Developing an operational high-resolution hydrometeorological system in a Mediterranean region: predictability analysis of two case studies (EGU2020-14140)

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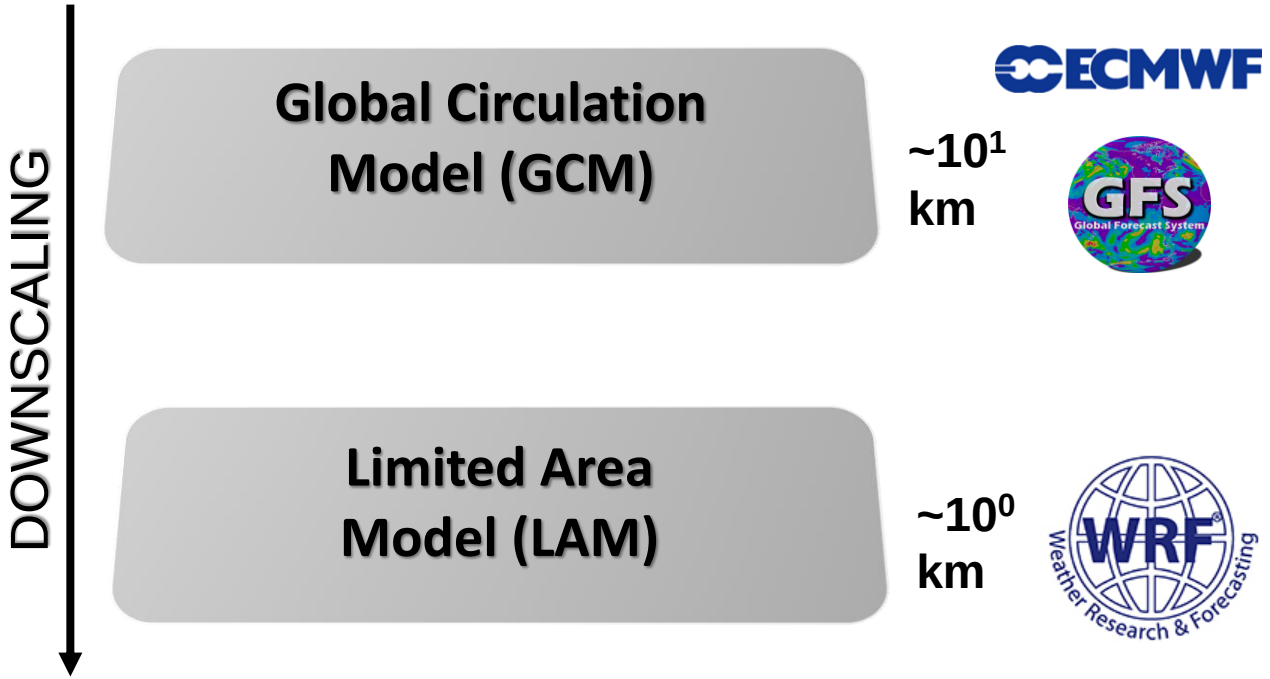
Study concept

This study investigates the predictability of two recent heavy rainfall events (11-13 Nov. 2019, 23-25 Nov. 2019) that hit the Calabria region (southern Italy). It is made through a dynamic downscaling based on the Weather Research Forecast (WRF) Model. Two different operational Global Circulation Models (GCMs) are adopted, namely Global Forecast System (GFS) at 0.25° as horizontal resolution, and the European Center for Medium-Range Weather Forecast's High-Resolution Model (ECMWF-HRES) at 0.075°.



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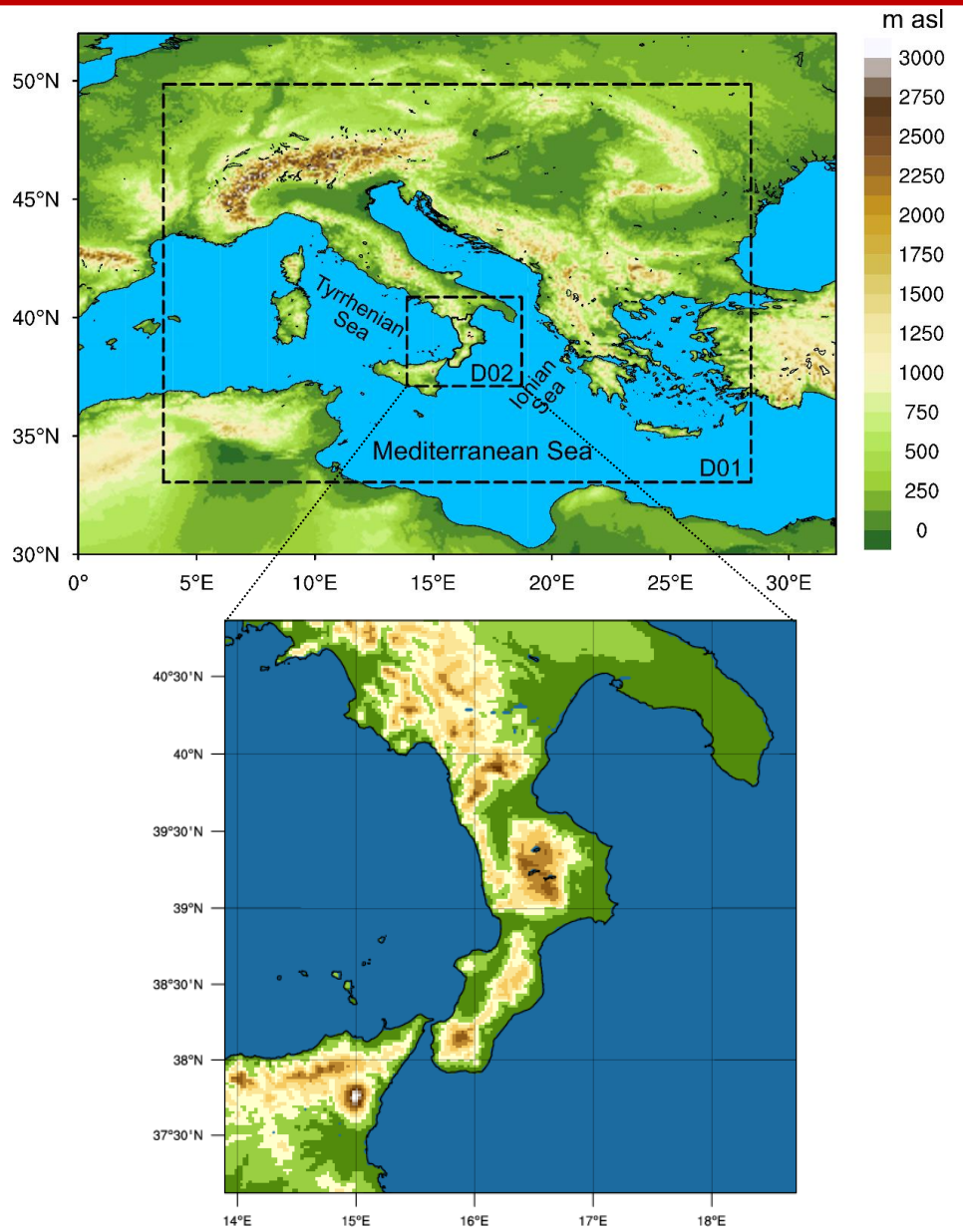
Study area and model setup

The Calabria region is surrounded by the sea and is characterized by a complex step orography which amplifies the frequency and the intensity of heavy rainfall events.

Two one-way nested domains are used, the outermost named D01 at resolution 10km for GFS's boundary conditions, and at 6km for the ECMWF-HRES's boundary conditions, while the innermost domain named D02 is at 2km. The physical schemes adopted are summarized in the table.

Component	Scheme
Microphysics	New Thompson
Planet Boundary Layer	Mellor–Yamada–Janjić
Shortwave	Goddard
Longwave	RRTM
Land Surface Model	NOAH
Cumulus	Tiedke (only D01)



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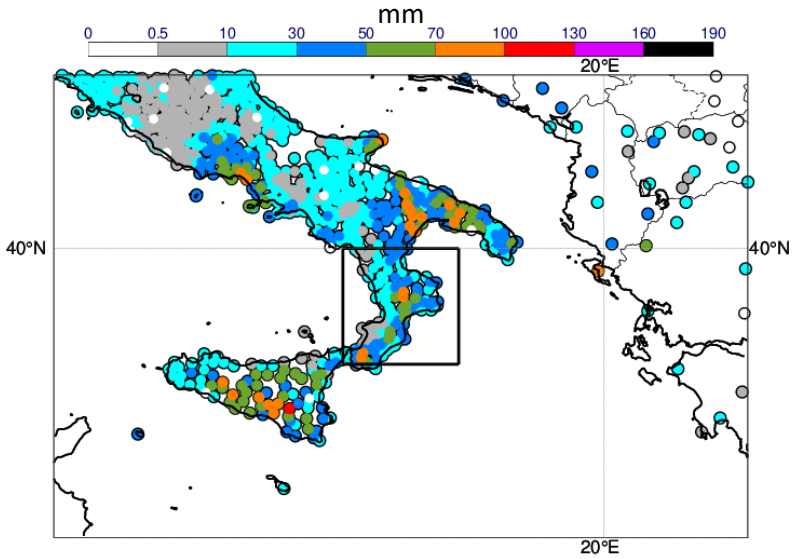
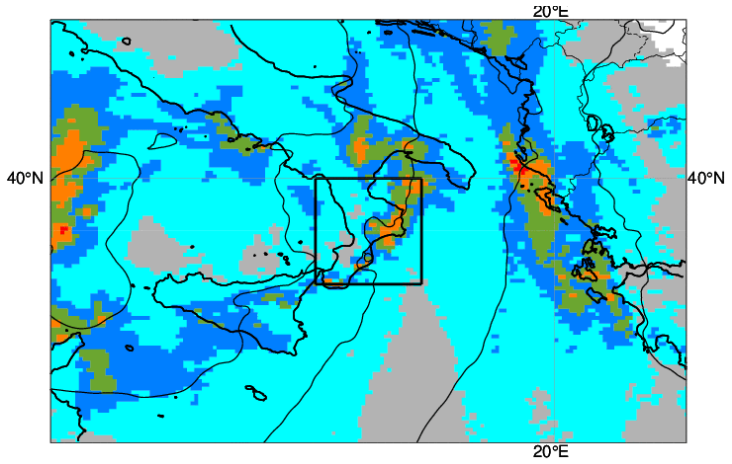
Results: 12 Nov.

24h **Obs**. from 00 UTC, 12 Nov

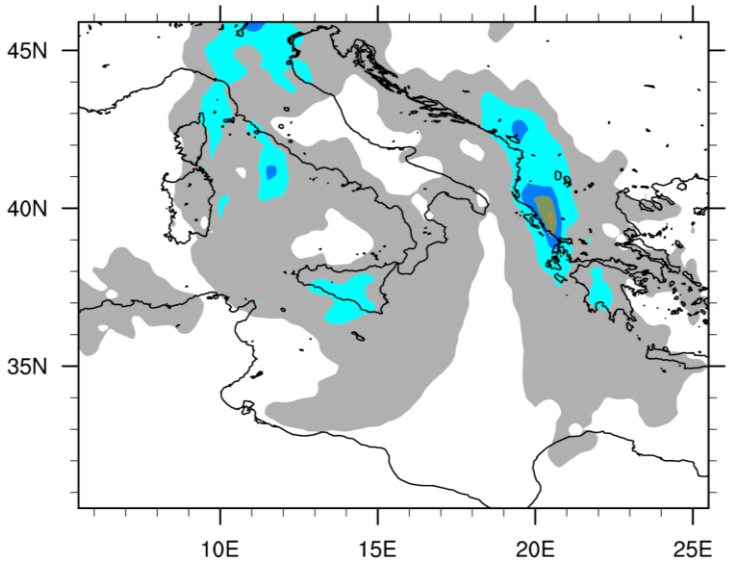


Colored dots are rain gauges

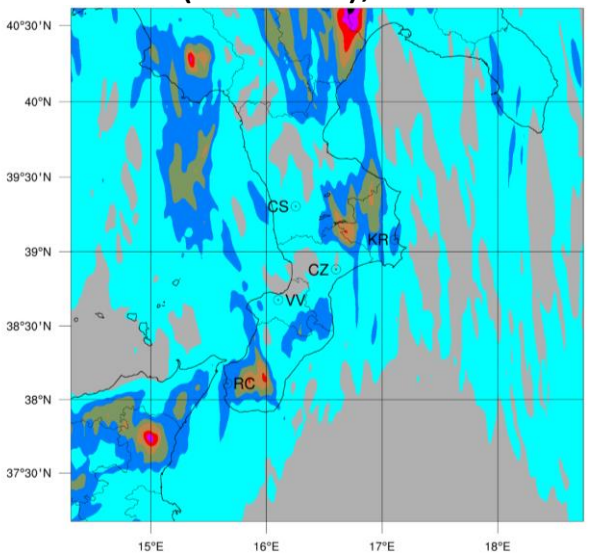
ECMWF-HRES, 24h forec.



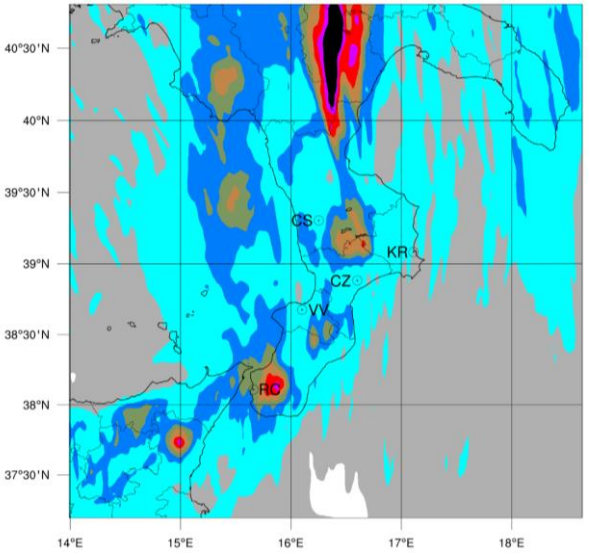
GFS, 24h forec.



WRF (ECMWF), 24h forec.



WRF (GFS), 24h forec.



Simulations start: 00 UTC, 12 Nov

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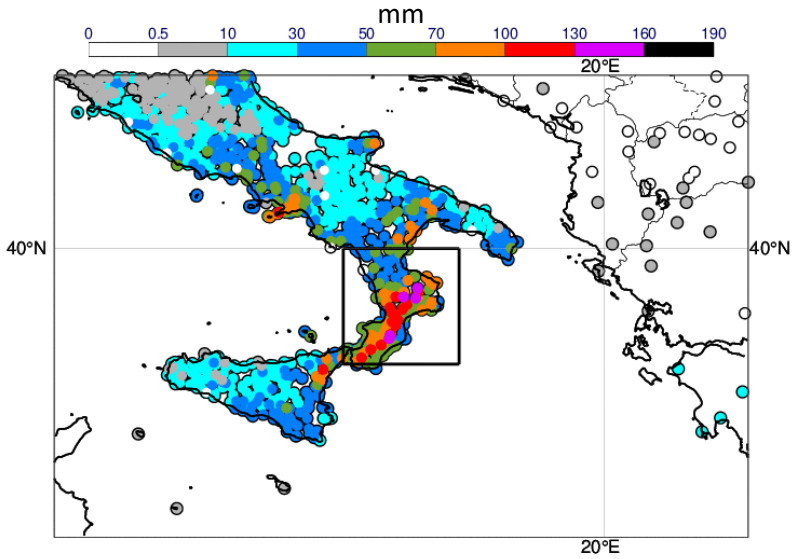
Results: 24 Nov.

24h **Obs**. from 00 UTC, 24 Nov



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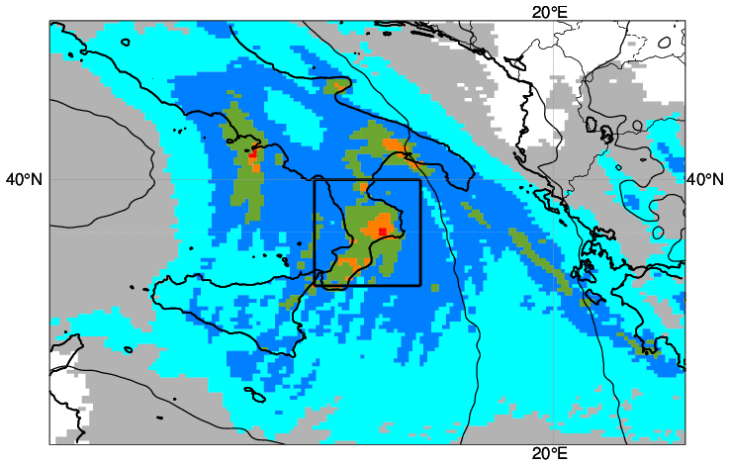
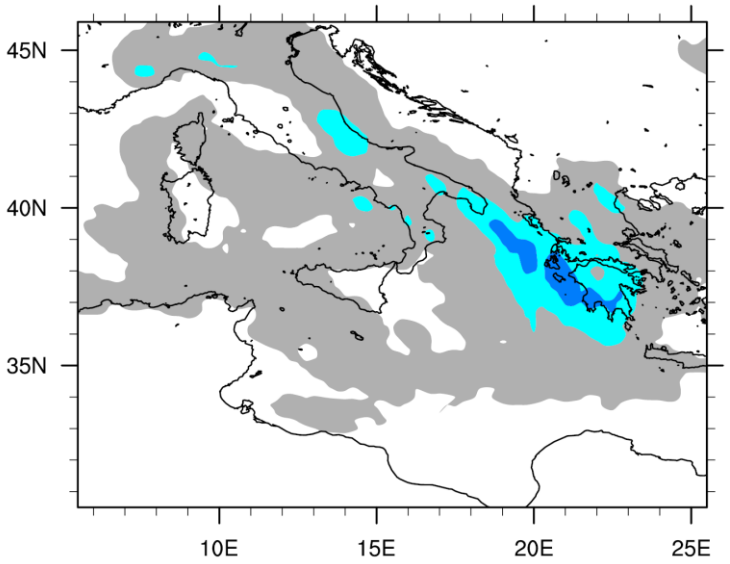
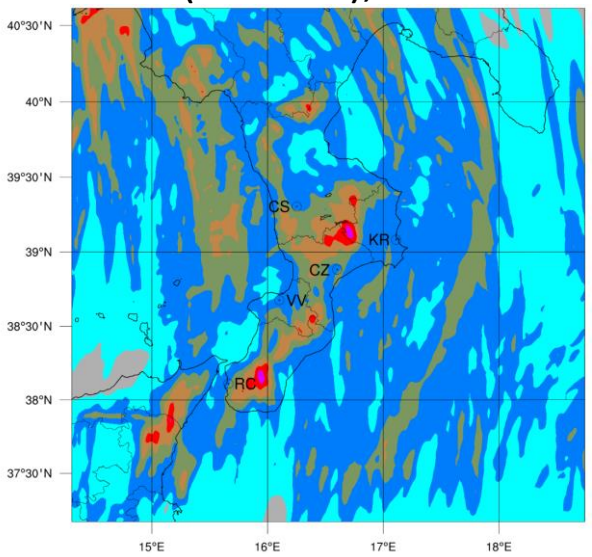
ECMWF-HRES, 24h forec.



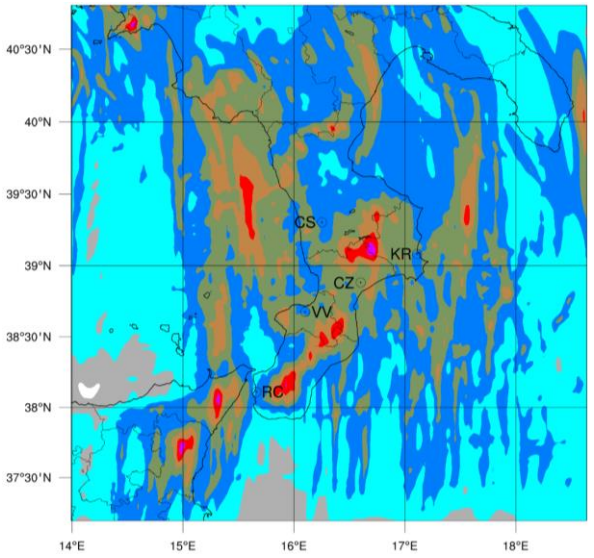
GFS, 24h forec.



WRF (ECMWF), 24h forec.



WRF (GFS), 24h forec.



Simulations start: 00 UTC, 24 Nov

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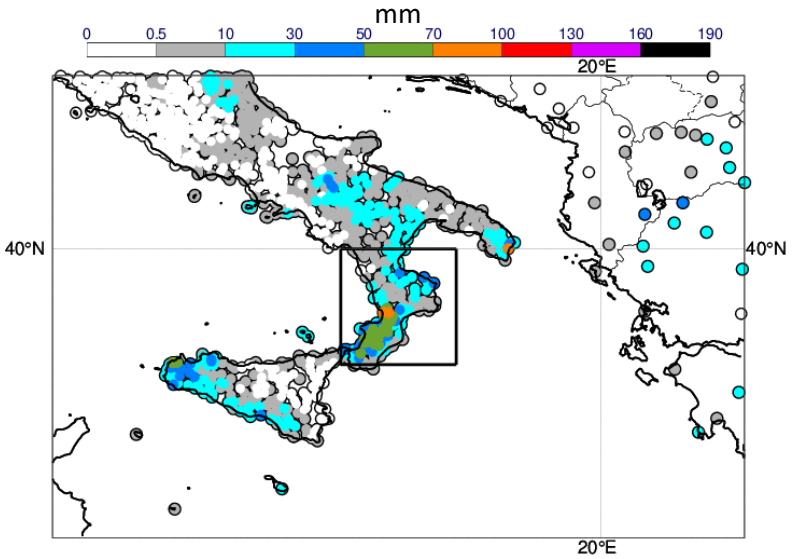
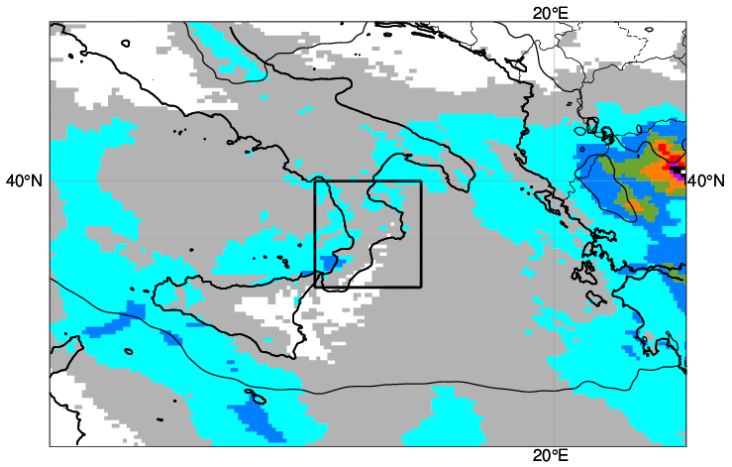
Results: 25 Nov.

24h **Obs**. from 00 UTC, 25 Nov

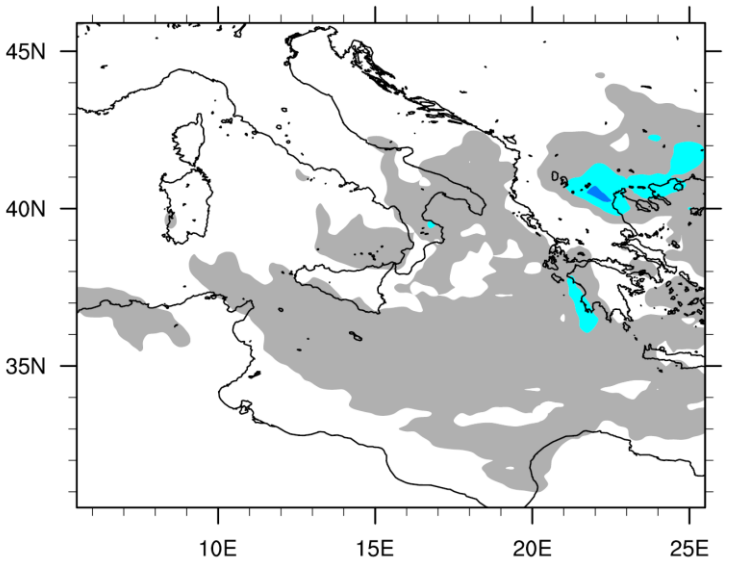


Colored dots are rain gauges

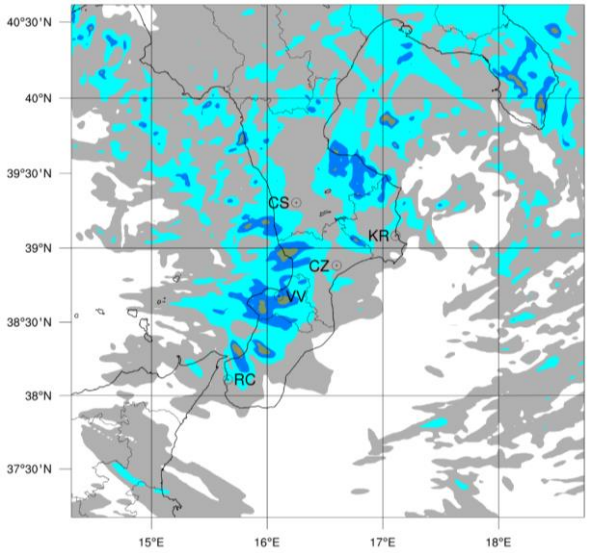
ECMWF-HRES, 24h forec.



GFS, 24h forec.



WRF (ECMWF), 24h forec.



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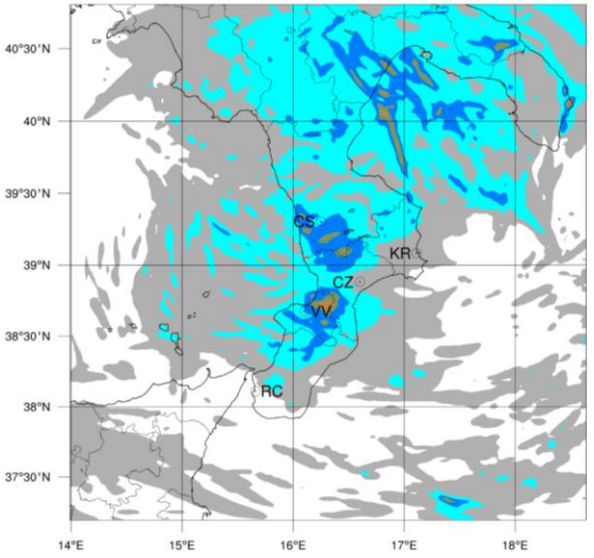

Simulations start: 00 UTC, 25 Nov

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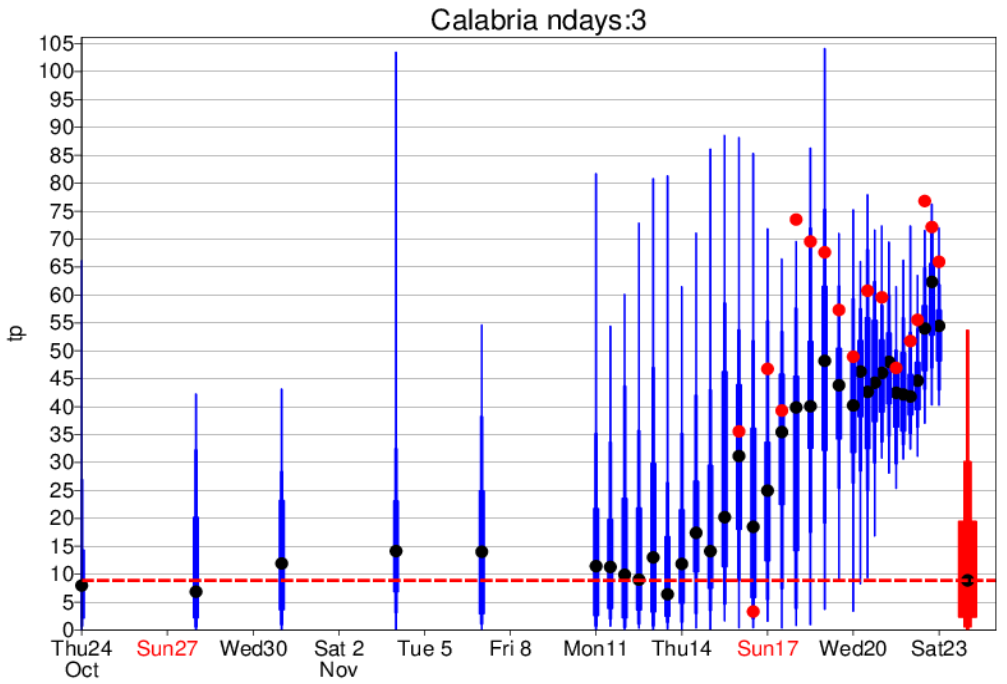
Conclusions and Future outlooks

The dynamic downscaling is essential to forecast accurately heavy rainfall events especially in regions with complex orography and sea-atmosphere interactions like Calabria.

Future outlooks will be to study the capability to correctly forecast these events in a medium-range time window adopting also some selected ECMWF's Ensemble Prediction System members. These simulations at low resolution (≈18 km) show that approaching the event date the total precipitation amount forecasted increases (image on the right).

These forecasts will be used to perform ensemble dynamic downscaling providing the "worst" scenarios and, finally, to simulate the ground effect with distributed hydrological models.

Evolution of forec., 23-25 Nov, Calabria



Ens. –, HRES ●, Ens. median ●, Model climate –

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