

A Mesoscale Convective System over the tropical Andes: role of the Orinoco Low-level Jet and PBL schemes

Alejandro Martínez, Universidad de Antioquia

Paola Arias, Universidad de Antioquia

Francina Dominguez, University of Illinois

Andreas Prein, NCAR

Daniel Vásquez, Universidad de Antioquia



**UNIVERSIDAD
DE ANTIOQUIA**

Facultad de Ingeniería

Northern South America

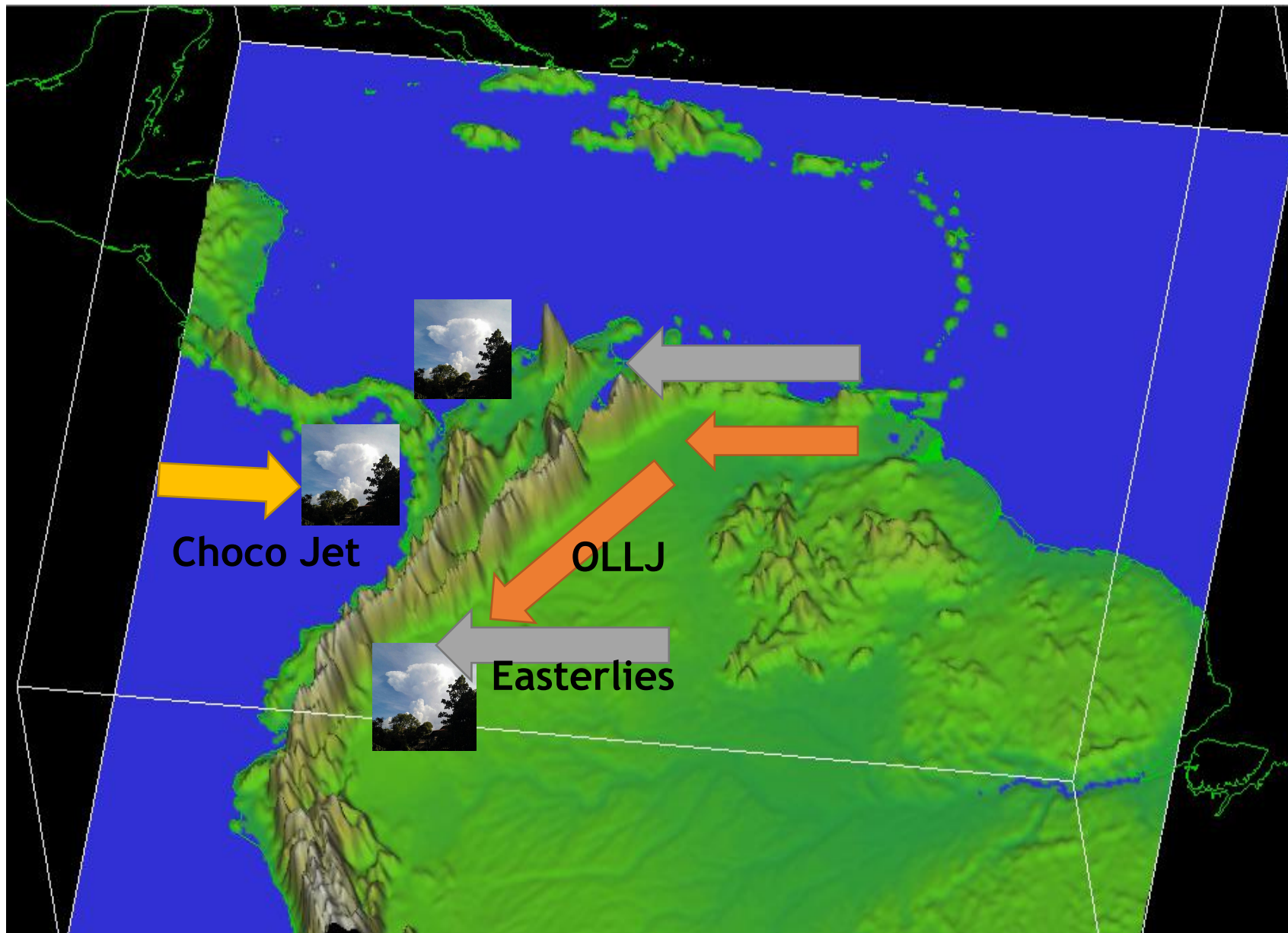
Tropical Andes:
Three branches in Colombia

Orinoco Low-level Jet:
can provide moisture convergence

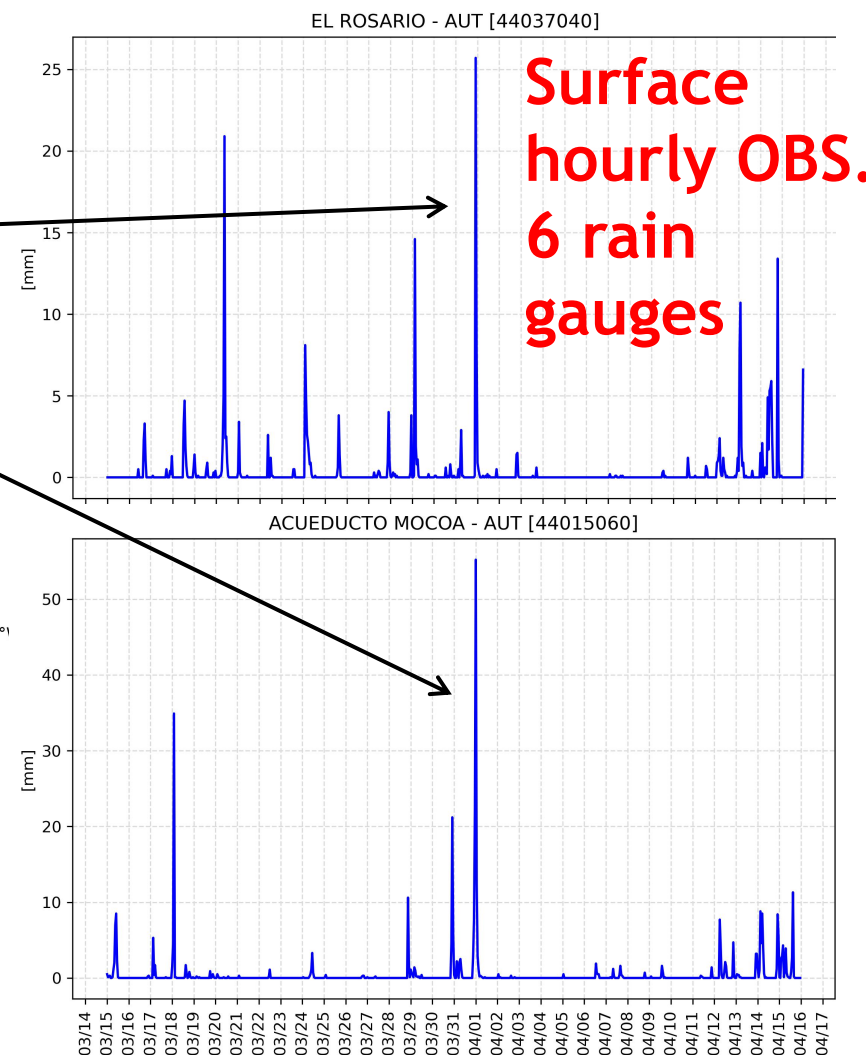
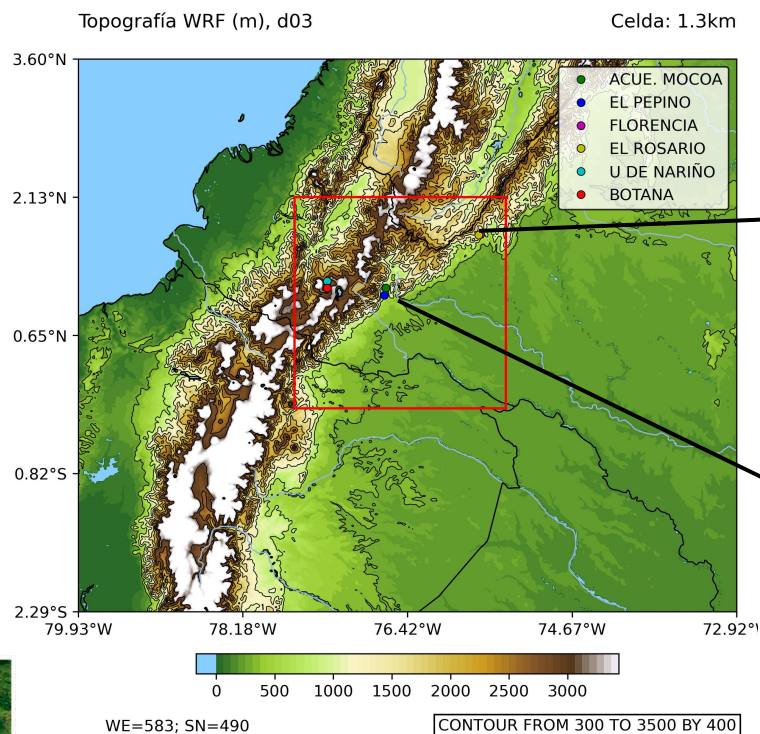
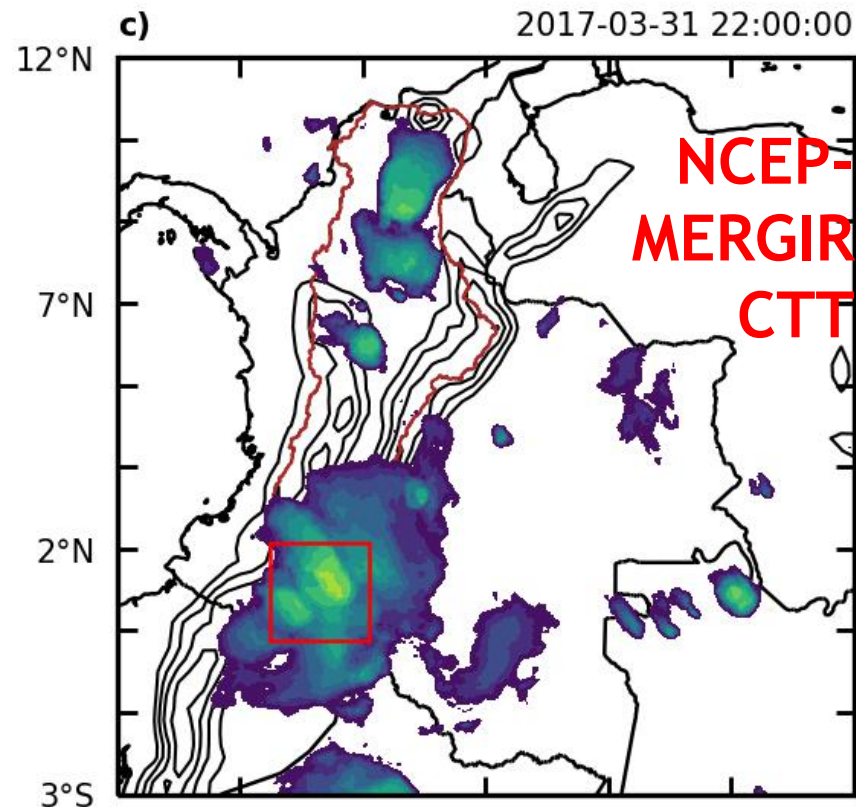
Easterlies can advect MCSs from
the Amazon to the Andes

Context:
Sparse surface observations
Very few soundings over the region
Radar available only recently

General Goal:
Use CP simulations to understand
and diagnose mesoscale
circulations associated to
topography and heavy
precipitation



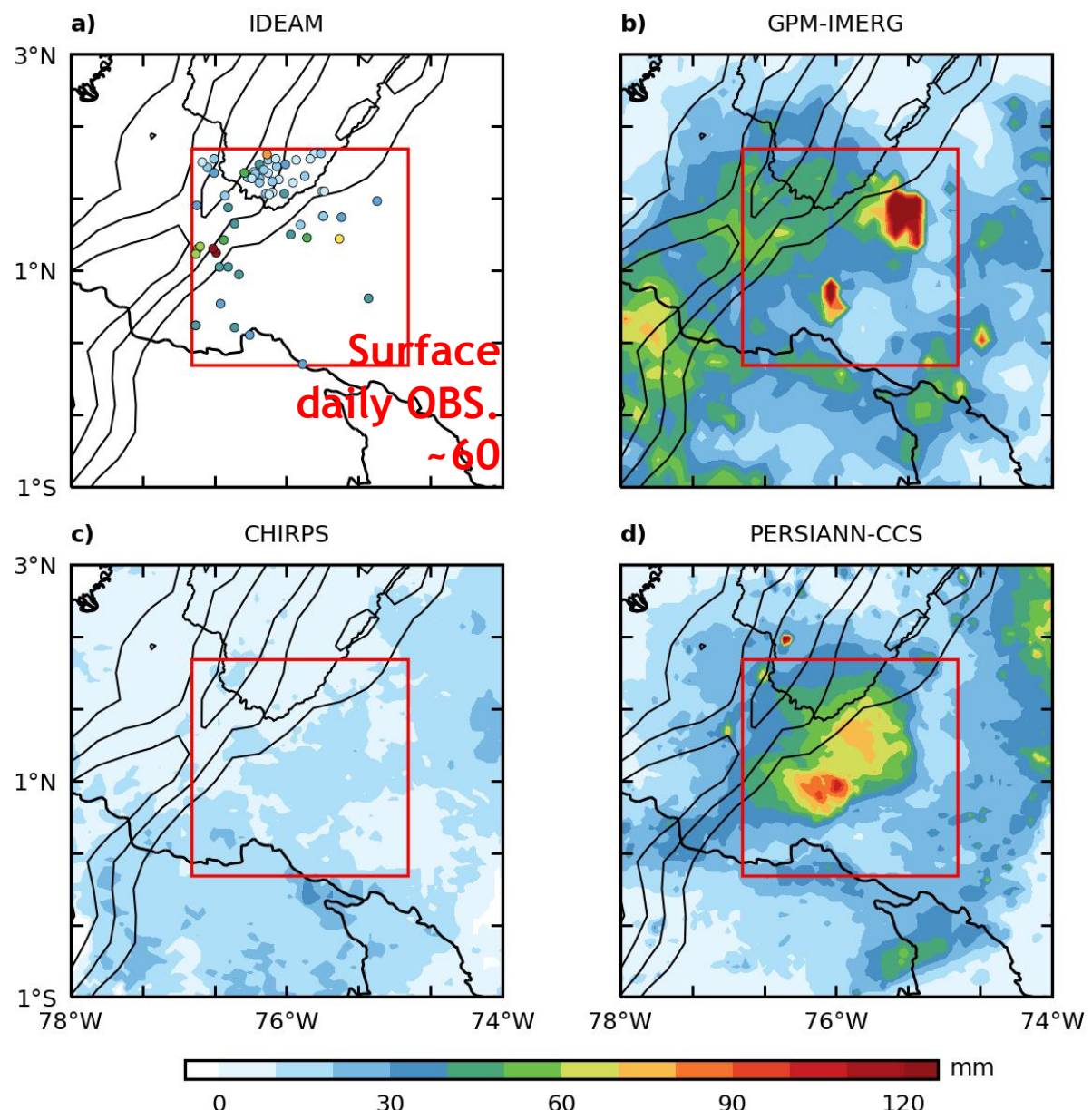
“Mocoa” Event (2017-04-01)



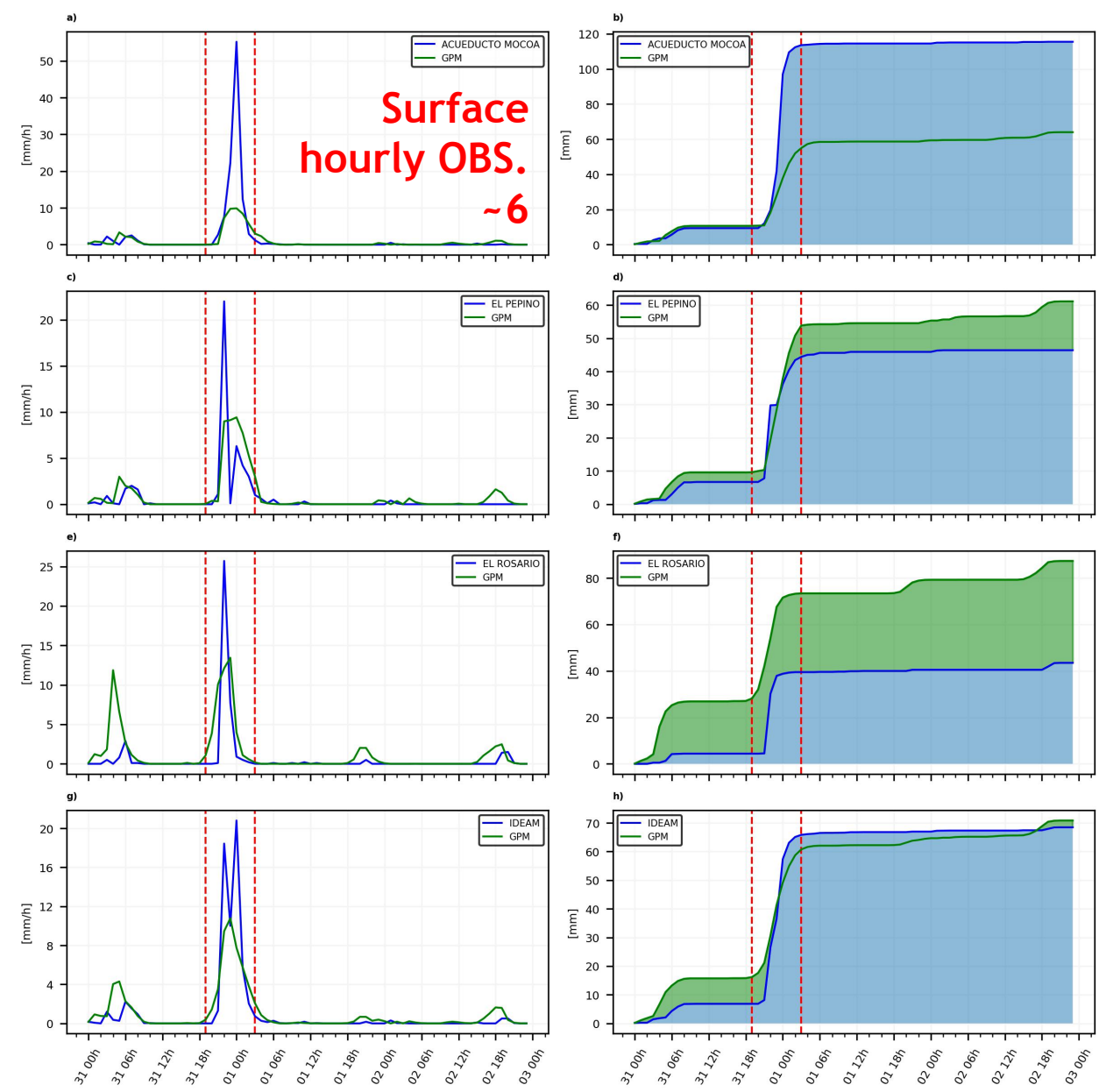
- Mesoscale Convective System formed over the Amazon, impacting parts of the Andes.
- More than 300 casualties
- Heavy precipitation during the event.
- Other events on previous days.



Larger accumulations over lowlands,
and impacts over mountain areas

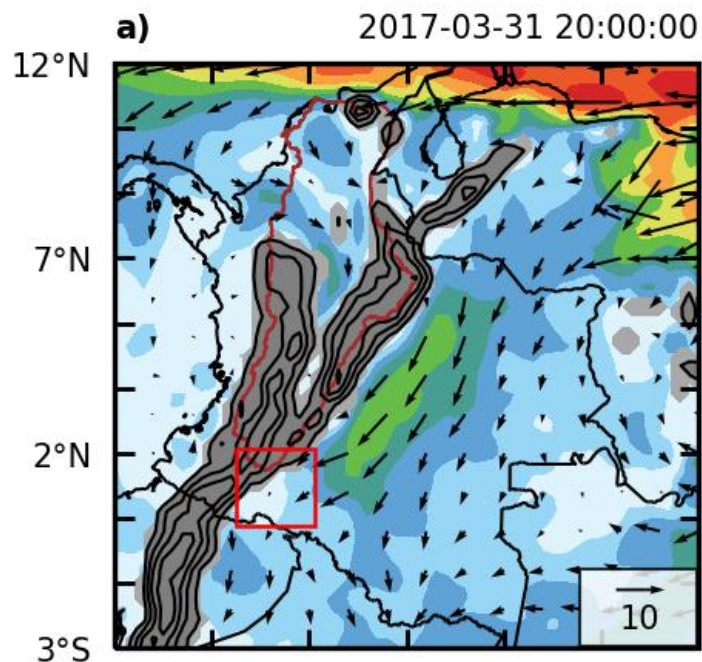


Few 1hly gauges. GPM ~ overestimates P.

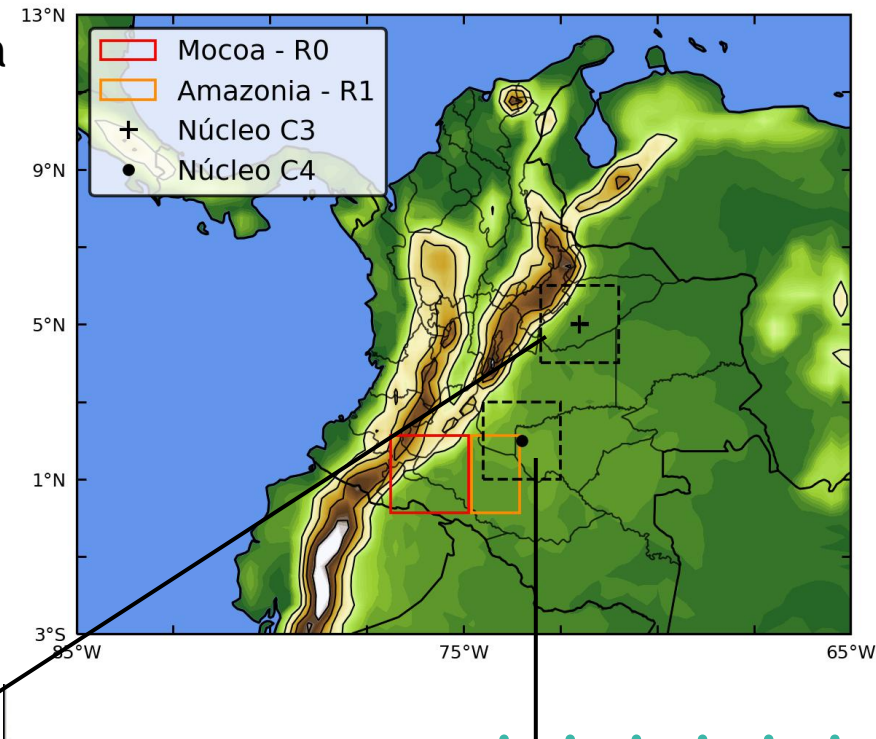
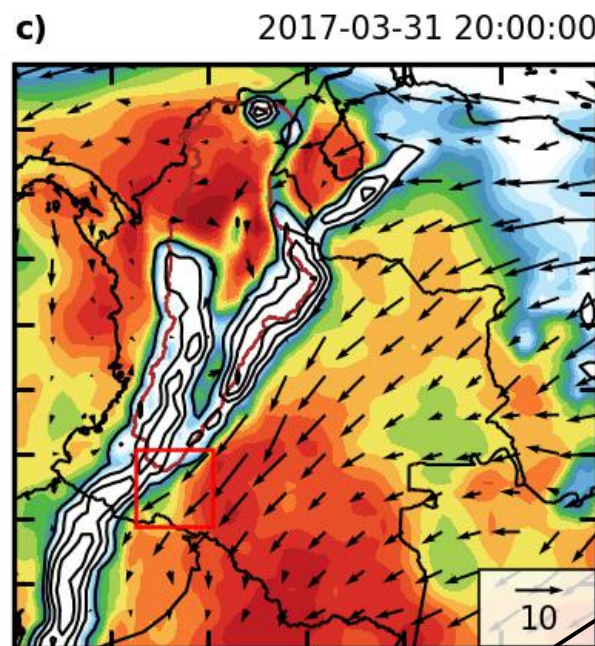


ERA5

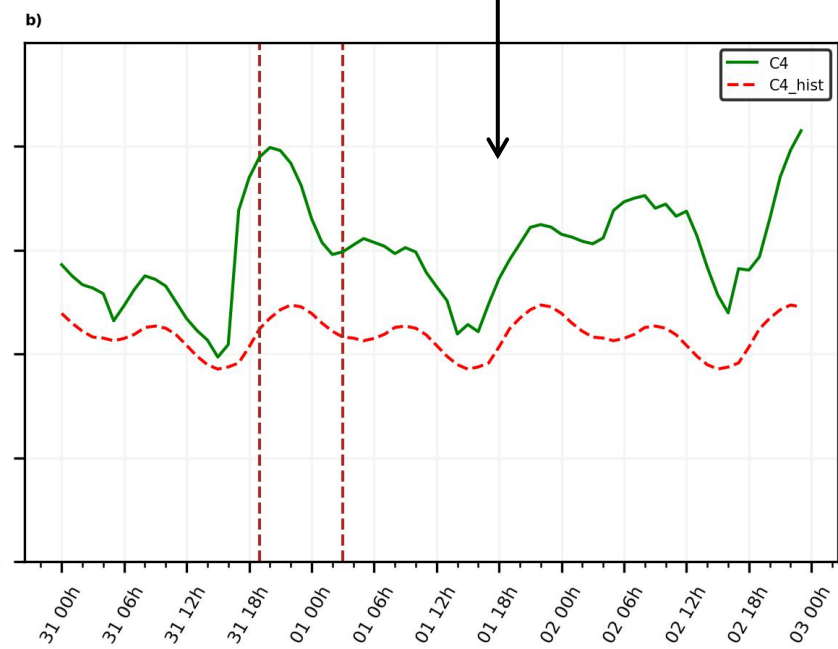
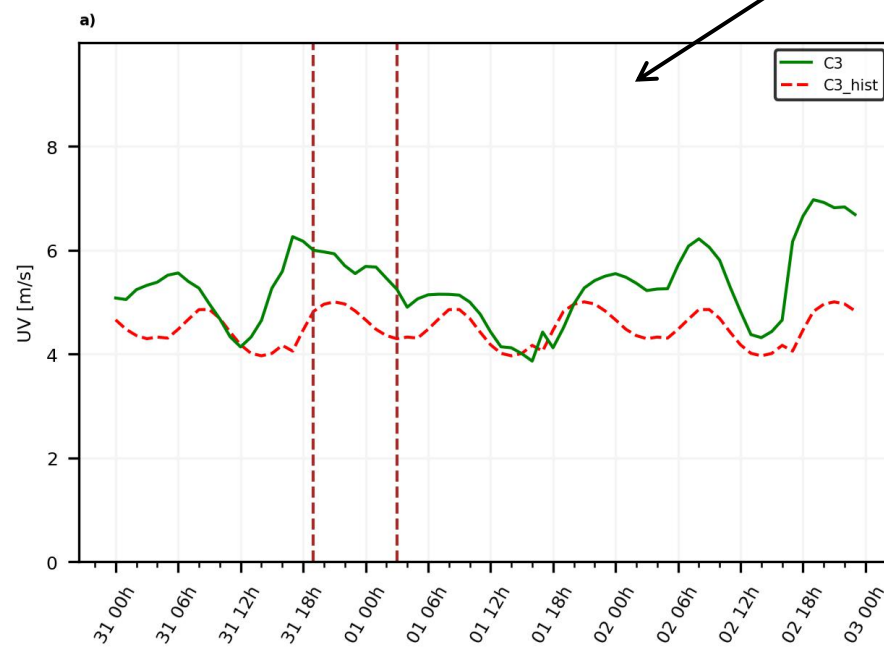
UV 925hPa (m/s)



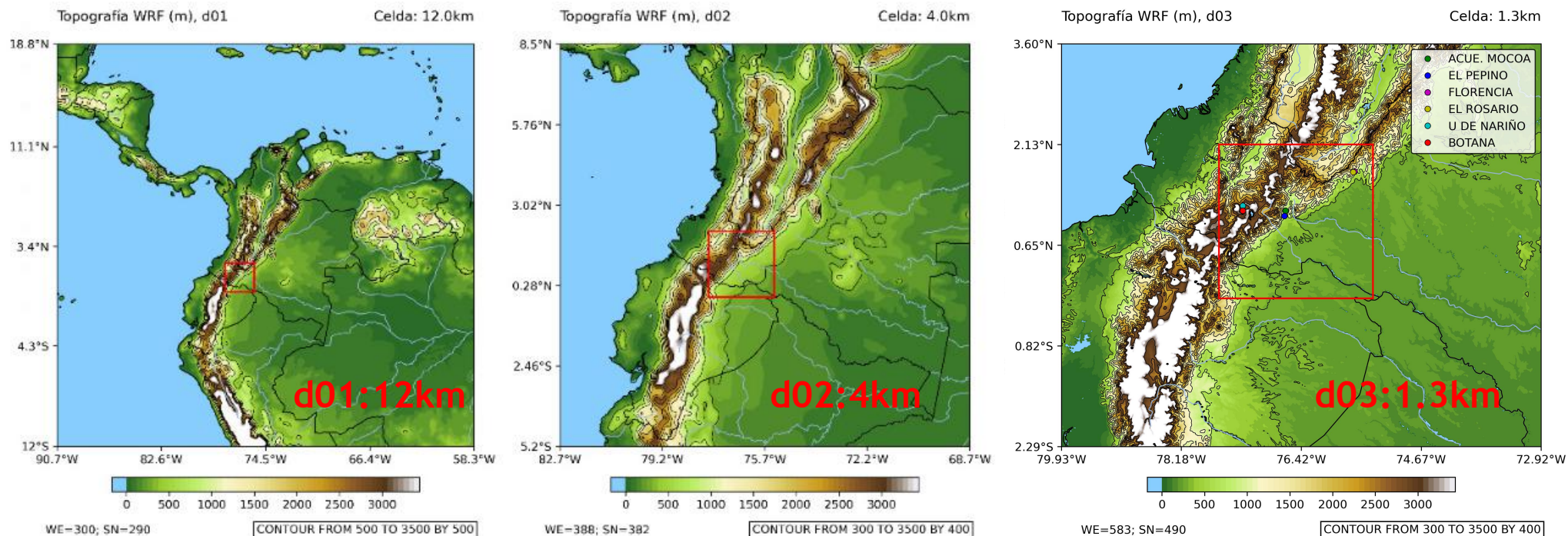
TCWV (mm) UV850hPa



- Strong OLLJ winds
- Cores C3 and C4 (green lines) were stronger than normal (red lines) during several days around the event.
- Strengthening ~ 5-6 hours before the event

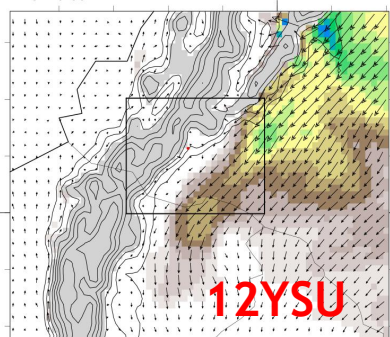


Question: which are the characteristics of low-level structures that are associated with the simulated MCS over this mountainous region?

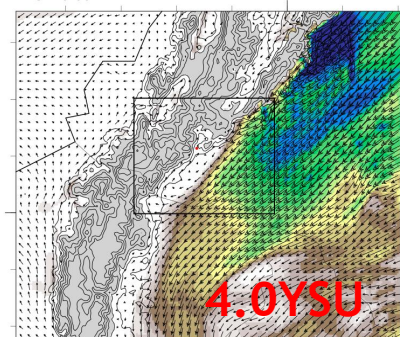


- WRF 4.1.5, d01: 12km, d02: 4.0km, d03: 1.33km, 50 vertical levels, top at 20hPa
- 48 hour simulations, IC/BC from ERA5
- MP: Morrison; LSM: Noah; Rad: RRTMG, Cu-d01: New Tiedtke;
- 9 simulations: 3 grids (12, 4, 1.3km) x 3 PBL schemes (YSU, MYNN, QNSE)

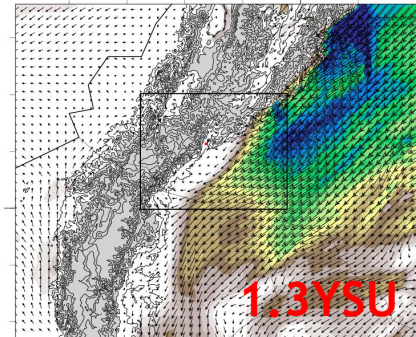
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



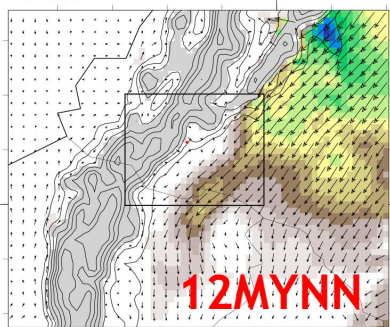
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



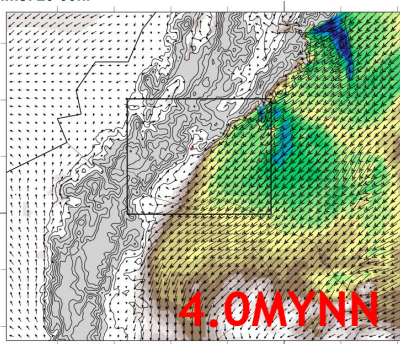
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



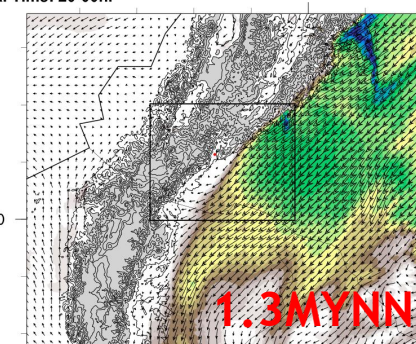
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



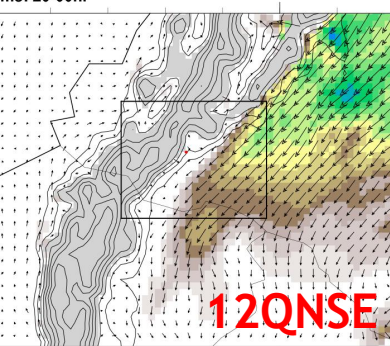
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



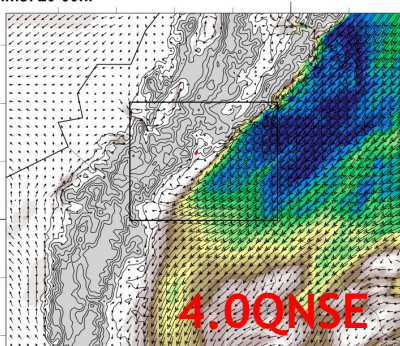
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



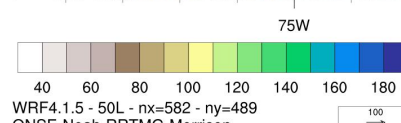
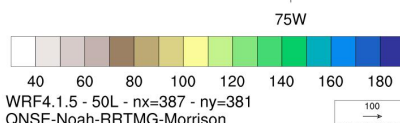
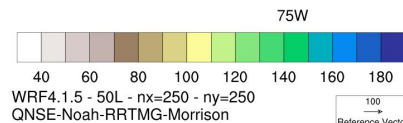
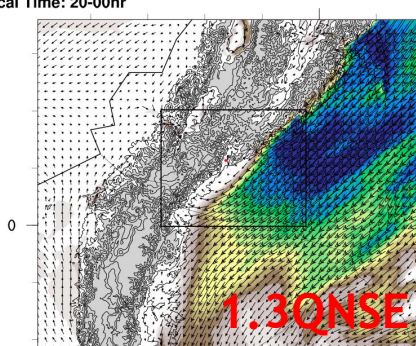
WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



WRF qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 AVE Time: 2017-04-01, 01-05UTC
 Local Time: 20-00hr



ERIA UdeA
 rendizaje

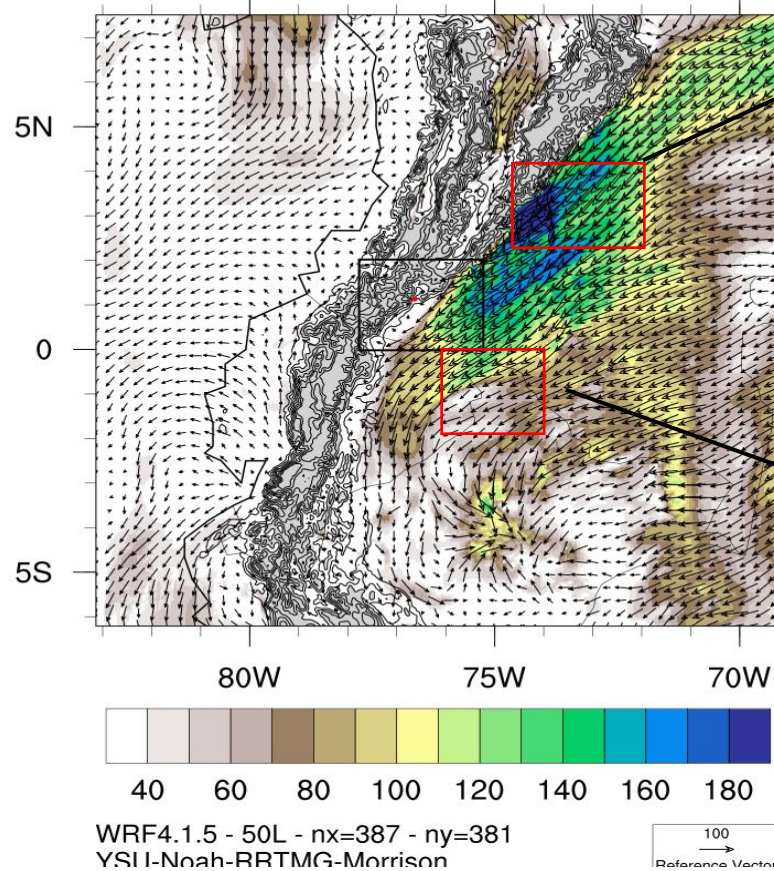
- Strong transport of moisture (qV at 850hPa) during the 4 hours prior to the simulated precipitation event.
- Weaker transport with $dx = 12\text{km}$.
- With MYNN weaker flow near the Andes.
- Stronger flow is also associated with stronger gradients, since the Andes provide blocking in all cases.

Similar to previous work:
"The Orinoco Low-Level Jet and the Cross-Equatorial Moisture Transport Over Tropical South America: Lessons From Seasonal WRF Simulations"

Martinez et al., 2022

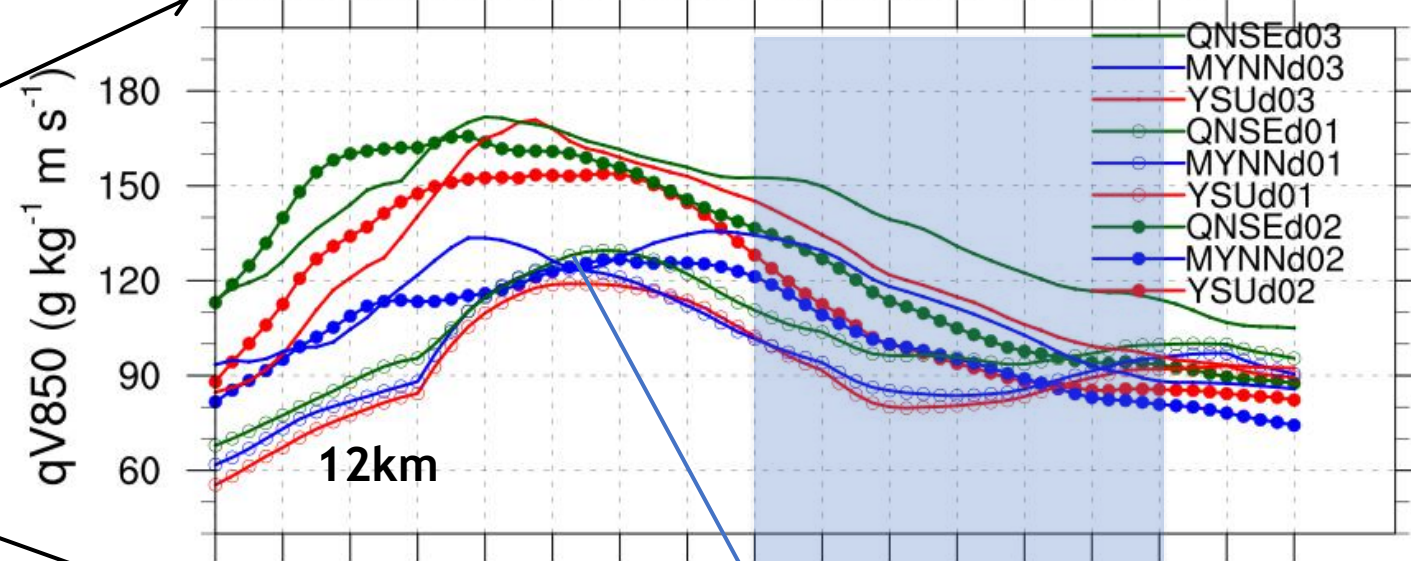
<https://doi.org/10.1029/2021JD035603>

WRF-ERA5 qV850 ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 ACC Time: 2017-04-01_01:05UTC
 Local Time: 20-00hr

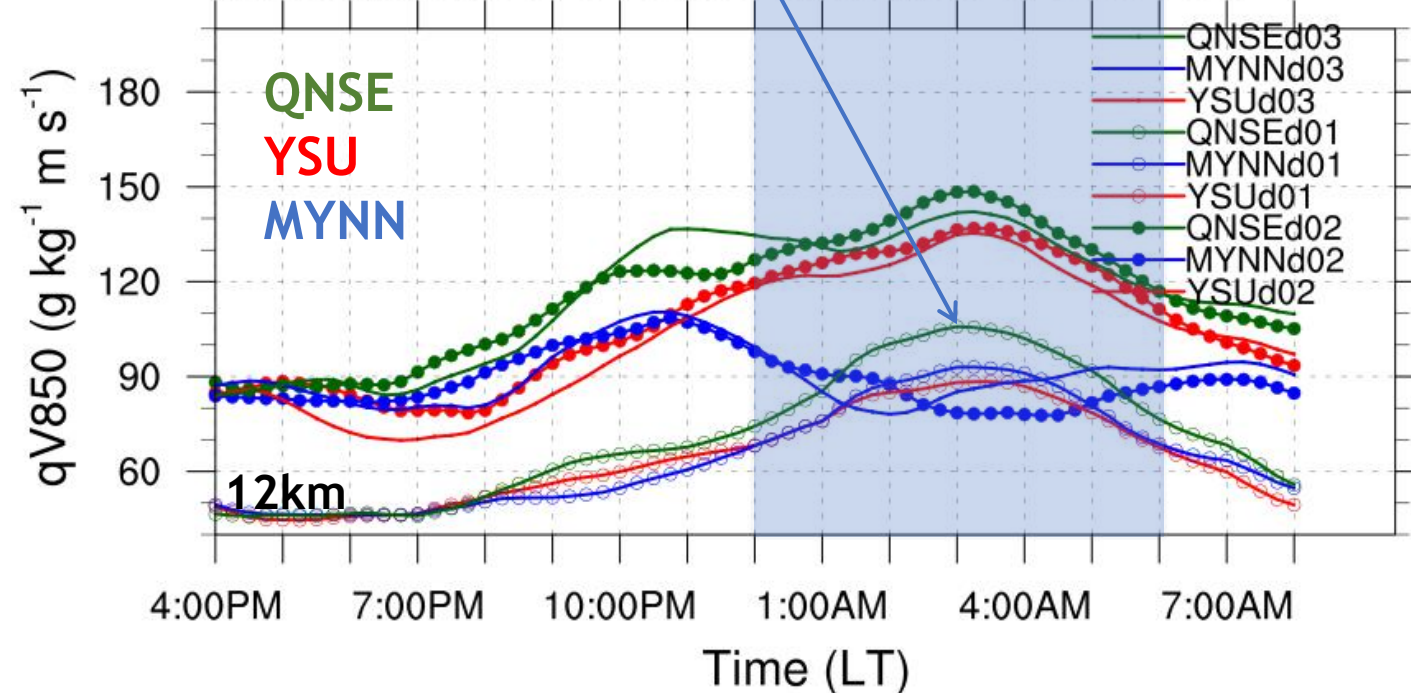


- Strong transport of moisture 6-4 hours prior to the simulated precipitation event.
- Perturbation traveling southward, contributing with formation of lines of convergence.

(a) Magnitude of qV@850 averaged over OLLJ1

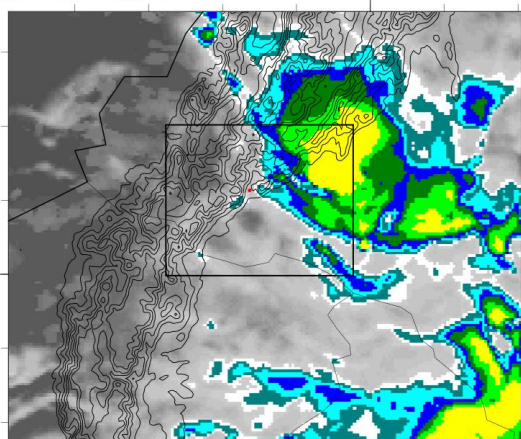


(a) Magnitude of qV@850 averaged over OLLJ2



WRF OLR (W m^{-2}), d02-4.0km,PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

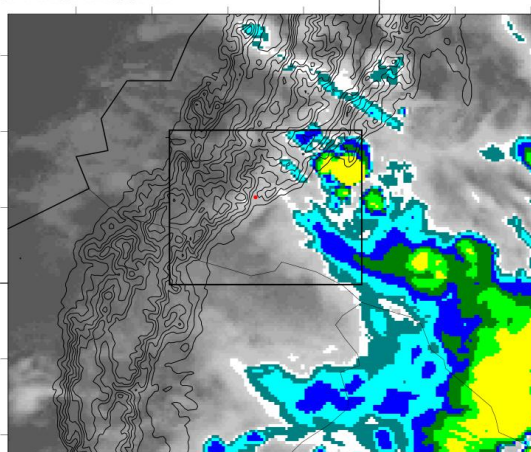
4.0YSU



75W

WRF OLR (W m^{-2}), d02-4.0km,PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

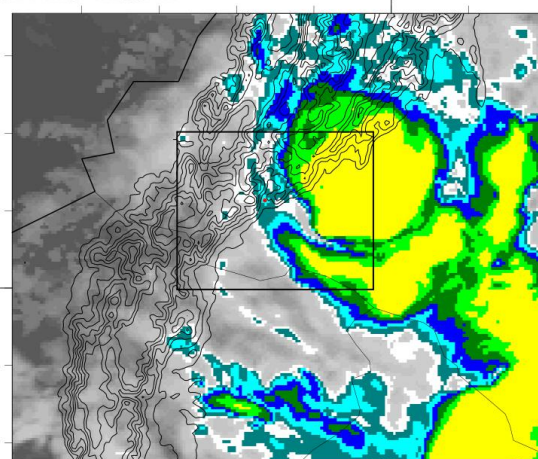
4.0MYNN



75W

WRF OLR (W m^{-2}), d02-4.0km,PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

4.0QNSE



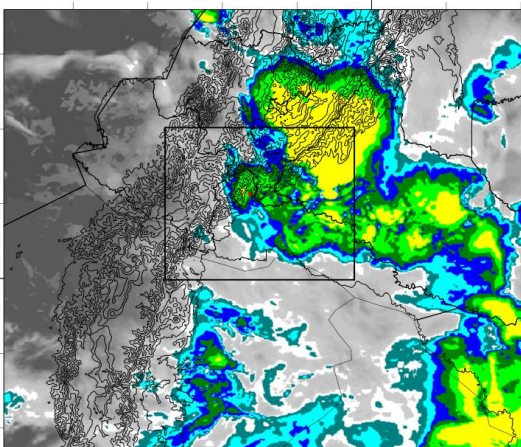
75W

- An organized simulated convective system hit the Andes near the time of the real event.

- With MYNN the system was smaller, less organized, moving less into the Andes.

WRF OLR (W m^{-2}), d03-1.3km,PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

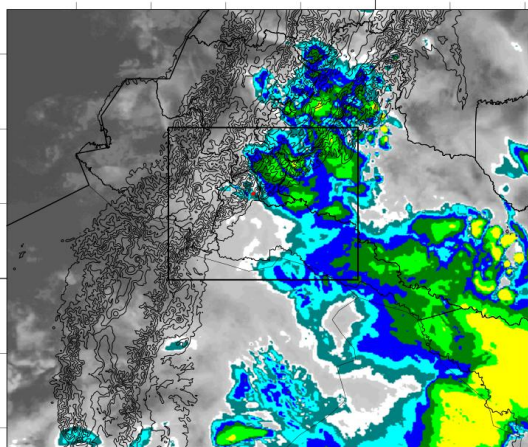
1.3YSU



75W

WRF OLR (W m^{-2}), d03-1.3km,PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

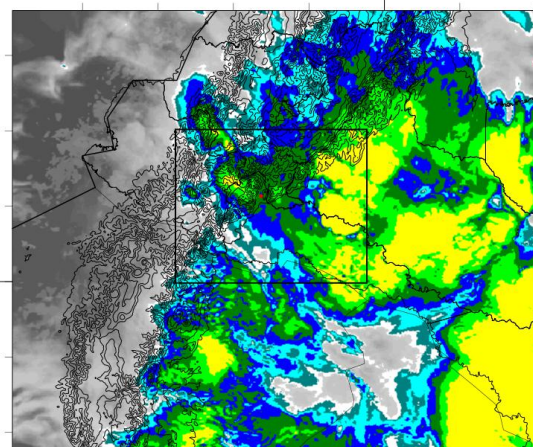
1.3MYNN



75W

WRF OLR (W m^{-2}), d03-1.3km,PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 VER Time: 2017-04-01_05:00UTC
 Local Time: 12:00AM

1.3QNSE



75W

- Real system moved farther into the Andes (similar to YSU and QNSE)



WRF4.1.5 - 50L - nx=582 - ny=489
 YSU-Noah-RRTMG-Morrison



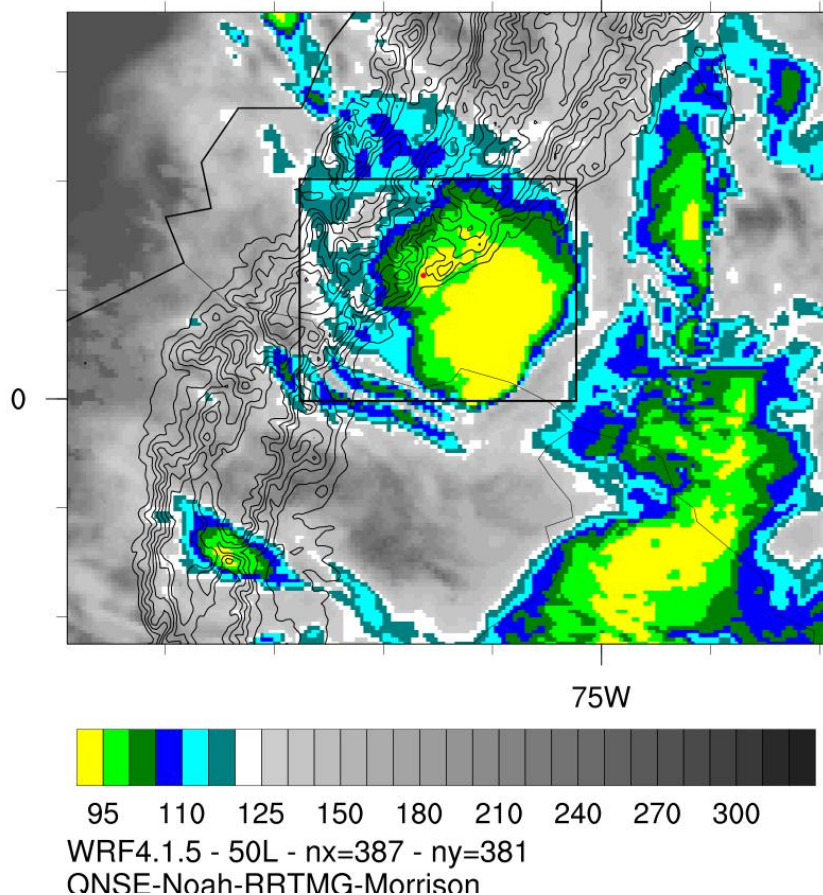
WRF4.1.5 - 50L - nx=582 - ny=489
 MYNN-Noah-RRTMG-Morrison



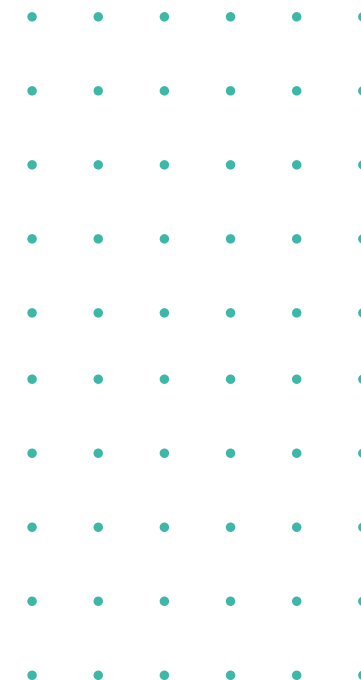
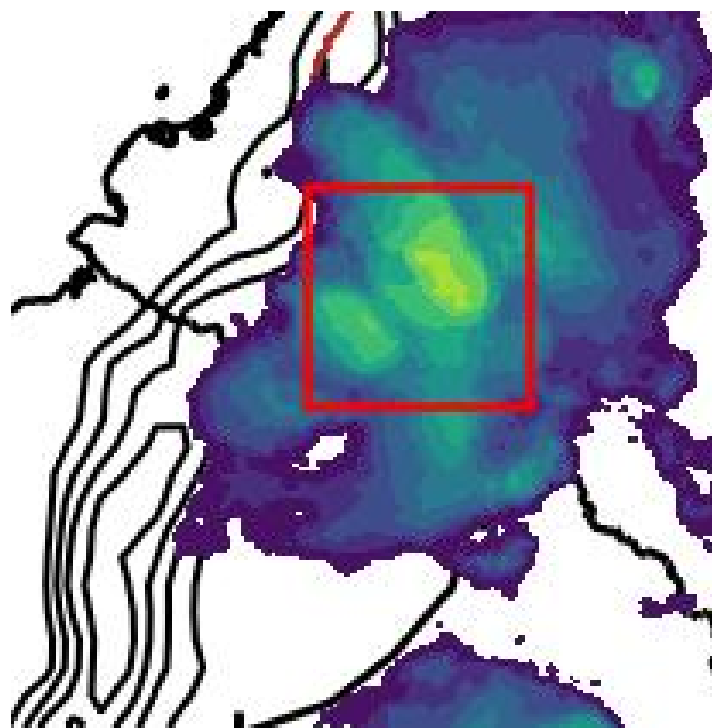
WRF4.1.5 - 50L - nx=582 - ny=489
 QNSE-Noah-RRTMG-Morrison

WRF OLR (W m^{-2}), d02-4.0km, PBL:QNSE
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_07:00UTC
Local Time: 2:00AM

4.0QNSE



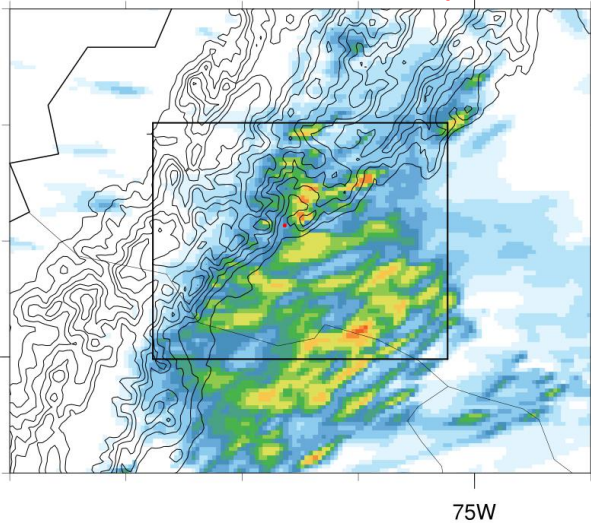
CTT NCEP-MERGIR



- An organized simulated convective system hit the Andes near the time of the real event.
- With MYNN the system was smaller, less organized, moving less into the Andes.
- Real system moved farther into the Andes (similar to YSU and QNSE).

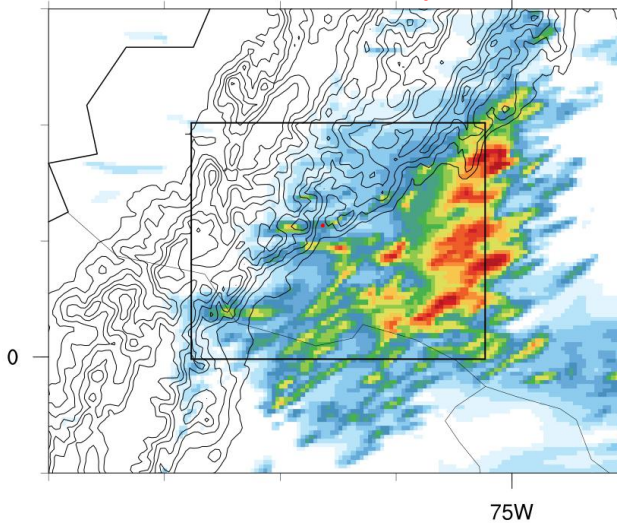
WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:YSU
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

4.0YSU



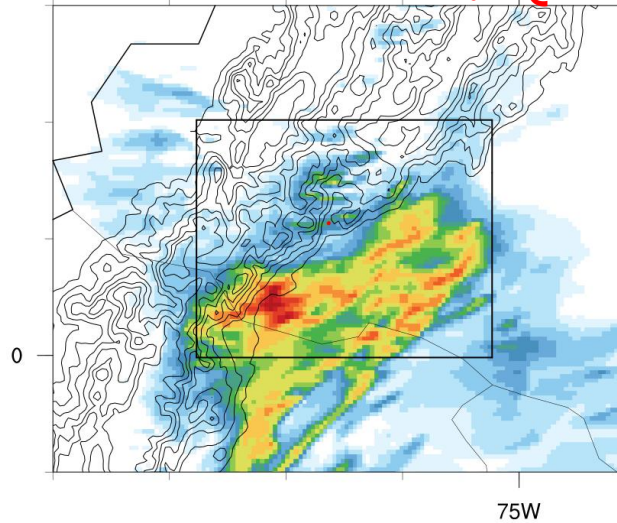
WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:MYNN
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

4.0MYNN



WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:QNSE
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

4.0QNSE



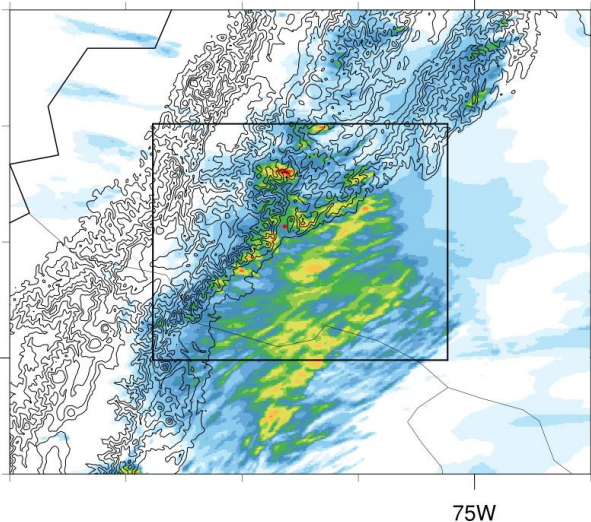
- Substantial 6-hour accumulated precipitation over Andes-Amazon region (convergence/blocking).

- In this case, smaller maxima of precipitation over the Andes with MYNN.

- Larger precipitation at 4km than at 1.3km for all tested PBL schemes.

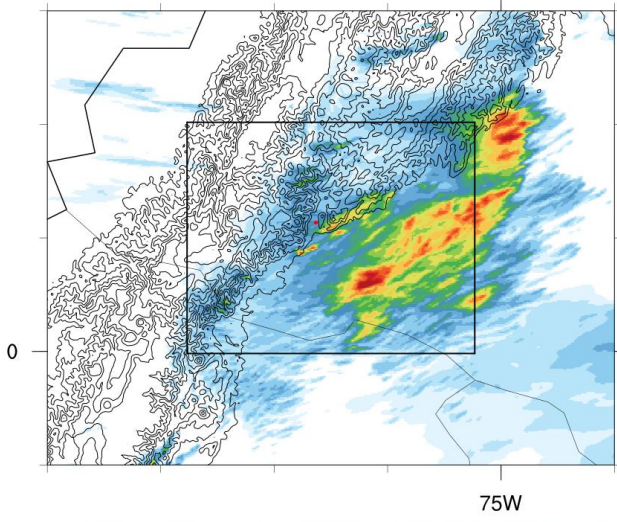
WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:YSU
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

1.3YSU



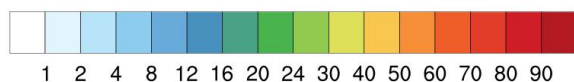
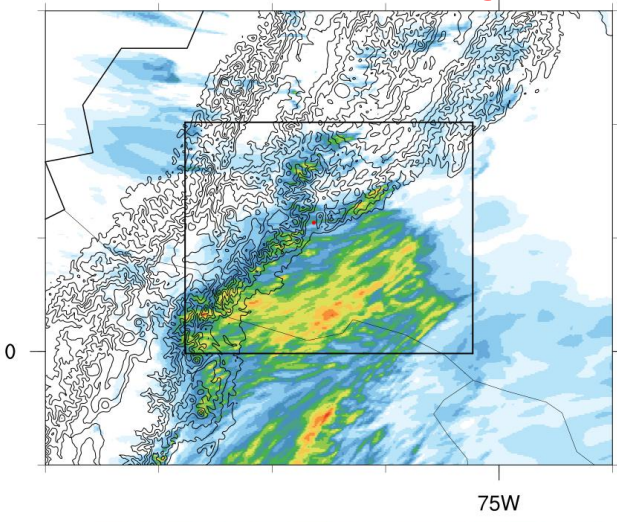
WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:MYNN
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

1.3MYNN



WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:QNSE
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

1.3QNSE



WRF4.1.5 - 50L - nx=582 - ny=489
YSU-Noah-RRTMG-Morrison

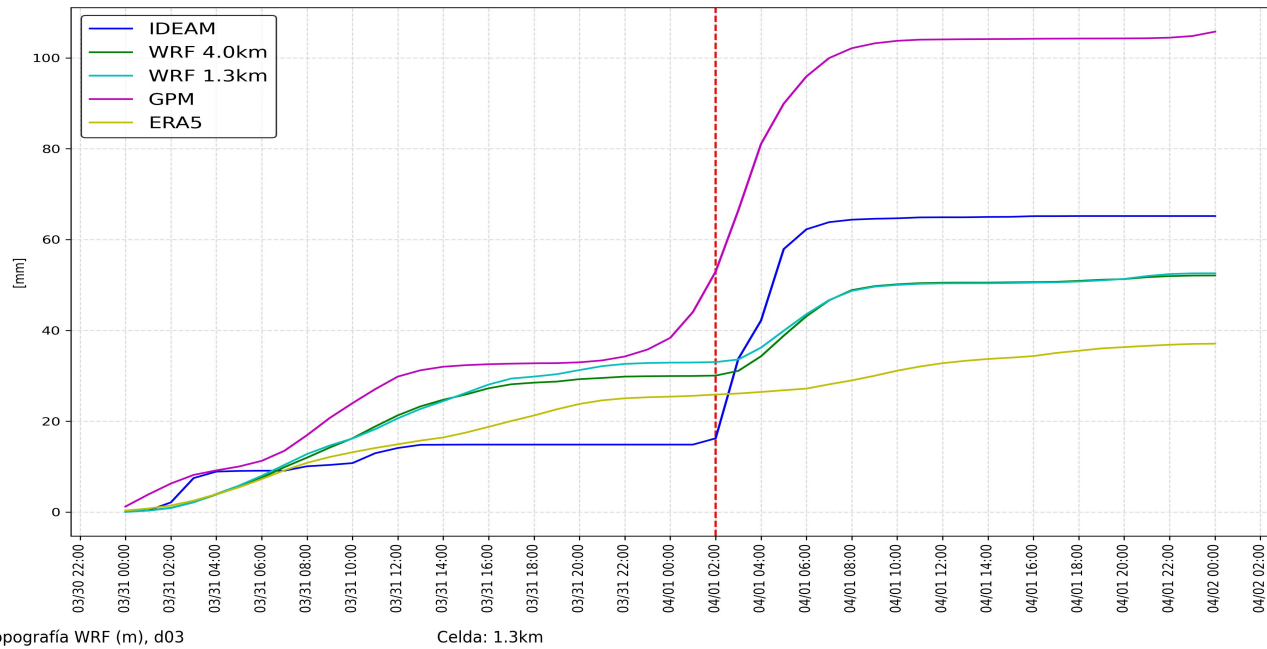
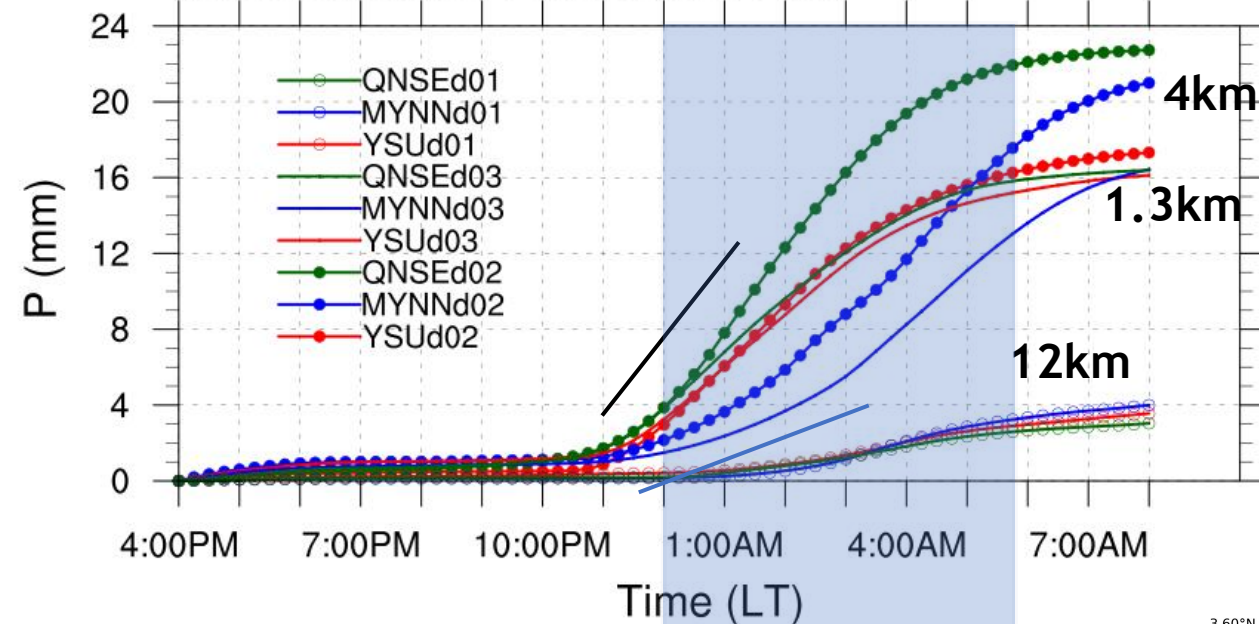


WRF4.1.5 - 50L - nx=582 - ny=489
MYNN-Noah-RRTMG-Morrison

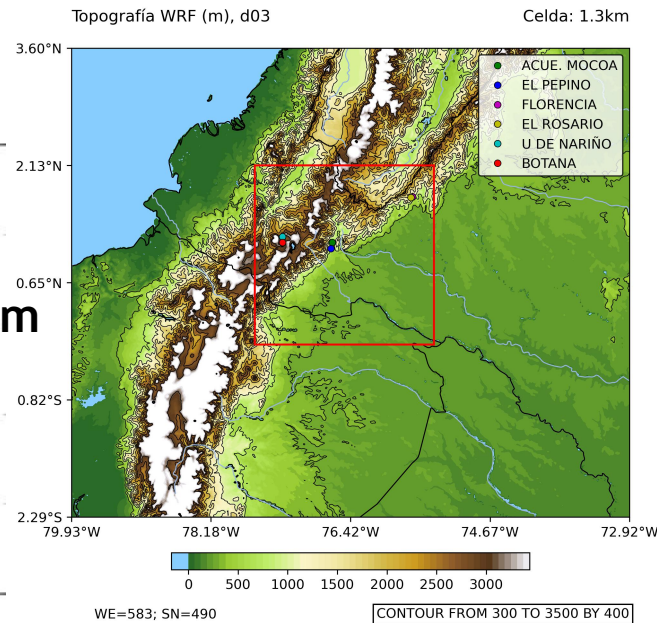
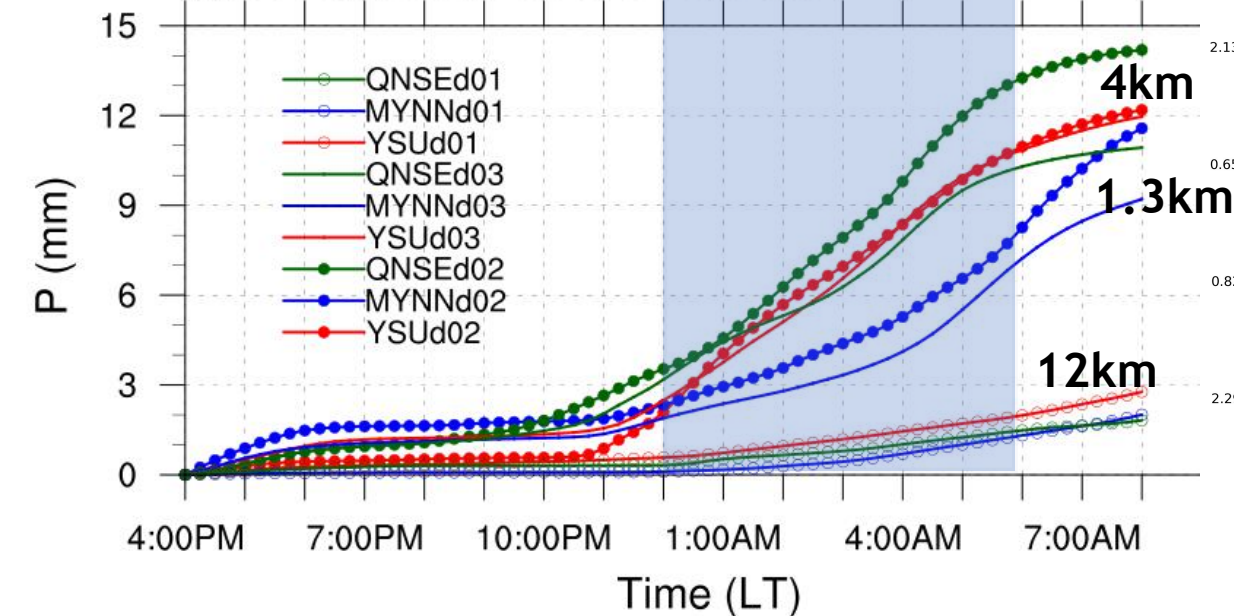


WRF4.1.5 - 50L - nx=582 - ny=489
QNSE-Noah-RRTMG-Morrison

(a) Accumulated Precipitation Box



(b) Precipitation Above 500m Box

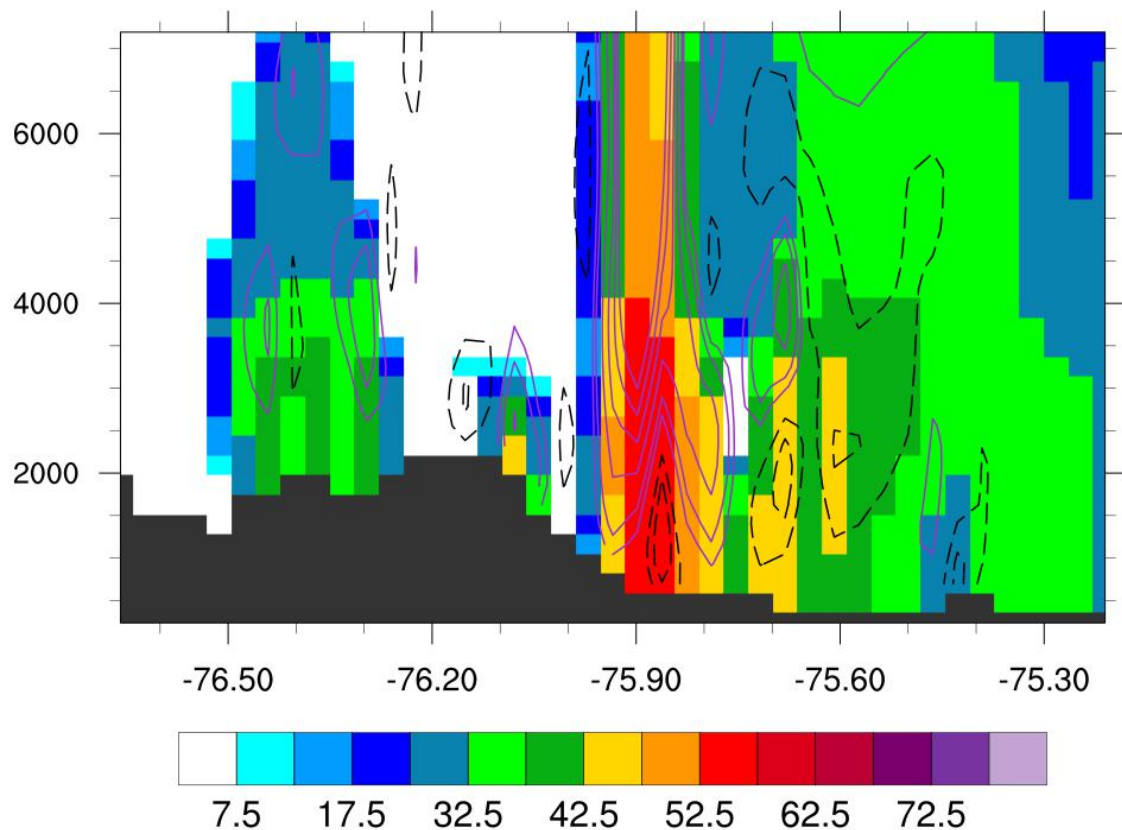


- More precipitation at 4 km than at 1.3km
- Smaller precipitation rates with MYNN, especially above 500m.

Mesoscale circulations and Orographic Enhancement ...

WRF Reflectivity (dBz), d02-4.0km
w(m/s) (Continuous: Upward)
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM

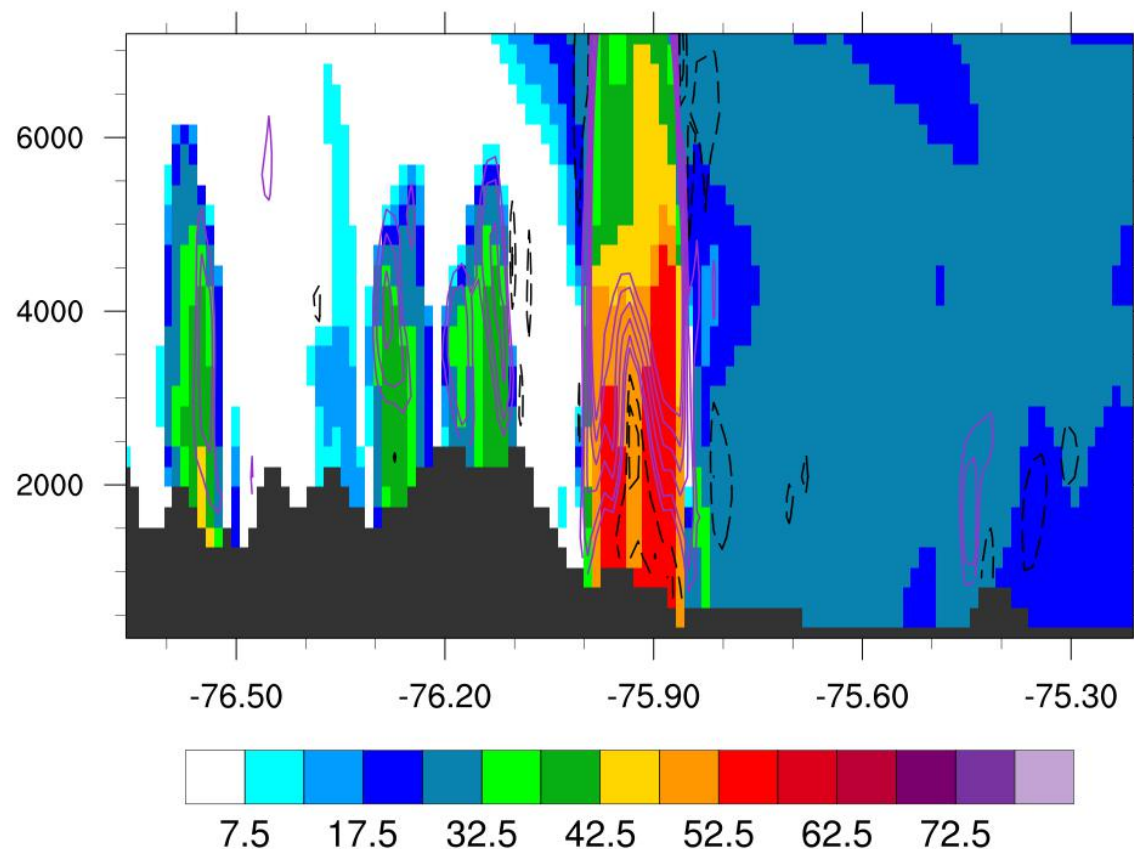
4.0YSU



WRF4.1.5 - 50L - nx=387 - ny=381
YSU-Noah-RRTMG-Morrison

WRF Reflectivity (dBz), d03-1.3km
w(m/s) (Continuous: Upward)
VER Time: 2017-04-01_05:30UTC
Local Time: 12:30AM

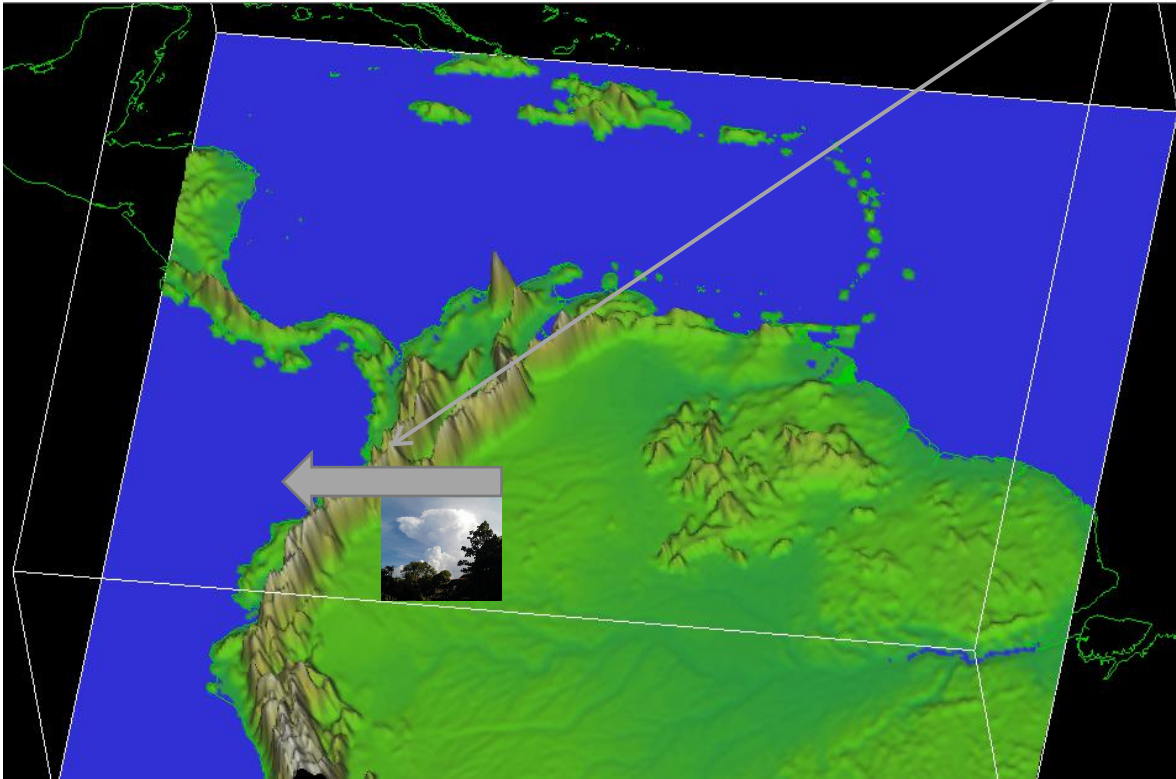
1.3YSU



WRF4.1.5 - 50L - nx=582 - ny=489
YSU-Noah-RRTMG-Morrison

Concluding remarks

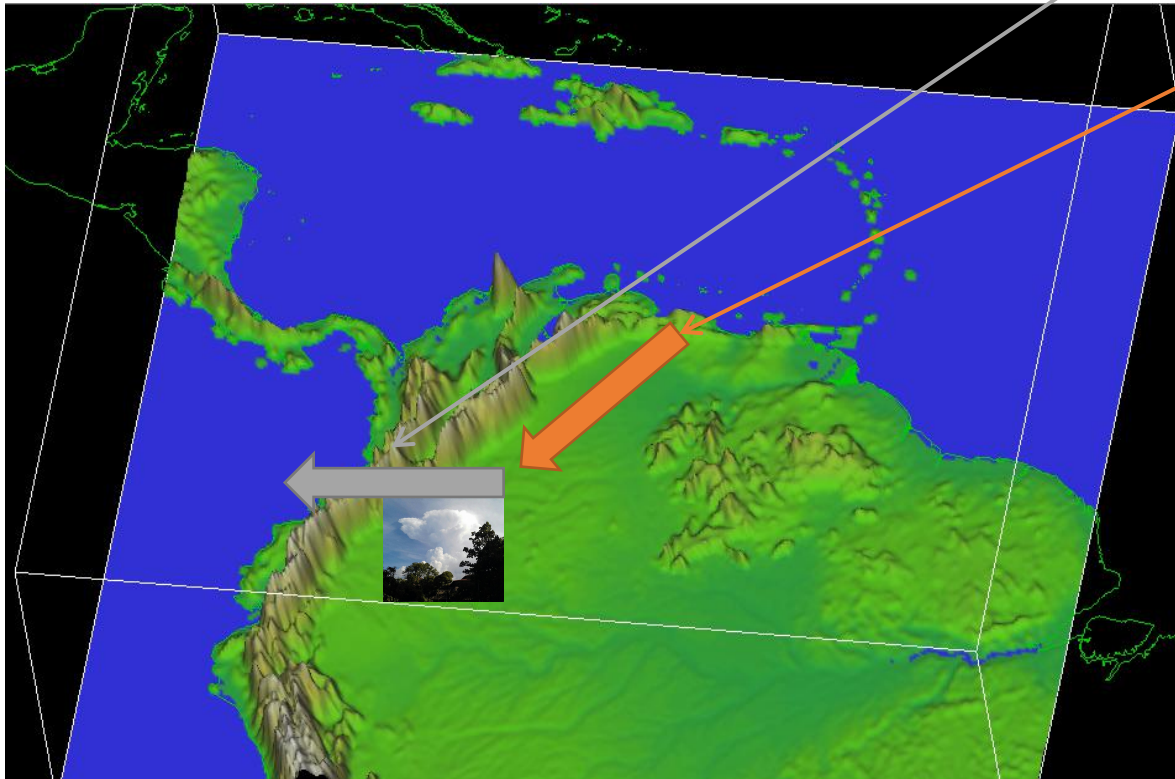
1. Heavy precipitation event over the Andes from an MCS formed in the Amazon.



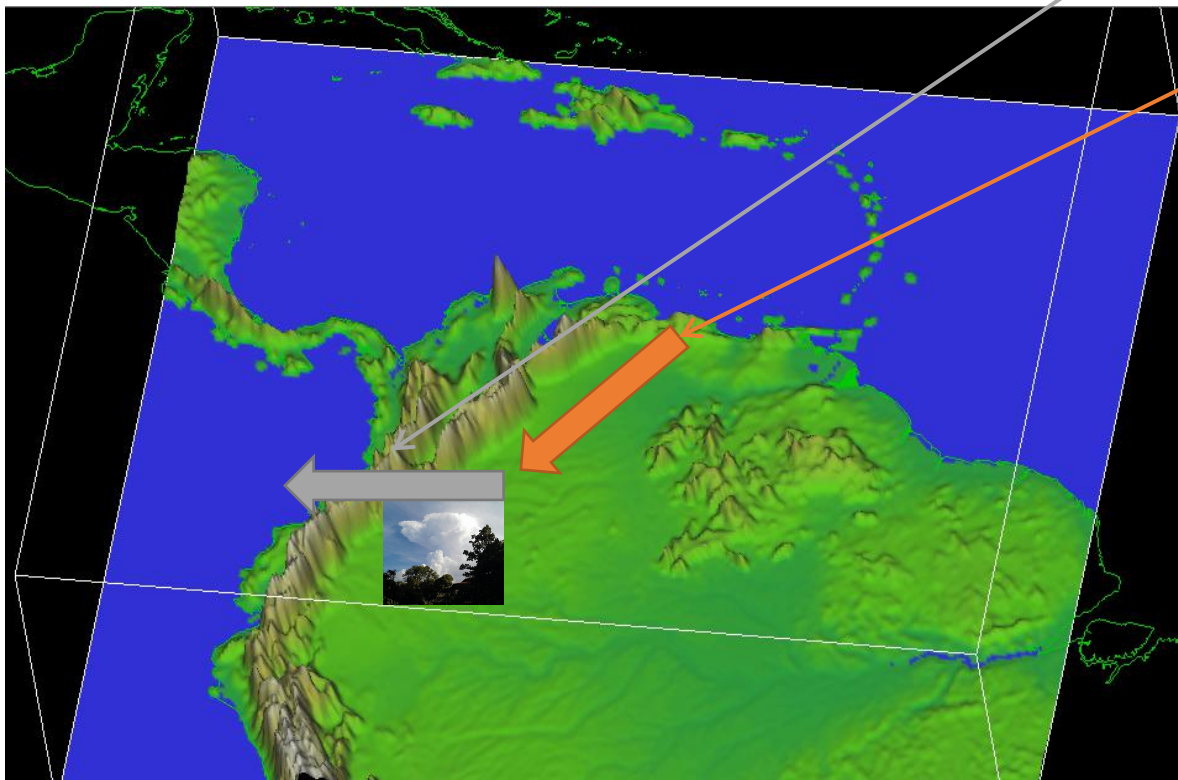
Concluding remarks

1. Heavy precipitation event over the Andes from an MCS formed in the Amazon.

2. Strong OLLJ (t ~ -12-4 hrs) favoring lines of convergence and transport of moisture.

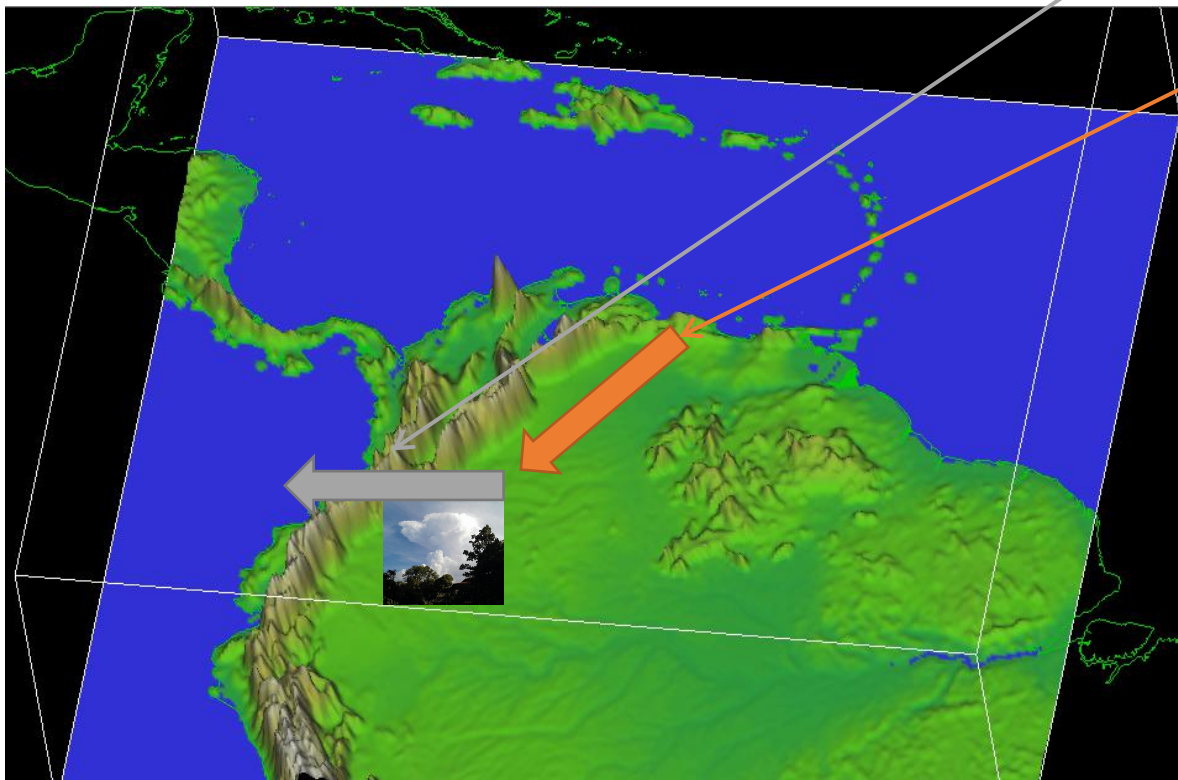


Concluding remarks



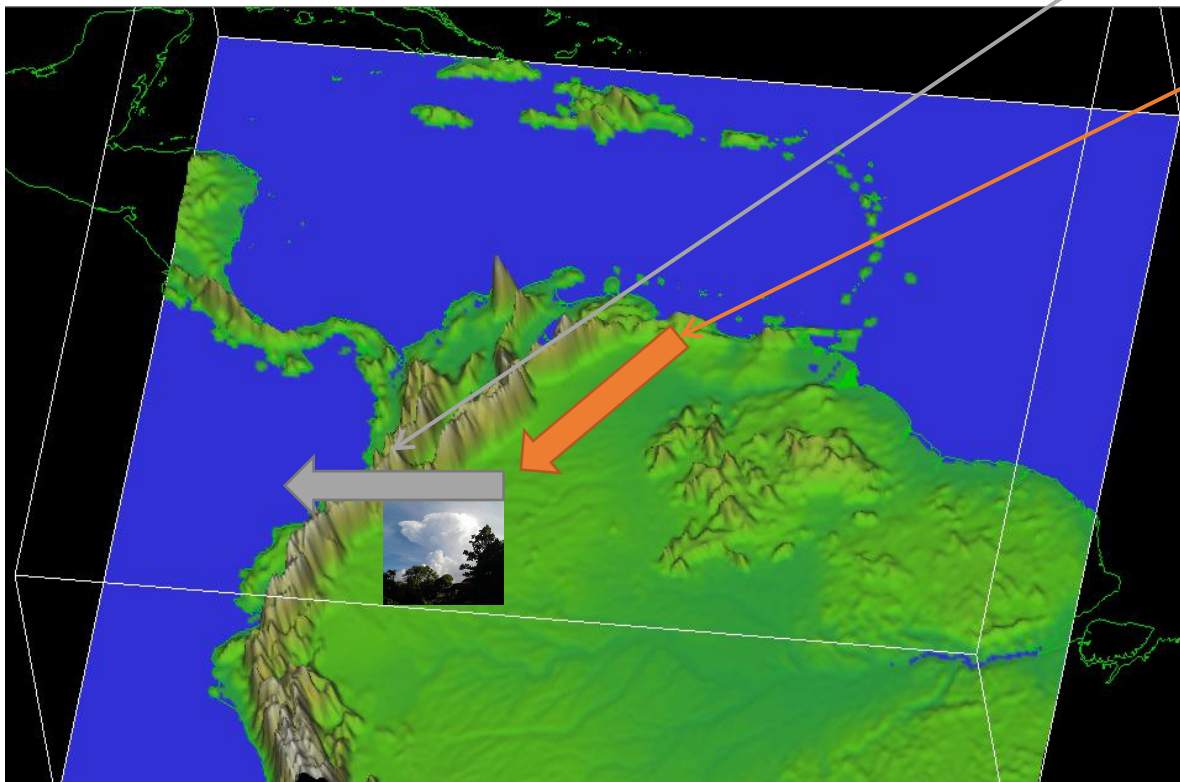
1. Heavy precipitation event over the Andes from an MCS formed in the Amazon.
2. Strong OLLJ ($t \sim -12-4$ hrs) favoring lines of convergence and transport of moisture.
3. PBL schemes with stronger OLLJ and cross-equatorial moisture transport simulated a **more organized (realistic) MCSs**, and **enhanced mean precipitation over the Andes region**.

Concluding remarks



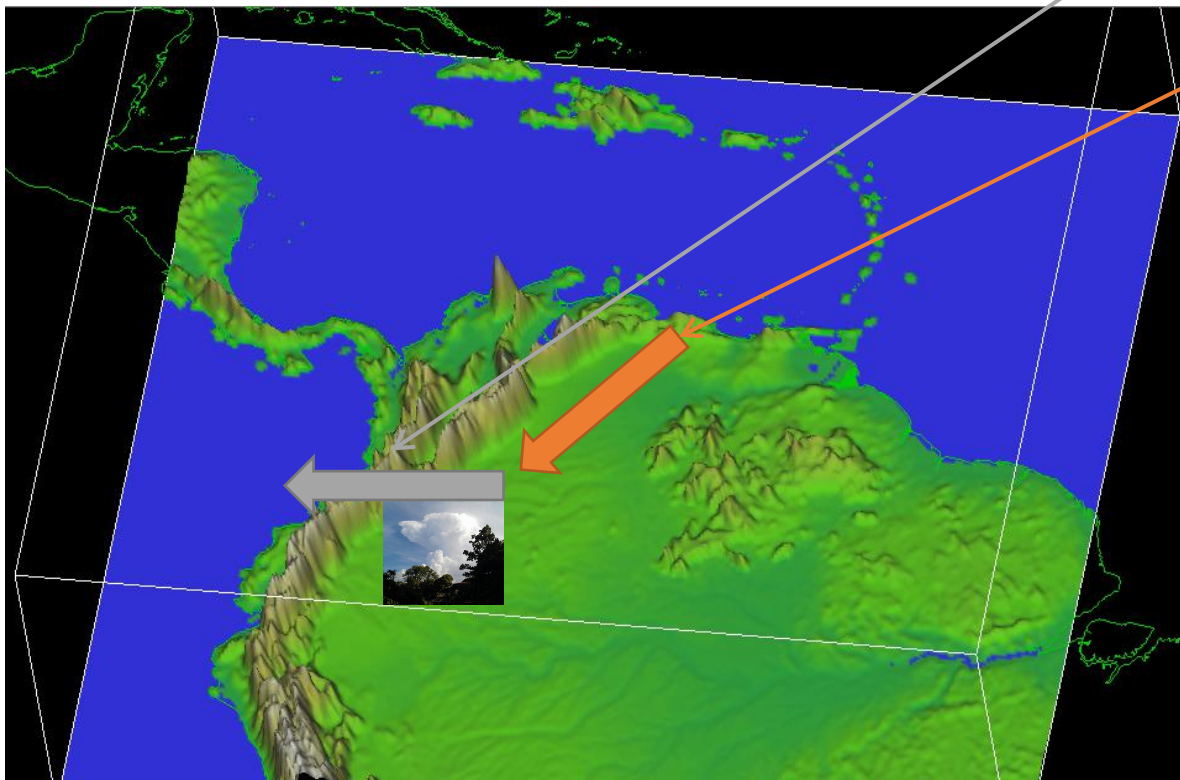
1. **Heavy precipitation event over the Andes** from an MCS formed in the Amazon.
2. **Strong OLLJ** ($t \sim -12-4$ hrs) favoring lines of convergence and transport of moisture.
3. **PBL schemes with stronger OLLJ** and cross-equatorial moisture transport simulated a **more organized (realistic) MCSs**, and **enhanced mean precipitation over the Andes region**.
4. **Heavier precip at 1.3km than at 4km.**

Concluding remarks



1. **Heavy precipitation event over the Andes** from an MCS formed in the Amazon.
2. **Strong OLLJ** ($t \sim -12-4$ hrs) favoring lines of convergence and transport of moisture.
3. **PBL schemes with stronger OLLJ** and cross-equatorial moisture transport simulated a **more organized (realistic) MCSs**, and **enhanced mean precipitation over the Andes region**.
4. Heavier precip at 1.3km than at 4km.
5. Heavy mountain precipitation: **more obs.** of surface precip. and vertical soundings (e.g. OLLJ monitoring).

Concluding remarks



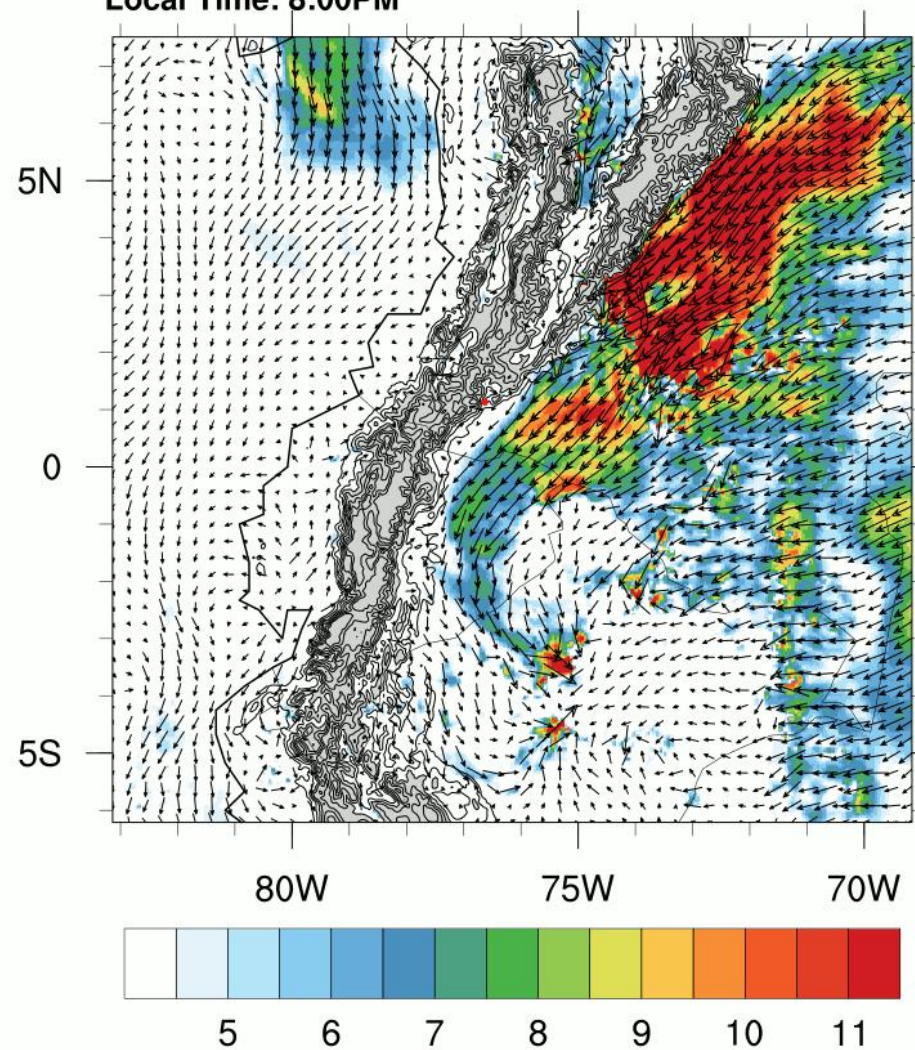
1. **Heavy precipitation event over the Andes** from an MCS formed in the Amazon.
2. **Strong OLLJ** ($t \sim -12-4$ hrs) favoring lines of convergence and transport of moisture.
3. **PBL schemes with stronger OLLJ** and cross-equatorial moisture transport simulated a **more organized (realistic) MCSs**, and **enhanced mean precipitation over the Andes region**.
4. Heavier precip at 1.3km than at 4km.
5. Heavy mountain precipitation: **more obs.** of surface precip. and vertical soundings (e.g. OLLJ monitoring).
6. **Process oriented diagnostics/evaluation** (e.g. wind-hydrometeors relationships and orographic enhancement).

Thank you!

Questions?

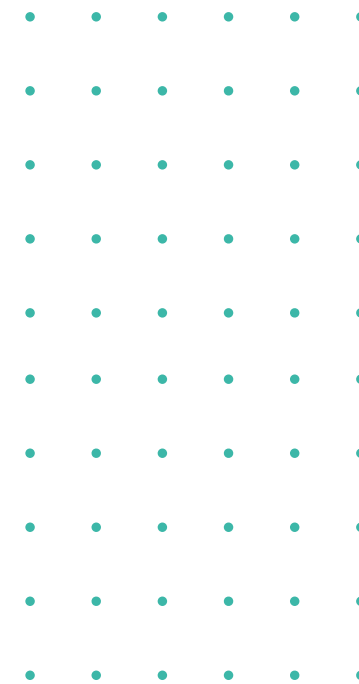
J. Alejandro Martinez
john.martinez@udea.edu.co
<https://atmosudea.wordpress.com/>

WRF-ERA5 UV850 (m s^{-1}), d02-4.0km
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_01:00UTC
Local Time: 8:00PM

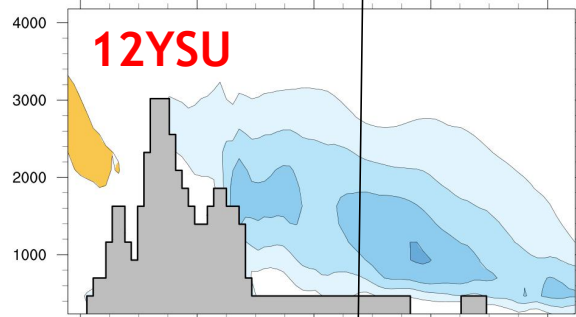


WRF4.1.5 - 50L - nx=387 - ny=381
YSI I-Noah-BRTMG-Morrison

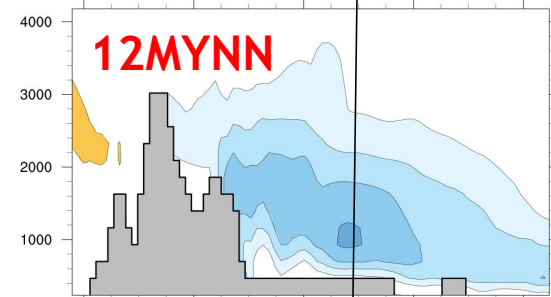
10
→
Reference Vector



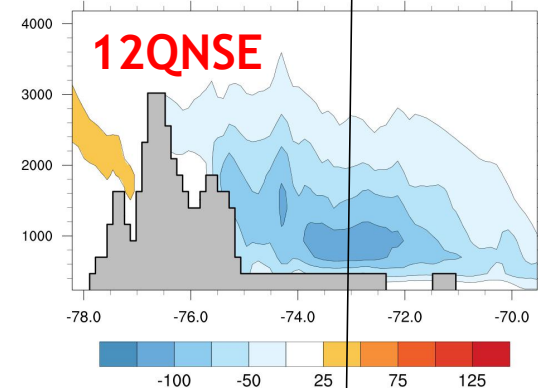
WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC



WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC

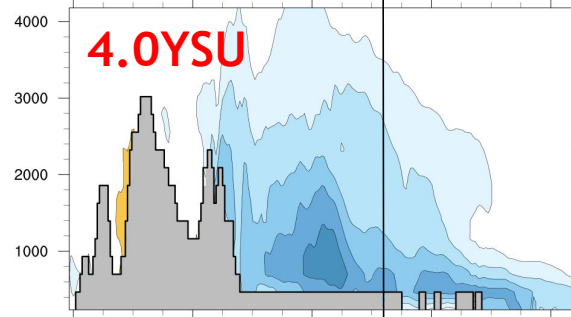


WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d01-12km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC

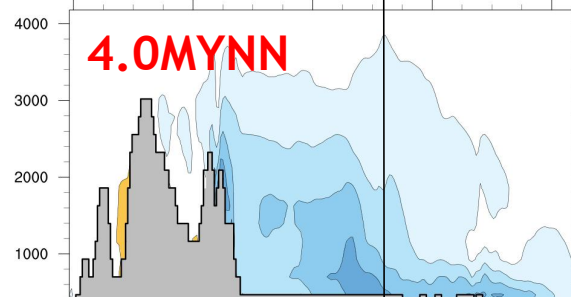


WRF4.1.5 - 50L - nx=250 - ny=250
 QNSE-Noah-RRTMG-Morrison

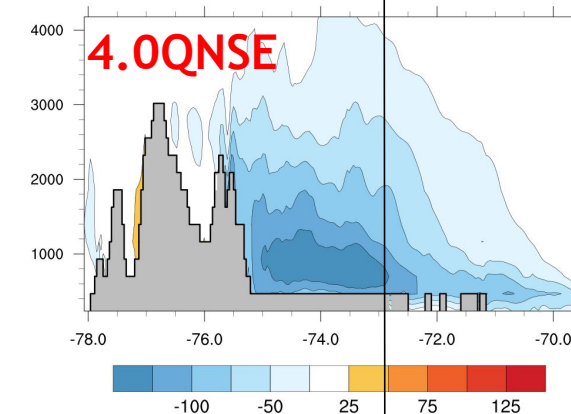
WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC



WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC

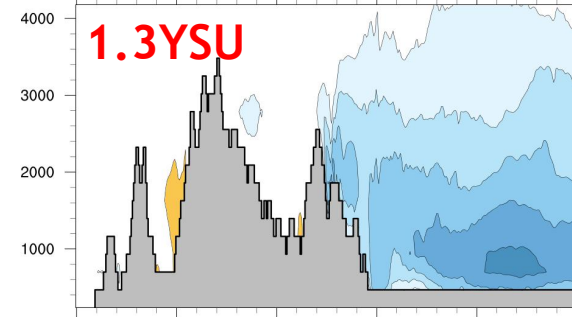


WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d02-4.0km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC

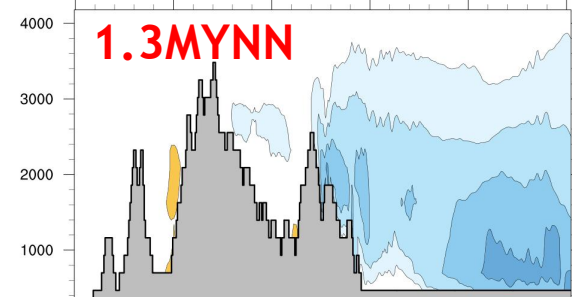


WRF4.1.5 - 50L - nx=387 - ny=381
 QNSE-Noah-RRTMG-Morrison

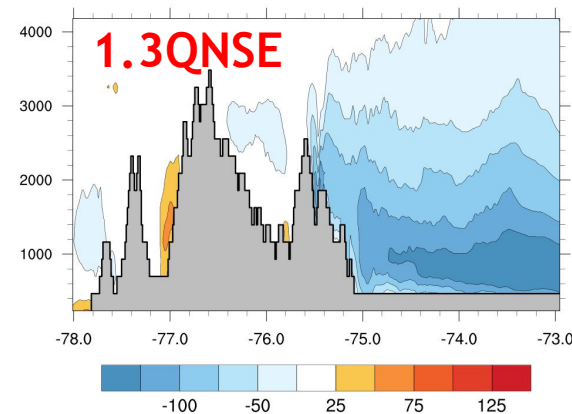
WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:YSU
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC



WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:MYNN
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC



WRF qv ($\text{g kg}^{-1} \text{ m s}^{-1}$), d03-1.3km, PBL:QNSE
 RUN Time: 2017-03-31_00:00UTC
 Time Average: 2017-04-01, 01-05UTC



WRF4.1.5 - 50L - nx=582 - ny=489
 QNSE-Noah-RRTMG-Morrison

- Vertical cross-section of meridional transport across the 2° N latitude.

- Strong transport of moisture during the 4 hours prior to the simulated precipitation event.

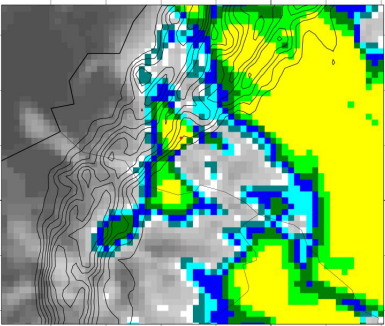
- With MYNN weaker flow near the Andes.

Similar to previous work:
"The Orinoco Low-Level Jet and the Cross-Equatorial Moisture Transport Over Tropical South America: Lessons From Seasonal WRF Simulations"

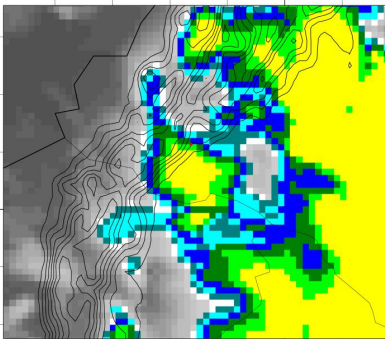
Martinez et al., 2022

<https://doi.org/10.1029/2021JD035603>

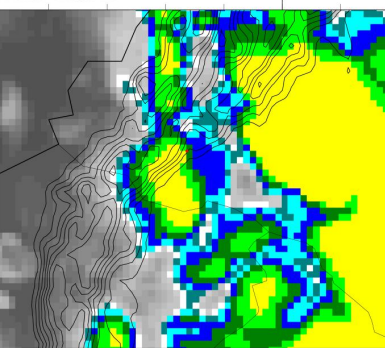
WRF OLR (W m⁻²), d01-12.0km, PBL:YSU
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



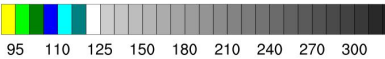
WRF OLR (W m⁻²), d01-12.0km, PBL:MYNN
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



WRF OLR (W m⁻²), d01-12.0km, PBL:QNSE
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM

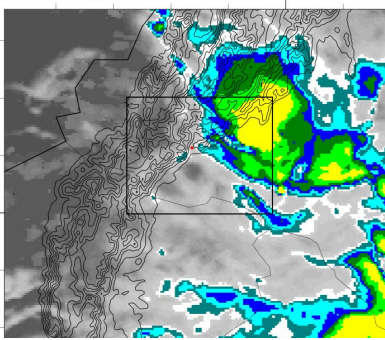


75W

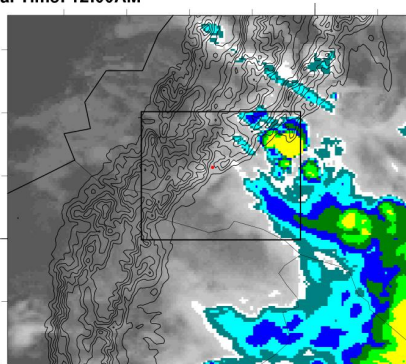


WRF4.1.5 - 50L - nx=250 - ny=250
QNSE-Noah-RRTMG-Morrison

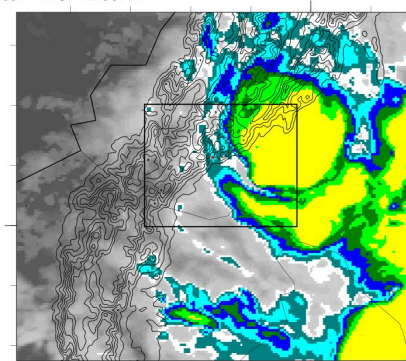
WRF OLR (W m⁻²), d02-4.0km, PBL:YSU
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



WRF OLR (W m⁻²), d02-4.0km, PBL:MYNN
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



WRF OLR (W m⁻²), d02-4.0km, PBL:QNSE
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



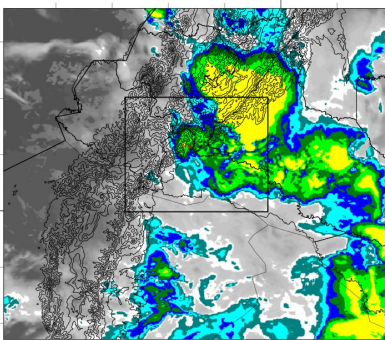
75W



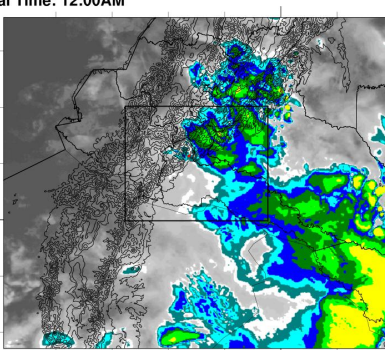
WRF4.1.5 - 50L - nx=387 - ny=381
QNSE-Noah-RRTMG-Morrison

T A
facu

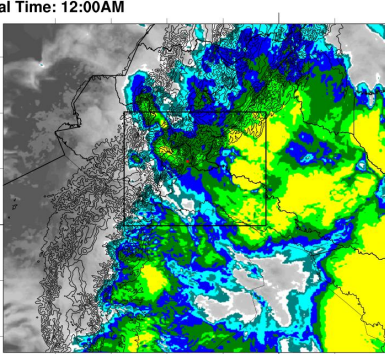
WRF OLR (W m⁻²), d03-1.3km, PBL:YSU
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



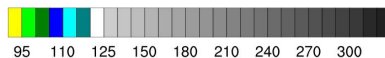
WRF OLR (W m⁻²), d03-1.3km, PBL:MYNN
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



WRF OLR (W m⁻²), d03-1.3km, PBL:QNSE
RUN Time: 2017-03-31_00:00UTC
VER Time: 2017-04-01_05:00UTC
Local Time: 12:00AM



75W



WRF4.1.5 - 50L - nx=582 - ny=489
QNSE-Noah-RRTMG-Morrison

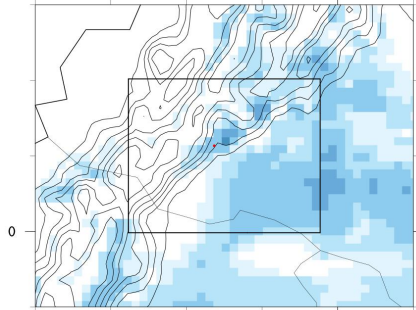
UdeA

- An organized simulated convective system hit the Andes near the time of the real event.

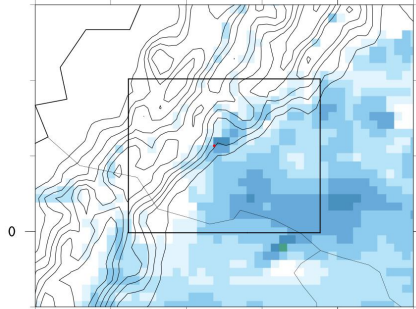
- With MYNN the system was smaller, less organized, moving less into the Andes.

- Real system moved farther into the Andes (similar to YSU and QNSE)

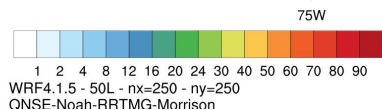
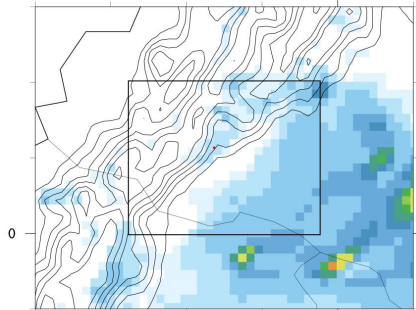
WRF-ERA5 RAINACC (mm), d01-12km, PBL:YSU
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



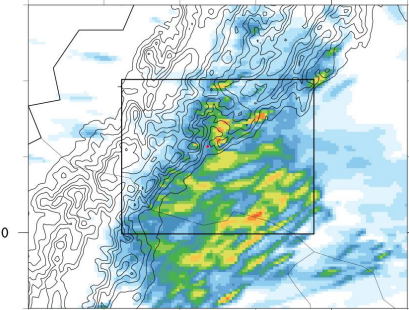
WRF-ERA5 RAINACC (mm), d01-12km, PBL:MYNN
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



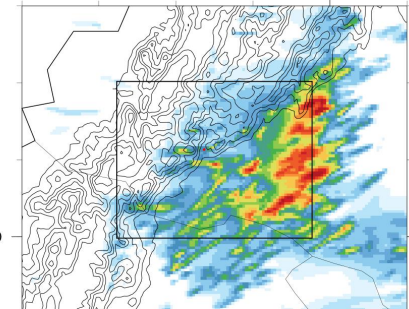
WRF-ERA5 RAINACC (mm), d01-12km, PBL:QNSE
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



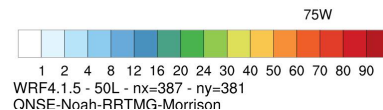
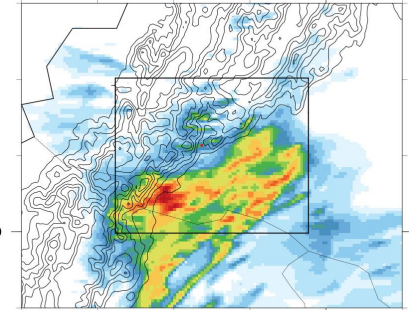
WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:YSU
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



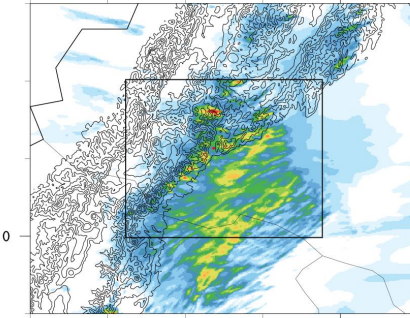
WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:MYNN
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



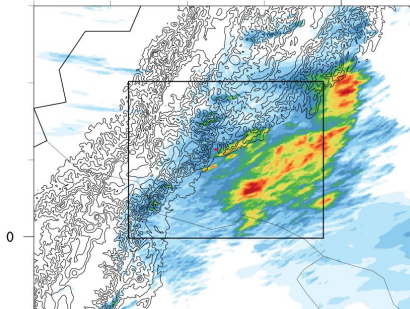
WRF-ERA5 RAINACC (mm), d02-4.0km, PBL:QNSE
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



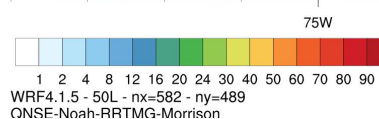
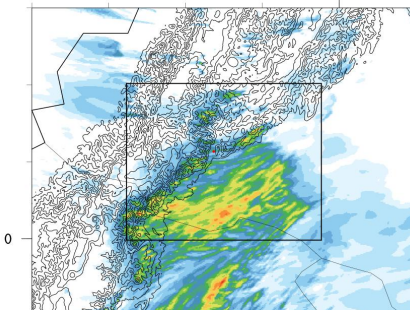
WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:YSU
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:MYNN
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:QNSE
RUN Time: 2017-03-31 00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr

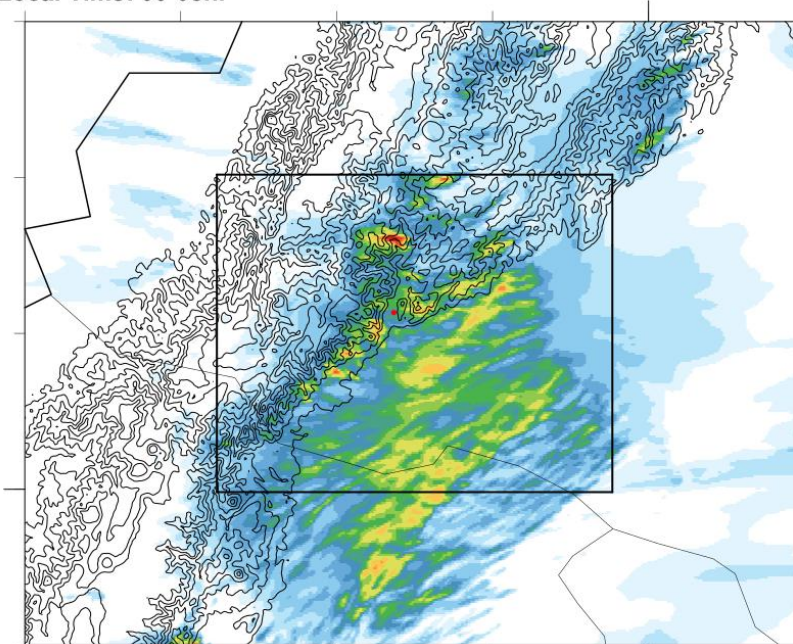


- Substantial 6-hour accumulated precipitation over Andes-Amazon region (convergence/blocking).

- In this case, smaller maxima of precipitation over the Andes with MYNN.

- Larger precipitation at 4km than at 1.3km for all tested PBL schemes.

WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:YSU
RUN Time: 2017-03-31_00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



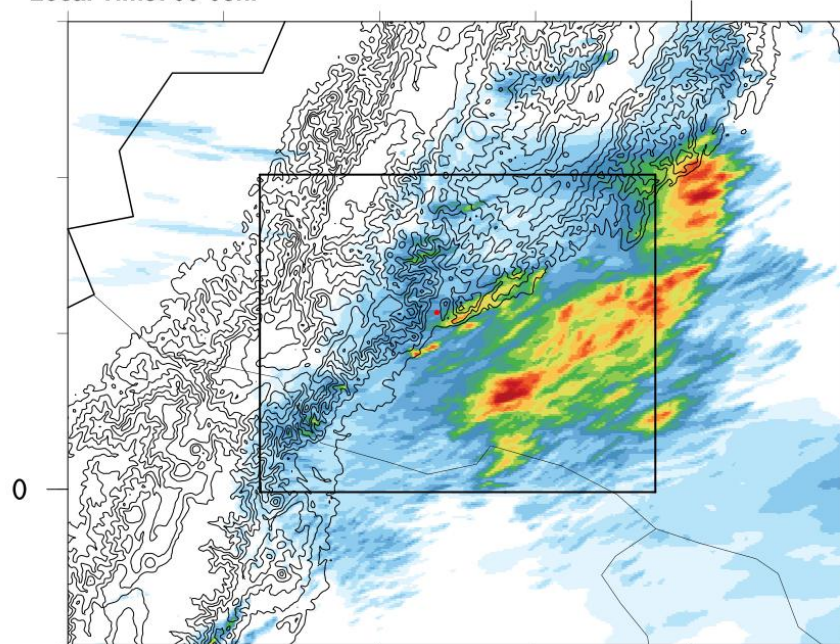
75W



1 2 4 8 12 16 20 24 30 40 50 60 70 80 90

WRF4.1.5 - 50L - nx=582 - ny=489
YSU-Noah-RRTMG-Morrison

WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:MYNN
RUN Time: 2017-03-31_00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



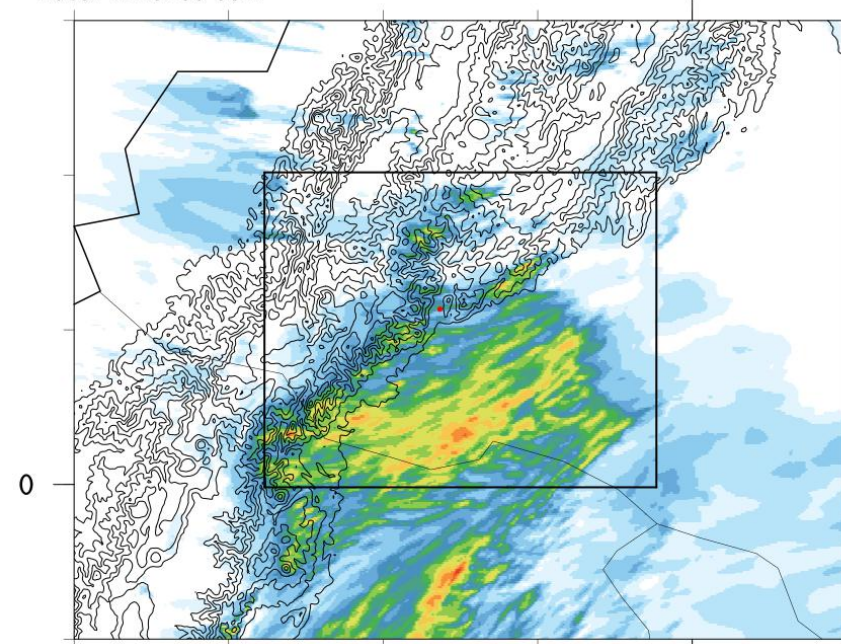
75W



1 2 4 8 12 16 20 24 30 40 50 60 70 80 90

WRF4.1.5 - 50L - nx=582 - ny=489
MYNN-Noah-RRTMG-Morrison

WRF-ERA5 RAINACC (mm), d03-1.3km, PBL:QNSE
RUN Time: 2017-03-31_00:00UTC
ACC Time: 2017-04-01, 05-11UTC
Local Time: 00-06hr



75W



1 2 4 8 12 16 20 24 30 40 50 60 70 80 90

WRF4.1.5 - 50L - nx=582 - ny=489
QNSE-Noah-RRTMG-Morrison

- Substantial 6-hour accumulated precipitation over Andes-Amazon region (convergence/blocking).
- In this case, smaller precipitation maxima over the Andes with MYNN.



**UNIVERSIDAD
DE ANTIOQUIA**
Facultad de Ingeniería