WCRP World Climate Research Programme

GEWEX

Grand Challenge in **Weather and Climate Extremes**

L. Alexander, G. Hegerl, S. Seneviratne, and X. Zhang

'We are losing everything': Flooding in cyclone-hit Mozambique

ALJAZEERA

Floodwaters triggered by Cyclone Kenneth's heavy rains rage in parts of Mozambique, causing homes to collapse.

28 Apr 2019

A woman crosses a flooded street in the aftermath of Cyclone Kenneth in Pemba [Mike Hutchings/Reuters]

California wildfires estimated to cost insurers up to $13bn

FINANCIAL TIMES

The Camp Fire burns in the hills on November 10, 2018 near Oroville, California © Getty

Oliver Ralph NOVEMBER 19, 2018

The spate of wildfires burning across California will cost the insurance industry between $9bn and $13bn, according to new estimates from modelling firm RMS.

How one heatwave killed 'a third' of a bat species in Australia

BBC

By Frances Mao
BBC News, Sydney

15 January 2019 Share

Many spectacled flying foxes were found dead around Cairns, a city in Queensland

Over two days in November, record-breaking heat in Australia's north wiped out almost one-third of the nation's spectacled flying foxes, according to researchers.

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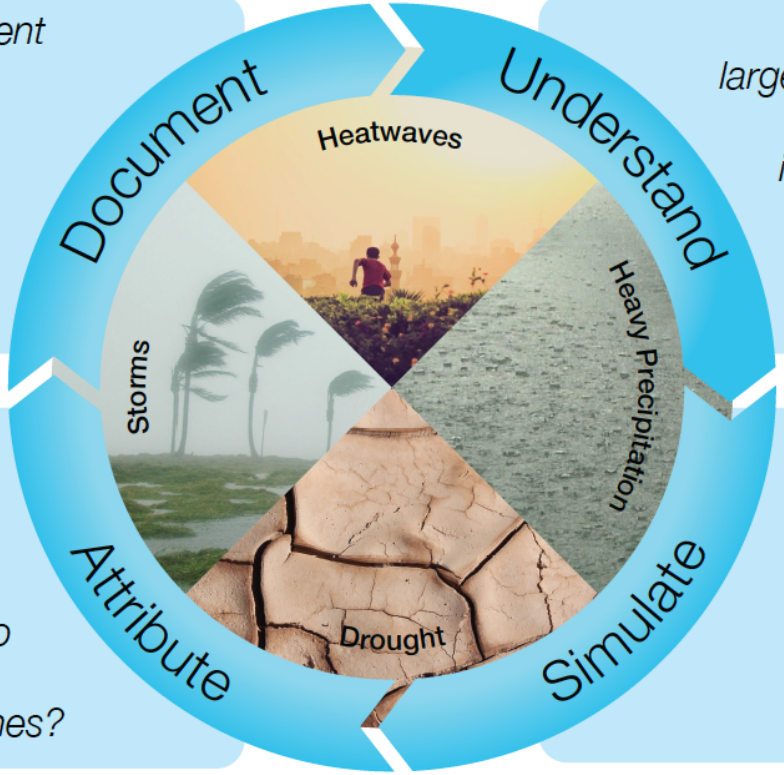
4 main extremes, 4 over arching themes

Are existing observations sufficient to underpin the assessment of extremes?

What are the relative roles of large-scale, regional and local scale processes, as well as their interactions, for the formation of extremes?



What are the contributors to observed extreme events and to changes in the frequency and intensity of the observed extremes?

Are models able to reliably simulate extremes and their changes, and how can this be evaluated and improved?

Looks at both service and science perspective; targeting opportunities

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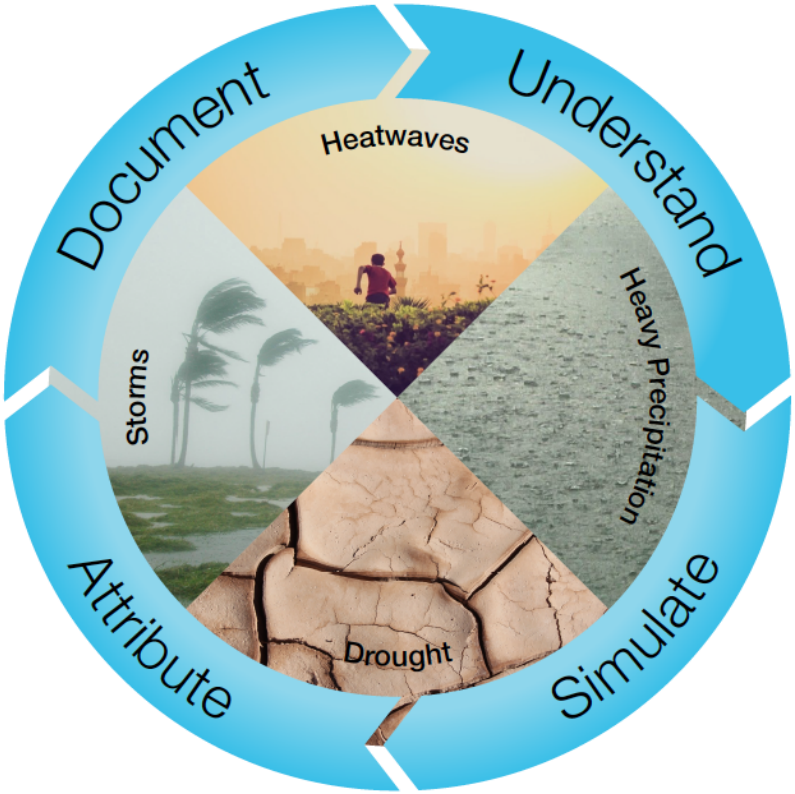
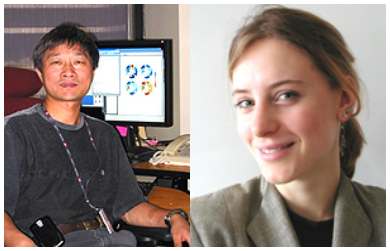
Leads

Most involved in IPCC, some in leading roles (e.g. Robert, Sonia, Xuebin; LAs Fredi, Jana; RE GH)

Lisa Alexander | Ali Behrangi



Sonia Seneviratne | Olivia Martius | Robert Vautard



Xuebin Zhang | Fredi Otto

Gabi Hegerl | Jana Sillmann | Erich Fischer

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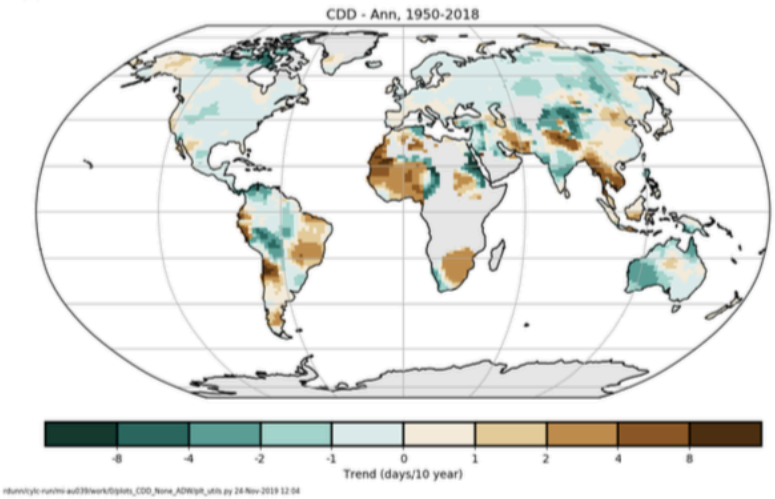
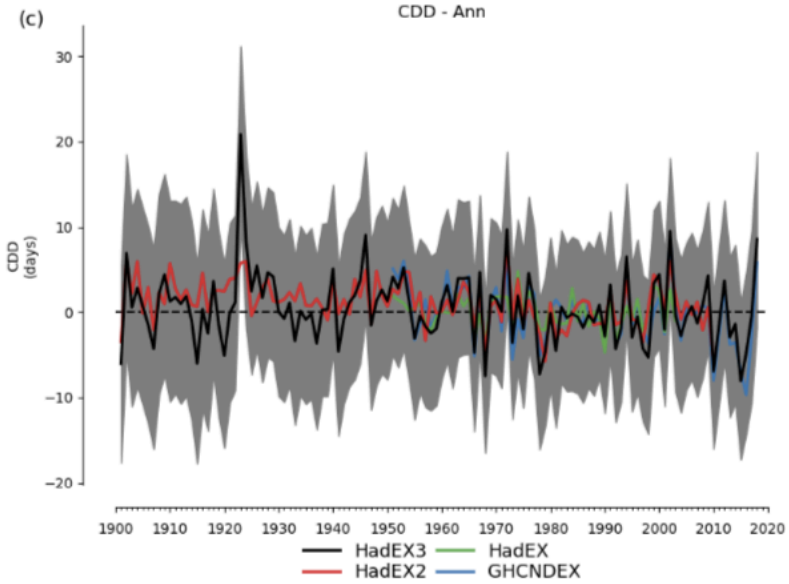
Document





Dataset development: **REGEN** (daily precip, 1950-2016), **HadEX3** (ETCCDI indices, 1901-2016), **GSDR** (sub-daily precip)

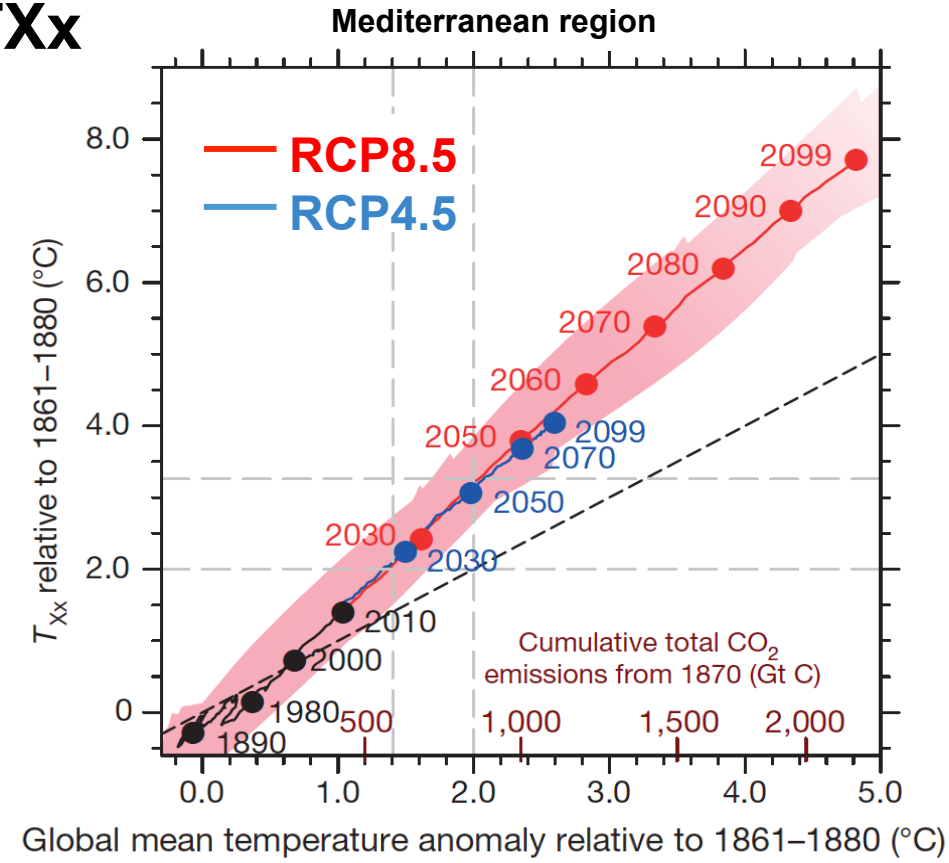
Database and intercomparisons: **FROGs** (Roca), ERL Special Issue

Used for IPCC relevant papers

Old

Understanding: Global scale vs regional scale drivers, role of land-atmosphere interactions

TXx



Source: Seneviratne et al. 2016, Nature

Daily maximum temperature linear with cumulative emissions

Increase can be regionally moderated by increasing/ decreasing land drying

(e.g. Great Plains records in 1930s, vegetation dieback/ irrigation? Cowan et al.)

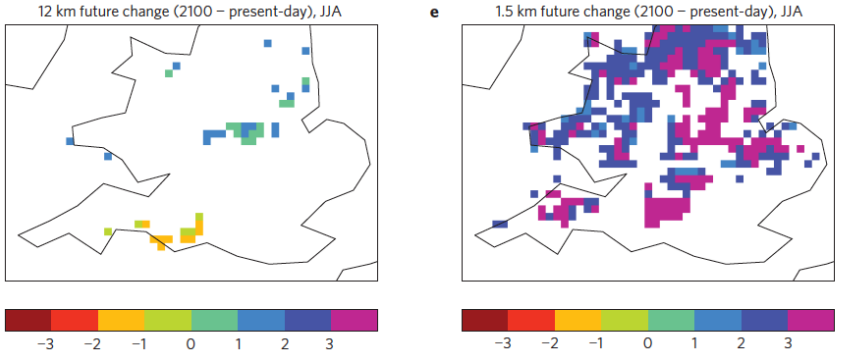
Simulate

Learn from new high resolution capability (change in both mean and intense rainfall; Fowler)

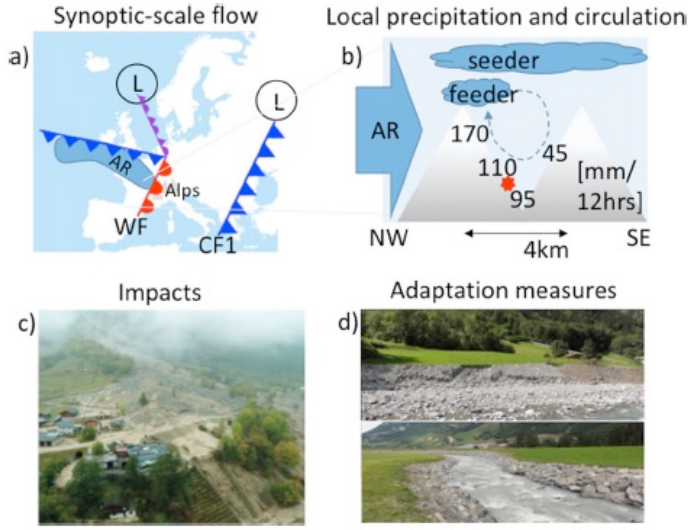
Using both statistical methods and storylines to understand and quantify risk

Prediction of extremes from seasons to decades (e.g. H2020 project EUCP)

- Initialized
- scenarios
- samples from NWP



Source: Kendon et al. 2014, Nature Climate Change



Source: Shepherd et al., DOI: http://dx.doi.org/10.1007/s10584-018-2317-9

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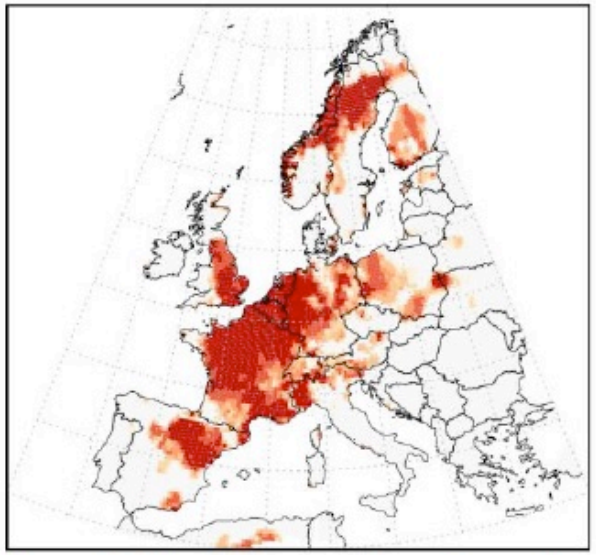

Figure 1: Rank of annual maximum temperatures observed in Europe in 2019 compared to 1950 - 2018, based on the E-OBS data set (Haylock et al., 2008, version 20.0).

Vautard et al., in review:

- Humans have increased risk of 2019 extreme heat in Europe>>10) as well as intensities

Challenging: human role in some wet extremes

Drought; fires (fireweather)

Old extremes: Schurer et al 2019: Tambora caused the year without a summer

GC extremes Success stories

- Compound events well taken up (supported workshops; now everywhere on agenda)
- On-going collaboration with GDAP/IPWG has led to the FROGs database and ERL Special Issue
- CMIP strongly influenced by research needs of extremes including GLACE-CMIP5, LUMIP, LS3MIP, also DAMIP, VOLMIP and HAPPI
- Training of young scientists (WCRP summer school in 2014, Nanjing fall school in 2019)

Bridging climate research and risk management communities

…439 applications (post-doc level), 29 participants outside China were selected + 9 from China; + 6 lecturers (Bart van den Hurk, Erich Fischer, Alexis Hannart, Xuebin Zhang, Francis Zwiers, Reinhard Mechler)

(http: https://www.wcrp-climate.org/extremes-risk-summer-school-overview)

With sunset on ETCCDI no home for coordination of extreme activities

Core project on extremes?

An extremes project would relate to all four WCRP themes:

- Understanding/mechanisms (needs to be global)
- Extremes are vital for useful near-term predictions
- Long-term change influences carbon cycle as well as costing long-term climate change damage vs mitigation costs
- Clear bridge to society (prediction; attribution)
- NUIST would support a project office