Evaluation of the convection resolving climate modeling simulations (RegCM4) over different European regions

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Italian National Agency for New Technologies, Energy and Sustainable Economic Development

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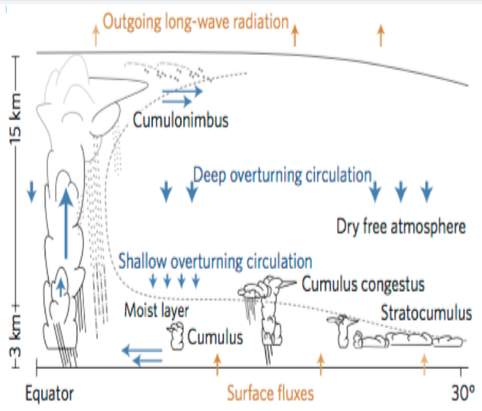
The Abdus Salam International Centre for Theoretical Physics

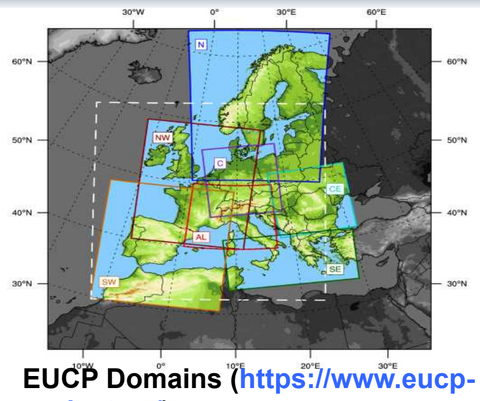
1) Introduction : Convection



- ✓ Driving damaging extreme events
- ✓ It is the dominant type of precipitation in many parts of the world (tropics)
- ✓ Influences the general circulation of the atmosphere

Unfortunally, parameterization of convection, which is required at the grid spacing of most Global and Regional Climate Models contributes to errors in climate simulations

2) Introduction : Overview of the work



EUCP Domains (https://www.eucp-project.eu/)

We are performing some convection resolving climate simulation in the framework of **CORDEX FPS** and European climate Prediction System (**EUCP**) using the non-hydrostatic version of **RegCM4.7.0** model:

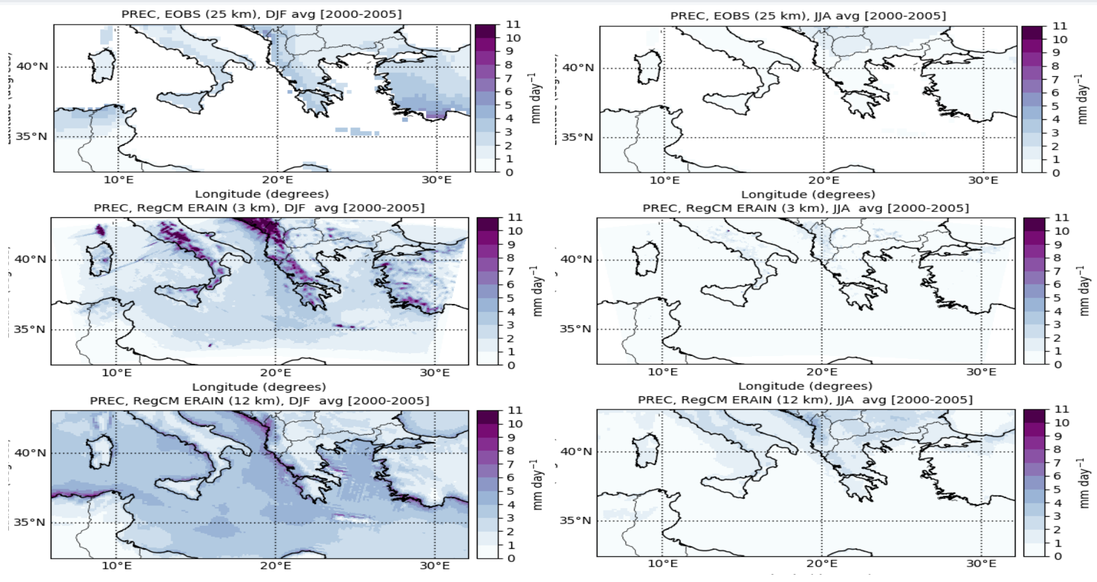
1. Non hydrostatic simulation (3 km of resolution)
2. The ERA-Interim reanalysis, drives the perfect boundary simulation, cover the period 2000–2015

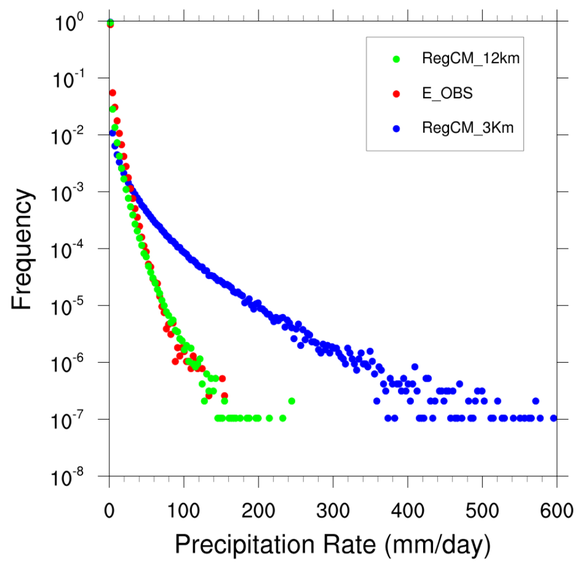
3. the scenario simulation , driven by the Global Climate model HadGEM, historycal (1996-2005), the near future (2041-2050) far future (2090-2099) for the RCP8.5 scenarios,

3) Introduction : Purpose of the work

Provide a preliminary comparison of the first six years long **RegCM4-3 km** simulations with the driving 12 km simulation driven by the ERA-Interim reanalysis and observations. We compare 3 years of simulations for a pan-european domain (**ALPS**), South East Europe (**SE_E**) and Central Europe (**CE_E**) with observations. We used two observational datasets, the european-wide EOBS dataset (25 km) (Haylock et al. 2008) for SE-E and CE_E and a merging of high resolution regional datasets for the Alps covering France, Germany, Netherlands, Alps and Spain (EURO4M, SAFRAN, SPAIN, REGNIE).

4) Results : South East Europe





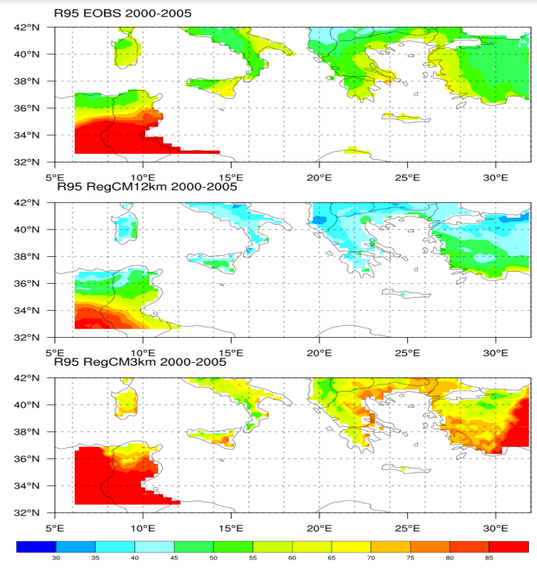
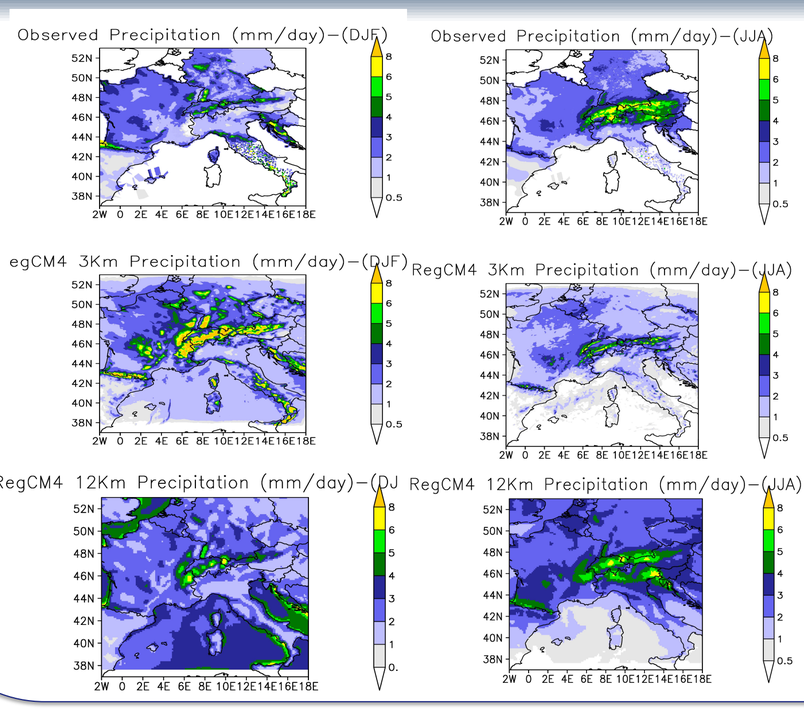


Fig.1: Mean seasonal precipitation amount (mm/day) (200-2005) for winter (DJF) (left) and summrer JJA (right). EOBS (Top), RegCM at 3 km (middle) and RegCM at 12km (bottom) (Right panel). Probability density function (PDF) defined as the normalized frequency of occurrence of daily precipitation events of intensity within a certain bin interval over SE_Europe for 2000-2005 (Central Panel). Percentage of total precipitation amount per time period due to very wet days (over 95° percentile) (right panel)

5) Results : Alps



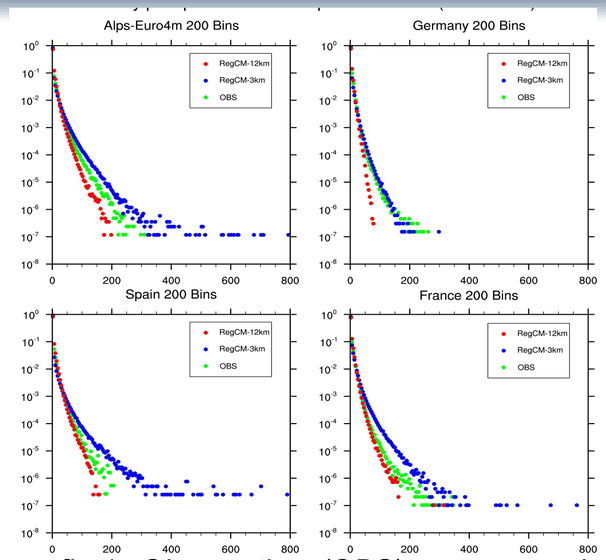
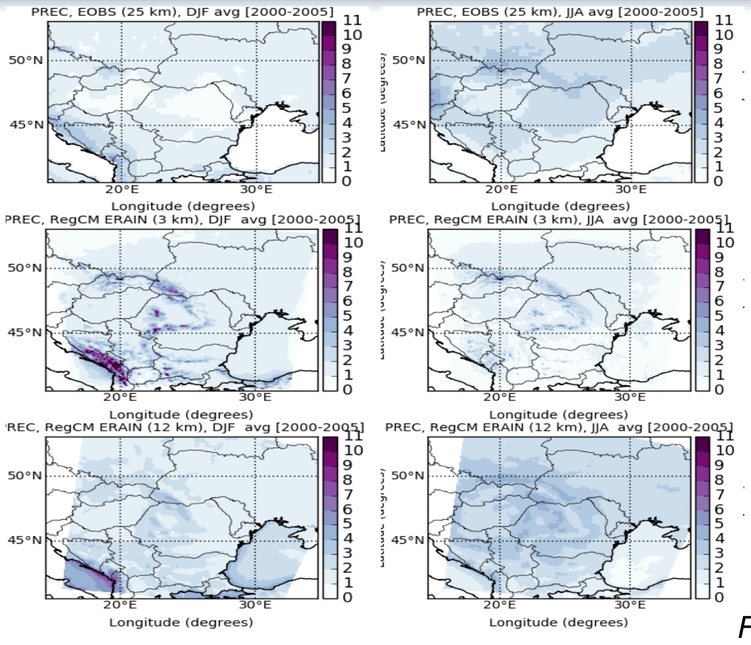
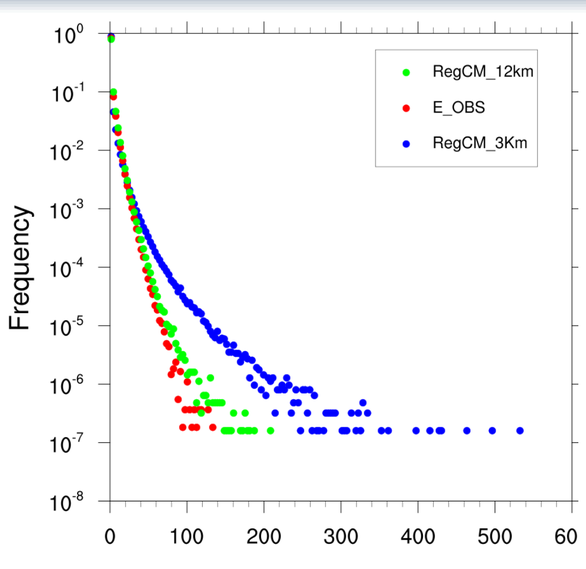


Fig.2: Same as fig.1: Observation (OBS) are a merging of some high resolution regional datasets covering France, Germany, Netherlands, Alps and Spain (EURO4M, SAFRAN, SPAIN, REGNIE)

6) Results : Central Europe





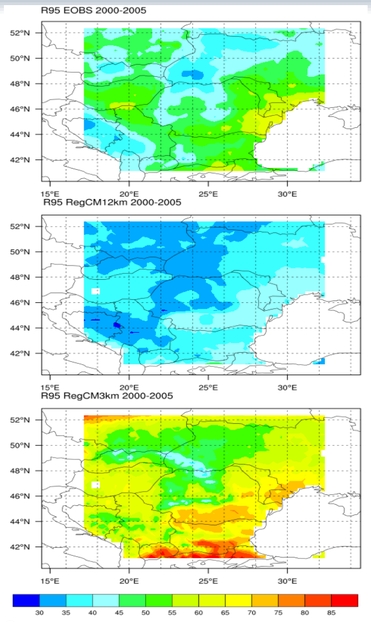


Fig.3: Same as figure 1 but for Central Europe area

7) Conclusion and future work

The spatial distribution of the precipitation amount show more detailed spatial distribution across the three domains; the bias with the low-resolution observations would probably be reduced using high resolved data more suitable to a comparison at convection permitting scale. The small-scale spatial variability of precipitation is enhanced in the convection-resolving simulation with improvement in particular in summer season but the intensity and the extremes of the precipitation, here apparently overestimated especially over the topography, would probably be recovered in a more fair comparison.

Future work: For future work we plan to compare our convection permitting simulations with observations in high temporal and spatial resolution in order to evaluate the model result both at daily and sub-daily scale in order to see if RegCM is inline or not with present literature risults at similar scale. A significant improvement is expected at the sub-daily rainfall scale in line with Ban et al. 2014, Kenond et al. 2012, Langhans et al. 2013, Prein et al., 2013, Fosser et al., 2014, Berthou et al., 2018 , Kendon et al, 2012, Berthou et al., 2018, Chan et al. 2014 Ban et.al 2014 Fosser et al. 2015.