Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

The extreme summer heat wave of 2017 in Southern Europe

Sjoukje Philip
Sarah Kew

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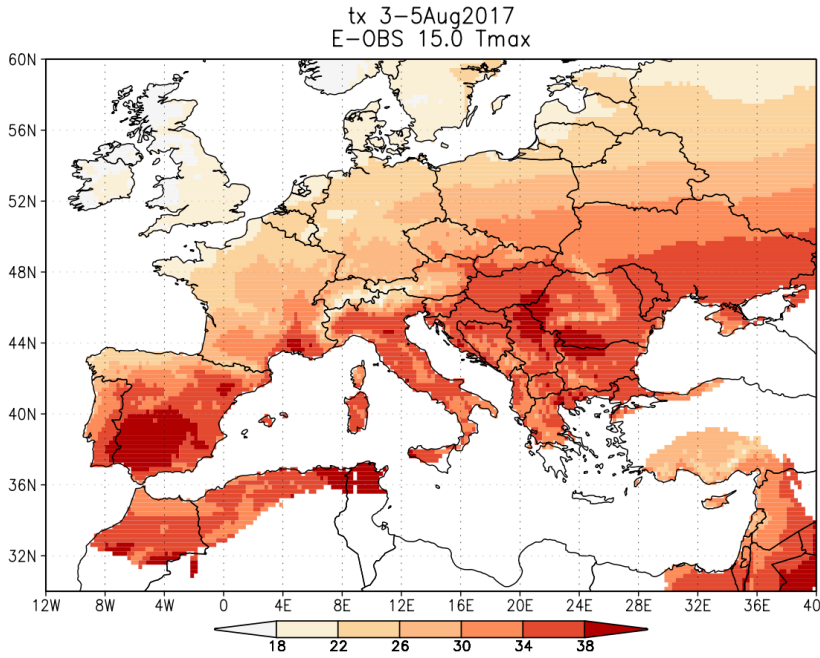
Outline

- Question - extreme temperature events
- Example - heat wave 2017
- Show attribution study
- Discussion

Question

- Was this extreme event caused by climate change?
- internal question:

  Can we use datasets (and models) to analyse extreme weather events?
  - calculate return period
  - calculate trend or risk ratio - *change in the likelihood of the event*
  - can we attribute this to climate change

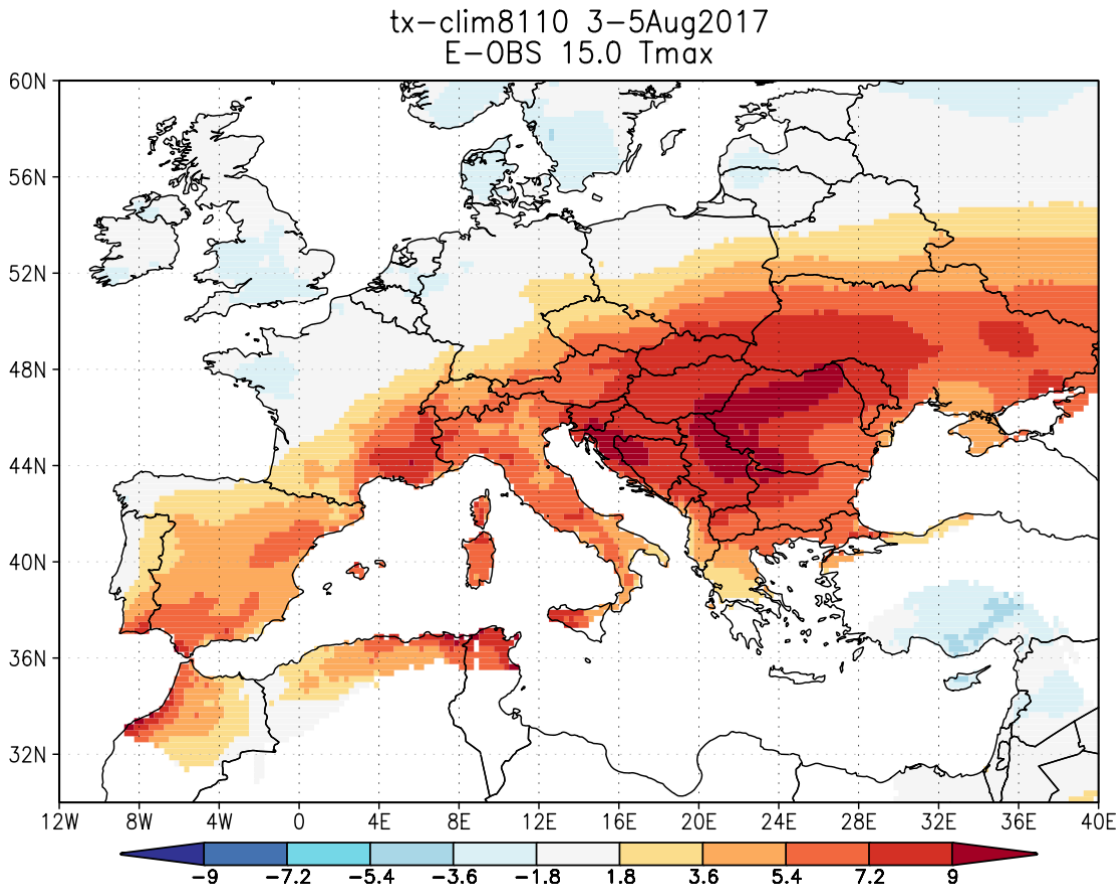


Heatwave Jul/Aug 2017

E-OBS daily data

Tmax

anomalies

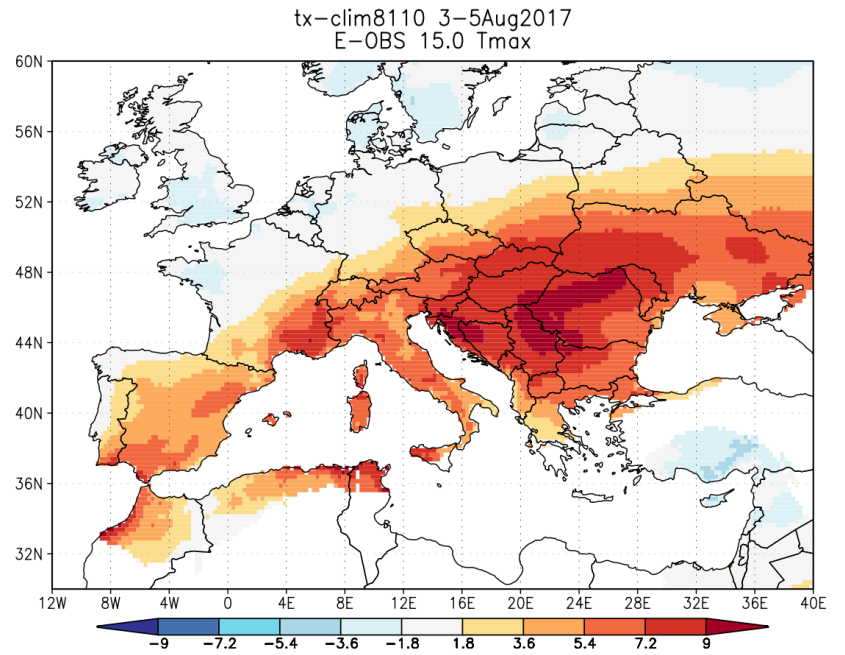


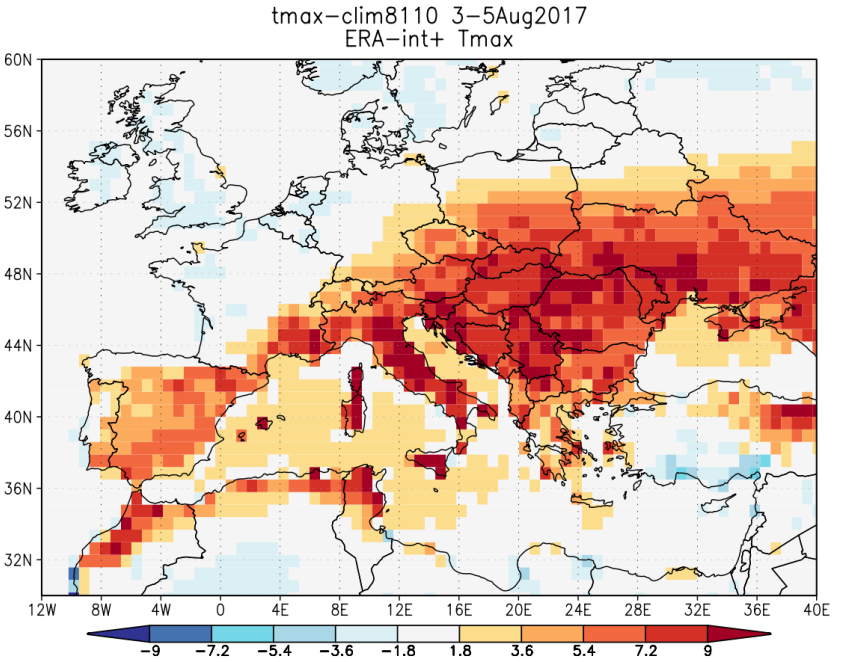
Heatwave Jul/Aug 2017

different datasets:

- E-OBS: in some countries only a few stations, some stations deviate a lot from surroundings ⇒ we need homogenization
- ERA-interim (extended with ECMWF analysis): non-consistent merge of re-analysis and analysis, models have problems with Tmax on hot days
- Berkeley: decorrelation scale too large

- station data

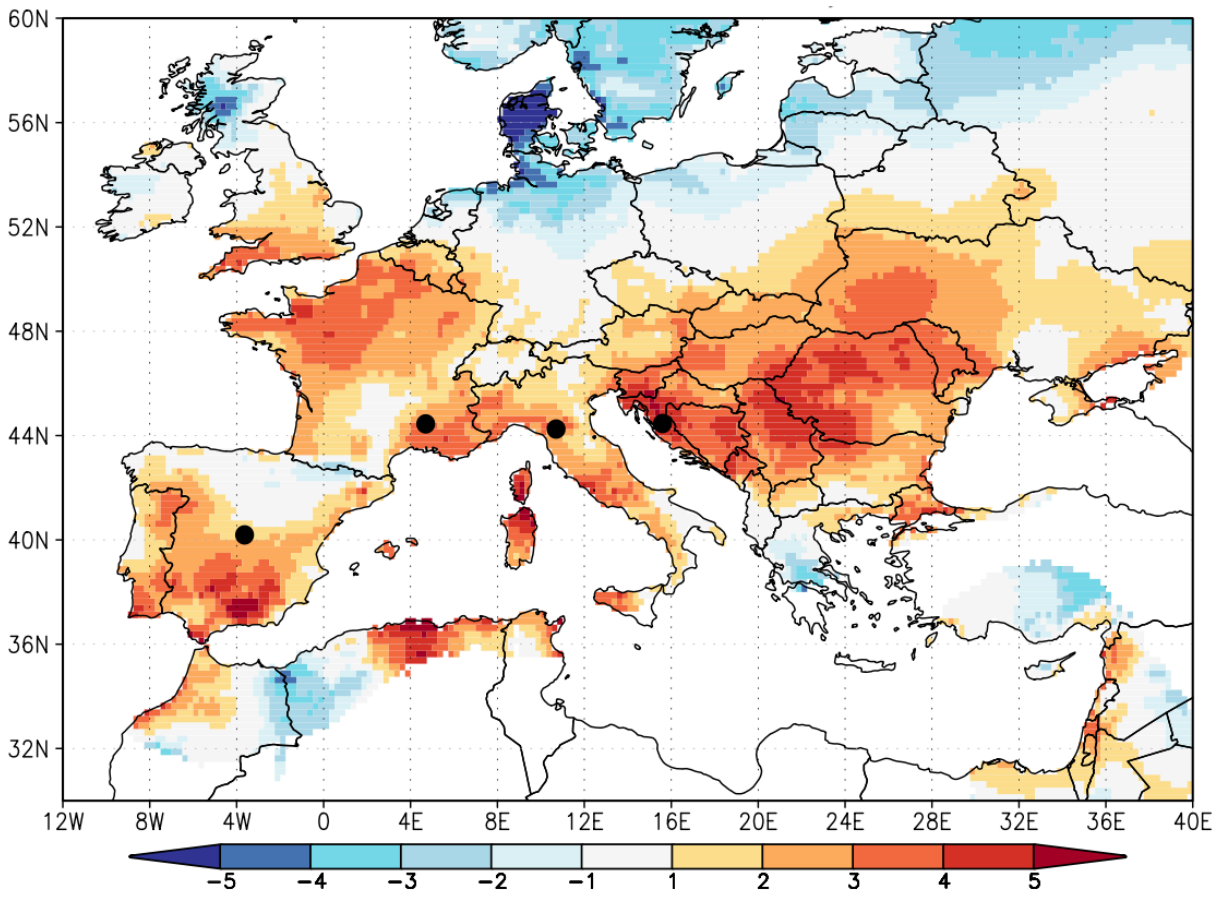




3-day Tmax

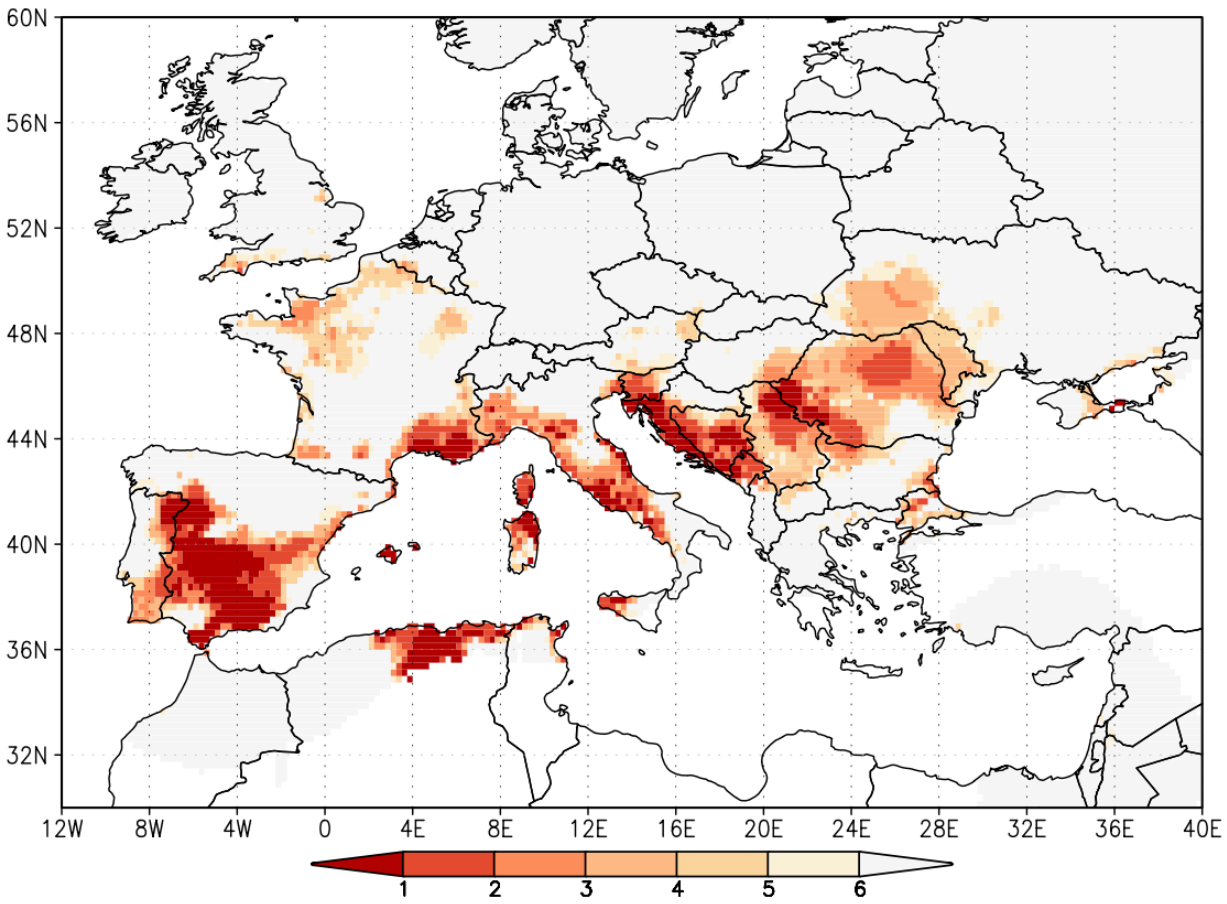
annual 3-day max

station data



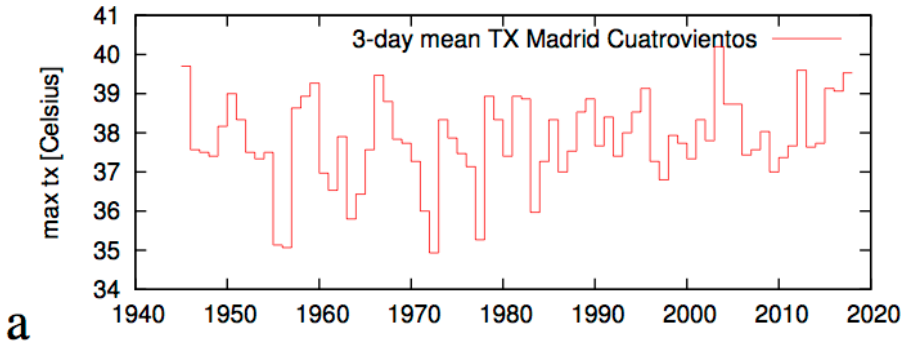
Rank - 3-day Tmax

annual 3-day max
rank 1950-now

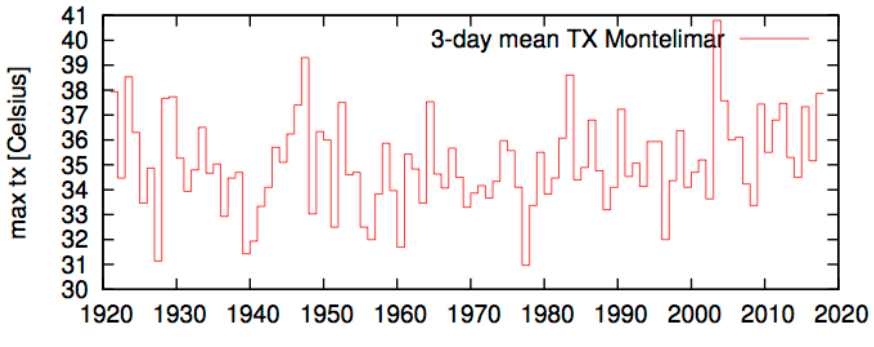


Station data

- one location vs grid box
- length dataset?
- gaps?
- changing variability?
- jumps?



a



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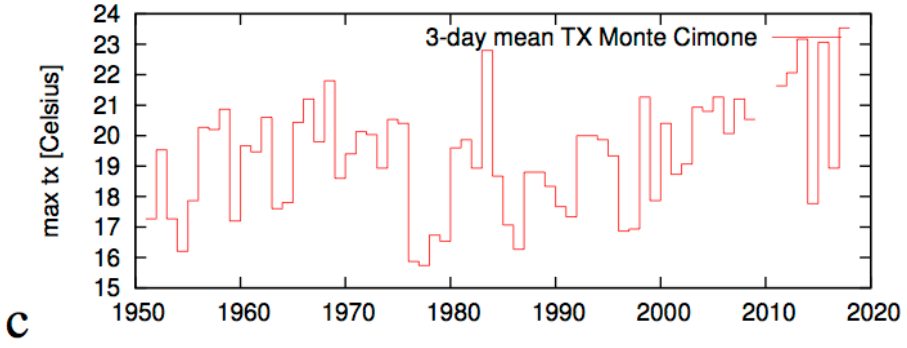
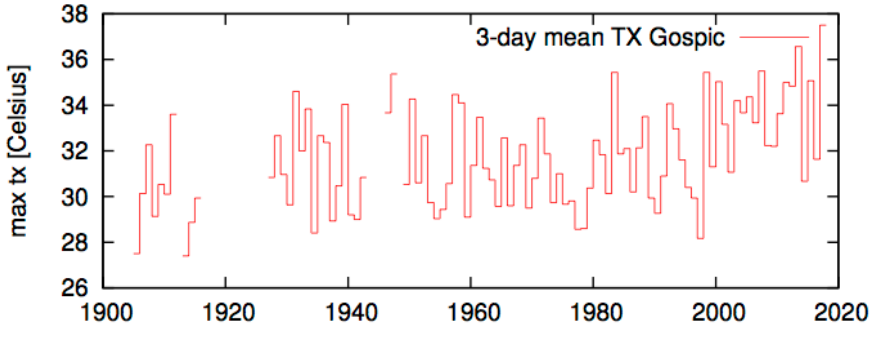
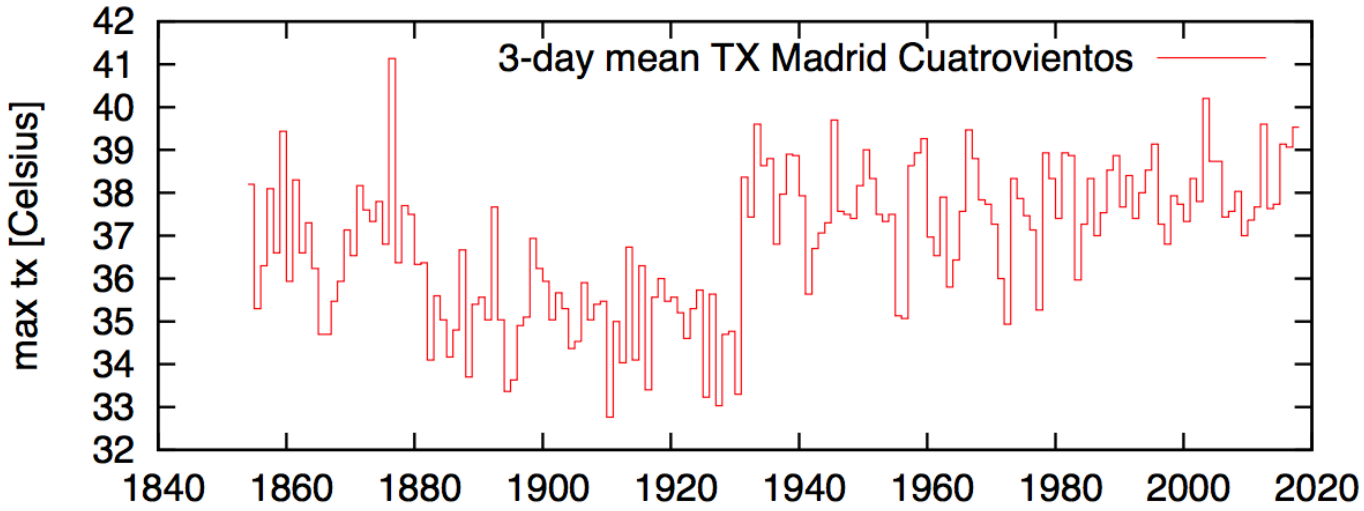


c



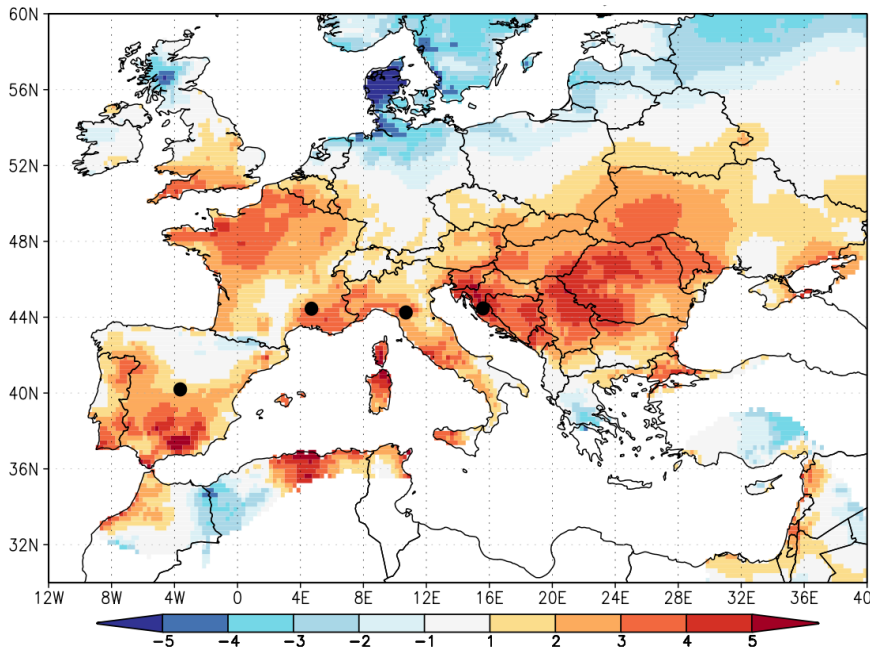
d

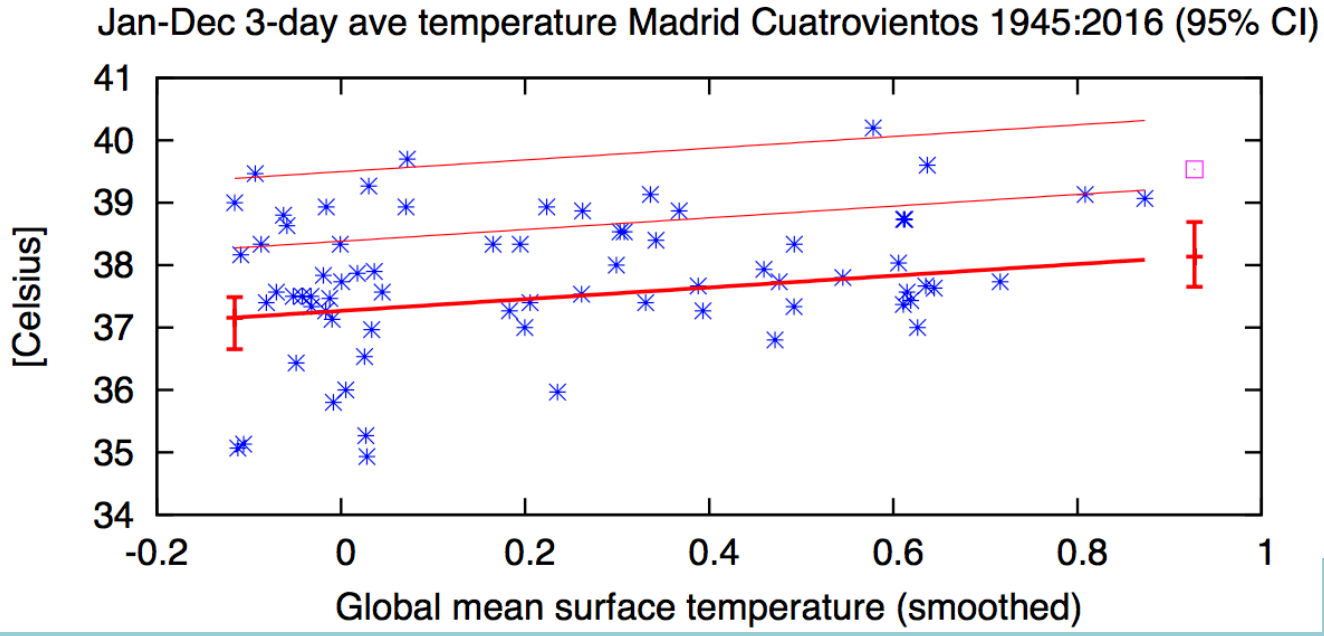
jump…


3-day mean TX Madrid Cuatrovientos
max tx [Celsius]
42
41
40
39
38
37
36
35
34
33
32
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020

Return period and risk ratio

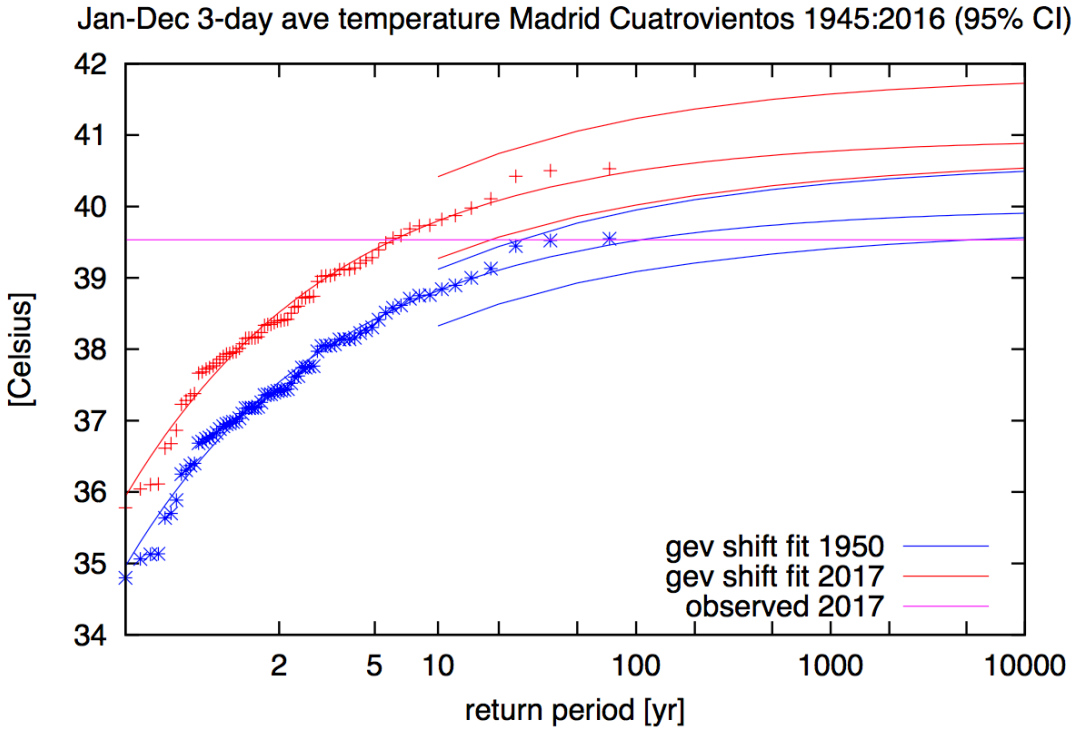
- Use statistical method
  - fit GEV, dependent on GMST
  - return period and risk ratio
  - include error margins on fit





Return period and risk ratio

- result 3-day Tmax:
  - Madrid-Cuatro Vientos
  - 39.5ºC (anomaly 6.3ºC)
  - return period 6 yr (3 to 19 yr)
  - risk ratio 13 (2 to 1300)
  - dT 1.1ºC (0.3 to 2.1ºC)



Models

- more data
- consistent data
- confine error margins
- assess the role of climate change

- validate

Result

- result for each station separately
  - Madrid-Cuatro Vientos:
    - obs: risk ratio 2-1300
    - including models: risk ratio 6-50

- general result:

observations and models agree on a trend toward higher three-day summer temperature extremes like the event in summer 2017, at the selected individual station locations. Probabilities in 2017 are at least four-fold higher compared to 1950.

Discussion

- problems in datasets:
  - gaps,
  - jumps,
  - changing variability,
  - short dataset

Discussion

- does homogenization, validation and interpolation not suppress or change extremes?
- how trustworthy are extremes far back in time?
- how do (homogeneous station) data compare with gridded dataset

share knowledge and thoughts about this

to be deleted

- question: use datasets to analyse extremes
- example: heat wave july/august 2017
- show datasets: station and E-OBS (use best dataset we have)
- calculate return period & trend
- include models gives synthesis result
- discuss:
    - problems in gaps, jumps, changing variability, short dataset
    - does validation and interpolation not suppress extremes?
    - how trustworthy are extremes far back in time?

abstract: The summer of 2017 was marked by extreme heat in Southern Europe. We conducted a multi-method attribution analysis to assess whether and to what extent human-caused climate change played a role in three-day heat waves such as the early August heat wave dubbed Lucifer. For this we use station data, E-OBS data and model data.