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

Carlos Calvo-Sancho[1], Juan Jesús González-Alemán[2], Yago Martín[3], Javier Calvo[2], Maria Luisa Martín[1,4], Daniel Martín Pérez[2], and Samuel Viana Jiménez[2]

[1]University of Valladolid, Faculty of Computer Engineering, Applied Mathematics, Segovia, Spain (carlos.calvo.sancho@uva.es)
[2]Department of Development and Applications, Agencia Estatal de Meteorología (AEMET), Madrid, Spain
[3]Department of Geography, Faculty of History and Philoshophy, University Pablo de Olavide, Sevilla, Spain
[4]Complutense University of Madrid, Institute of Interdisciplinary Mathematics (IMI), Madrid, Spain

On 3 May 2022, a very high-impact static convective system formed in front of Valencia (Spain). The storm produced heavy precipitation and reported the largest accumulation for one day in May for Valencia. The socioeconomic impact was severe, with numerous damages to low houses, cars and in the traffic state due to flash-floods.

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 development in the east of Spain.

Large-scale environment was characterized by a cut-off low and a slightly surface low on the south of Iberia Peninsula. The mesoscale environment was defined by low amounts of CAPE, large 0-6 km wind shear and large 0-3 km storm-relative helicity. This environment is not one of the most favorable to support convective systems, but in this event a low-level wind convergence line may organize the convective system. Therefore, this storm is a challenge from a numerical modelling point of view.

In this survey we evaluate the representation of convective initiation and mesoscale dynamics that favors the convective system and the support of the quasi-stationary system with very high-resolution numerical simulations (500 meters) from an operational numerical weather prediction model in their research mode, the HARMONIE-AROME numerical model. HARMONIE-AROME is a convection-permitting model which belongs to ACCORD community and its used operationally in some European countries. Also, this model is being used in European projects such as Destin-E Extremes and UWC. Thus, it becomes necessary to evaluate this model’s behaviour in simulating such very high-impact events.