

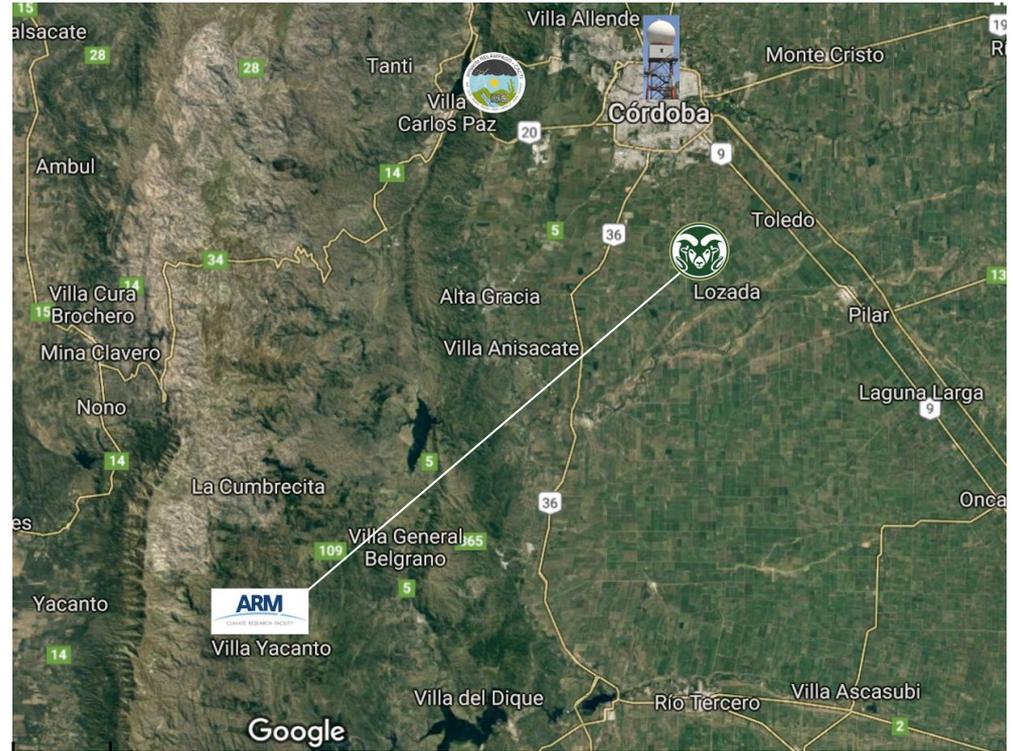
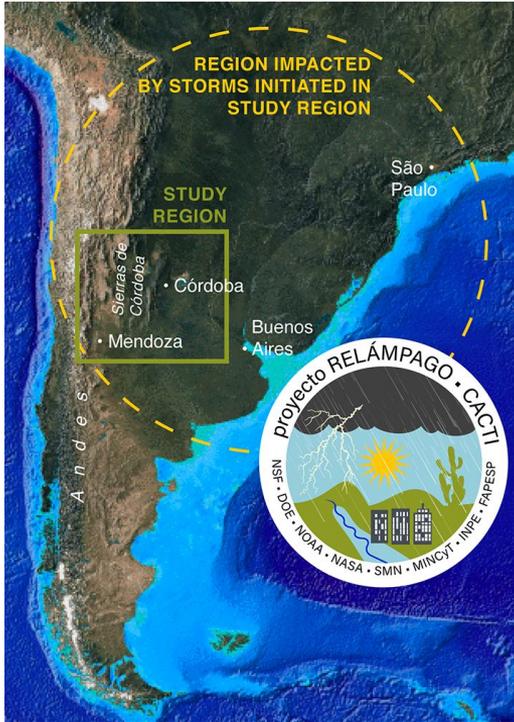
Dual Radar Time Sequence Observation of Convective Initiation over Sierras de Cordoba during RELAMPAGO field campaign - Dec 13-14 Case

Ivan Arias, V. Chandrasekar and Angela Rowe
AMS Mountain Conference
July 13th, 2020



Colorado State University

RELAMPAGO Location



RELAMPAGO and CSU-CHIVO



CHIVO
CSU-ARDEC site

Nov. 10, 2018 to Jan. 31, 2019
CHIVO traveling from Colorado to Córdoba



CHIVO
Córdoba - Argentina



C-band Hydrological Instrument for Volumetric Observation (CHIVO)

Dec 13-14 Case



courtesy F. Piscitelli

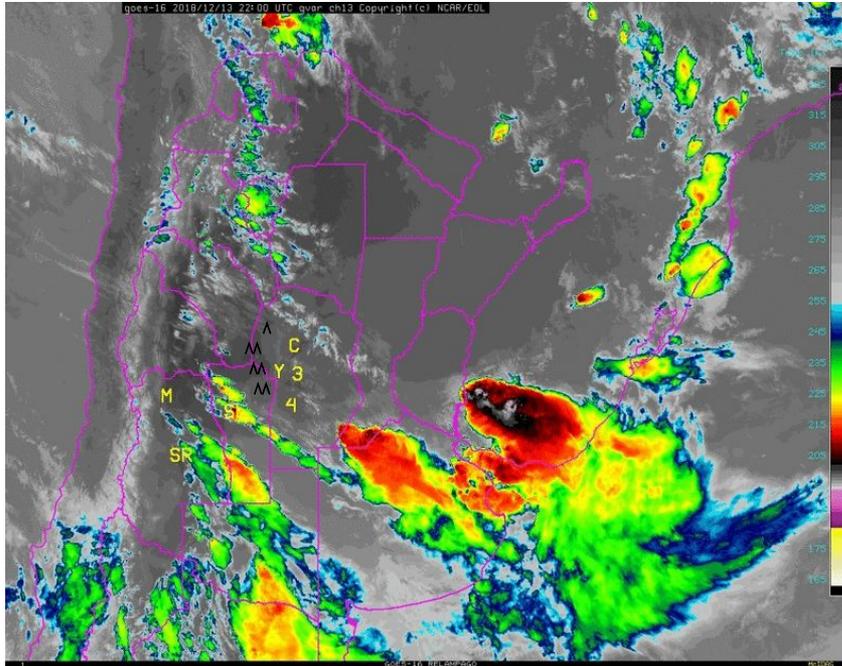
2018/12/13-14 Storm



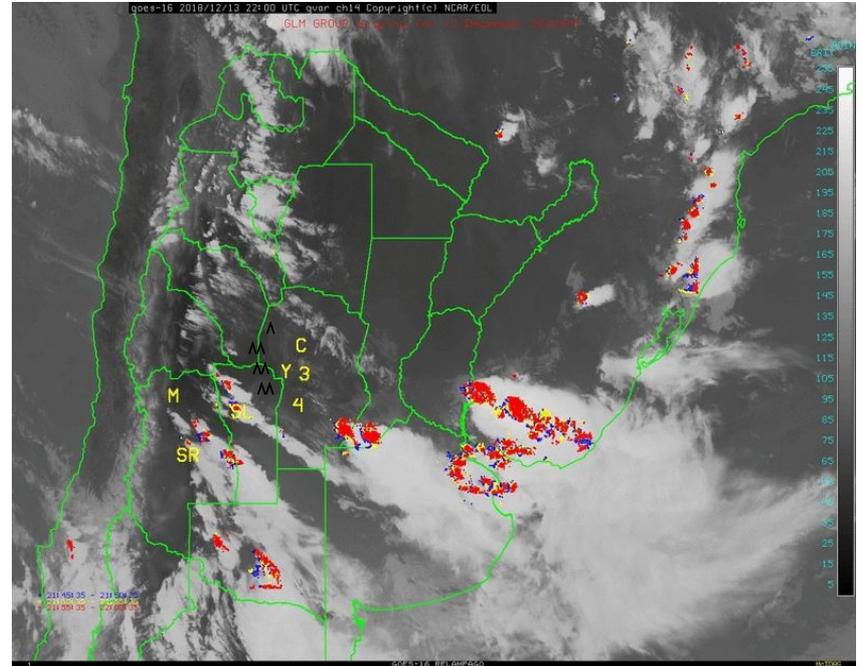
Hail reported in social media

Case: 2018/12/13 ~22:00 UTC

GOES-16 Ch. 13: Clean Window



GOES-16 Ch. 14 and GLM

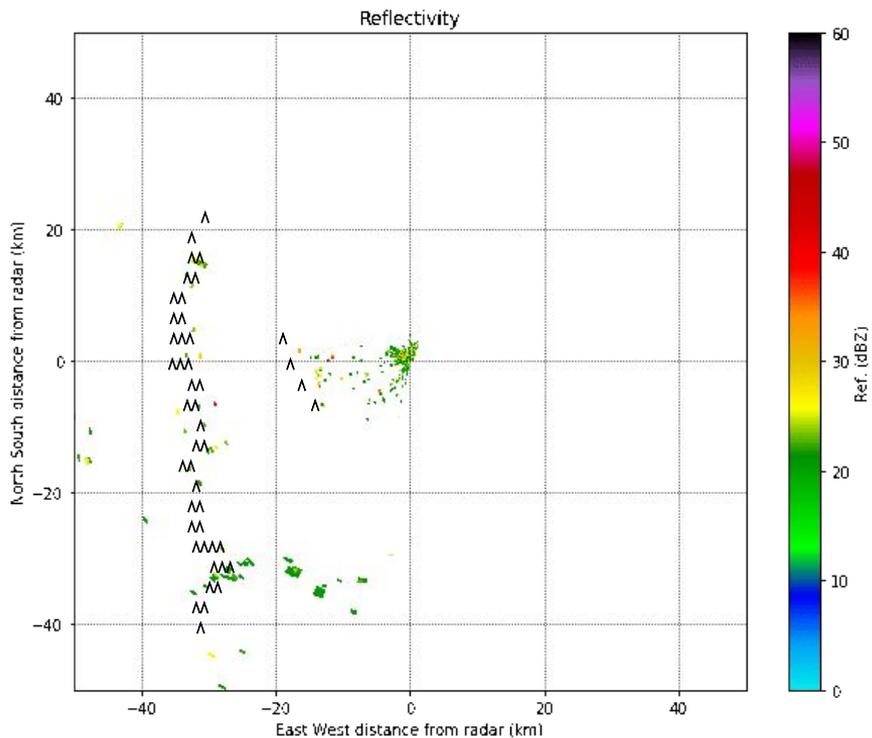


Outline

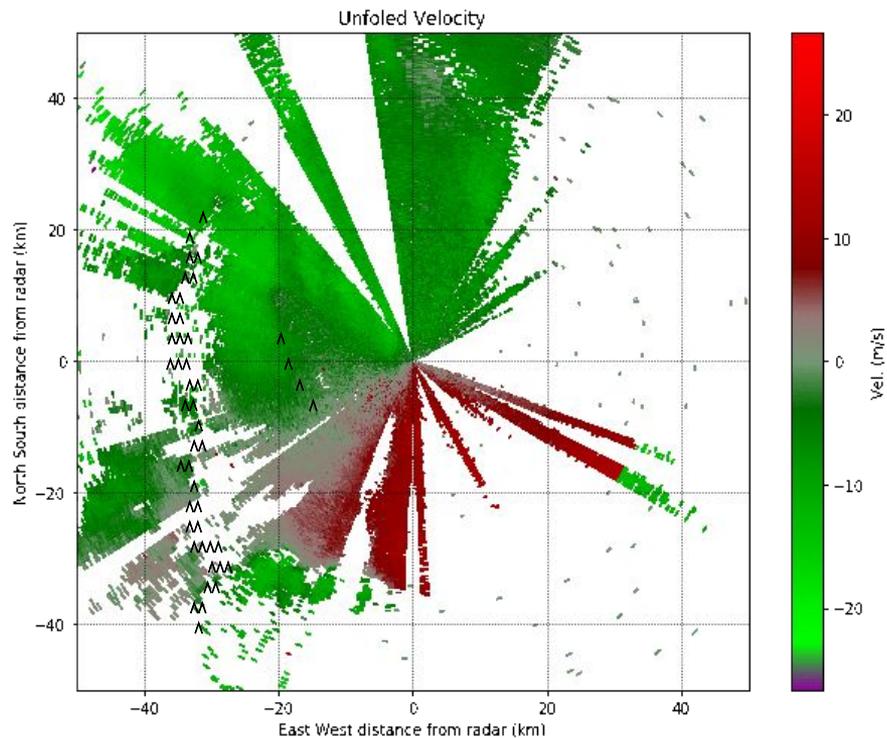
- Boundary evolution
- Time sequence of the initiation
- Dual pol. evolution
- Insight from dual Doppler winds and hydrometeor classification

Boundary Evolution

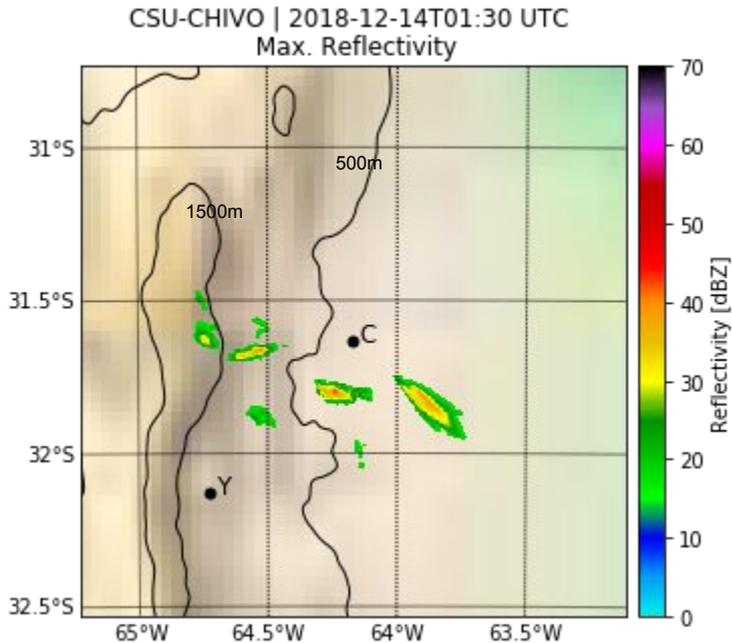
CSU-CHIVO| Elevation: 0.5 Deg.| 2018-12-14T00:30:44



CSU-CHIVO| Elevation: 0.5 Deg.| 2018-12-14T00:30:44



Challenges for CI observation

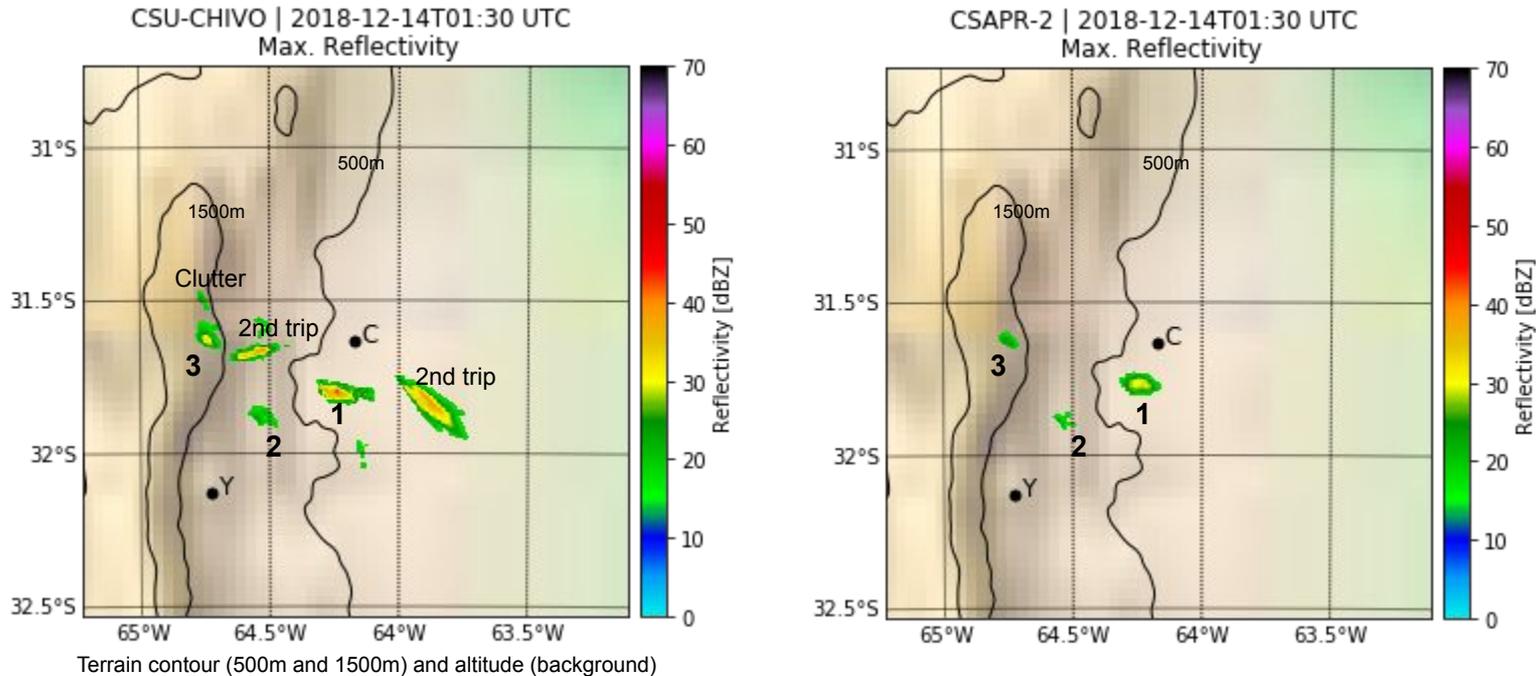


Terrain contour (500m and 1500m) and altitude (background)

Y: CSARP-2 at Yacanto site

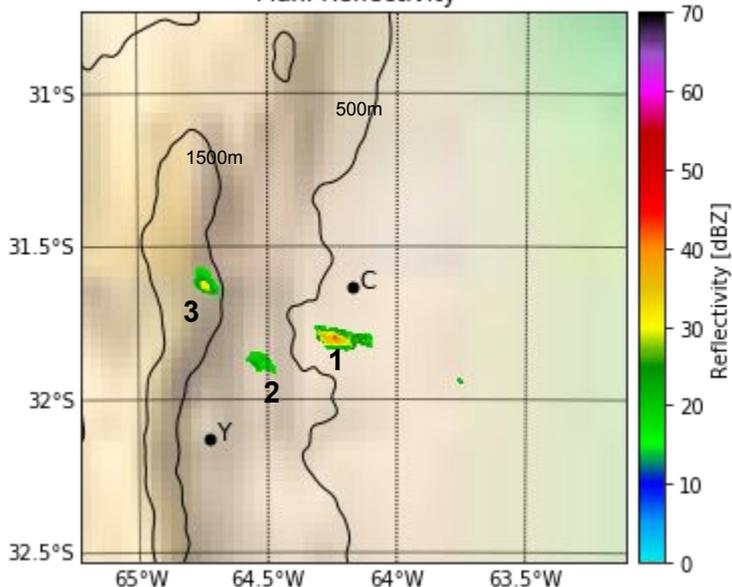
C: CSU-CHIVO South Cordoba City

Challenges for CI observation



01:30 UTC

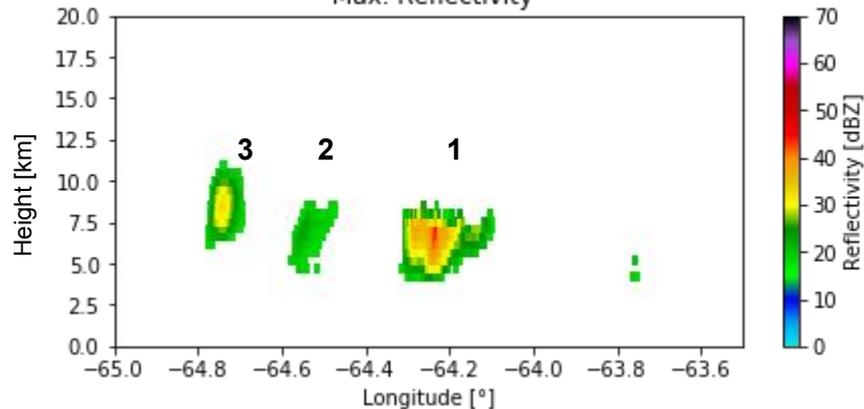
CSU-CHIVO | 2018-12-14T01:30 UTC
Max. Reflectivity



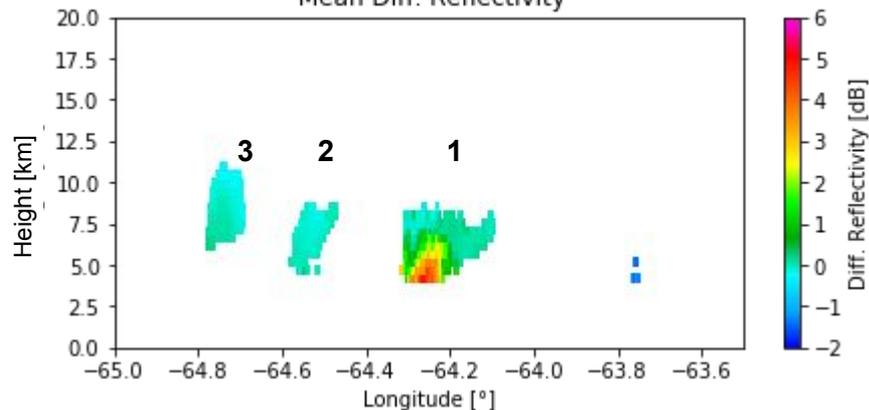
Terrain contour (500m and 1500m) and altitude (background)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

CSU-CHIVO | 2018-12-14T01:30 UTC
Max. Reflectivity

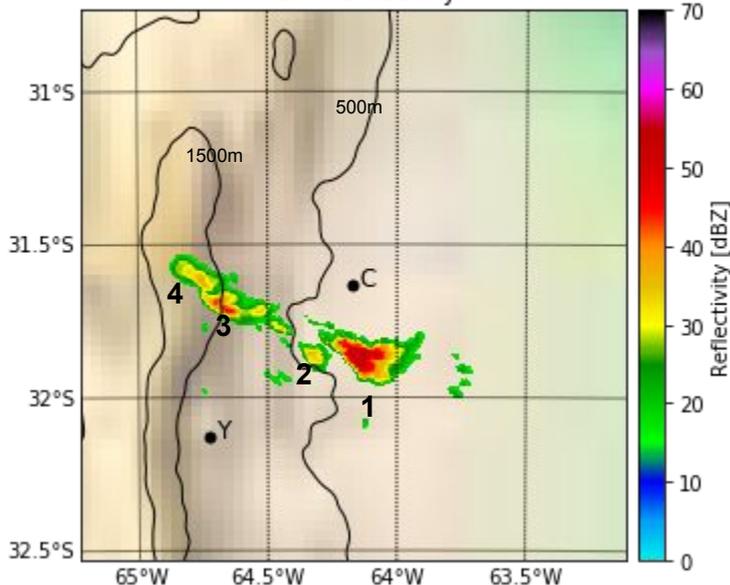


CSU-CHIVO | 2018-12-14T01:30 UTC
Mean Diff. Reflectivity



01:40 UTC

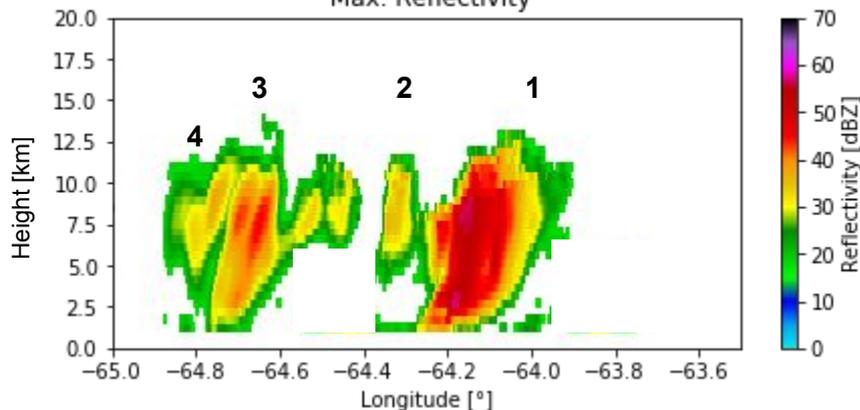
CSU-CHIVO | 2018-12-14T01:40 UTC
Max. Reflectivity



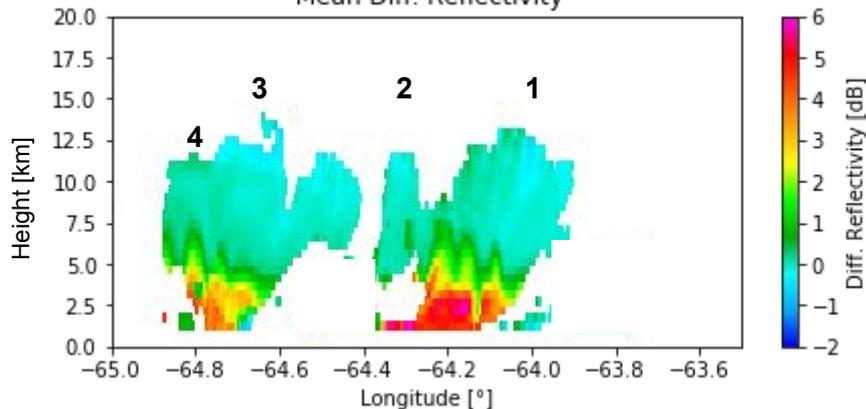
Terrain contour (500m and 1500m) and altitude (background)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

CSU-CHIVO | 2018-12-14T01:40 UTC
Max. Reflectivity

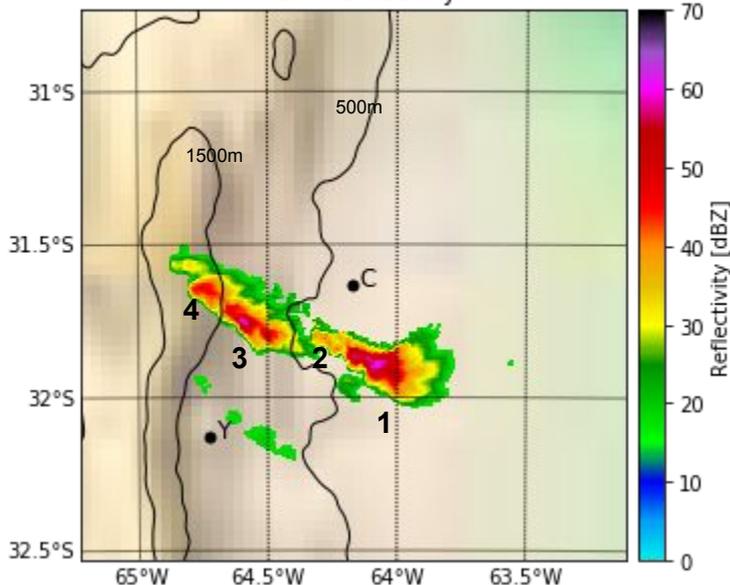


CSU-CHIVO | 2018-12-14T01:40 UTC
Mean Diff. Reflectivity



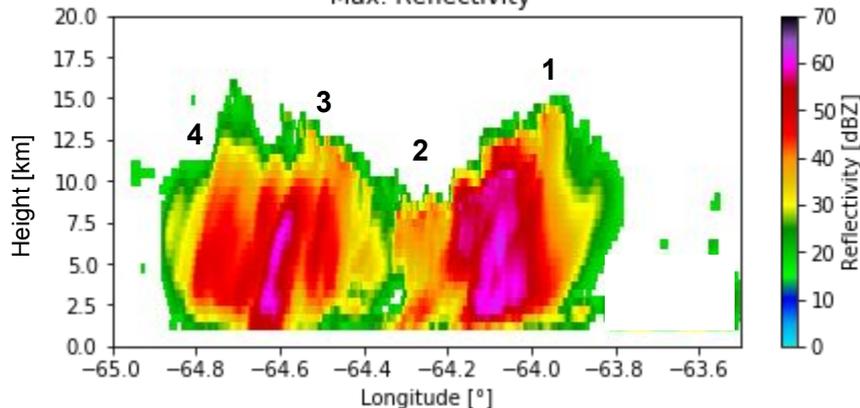
01:50 UTC

CSU-CHIVO | 2018-12-14T01:50 UTC
Max. Reflectivity

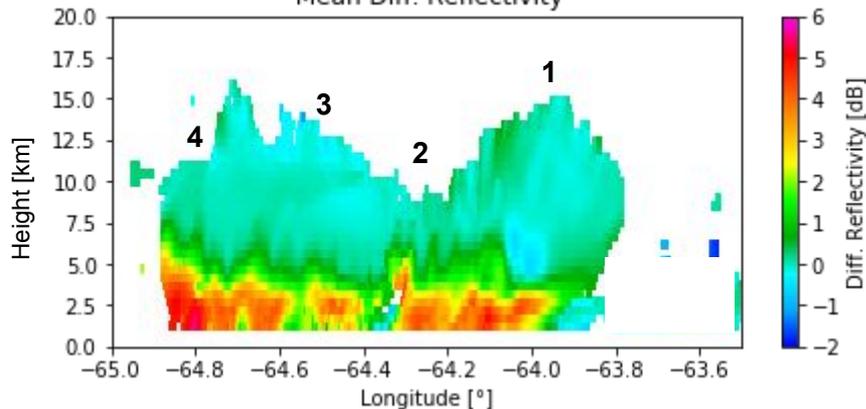


Terrain contour (500m and 1500m) and altitude (background)

CSU-CHIVO | 2018-12-14T01:50 UTC
Max. Reflectivity



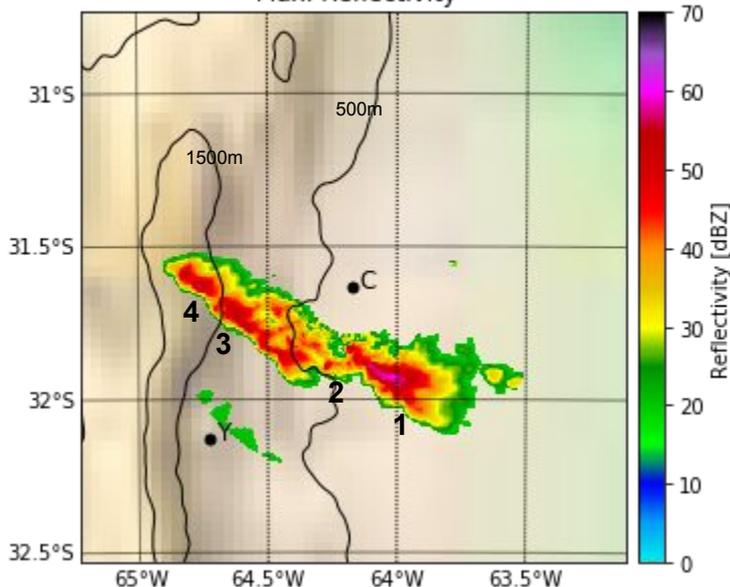
CSU-CHIVO | 2018-12-14T01:50 UTC
Mean Diff. Reflectivity



Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

02:00 UTC

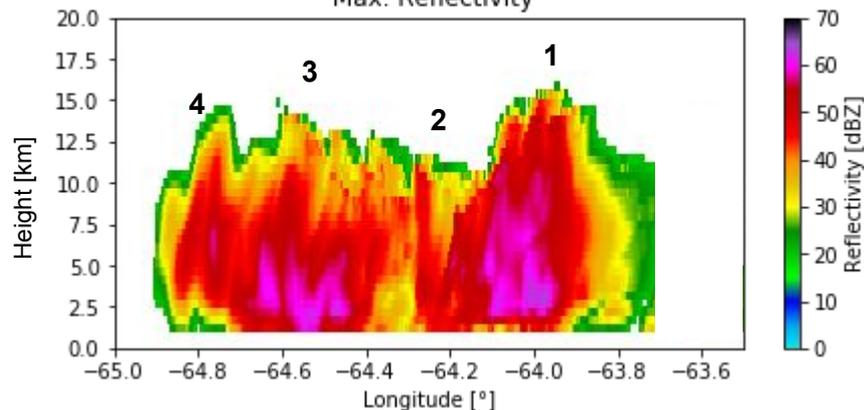
CSU-CHIVO | 2018-12-14T02:00 UTC
Max. Reflectivity



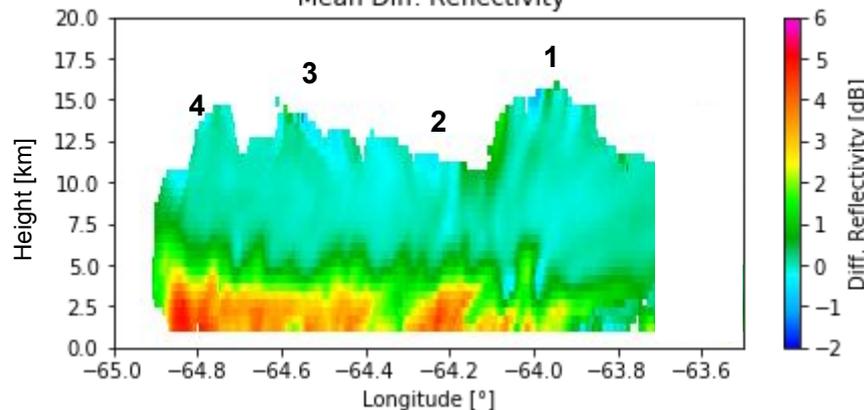
Terrain contour (500m and 1500m) and altitude (background)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

CSU-CHIVO | 2018-12-14T02:00 UTC
Max. Reflectivity

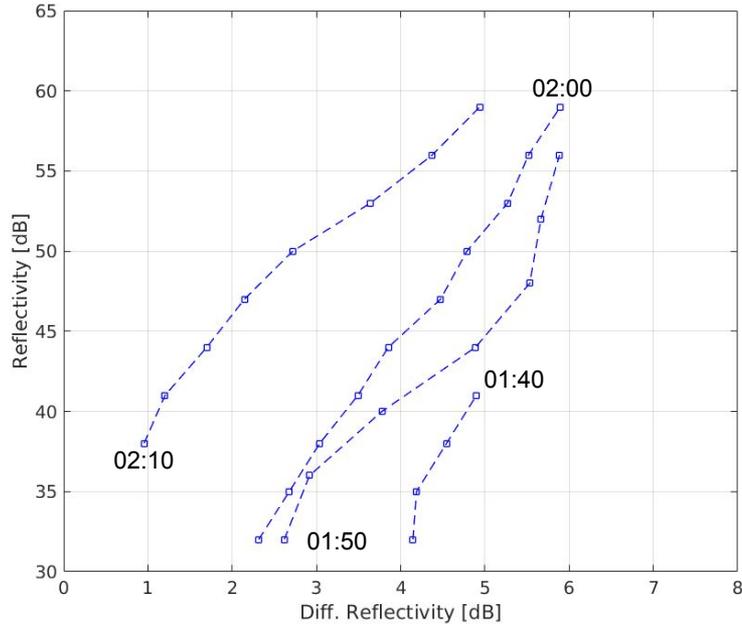


CSU-CHIVO | 2018-12-14T02:00 UTC
Mean Diff. Reflectivity

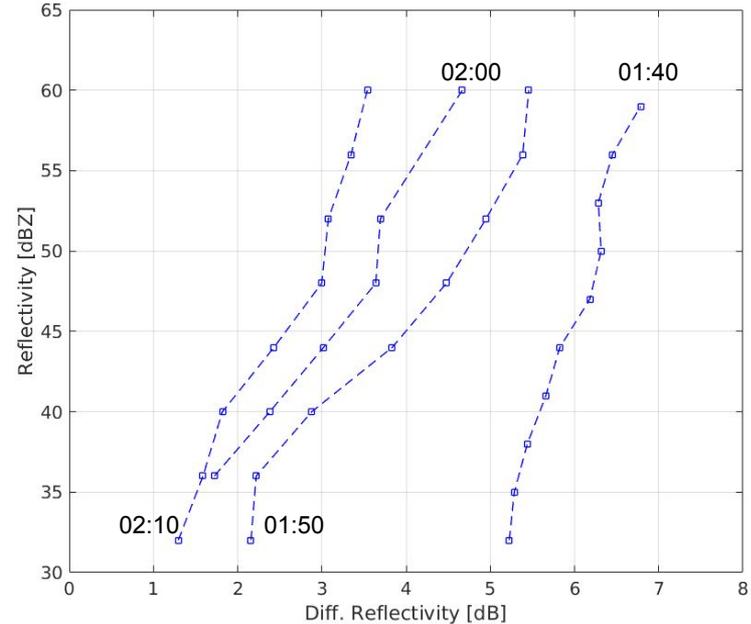


Evolution of Z_{dr} and Z per cell

Cell 3 (over the Sierras)



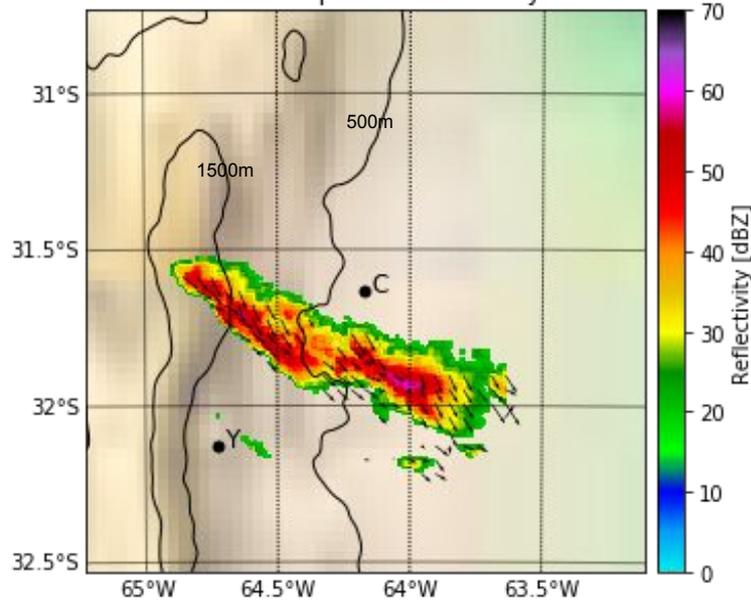
Cell 1 (over the plains)



Dual Doppler Winds (shear)

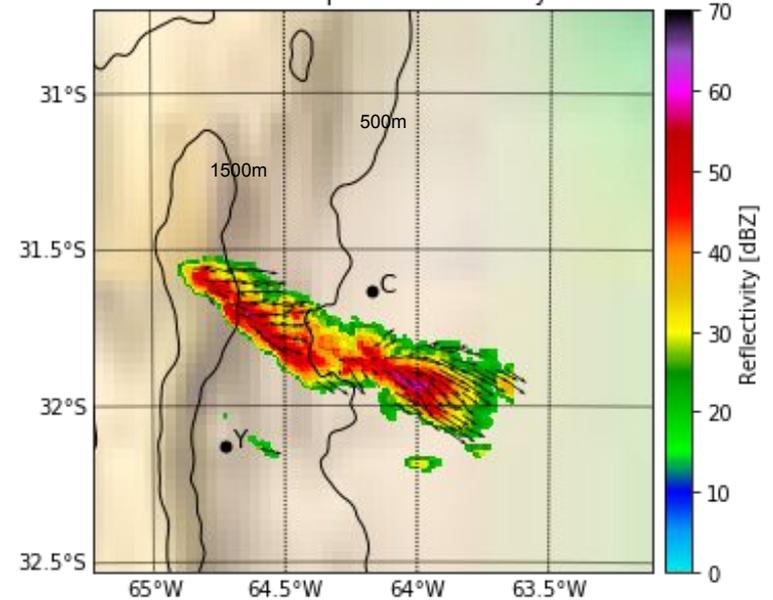
2km horizontal winds

CHIVO and CSARP | 2018-12-14T02:00 UTC
Max. Composite Reflectivity



10km horizontal winds

CHIVO and CSARP | 2018-12-14T02:00 UTC
Max. Composite Reflectivity



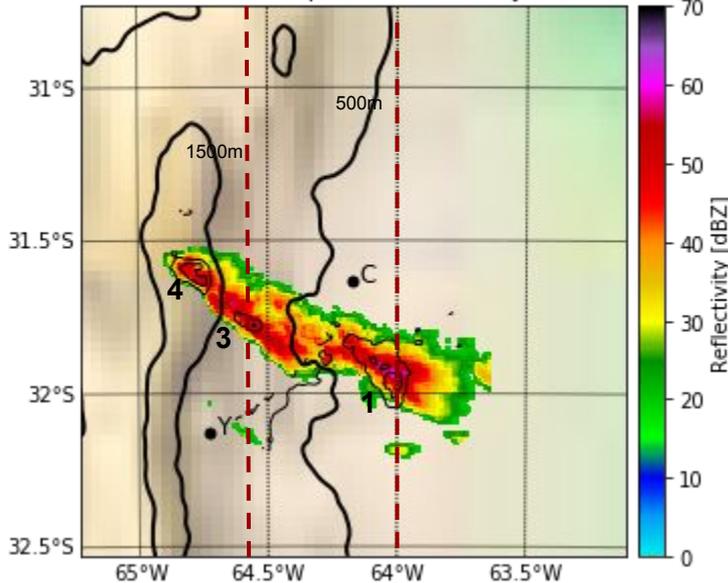
Terrain contour (500m and 1500m) and altitude (background)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

- Vertical Motion 10(m/s)

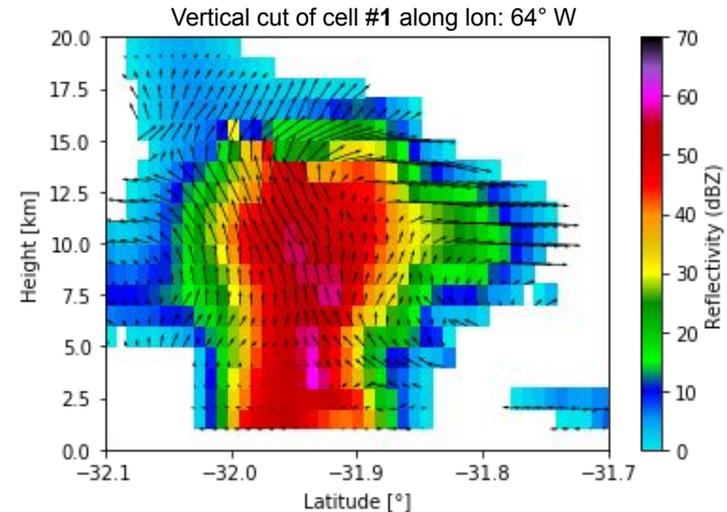
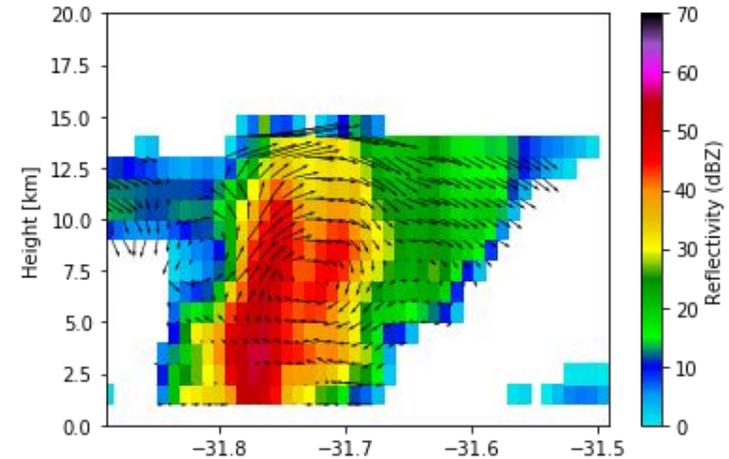
Dual Doppler Winds (updraft)

CHIVO and CSARP | 2018-12-14T02:00 UTC
Max. Composite Reflectivity



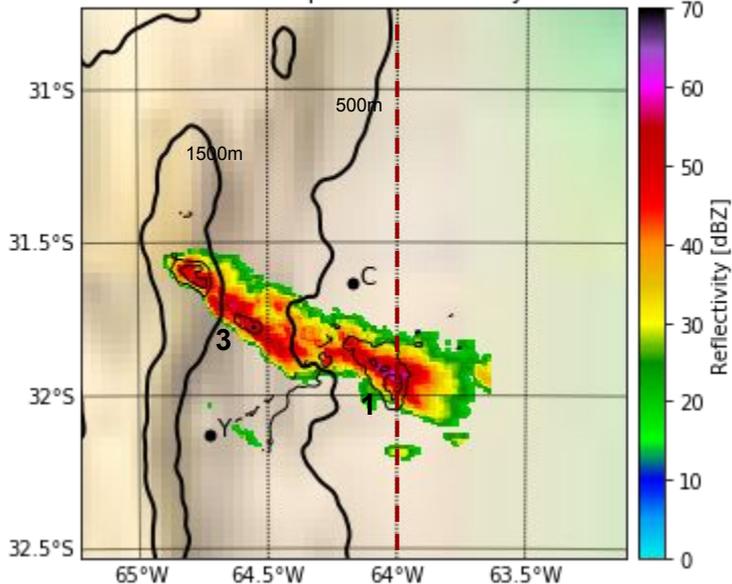
Terrain contour (500m and 1500m) and max. updraft contour (10 and 20m/s)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City



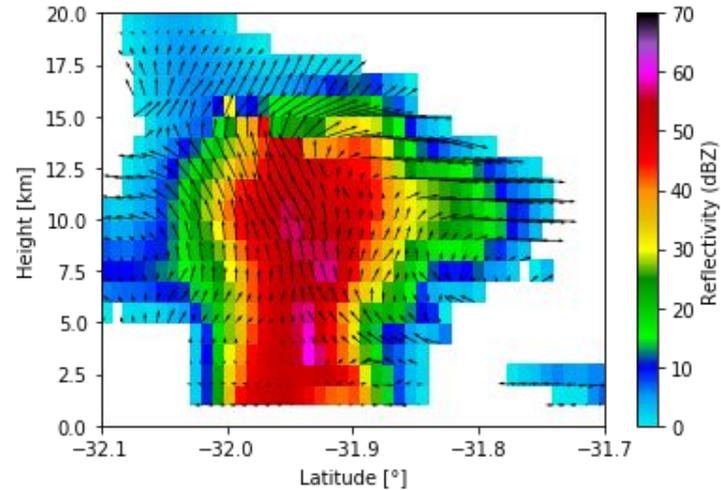
Dual Doppler and Hydroclass

CHIVO and CSAPR | 2018-12-14T02:00 UTC
Max. Composite Reflectivity

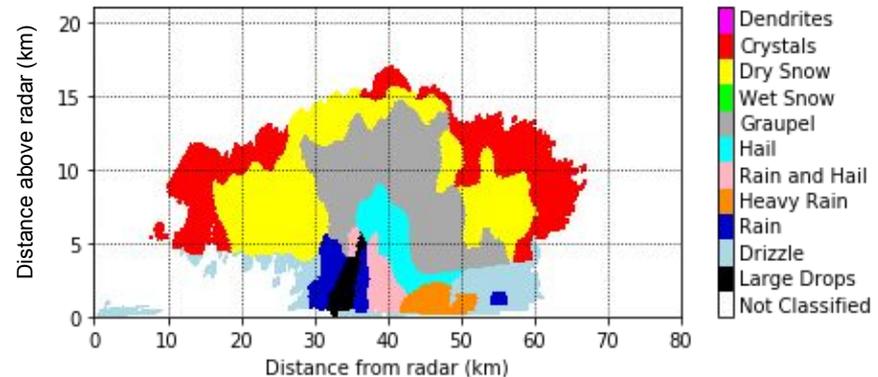


Terrain contour (500m and 1500m) and max. updraft contour (10 and 20m/s)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

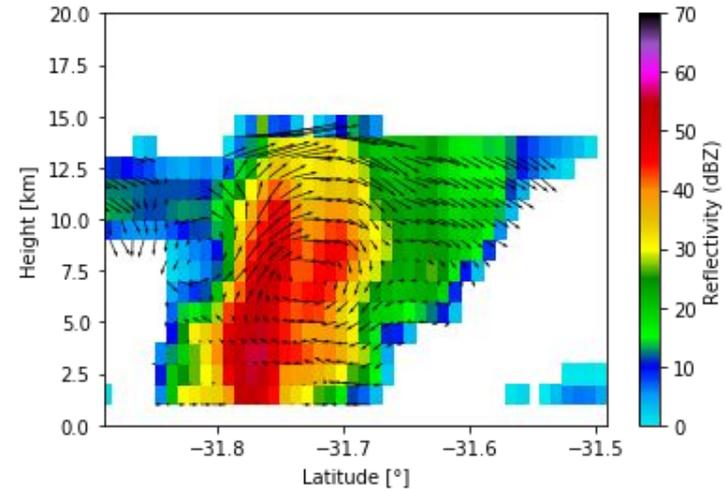


CSU-CHIVO | Azimuth: 152 deg. | 2018-12-14 2:07 UTC
Hydrometeor Classification

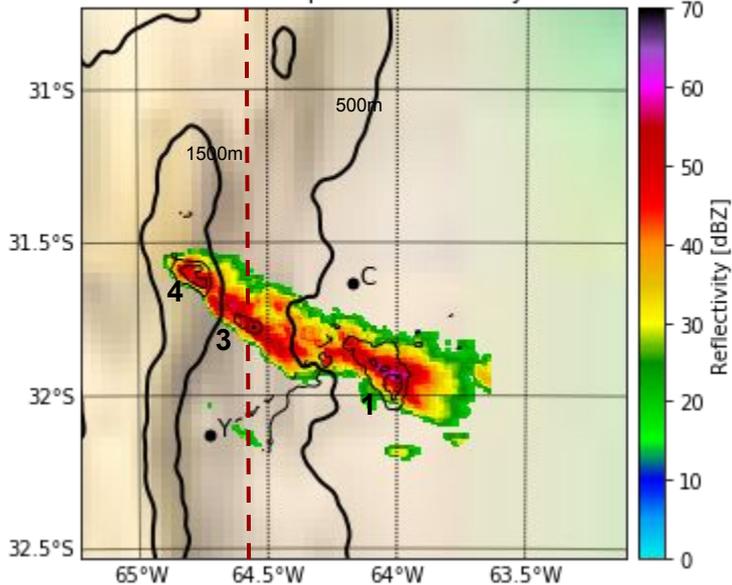


Dual Doppler and Hydroclass

→ Vertical Motion 10(m/s)



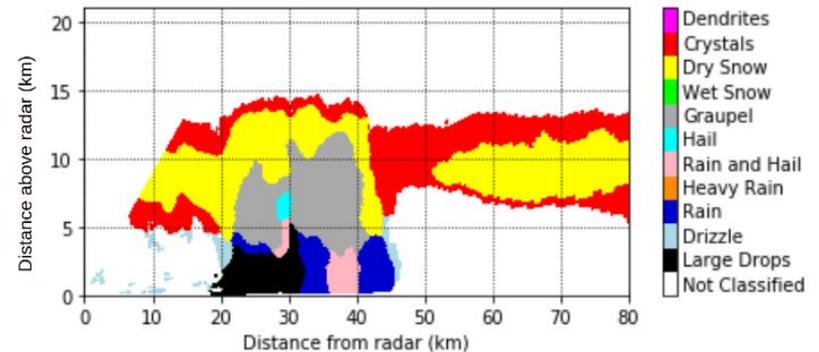
CHIVO and CSARP | 2018-12-14T02:00 UTC
Max. Composite Reflectivity



Terrain contour (500m and 1500m) and max. updraft contour (10 and 20m/s)

Y: CSARP-2 at Yacanto site
C: CSU-CHIVO South Cordoba City

CSU-CHIVO | Azimuth: 248 deg. | 2018-12-14 02:06 UTC
Hydrometeor Classification



Summary

- Low elevation scans from CHIVO show a boundary moving North before the convective initiation
- CSAPR is used to distinguished early echos from ground clutter and second trip on CHIVO observation
- A rapid transition between towering to mature phase of the cells was observed
- The terrain seems to play an important role in the growth of the cells
- Zdr column develops very fast
- Doppler winds show circulation of particles while hydrometeor classification shows significant hail production for this case

Acknowledgment

- This project is funded by the US National Sciences Foundation
- We thanks all the RELAMPAGO participants and leaders
- Python ARM Radar Toolkit, Py-ART
- Python Multi-Doppler Radar Analysis Suite, MultiDop