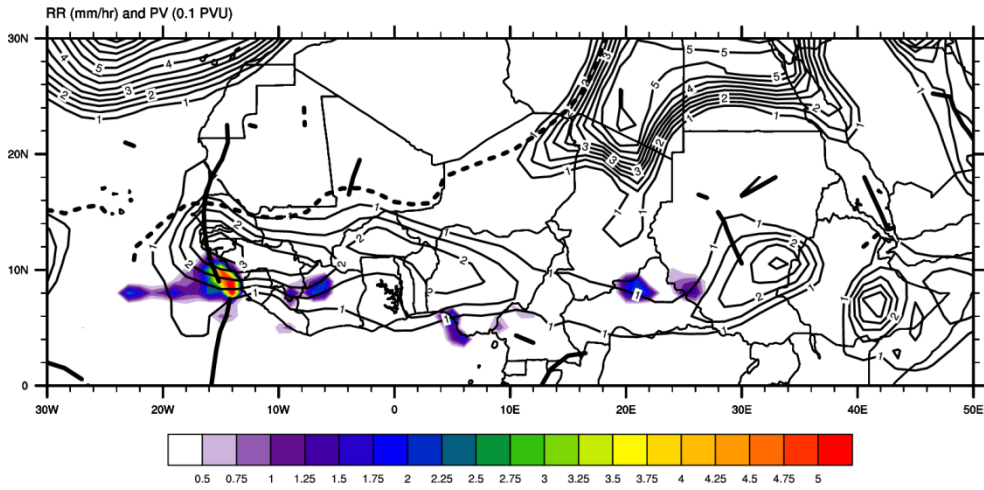
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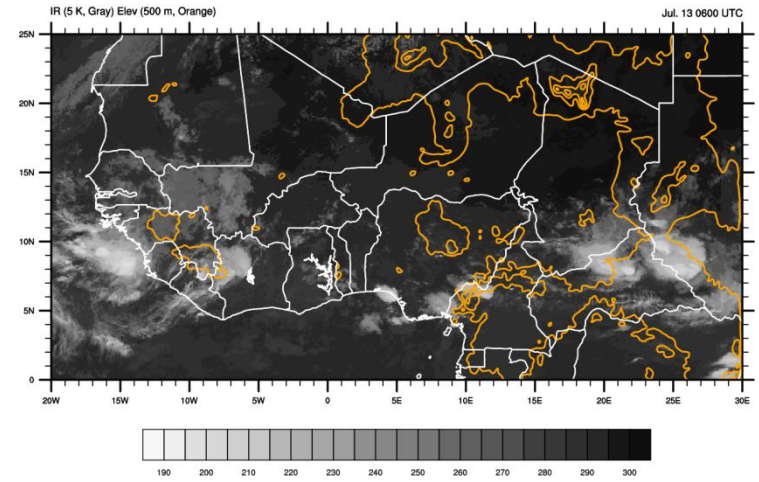
2008/7/13 0 UTC 650 hPa Streamfunction and PV



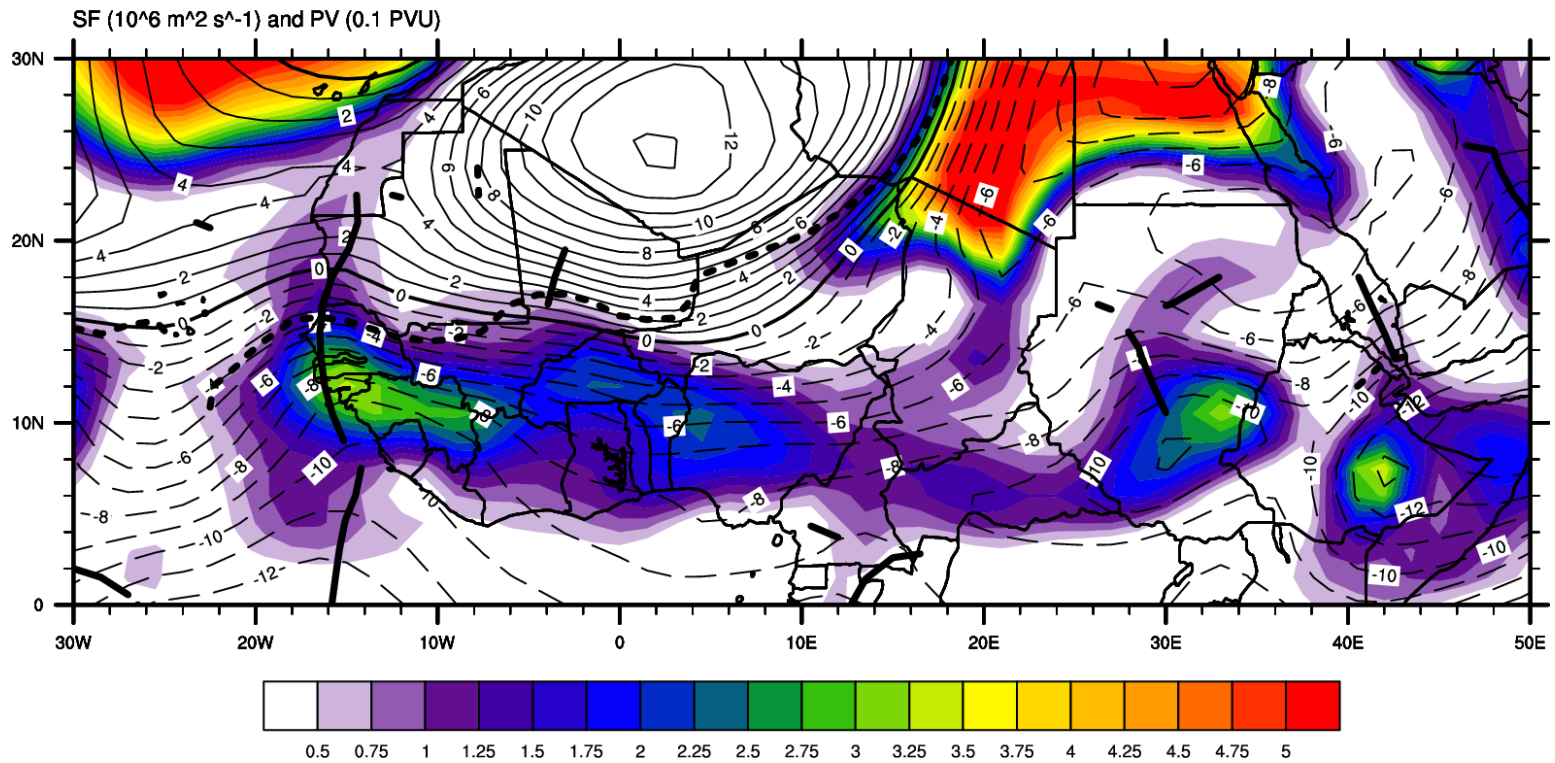
2008/7/13 6 UTC 650 hPa PV and TRMM3B42



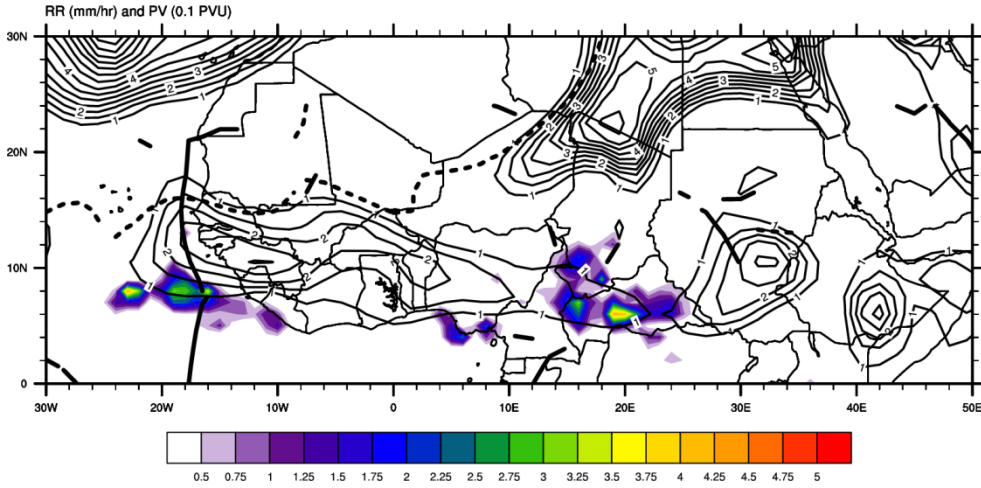
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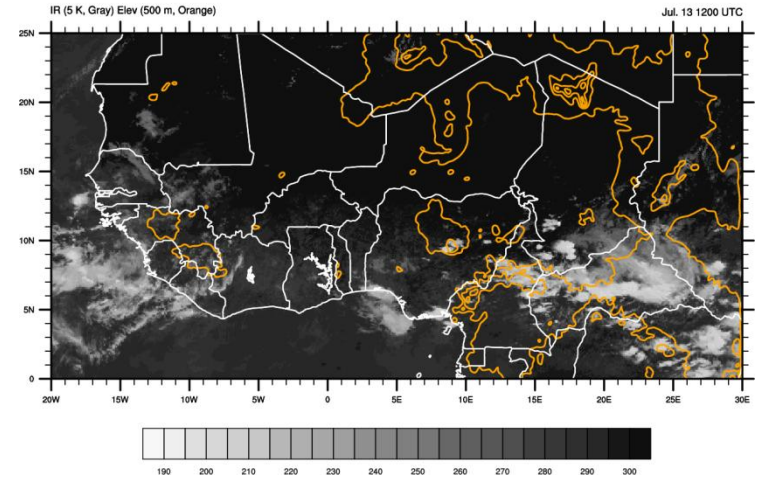
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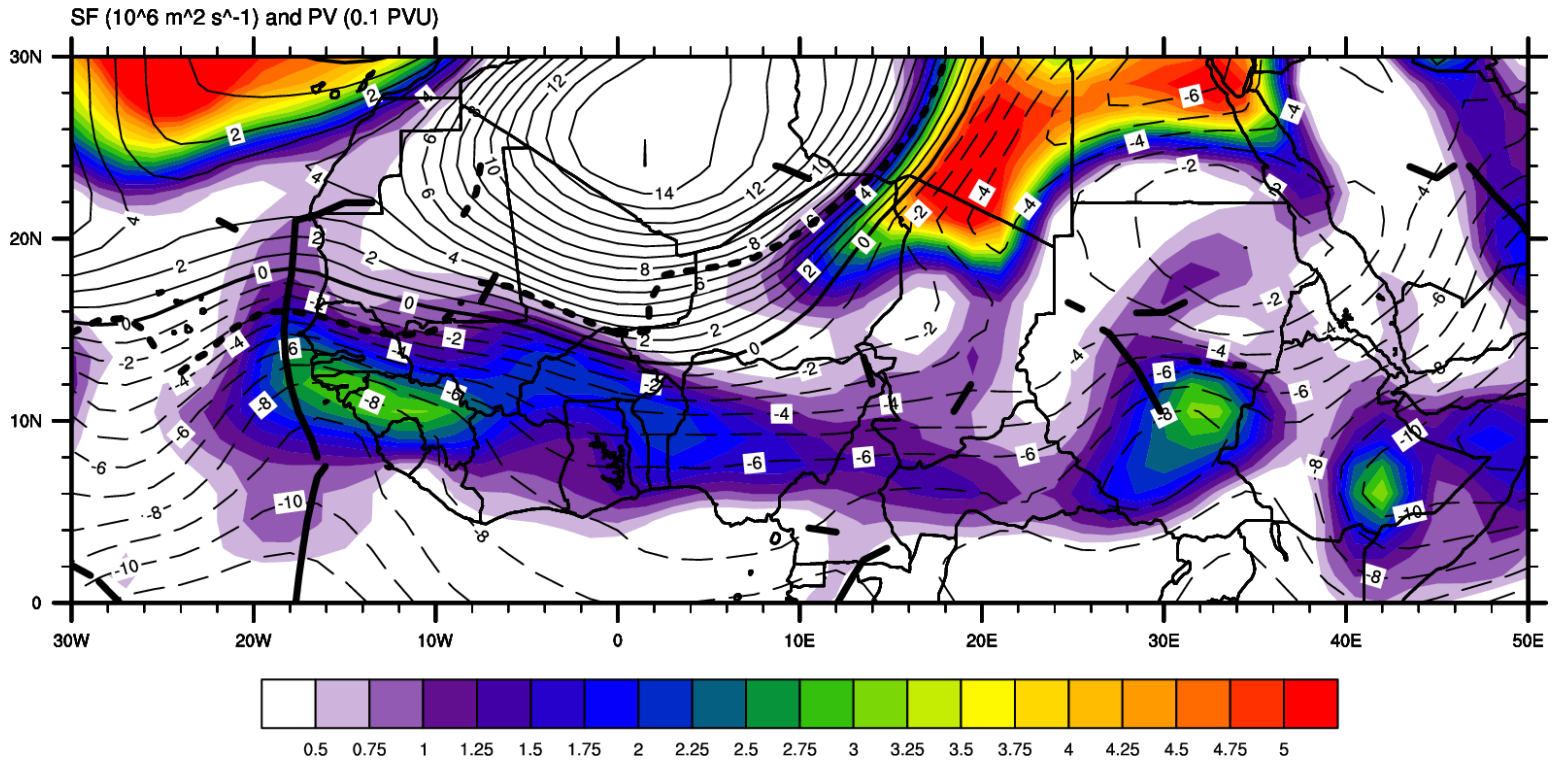
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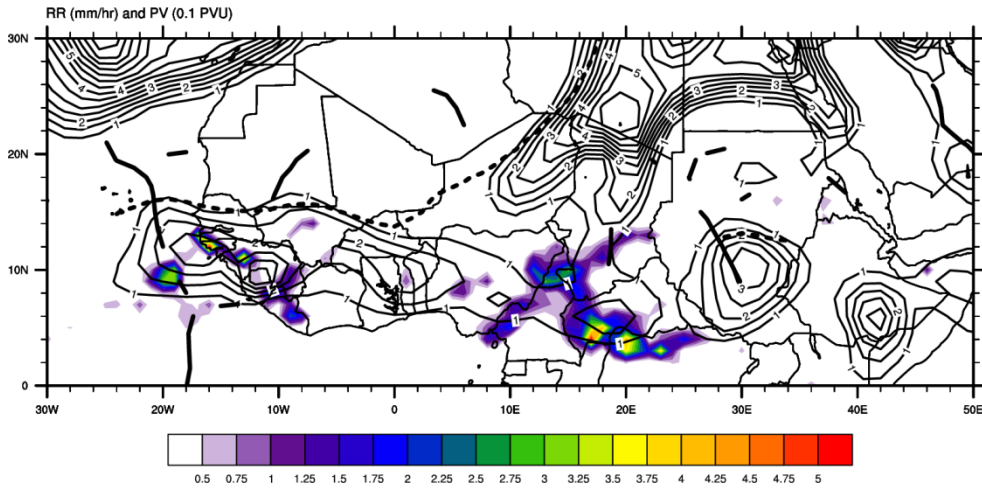
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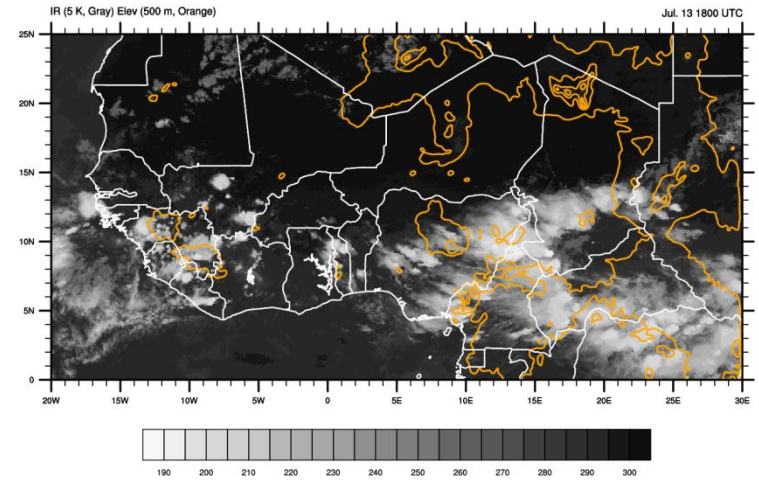
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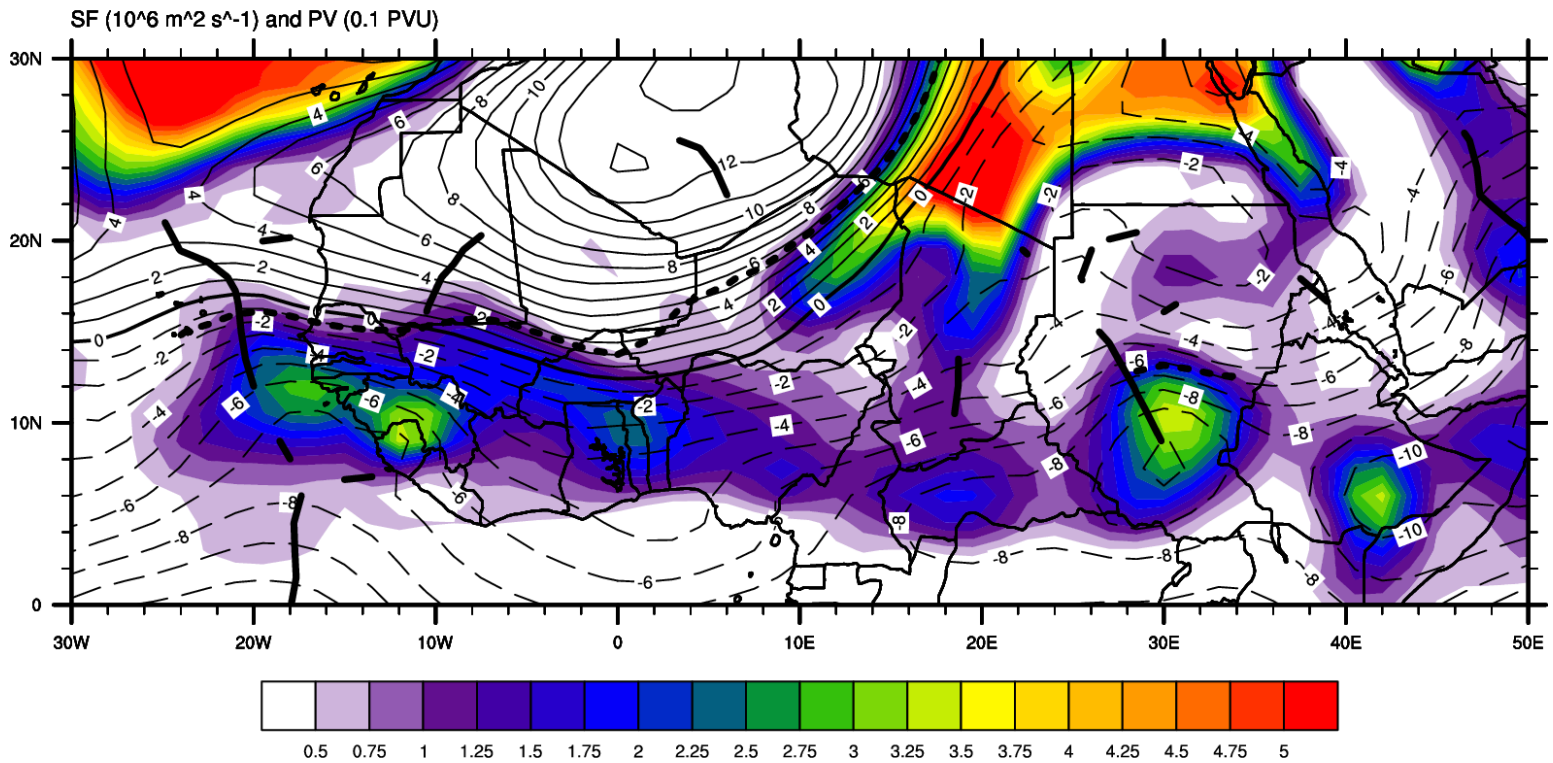
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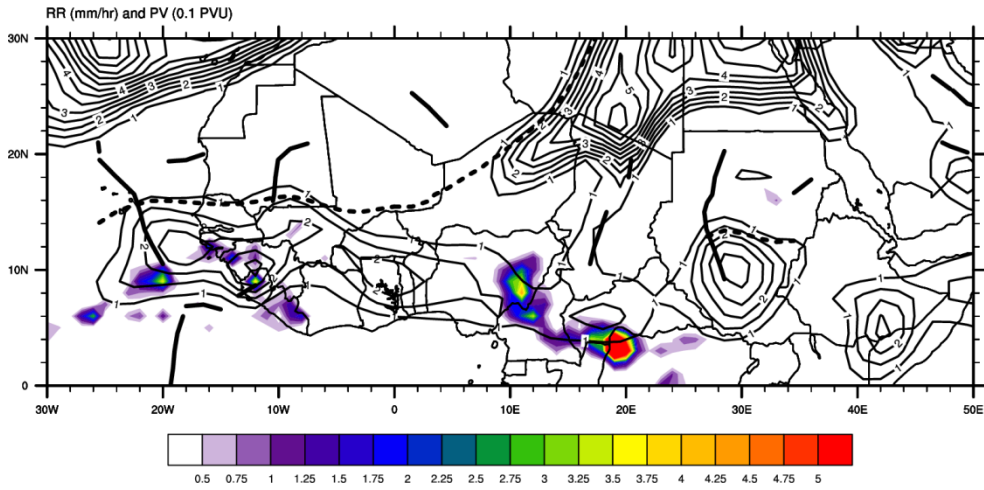
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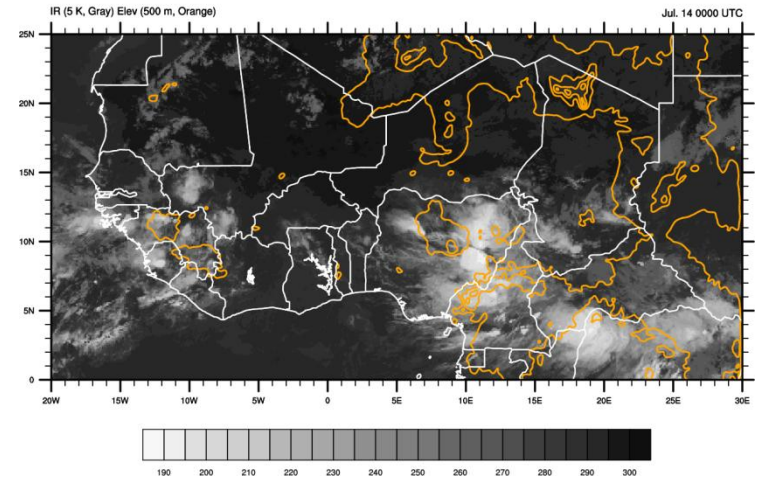
2008/7/13 18 UTC 650 hPa Streamfunction and PV



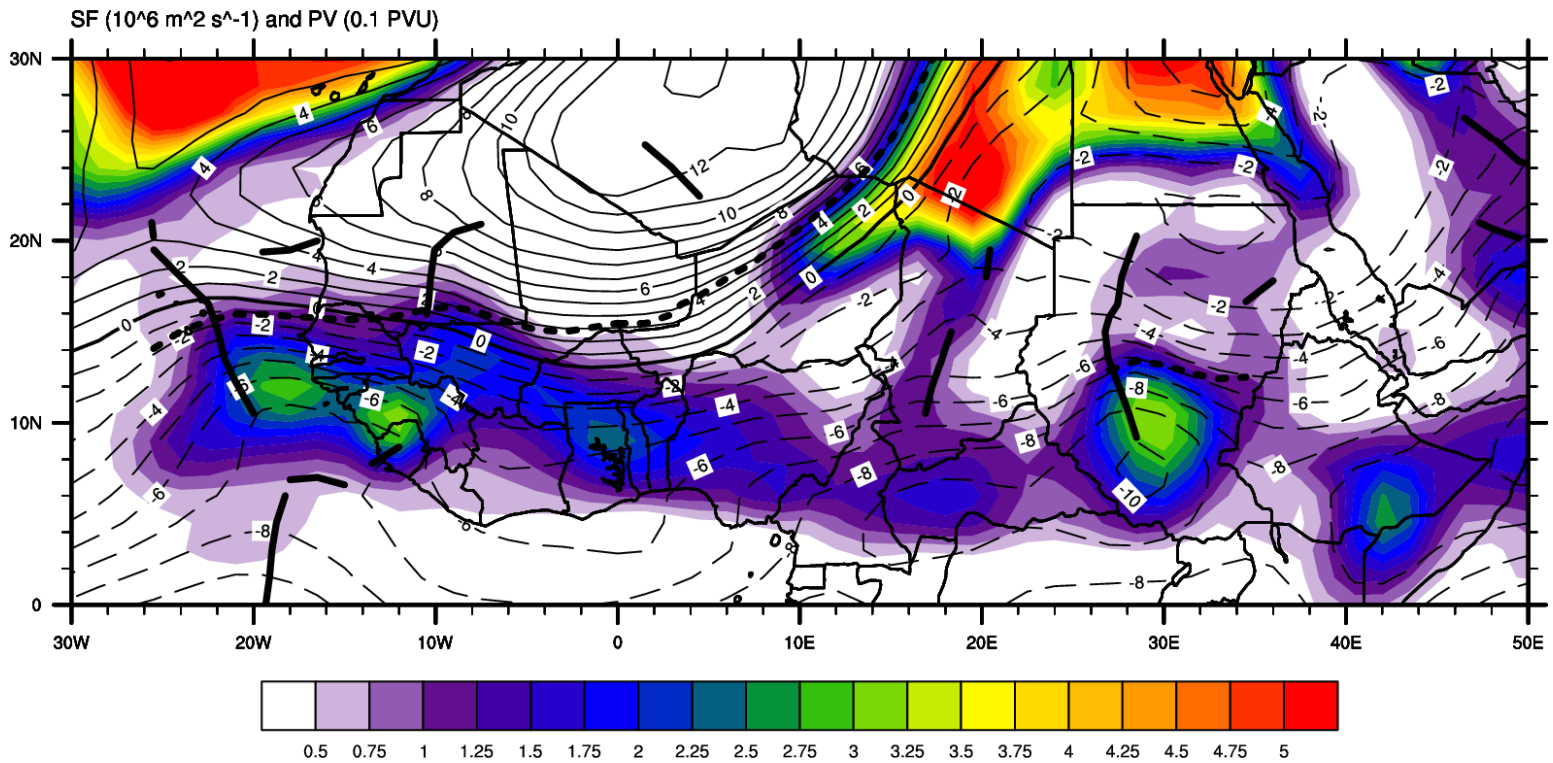
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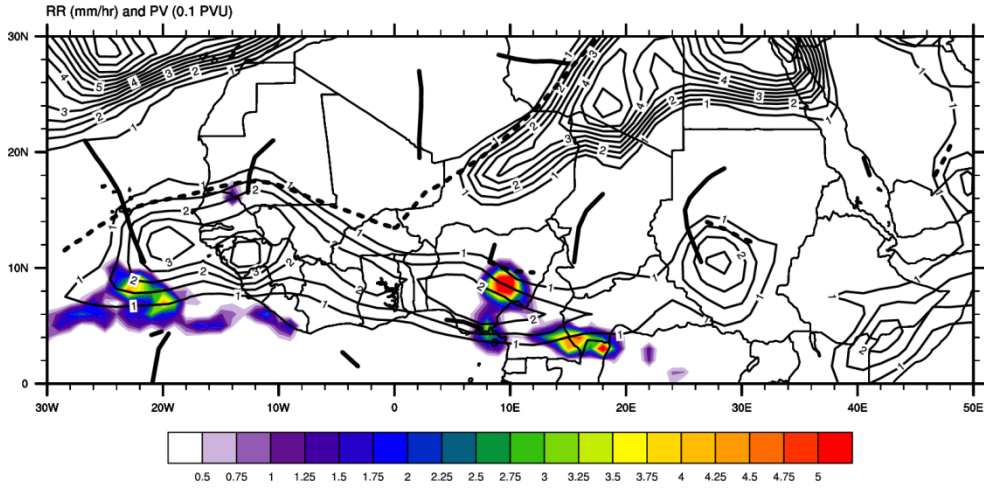
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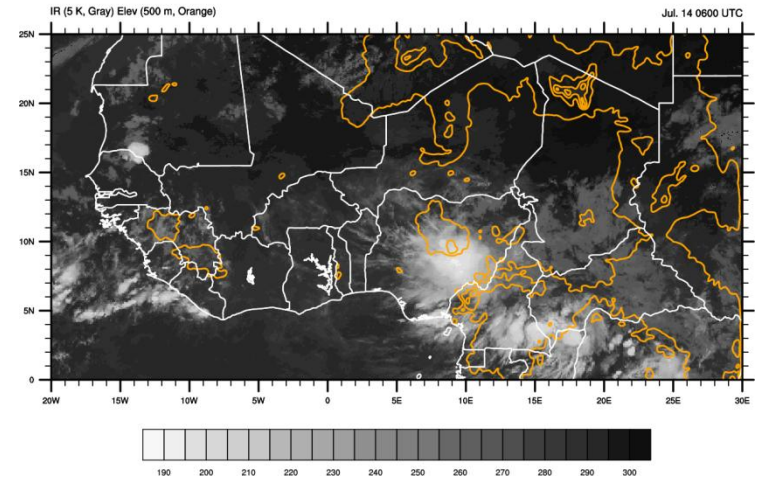
2008/7/14 0 UTC 650 hPa Streamfunction and PV



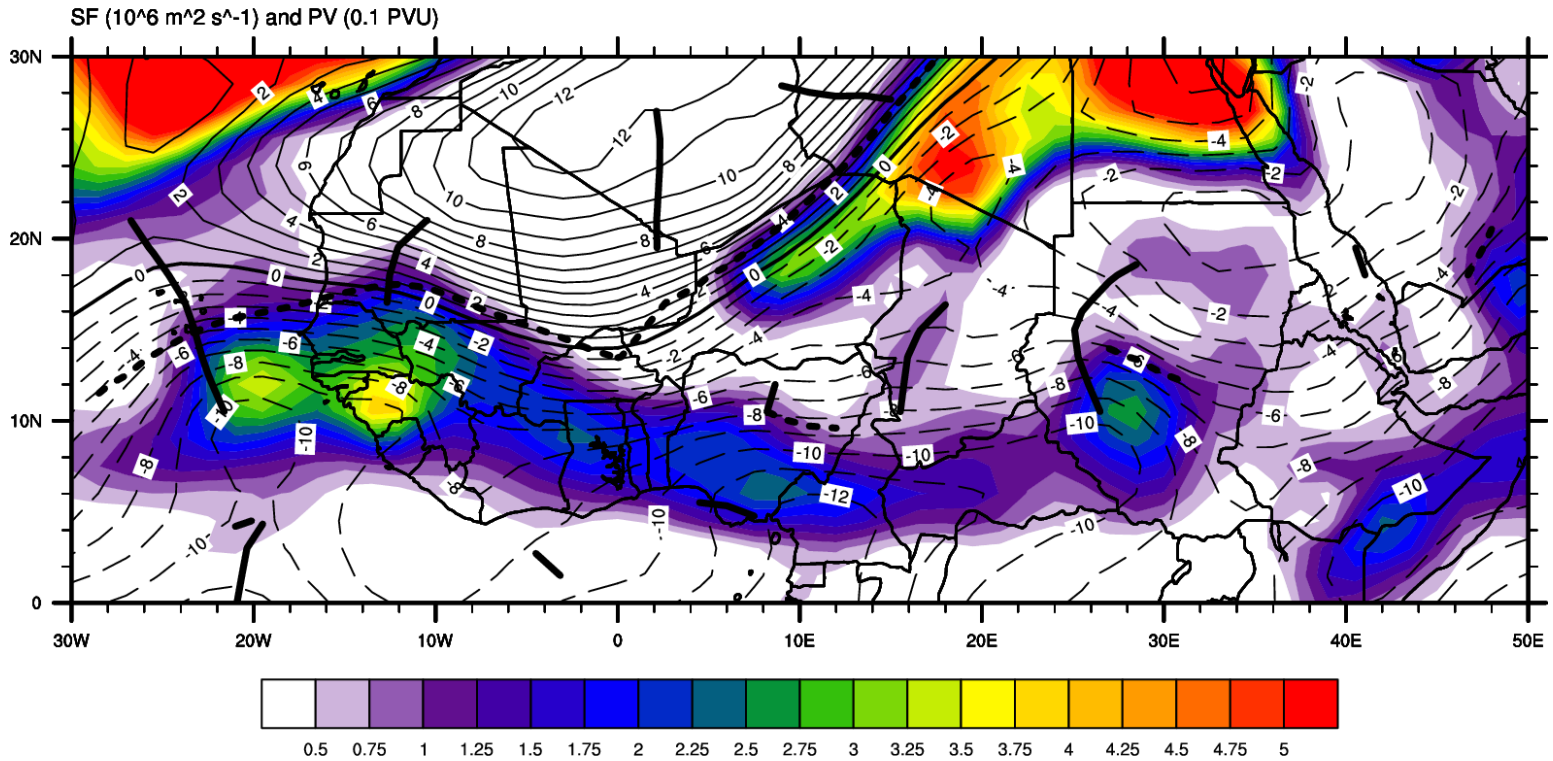
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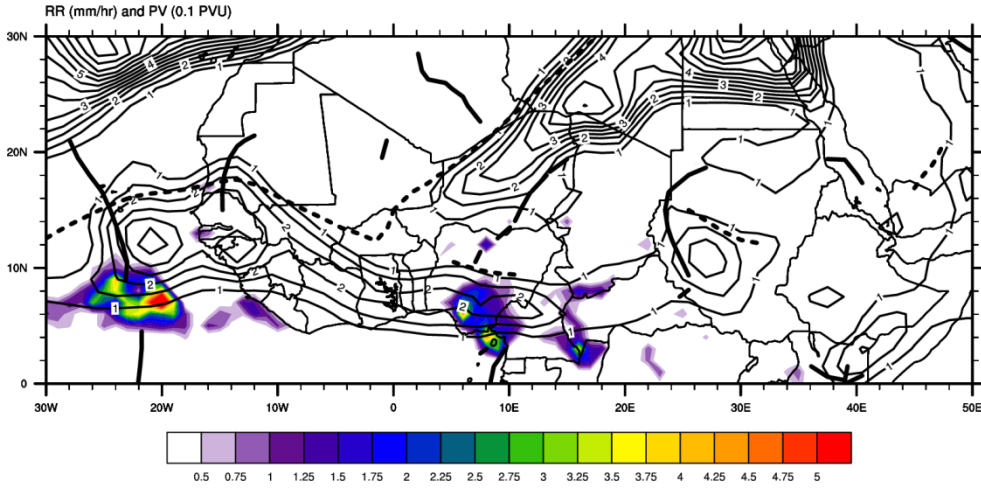
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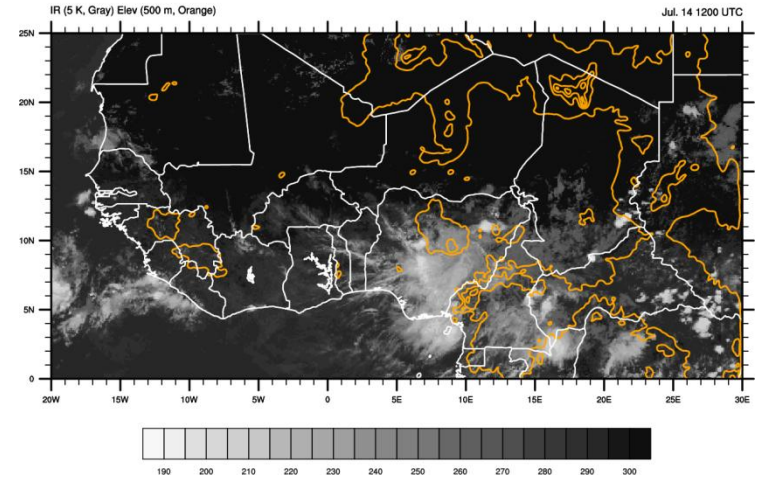
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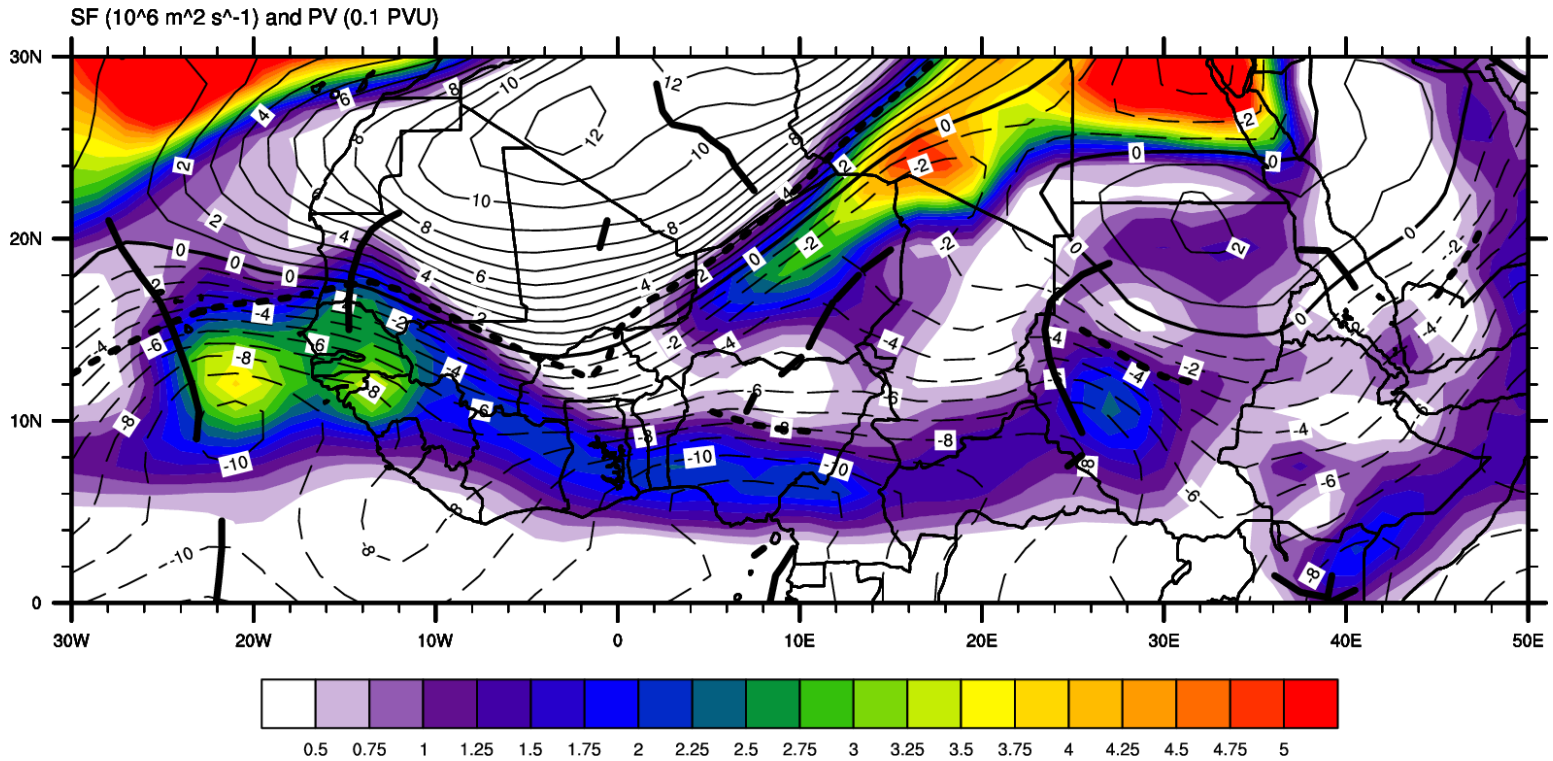
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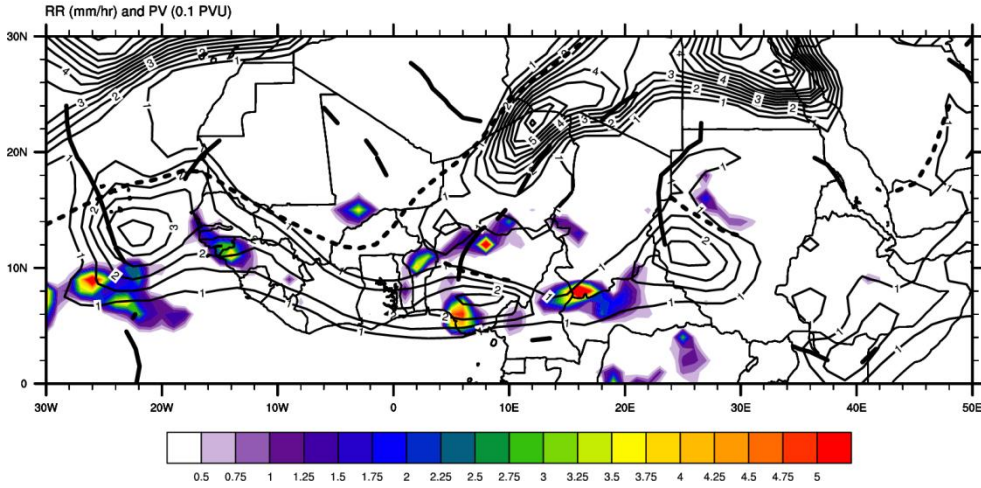
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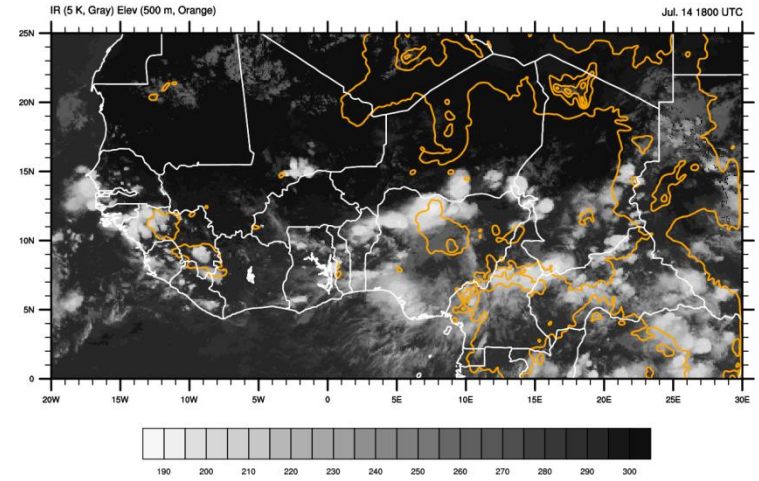
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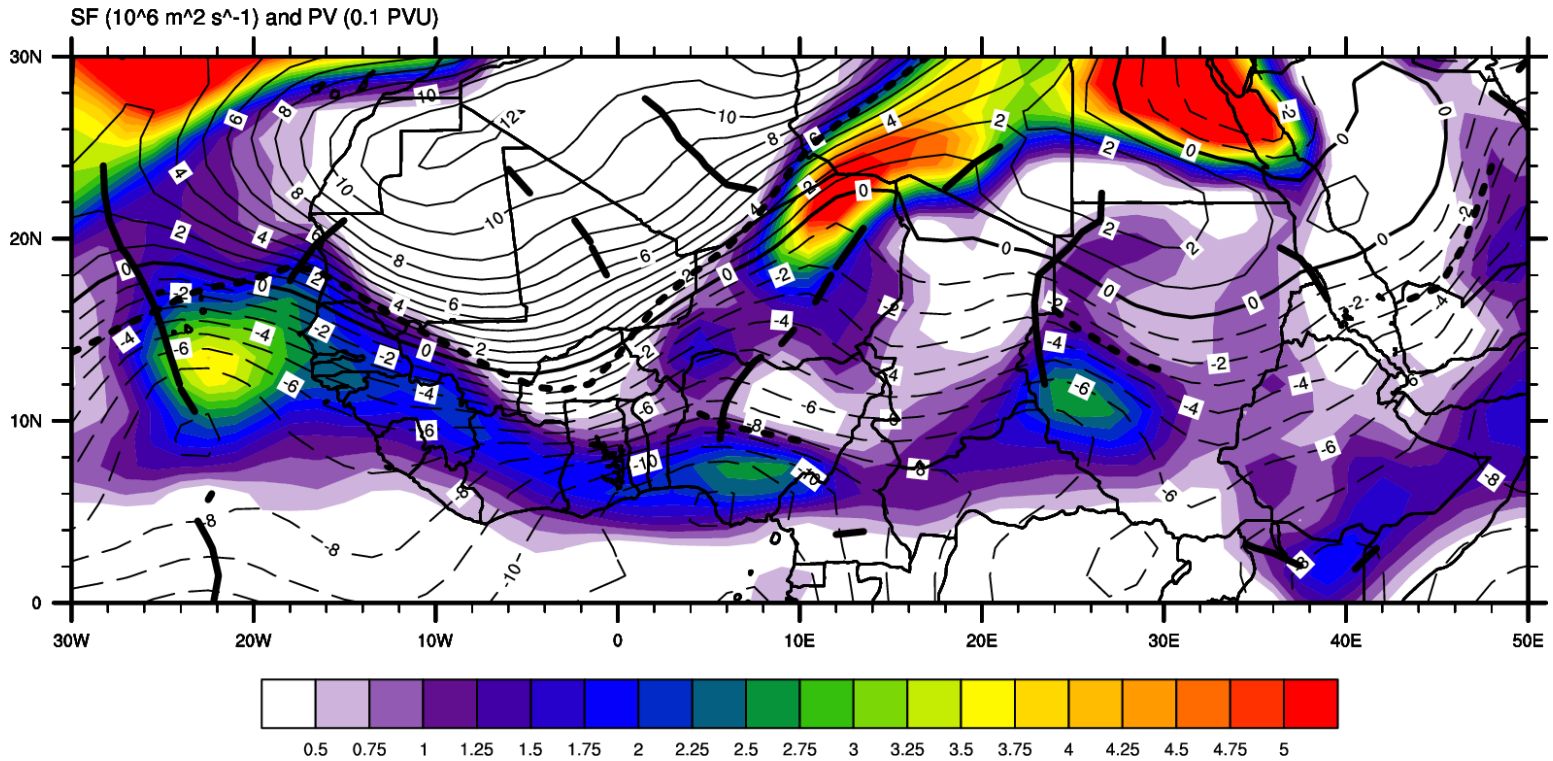
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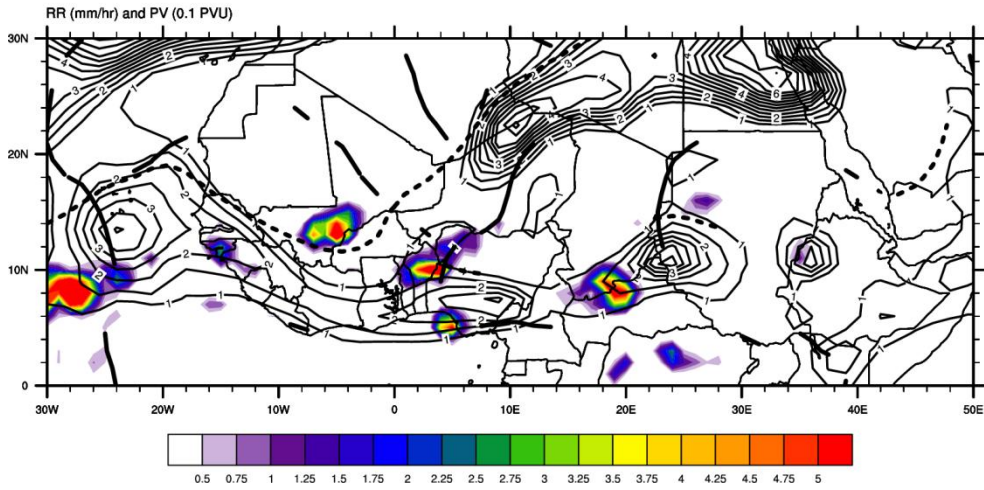
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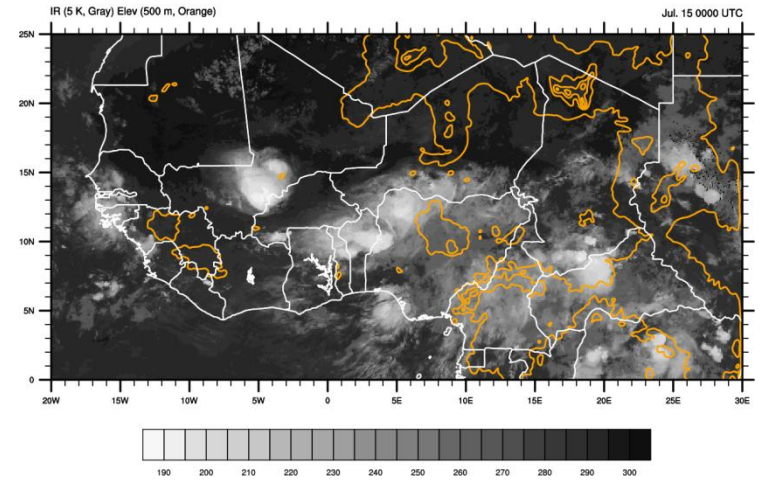
2008/7/14 18 UTC 650 hPa Streamfunction and PV



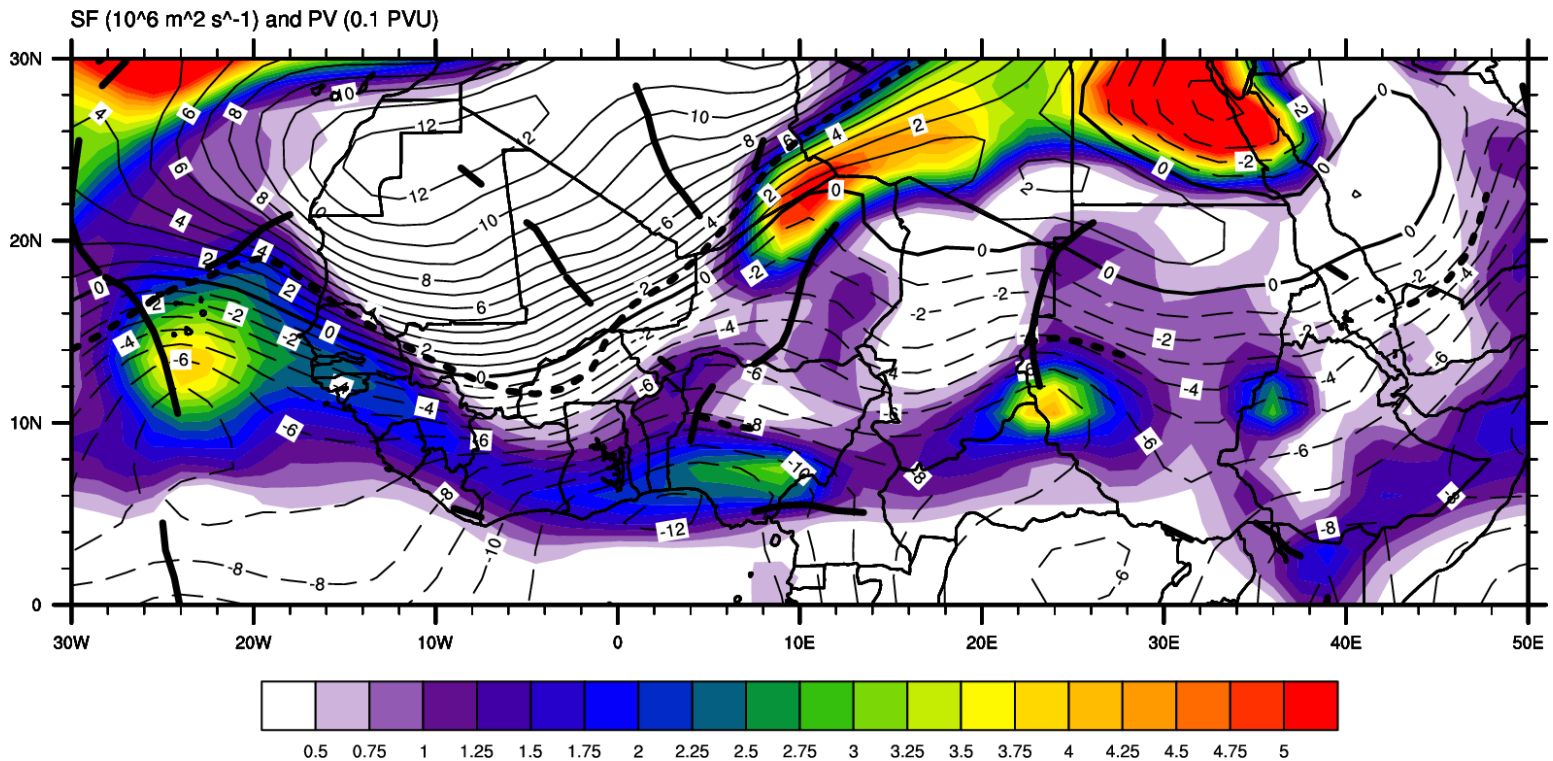
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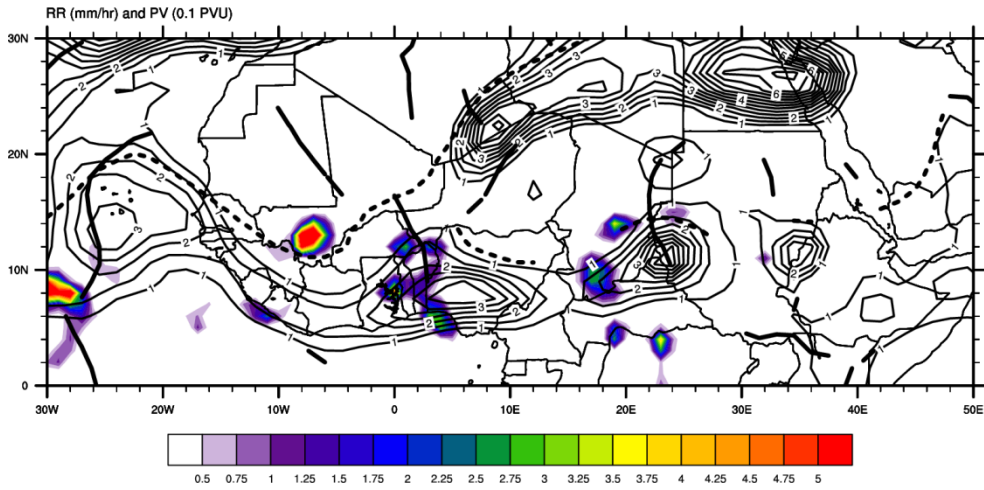
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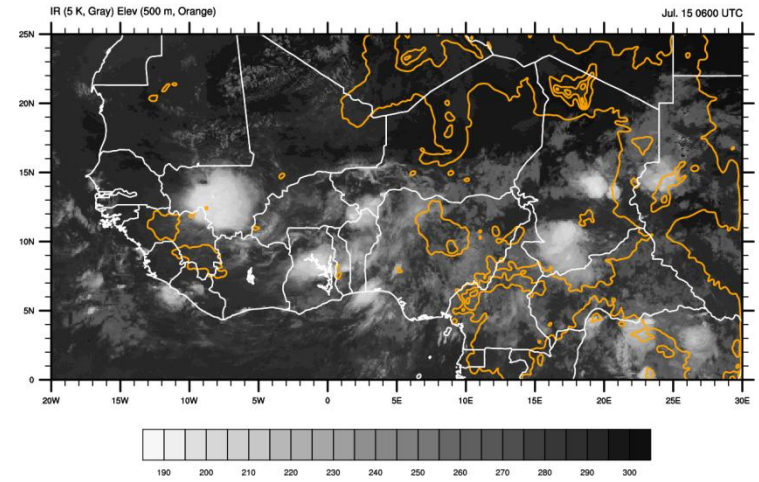
2008/7/15 0 UTC 650 hPa Streamfunction and PV



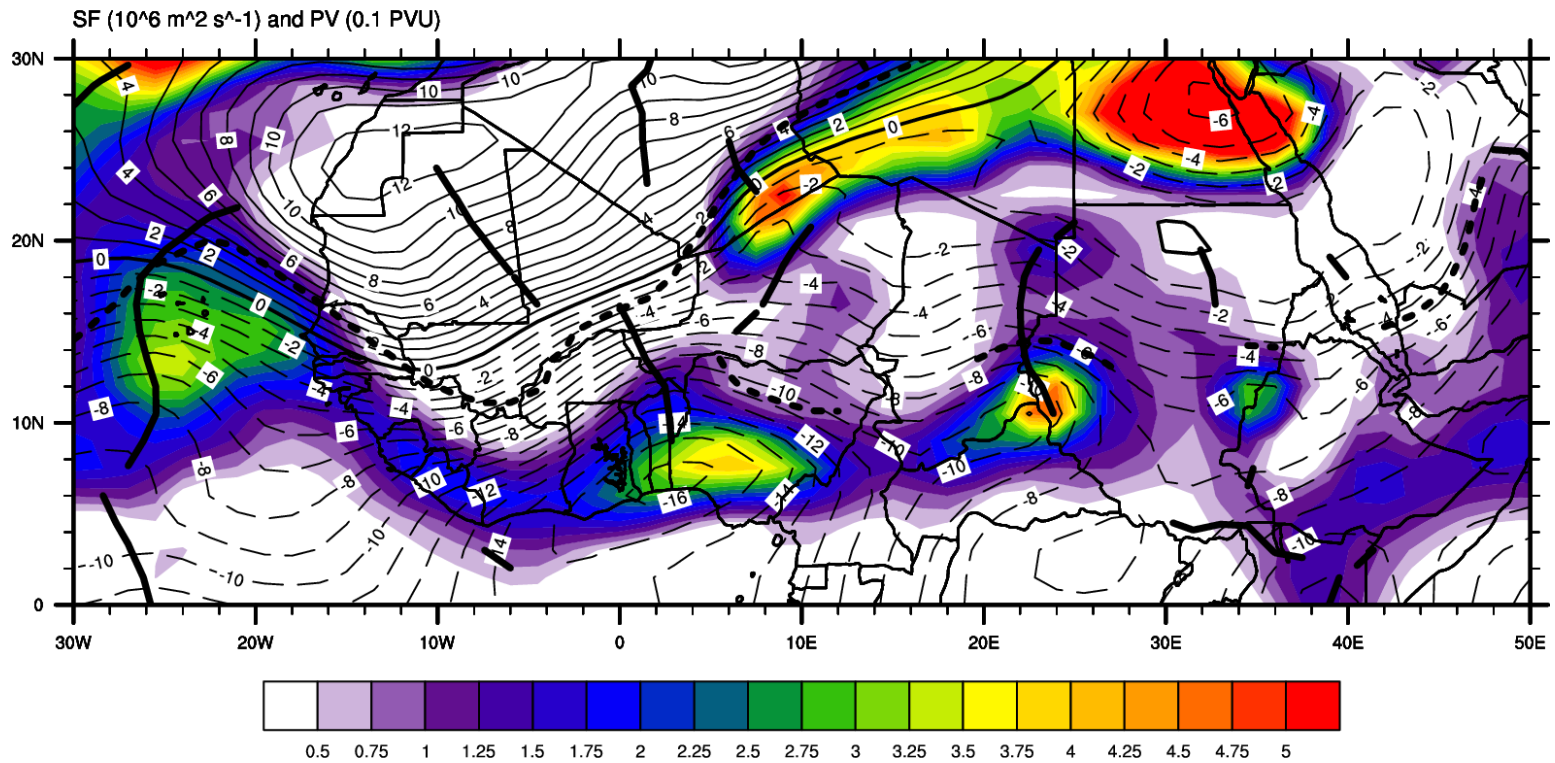
2008/7/15 6 UTC 650 hPa PV and TRMM3B42



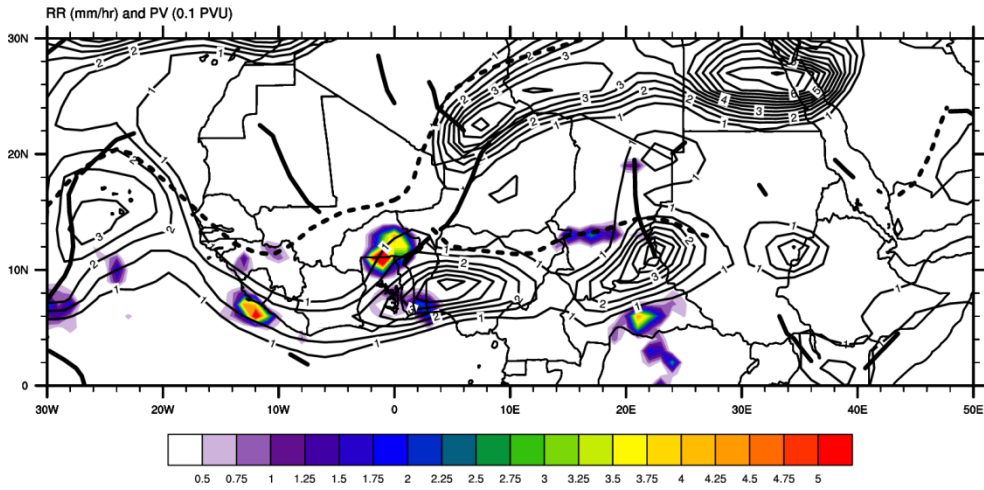
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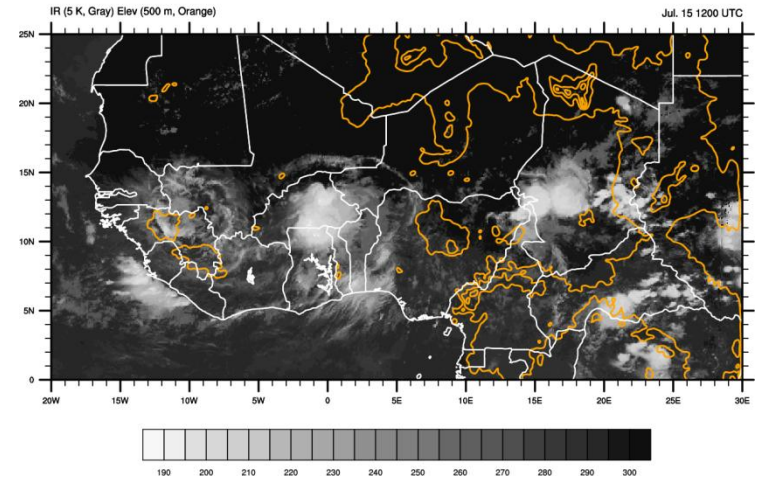
2008/7/15 6 UTC 650 hPa Streamfunction and PV



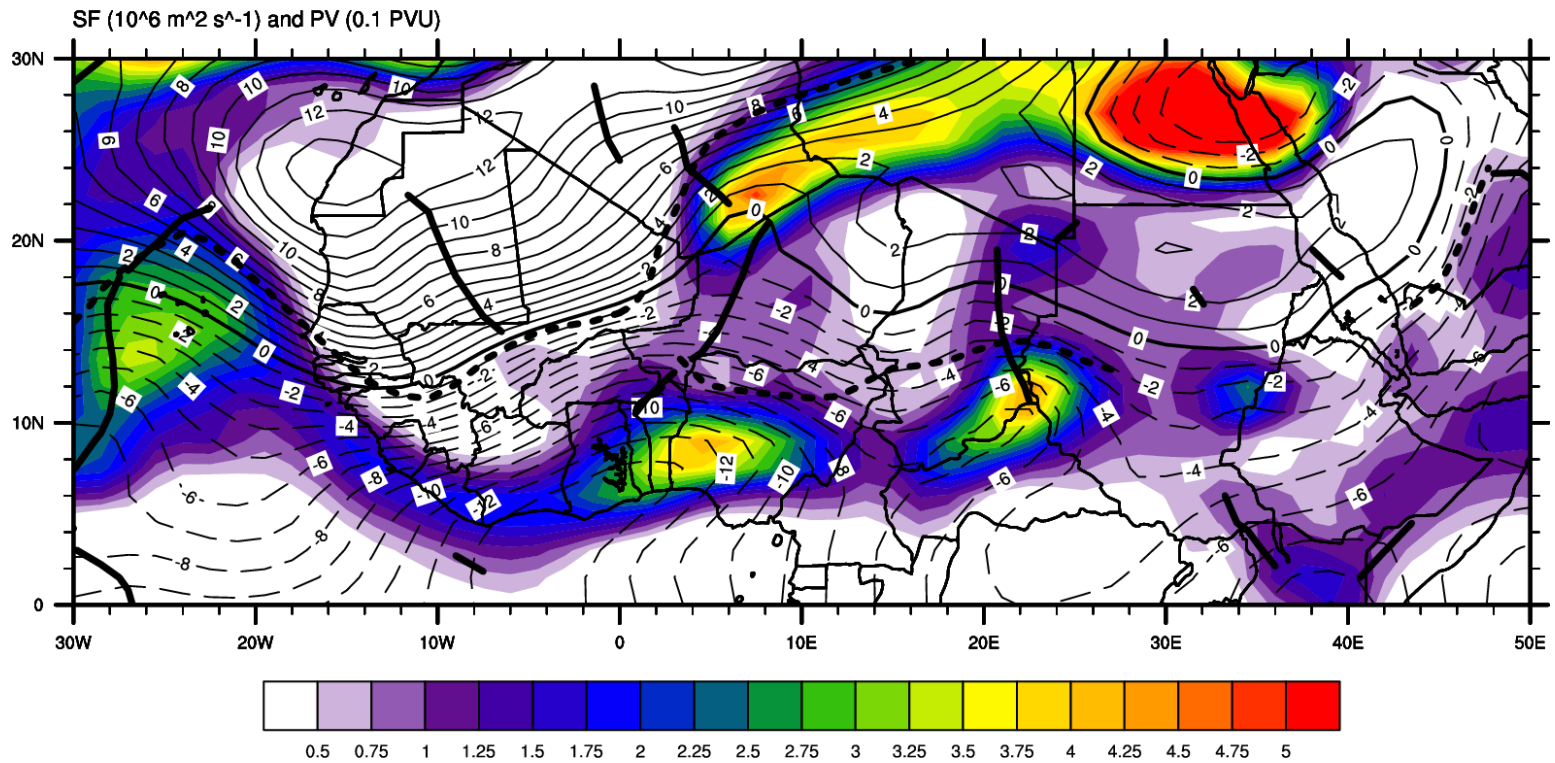
2008/7/15 12 UTC 650 hPa PV and TRMM3B42



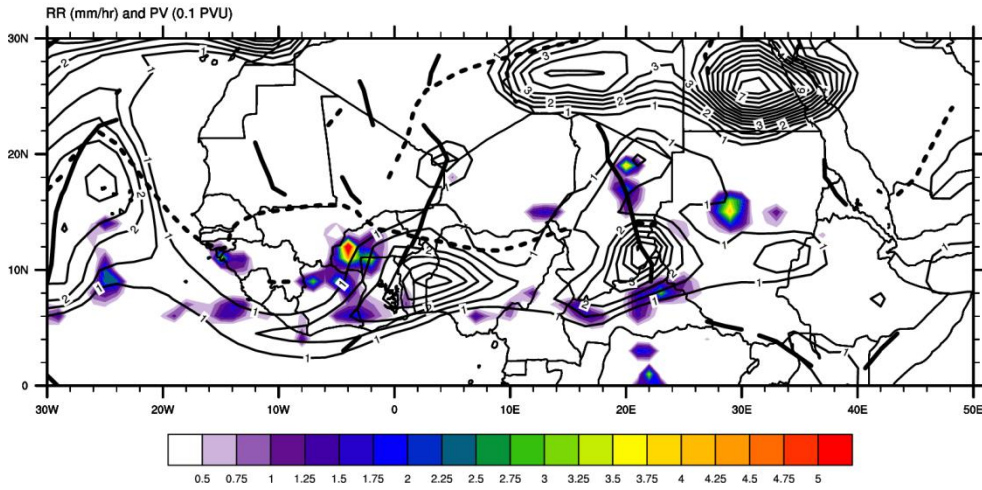
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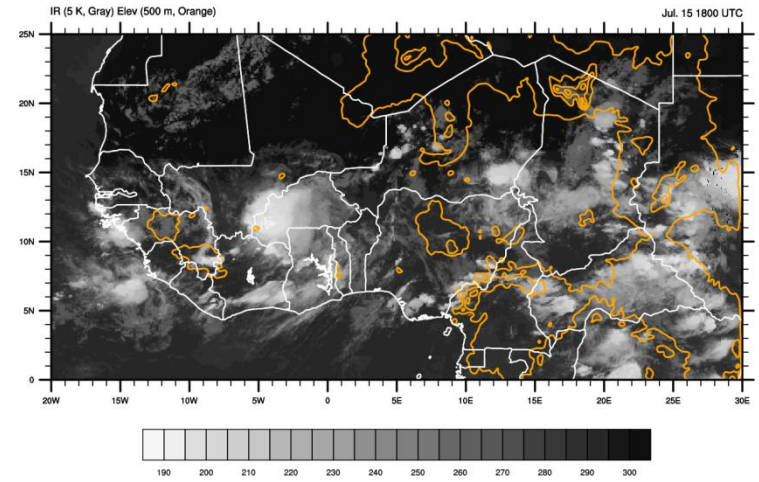
2008/7/15 12 UTC 650 hPa Streamfunction and PV



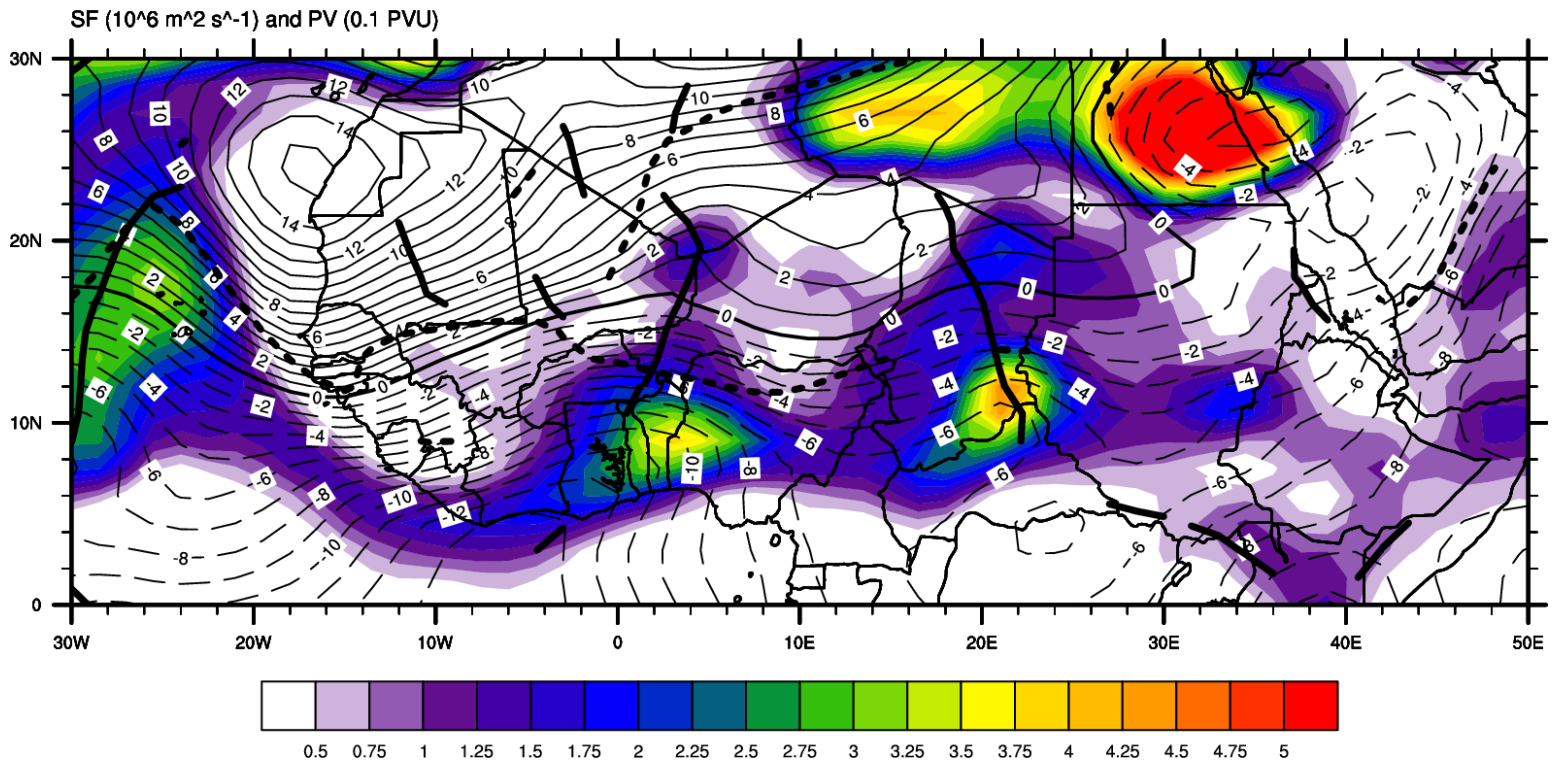
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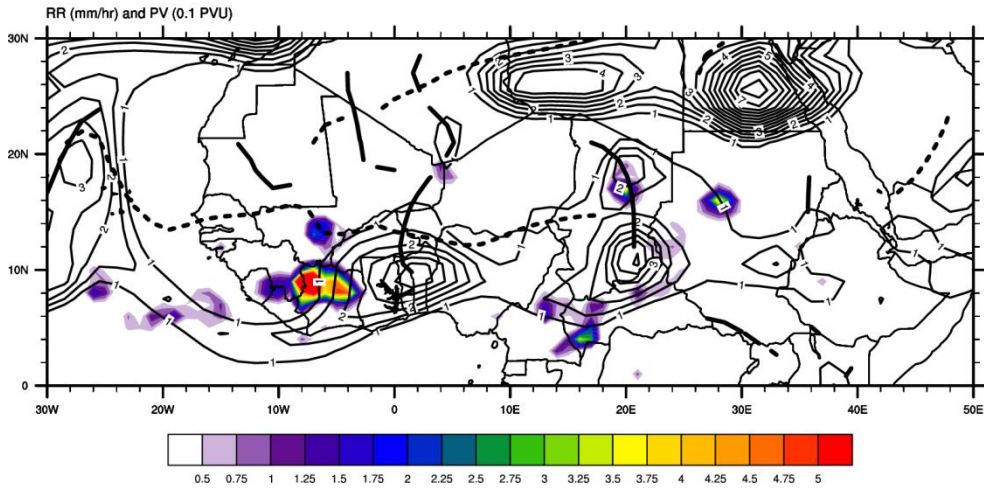
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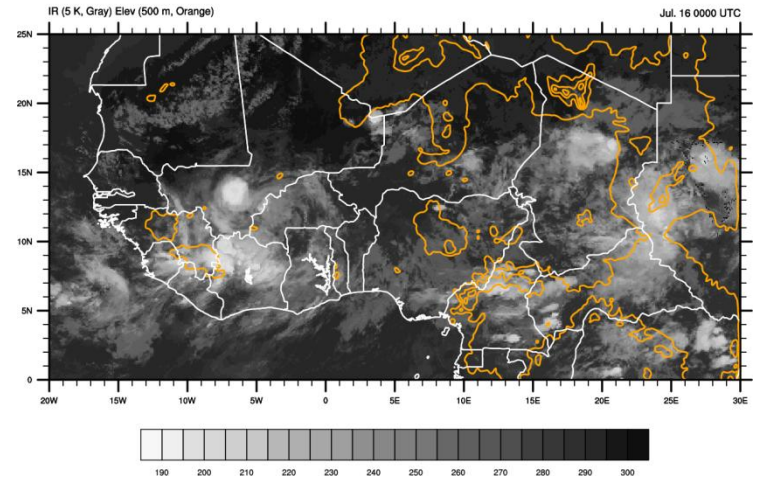
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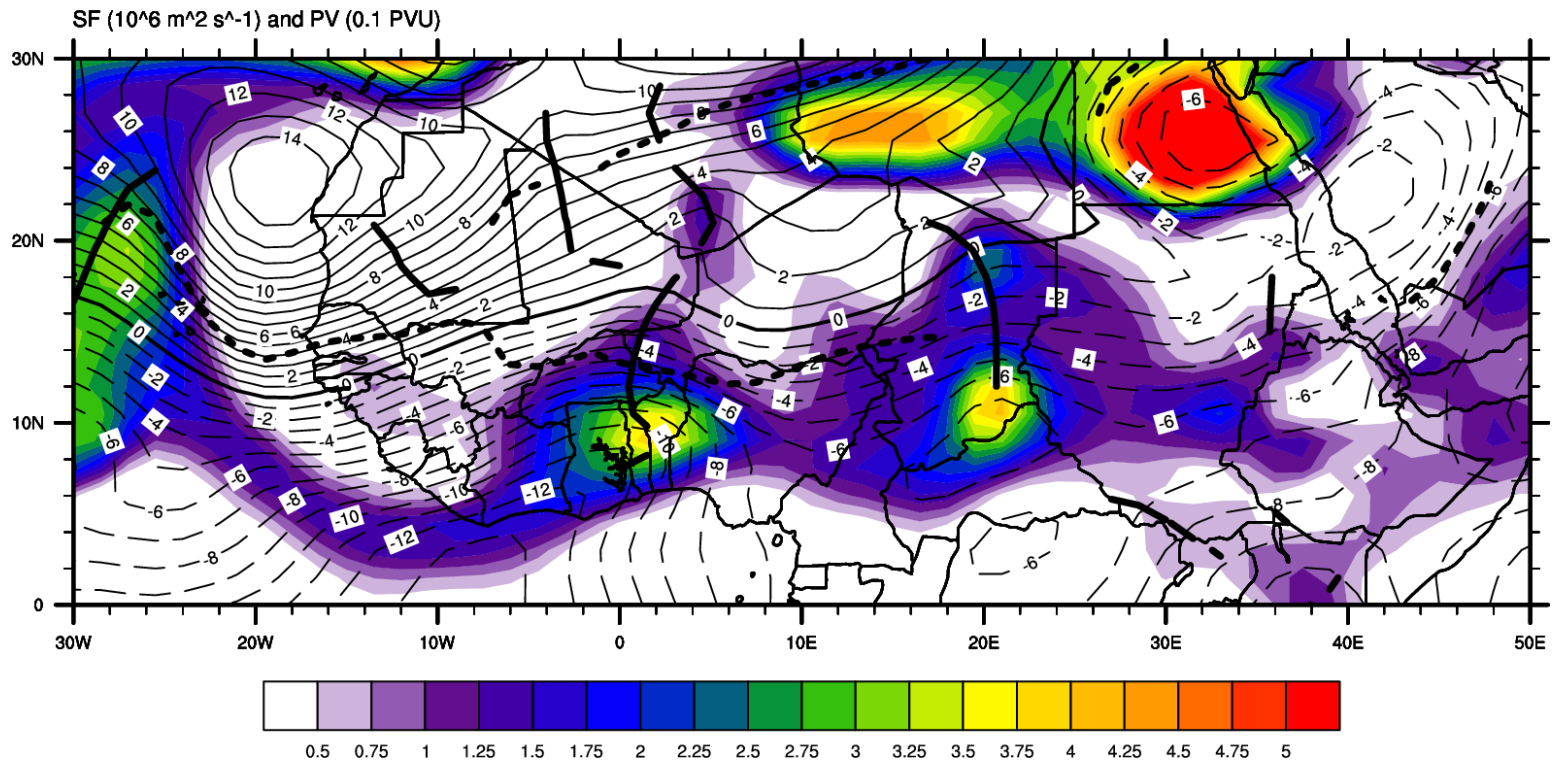
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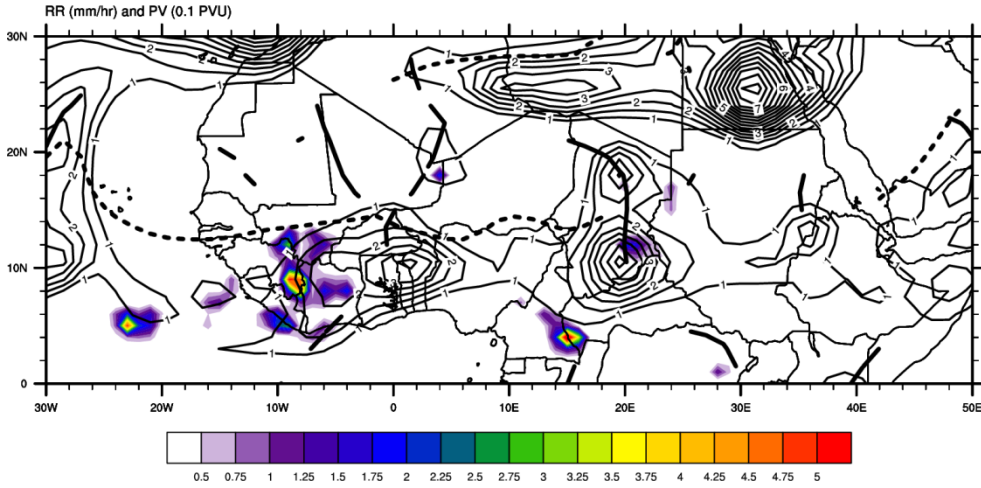
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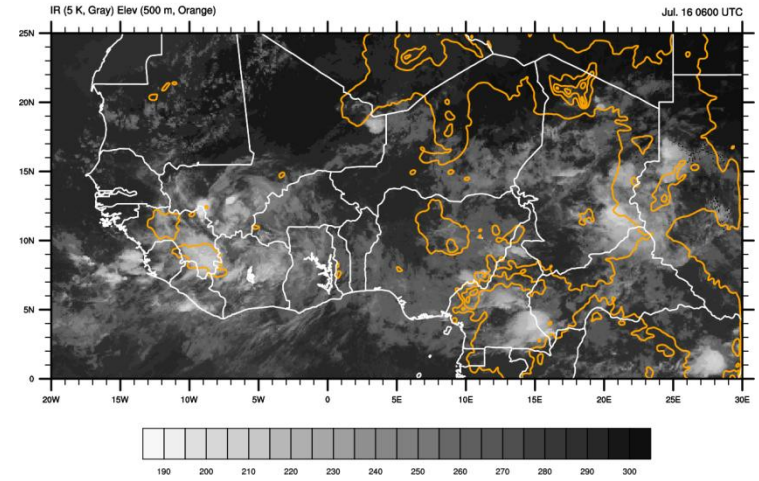
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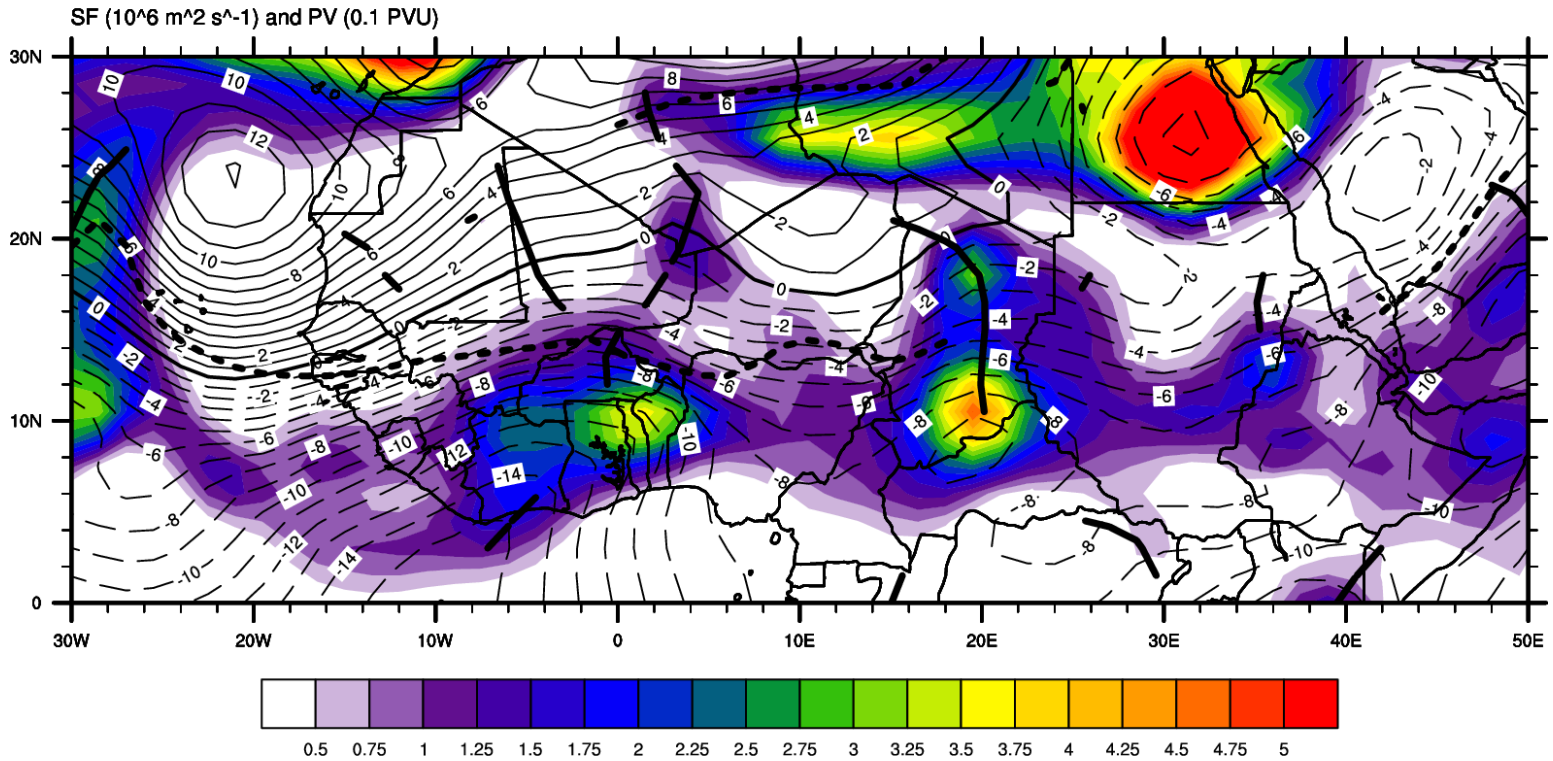
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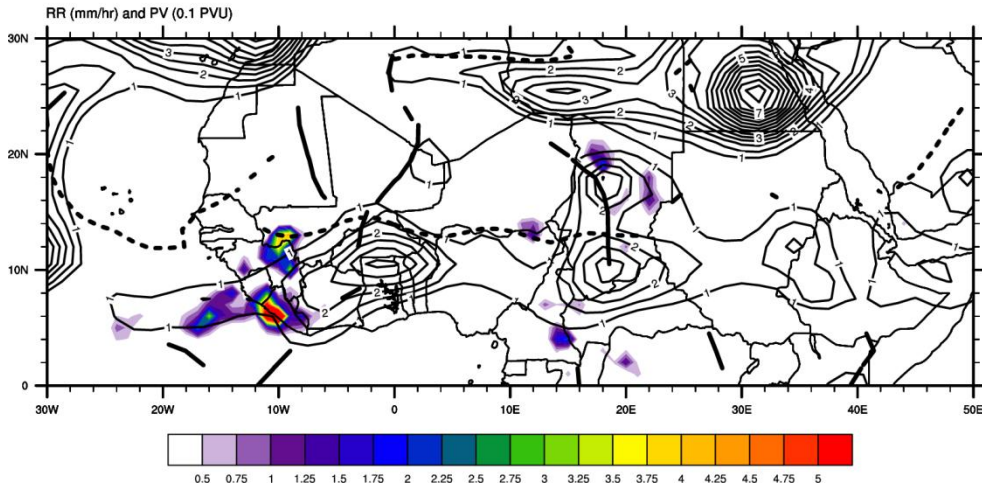
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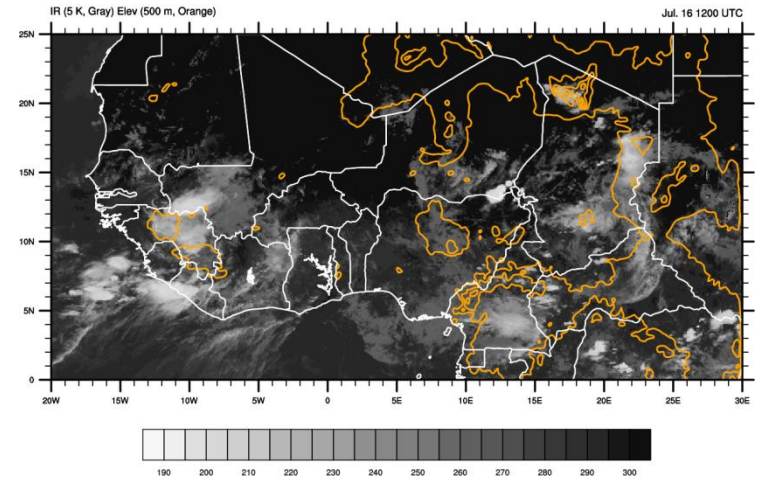
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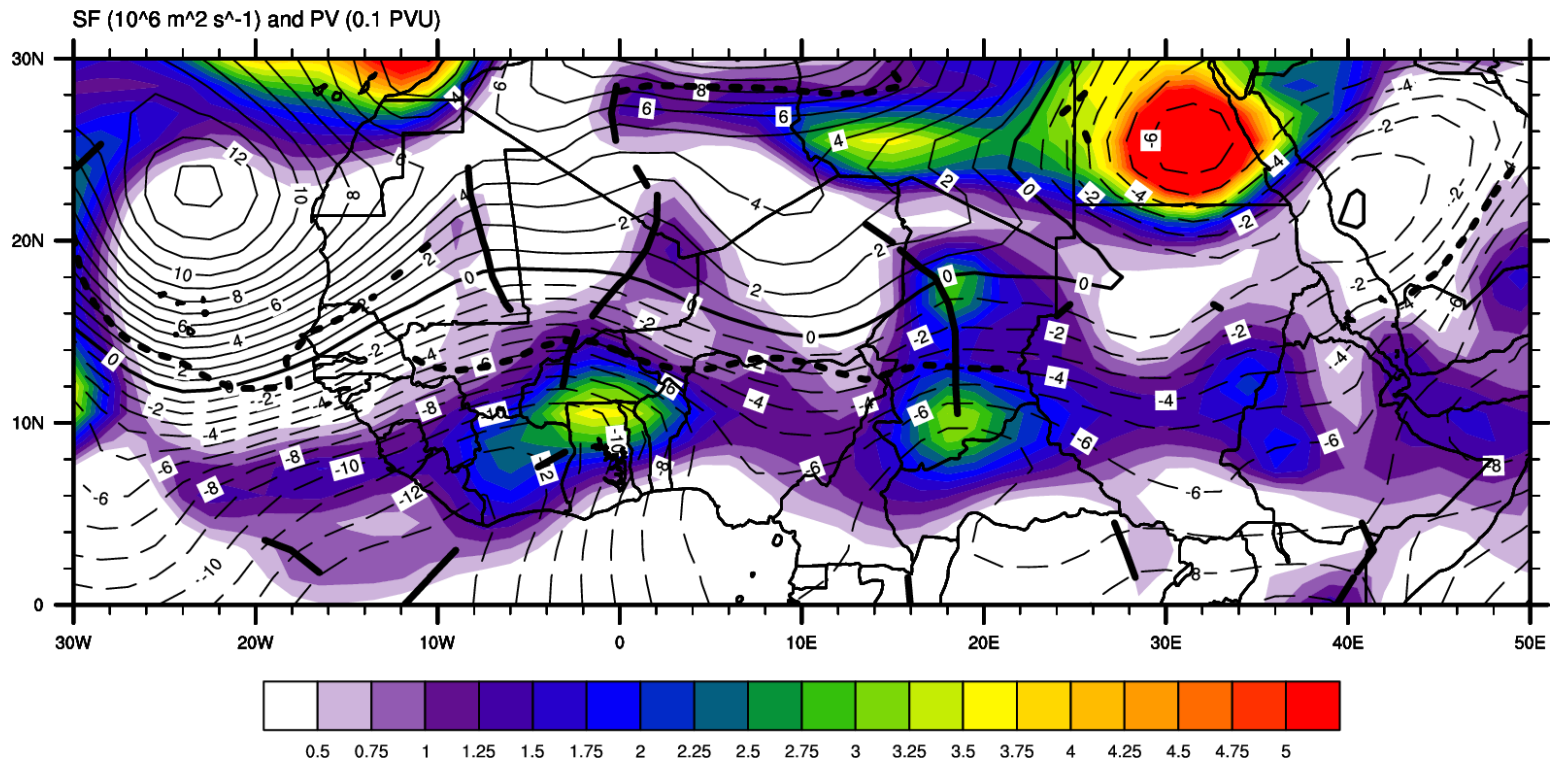
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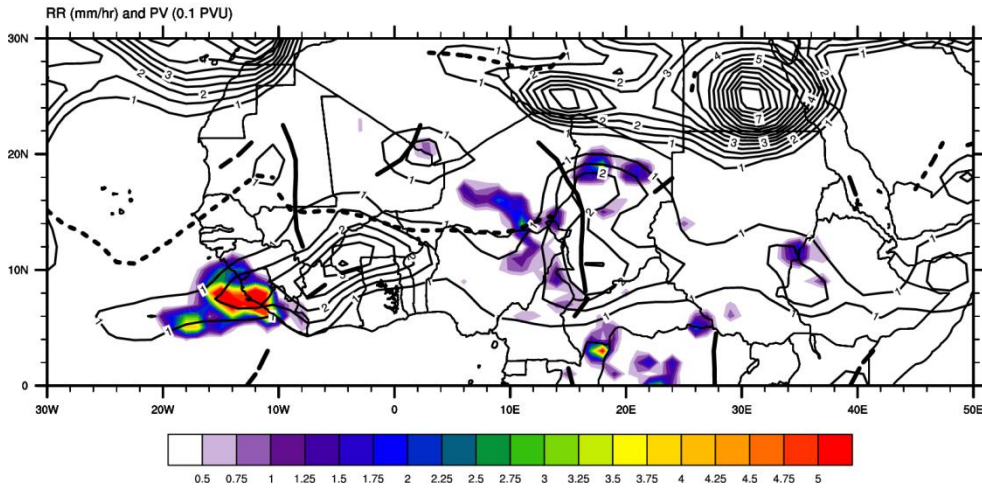
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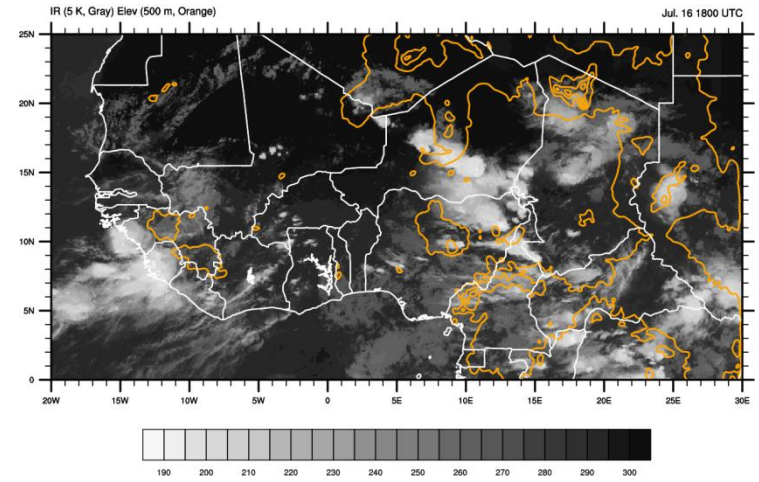
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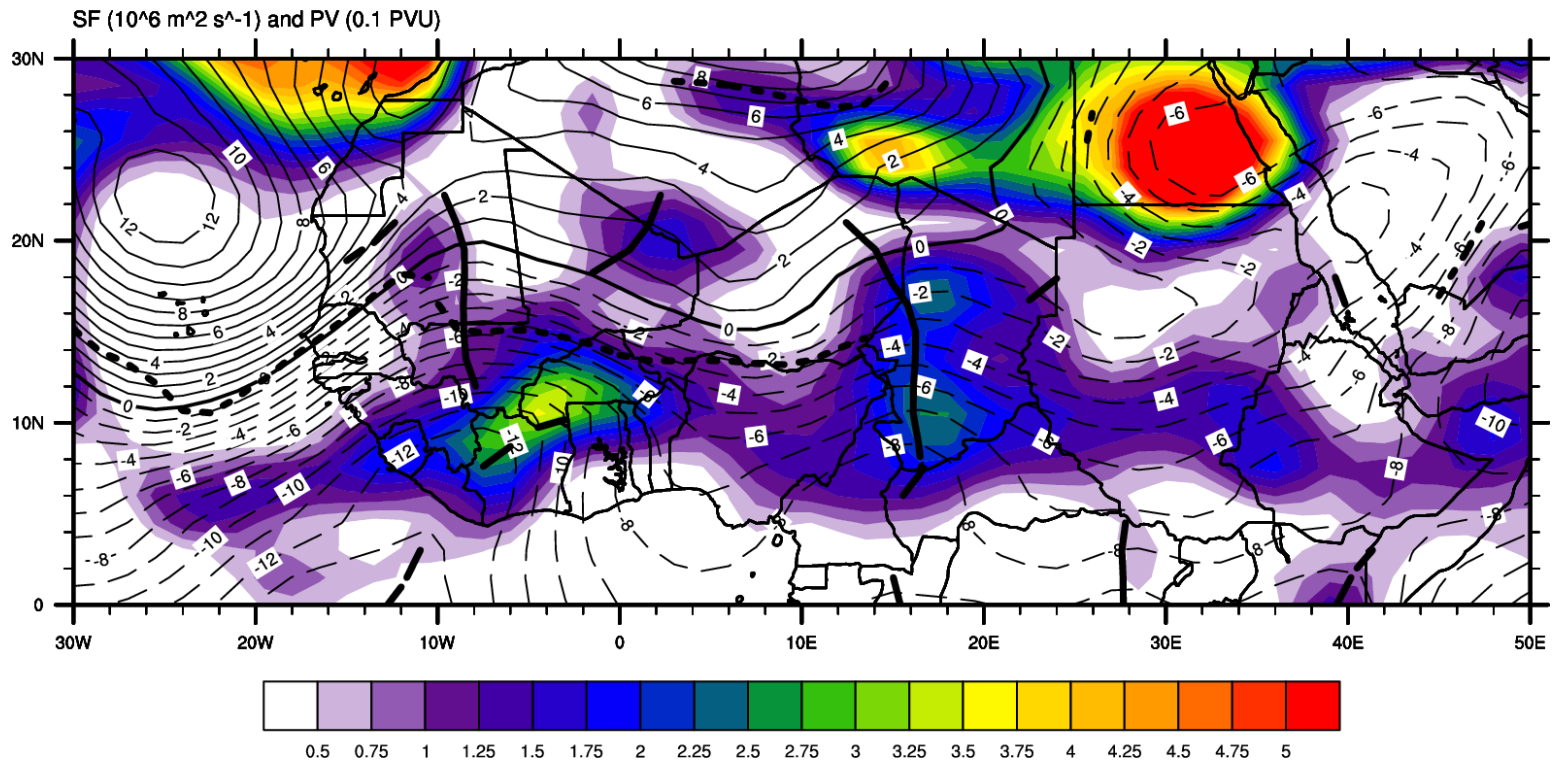
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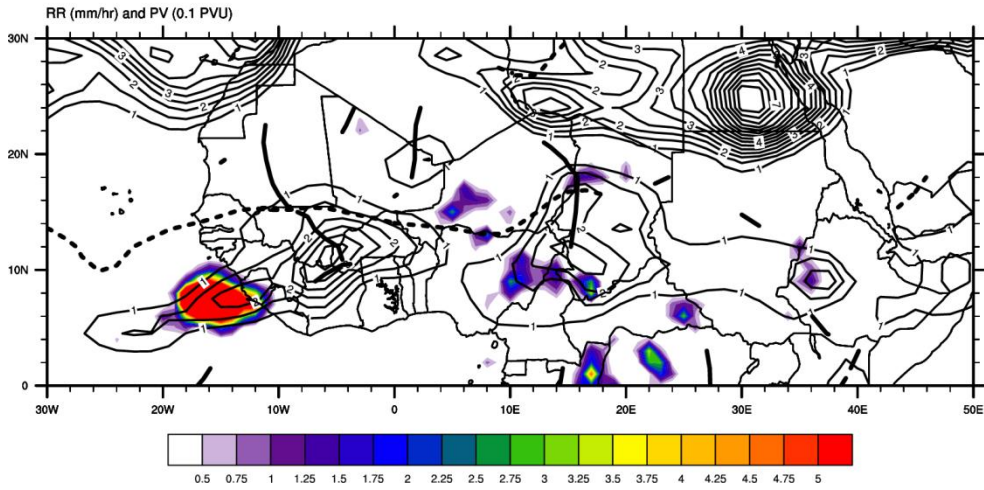
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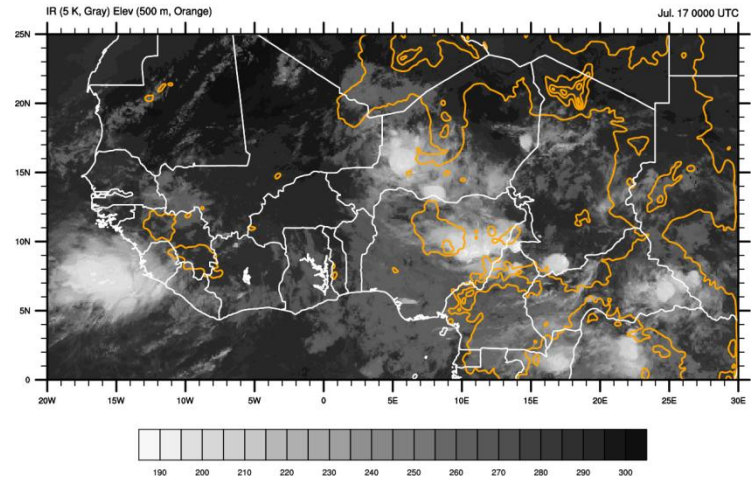
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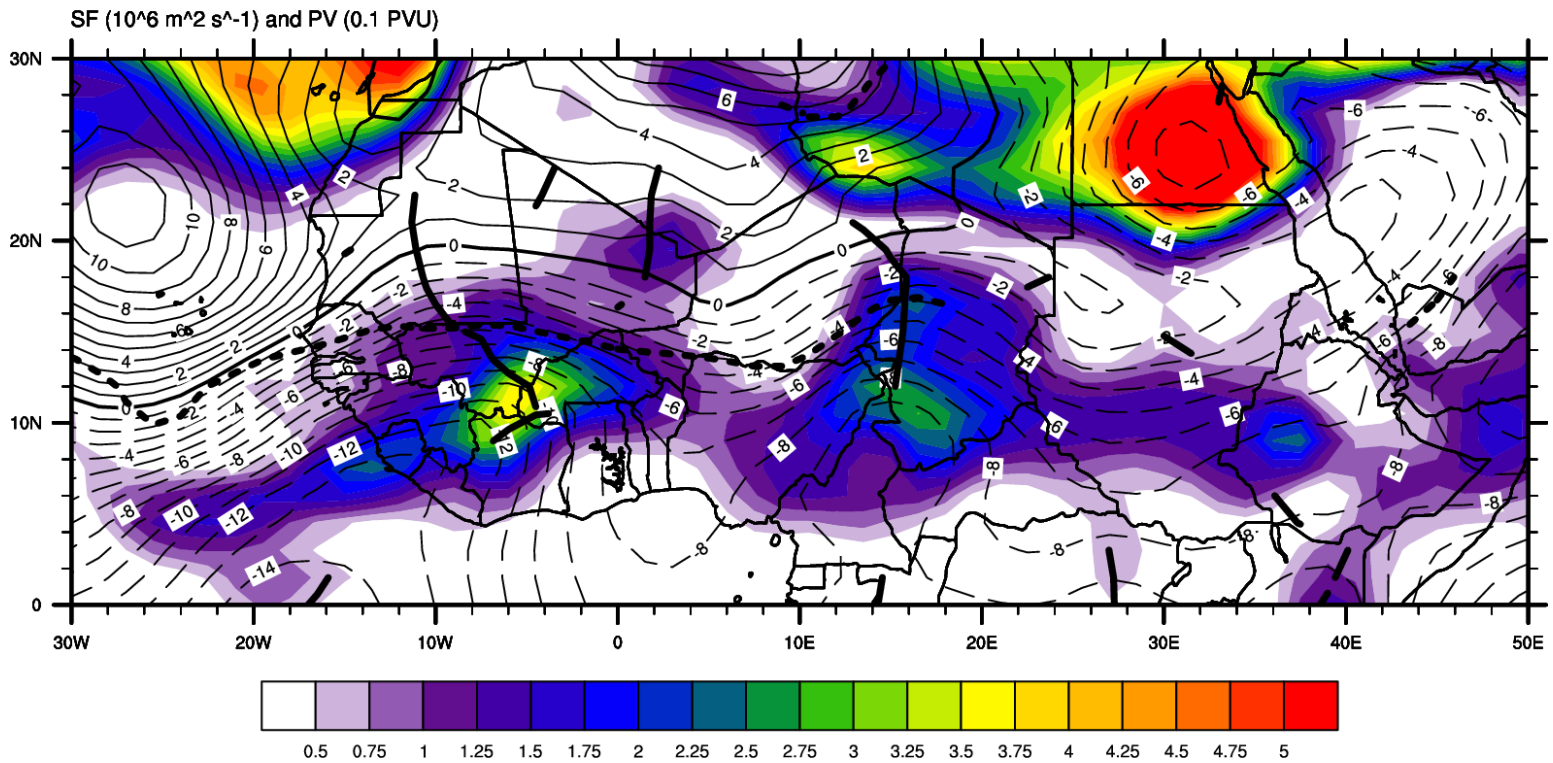
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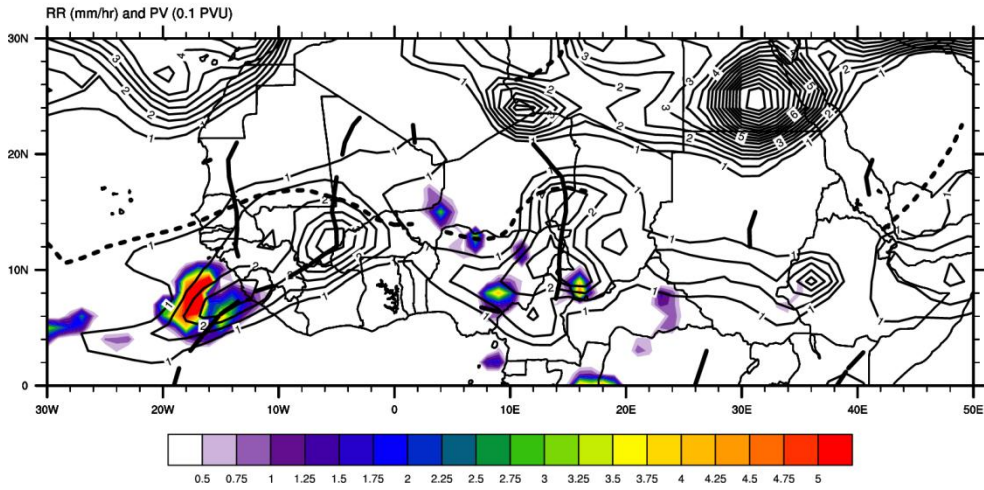
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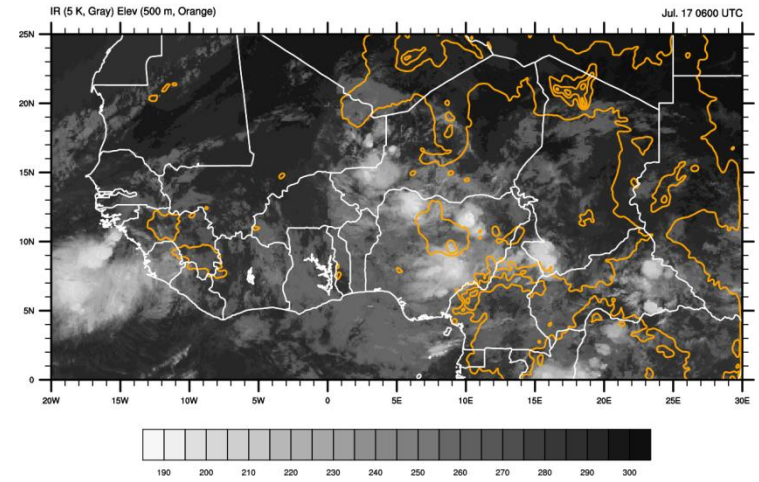
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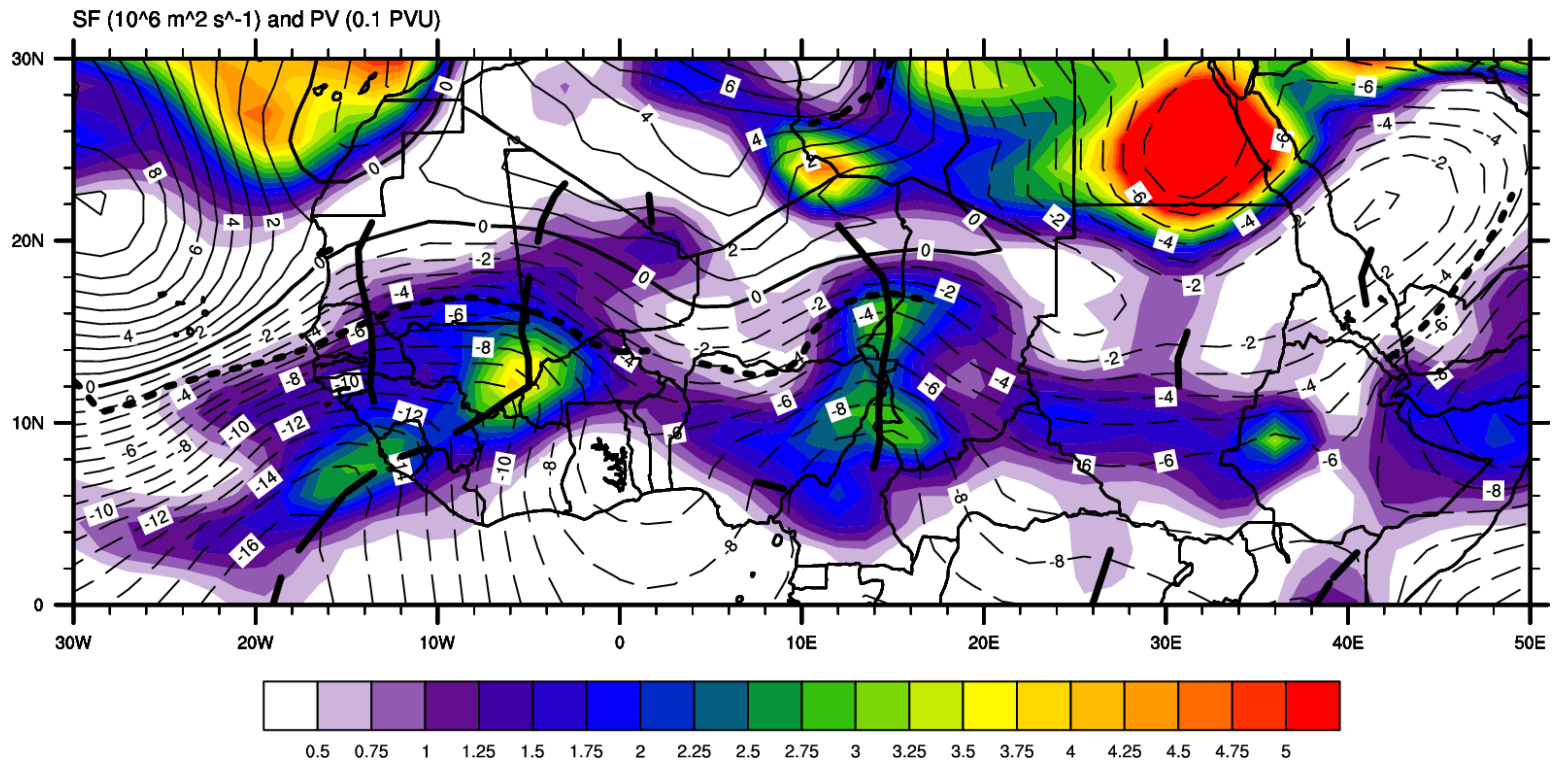
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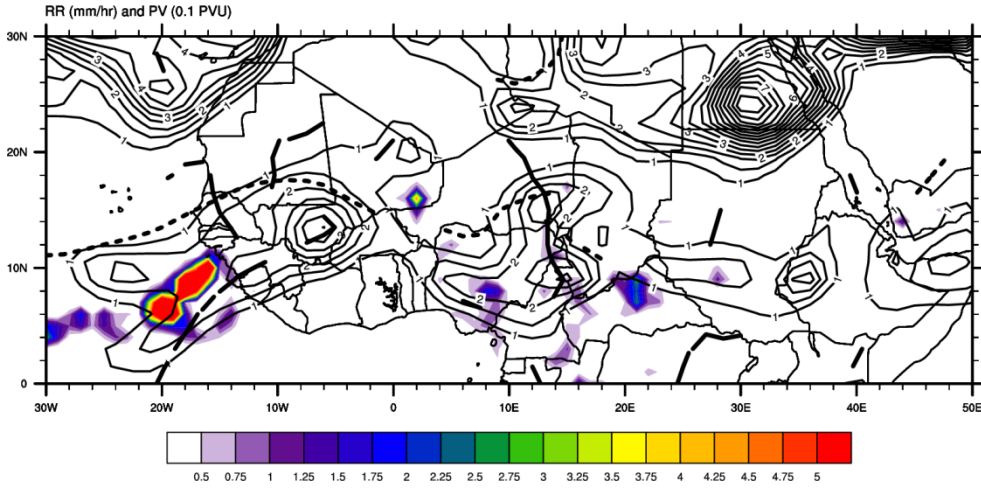
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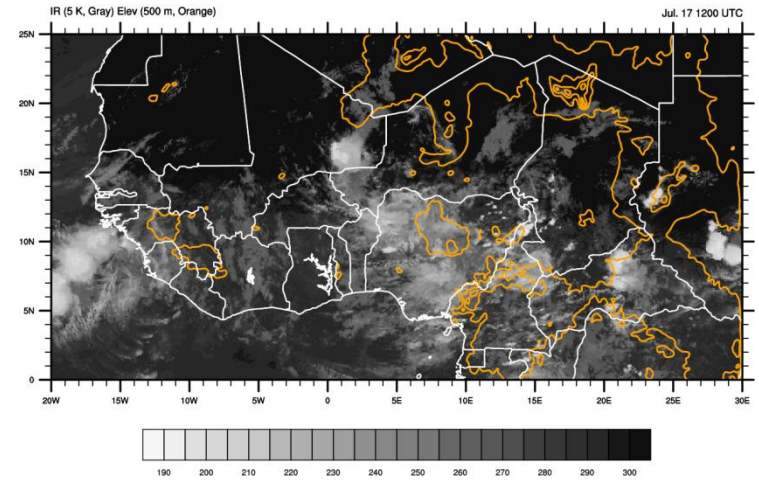
2008/7/17 6 UTC 650 hPa Streamfunction and PV



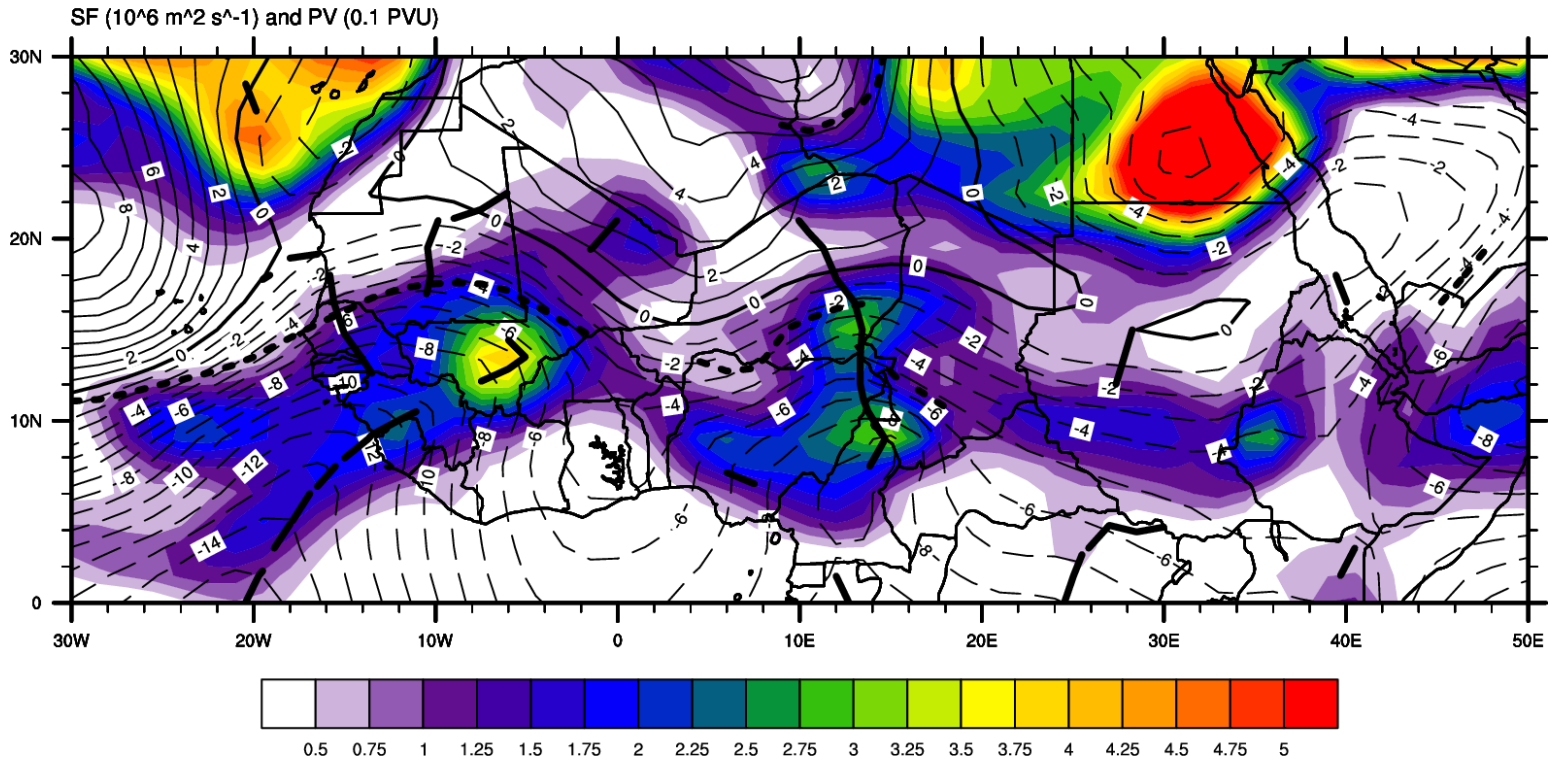
2008/7/17 12 UTC 650 hPa PV and TRMM3B42



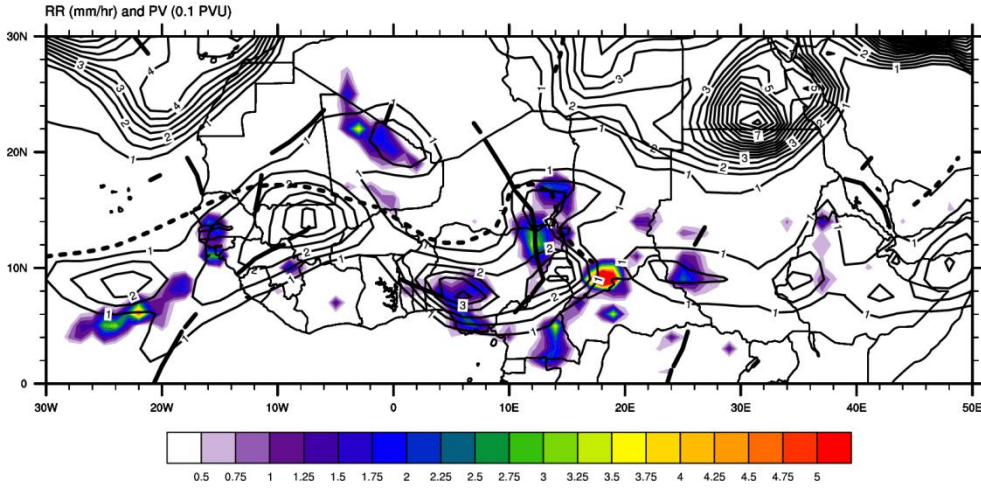
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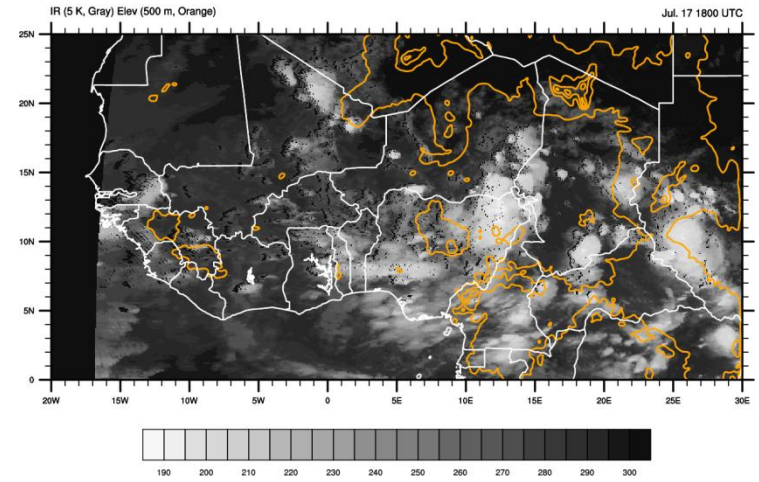
2008/7/17 12 UTC 650 hPa Streamfunction and PV



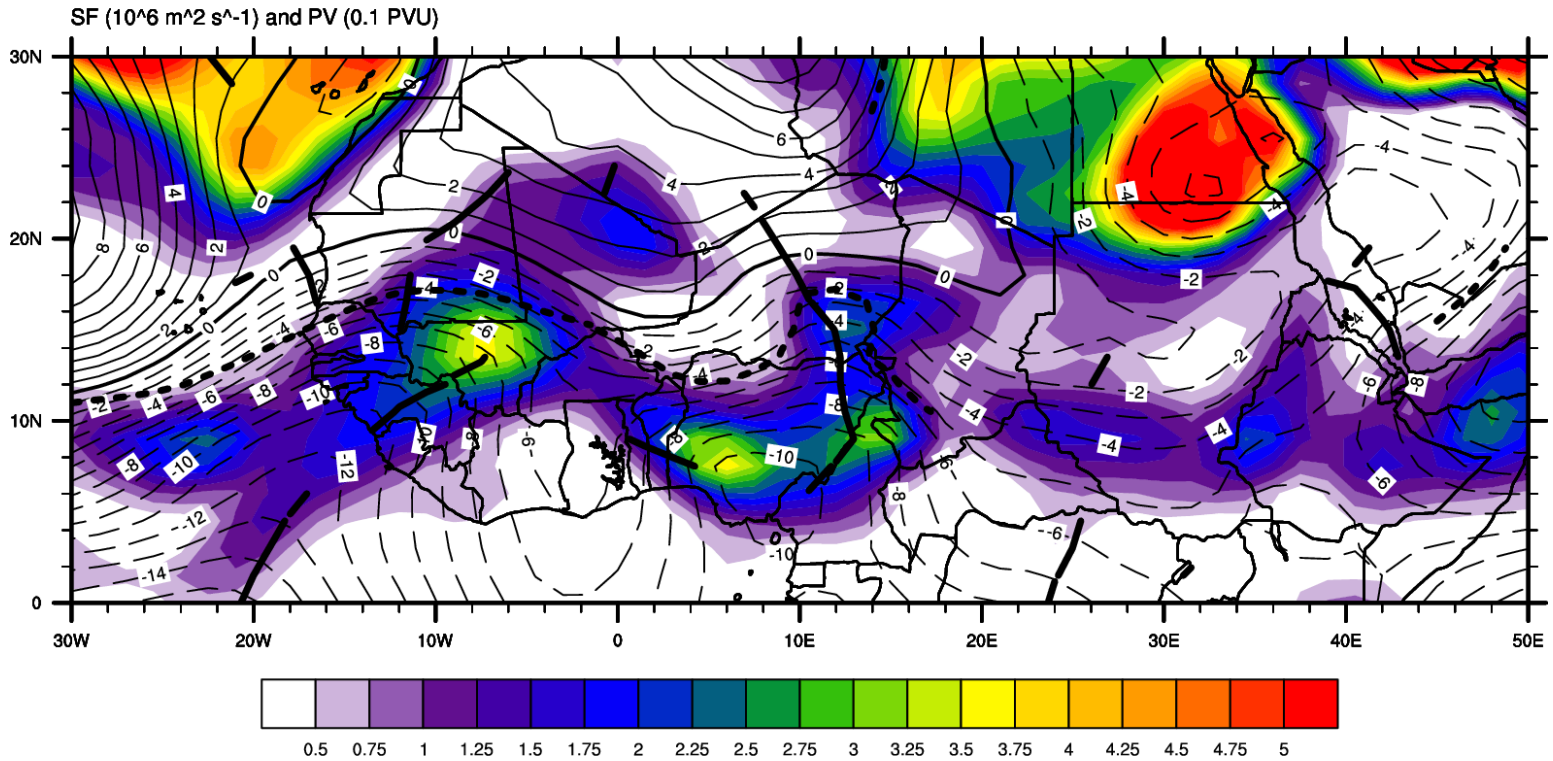
2008/7/17 18 UTC 650 hPa PV and TRMM3B42



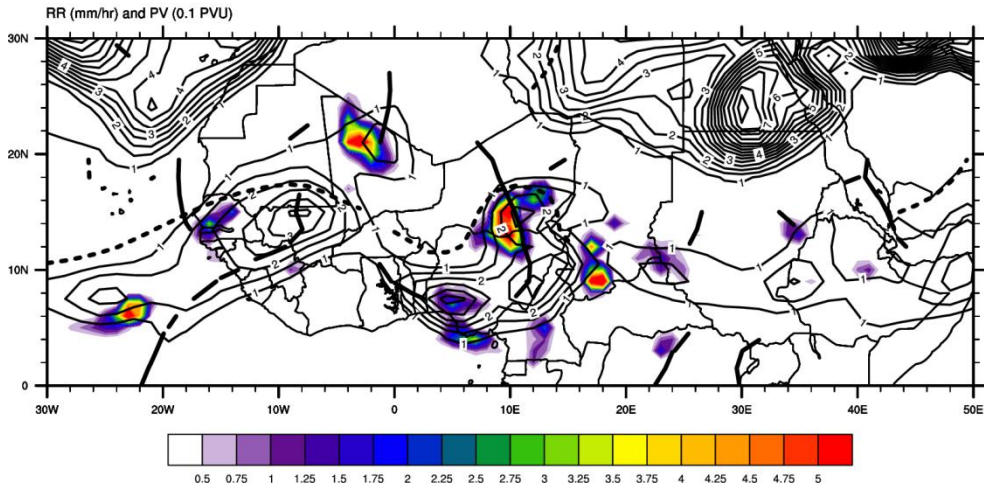
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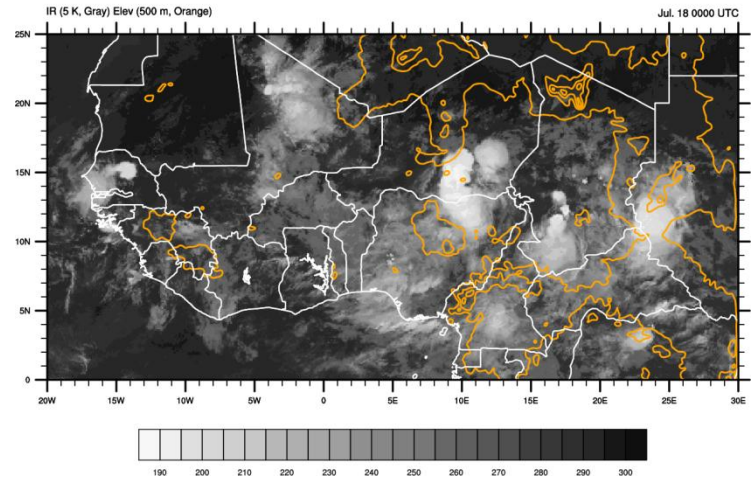
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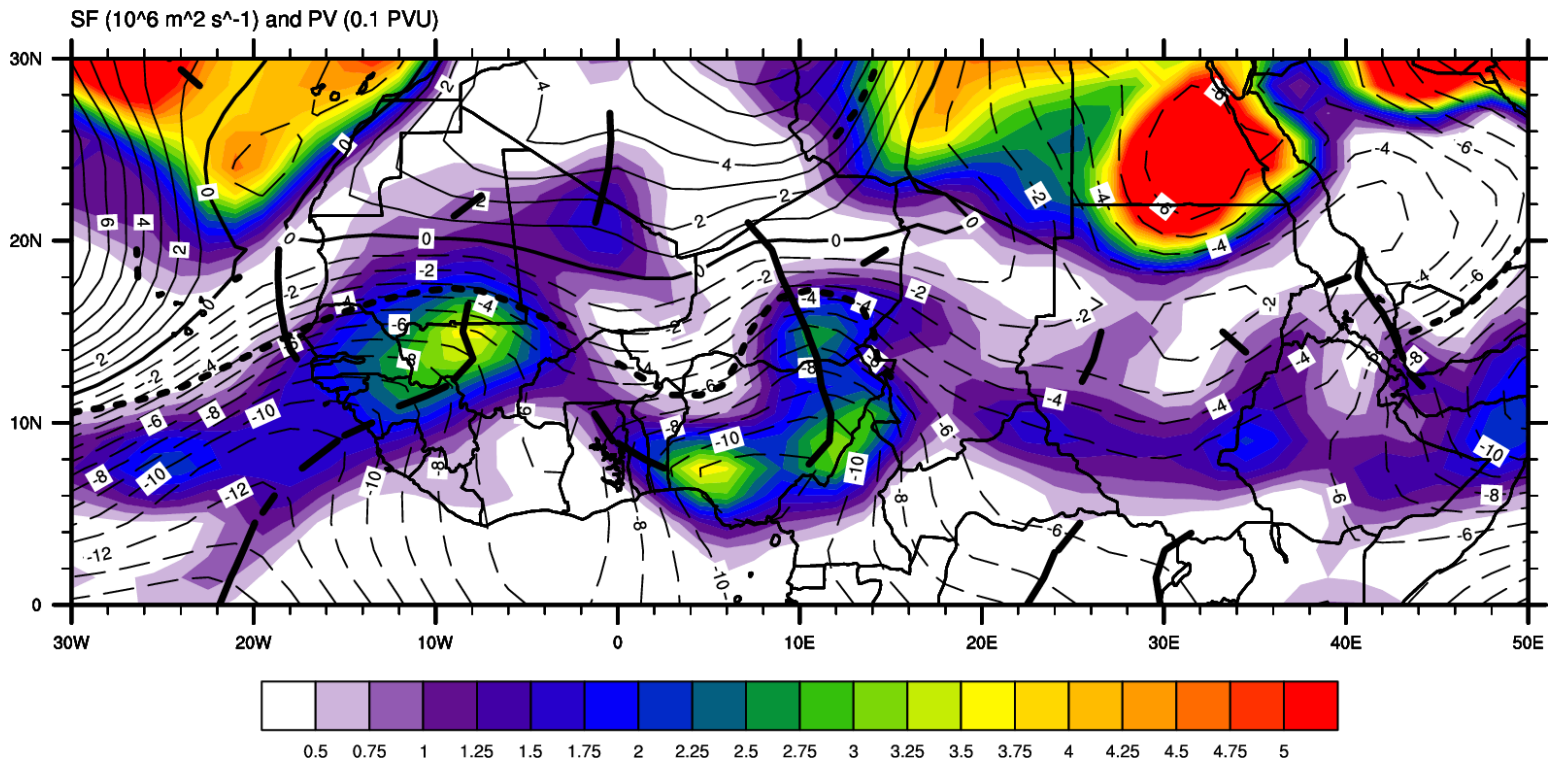
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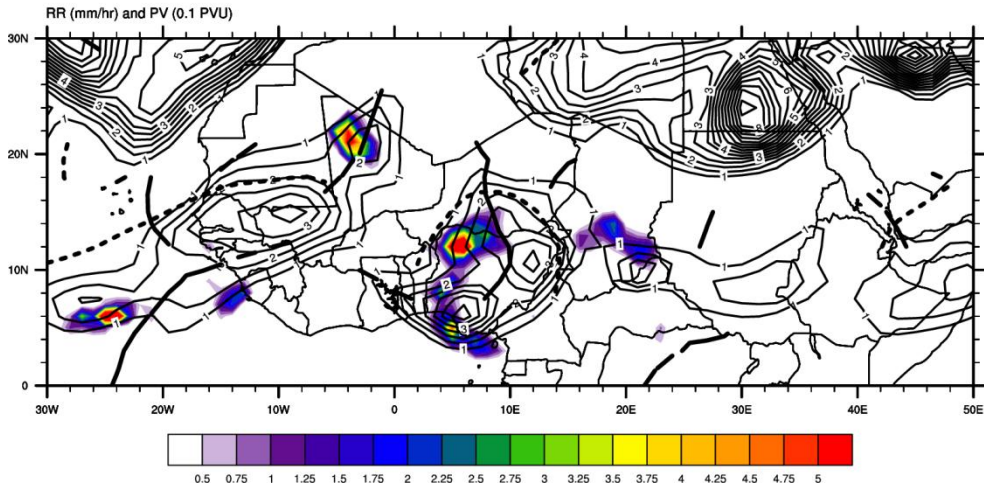
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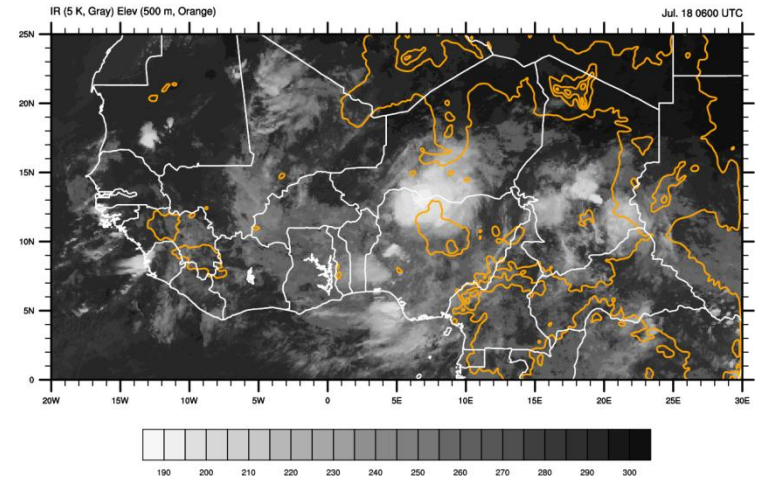
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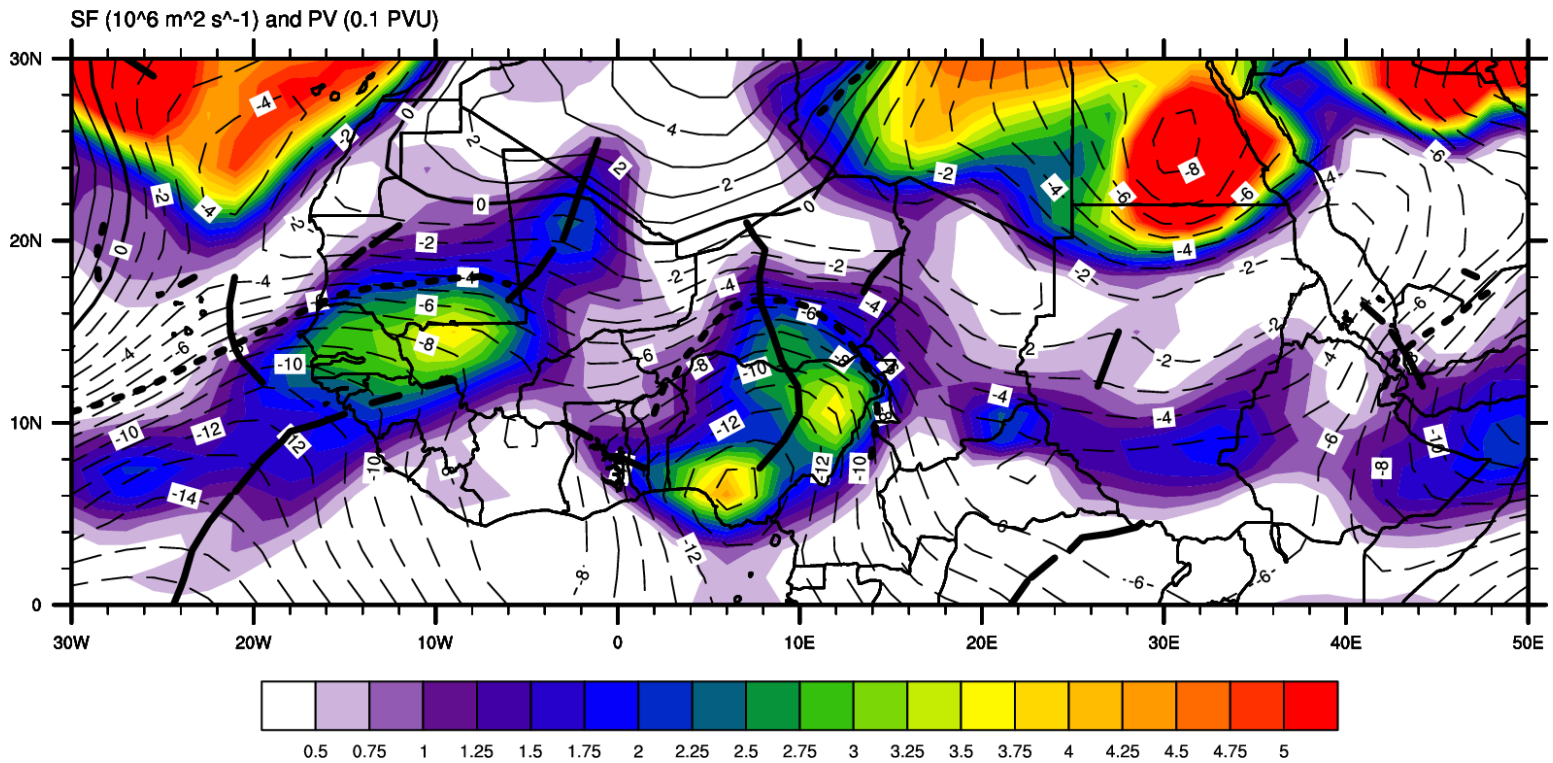
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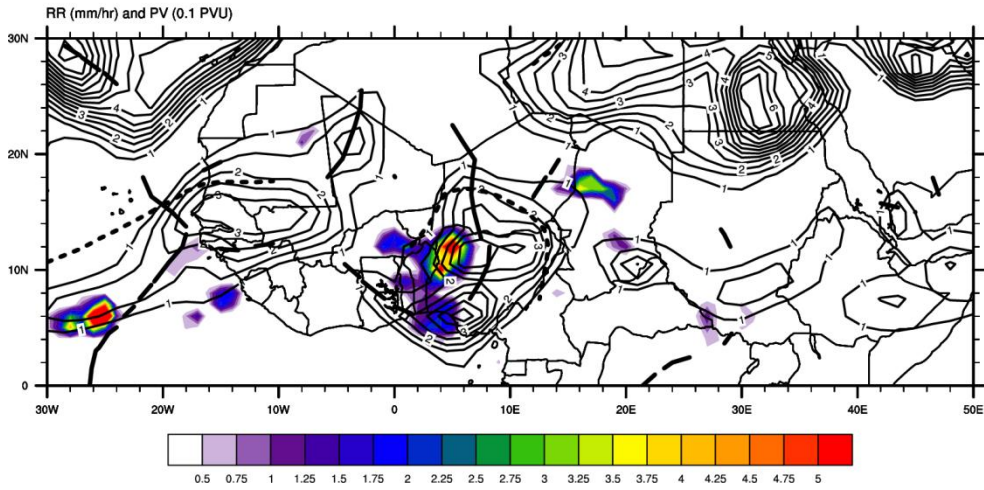
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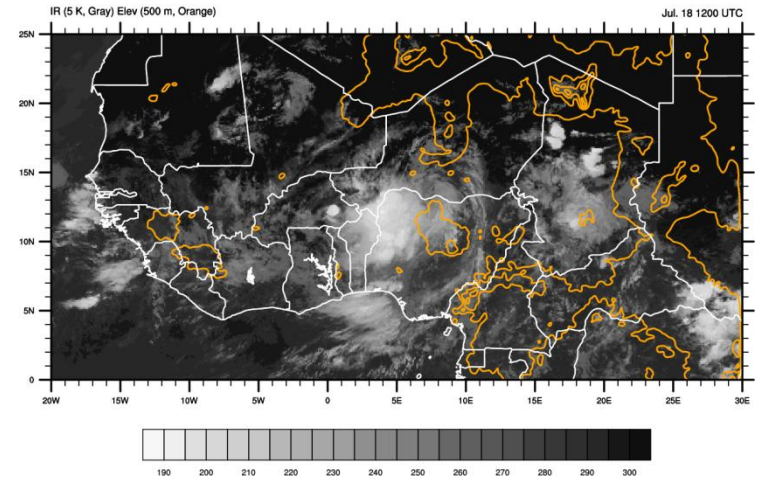
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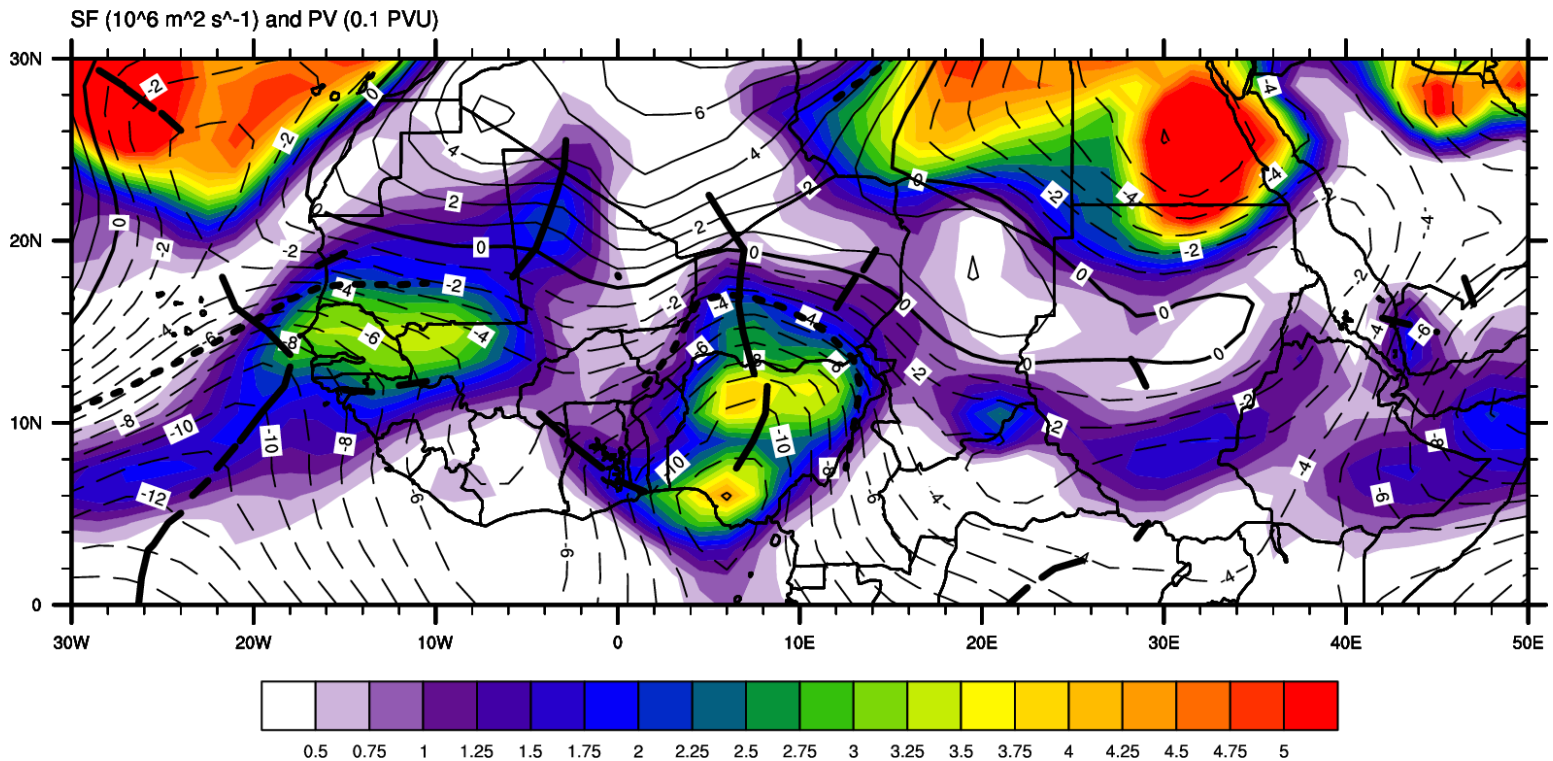
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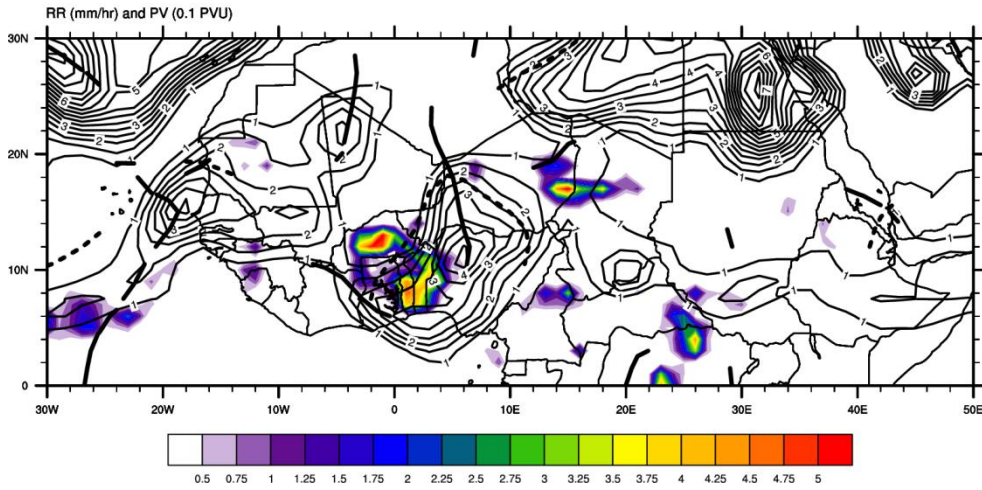
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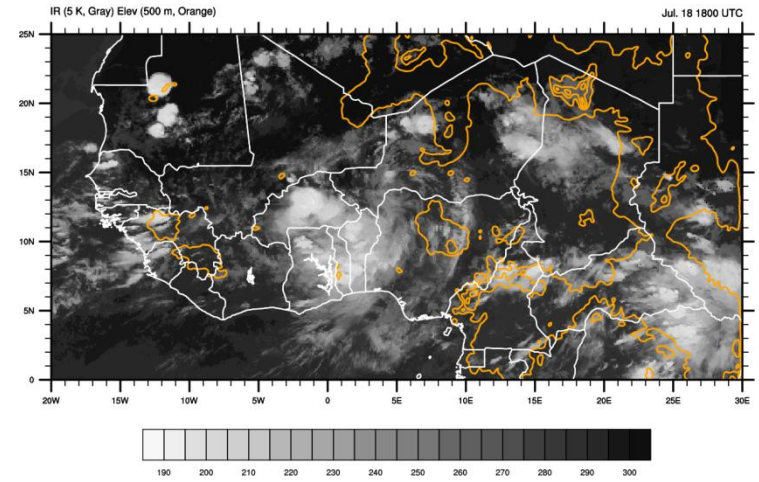
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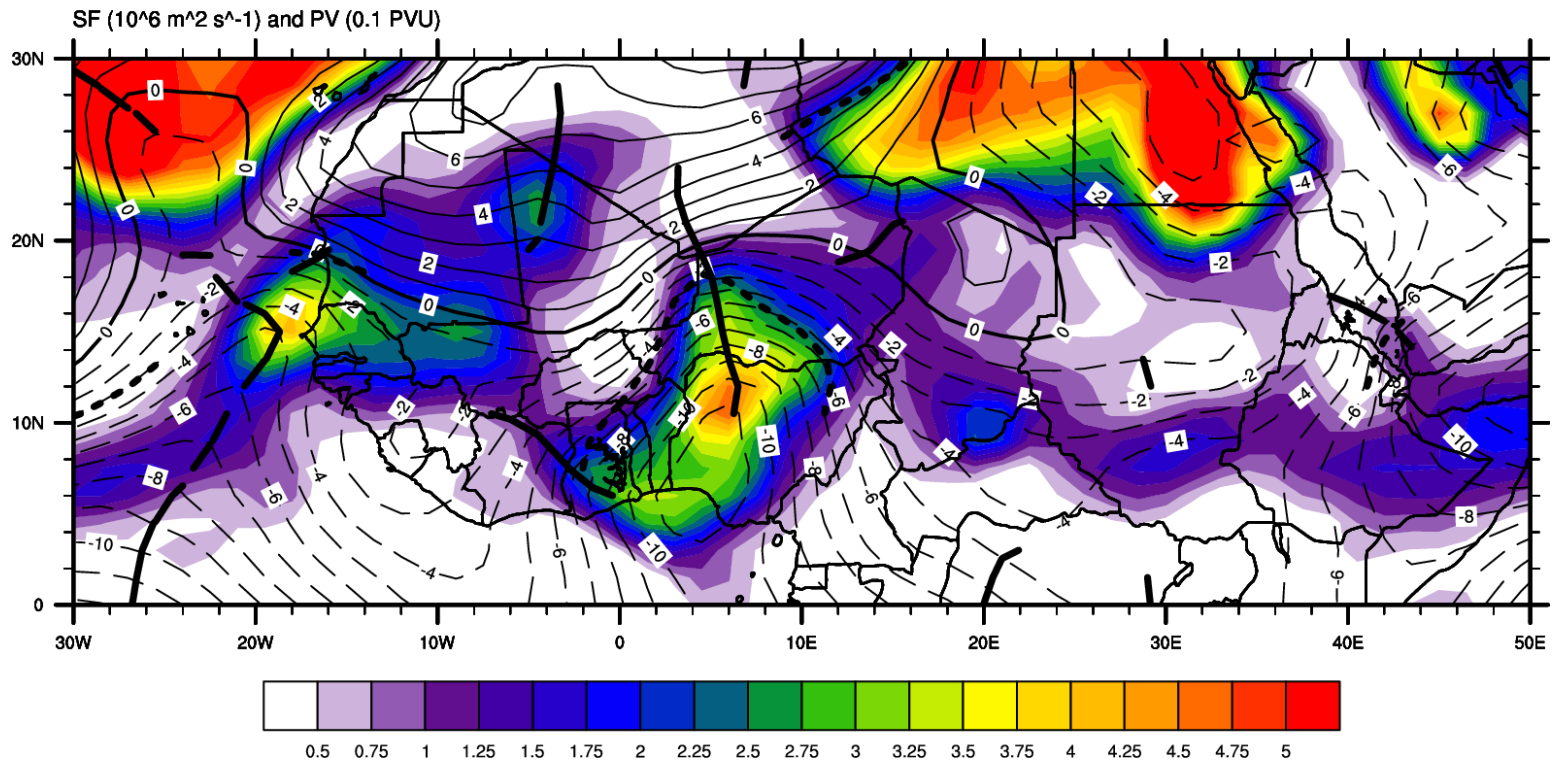
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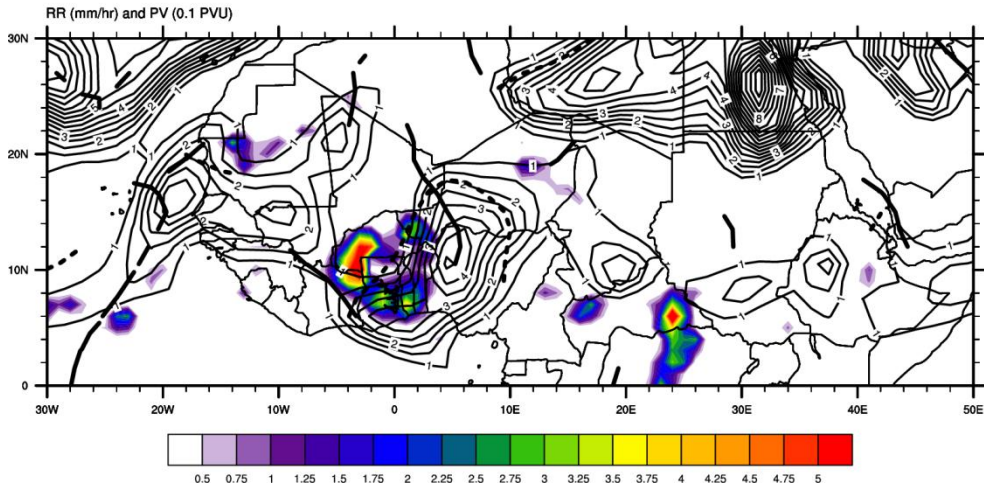
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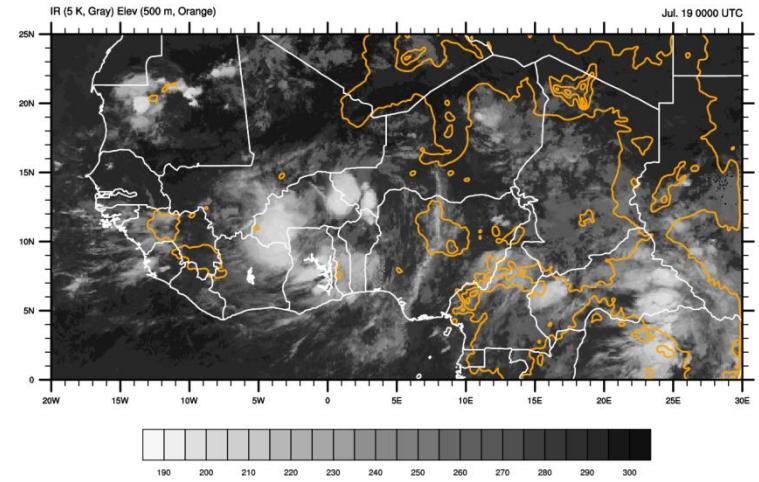
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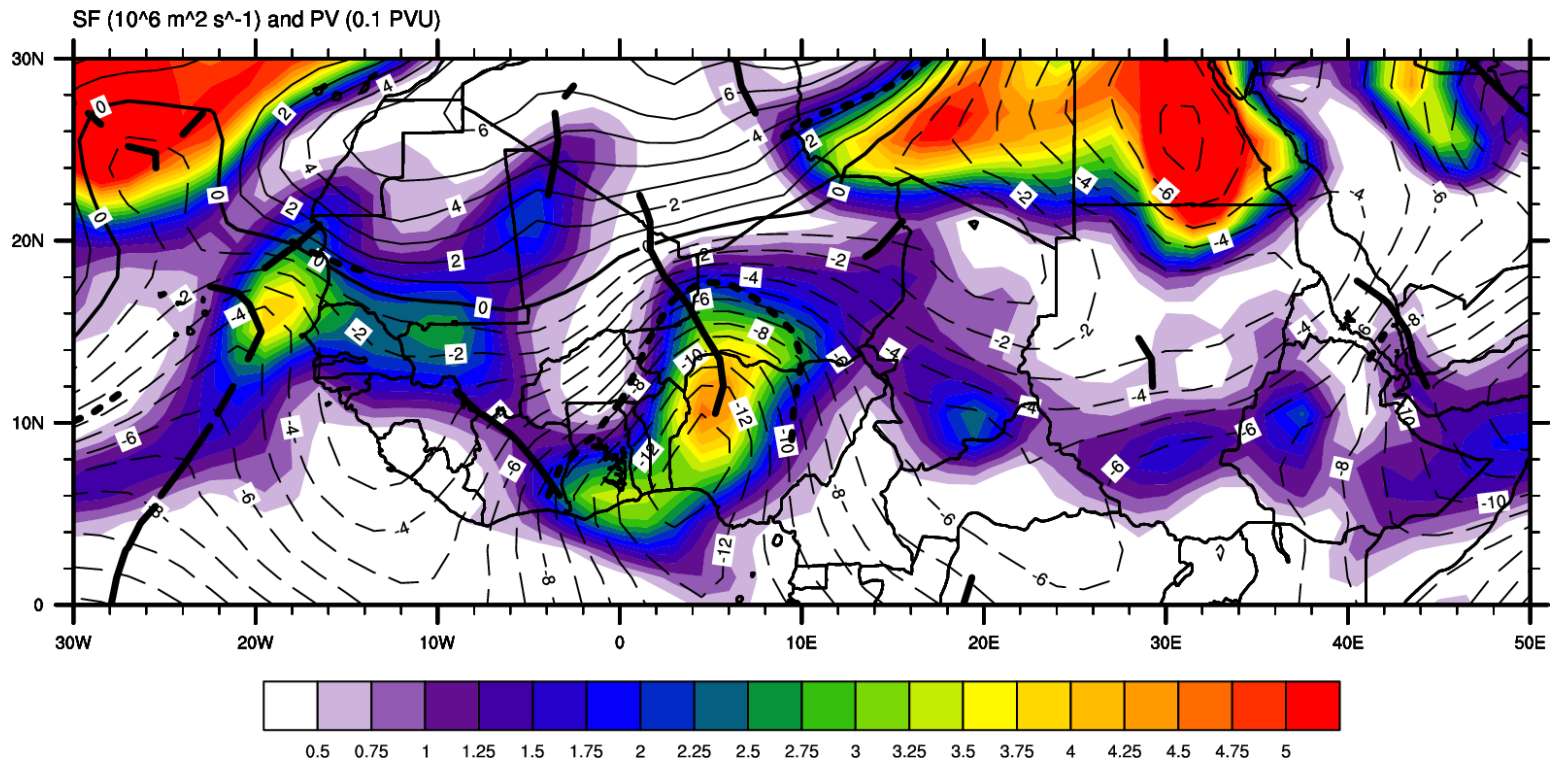
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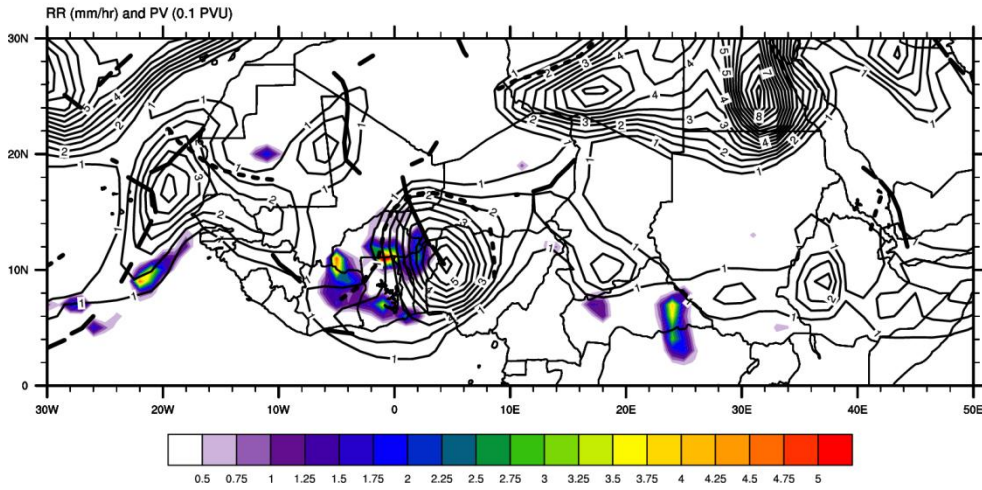
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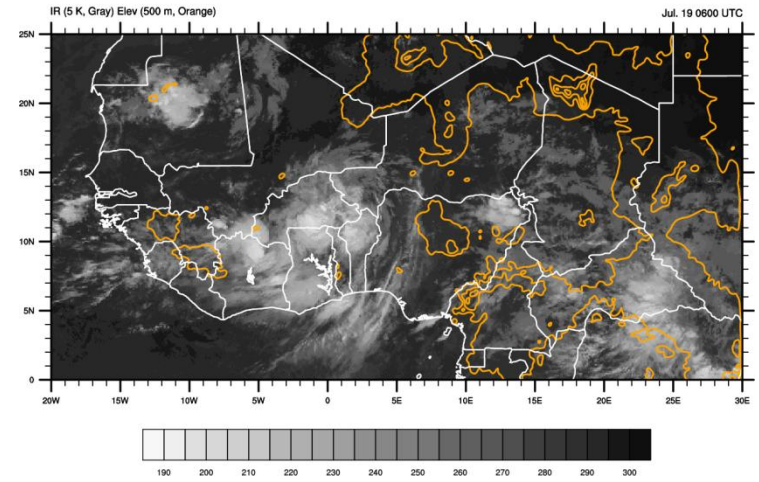
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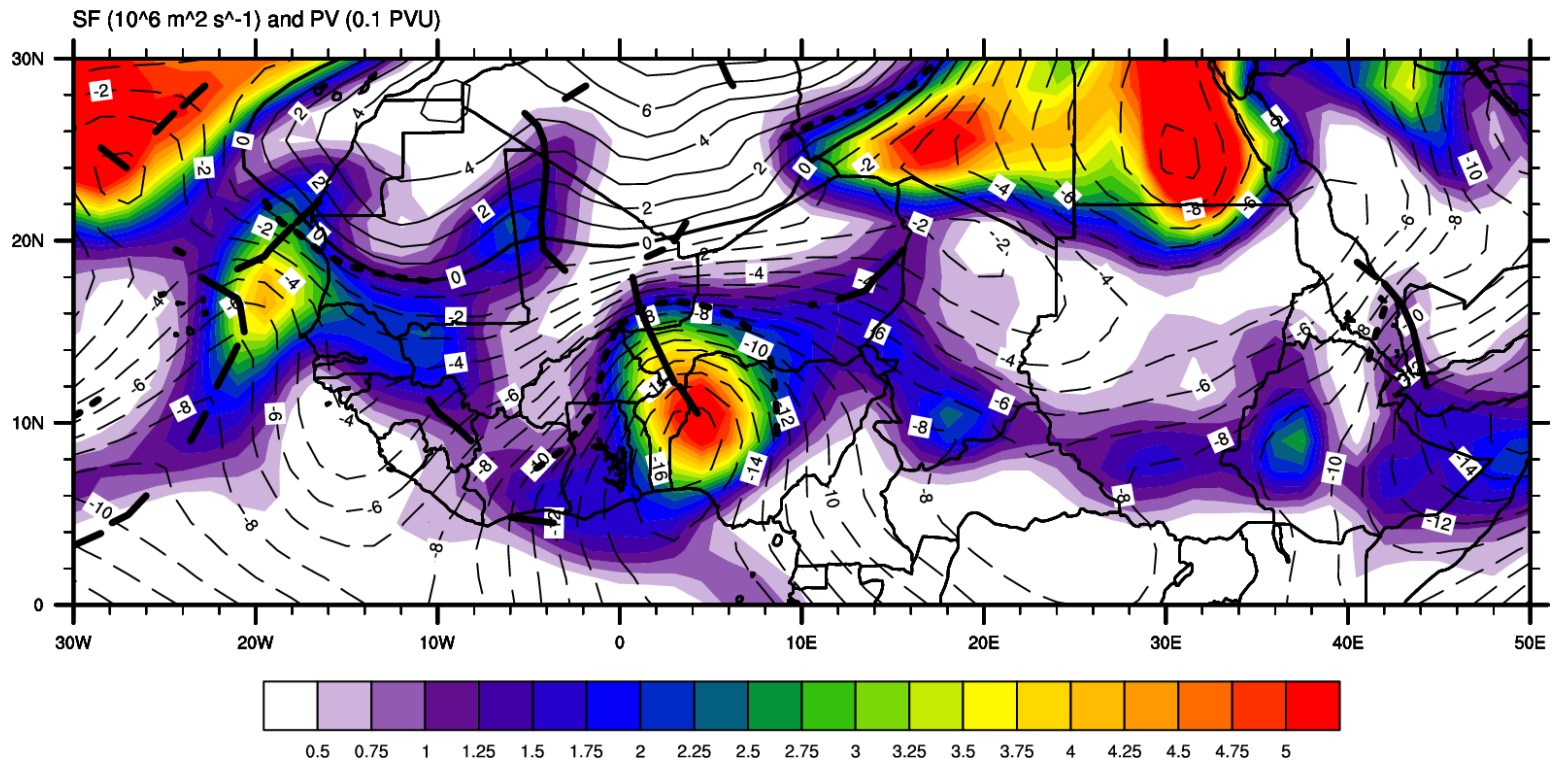
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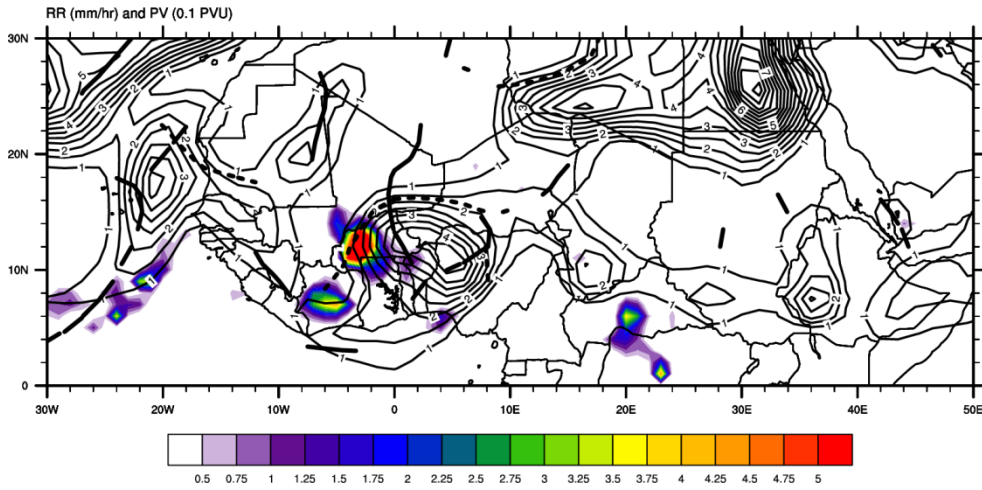
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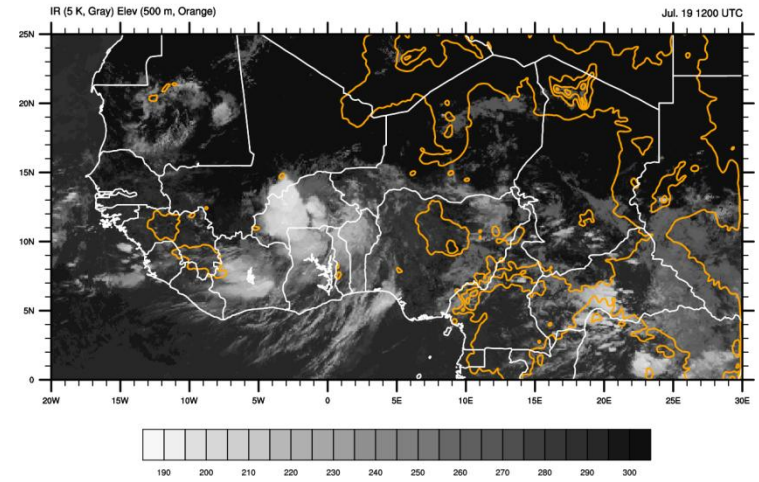
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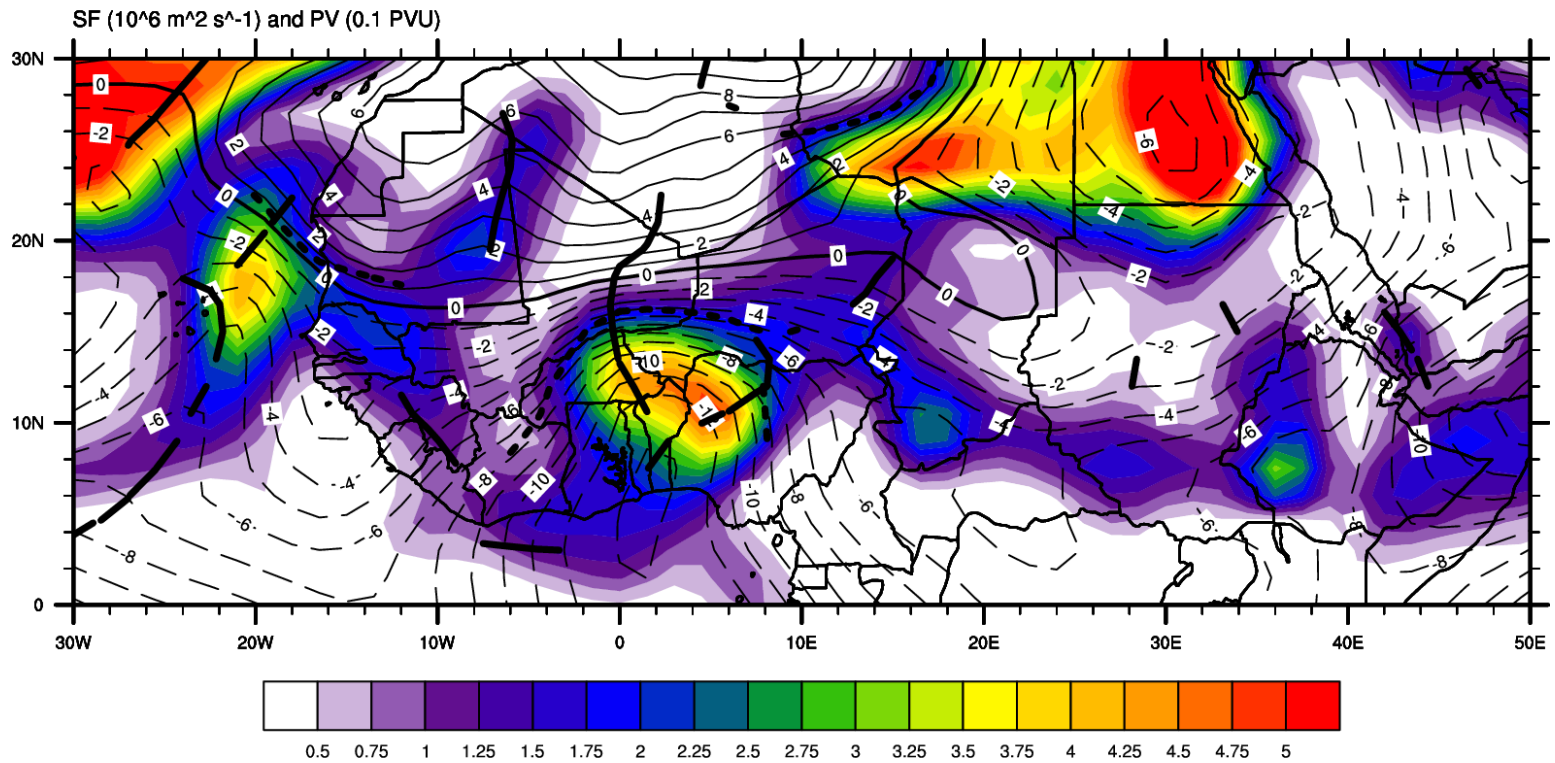
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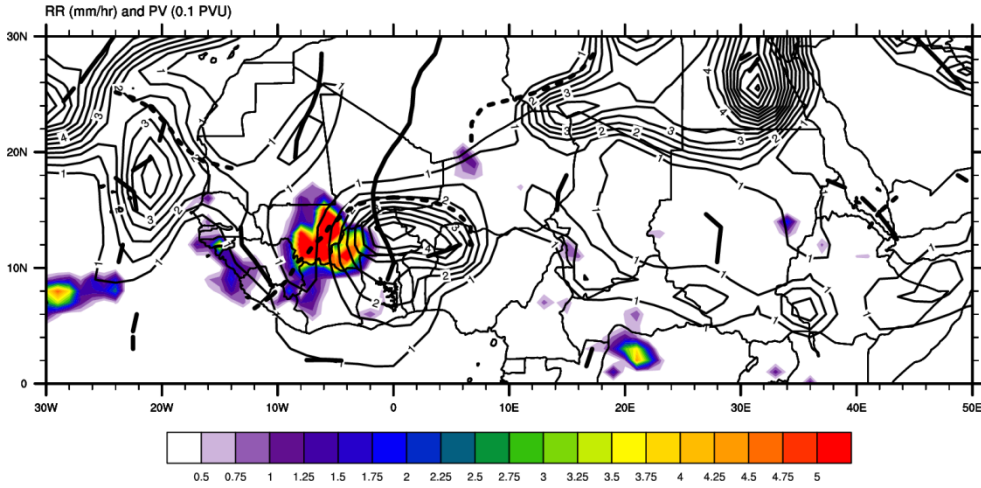
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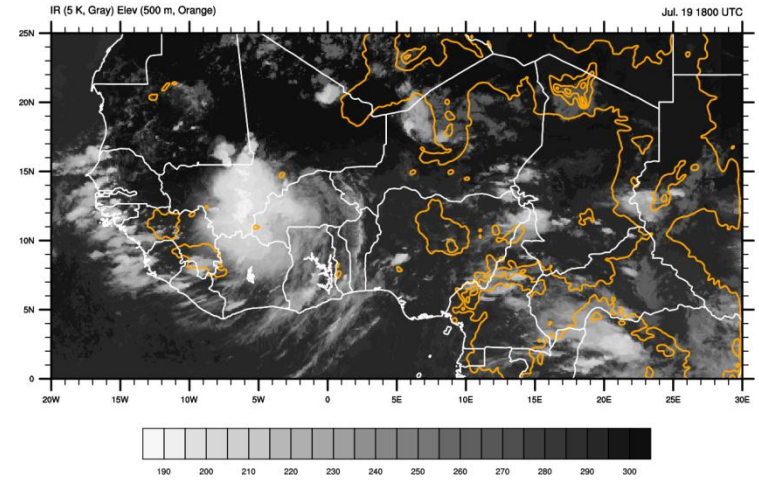
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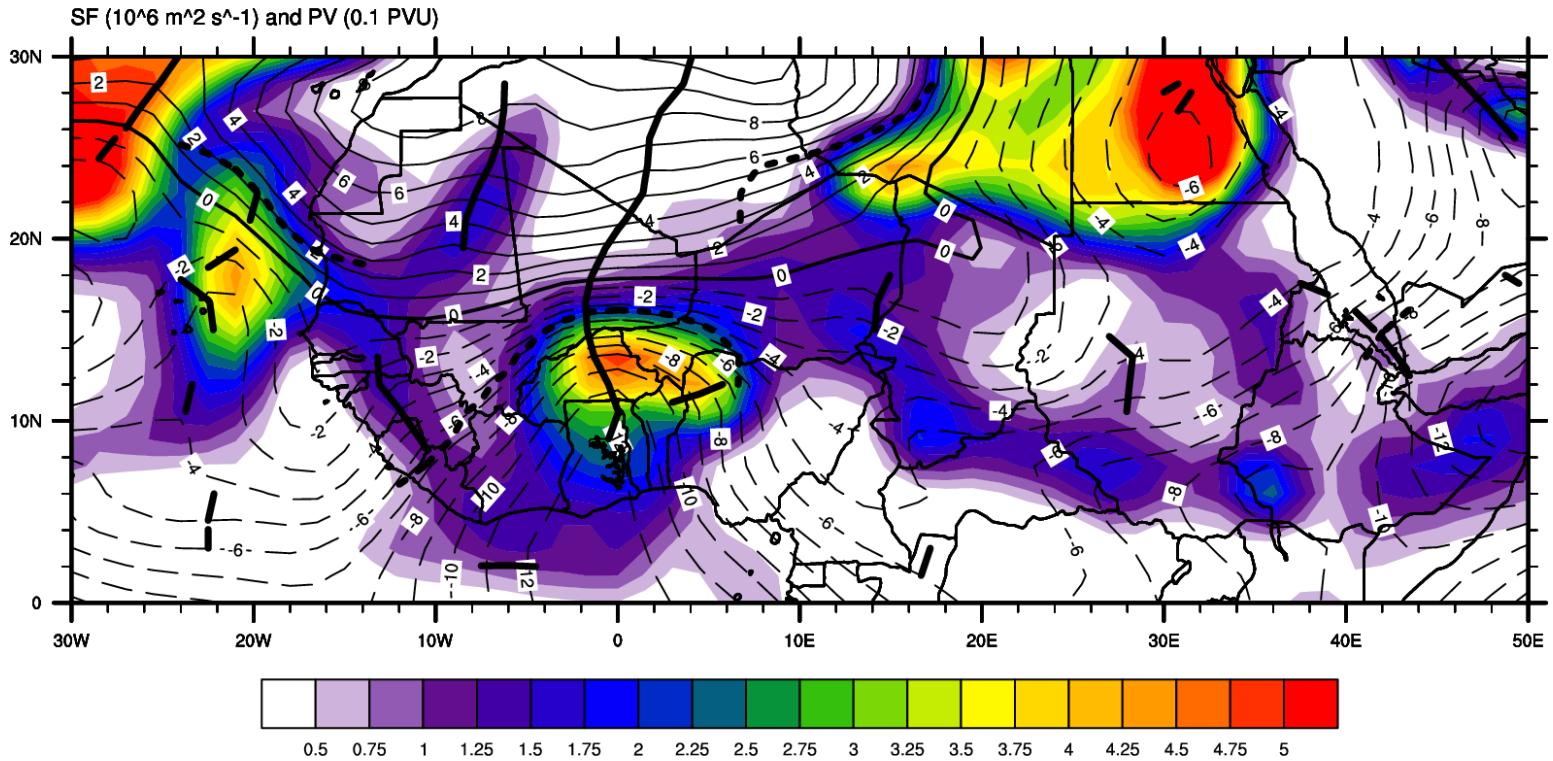
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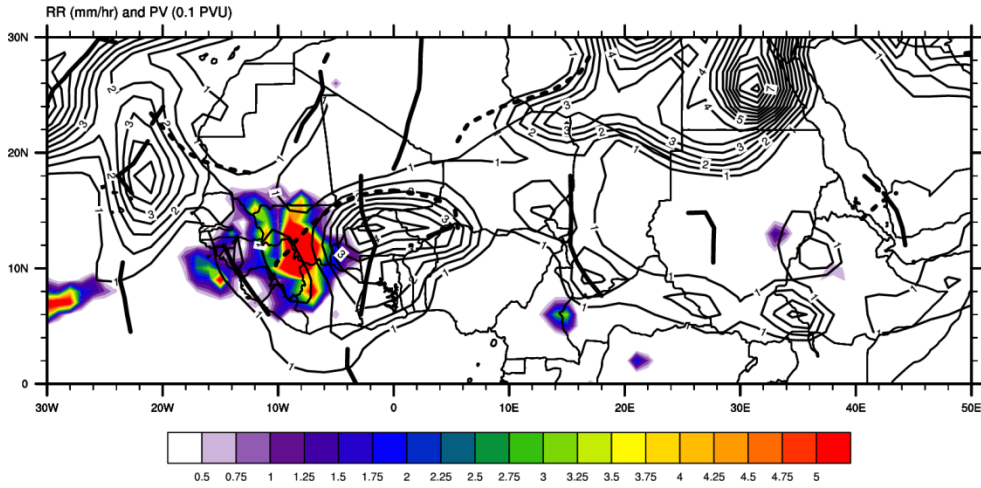
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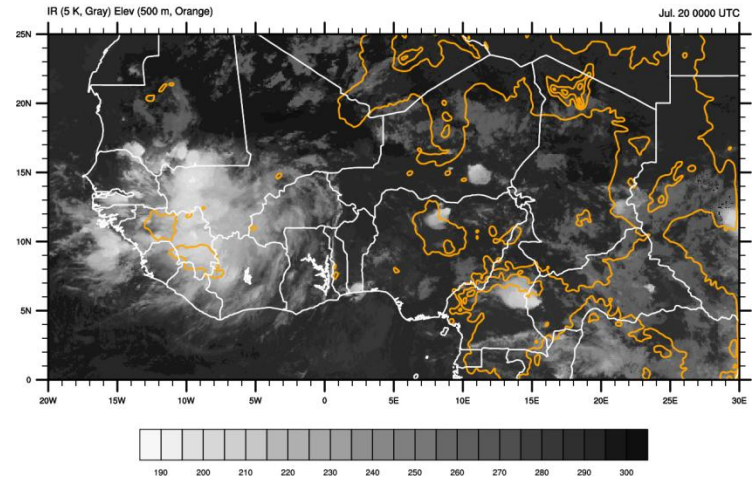
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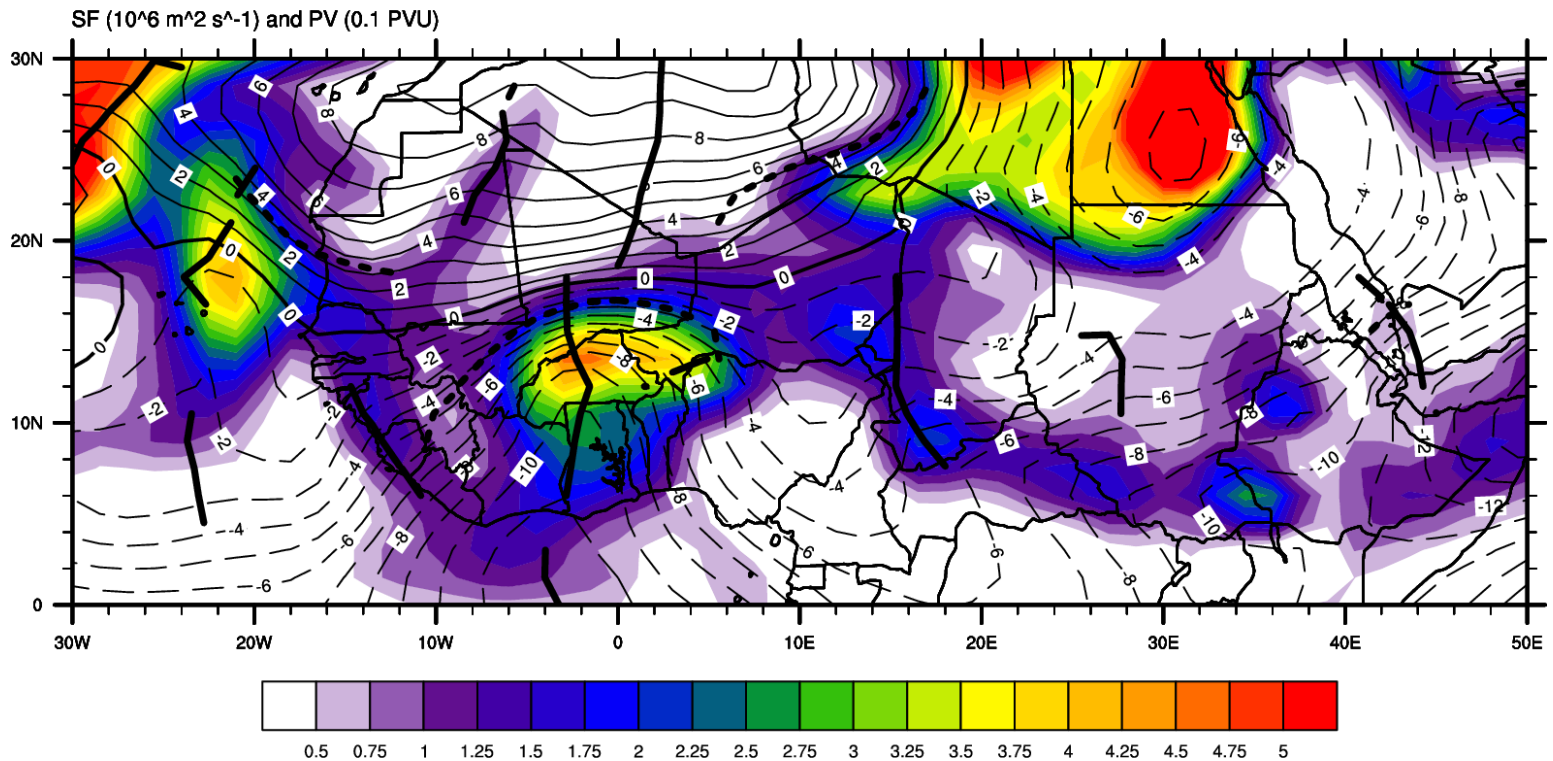
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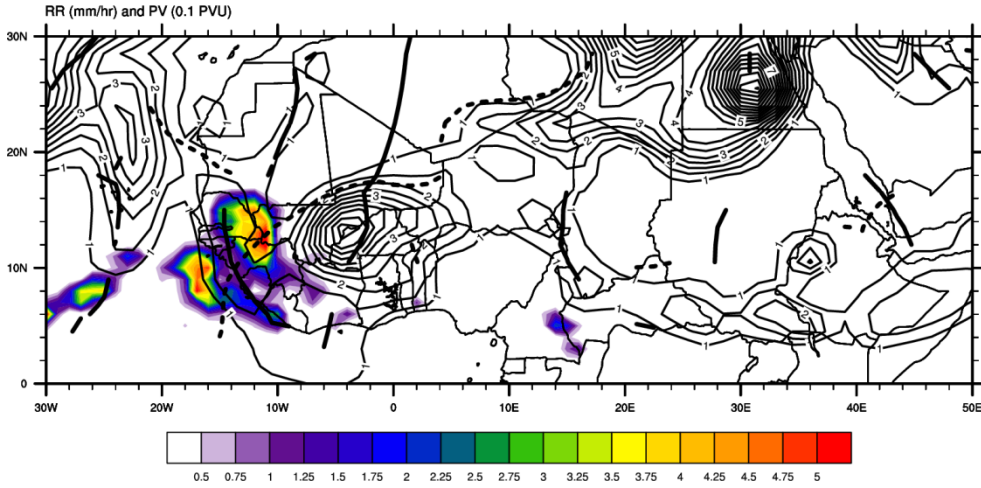
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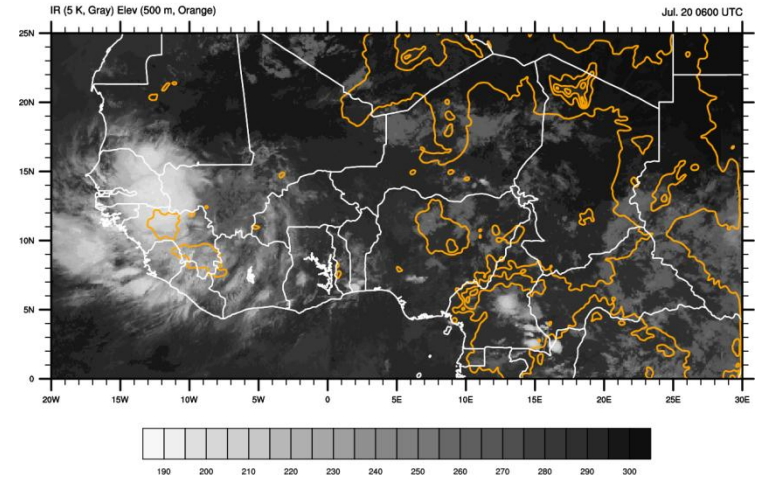
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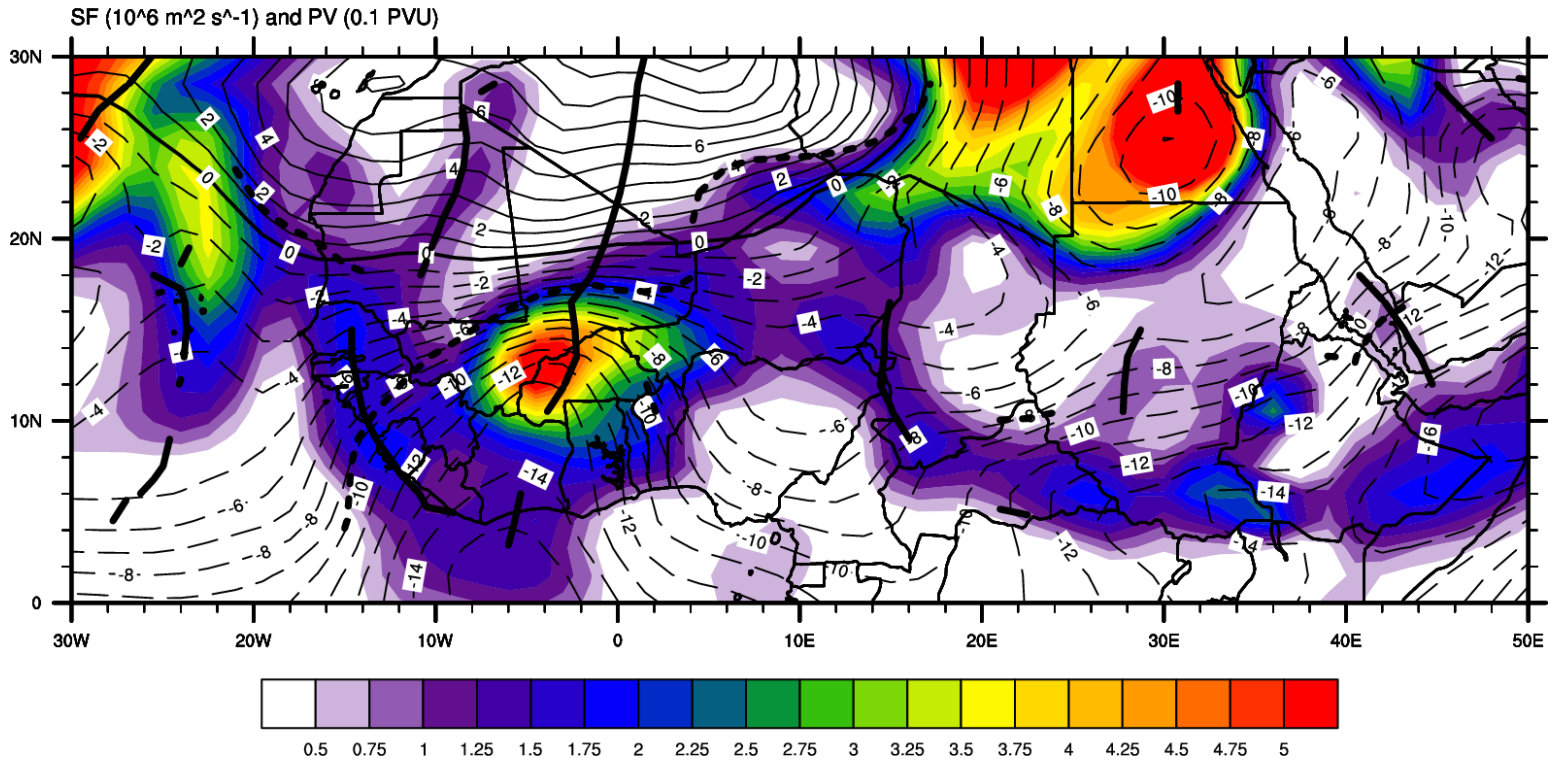
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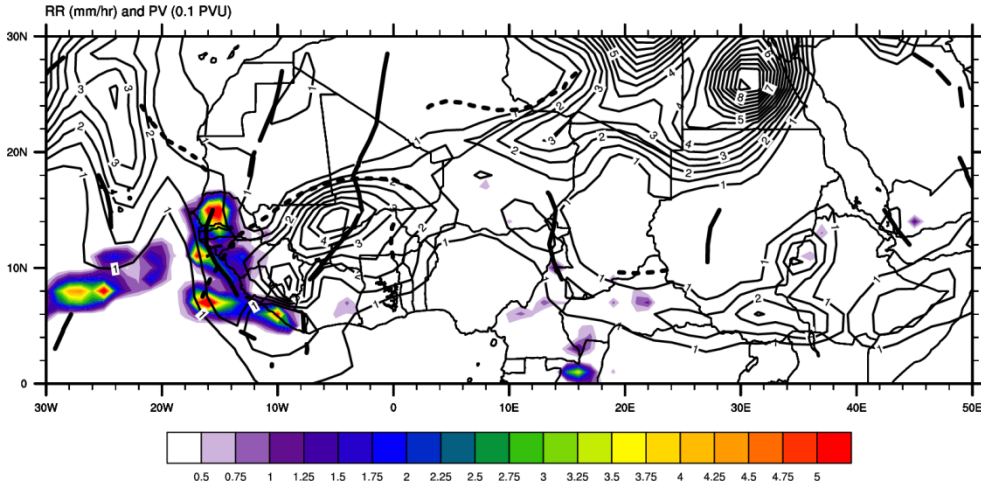
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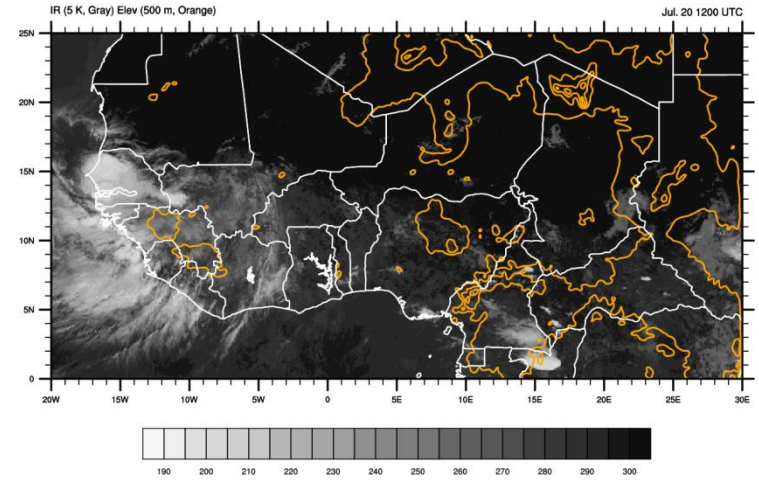
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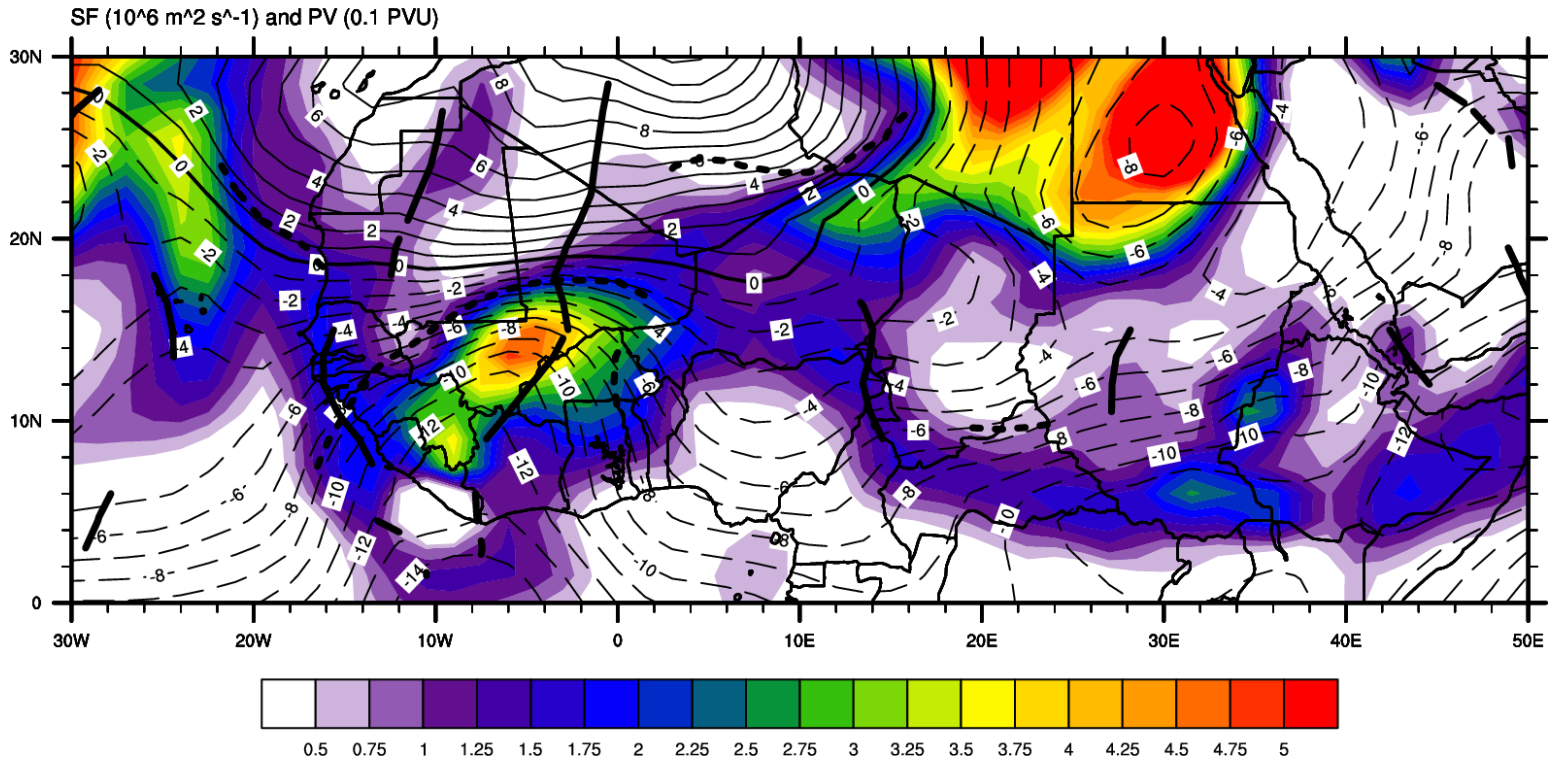
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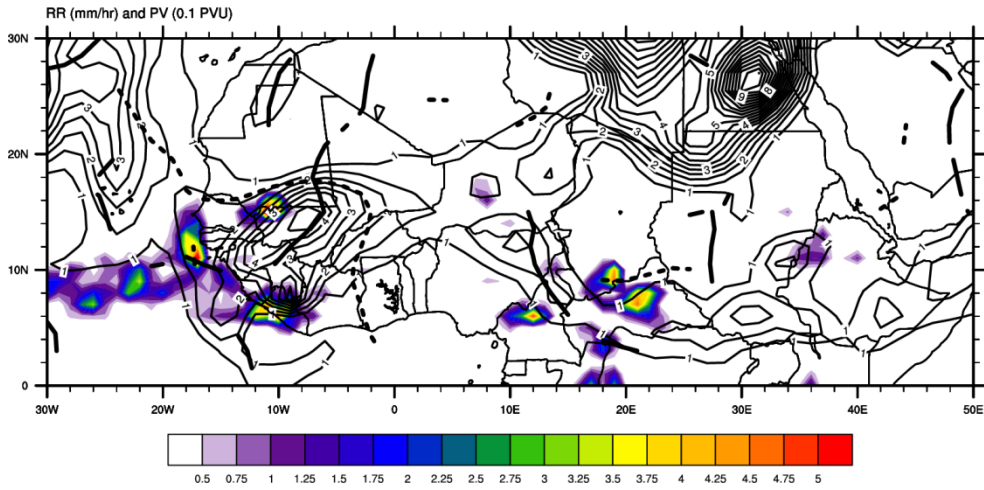
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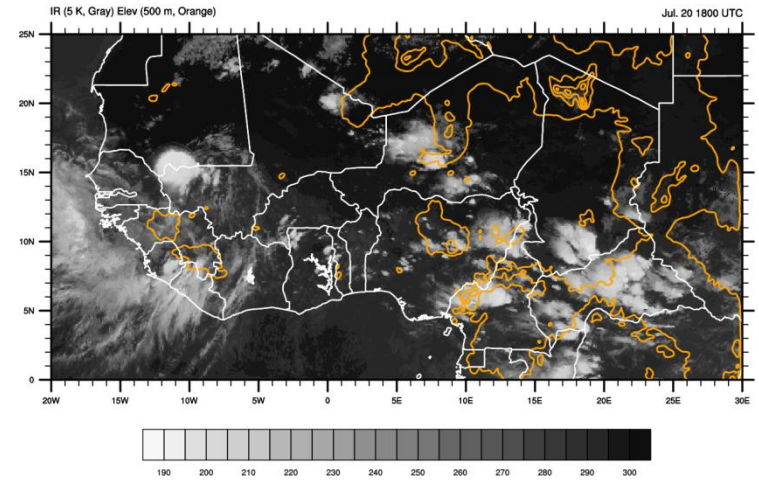
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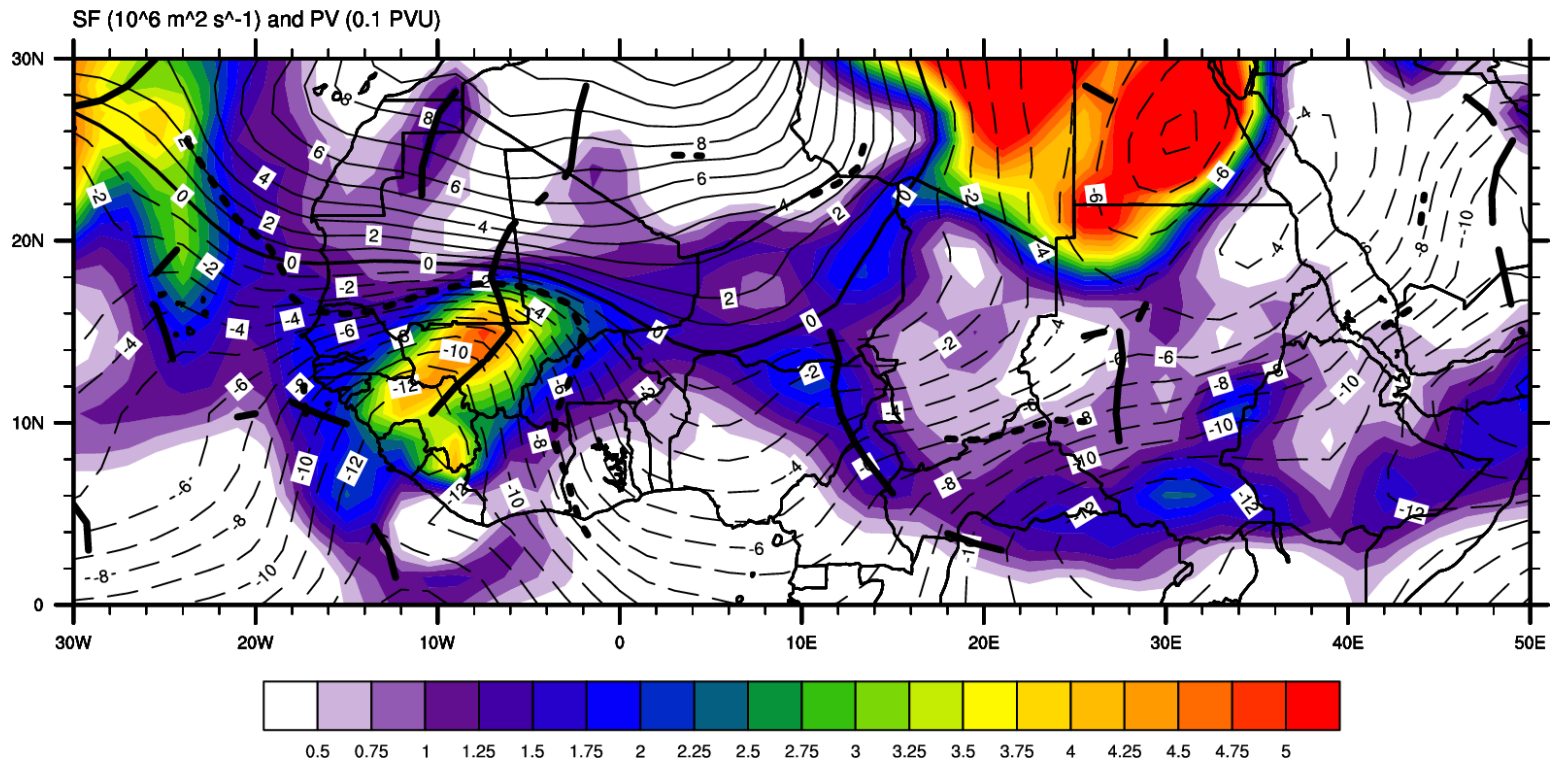
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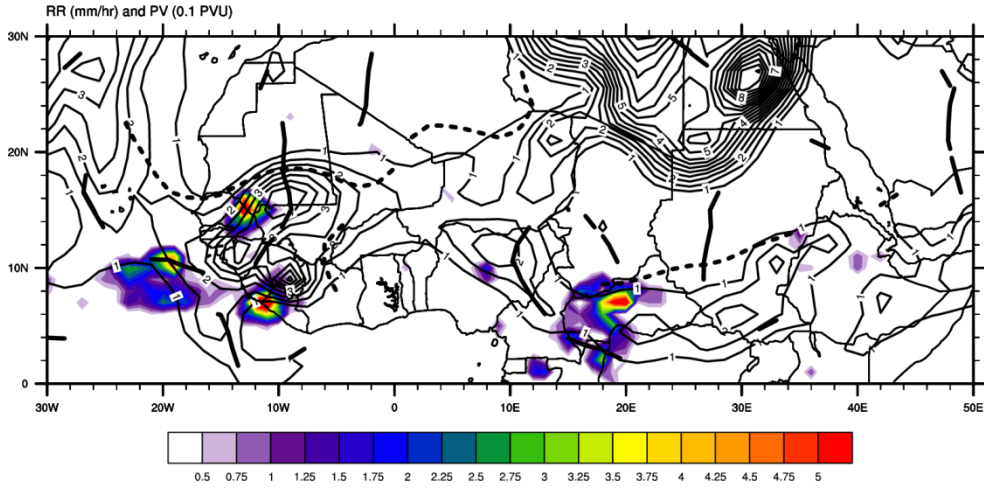
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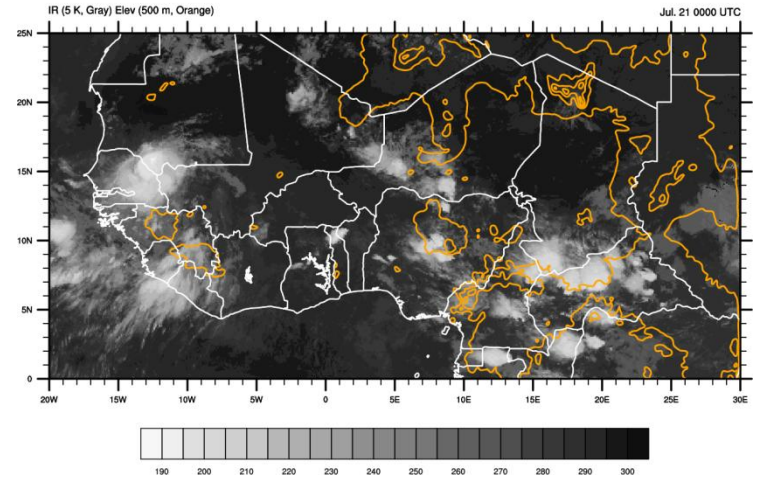
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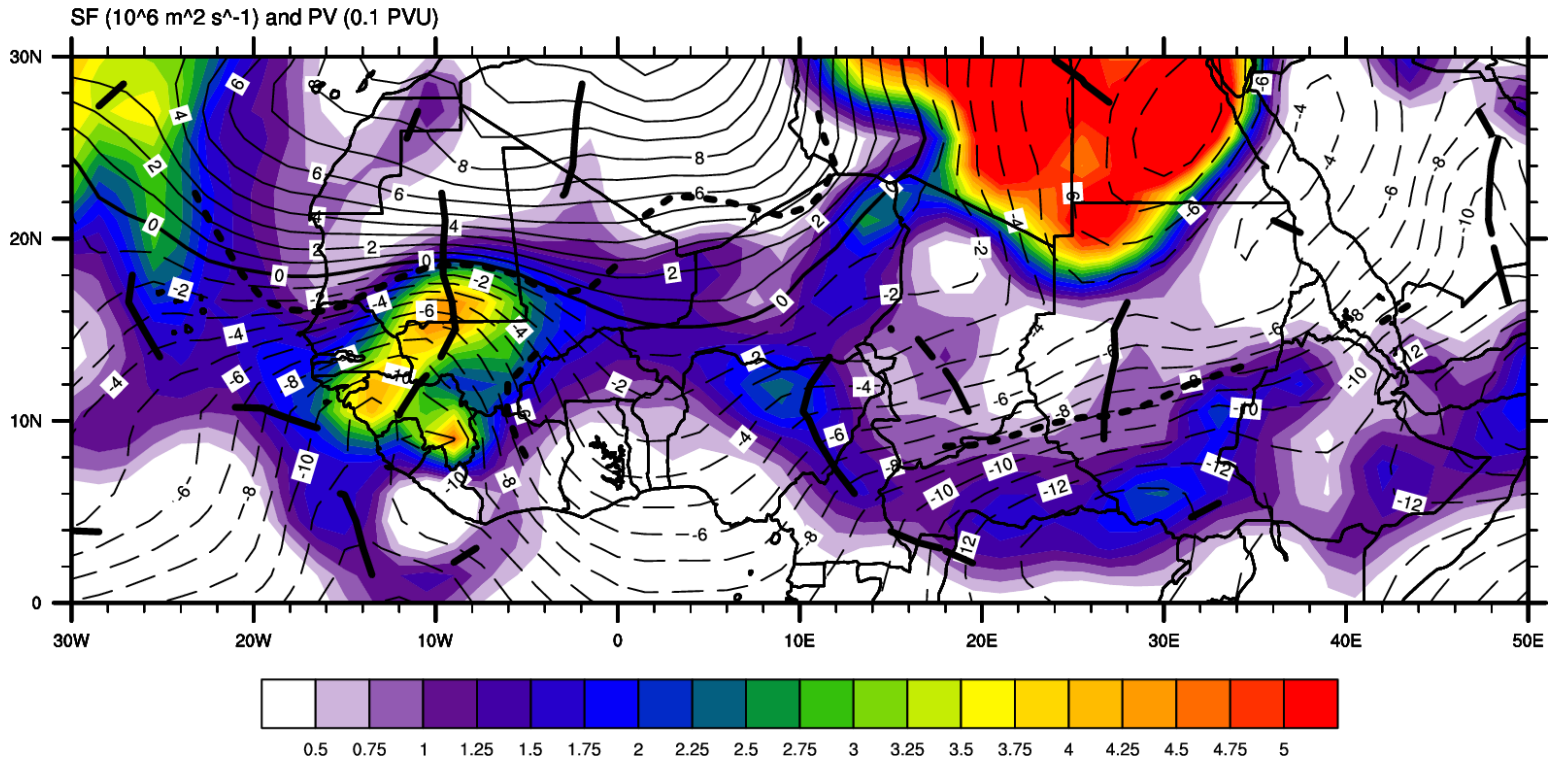
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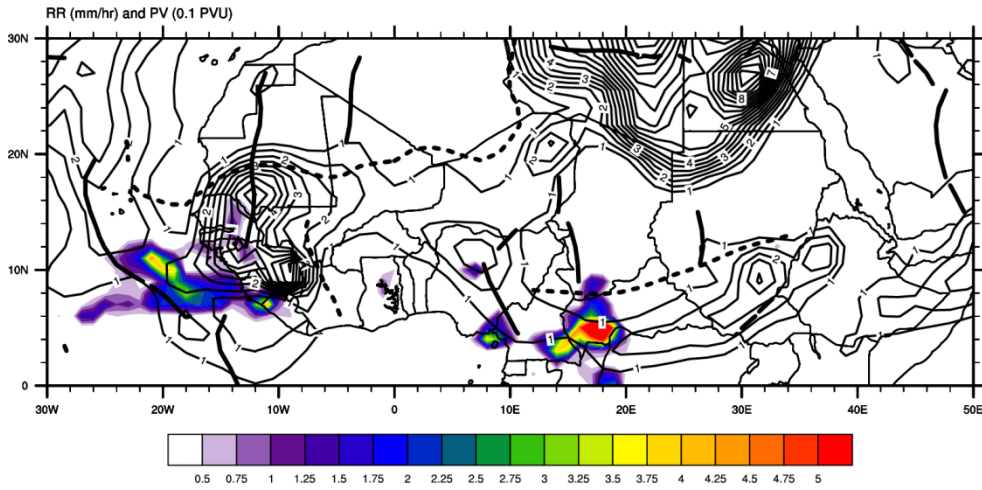
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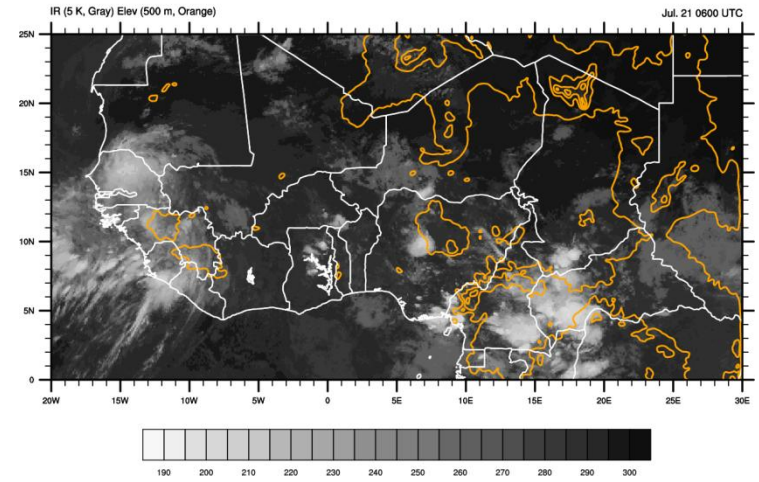
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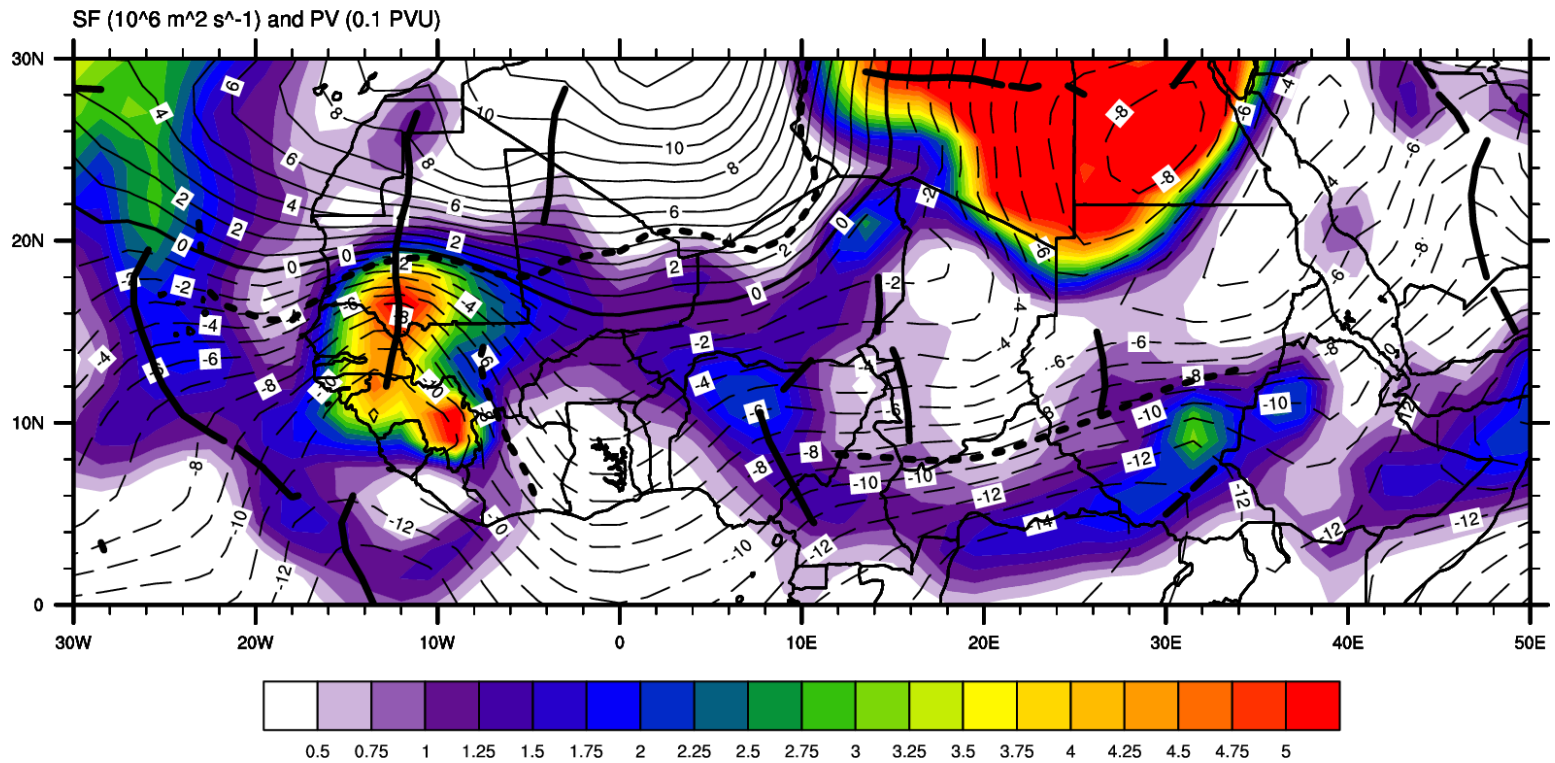
2008/7/21 6 UTC 650 hPa PV and TRMM3B42



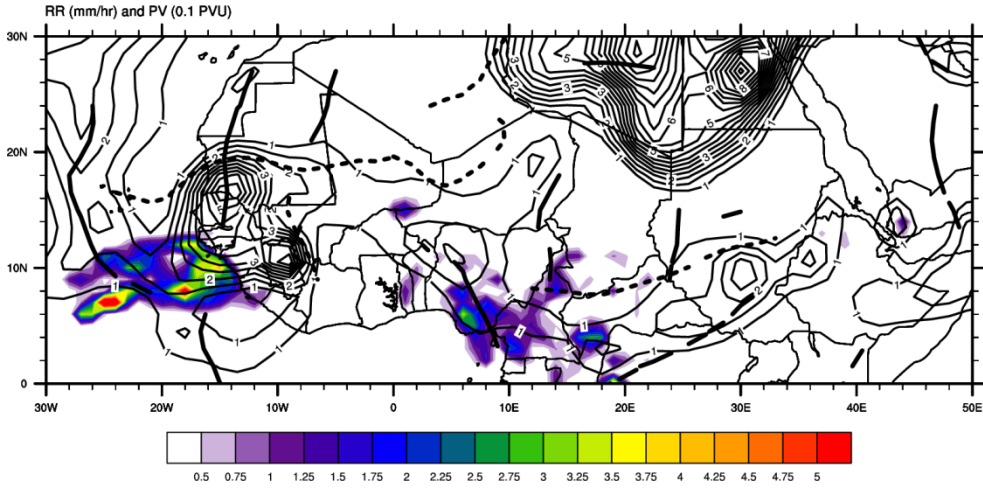
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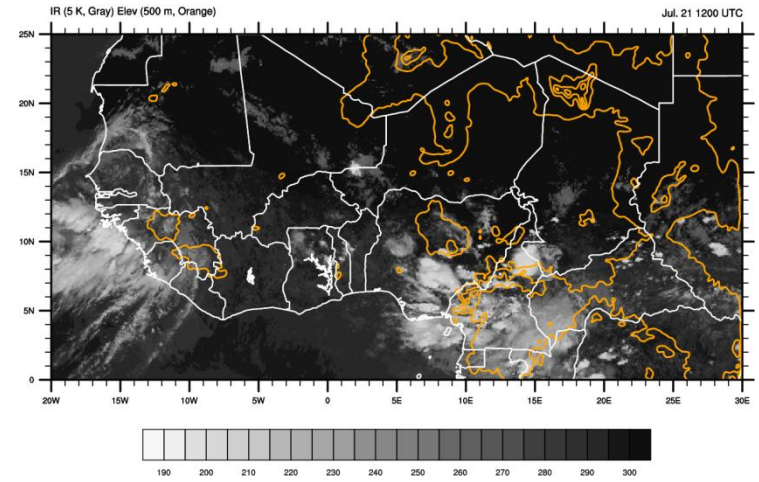
2008/7/21 6 UTC 650 hPa Streamfunction and PV



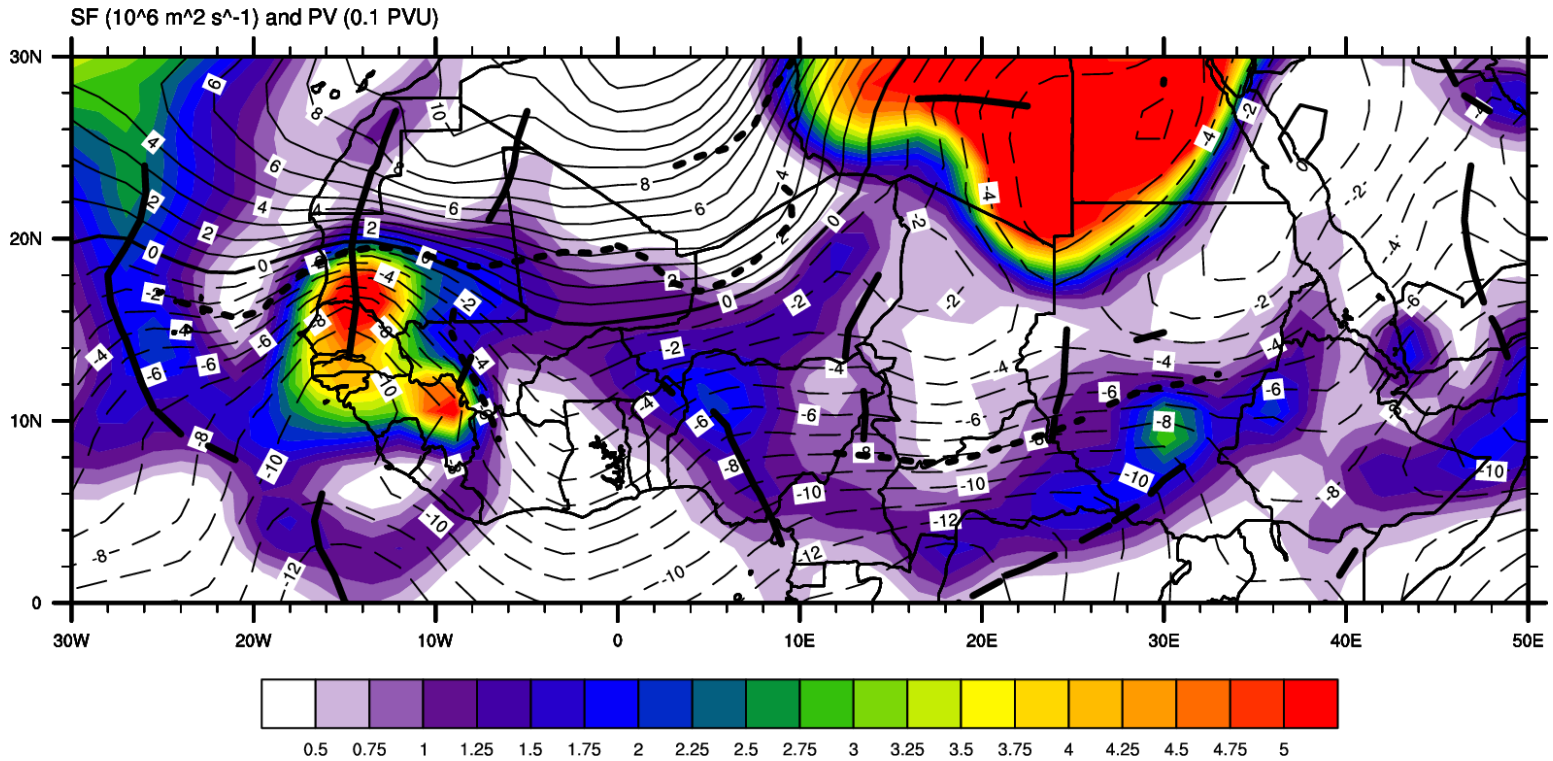
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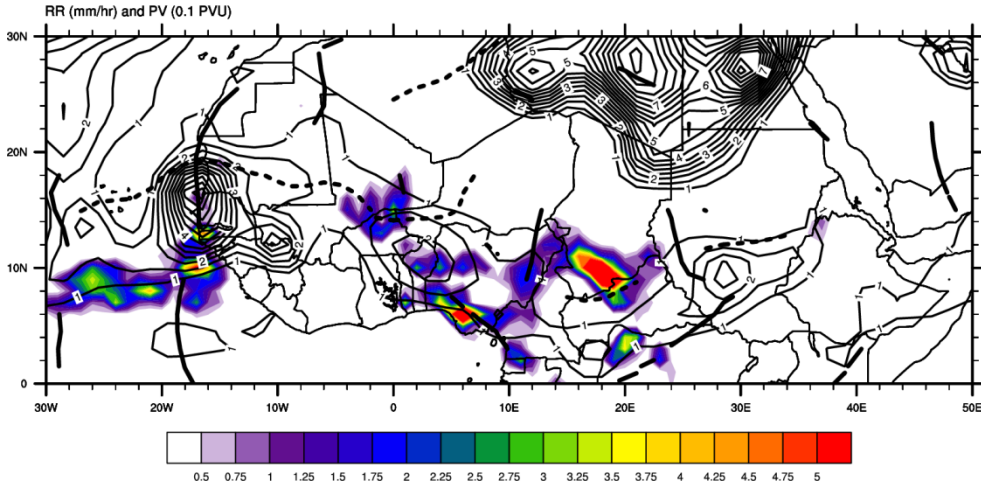
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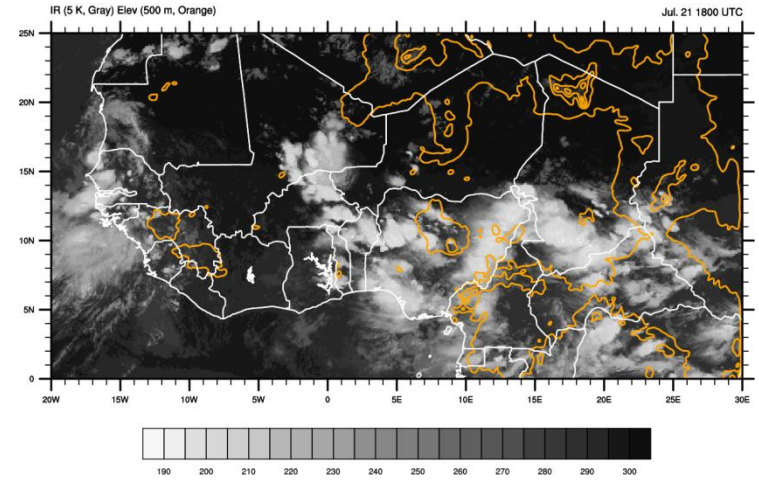
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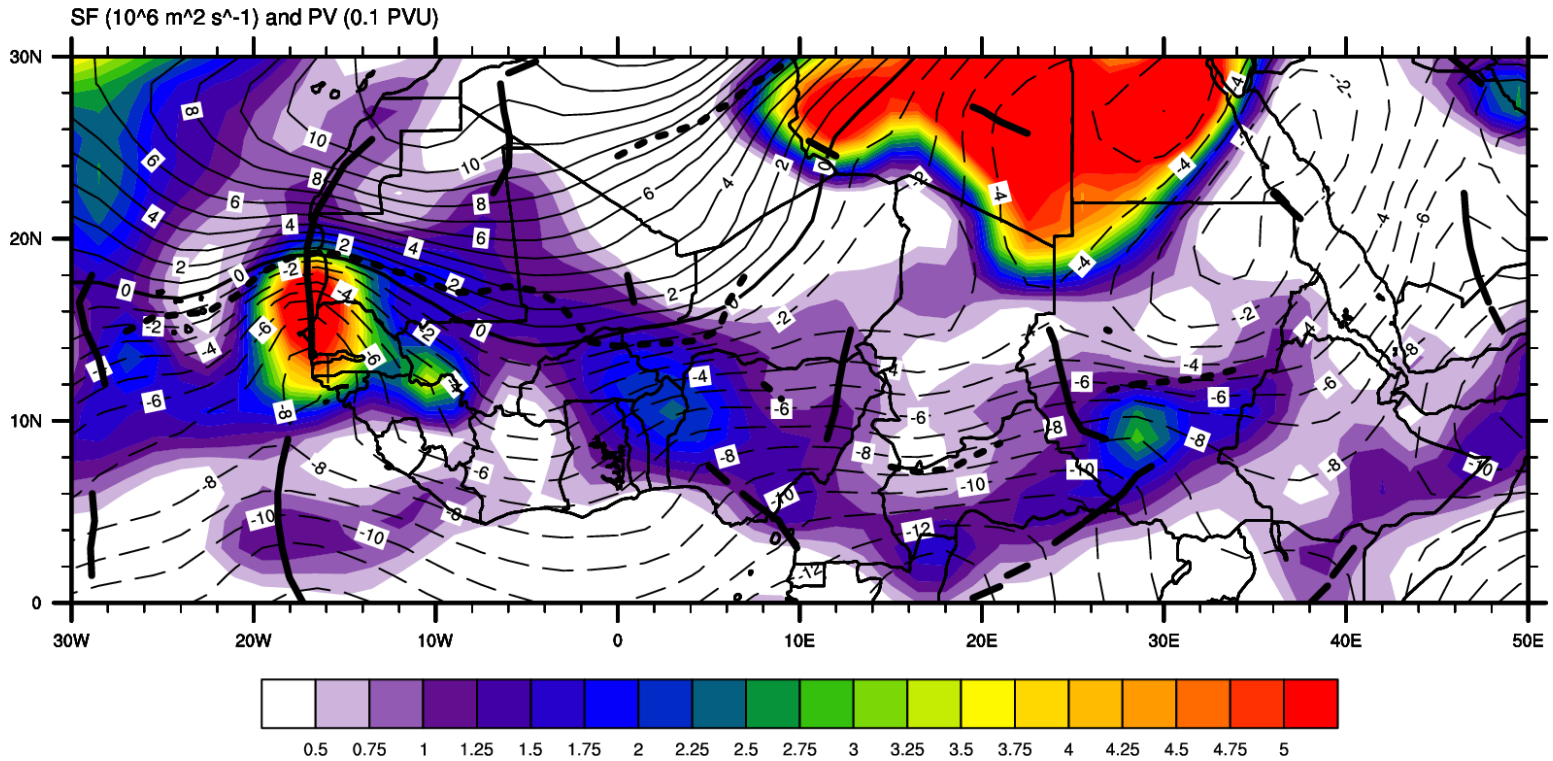
2008/7/21 18 UTC 650 hPa PV and TRMM3B42



10.9 um IR, Elev.



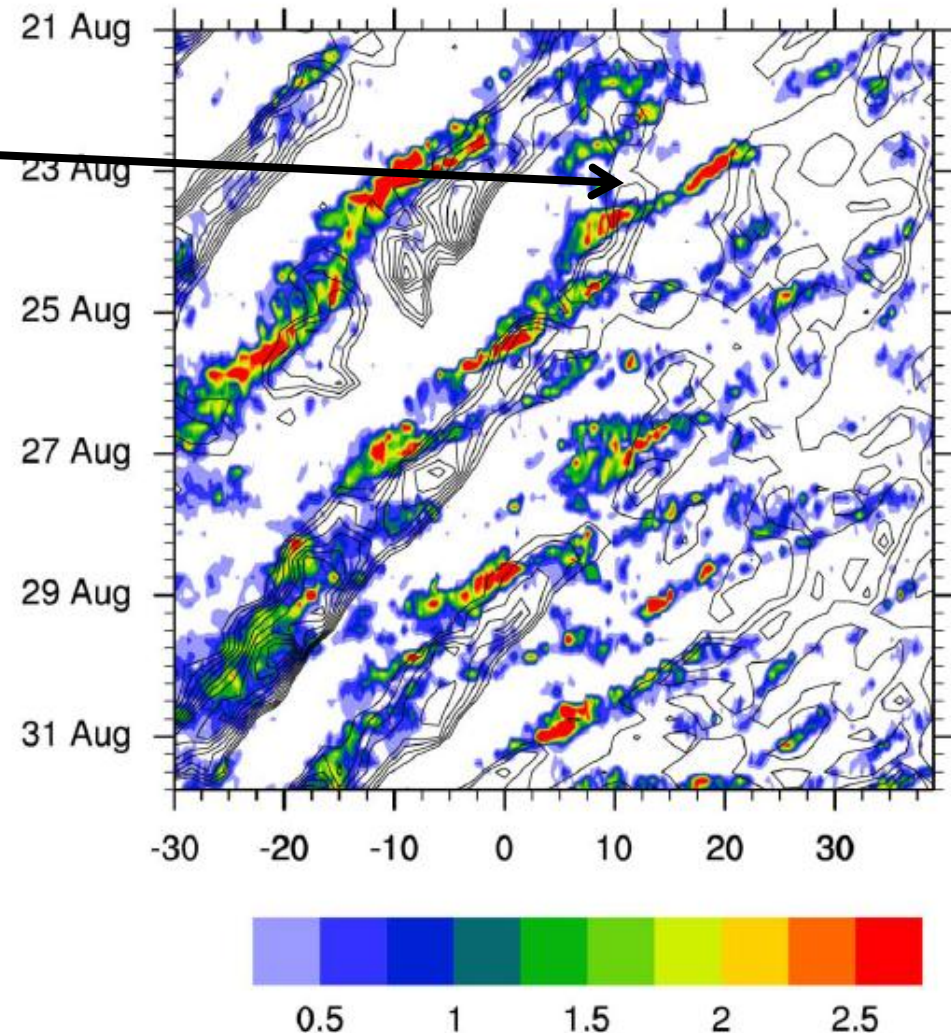
2008/7/21 18 UTC 650 hPa Streamfunction and PV



3. Some Interesting Cases

Dramatic AEW started around the 23rd August close to about 10°E.

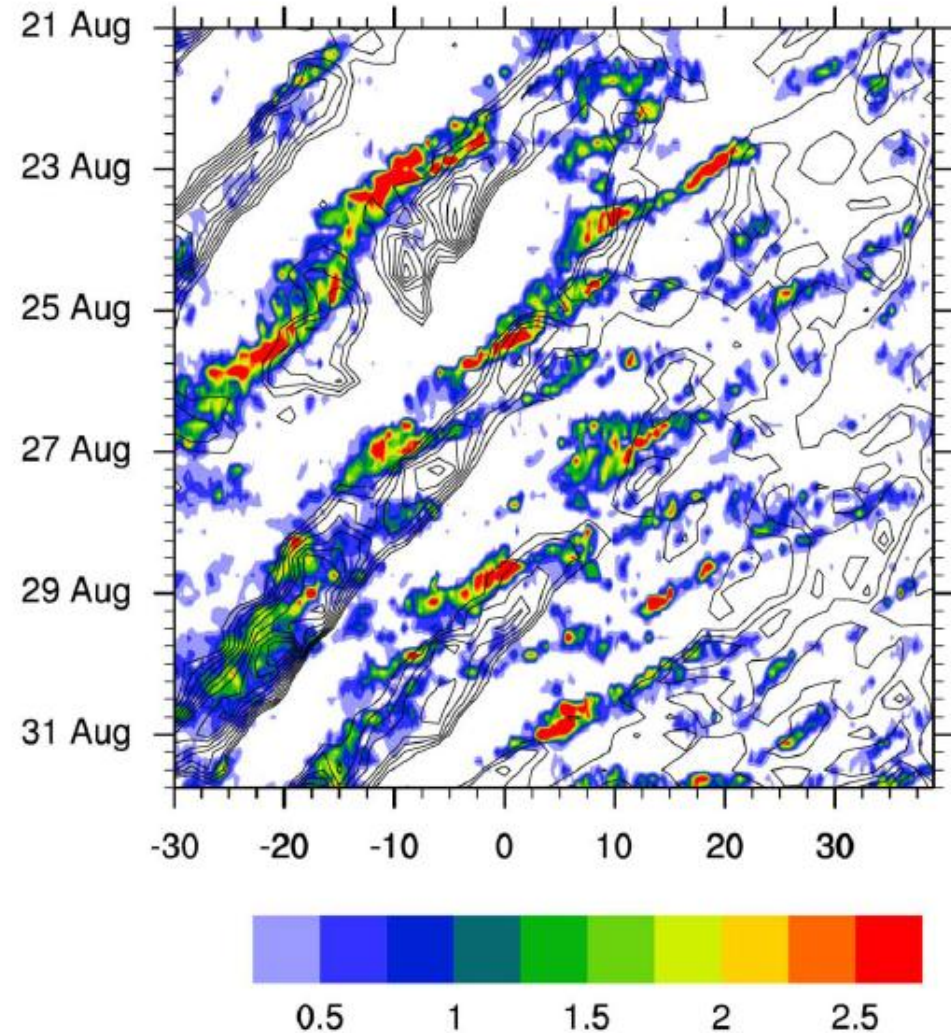
This event was special in the sense that it was associated with multiple interactions with convection and associated MCSs.



3. Some Interesting Cases

At least four convective streaks appear to have been initiated east of the trough, and subsequently passed through the trough and stalled ahead of the trough.

This is possibly a very interesting case for studying scale interactions between the synoptic AEW and convection including propagating MCSs.

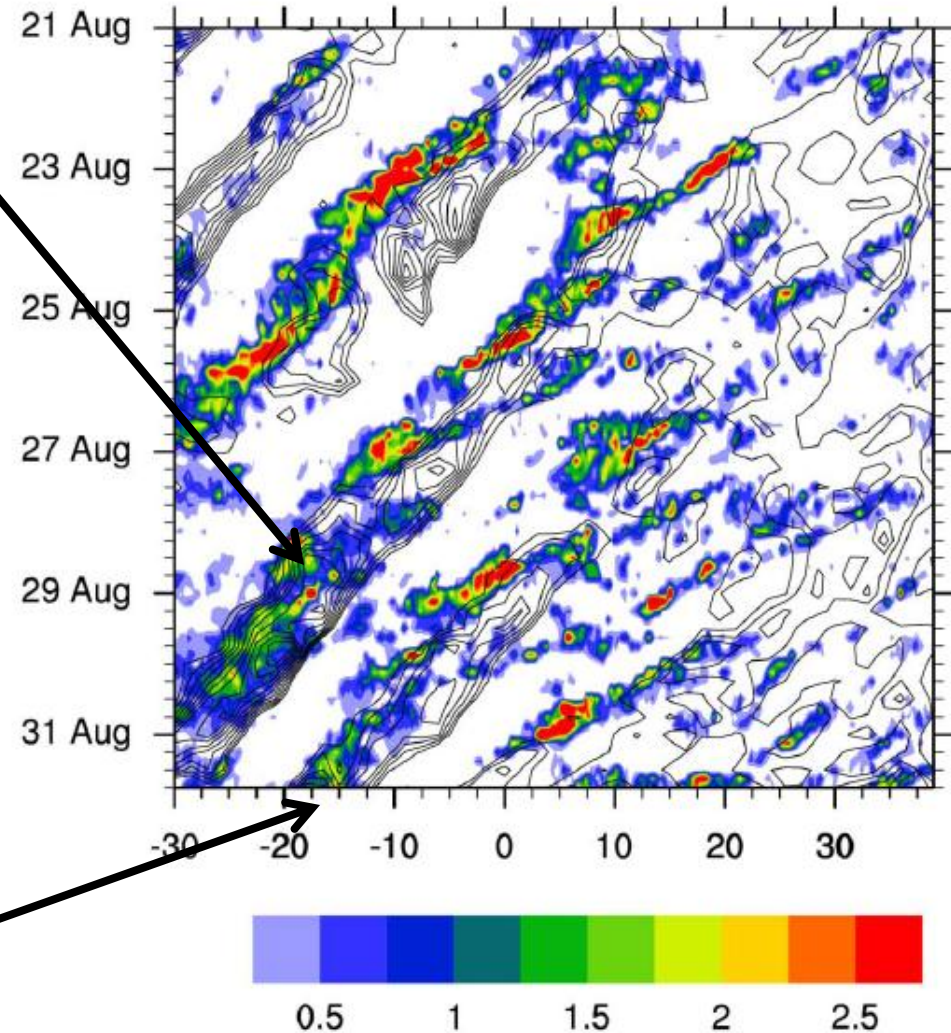


3. Some Interesting Cases

This system also appears to have been associated with significant convection close to the West African coast.

This system became named tropical cyclone Ike on September 1st and was likely strongly impacted by the events which took place over the continent.

The wave to follow this, also characterized by significant interactions with convection subsequently became tropical cyclone Josephine close to West Africa on the 6th September.



4. Summary

- The 2008 Summer season certainly has significant AEW activity with coherent convective structures particular obvious in July and August.
- This was a wet Sahel year
- Little notable Easterly wave activity seen elsewhere in the tropics during this period

4. Summary

- Notable events for further potential study include:
 - (i) Intense AEW (July 7-22)
 - Interaction with midlatitudes during initiation
 - Interaction with one convective event
 - No tropical cyclogenesis
 - (ii) Intense AEW (Aug 22 – Sep 14th)
 - Multiple interactions with convective events
 - West coast development?
 - Tropical cyclogenesis
 - (iii) Notable Kelvin wave passages including the beginning of June and July