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A Study on Heavy Rainfall and Flash Floods Using Different Climate Toolboxes

Inna Khomenko[1] and Roshanak Tootoonchi[2,3]
[1]Odessa State Environmental University (OSENU), Odessa, Ukraine (innchom.ik@gmail.com)
[2]Department of Civil, Environmental and Mechanical Engineering (DICAM), University of Trento, Trento, Italy (roshanaktootoonchi94@gmail.com)
[3]Center for Agriculture Food and Environment (C3A), Edmund Mach Foundation, San Michele all'Adige, Italy (roshanaktootoonchi94@gmail.com)

Under the climate change, extreme precipitation responsible for flash floods, which can cause significant economic losses and human casualties, become more frequent and severe. These escalations are expected to become higher due to global warming which leads to increased water vapor in the atmosphere and thus, intensified precipitation events. Recent reports show that most flood events in Italy constitute flash floods, therefore it is projected for the region of Italy to be increasingly affected by flood events caused by heavy precipitation.

In this study, trends in extreme precipitation for present day and future projections up to 2100 under the worst-case scenario of warming, namely the Representative Concentration Pathway (RCP) 8.5 scenario are investigated using Copernicus and KNMI Climate Explorer databases.

On the basis of extremely easy-to-use KNMI Climate Explorer database anomalies of RX1day (1981-2010 reference period) for historical period and up to 2100 are retrieved for 7 Italian cities highly affected by flash floods (Venice, Rome, Naples, Genoa, Cagliari, Catanzaro, Palermo).For the mentioned regions the strong positive trends are calculated and the highest positive anomalies up to 50-80 mm/day are observed in the half of the XXI century.

The Copernicus toolbox editor was used to retrieve the RX1day index and 95th percentile from present day simulation (2011–2020) and future projection (2021–2100) of global precipitation from a total of 18 bias adjusted Global Climate Models from CMIP5 and precipitation time series for 7 Italian cities were extracted in order to obtain the trends. RX1day index doesn't show significant increasing trend. Moreover, for the 95th percentile negative trends are obtained for most of the Italian cities in question.

Since heavy rainfalls are usually caused by convective precipitation, near surface convective precipitation trends for the period of 1991 to 2020 are derived from ERA5 monthly averaged reanalysis for the Mediterranean region and Italy, for the months in which the flash floods are often observed. The most significant increases in convective precipitation are obtained in July for Northern Italy, and in September for Southern Italy, and in November for the west coast zone.

It can therefore be said that for the historical data the positive trends in precipitation are dominated. However, for different projections and climate models from different database different results, sometimes even opposite results, are obtained.