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Improving weather forecasts by means of HPC solutions: the LEXIS approach in the 2020 Bitti flood event

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In the framework of LEXIS (Large-scale EXecution for Industry & Society) H2020 project, CIMA Research Foundation is running a 3 nested domain WRF (Weather Research and Forecasting) model with European coverage and weather radar data assimilation over Italy. Forecasts up to 48 hours characterized by a 7.5 km resolution are then processed by ITHACA ERDS (Extreme Rainfall Detection System), an early warning system for the heavy rainfall monitoring and forecasting. This type of information is currently managed by ERDS together with two global-scale datasets. The first one is provided by NASA/JAXA GPM (Global Precipitation Measurement) Mission through the IMERG (Integrated Multi-satellitE Retrievals for GPM) Early run data, a near real-time rainfall information with hourly updates, 0.1° spatial resolution and a 4 hours latency. The second one is instead provided by GFS (Global Forecast System) at a 0.25° spatial resolution.

The entire WRF-ERDS workflow has been tested and validated on the heavy rainfall event that affected the Sardinia region between 27 and 29 November 2020. This convective event significantly impacted the southern and eastern areas of the island, with a daily rainfall depth of 500.6 mm recorded at Oliena and 328.6 mm recorded at Bitti. During the 28th, the town of Bitti (Nuoro province) was hit by a severe flood event.

Near real-time information provided by GPM data allowed us to issue alerts starting from the late morning of the 28th. The first alert over Sardinia based on GFS data was provided in the late afternoon of the 27th, about 40 km far from Bitti. In the early morning of the 28th, a new and more precise alert was issued over Bitti. The first alert based on WRF data was instead provided in the morning of the 27th and the system continued to issue alerts until the evening of the 29th, confirming that, for this type of event, precise forecasts are needed to provide timely alerts.

Obtained results show how, taking advantage of HPC resources to perform finer weather forecast experiments, it is possible to significantly improve the capabilities of early warning systems. By using WRF data, ERDS was able to provide heavy rainfall alerts one day before than with the other data.

The integration within the LEXIS platform will help with the automatization by data-aware orchestration of our workflow together with easy control of data and workflow steps through a user-friendly web interface.