UNIVERSITÄT
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19. Sächsische Gewässertage

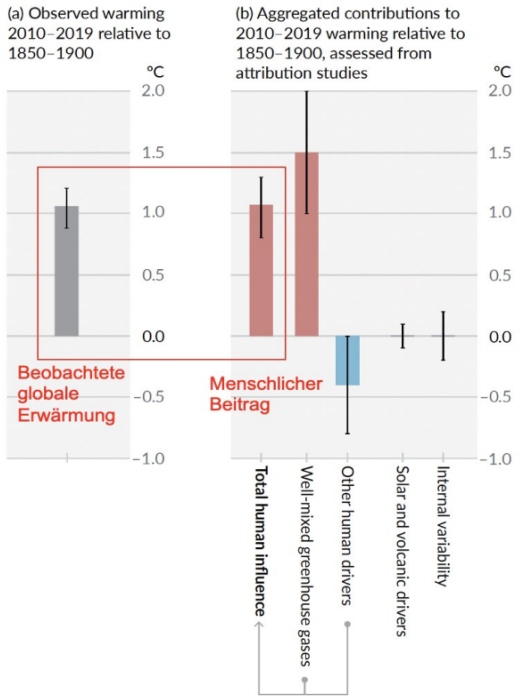
Änderungen des Niederschlags im Klimawandel - Erkenntnisse aus dem aktuellen Sachstandsbericht des IPCC

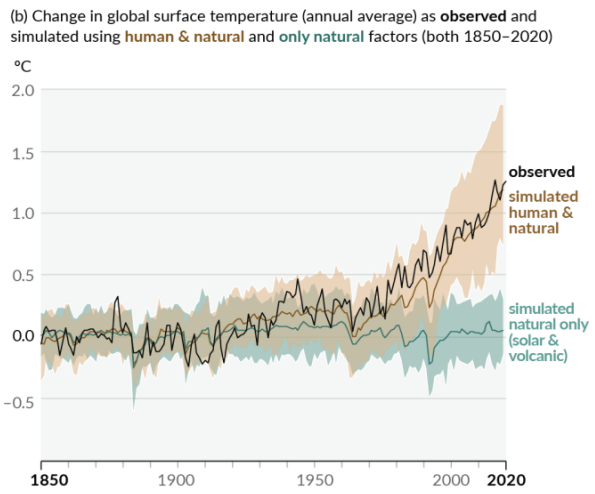
Dr Karsten Haustein

Gewässer in
Zeiten des Klimawandel

Globale und regionale Erwärmung

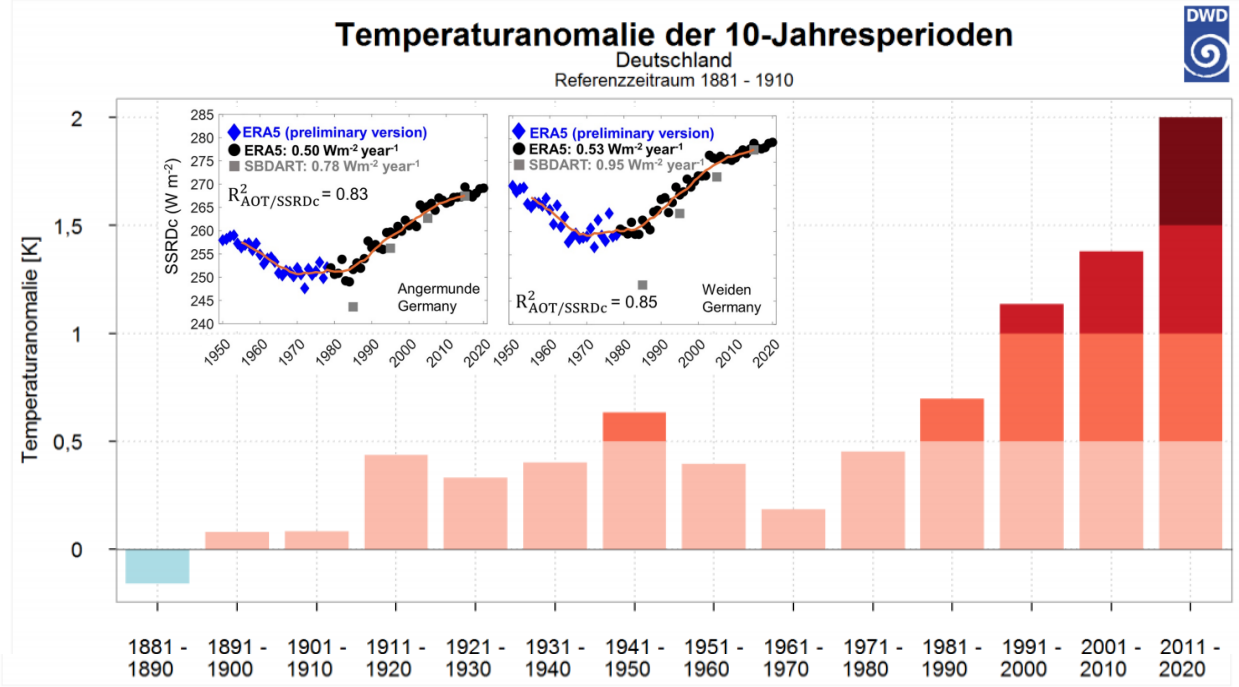
ENTWICKLUNG DER GLOBALTEMPERATUR SEIT 1850





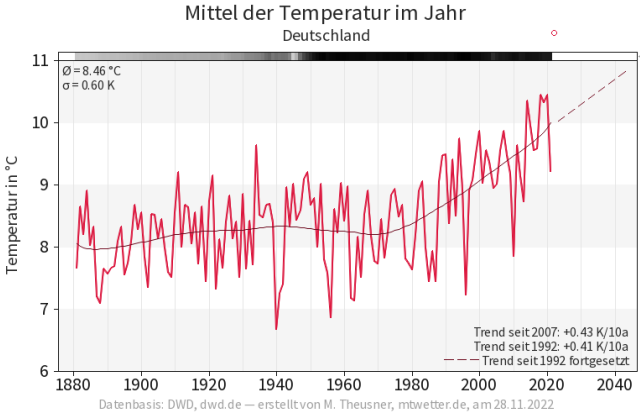
100% der beobachteten globalen Erwärmung seit 1850 sind menschengemacht (IPCC)!

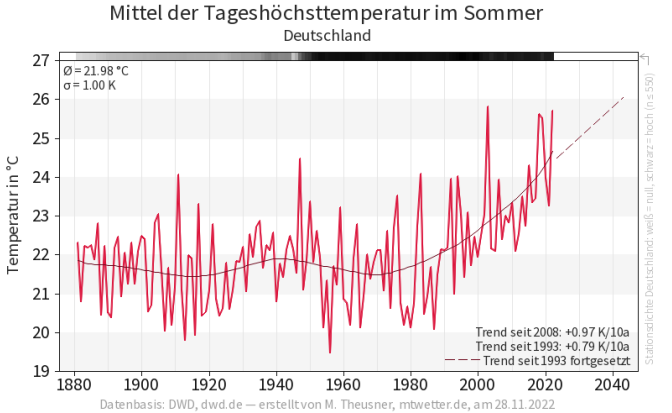
ENTWICKLUNG DER TEMPERATUR IN DEUTSCHLAND SEIT 1880



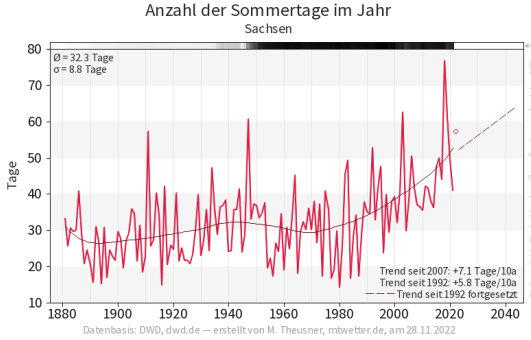
kühlender Aerosoleffekt zwischen 1950-1980; seitdem steiler quasi-linearer Aufwärtstrend

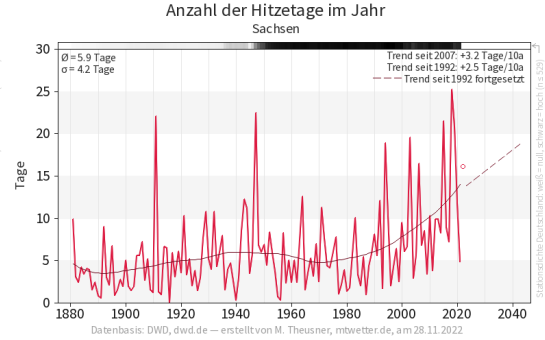
ENTWICKLUNG DER TEMPERATUR IN DEUTSCHLAND SEIT 1880





SACHSEN TAGE > 25°C



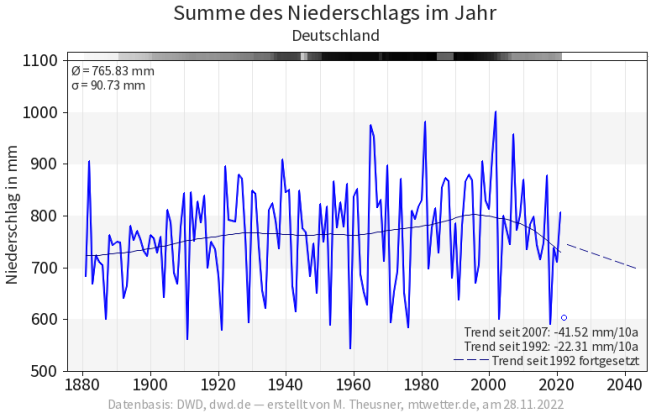


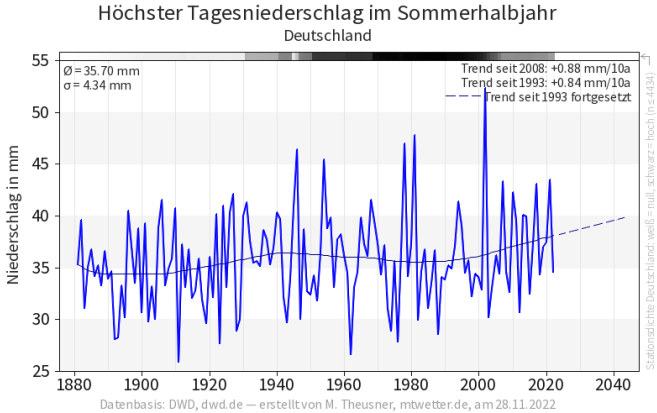
TAGE > 30°C SACHSEN

Gewässer in
Zeiten des Klimawandel

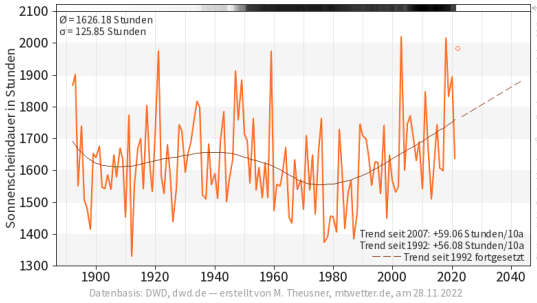
Änderungen des Niederschlags (IPCC)

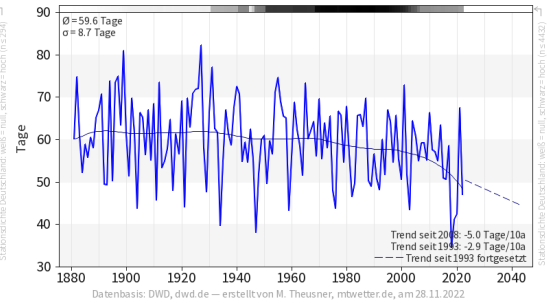
ENTWICKLUNG DES NIEDERSCHLAG IN DEUTSCHLAND SEIT 1880





SACHSEN Sonnenschein

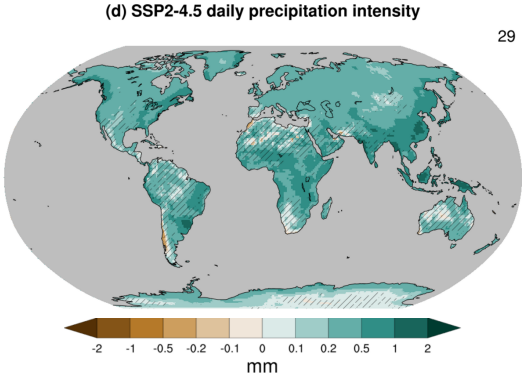


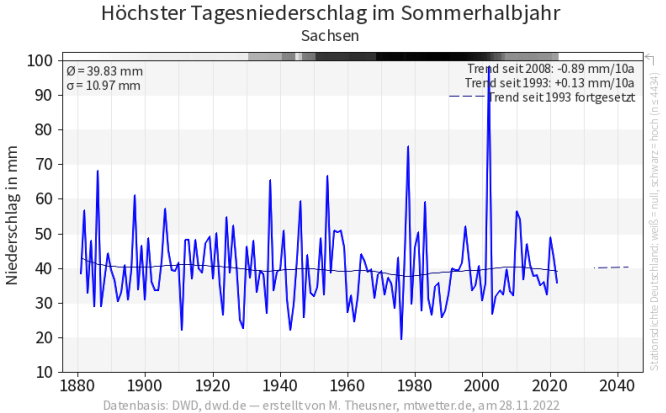


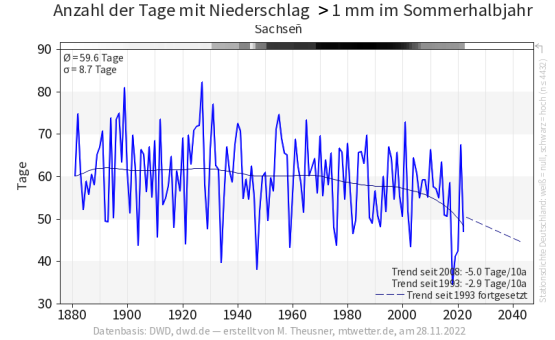
TAGE > 1mm SACHSEN

ENTWICKLUNG DES NIEDERSCHLAG IM KLIMAMODELL-KONTEXT

Multi-model annual mean long-term changes in daily precipitation statistics



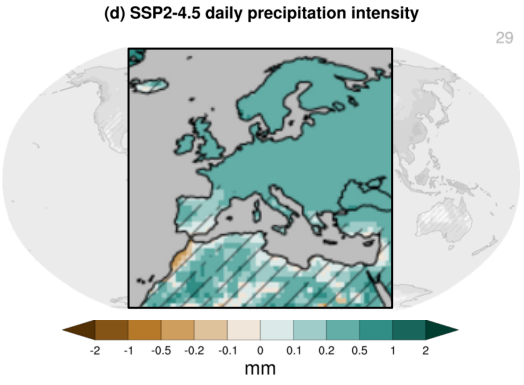


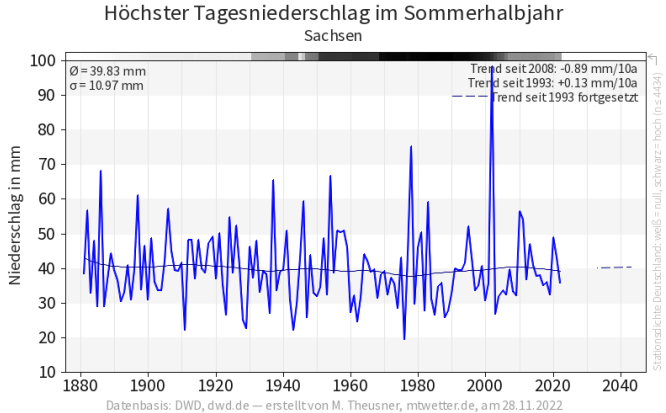


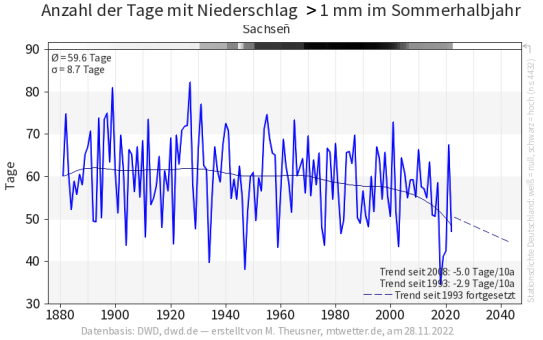
TAGE > 1mm SACHSEN

ENTWICKLUNG DES NIEDERSCHLAG IM KLIMAMODELL-KONTEXT

Multi-model annual mean long-term changes in daily precipitation statistics



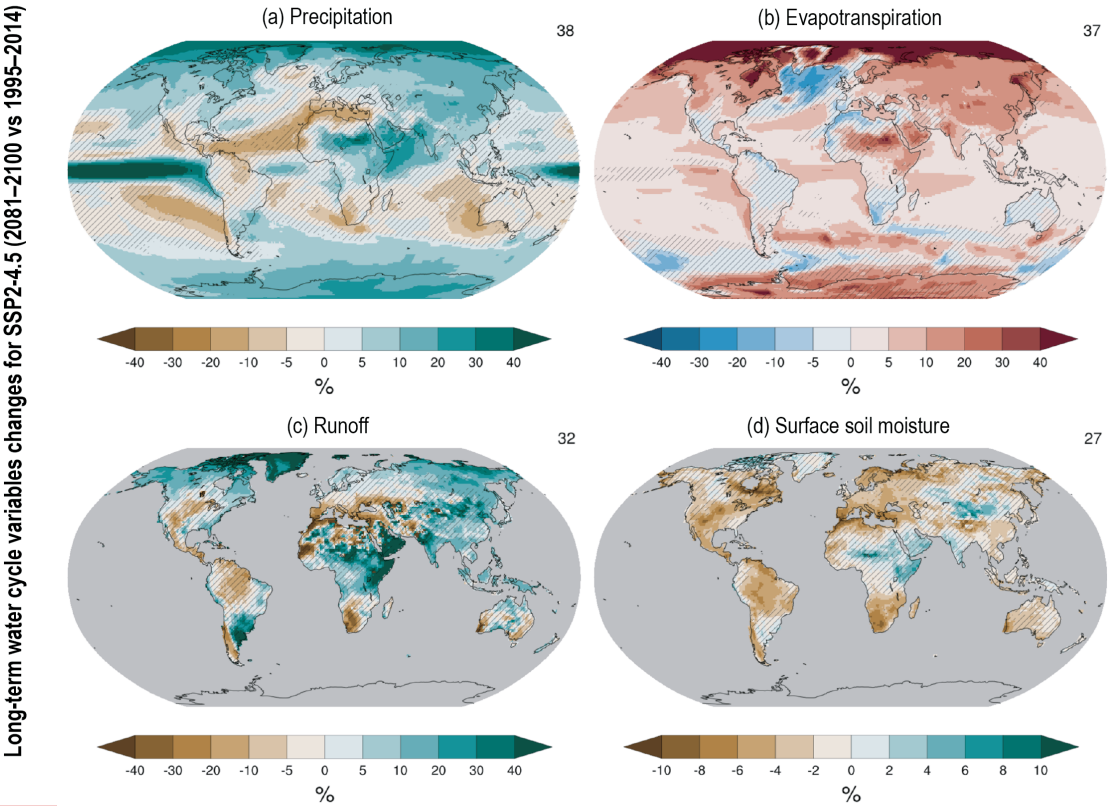




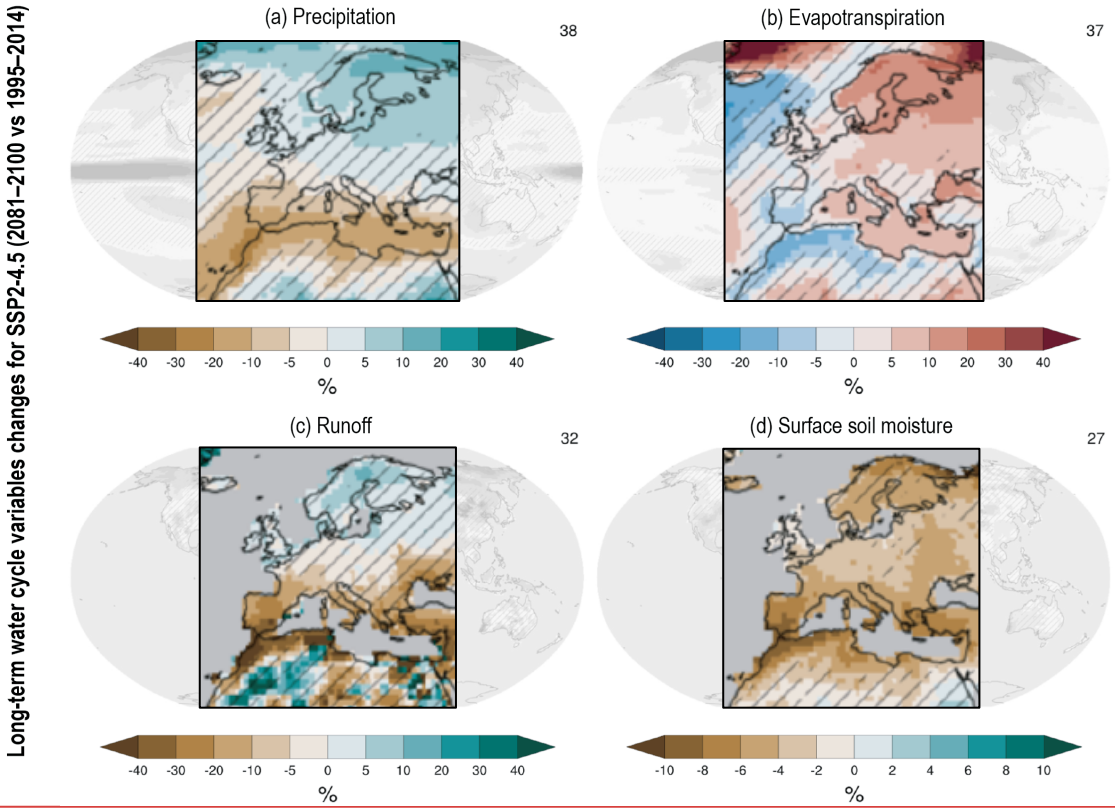
TAGE > 1mm SACHSEN

Color High model agreement (≥80%)
Low model agreement (<80%)

ÄNDERUNGEN DES WASSERKREISLAUF (BAU IPCC)

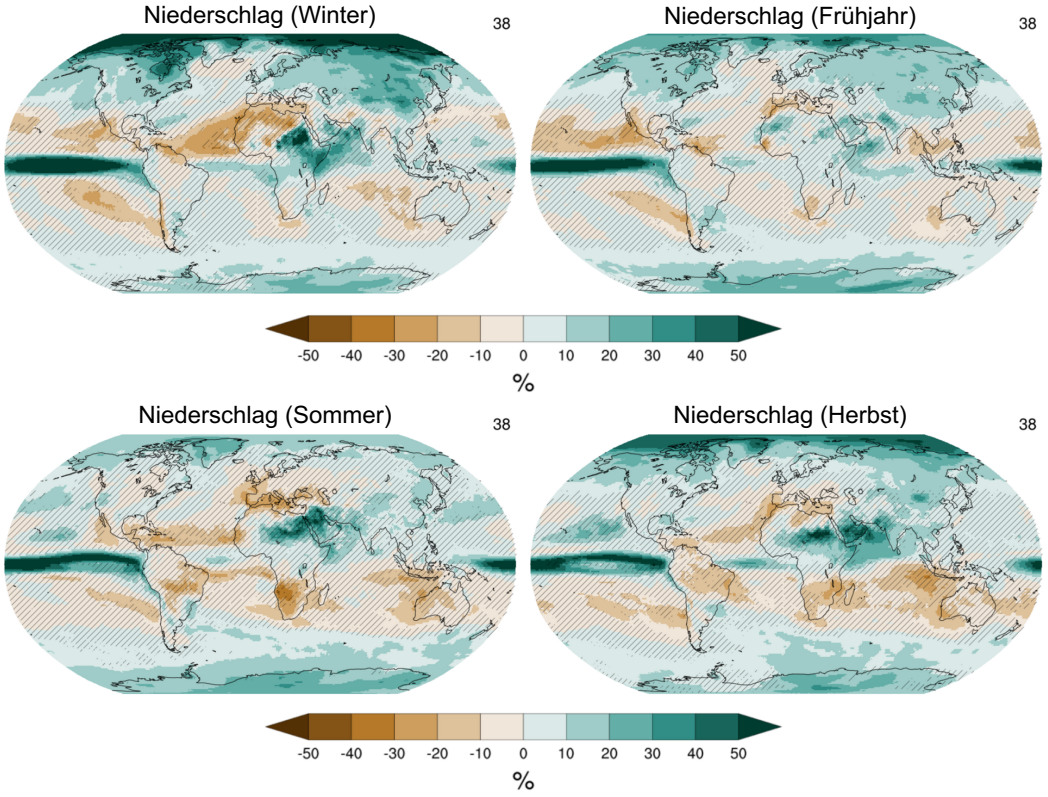


ÄNDERUNGEN DES WASSERKREISLAUF (BAU IPCC)



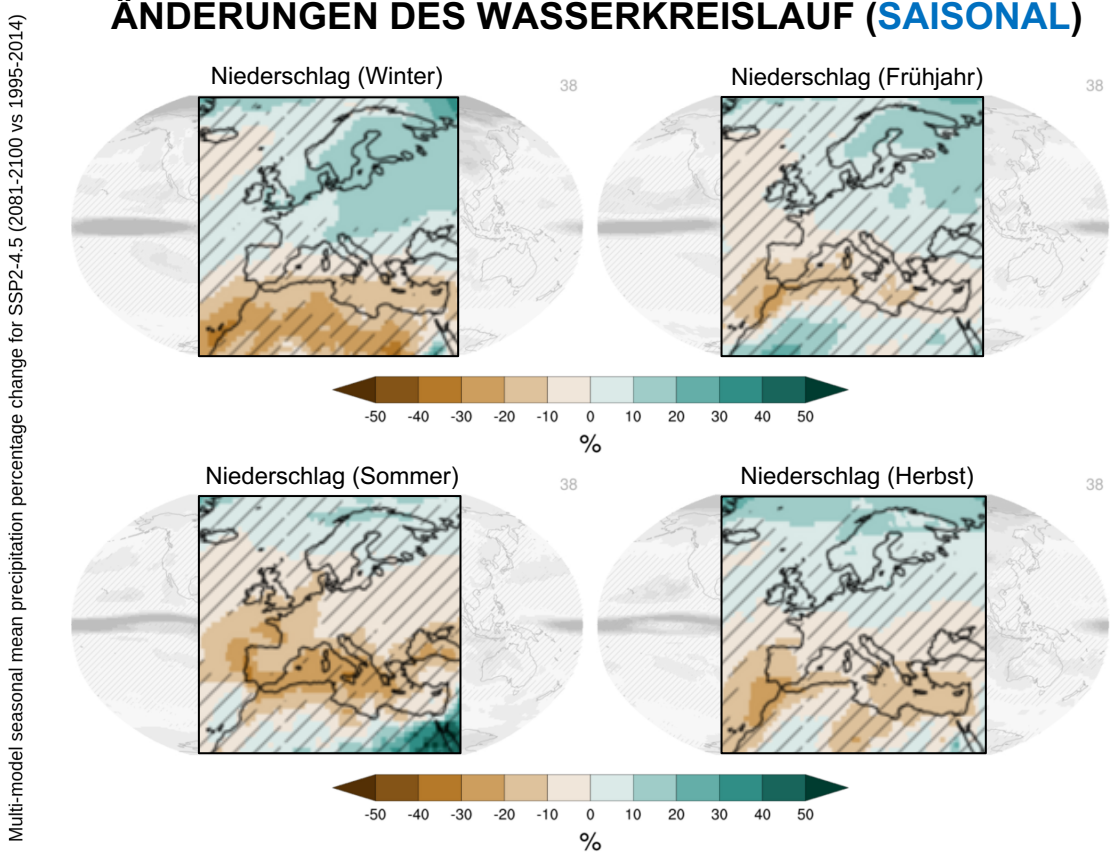
ÄNDERUNGEN DES WASSERKREISLAUF (SAISONAL)

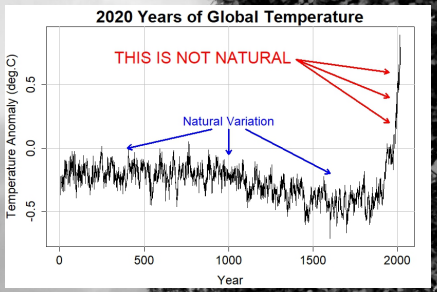
Multi-model seasonal mean precipitation percentage change for SSP2-4.5 (2081-2100 vs 1995-2014)



Color High model agreement (≥80%)
Low model agreement (<80%)

ÄNDERUNGEN DES WASSERKREISLAUF (SAISONAL)



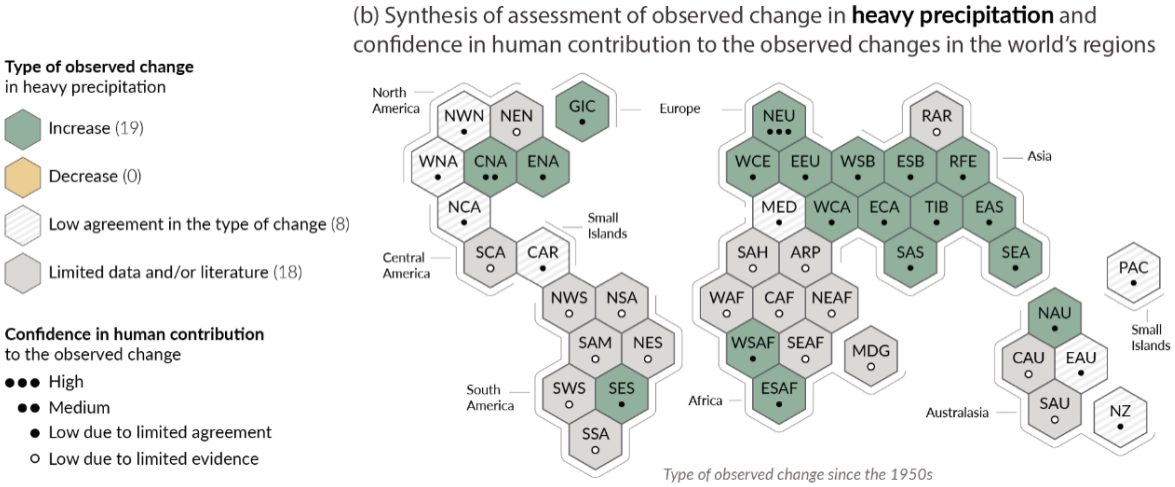


Gewässer in
Zeiten des Klimawandel

Attribution der Änderungen

EXTREMWETTER (EXTREMER NIEDERSCHLAG)

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes



IPCC AR6 fasst die attributierbaren Änderungen per Kategorie nach Region zusammen.

ATTRIBUTION VON EXTREMWETTER (ÜBERSCHWEMMUNG)

Home > Extreme rainfall > Heavy rainfall which led to severe flooding in Western Europe made more likely by climate change

Heavy rainfall which led to severe flooding in Western Europe made more likely by climate change

23 August, 2021

EXTREME RAINFALL
EUROPE

From the 12th to the 15th of July, heavy rainfall associated with cut-off low-pressure system "Bernd" led to severe flooding particularly in the German states North Rhine-Westphalia and Rhineland-Palatinate, as well as in Luxembourg, and along the river Meuse and some of its tributaries in Belgium and the Netherlands.

Full study

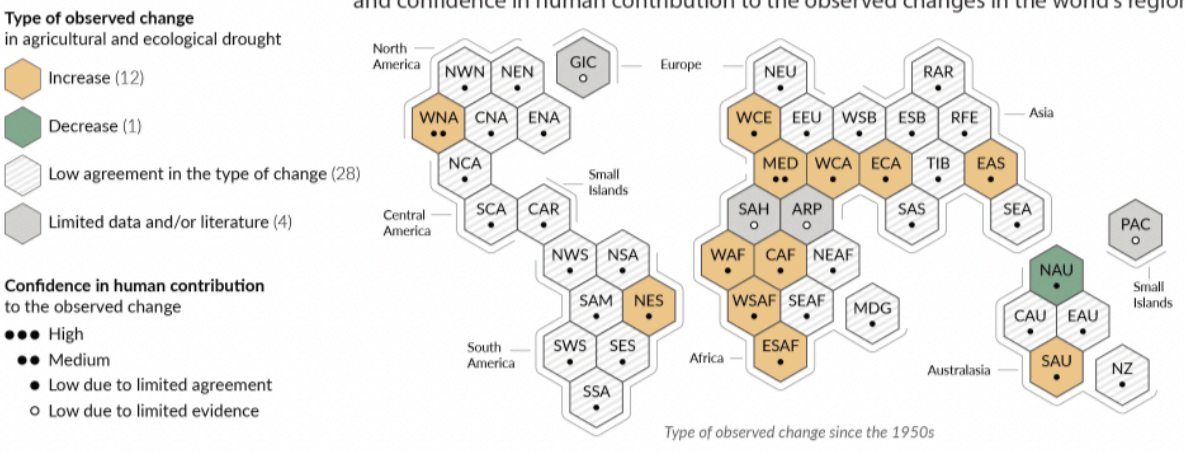
- **Download the full study:** Rapid attribution of heavy rainfall events leading to the severe flooding in Western Europe during July 2021, pdf **(54 pages, 2.6 MB)**

World Weather Attribution das bisher erfolgreichste Projekt die Problematik zu verstehen

EXTREMWETTER (EXTREME DÜRRE)

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

(c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions



IPCC AR6 fasst die attributierbaren Änderungen per Kategorie nach Region zusammen.

ATTRIBUTION VON EXTREMWETTER (DÜRRE)

Home > Drought > High temperatures exacerbated by climate change made 2022 Northern Hemisphere droughts more likely

High temperatures exacerbated by climate change made 2022 Northern Hemisphere droughts more likely

05 October, 2022

DROUGHT

EUROPE, NORTH AMERICA, NORTHERN ASIA

Western Central Europe, North America, China, and other parts of the Northern Hemisphere faced water shortages, extreme heat, and soil moisture drought conditions throughout the summer of 2022

Full study

- Download the full study: High temperatures exacerbated by climate change made 2022 Northern Hemisphere droughts more likely, pdf (55 pages, 5.2 MB)

World Weather Attribution hat auch hier jüngst erste interessante Ergebnisse geliefert

ATTRIBUTION VON EXTREMWETTER (DÜRRE)

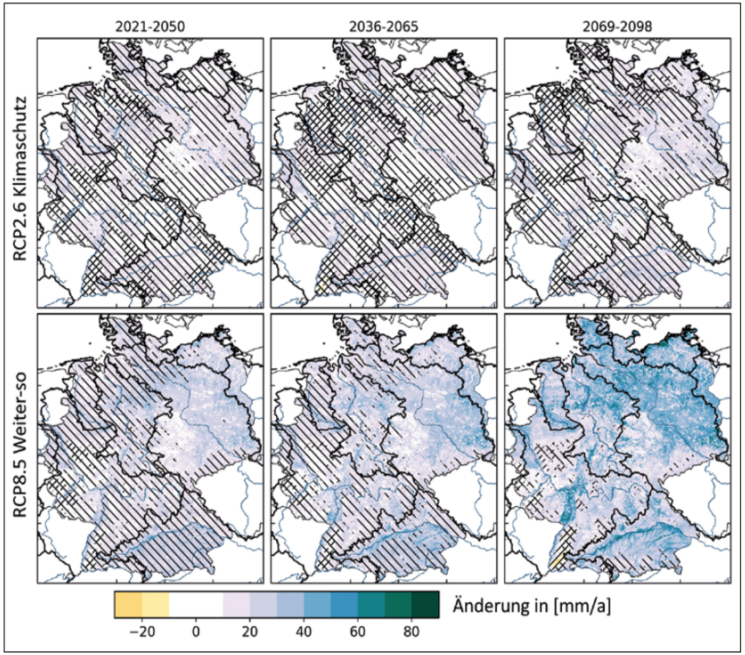
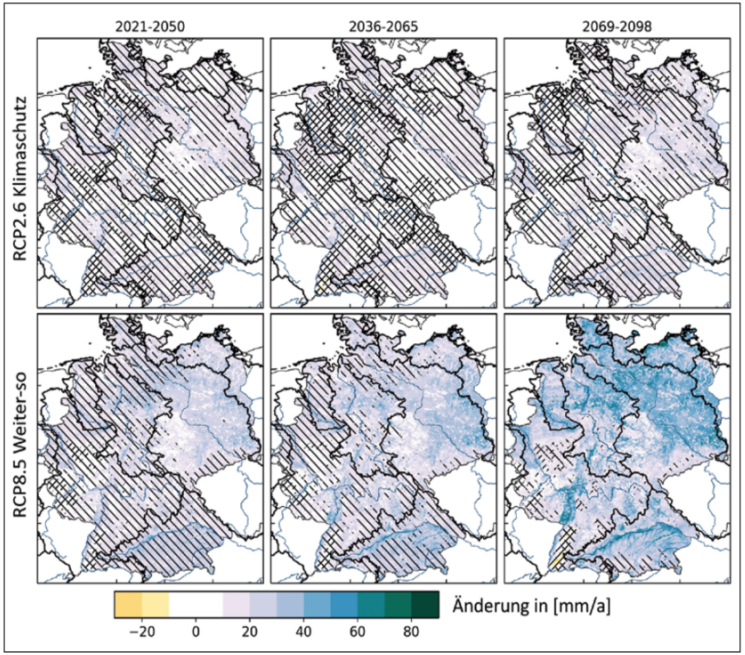


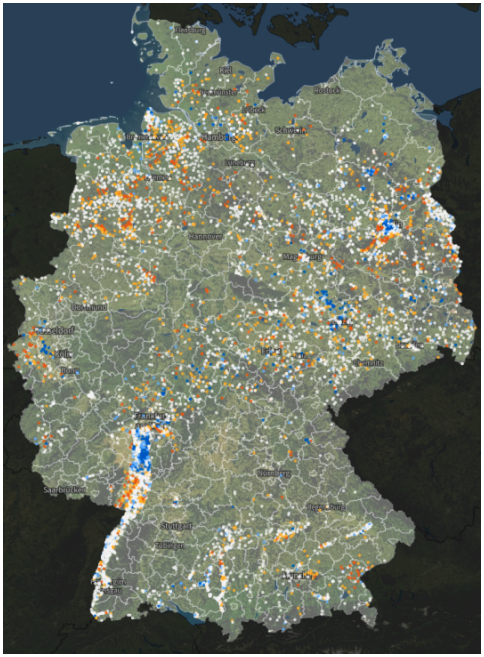
Abb. 2: *Median der absoluten Änderung der jährlichen Grundwasserneubildung [mm/a] in drei Zukunftszeitscheiben verglichen mit 1971 bis 2000. Oben ist das Klimaschutzszenario RCP2.6, unten das Weiter-So-Szenario RCP8.5 dargestellt. Die Schraffuren kennzeichnen die Robustheit. Unschraffierte Bereiche zeigen dabei robuste Änderungen, gekreuzte Schraffur bedeutet, dass keine Änderung im Vergleich zur Vergangenheit festgestellt wird.*

Die Frage ist bisher, ob nur ein Ausreißer oder doch eher ‘neues Normal’ im Sommer?

ATTRIBUTION VON EXTREMWETTER (DÜRRE)

CORRECTIV
Recherchen für die Gesellschaft





Insbesondere im Kontext teils sinkender Grundwasserspiegel eine entscheidende Frage

- mittlerweile > *2°C Erwärmung in Deutschland* bei 1.25°C globaler Erwärmung
- *sämtliche Erwärmung* ist durch anthropogene GHG Emissionen verursacht
- *Hitzeextreme* sind oft um ein Mehrfaches wahrscheinlicher geworden (WWA)
- *Niederschlagsextreme* (insbesondere Trockenheit) etwas komplizierter
- dennoch sehr *gutes physikalisches Verständnis* der involvierten Prozesse
- insbesondere *sommerliche Dürre* bereits ein ernsthaftes Problem
- *Anpassung* sollte sich daher am worst case orientieren

Zusammenfassung

- mittlerweile > *2°C Erwärmung in Deutschland* bei 1.25°C globaler Erwärmung
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- *Anpassung* sollte sich daher am worst case orientieren

VIELEN DANK!

Dr Karsten Haustein
Leipziger Institut für Meteorologie

karsten.haustein@uni-leipzig.de

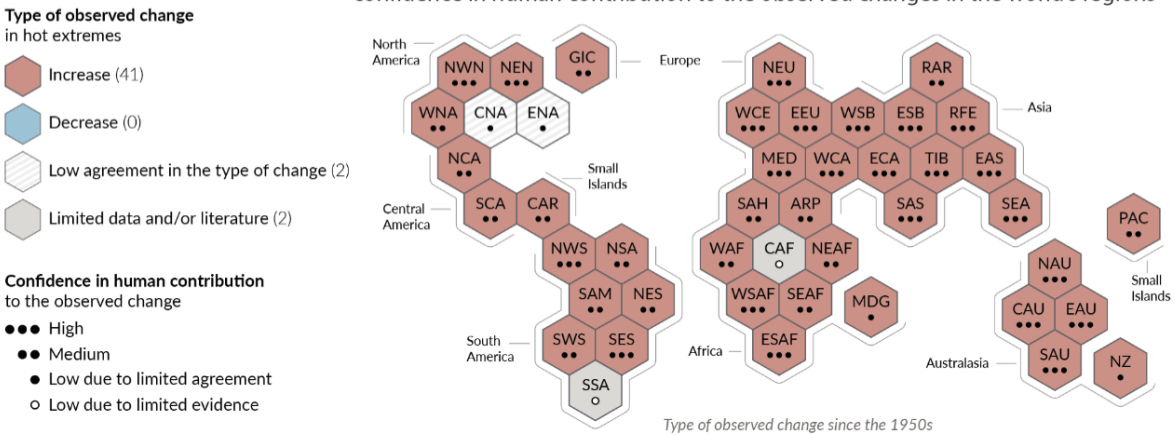
UNIVERSITÄT
LEIPZIG

SPARE SLIDES

EXTREMWETTER (EXTREME HITZE)

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

(a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions



IPCC AR6 fasst die attributierbaren Änderungen per Kategorie nach Region zusammen.

ATTRIBUTION VON EXTREMWETTER (HITZEWELLE)

Home > Heatwave > Without human-caused climate change temperatures of 40°C in the UK would have been extremely unlikely

Without human-caused climate change temperatures of 40°C in the UK would have been extremely unlikely

28 July, 2022

HEATWAVE

EUROPE

On Monday and Tuesday, 18 & 19 July 2022, an exceptional heatwave affected large parts of the UK. It was the first time that temperatures of 40°C and above have been forecast in the UK.

On Tuesday, 40.3°C was reached in Coningsby in Lincolnshire, breaking the previous maximum temperature record of 38.7°C set in 2019. Local records have been broken in 46 stations across the country. Minimum temperatures were also extremely high with 25.8°C provisionally being recorded in Kenley in Surrey, breaking the previous record from 1990 by 1.9°C.

The heatwave was very well forecast, and the UK Met Office issued severe weather warnings well ahead of the heat. A Level 4 UK Health Security Agency Heat Health Alert had been issued for Monday and Tuesday. This level of alert is used when a heatwave is so severe and/or prolonged that its effects extend outside the health and social care system. At this level, illness may occur among the fit and healthy, not just in high-risk groups.

Scientists from South Africa, Germany, France, Switzerland, New Zealand, Denmark, United States of America and the United Kingdom, collaborated to assess to what extent human-induced climate change altered the likelihood and intensity of the heatwave.

Full study

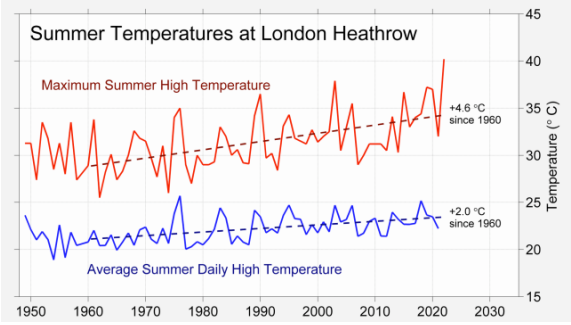
- Download the full study: Without human-caused climate change temperatures of 40°C in the UK would have been extremely unlikely (26 pages, 3.9 MB)

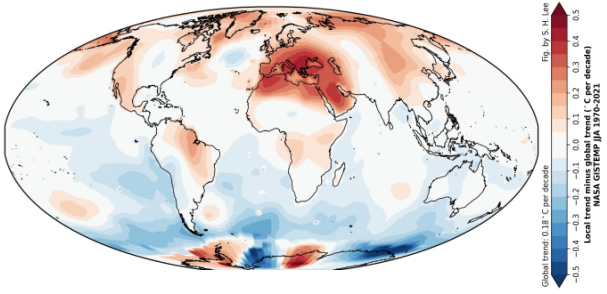
Guide for journalists

- Reporting extreme weather and climate change: a guide for journalists – in a number of languages)

You may also be interested in...

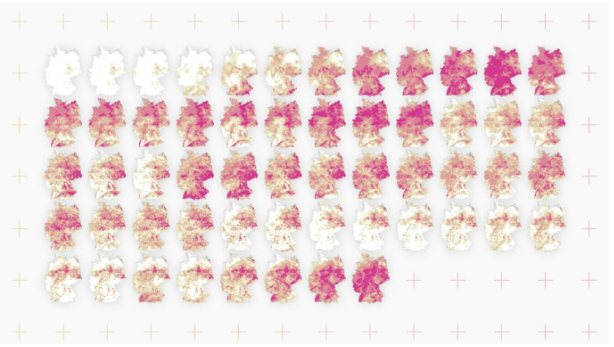
- Climate Change made devastating early heat in India and Pakistan 30 times more likely
- Western North American extreme heat virtually impossible without human-caused climate change
- Siberian heatwave of 2020 almost impossible without climate change
- Attribution of the Australian bushfire risk to anthropogenic climate change

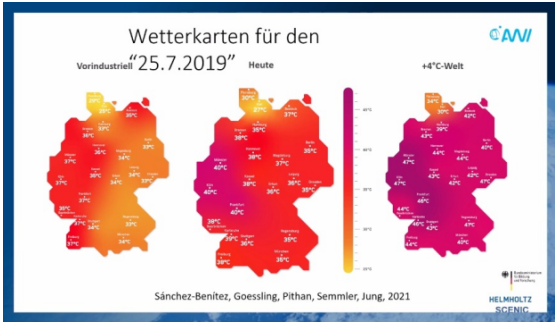


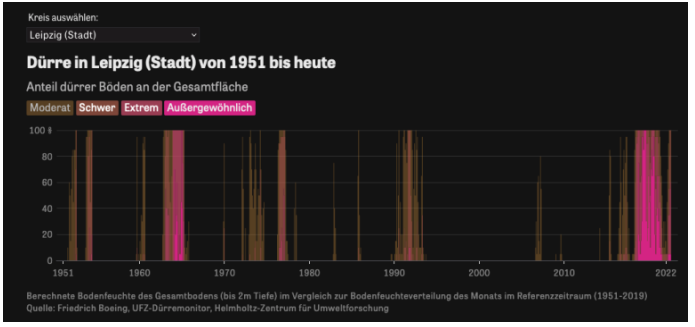


Die gemessenen 40°C in UK wären ohne Klimawandel im Prinzip nicht möglich gewesen.

ATTRIBUTION VON EXTREMWETTER (DÜRRE)

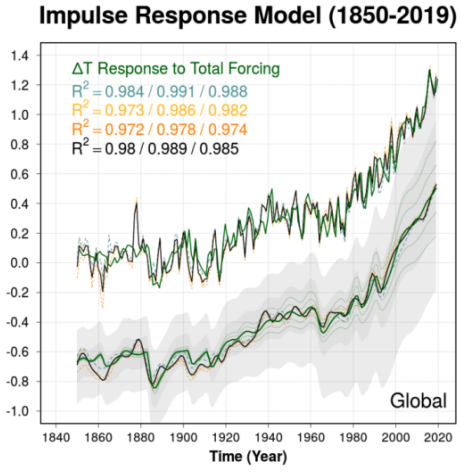


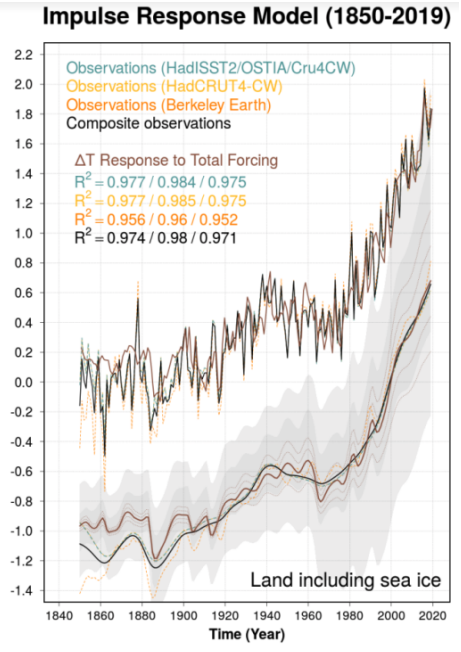


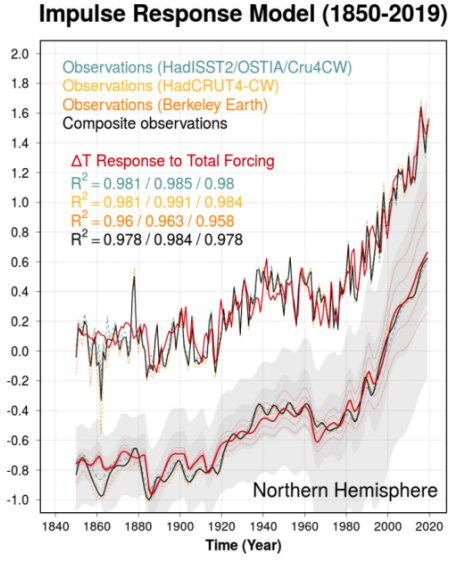


Nach der 2021er Flutkatastrophe war Dauerdürre erneut das Hauptthema in 2022 in DE.

GLOBAL TEMPERATURE EVOLUTION SINCE 1850

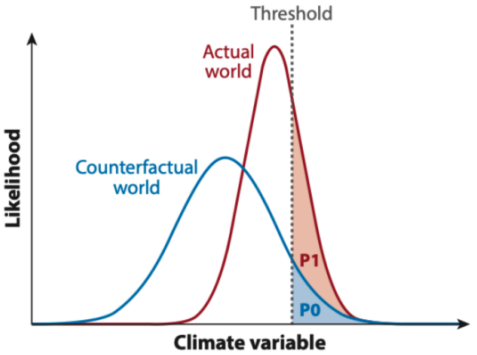






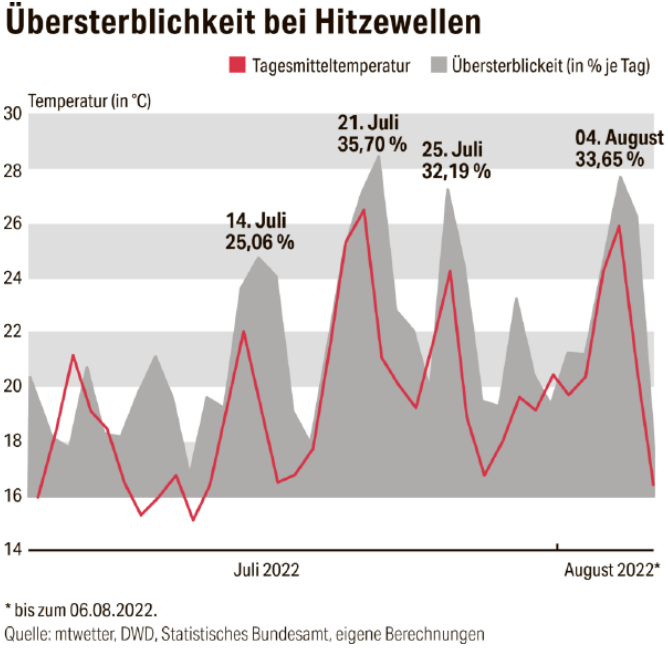
Dabei können wir sowohl Kurz- als auch Langfristschwankungen genau attributieren.

EXTREME WEATHER EVENTS



Analogie des gezinkten Würfel (loaded dice) bzgl der statistischen Effekte von Extremen.

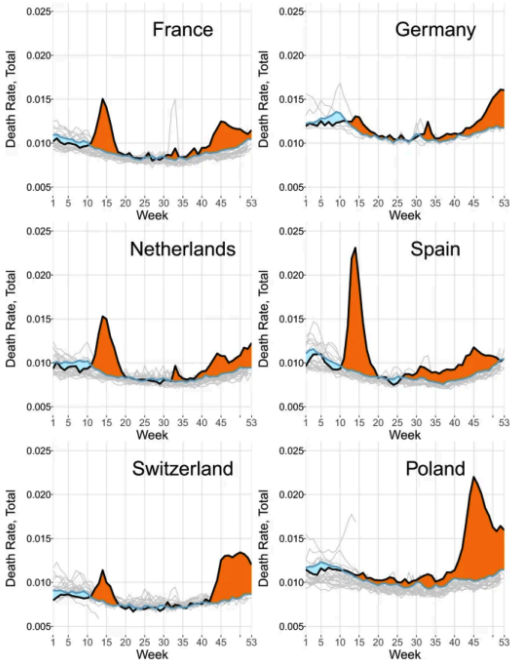
EXTREME WEATHER EVENTS: HEAT

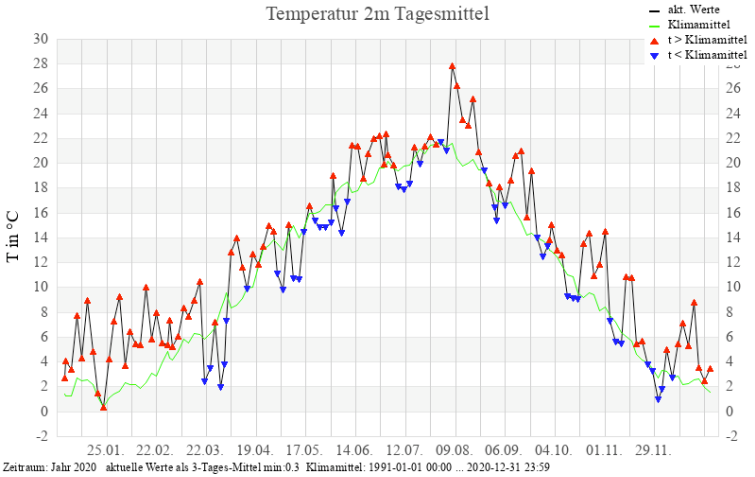


taz grafik: infotext-berlin.de/ A.E.

Und das Ganze hat sich in 2022 episodisch wiederholt! Attribution ebenfalls verfügbar!

EXTREME WEATHER EVENTS: HEAT





Nicht so eindrücklich wie Überschwemmungen, aber mit deutlich mehr Todesopfern.