

The new Italian regional reanalysis SPHERA: benefits of the convection-permitting resolution in detecting severe-weather events

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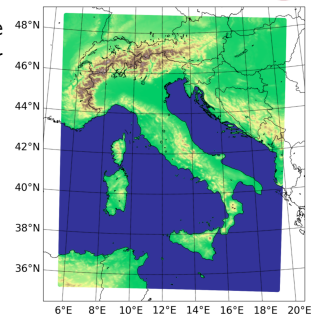
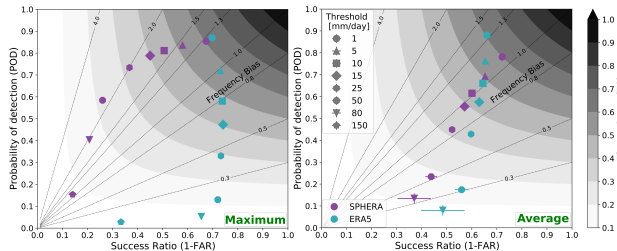
- **SPHERA: High rEsolution regional ReAnalysis over Italy:** downscaled from ERA5 with COSMO at 2.2km + assimilation of regional observations, spans 1995-2020



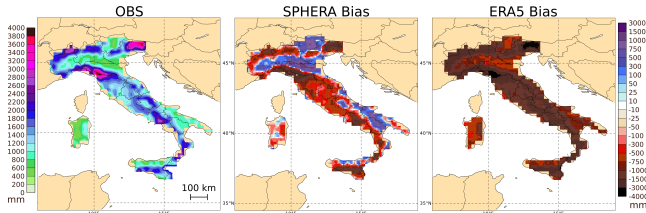
Reanalysis	Domain	Resolution	Model	Forcing	DA	Coverage	Developing group
ERA 5	Global	31km	IFS (2016)	-	IFS Cycle 31r2	1979-now (1950-now)	ECMWF
SPHERA	Italy	2.2km	COSMO	ERA 5	Cont. nudging	(1995-2020)	ARPAE

Aim: better describe high-impact weather events (convection)

- Validation of SPHERA and ERA5 vs daily- & hourly-accum. precipitation datasets (DEWETRA & ARCIS) 2003-2017: upscaling rean-obs fields and taking mean/max values

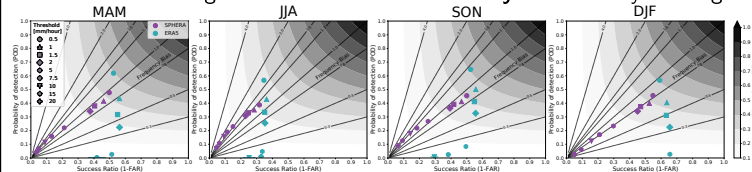


- Performance diagrams of **daily** precipitations: higher skill of SPHERA in simulating heavy rainfalls



- Maximum **yearly** rainfall 15-years avg and deviation from obs.: systematic dry bias for ERA5, smaller locally-driven deviations for SPHERA (orography)

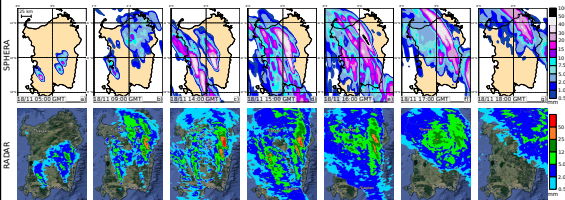
Performance diagrams for seasonal max hourly rainfall 15-years avg:



- SPHERA always more skillful for pp > 2mm/h
- Lower frequency bias for max estimates than daily

Case studies:

- MCS over Sardinia (Nov 2013)

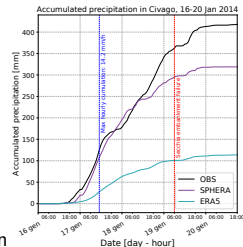


- Flood of the Secchia river (Jan 2014)

→ Long-lived orographic rainfalls(>250mm/72h)

→ SPHERA well predicts intensity, localization and timing of rainfall

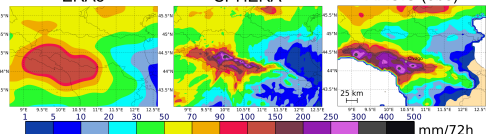
→ ERA5 underestimates and delays precipitation due to coarser resolution



→ Cyclone Cleopatra causes the advection of warm and humid subtropical air which convective potential is orographically triggered over Sardinia causing the formation of multiple MCS enhanced by the passage of the cyclonic cold front

→ SPHERA skillfully reproduces the heavy rainfall hourly evolution linked to the stationary MCSs, their fast intensification and depletion after the passage of the front

ERA5 SPHERA ARCIS (obs)



Conclusions:

The new convection-permitting regional reanalysis SPHERA shows added value in the representation of heavy rainfalls over its driver ERA5 due to a better description of locally-driven convective activity and of the orography allowed by the enhanced grid resolution. **Next step:** focus on high-impact weather events (hail climatology with reanalysis proxies)