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Abstract title: Past, present and future high-temperature extremes over the Euro-Mediterranean region at the local scale

High-resolution Regional Climate Models (RCMs) might be an appropriate tool to address the study of future potential impacts of climate change at local scale. In this study, the performance of RCMs from the Euro-CORDEX-11 exercise in the simulation of extreme values and trends of high temperatures at local scale is evaluated. A list of major Euro-Mediterranean airports, within which a large variety of topographies are represented, is selected as case studies, as this work is particularly motivated by the emerging concern about the impacts of climate change on aviation at the airport scale. We consider the upper percentiles (90, 95 and 99th) of the daily maximum near-surface air temperature (*TX*) in summer as representative for high-temperature extremes. Summer *TX* trends are computed by quantile regression for each airport. E-OBS is considered as observational reference after having verified, from the intercomparison of several observations and reanalysis, that the choice of the observational reference will not be determinant for the CMs evaluation in these terms. The added value of RCMs over the coarser resolution Global Climate Models (GCMs) is then assessed by comparing the Euro-CORDEX-11 ensemble with the driving GCMs from CMIP5 regarding summer *TX* extremes and trends in recent decades at the selected airports. Next, whether future projections differ between RCMs and GCMs over the same locations is addressed, focusing on two time horizons: near term (2021-2050) and long term (2071-2100). Finally, the bias correction of CM projections is performed by applying a variation of the quantile delta mapping method,

which allows the future magnitude of summer *TX* extremes to be estimated over the selected locations.

Results show that RCMs overestimate the magnitude of *TX* extremes at the airports when forced by quasi-observational data, while the driving GCMs underestimate it. The distributions of past trends simulated by both the RCM and GCM ensembles remain compatible with observations. Therefore, we conclude that there is no generally prevailing added value in the Euro-CORDEX-11 RCMs regarding the magnitude of extreme values nor the trends of high temperatures at the airport's local scale, despite their higher spatial resolution. Besides, GCMs are found to project a larger warming than RCMs over the same locations (between 0.8 and 1.2ºC greater, on average, by the near term and between 1.8 and 2.7ºC greater, on average, by the long term), which is coherent with previous studies. We find that, as long as this difference between the two ensembles is not fully explained, impact studies and the design of adaptation and/or mitigation policies at regional to local scales should not be solely based on RCM simulations, in order to not underestimate the actual uncertainty in future climate projections. Both RCM and GCM future projections should be taken into cosideration.

The future magnitude of high-temperature extremes obtained here could be used for any other impact study concerning the increasing intensity of these events at the airports considered. Also, the methodology developed and used in this study could be followed to carry out any other local impact study in the same terms.

References:

Gallardo, V., Sánchez-Gómez, E., Riber, E., Boé, J. And Terray, L. Evolution of high-temperature extremes over the main Euro-Mediterranean airports. *Clim Dyn* 61, 1717–1740 (2023). https://doi.org/10.1007/s00382-022-06652-z

Gallardo, V. (2023). *Impacts of increasing high-temperature extremes on aircraft takeoff performance over the Euro-Mediterranean region* (Doctoral thesis, Université Paul Sabatier-Toulouse III). https://theses.hal.science/tel-04325649/