Monitoring European changes in extreme weather and climate events

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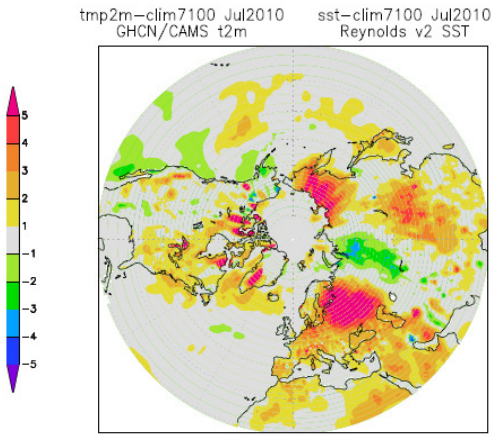
Event: Russian heat wave July 2010



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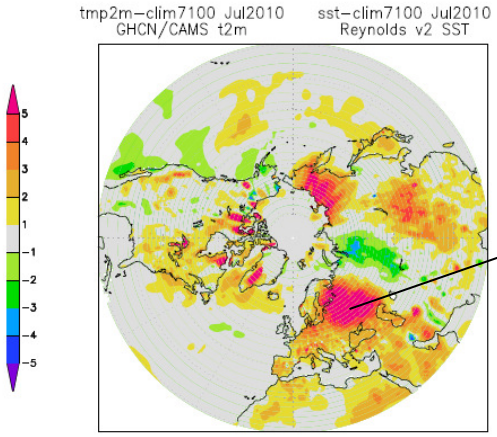

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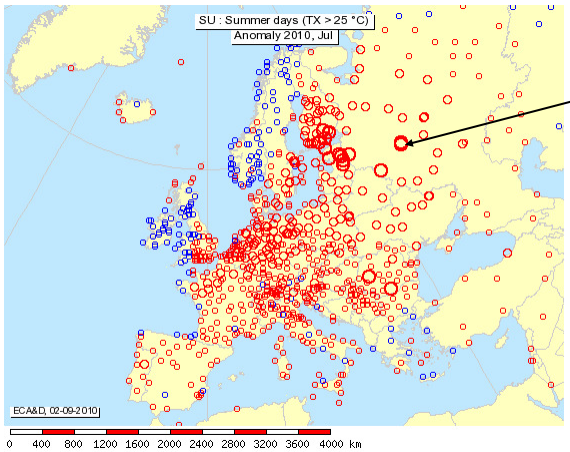

31 days with Tx>25°C; normal is 9.5 days

Data available from http://eca.knmi.nl

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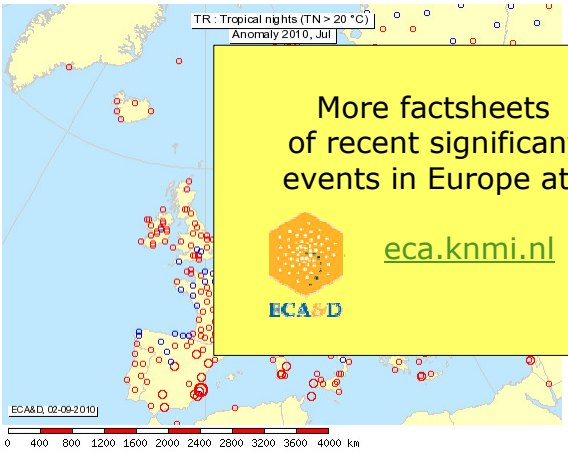
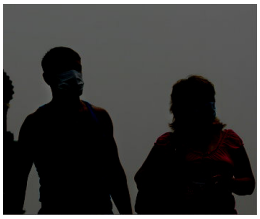


More factsheets of recent significant events in Europe at:

eca.knmi.nl

16 nights with Tn>20°C; normal is 0.5 night



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What makes an event extreme?

- Different definitions exist:
  - high impact events
  - unprece rd)
  - exceede) °C at night)
  - rare eve g time)

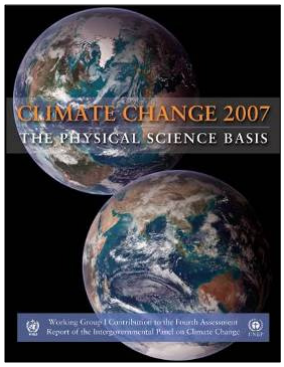
In fact, "extreme" is a property of a process rather than a binary quality of events

Extremes analysis

- Questions addressed by climate scientists:
  - what is the probability of exceedance?
  - has this probability changed over time?
  - does the event fit in a long term trend?
  - is this trend consistent with projected climate change?
  - have the odds changed because of anthropogenic influence?

Extremes in IPCC-AR4

- 'confidence has increased that some extremes will become more frequent, more widespread and/or more intense during the 21st century'



IPCC-AR4 working group I report, 2007

Extremes in IPCC-AR4

Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend[b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[c]	*Likely*[d]	*Virtually certain*[d]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[e]	*Likely (nights)*[d]	*Virtually certain*[d]
Warm spells/heat waves. Frequency increases over most land areas	*Likely*	*More likely than not*[f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not*[f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not*[f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*	*More likely than not*[f,h]	*Likely*[i]

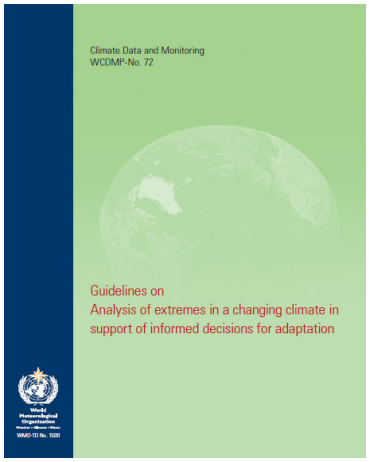
Traditional practice

- Design criteria for safety of infrastructure are often based on historical observations of extremes, assuming a stationary climate

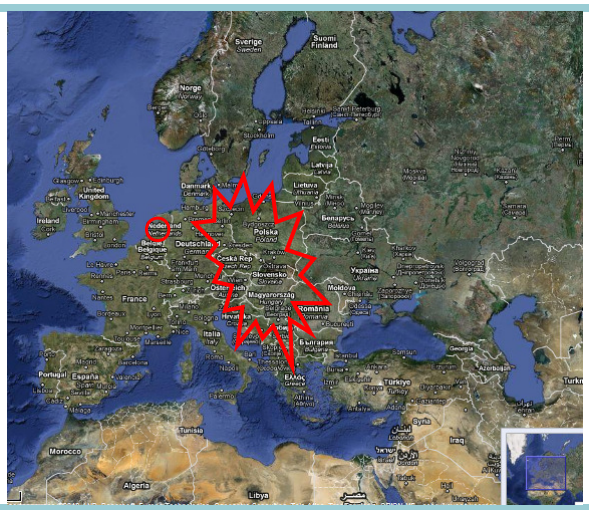
..., but climate change makes it likely that there will be change in some extremes that lies outside the envelope of constant variability

WMO guidelines document

- Klein Tank, Zwiers and Zhang, 2009, WCDMP-No. 72, WMO-TD No. 1500, 56pp.



Event: Floods in Central-Europe May 2010



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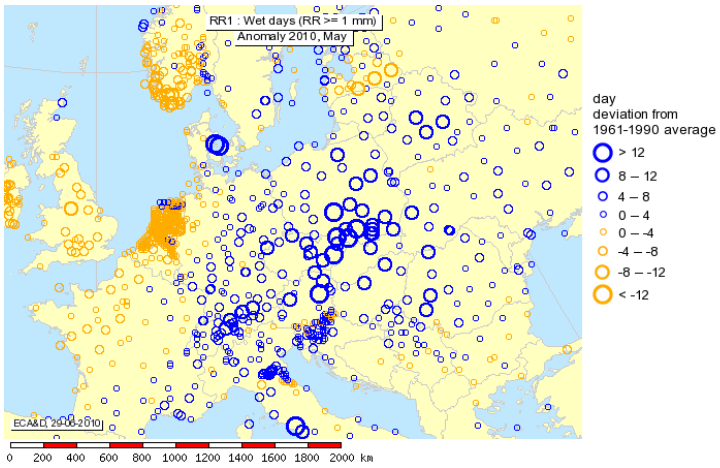
Anomaly in number of wet days May 2010



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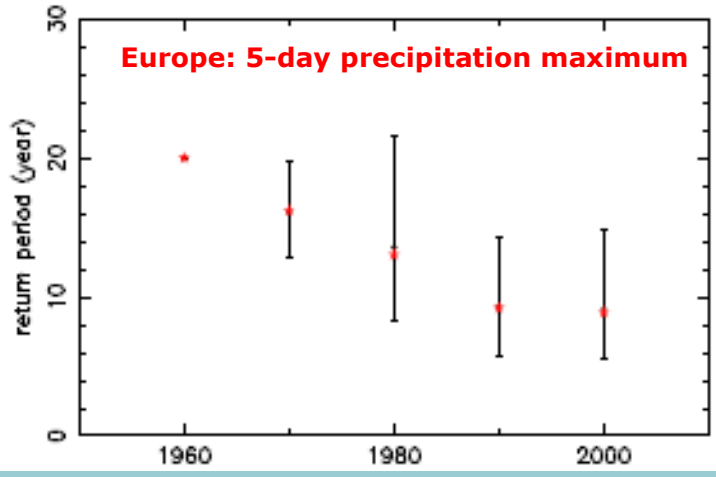
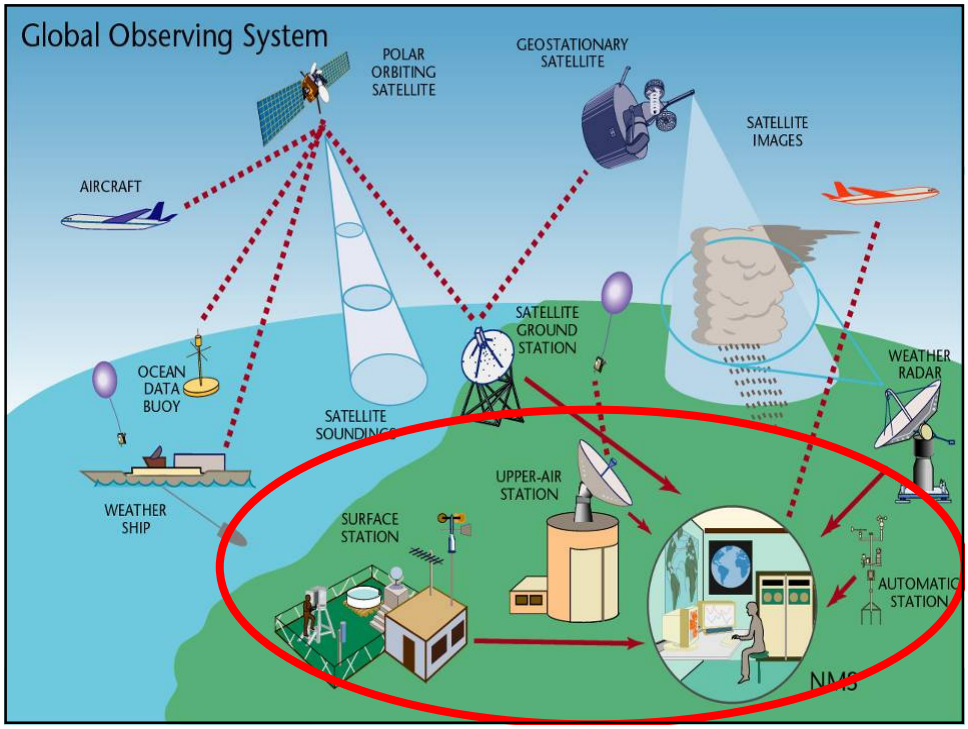
Change in waiting times



Van den Besselaar et al., (in prep)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GEOSTATIONARY SATELLITE
SATELLITE IMAGES
AIRCRAFT
SATELLITE GROUND STATION
WEATHER RADAR
OCEAN DATA BUOY
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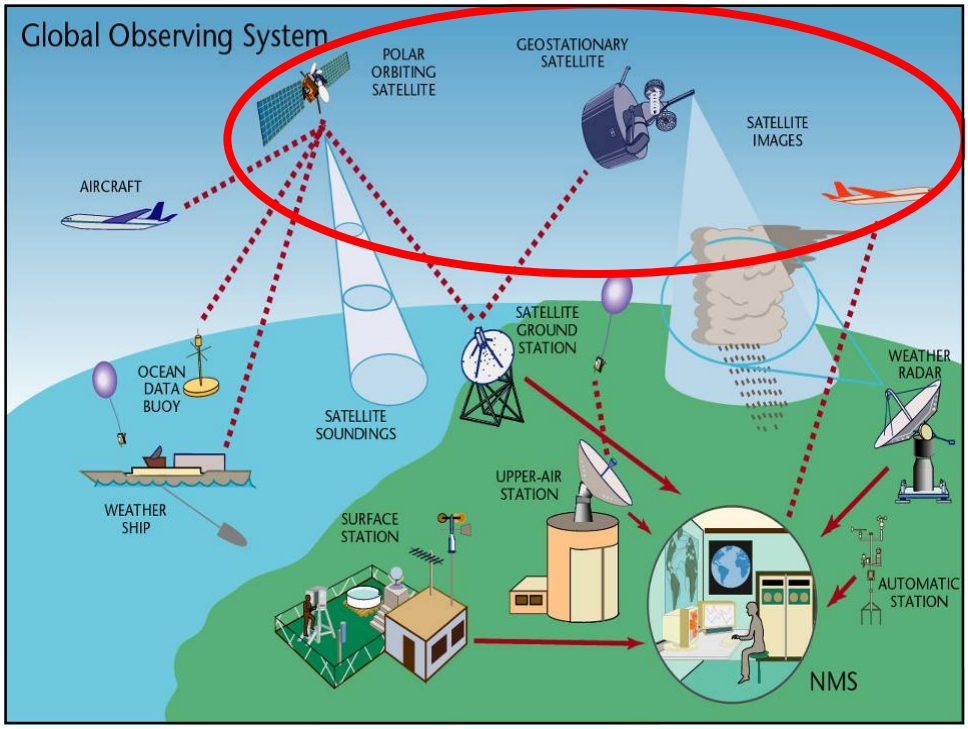
UPPER-AIR STATION
WEATHER SHIP
SURFACE STATION
AUTOMATIC STATION
NMS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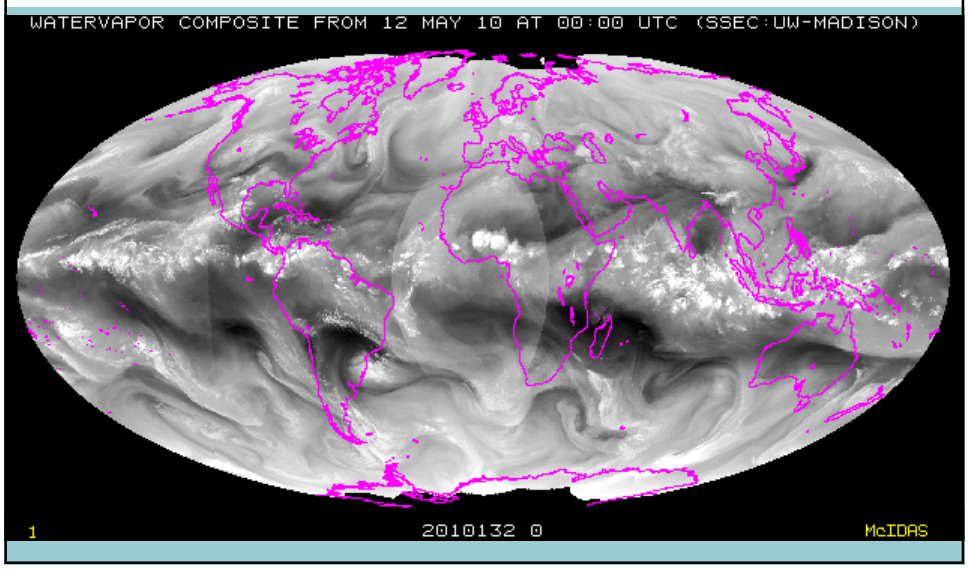
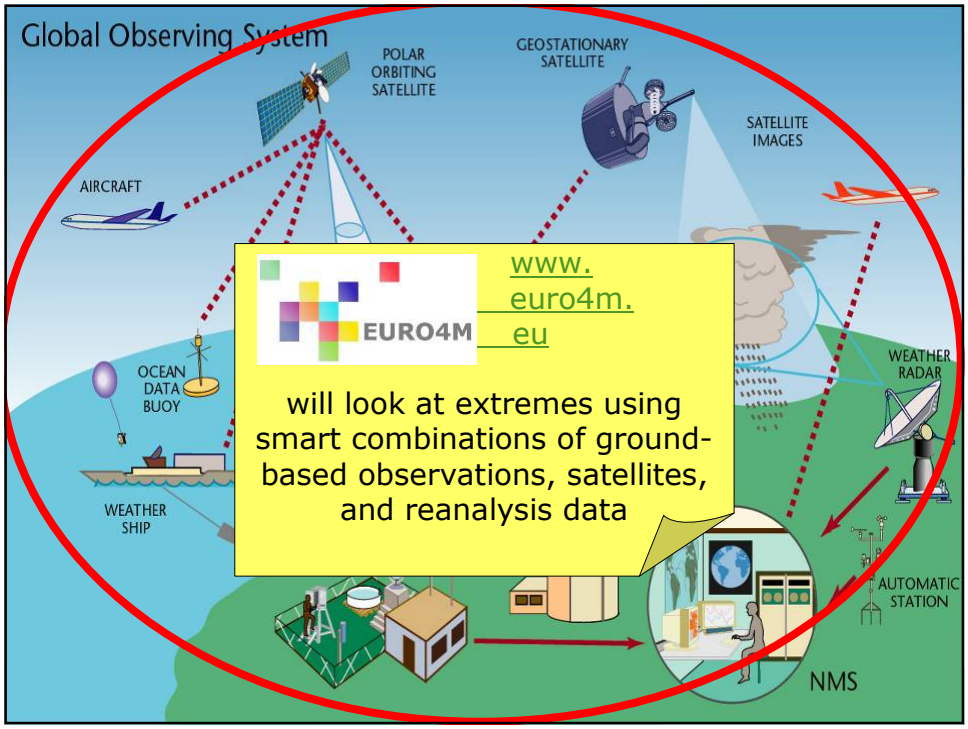
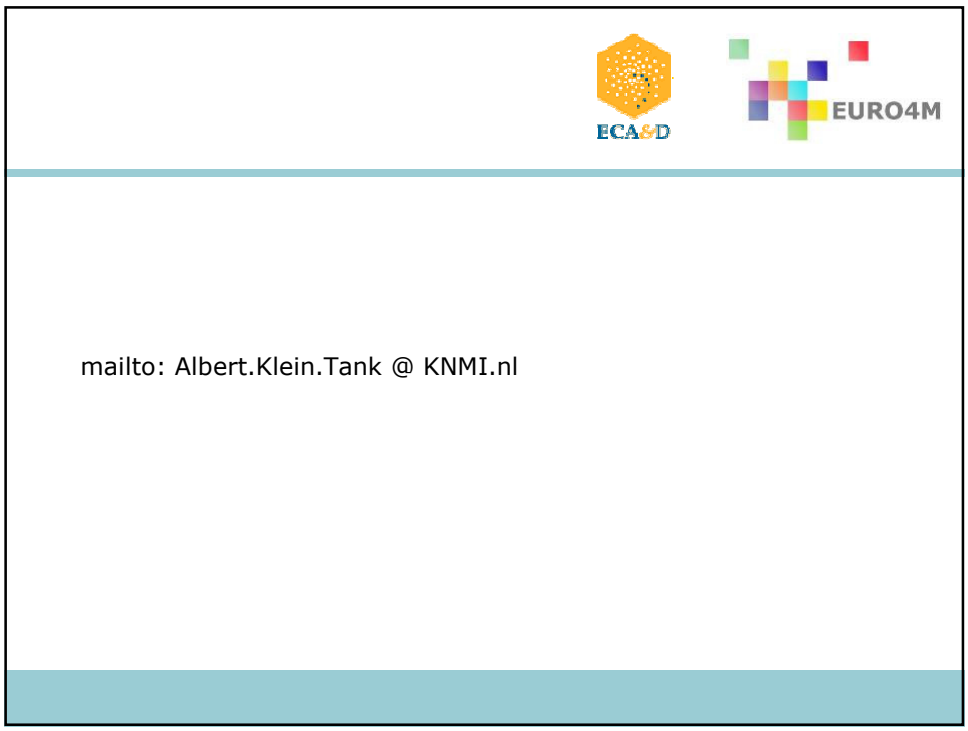
Water vapour transport
12-18 May 2010



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