Convective indices trends in Cyprus

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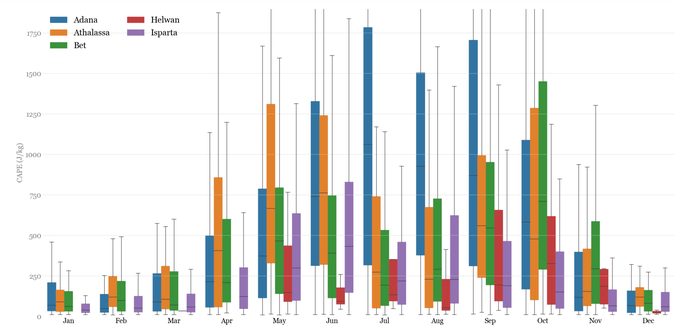
EMMENA region

The Eastern Mediterranean basin and the Middle East - region are often referred as a hotspot for climate change, with a rate of warming two times faster than the global average. Despite this, the infrastructure to study locally the atmospheric phenomena and constituents is sparse in the region. For example, in the region selected for this study (29° – 38° East, 29° – 38° North) there are only five radio-sounding stations (Adana, Athalassa, Bet Dagan, Helwan, and Isparta), stations that have two launches per day, and available in high-resolution mode starting from 2016*.



Monthly distribution of CAPE, from the radiosounding stations located in the domain used for this study. CAPE was computed using MetPy library.

ERA5 & CORDEX data

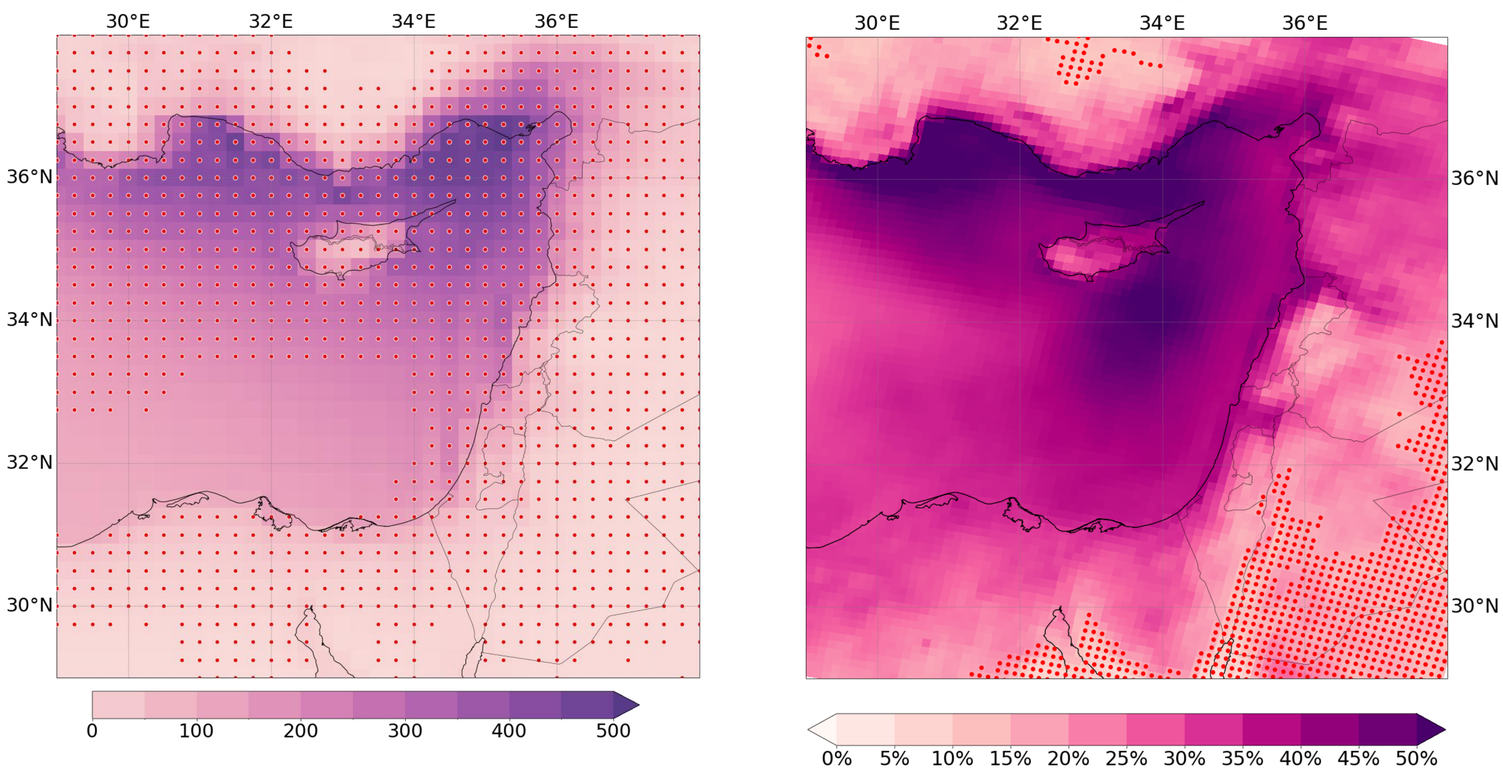
ERA5 1h data on single levels (**1940 - 2021**) & **CORDEX** 3h data (historical : **1971 – 2000** and projection: **2021 – 2050**)

→ Daily max, midpoint

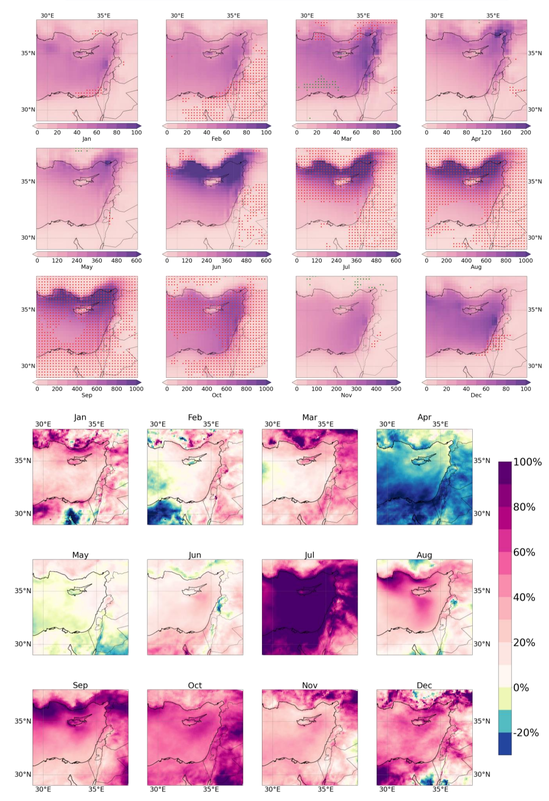
→ Annual & seasonal means

→ Mann-Kendall Trend Test (for ERA5 data)

→ Wilcoxon signed-ranked test (for CORDEX data)



Annual mean for the daily midpoint for CAPE (J/kg) from ERA5 for the period 1940 – 2021 (left image) and % difference of the projected (2021 - 2050) to the historical period (1971 - 2000) from CORDEX (right image). Red dots represent pixels with a statistically significant increasing trend.



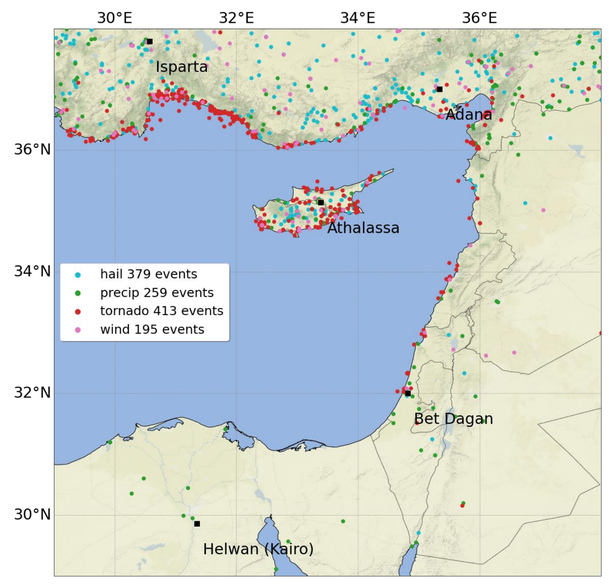
Same as the left plots, but with monthly data.
Upper plot: ERA5 data. Lower plot: CORDEX data.

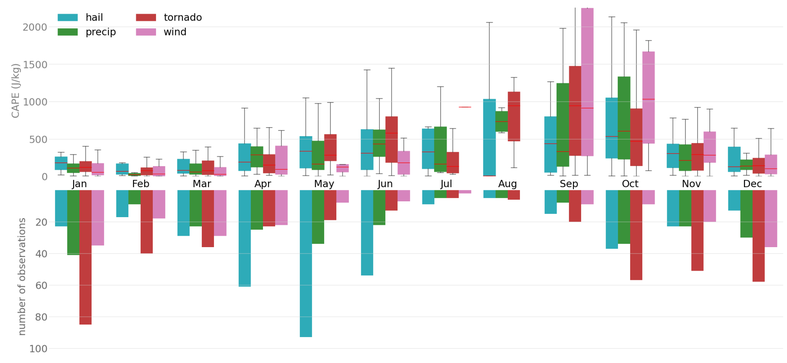
ESSL data

Observational data: ESSL database**, event type: large hail, heavy rain, tornadoes, severe wind gusts, reports from 1940 up to 2021.
CAPE highest values: **September and October**.
highest number of **reported events**: **January**

	Jan	Sep	Oct
no of events	85	20	57
max CAPE (J/kg)	794	2797	2925
mean CAPE (J/kg)	150	1025	679

Number of events for January, September and October, with the maximum and mean values of CAPE (values extracted from the ERA5).





Monthly occurrences of the event's type with a boxplot of the CAPE.

Conclusions

ERA5 data presents an increasing trend for more than 75% of the points from the considered study area. The highest values of CAPE are recorded in the coastal area of the south of Turkey, the coastal area of Cyprus and the coastal area of the Middle East. Most of the events from the ESSL database presented above are recorded in the coastal areas.
CORDEX data presents an increase from 10% to 50% between the projected period (2021 - 2050) relative to the historical period (1971 - 2020) for the annual midpoint means. Except for the months of April and May, there is an increase in CAPE for all the months. August, for the projected period, shows an increase of 100% compared with the historical period.
In the context of the H2020 project EXCELSIOR, remote sensing infrastructure for observations of clouds, aerosols and winds is being built in Limassol, Cyprus. The observations provided by this unique research infrastructure in the region will provide valuable information about the interaction of clouds and aerosol, and their dynamics in a region influenced by air masses travelling from the North of Africa, the Middle - East and the south-east of Europe.

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*data access from https://www.meteociel.fr/

** Observational events are provided by the ESSL - European Severe Storms Laboratory www.essl.org / ESWD - European Severe Weather Database www.eswd.eu. Dotzek, N., P. Groenemeijer, B. Feuerstein, and A. M. Holzer, 2009: Overview of ESSL's severe convective storms research using the European Severe Weather Database ESWD. Atmos. Res., 93, 575-586.