

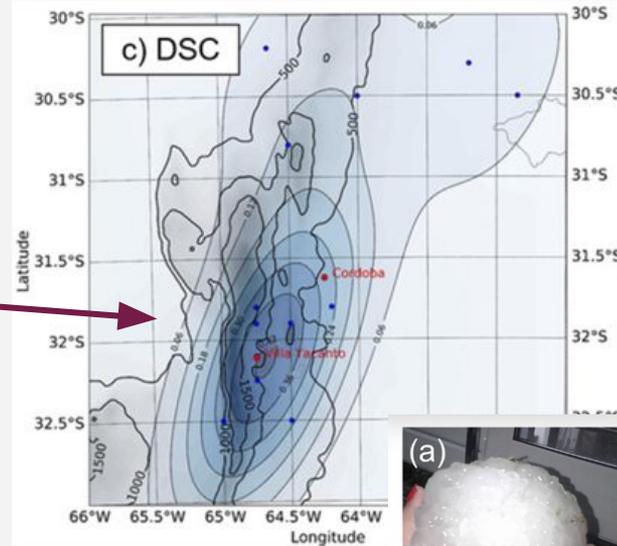
VI Convection-Permitting Climate Modeling Workshop
September 7-9 2022, Buenos Aires

Predictability of a supercell using convection-permitting ensemble simulations in Argentina

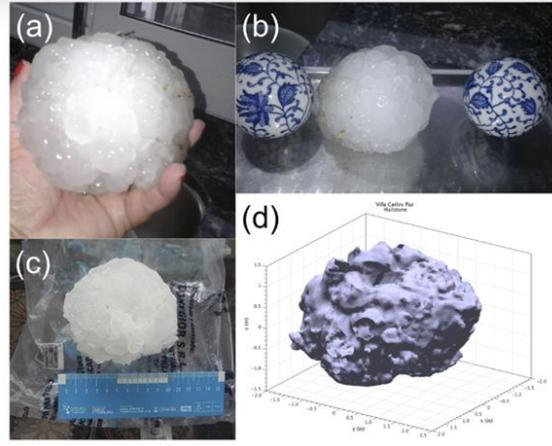
Milagros Alvarez Imaz, Paola Salio,
María Eugenia Dillon, Lluís Fita and Diego Saúl Carrió Carrió



Motivation

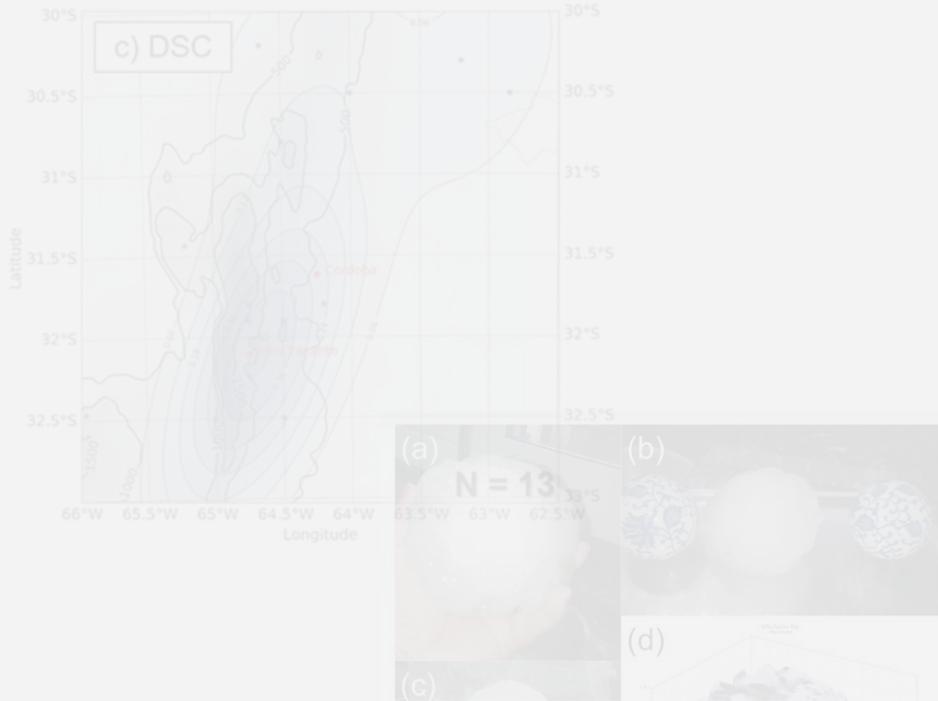


Spatial distribution of supercell initiations identified with Cordoba radar data (Mulholland et al., 2018).

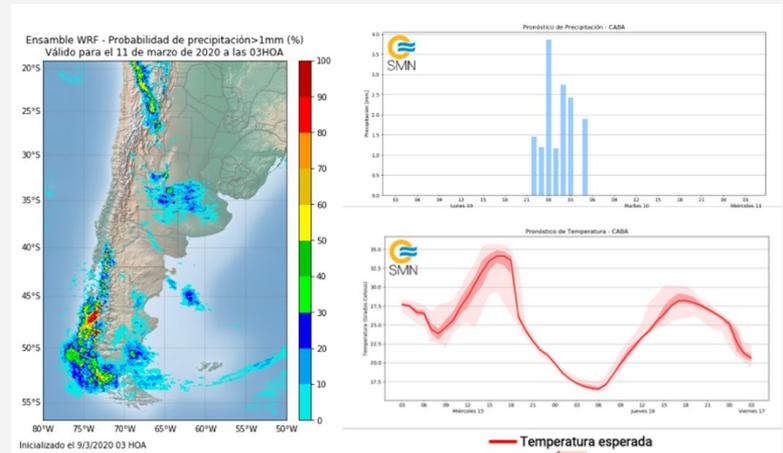
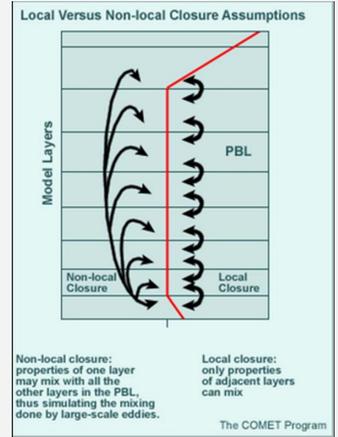
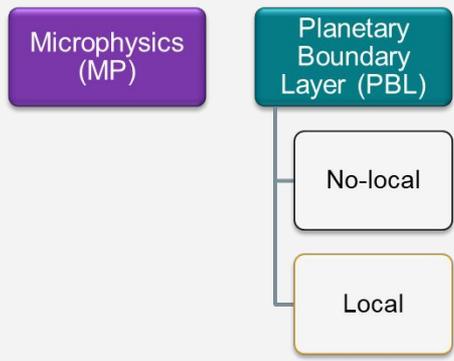


Kumjian et al., 2020

Motivation



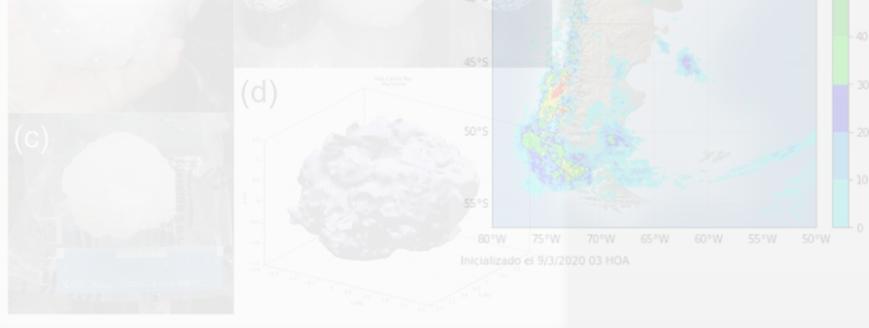
The National Meteorological Service of Argentina runs a 20-member operative ensemble initialized with the GFS/GEFS (Dillon et al., 2020).



Objective

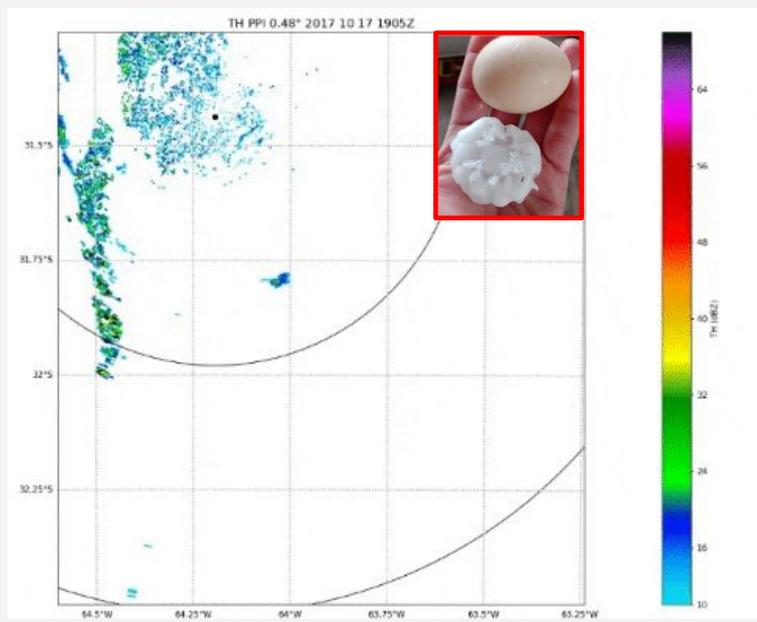


To study the predictability of the environment, CI and supercell organization of a case study using GEFs and ECMWF ensemble forecasts as initial and boundary conditions.



Case of study - Supercell convective initiation (CI)

Córdoba radar - RMA1

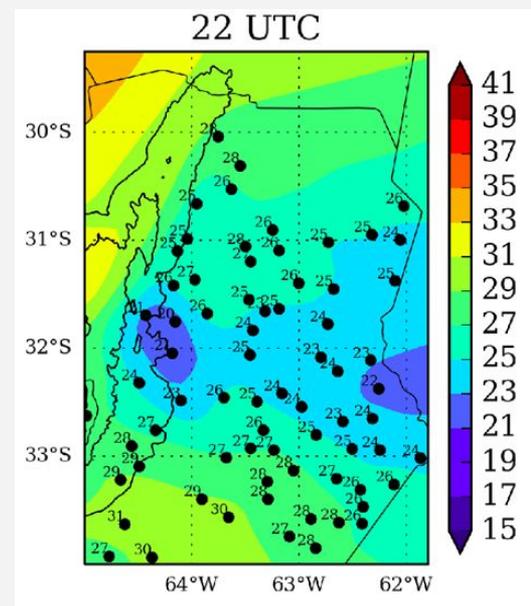


CI → 17/10/2017 19:26 UTC

Supercell: two splittings

One severe report from social media

Surface Stations



Cold pool detected with surface stations

Surface warm front main mechanism

Experimental Set-Up

WRF
V3.9.1.1

3km
convective-permitting
15 min
60 levels
24 h
Ini: 00 UTC

Initial and boundary conditions:
ensemble of 20 members

GEFS

50 km

ECMWF

18 km

MP and PBL parameterizations

Morrison-MYJ

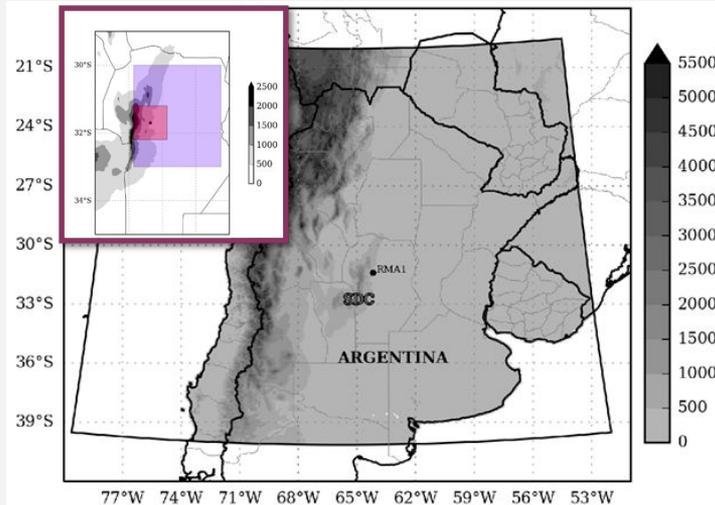
2M-local

Thompson-YSU

2M-no local

WSM6-YSU

1M-no local

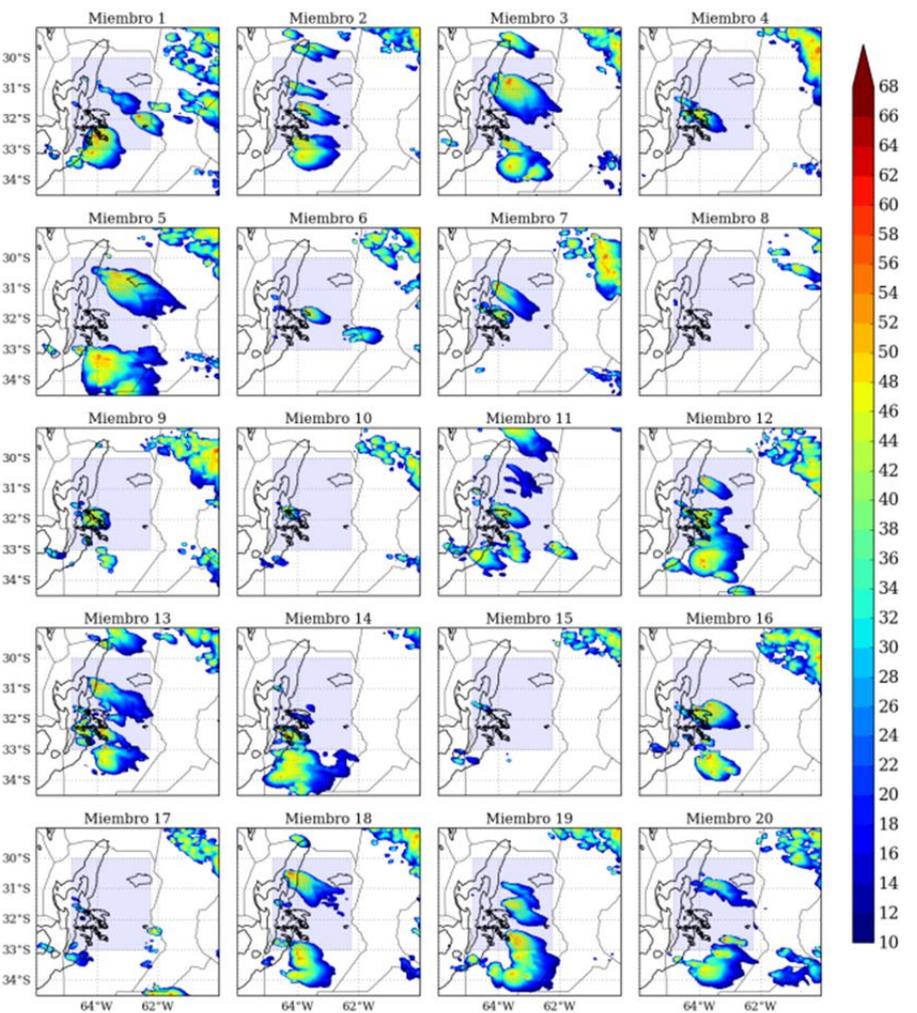


Lambert Conformal: 800 x 750 (WE x NS)

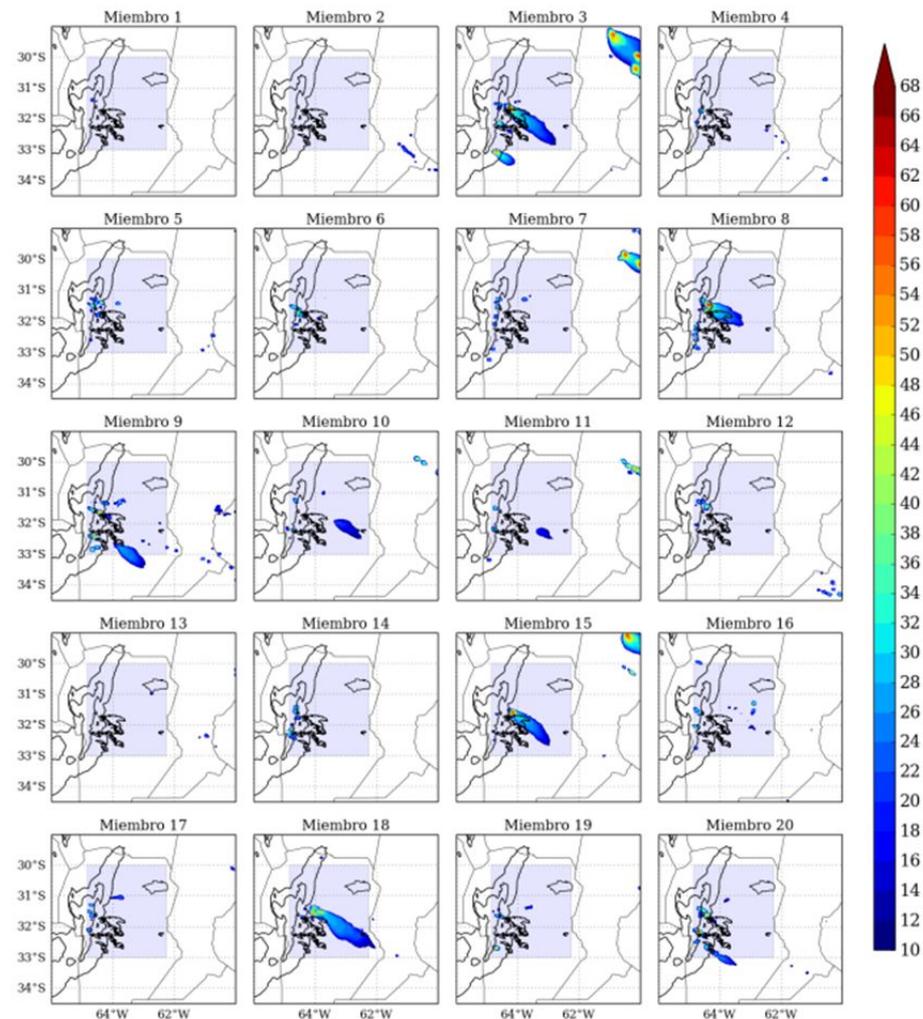
The selected parameterizations had a good performance for this case study in deterministic experiments (Alvarez Imaz et al., 2020).

EMM	ETY	EWY
GMM	GTY	GWY

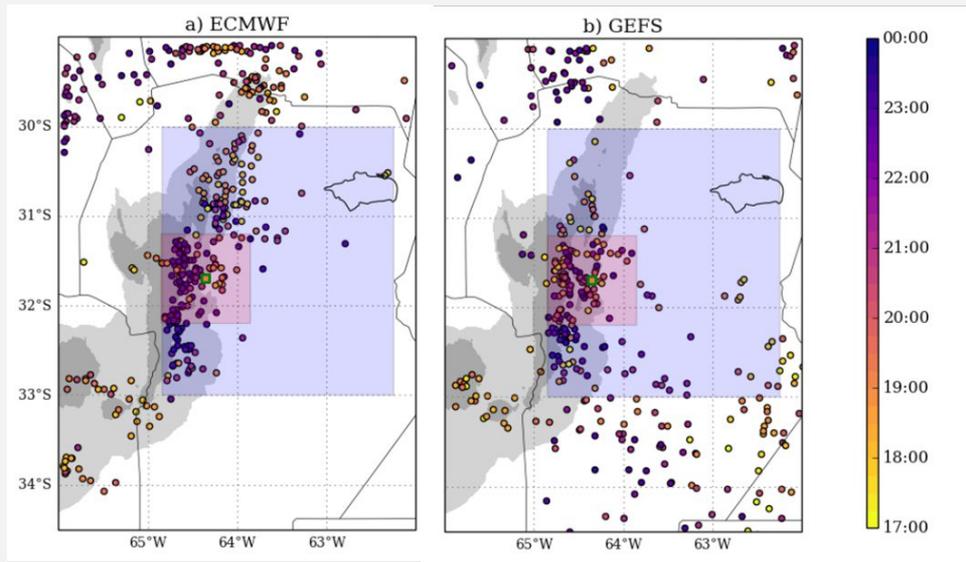
GMM - COLMAX [dBZ] - 20171017 20 UTC



ETY - COLMAX [dBZ] - 20171017 23 UTC



Results

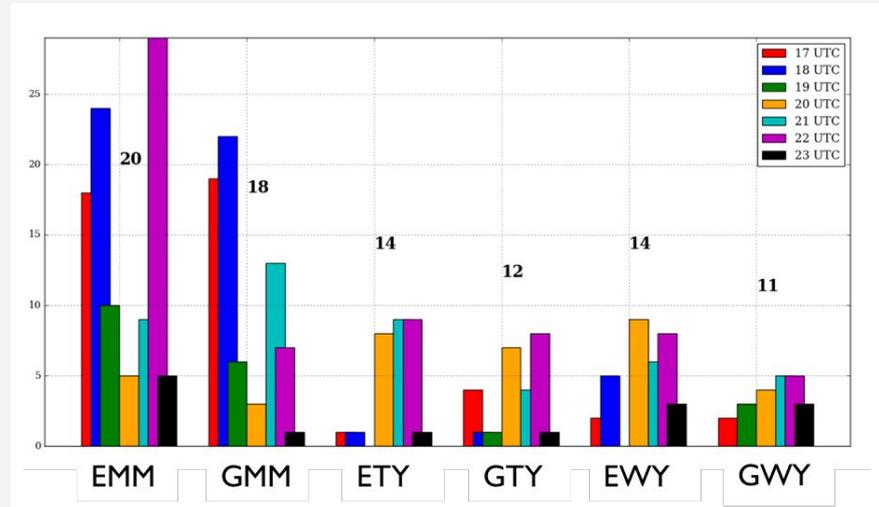


MYJ CI in most members and before observation
YSU CI in less members than MYJ and after observation

Based on BAB3T algorithm of Cancelada et al., 2020

ECMWF CI over topography
GEFS CI over topography and plains

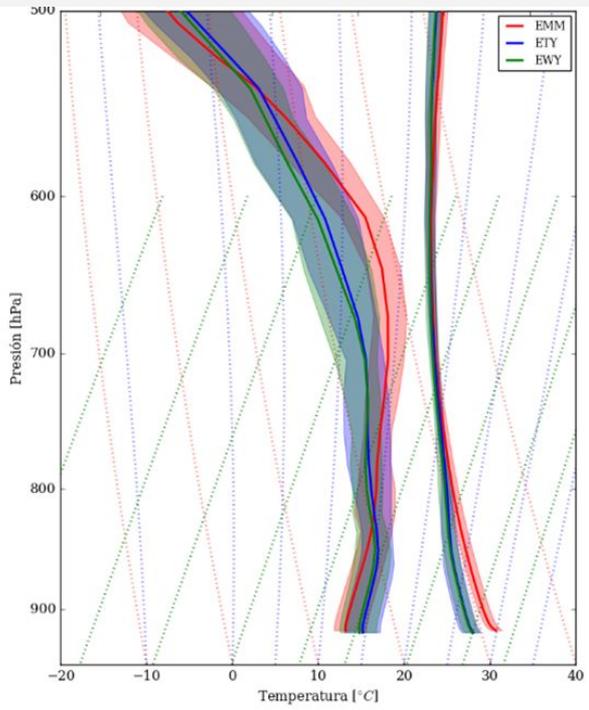
Blue area



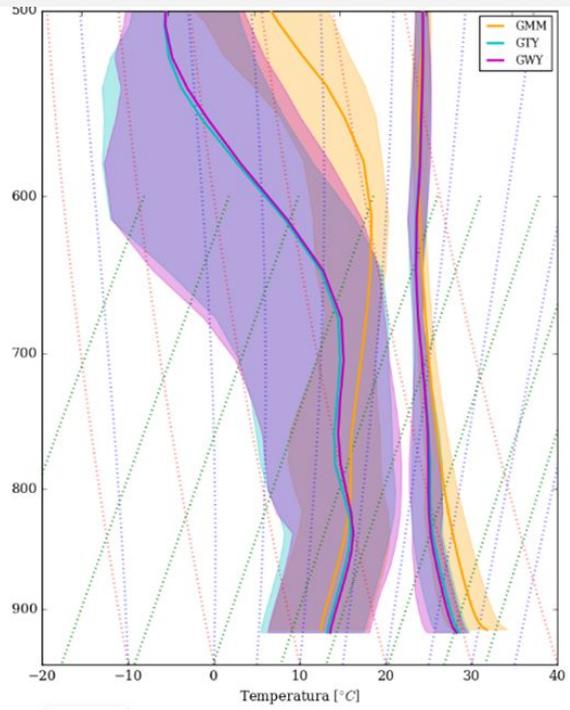
Results

ECMWF 18 UTC

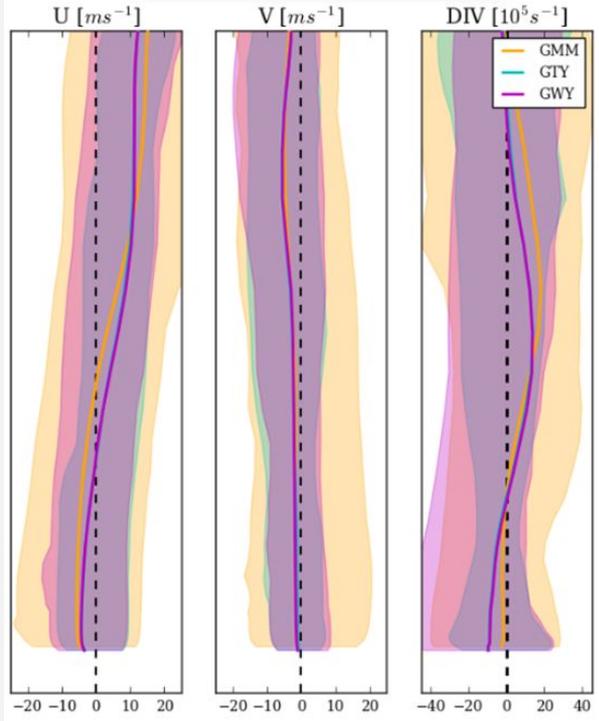
Red area



GEFS 18 UTC



GEFS 18 UTC



Most difference in Td
High spread for GEFS ensembles

Convergence due to
eastern wind

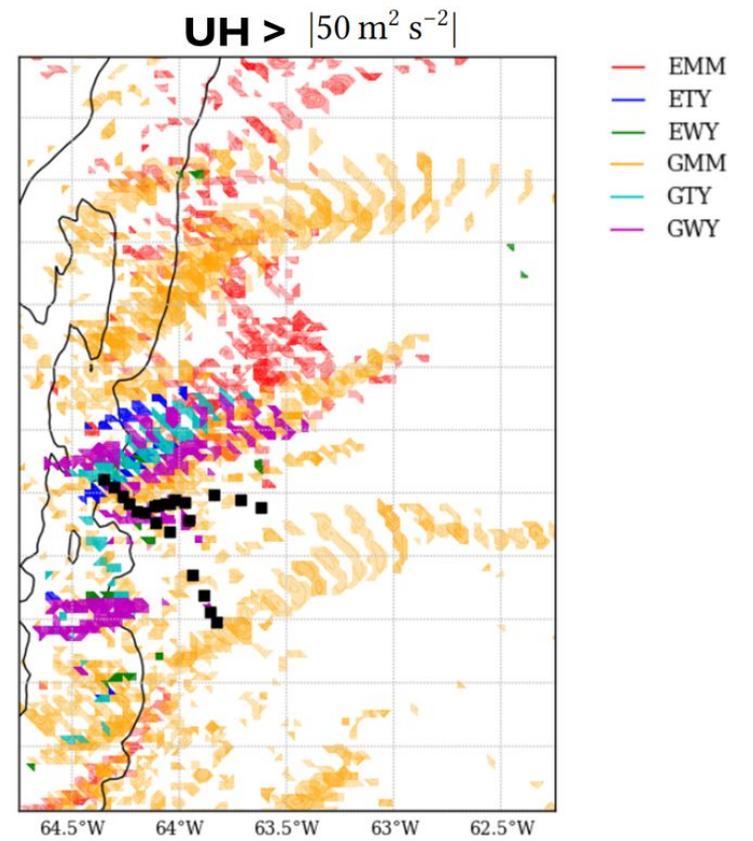
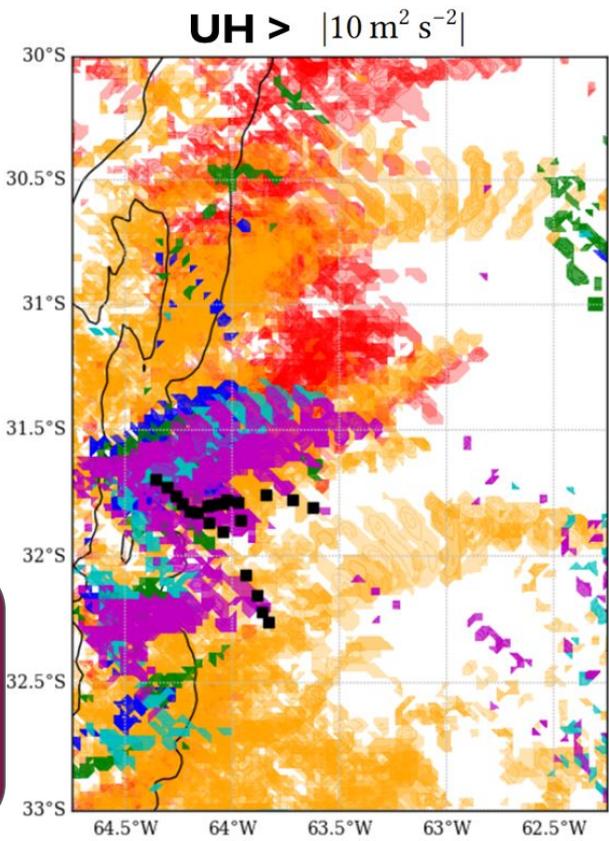
Results

Between 15 and 00 UTC

Updraft helicity (UH)
between 2-5 km

$$\int_{z_0}^{z_1} w\zeta dz$$

High predictability
of the supercell's
trajectory specially
for YSU
configurations



Summary

- A large number of CIs were resolved in the topography for the ECMWF ensembles and in the topography and plains for the GEFS ensembles. As for the CI times, they were later than the observed time, with the exception of the Morrison-MYJ configuration where members resolved a large number of CIs prior to 19 UTC.
- With some differences between the sets of simulations, **the ensembles show a high predictability of the environment resolving high values of MUCAPE and low values of NCL to the east and over the SDCs, which favors the CI.** The biggest challenge is at the local scale, where mesoscale circulations and small differences in the vertical profile of T and Td are determinant for CI in the region. Members with horizontal convergence at low levels due to a predominantly easterly wind and a moist and mixed T and Td profile are those that facilitated CI similar to the observation.
- Regarding the study of the predictability of the supercell trajectory, **the UH fields over time are a great tool to see the location and type of convective organization**, indicating that in the area near the observation there is a high probability of CI of a supercell with propagation similar to the observed one.

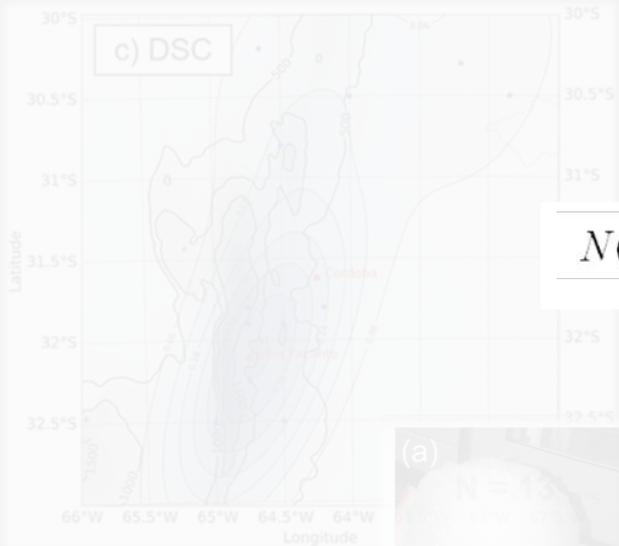
Future studies

- PBL parameterizations.
- Visualization of ensemble products.

Thank you!
malvarezimaz@smn.gob.ar



Motivation



$$N(D) = N_o D^\mu \exp^{-\lambda D}$$



The National Meteorological Service of Argentina runs a 20-member operative ensemble initialized with the GFS/GEFS (Dillon et al., 2020).

