Heat extremes in the eastern Mediterranean and the Middle East

Panos Hadjinicolaou

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The Cyprus Institute

Mediterranean, Middle East & North Africa (MENA)

Hot and arid mean conditions

Temperature extremes

Human-induced intensification

Adverse impacts (health, water/energy nexus)
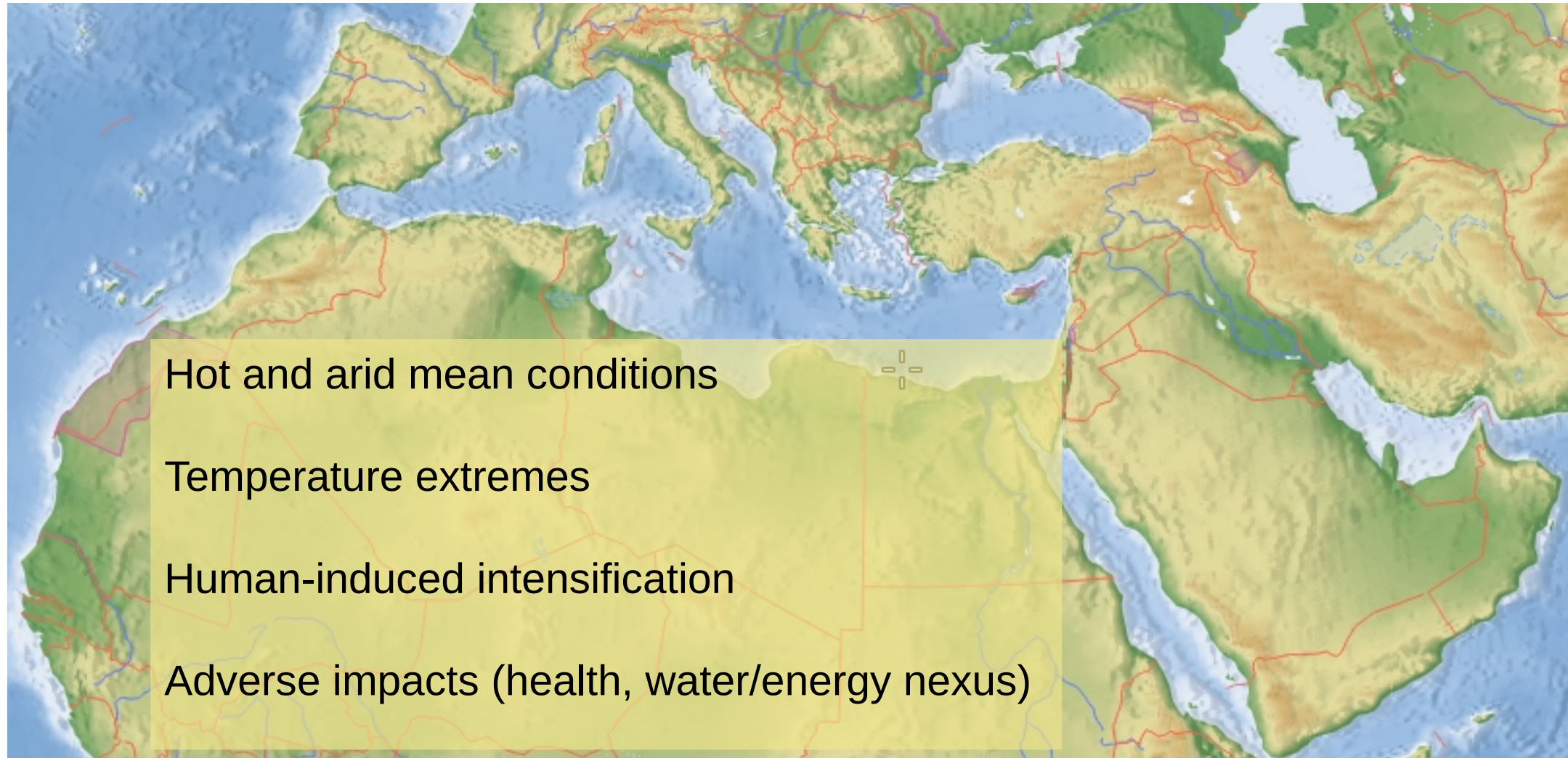
Observed global warming (land)

CRUTEM4 global land temperature

Aug2019-Jul2020 = 1.31°C (+/-0.15°C) above 1961-90

1981-2020 warming ~ 1.3°C

Legend:
- 12-month running mean
- 95% confidence interval

Y-axis: Temperature anomaly (°C from 1961-1990 mean)

X-axis: 1900, 1950, 2000

Tim Osborn (CRU, UEA)
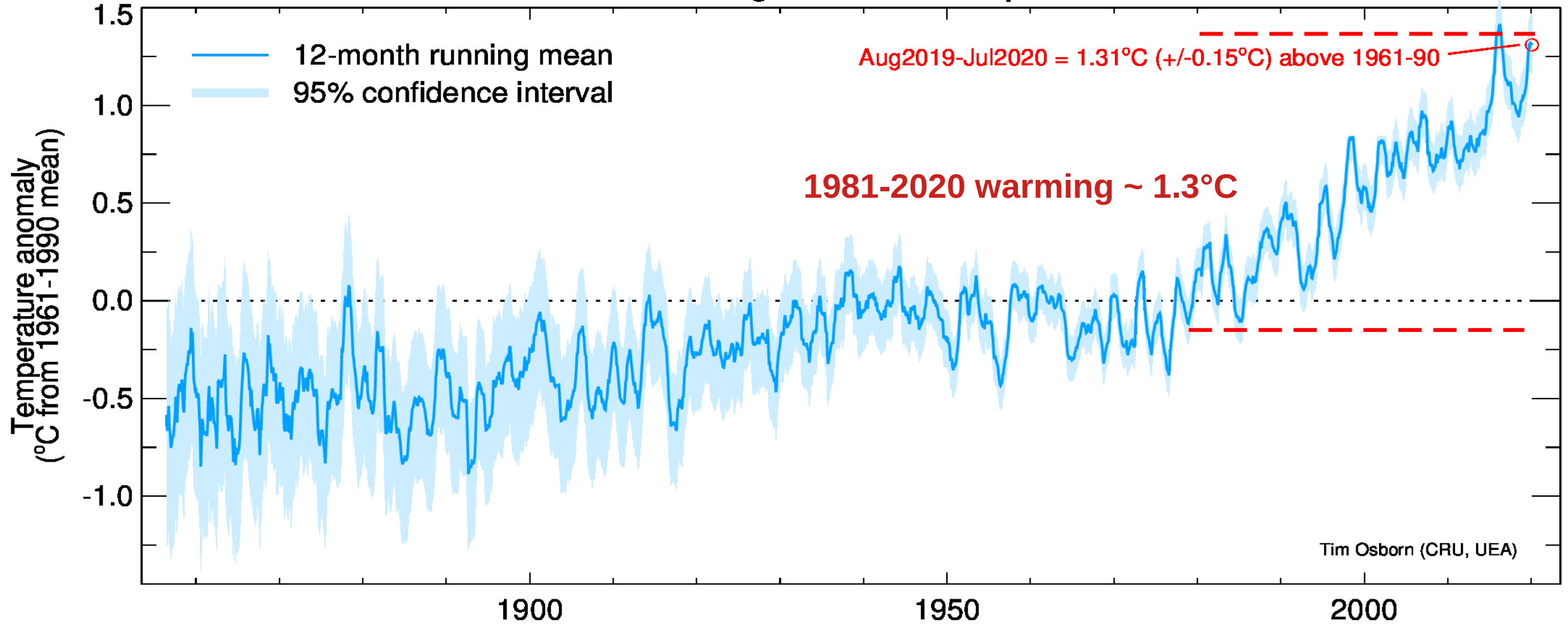
https://crudata.uea.ac.uk/~timo/diag/temptsland_12monrunning_global.png

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Mean Temperature Annual Trend
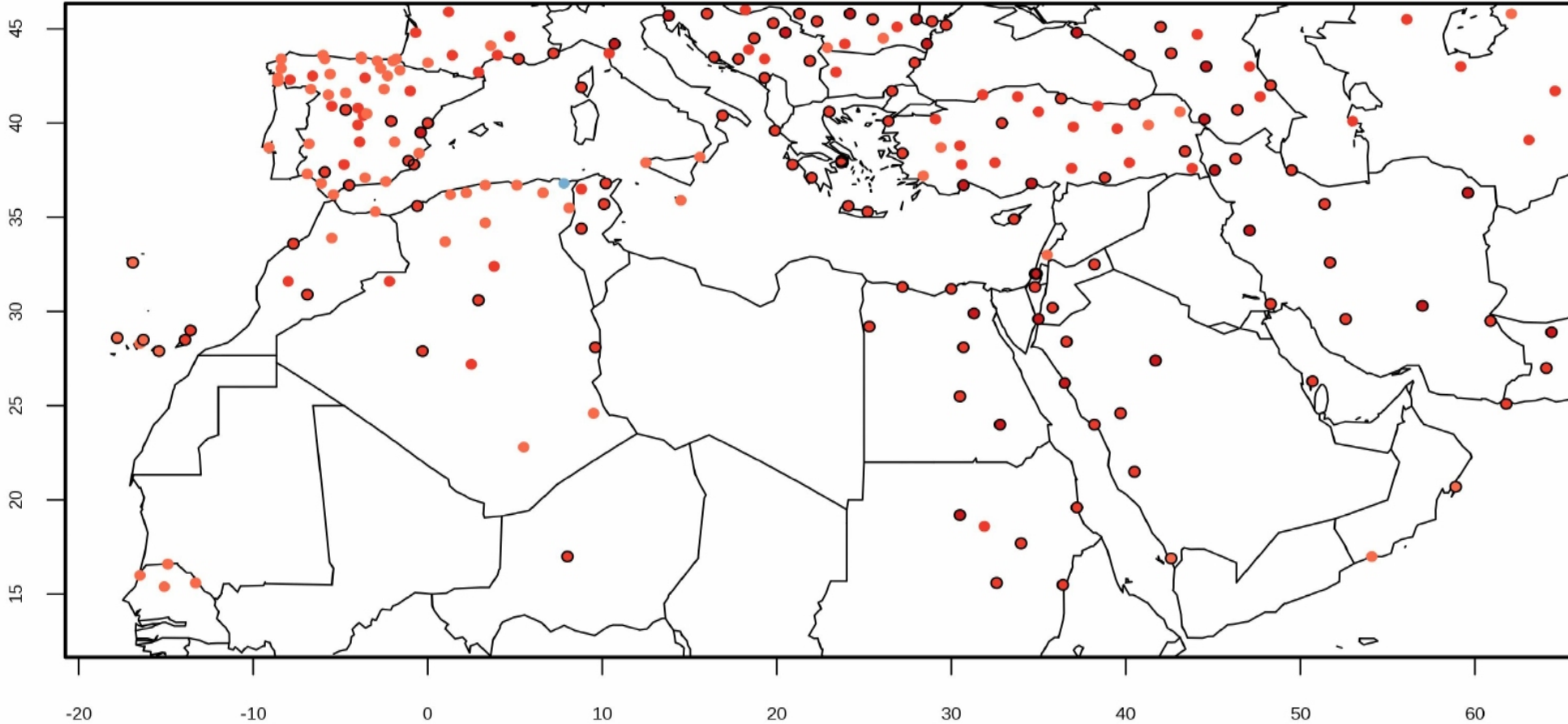
1981-2019

Median trend:

~ 0.4°C/decade

= +1.6°C

0.3°C larger than global average

degrees °C per decade

Data: CRUTEM 4.6

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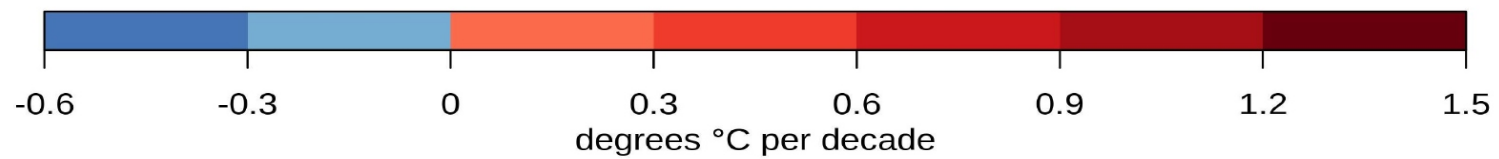
Nicosia Tmax 1983-2020   September
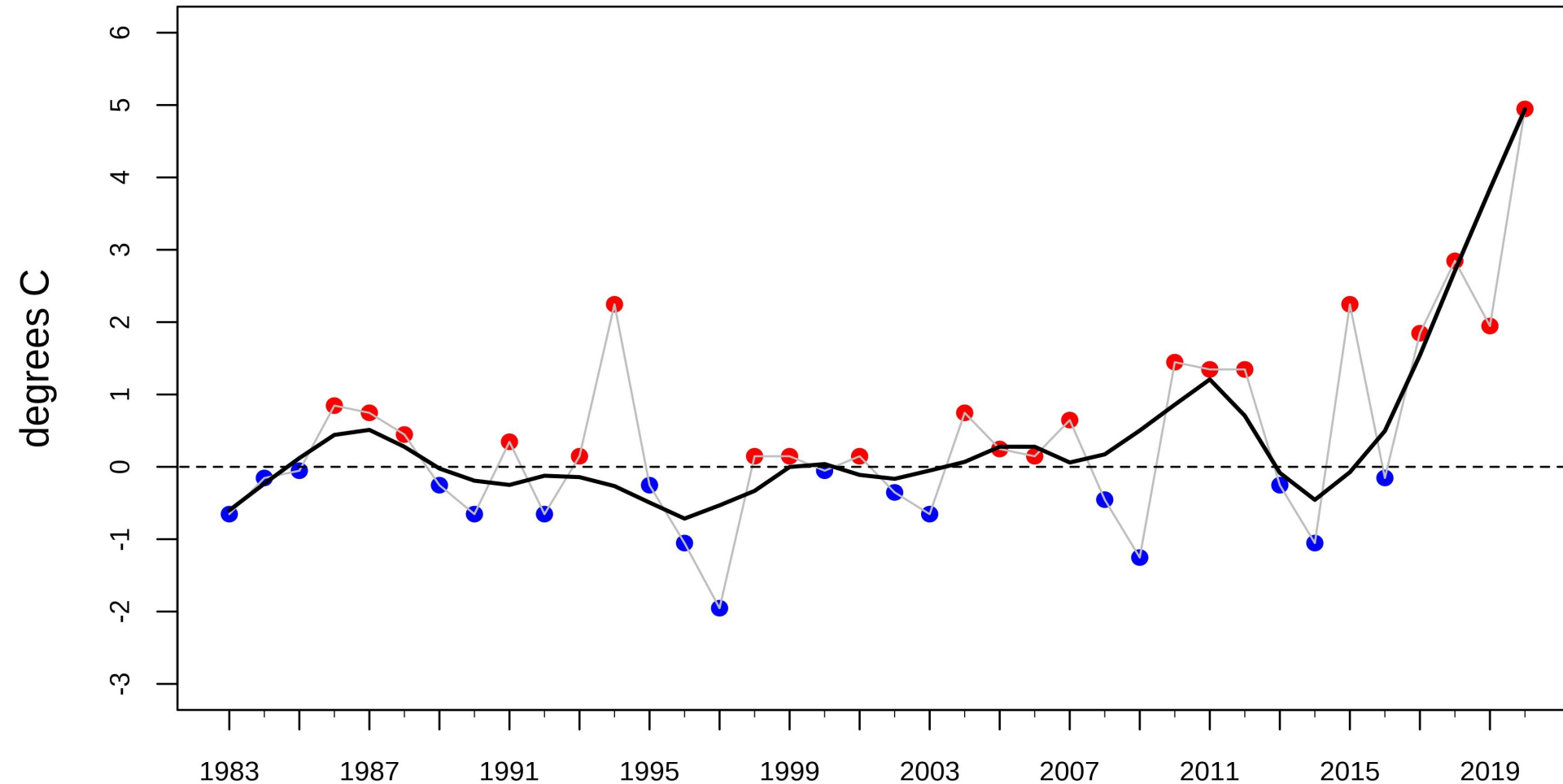
2020:

No. days > 40°C

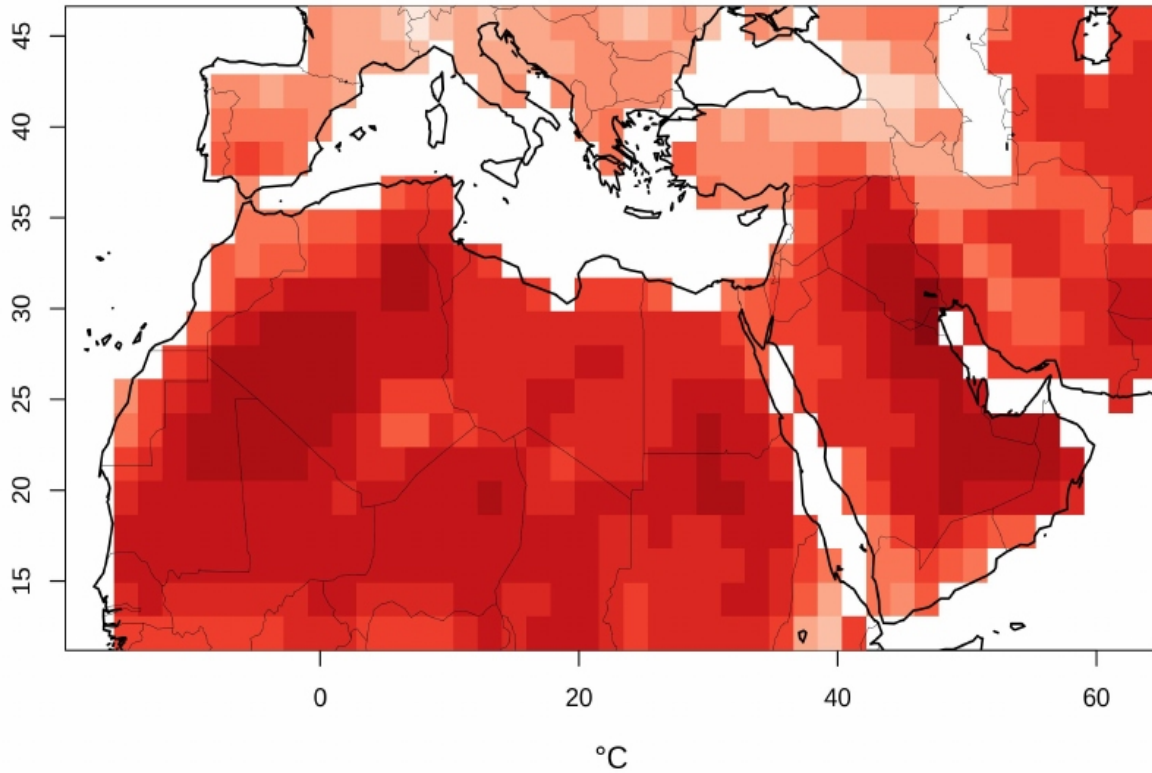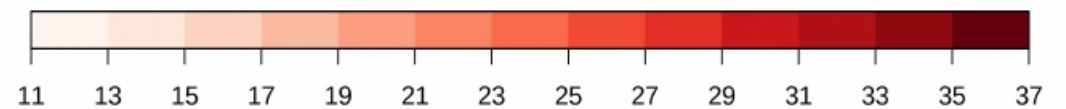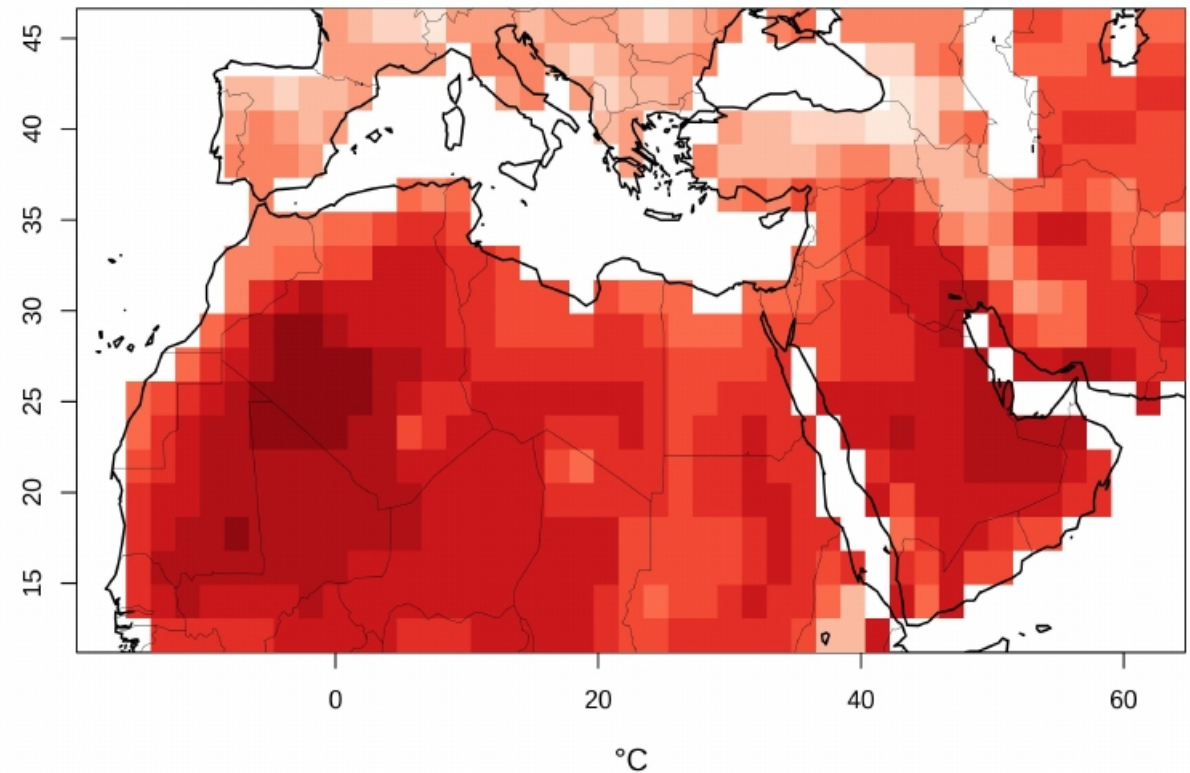|	
May:	6
June:	2
July:	18
August:	12
September:	9
October:	1
Total:	<u>48</u>

Data: Cyprus DoM

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Temperature extremes 1981-2019 Climatology   Obs.

Berkeley Earth Warmest Day (TXx)

Berkeley Earth Warmest Night (TNx)

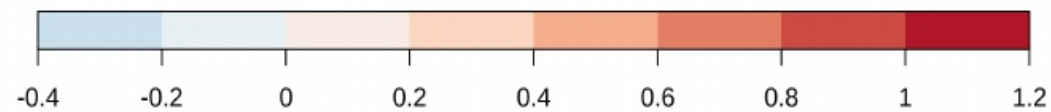CARE-C

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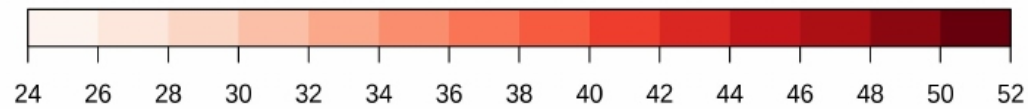
Temperature extremes 1981-2019 Trend Obs.

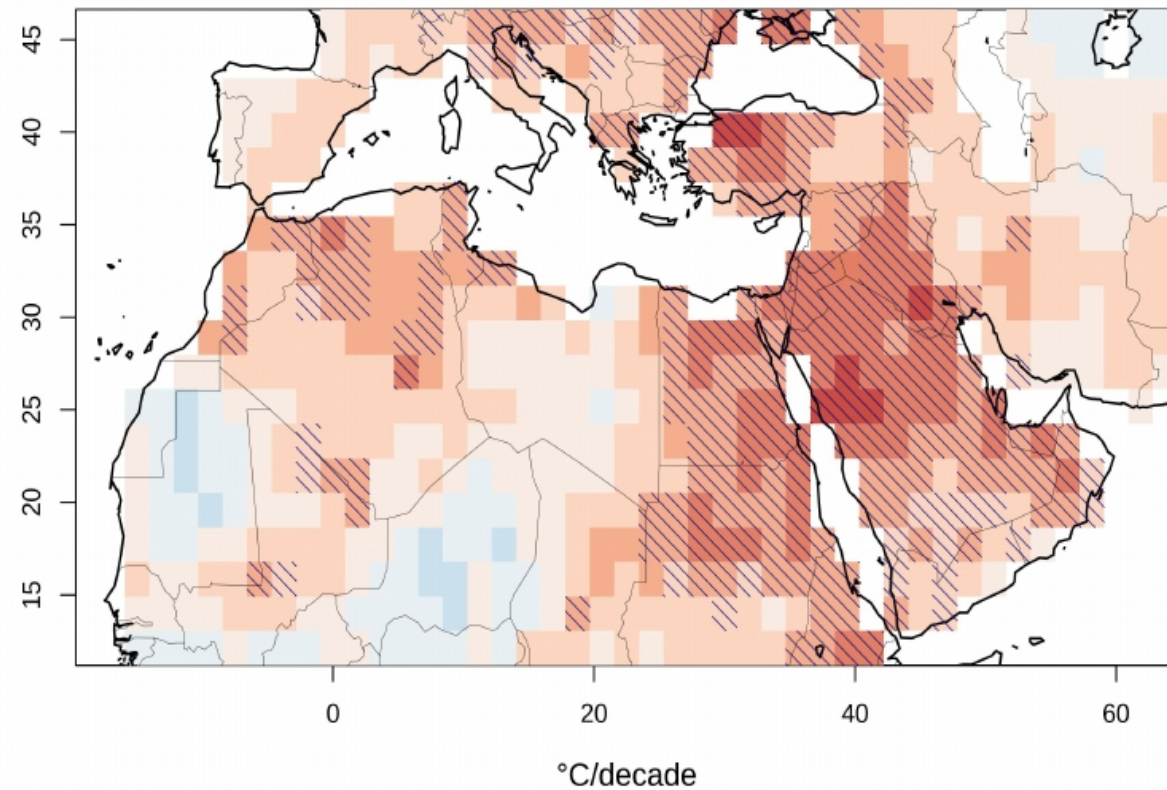**Berkeley Earth Warmest Day (TXx)**

Berkeley Earth Warmest Night (TNx)

°C/decade

°C/decade

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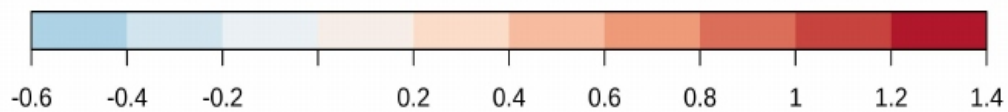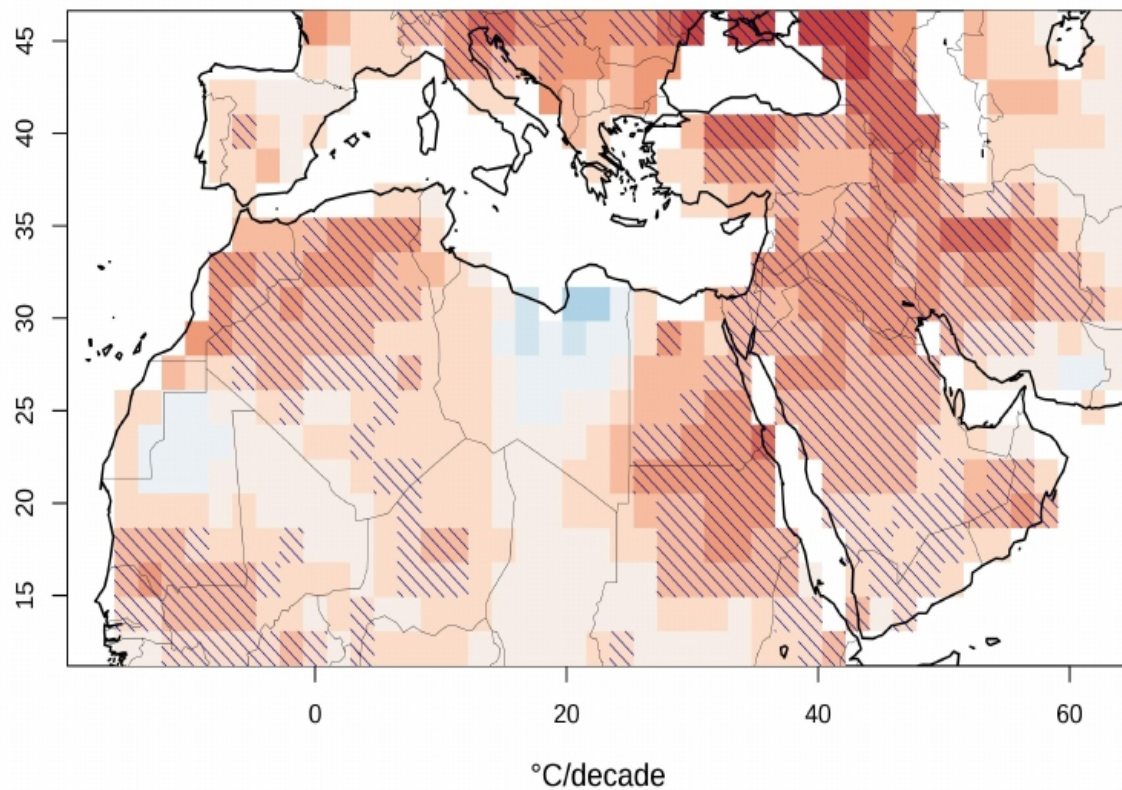
Temperature extremes 1951-2019   Models + Obs.
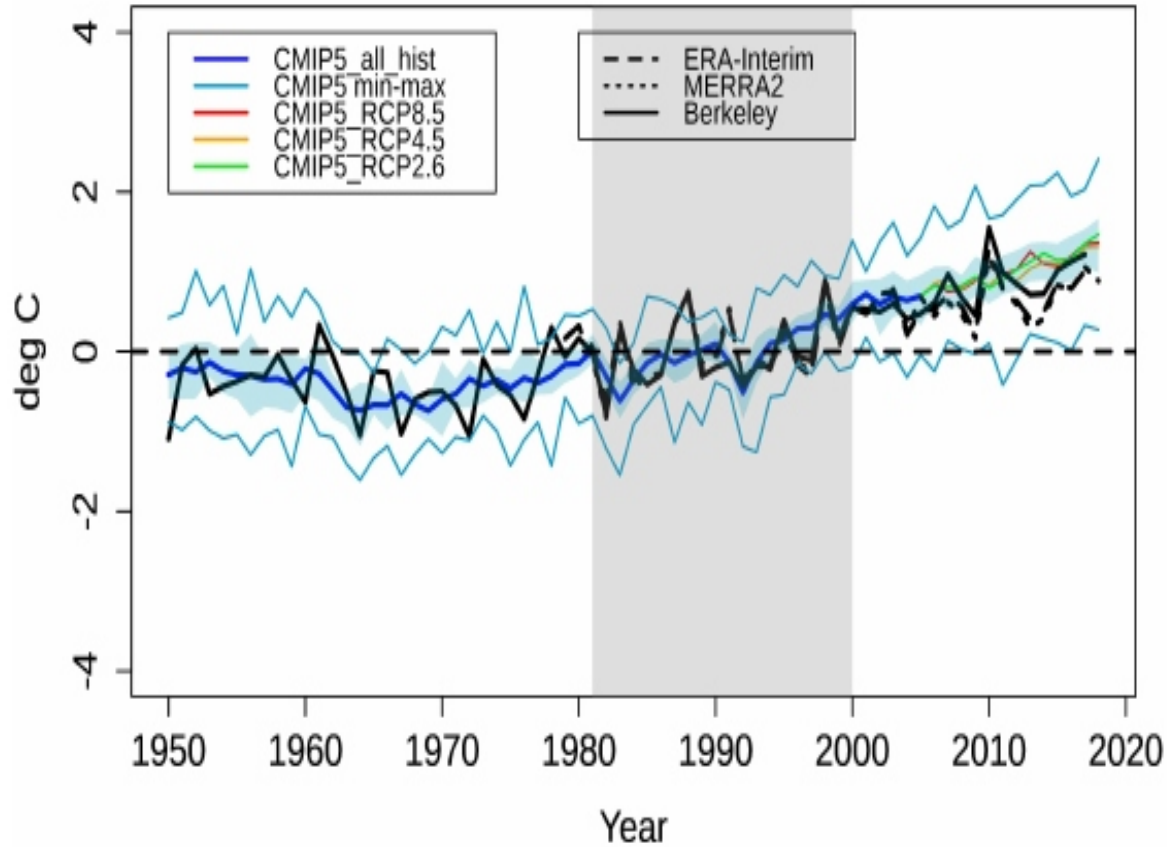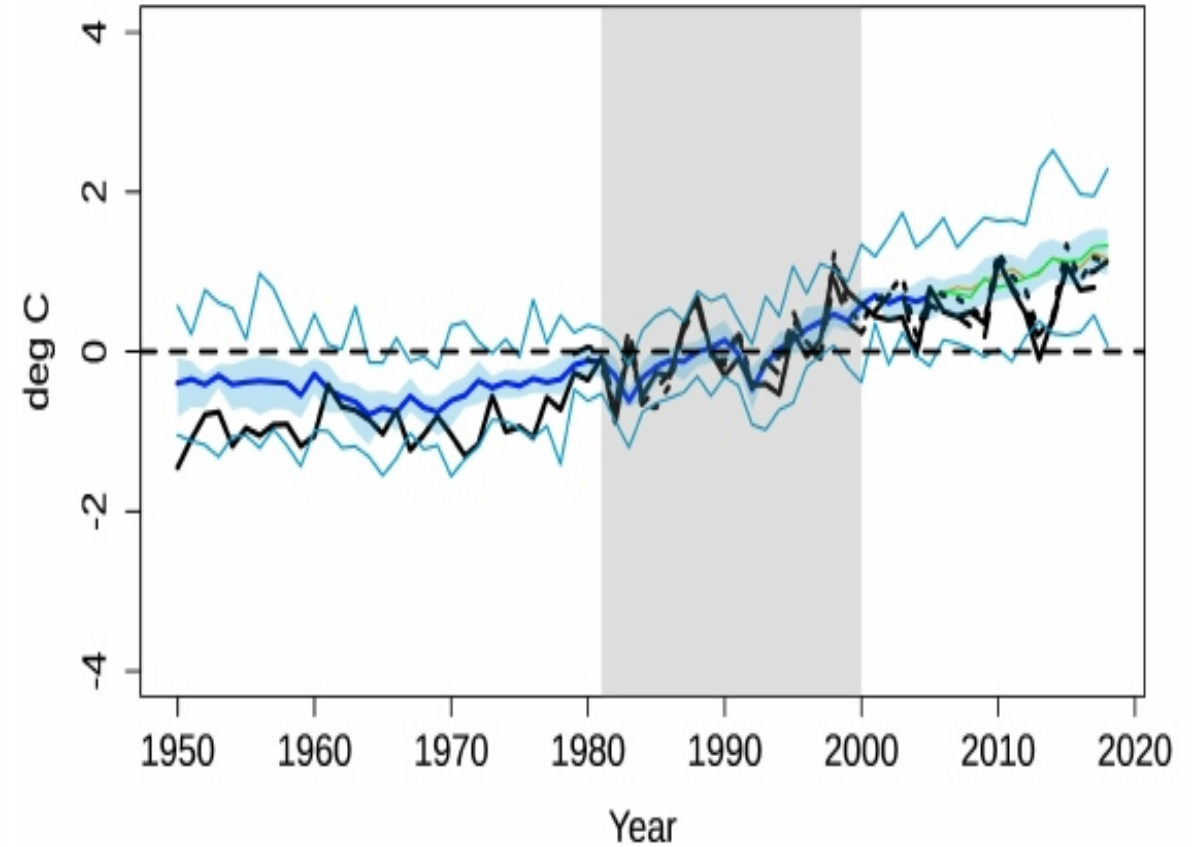
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Temperature extremes 1981-2100　　Models

Maximum of TX (TXx)

Maximum of TN (TNx)

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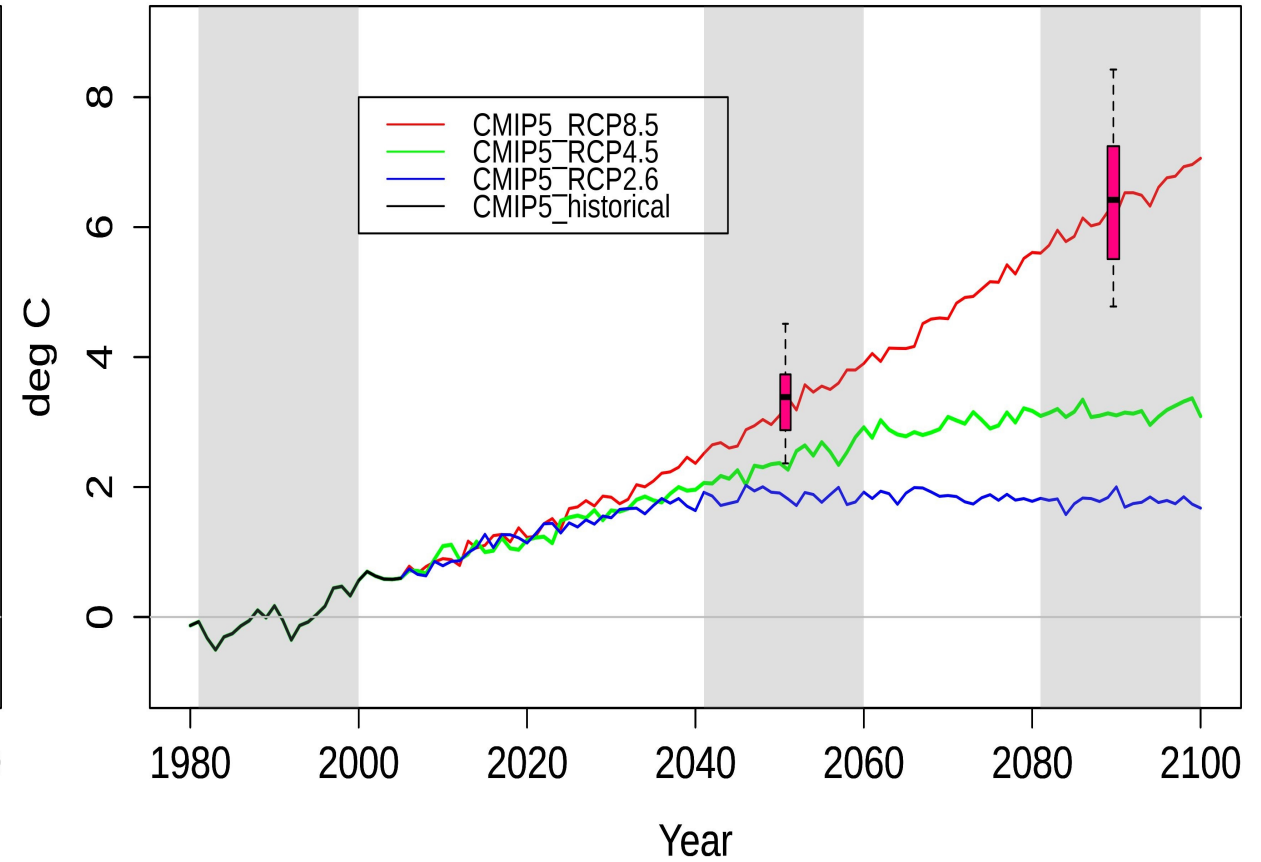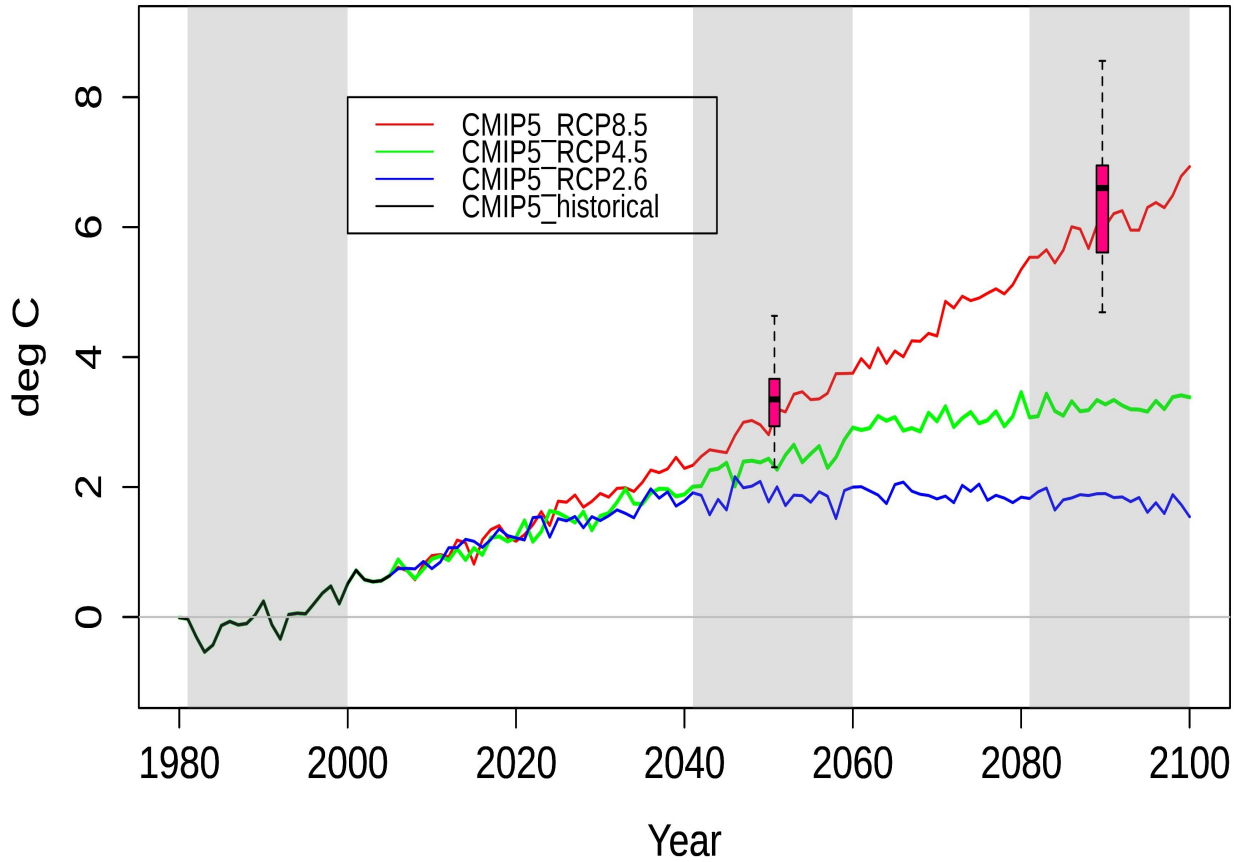
Heatwave magnitude to 2100   Models

Heat Wave Magnitude Index daily (HWMId)

Data: MENA-CORDEX

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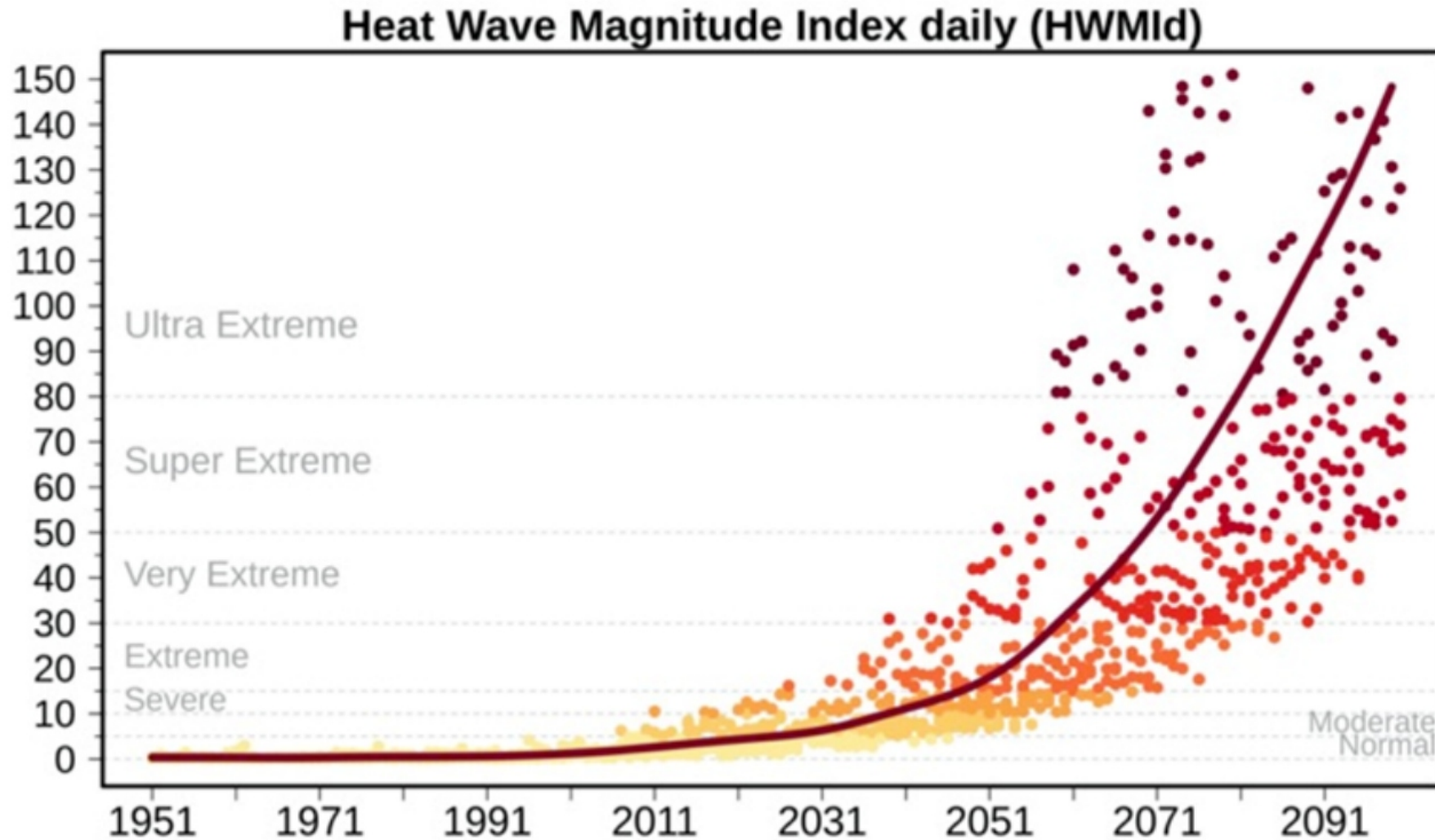
Heatwave frequency to 2100   Models

HW frequency, MENA-CORDEX Ens. mean, CTL:1981-2010

HW frequency, MENA-CORDEX Ens. mean, 21C1:2021-2050

HW frequency, MENA-CORDEX Ens. mean, 21C2:2071-2100

Number of severe, extreme & very extreme events in 30 years

1 3 6 9 12 15 18 21 24 27 30

Data: MENA-CORDEX

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Land Urban Heat Island

Not included in model projections!

Legend:
- <-1.5
- -1.5 to 0
- 0 to 1.5
- 1.5 to 3
- 3 to 4.5
- 4.5 to 6
- 6 to 7.5
- >7.5

https://yceo.yale.edu/research/global-surface-uhi-explorer

Land Urban Heat Island

Not included in model projections!

Legend:
- <-1.5
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- >7.5

https://yceo.yale.edu/research/global-surface-uhi-explorer

For urban inclusive climate projections

→ Explicit consideration in high-resolution GCM/RCM runs by incorporation of urban parameterizations:

e.g. Katzfey, J, Schlünzen, H, Hoffmann, P, Thatcher, M. How an urban parameterization affects a high-resolution global climate simulation. Q J R Meteorol Soc. 2020; 1– 22. https://doi.org/10.1002/qj.3874

→ Urban correction of existing resolution GCM/RCM output by statistical methods:

e.g. van der Schriek, T.; Varotsos, K.V.; Giannakopoulos, C.; Founda, D. Projected Future Temporal Trends of Two Different Urban Heat Islands in Athens (Greece) under Three Climate Change Scenarios: A Statistical Approach. Atmosphere 2020, 11, 637
https://www.mdpi.com/2073-4433/11/6/637

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Related projects:

https://emme-care.cyi.ac.cy

https://emme-c

Thank you for your attention!

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