Servicio Meteorológico Nacional
Argentina

Destructive convective system over Buenos Aires December 16-17, 2023

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The case as it developed

- A situation with a large, warm and moist, unstable air mass was forecast several days in advance by the main global models.
- It was a case of divided attention because a severe system was forecast (and took place) a few days in advance

Alerta para el Sábado 16/12

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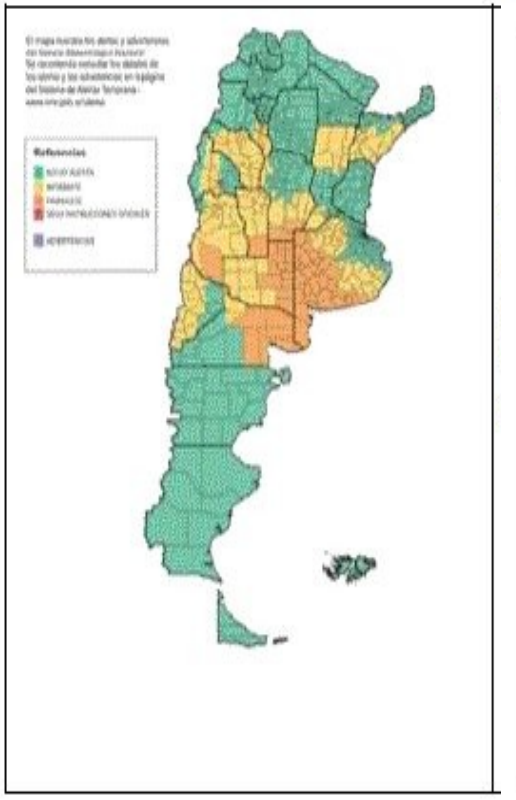
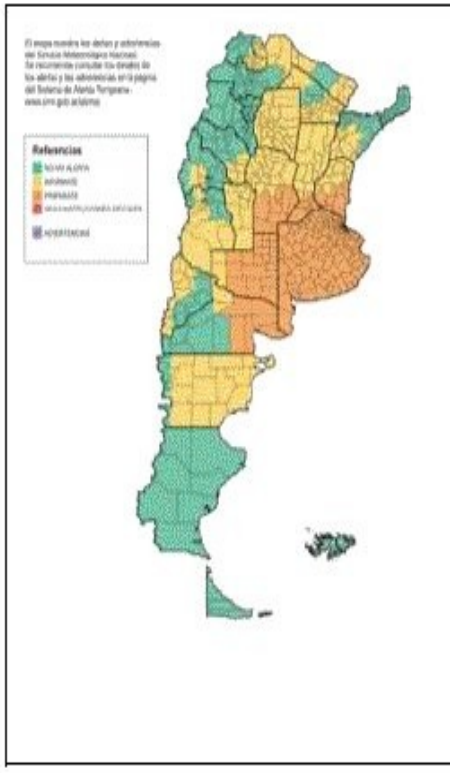


Alerta para el Domingo 17/12

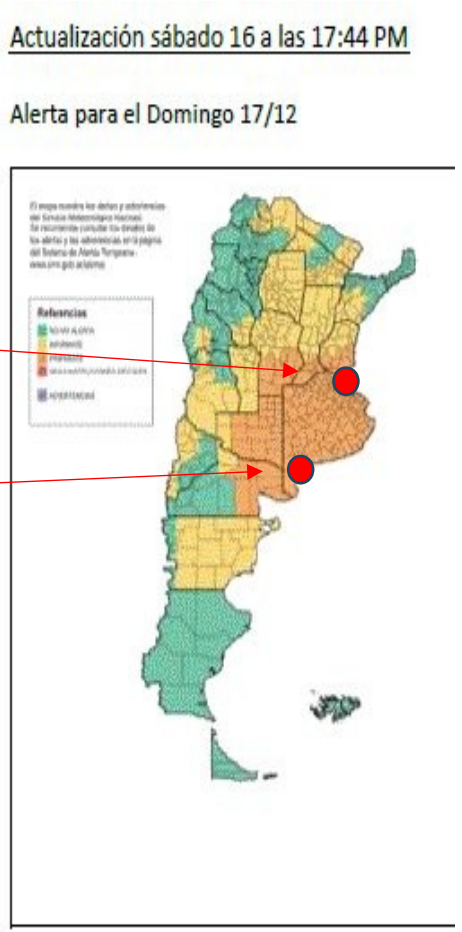


Thursday 0800hs **Friday 07:00hs** **Friday 19:00 hs** **saturday 17:00hs**

- Forecasters hesitated about the level of Alert (orange or red, they were inclined to orange)
- First week in office of the new president and minister

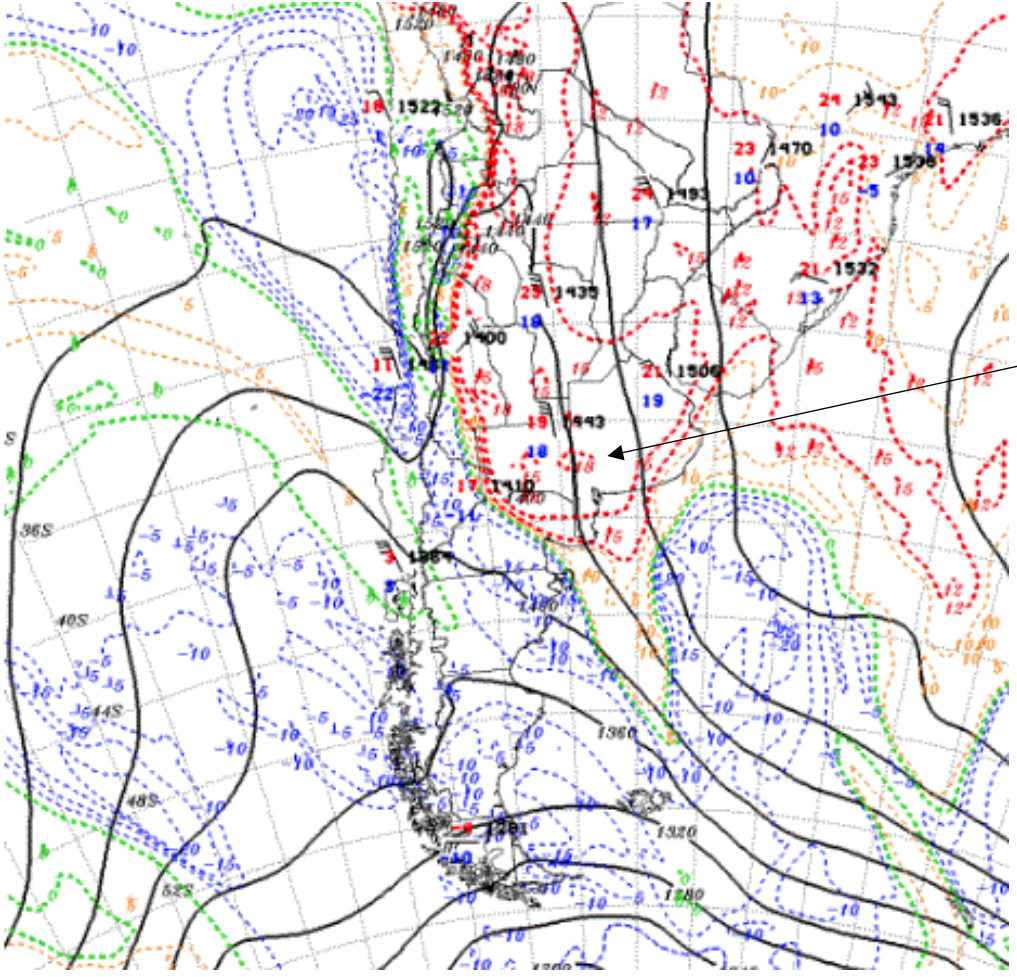
Buenos Aires, Sunday 17, 4 AM

Bahia Blanca, Saturday 16, 20 PM



The event first impacted Bahia Blanca in the South of the Province, then 700 km north in Buenos Aires

Analysis 850-hPa geopotential and Td isolines 9:00hs Saturday 16

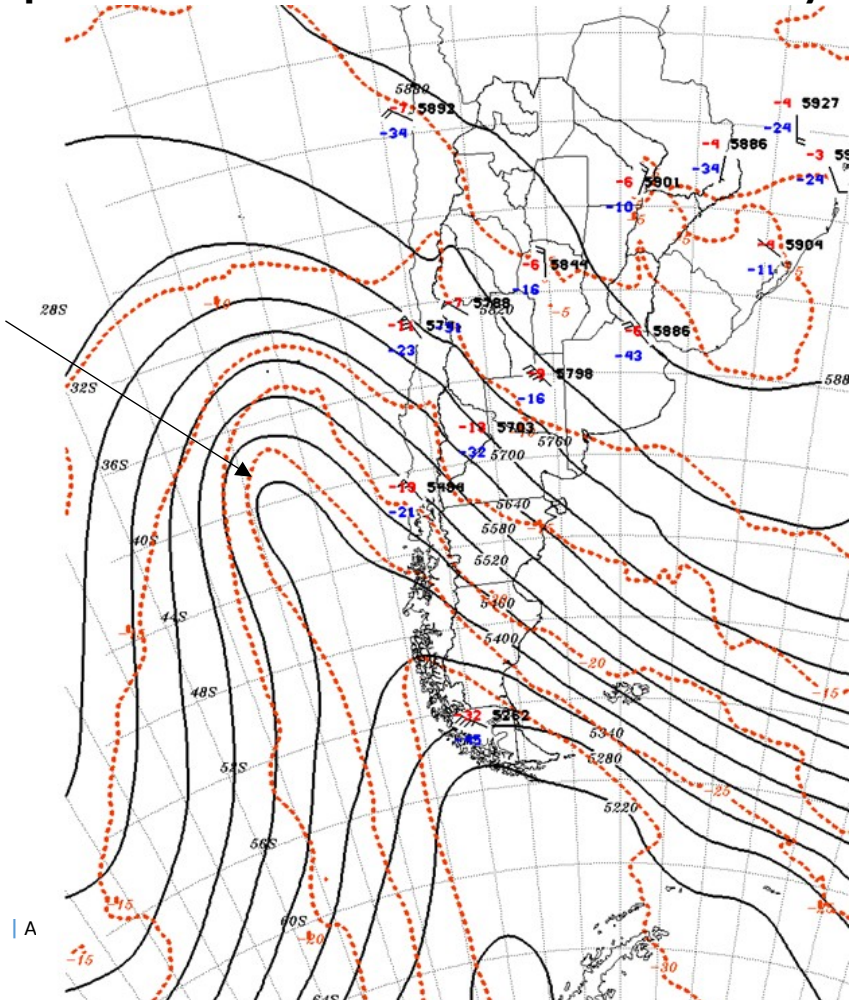


Warm and moist air (Td > 16°C in 850 hPa) was advected from several days before from northern to central Argentina

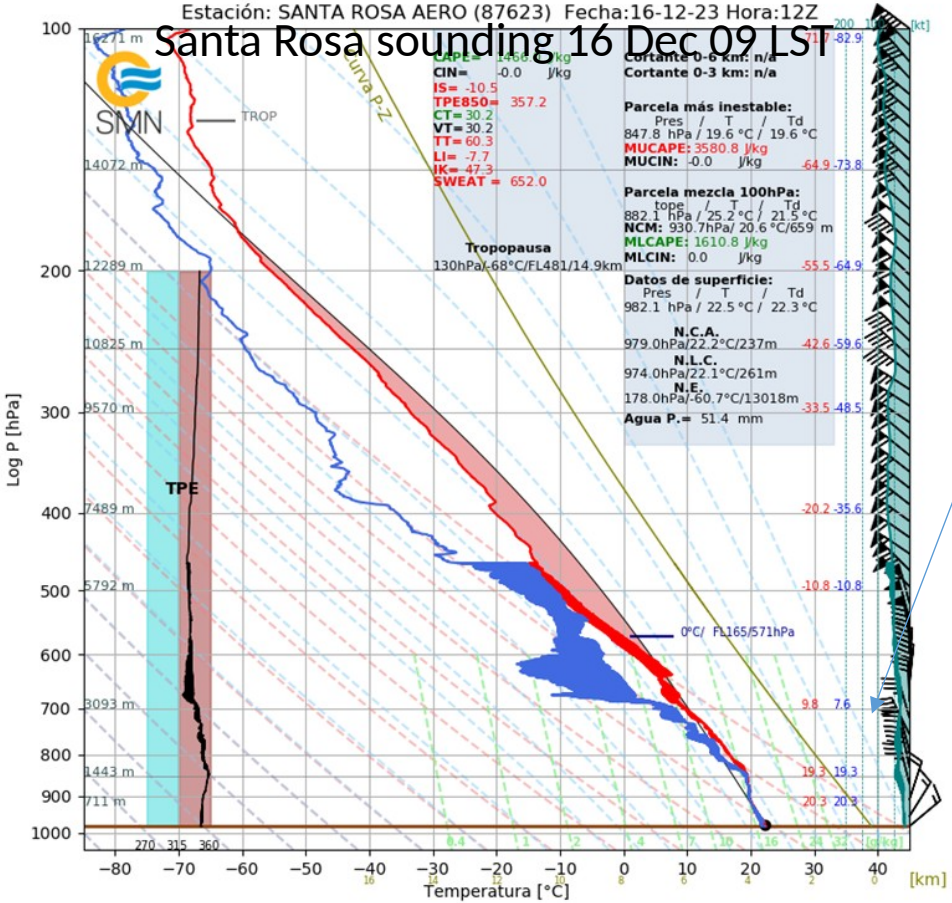
Dew points of 22-25°C at the surface

Analysis 500-hPa geopotential and T isolines 9:00hs Saturday 16

Very important trough moving eastwards from southern Pacific Ocean to central Argentina



Santa Rosa sounding 16 Dec 09 LST



Very unstable air mass (Mucape 3580 J/Kg) with large vertical wind shear, especially at low to mid levels

Bahia Blanca

13 people dead in the city of Bahía Blanca when part of a wall and the roof of a sports club collapsed

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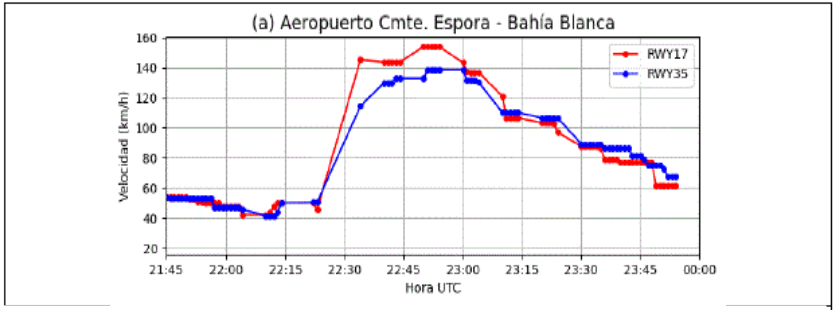
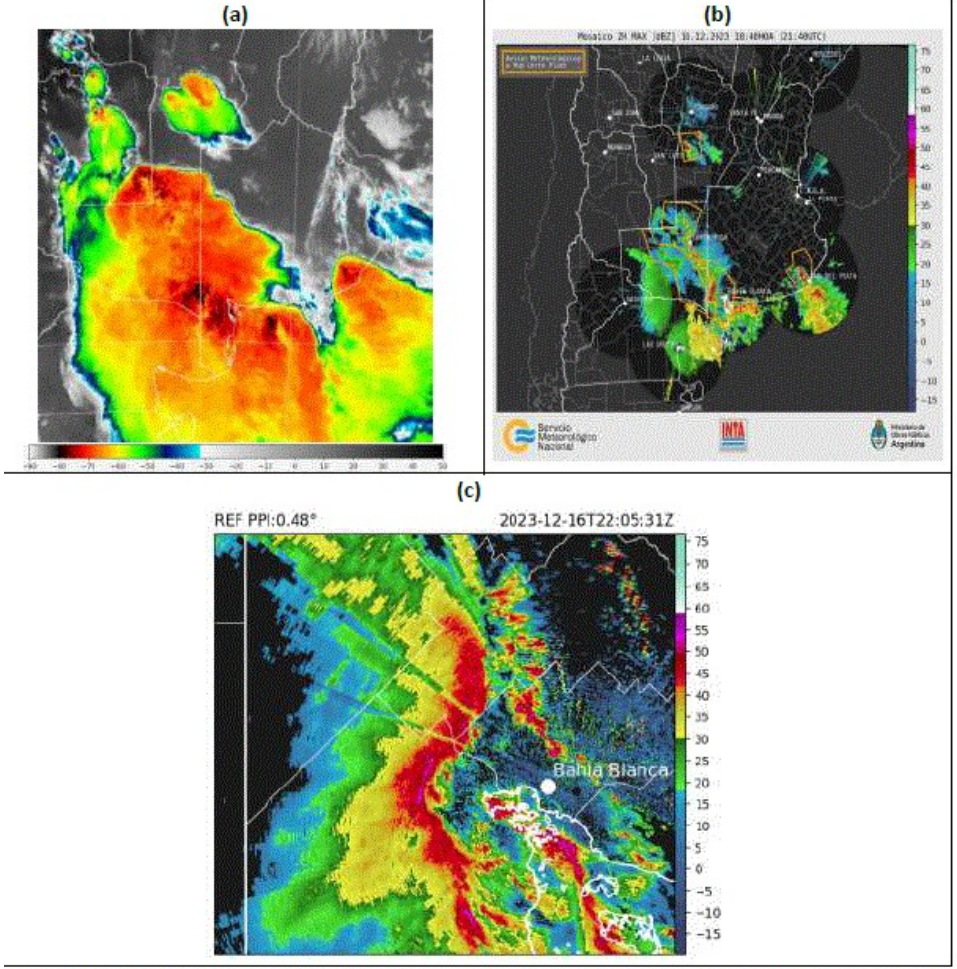
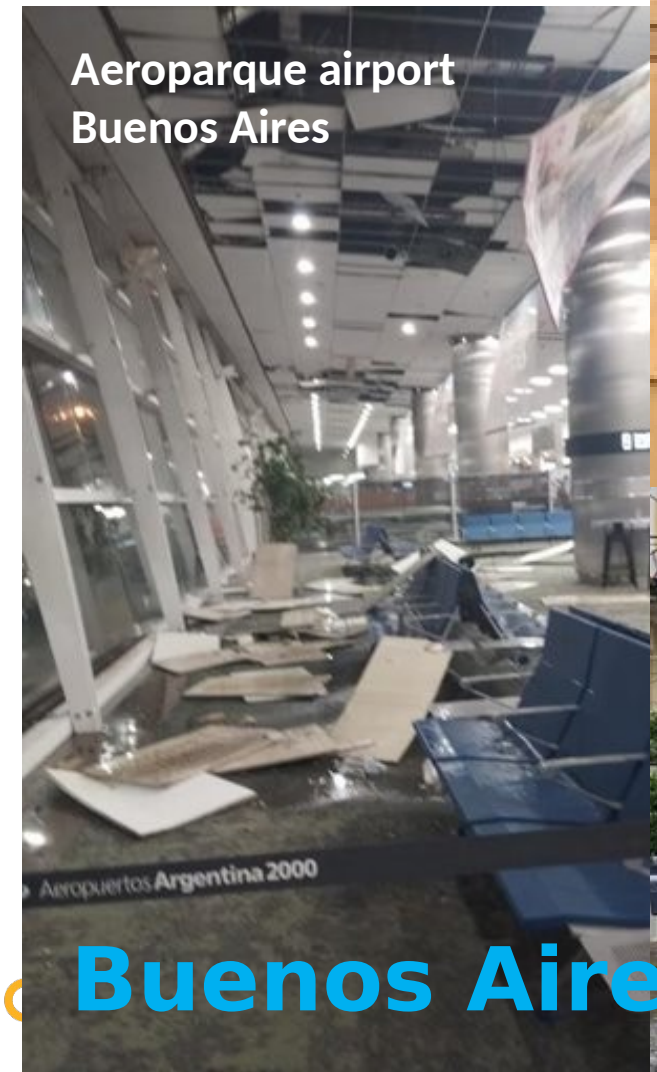
Bahia Blanca



Oficial station: 7:48 PM
Speed: 150 km/h
Direction: 250°



gura 3: (a) Imagen de temperatura de topes nubosos del satélite GOES-16 correspondiente al 16/12/2023 a las 18:40 ra local (21:40 UTC), (b) Compuesto de reflectividad máxima de la columna de la red SINARAME. En color naranja se uestran los polígonos correspondientes a los ACP vigentes en ese momento. (c) Escaneo de la elevación más baja de flectividad del radar RMA10-Bahía Blanca del SINARAME de las 19:05 hora local (22:05 UTC).



Buenos Aires

Buenos Aires

Oficial station: 3:54 AM
Speed: 140 km/h
Direction: 210°

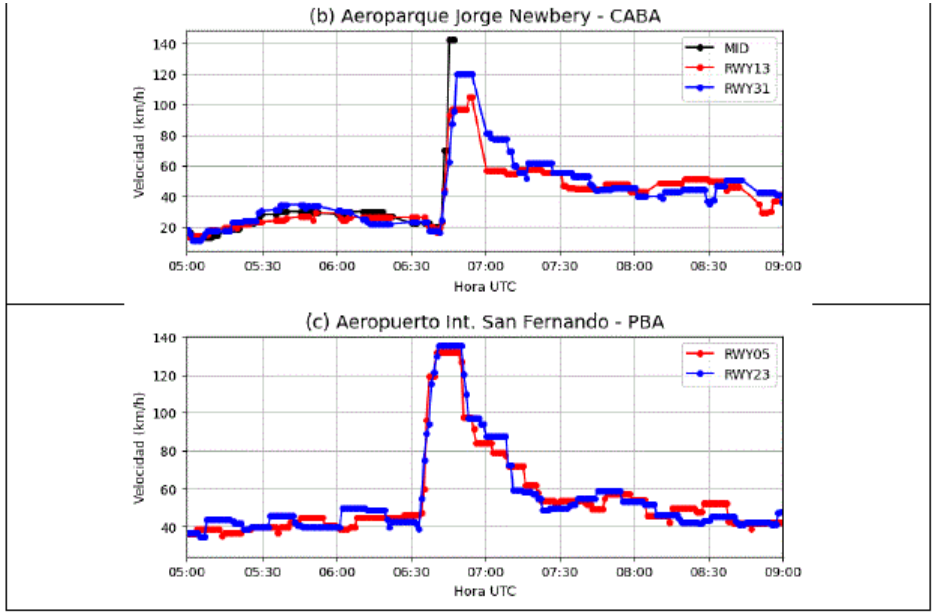


Figura 2: Evolución temporal de las ráfagas máximas en 10 minutos registradas el día 16/12/2023 (Bahía Blanca) y 17/12/2023 (Aeroparque y San Fernando) por los sistemas automáticos AWOS ubicados en los aeropuertos de Bahía Blanca (PBA), Aeroparque (CABA) y San Fernando (PBA). Los diferentes colores corresponden a los anemómetros ubicados en las diferentes cabeceras de las pistas con las que cuenta cada aeropuerto. La hora indicada es la UTC (HOA+3).

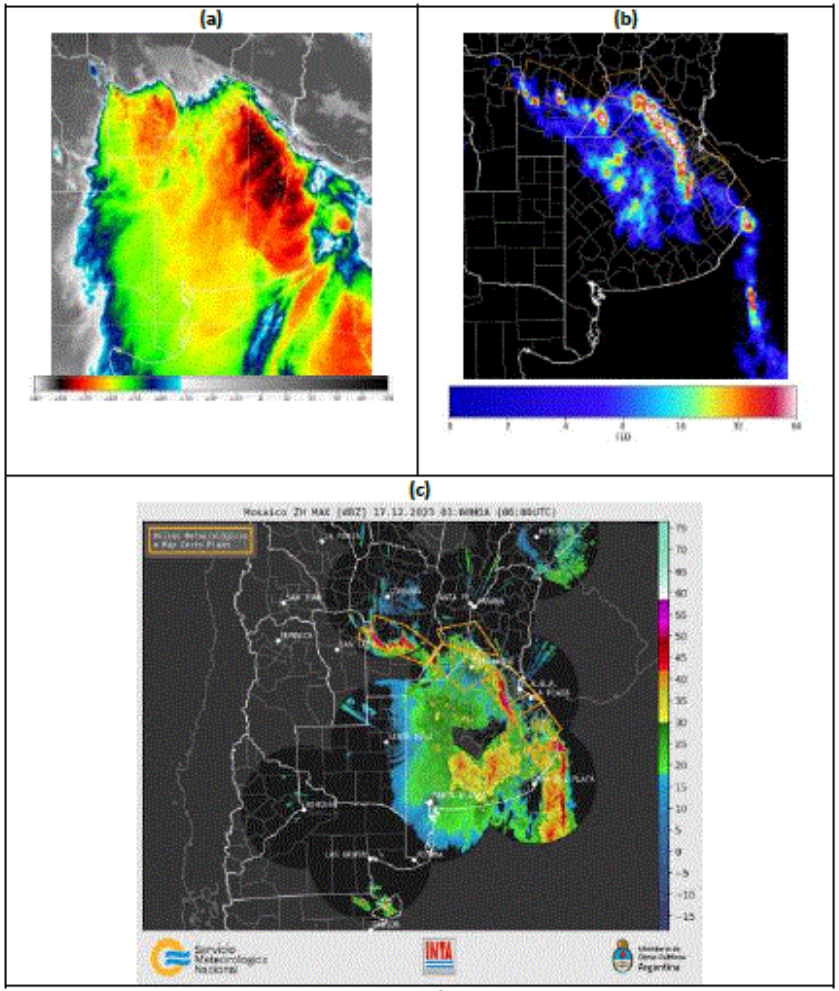
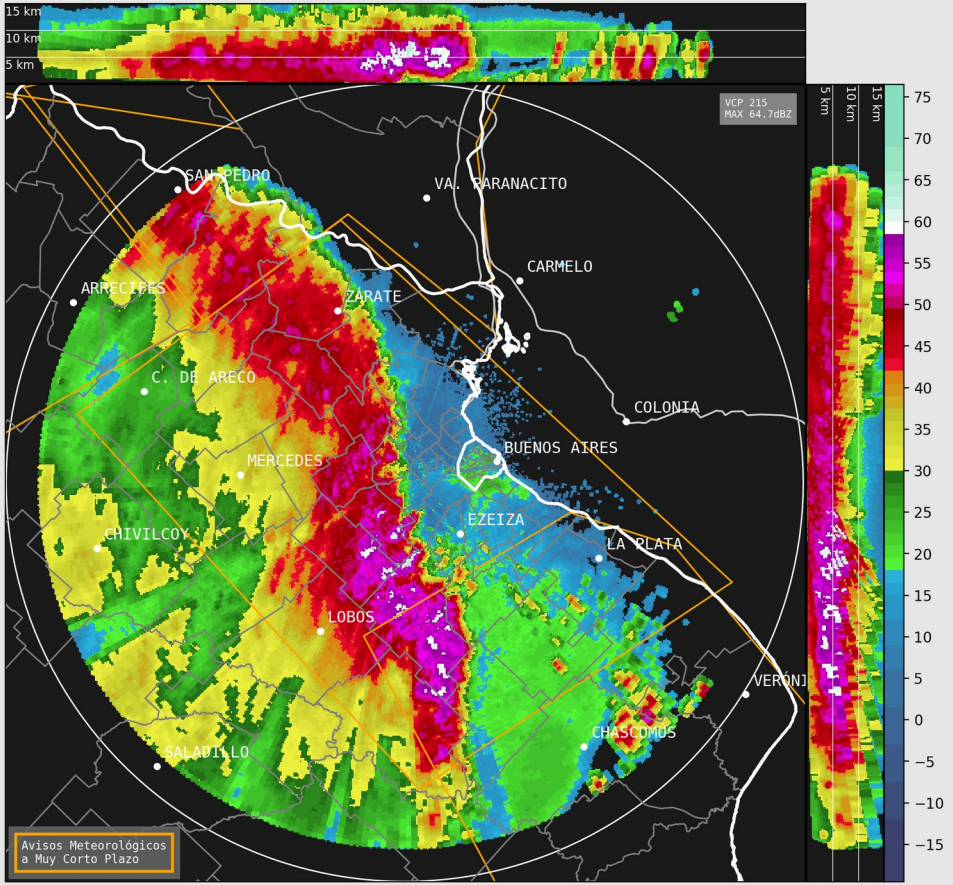
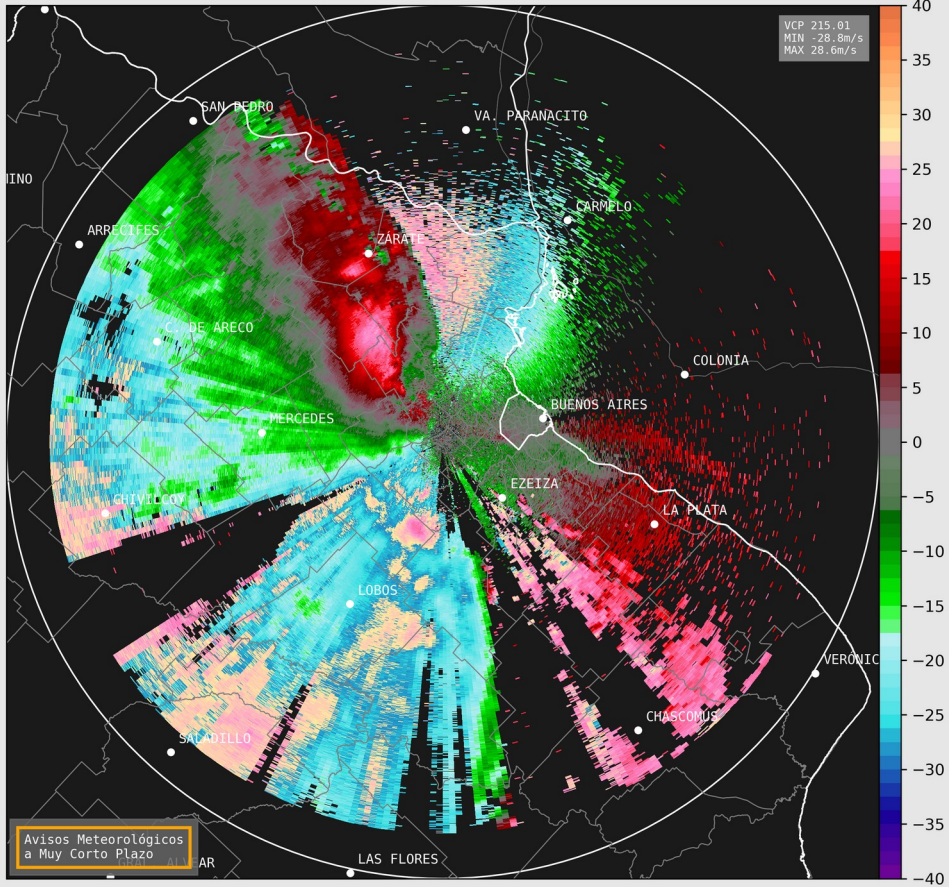


Figura 4: (a) Imagen de temperatura de topes nubosos del satélite GOES-16 correspondiente al 17/12/2023 a las 03:00 hora local (06:00 UTC). (b) Actividad eléctrica observada con el sensor GLM a bordo del satélite GOES-16 para el mismo día y hora. (c) Compuesto de reflectividad máxima de la columna de la red SINARAME. En color naranja se muestran los polígonos correspondientes a los ACP vigentes en ese momento.

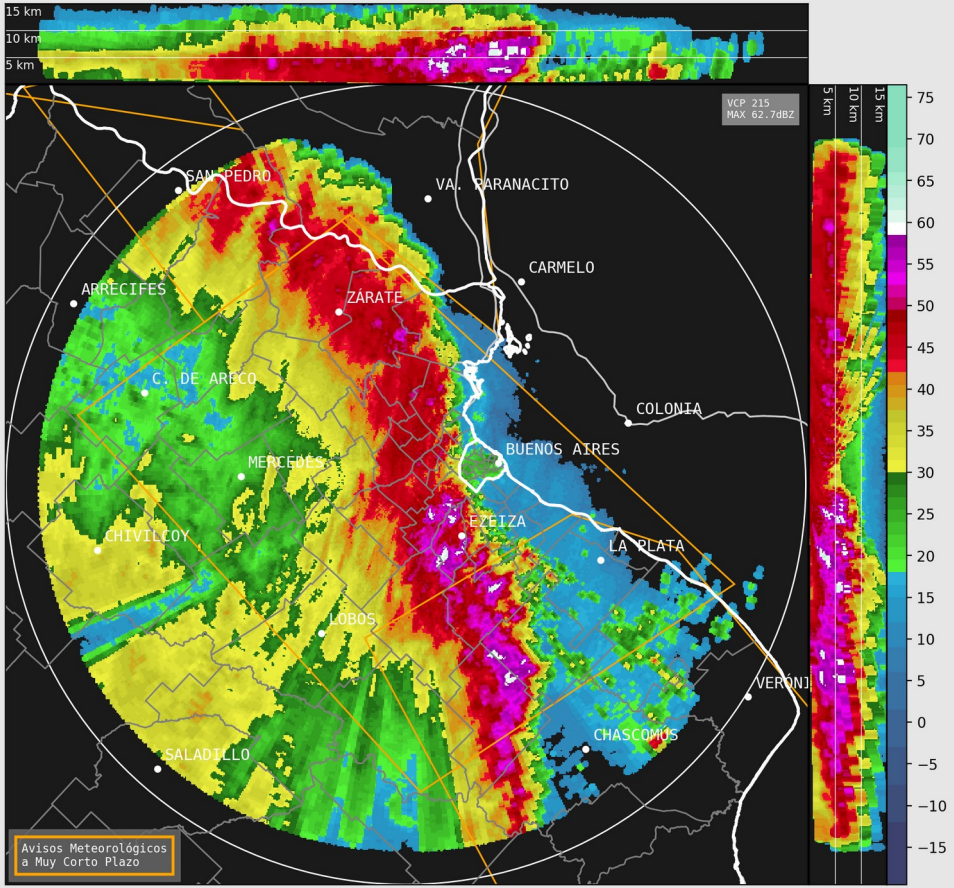
Merlo-GCABA ZH MAX [dBZ] 17.12.2023 03:15HOA (06:15UTC)



Merlo-GCABA VRAD PPI0.5 [m/s] 17.12.2023 03:15HOA (06:15UTC)



Merlo-GCABA ZH MAX [dBZ] 17.12.2023 03:34HOA (06:34UTC)



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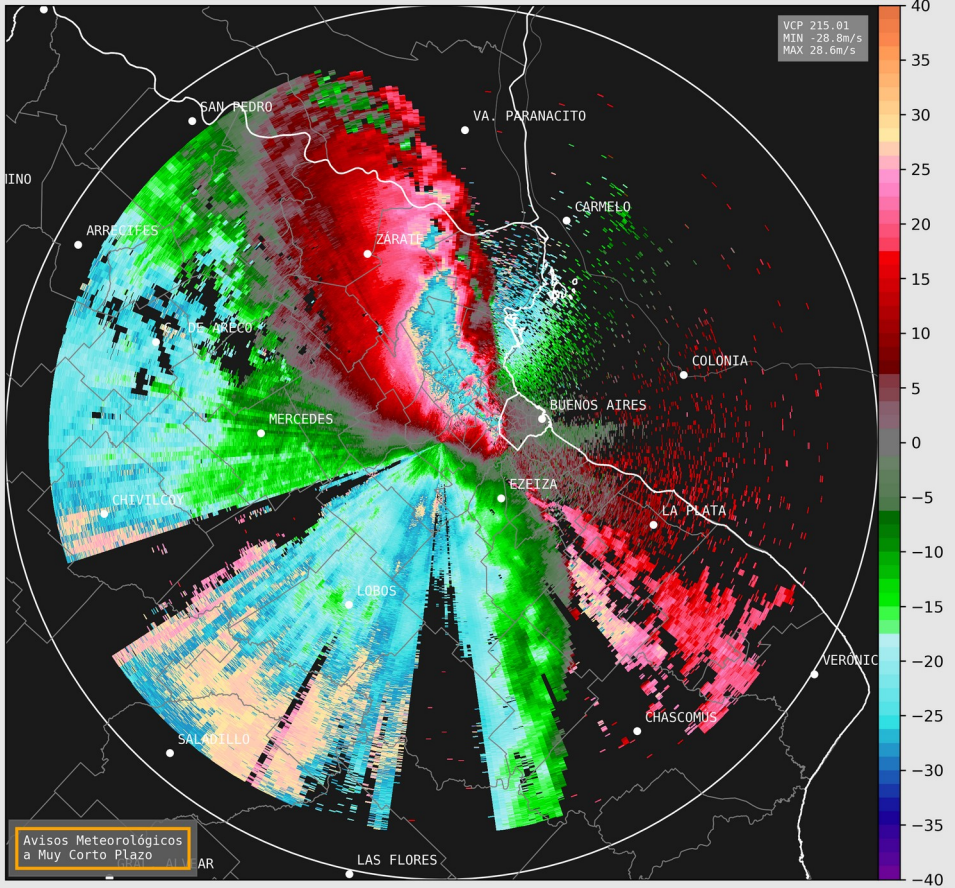

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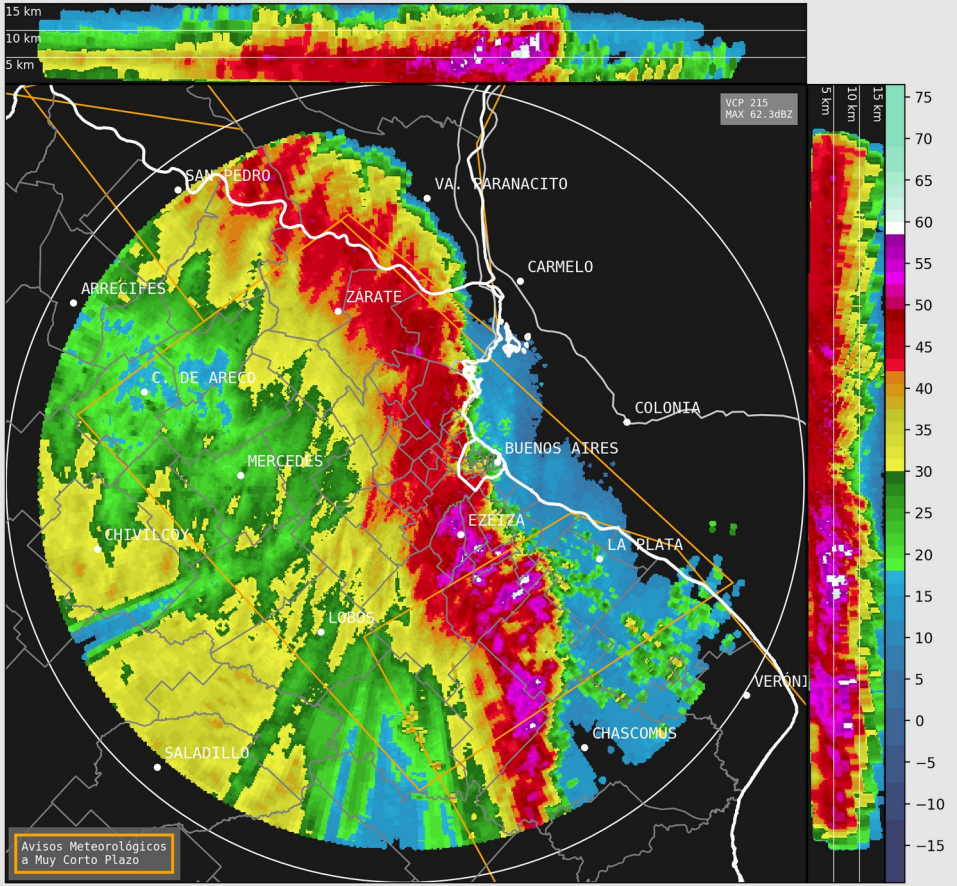
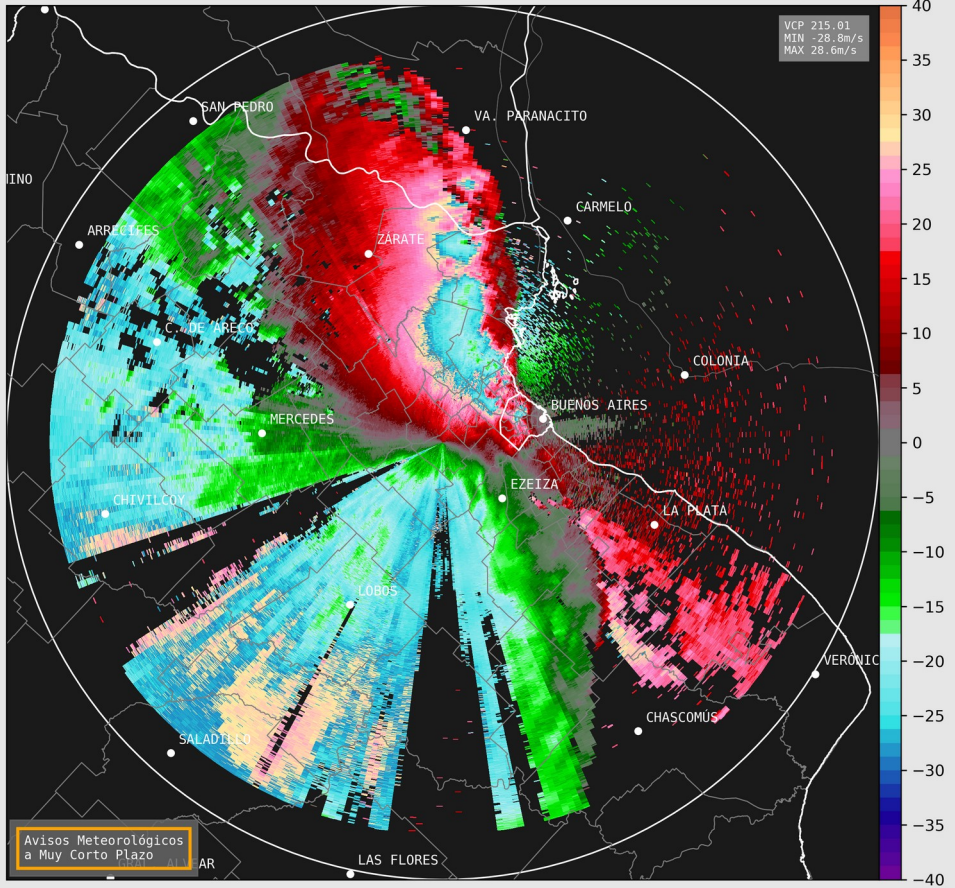
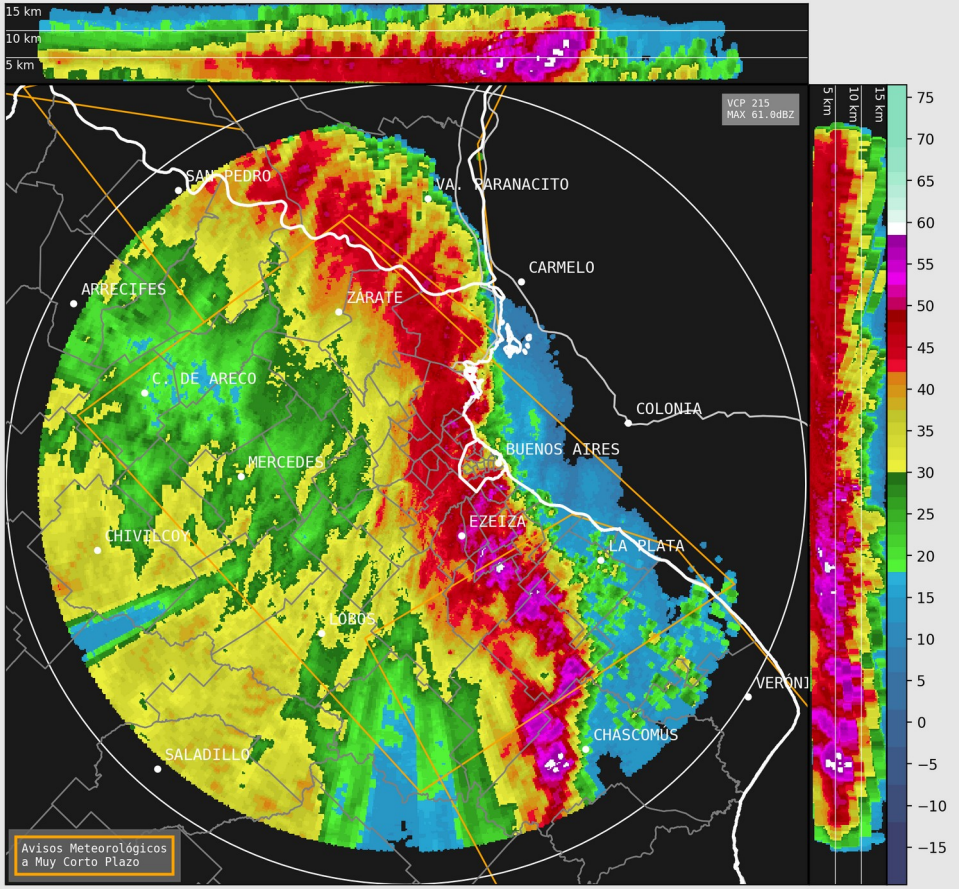


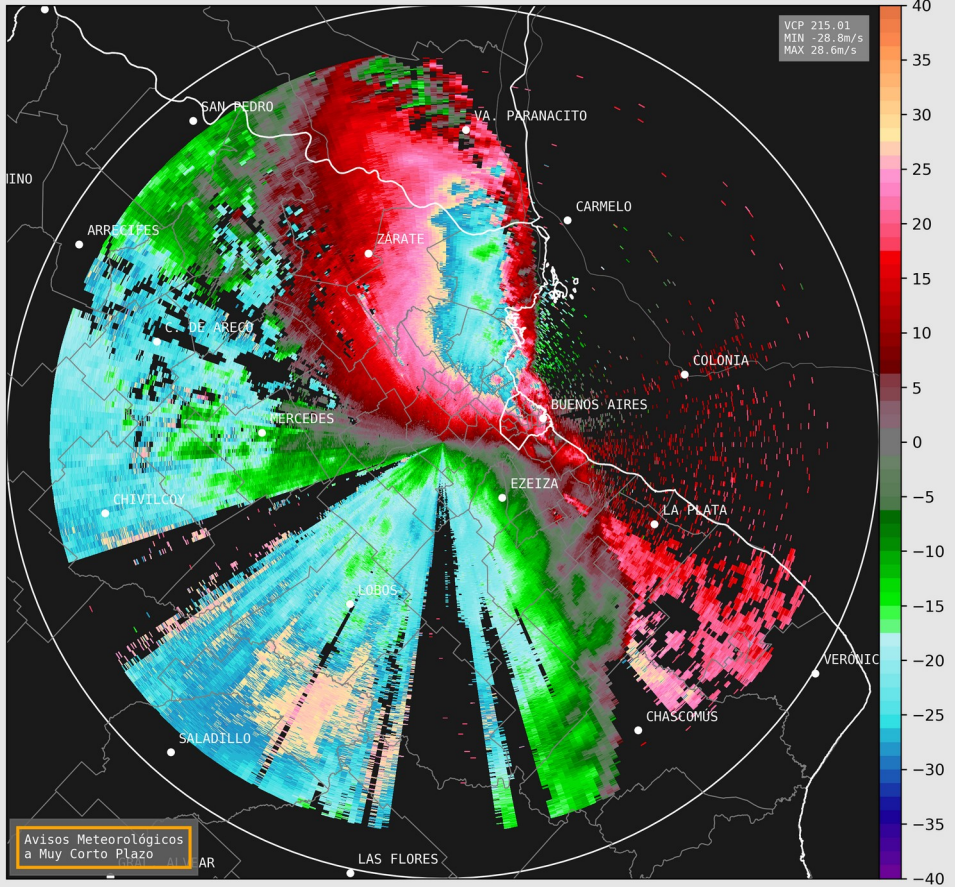
Merlo-GCABA VRAD PPI0.5 [m/s] 17.12.2023 03:41HOA (06:41UTC)



Merlo-GCABA ZH MAX [dBZ] 17.12.2023 03:47HOA (06:47UTC)



Merlo-GCABA VRAD PPI0.5 [m/s] 17.12.2023 03:47HOA (06:47UTC)



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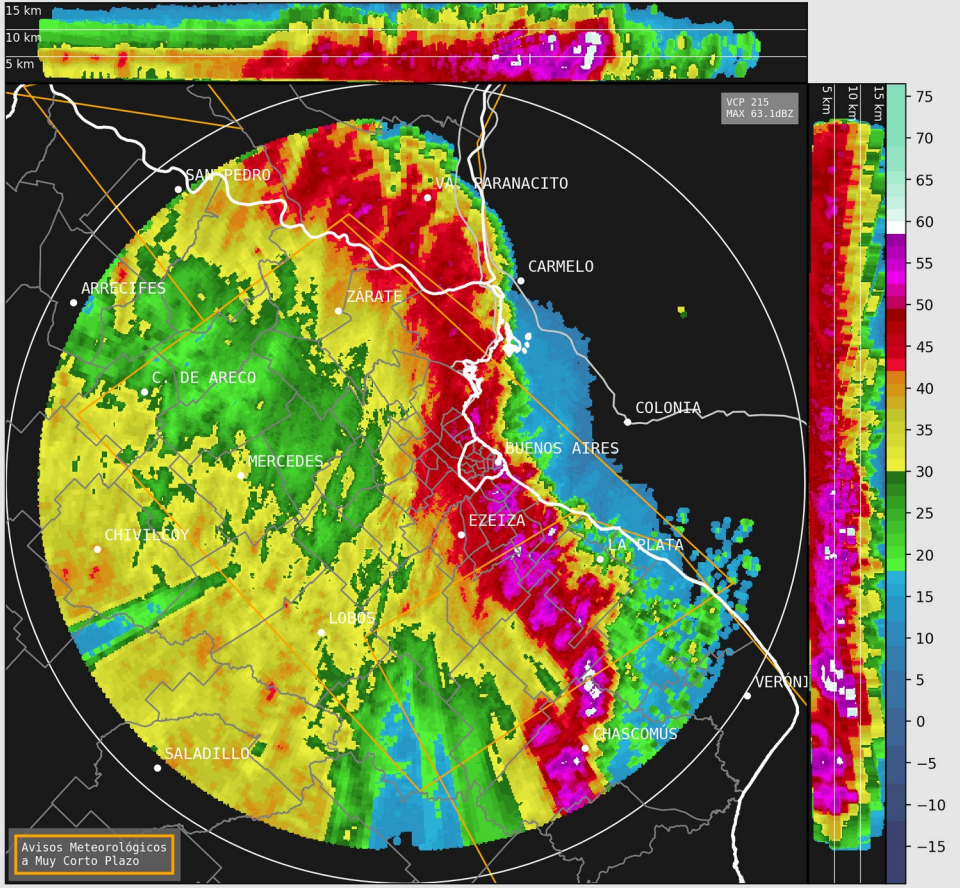

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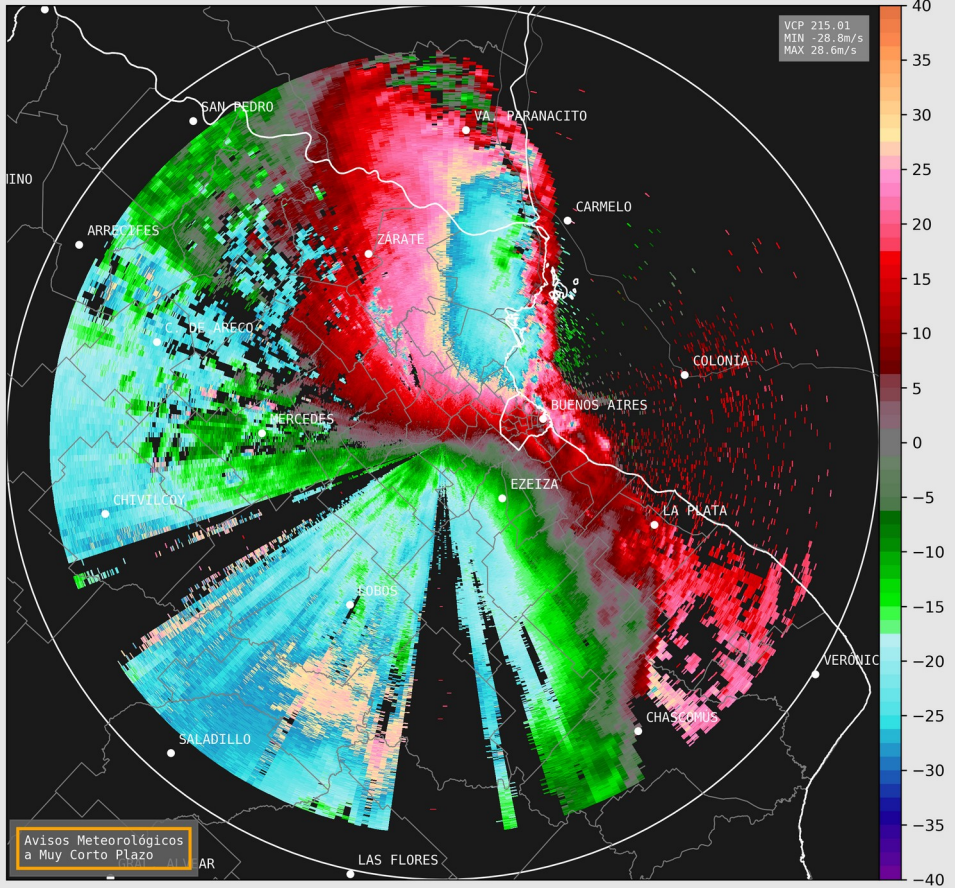


Estación	Fecha y Hora (HOA)	Dirección (grados) y Velocidad ráfaga máxima (kt –km/h)
Bahía Blanca	16/12/23 19:48	250/84 kt (155 km/h)
San Fernando	17/12/23 03:42	240/73 kt (135 km/h)
OCBA	17/12/23 03:42	230/54 kt (100 km/h)
Aeroparque	17/12/23 03:54	210/56 kt (104 km/h)
El Palomar	17/12/23 03:42	230/67 kt (124 km/h)
Morón	17/12/23 03:30	200/60 kt (111 km/h)
Ezeiza	17/12/23 03:30	200/47 kt (87 km/h)
La Plata	17/12/23 04:06	230/51 kt (94 km/h)

Intensidad y dirección de ráfaga máxima registradas en las estaciones del SMN entre la tarde del sábado 16 y la madrugada del domingo 17 de diciembre de 2023.

Numerical forecasts

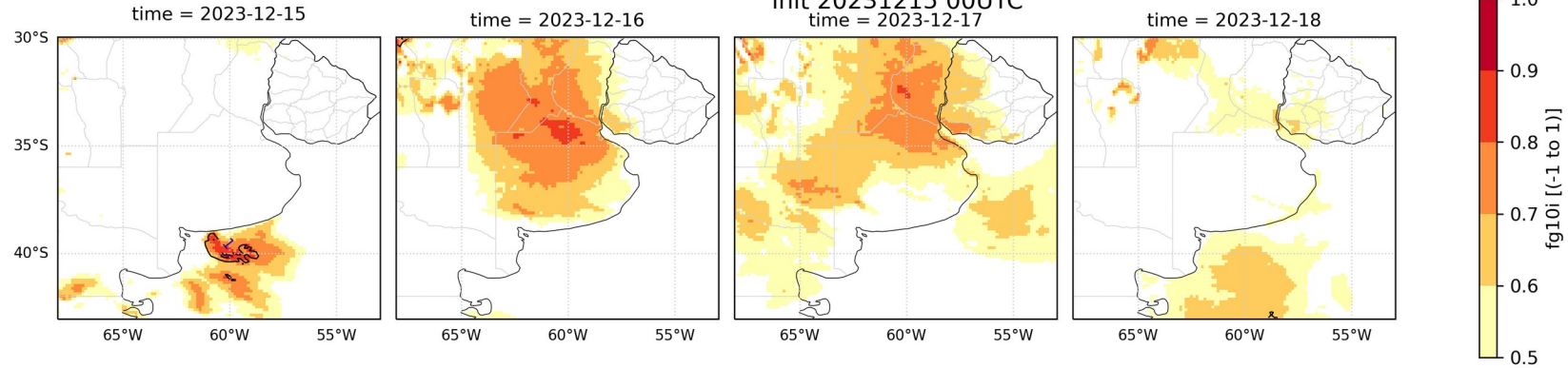
- What should we ask models in a case like this?
- To define the future environmental conditions?
- To forecast the event itself, located in time and space at least with some probability?
- Perspective of Tsonevsky et al (2018)

class: operational archive

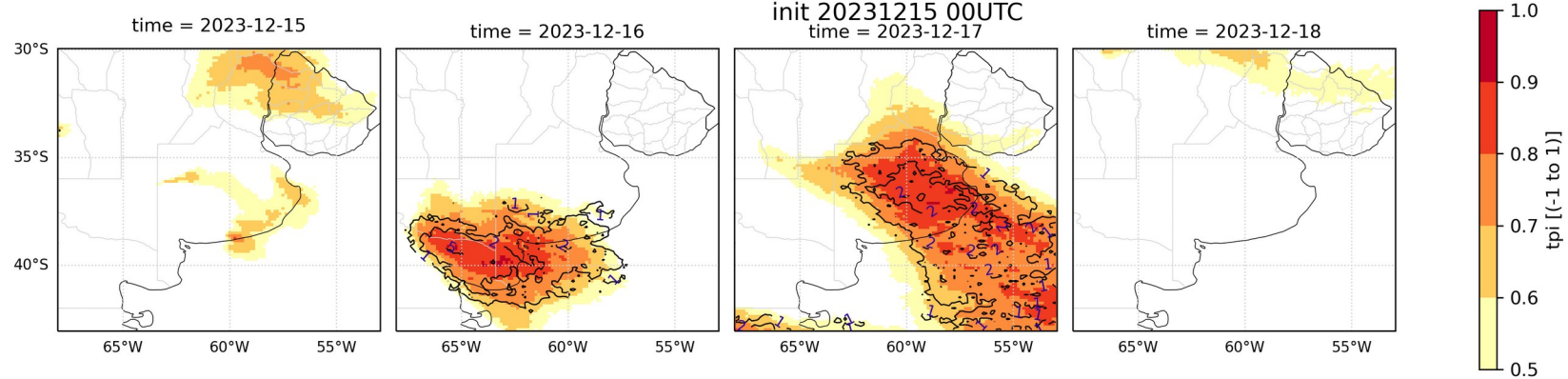
0.125° grid

Run: 20231215_00UTC (Max lead time: 66hs)

ENFO_grid0125_10 metre wind gust index: EFI + SOT [1,2,5,8]
init 20231215 00UTC

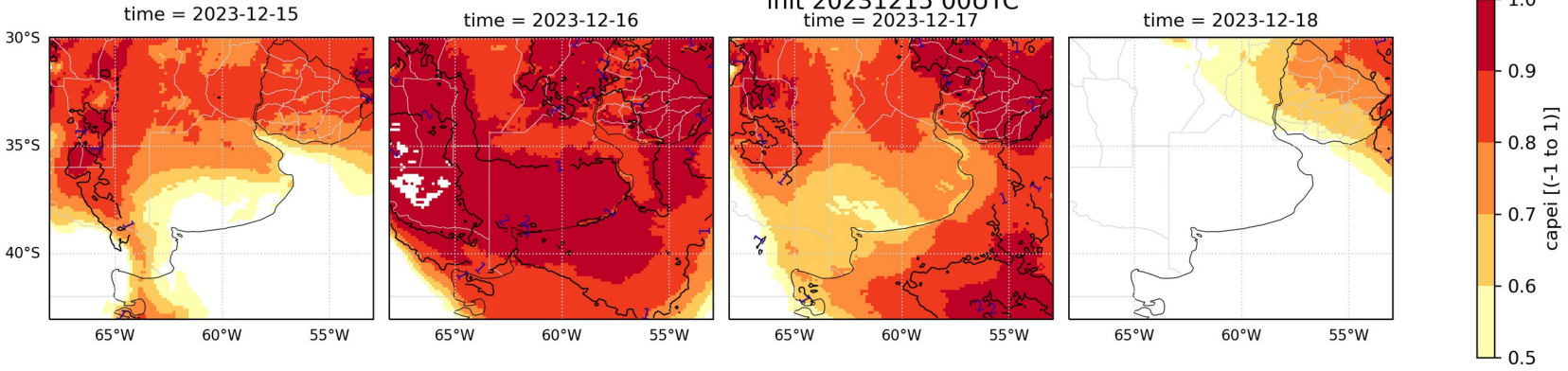


ENFO_grid0125_Total precipitation index: EFI + SOT [1,2,5,8]
init 20231215 00UTC

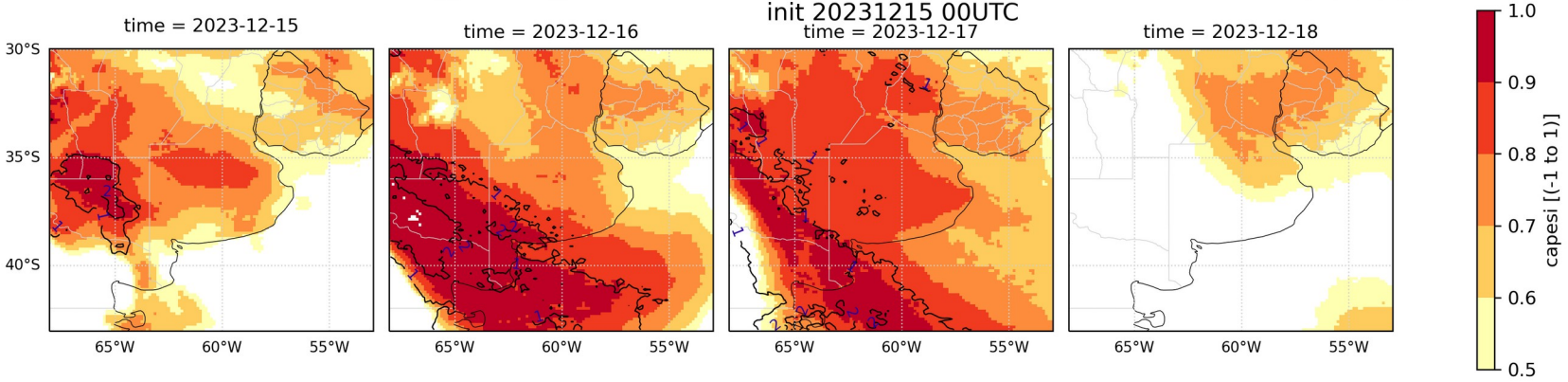


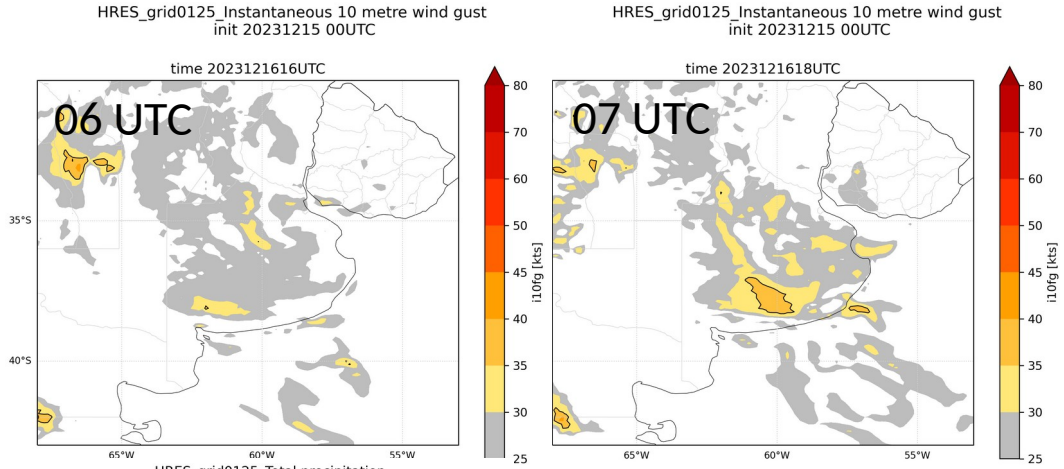
Al ser integrado en 24h no se ve el evento en Bahia Blanca

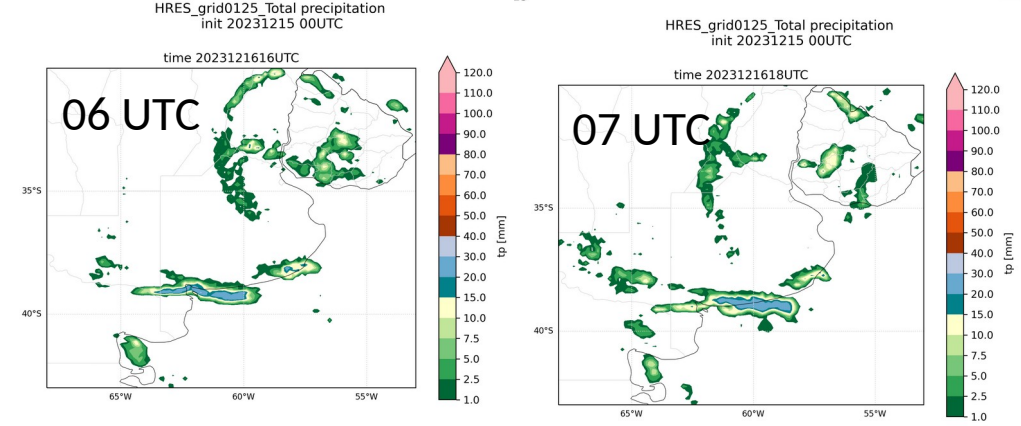
ENFO_grid0125_Convective available potential energy index: EFI + SOT [1,2,5,8]
init 20231215 00UTC



ENFO_grid0125_Convective available potential energy shear index: EFI + SOT [1,2,5,8]
init 20231215 00UTC

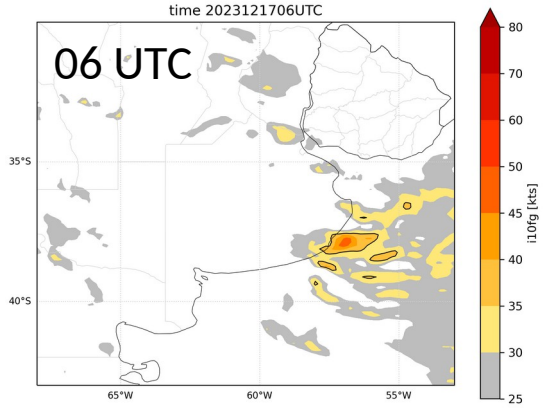




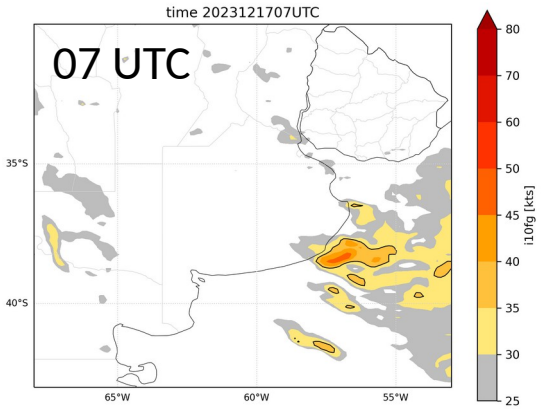


2023-12-16 18UTC

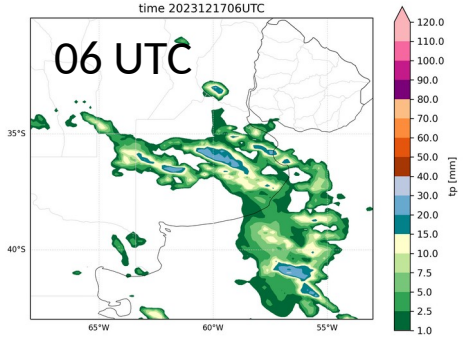
HRES_grid0125_Instantaneous 10 metre wind gust
init 20231215 00UTC



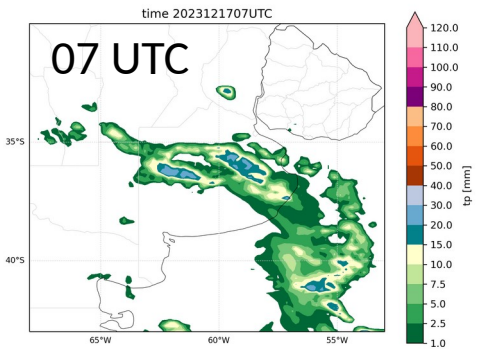
HRES_grid0125_Instantaneous 10 metre wind gust
init 20231215 00UTC



HRES_grid0125_Total precipitation
init 20231215 00UTC



HRES_grid0125_Total precipitation
init 20231215 00UTC

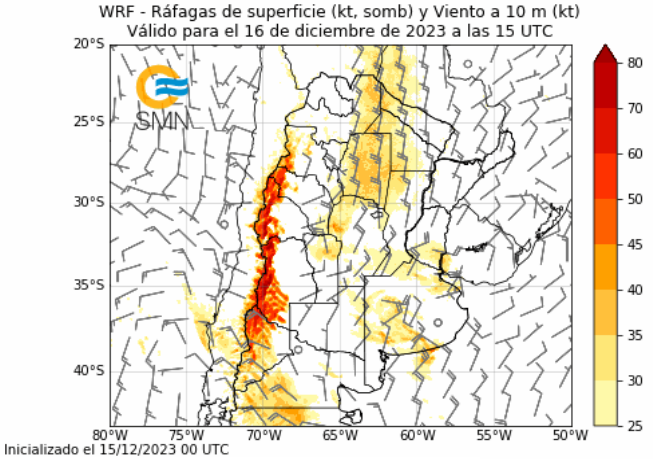


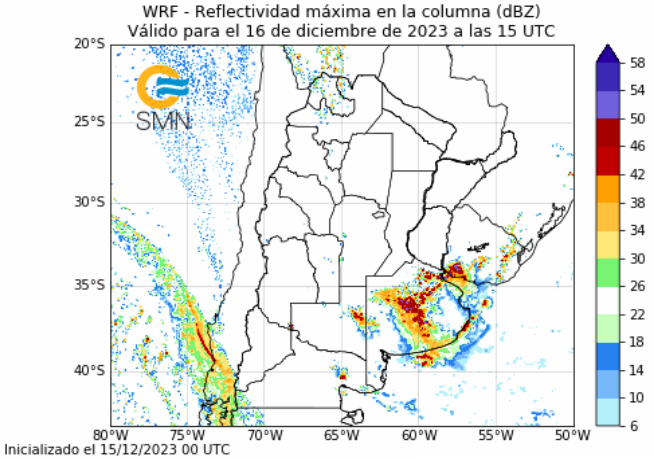
WRF (DET & ENS)

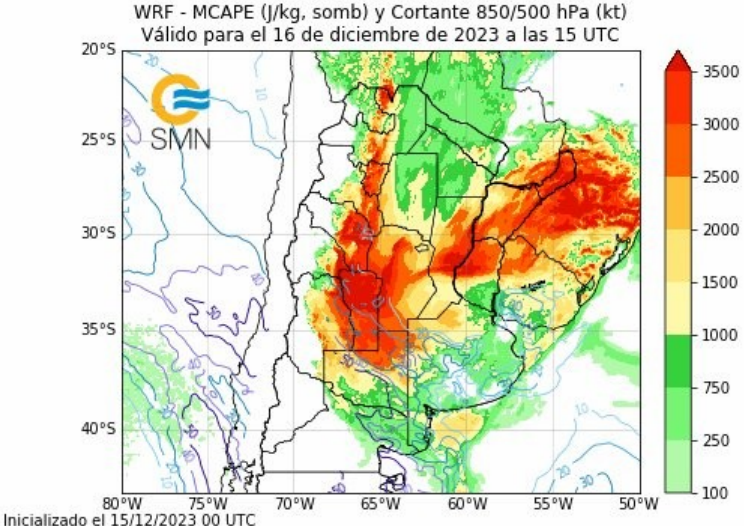
4 km

Run: 20231215_00UTC (Max lead time: **72/48hs**)

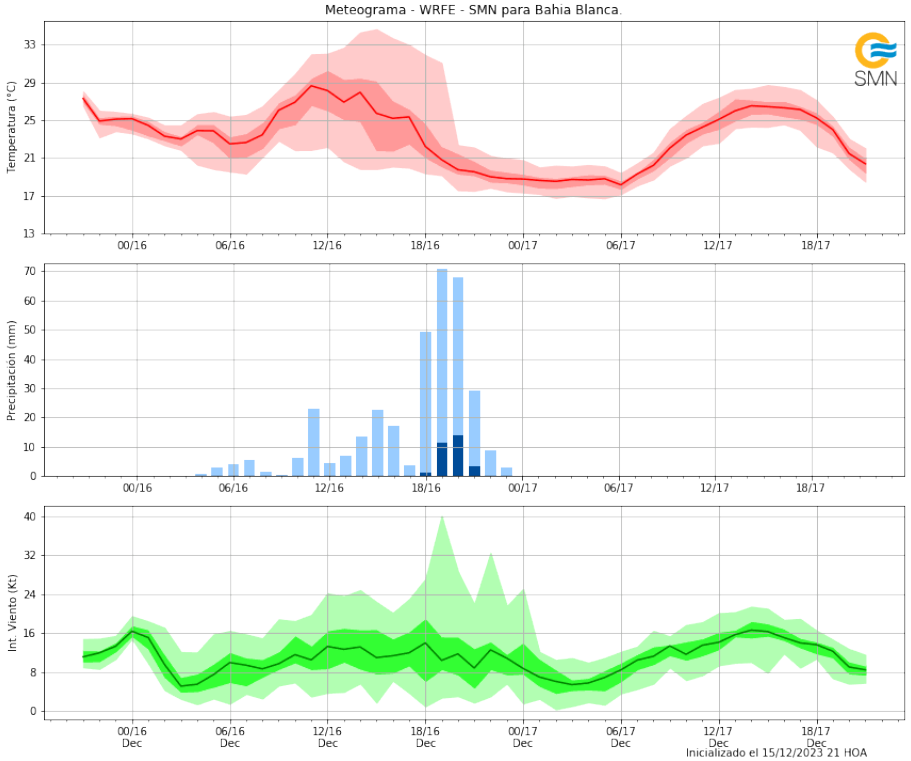
WRF-DET: init 20231215_00UTC (Bahia Blanca)



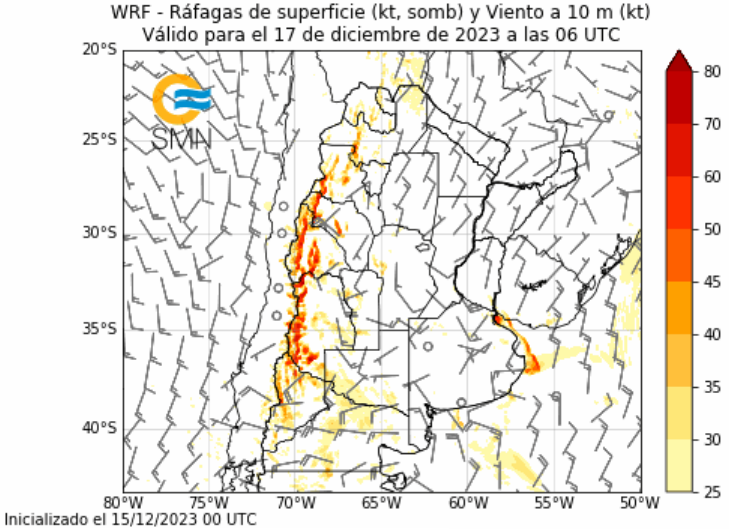


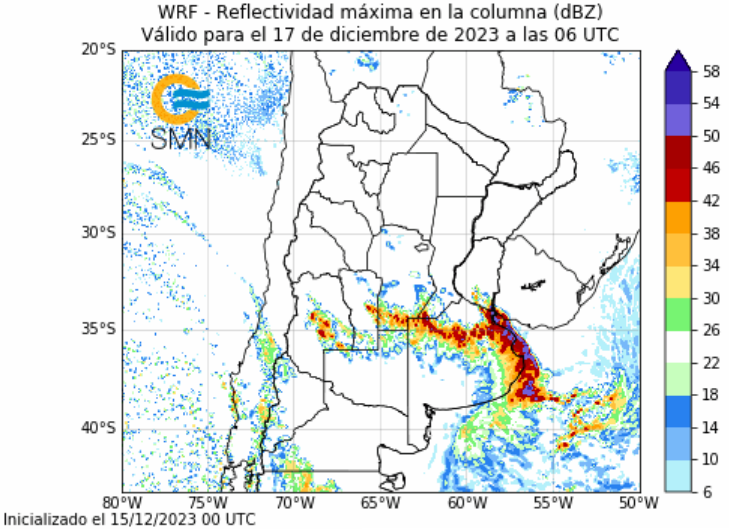


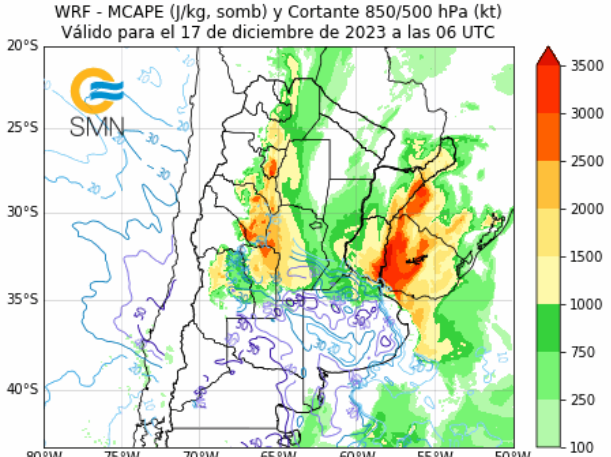
ENS: ana 20231216_00UTC (Bahia Blanca)



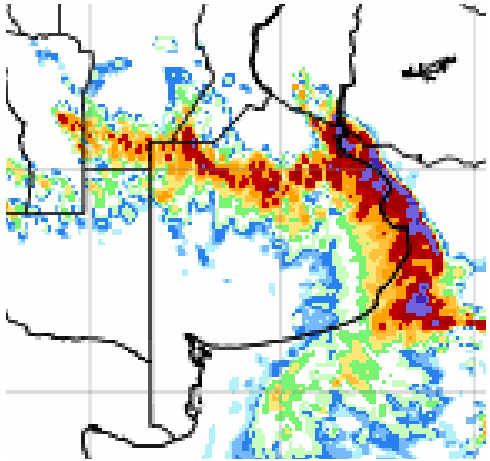
WRF-DET: init 20231215_00UTC (Buenos Aires)

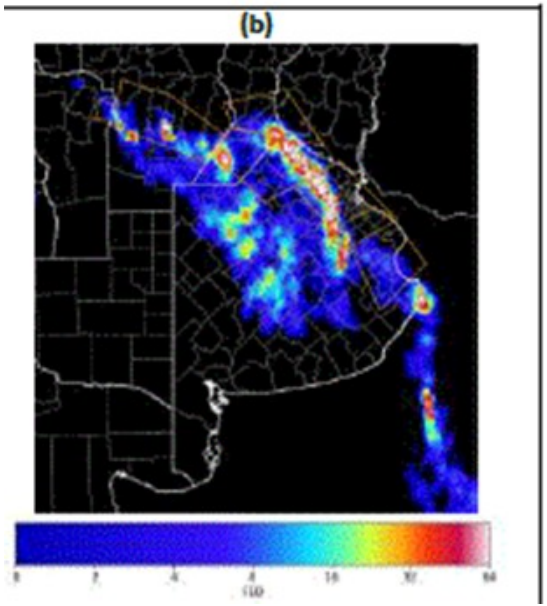






WRF-DET: init 20231215_00UTC (Buenos Aires)





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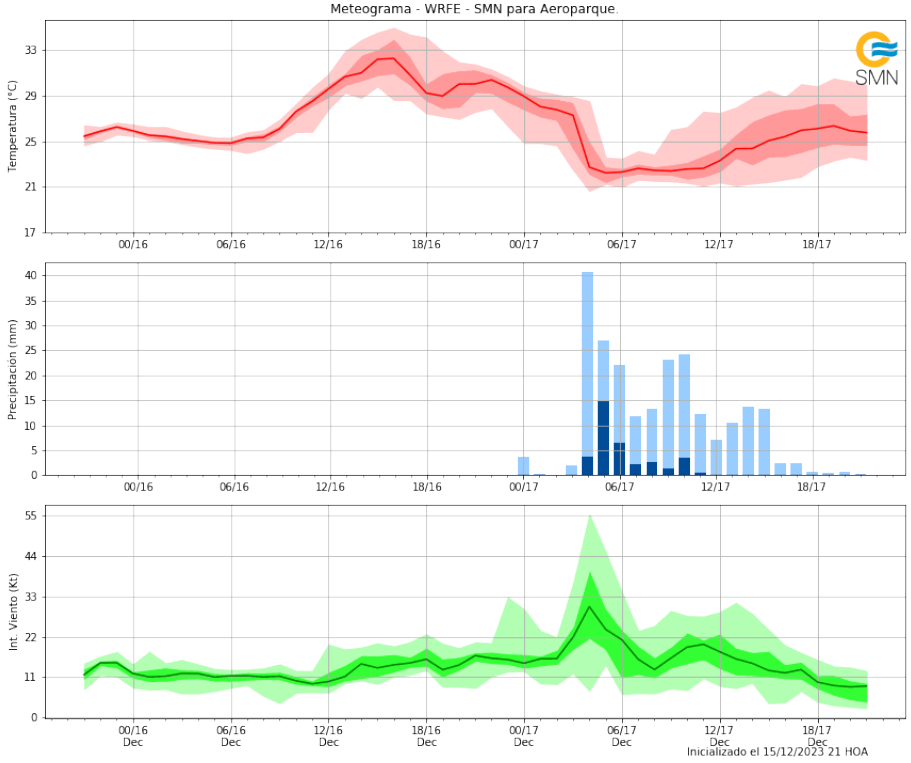

Tsonevsky, I., et al 2018: Early Warnings of Severe Convection Using the ECMWF Extreme Forecast Index. *Wea. Forecasting*, 33, 857–871,

- "...convective wind gusts could be significantly underestimated as a result of resolution and model constraints. A striking case ...was shown ... in which even short-range forecasts failed to give any sign of strong gusts while the EFI/SOT for both convective parameters, CAPE and CAPE–shear, presented here provided a very strong signal of a possible outbreak of severe convection 6 days in advance."
- "A global forecasting system, such as the ECMWF IFS, is unable to fully capture all the processes and details at convective scales, but it is capable of forecasting relatively accurately the ingredients necessary for triggering severe convective outbreaks. "

SMN Argentina

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www.smn.gob.ar

Año de la Defensa de la Vida, la Libertad y la Propiedad