

Testing very high-resolution simulations in a high-impact static convective system in Spain using HARMONIE-AROME model

Carlos Calvo-Sancho¹, Juan Jesús González-Alemán², Yago Martín³, Javier Calvo², María Luisa Martín¹, Daniel Martín³ and Samuel Viana³

¹Department of Applied Mathematics, Faculty of Computer Engineering, University of Valladolid. Spain. ²State Meteorological Agency (AEMET). Spain. ³Department of Geography, Faculty of History and Philosophy, University Pablo de Olavide, Spain.

INTRODUCTION

- ✓ On 3 May 2022, a high-impact static convective system over south-east Spain (mainly formed in front the city of Valencia) led to heavy rainfall and flash-floods in Valencia and its metropolitan area.
- ✓ This very high-impact event had a very low predictability in high-resolution convection-allowing models. None of the national meteorological services' operational models (AROME – 1.3km, HARMONIE-AROME 2.5km, etc.) showed signals of convective system developed in the east of Spain.
- ✓ Herein, we evaluate this quasistationary system with very high-resolution numerical simulation (500 meters) from an operational NWP model in their research mode.



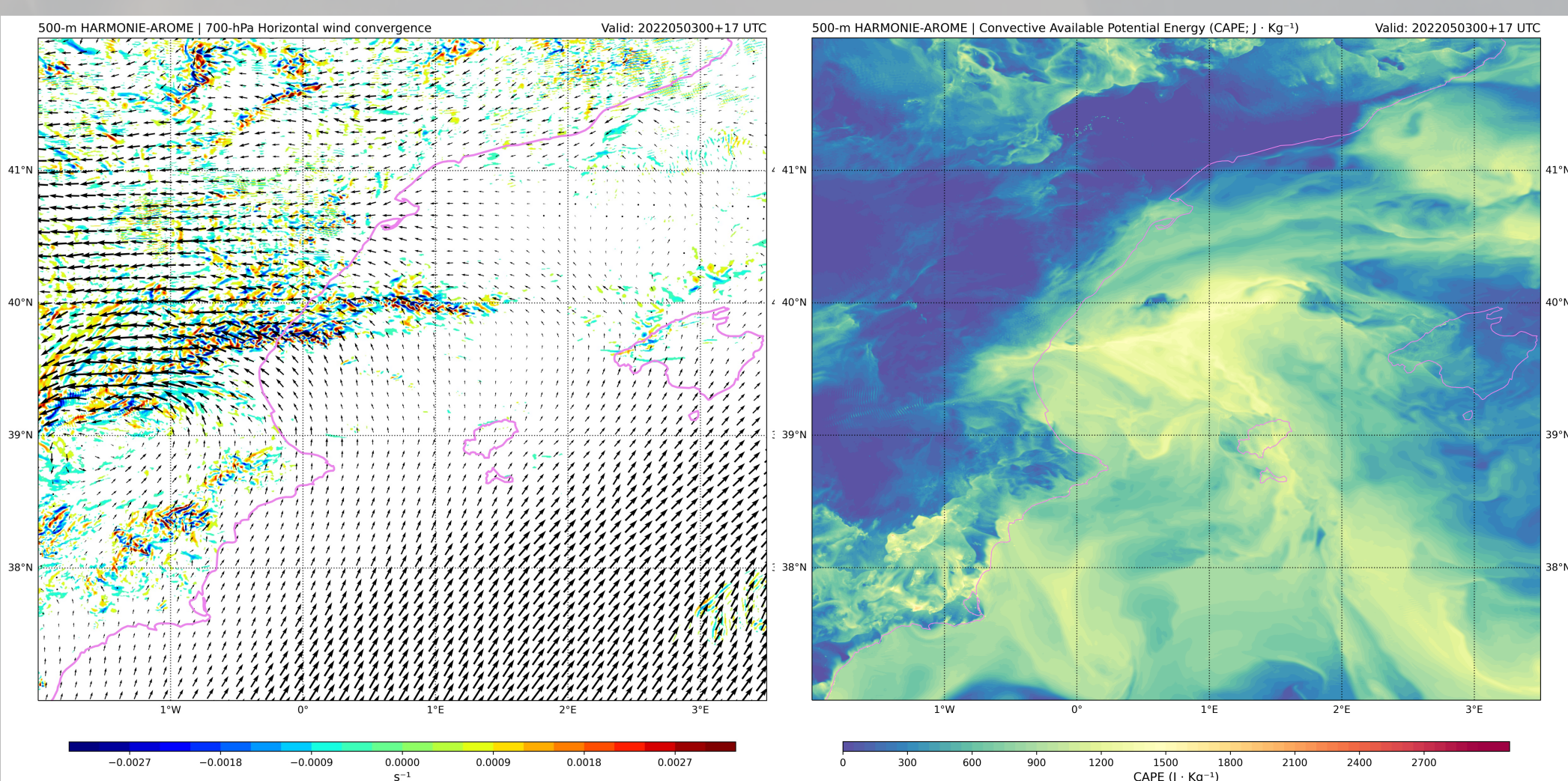
Figure 1: Headline of Spain's leading newspaper and its impact on the city of Valencia.

SETUP, DATA and METHODOLOGY

- ✓ Reference runs at 2.5 km:
- ✓ Cy43h2.1.1
- ✓ Start from AEMET operational initial conditions
- ✓ Full DA using AEMET operational observations
- ✓ Reference runs at 500 m:
- ✓ Cy46h dev
- ✓ Downscaling from IFS
- ✓ 1536x1620 points
- ✓ Tstep = 30s
- ✓ SETTLS and different diffusion dynamics
- ✓ Observational data used to evaluate:
- ✓ Ch9 MSG-SEVIRI (Brightness Temp.)
- ✓ IMERG Precipitation
- ✓ OPERA RADAR

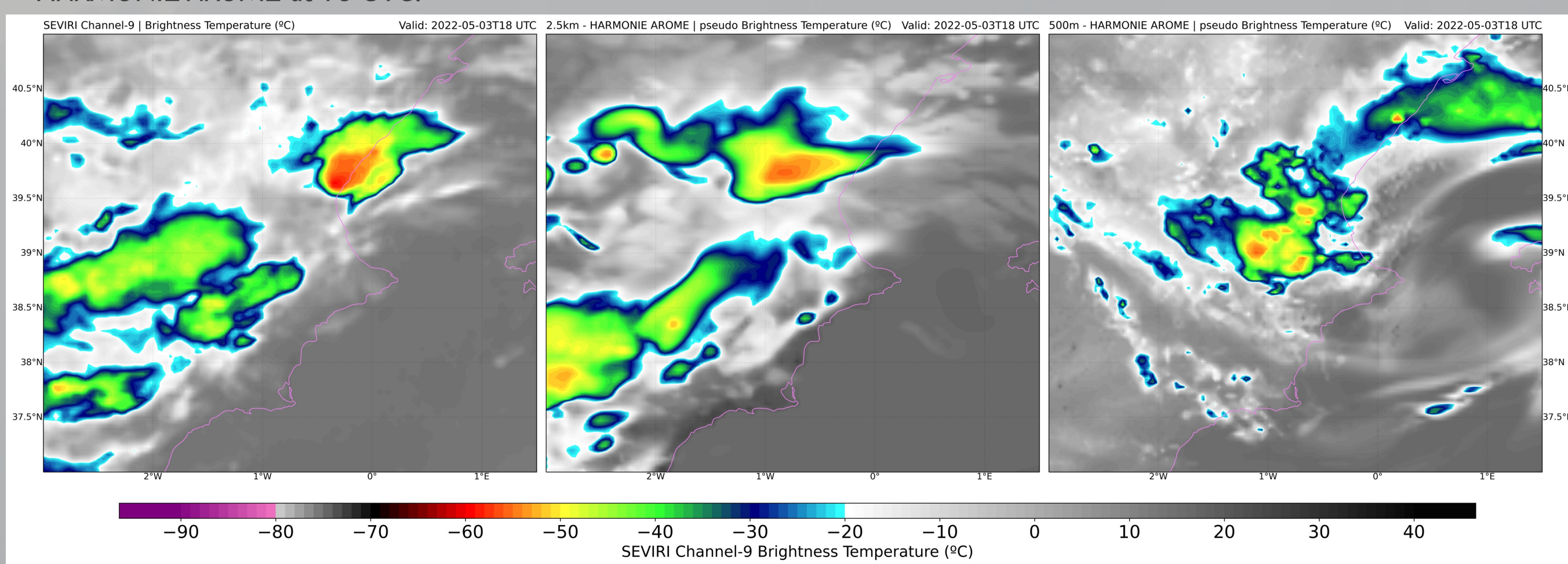
RESULTS

Figure 2: (left) 700-hPa horizontal wind convergence and wind vector; (right) convective available potential energy (CAPE).



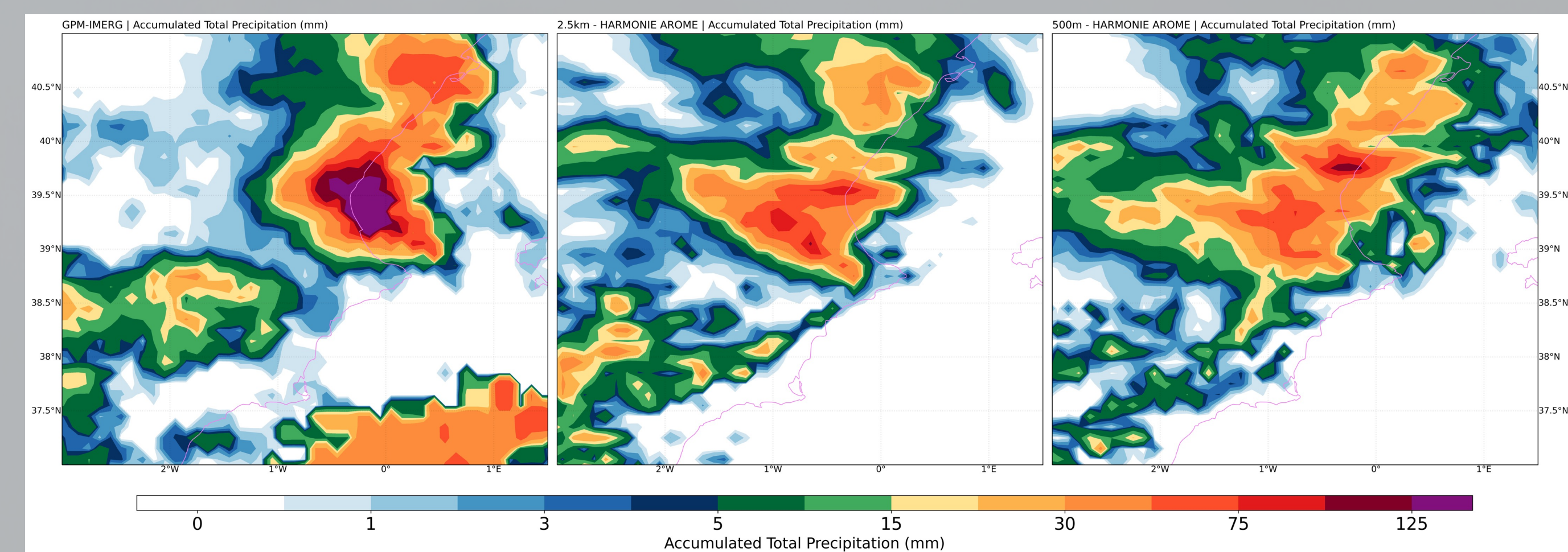
- ✓ The high-impact convective system was governed by deep horizontal wind convergence and moderate-high CAPE values
- ✓ The horizontal wind convergence triggered the convection and organized the system

Figure 4: Brightness Temperature images for (left) MSG-SEVIRI, (center) 2.5 km HARMONIE-AROME, and (right) 500-m HARMONIE-AROME at 18 UTC.



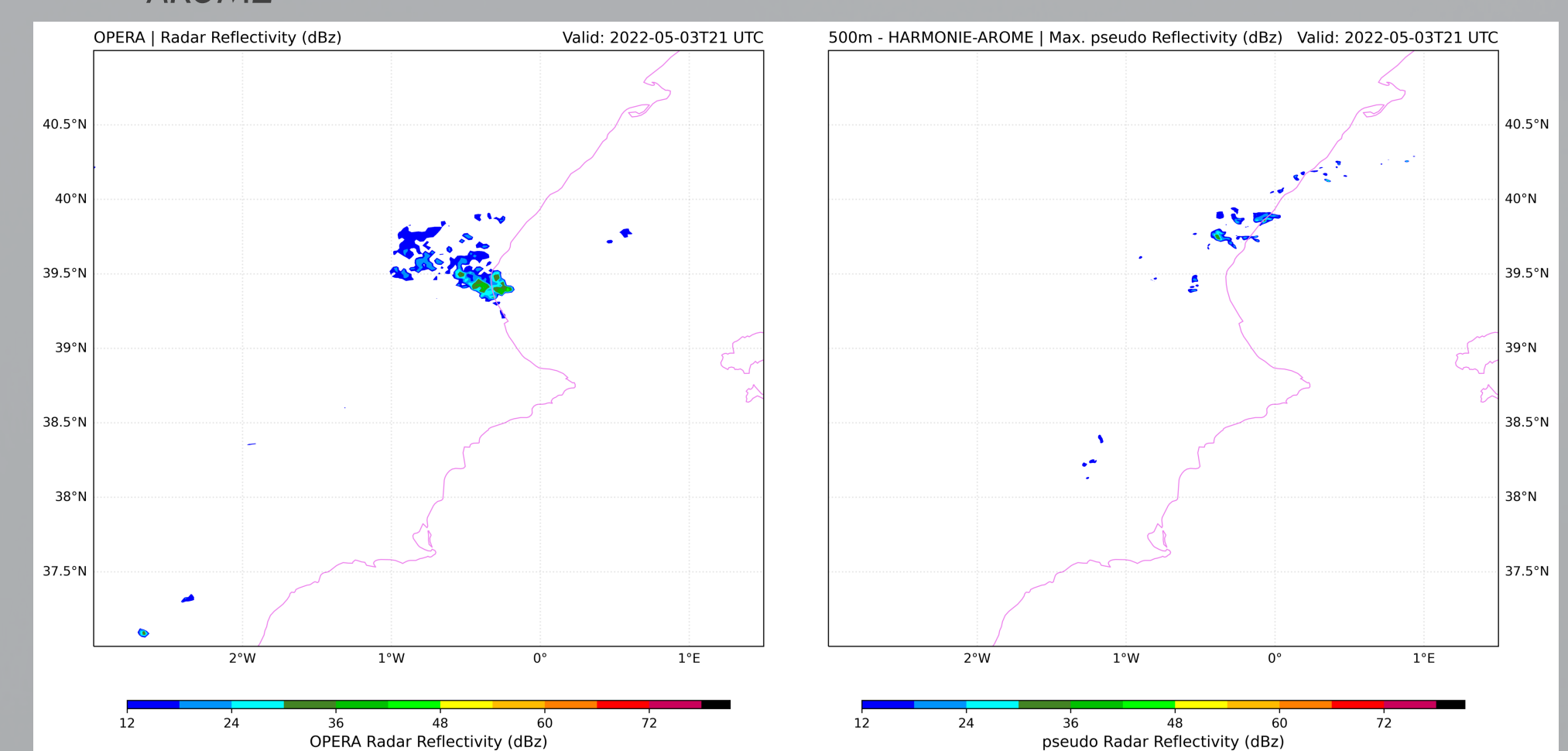
- ✓ The MSG SEVIRI Ch9 observational image shows a potential mesoscale convective system over Valencia city
- ✓ The operational HARMONIE-AROME model resolves a convective system inland Valencia's province, which is not as intense as the observed system
- ✓ The 500-m HARMONIE-AROME experiment resolves a convective system northward Valencia, which is not as extensive and intense as the observed convective system

Figure 3: Total accumulated precipitation in (left) GPM-IMERG, (center) 2.5 km HARMONIE-AROME and (right) 500-m HARMONIE-AROME



- ✓ A very high-rainfall event in Valencia (> 200 mm) which produces several socioeconomic impacts
- ✓ The 500-m HARMONIE-AROME experiment enhanced precipitation over a local zone, increasing the accumulated total precipitation near GPM-IMERG
- ✓ Both experiments have substantial differences from the satellite observational data

Figure 5: Maximum Radar Reflectivity for (left) OPERA and (right) 500-m HARMONIE-AROME



- ✓ The OPERA observational radar image shows a potential high-impact static convective system over Valencia
- ✓ The 500-m HARMONIE-AROME doesn't resolve a convective system and only shallow rainfalls
- ✓ This is contradictory with the accumulated total precipitation and the pseudo brightness temperature data.

Contact address

CARLOS CALVO-SANCHO
Email: carlos.calvo.sancho@uva.es

@MeteoZGZ
@glezjuanje



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CONCLUSIONS

1. Changes in cy46 vs cy43
2. The convective system responsible for the heavy rain is seen in the VHR simulation but no in the lower resolution.
3. Deeper evaluation and analysis is needed.