

Some challenges for climate and energy

**Robert Vautard
IPCC, WGI co-chair**

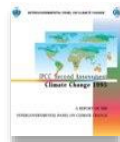
History | IPCC Reports: Unique, gather scientists, produce consensus



IPCC
jointly
established
by WMO
and UNEP



**First
Assessment
Report**
Led to
creation of
UNFCCC in
1994



**Second
Assessment
Report**
Kyoto Protocol



**Third
Assessment
Report**
Focus attention
on adaptation
to climate
change



**Fourth
Assessment
Report**
2°C Limit
Nobel Peace
Prize



**Fifth
Assessment
Report**
Paris
Agreement -
2015



**Sixth
Assessment
Report**
First Global
Stocktake -
COP28

AR7

1988

1990

1995

2001

2007

2014

2023

2028?

GROWTH IN SCIENTIFIC RESEARCH

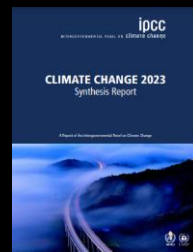
INCREASE IN STAKEHOLDER INVOLVEMENT

GROWING PUBLIC AWARENESS



The State of Knowledge about Climate Change

AR6



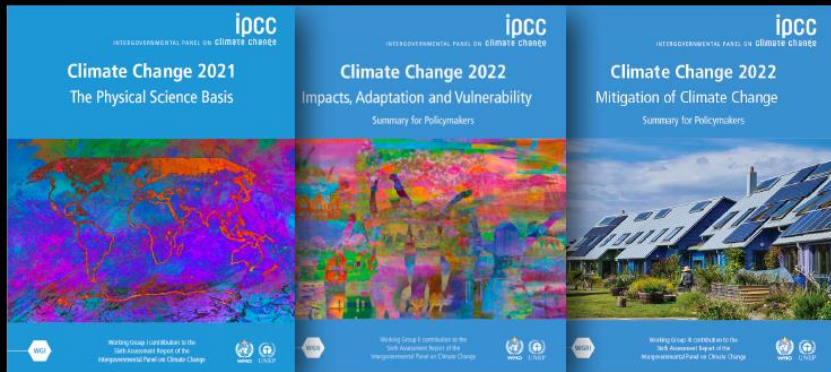
Synthesis Report

WGI

WGII

WGIII

Special Report



AR6 Climate Change 2021:
The Physical Science Basis

Climate Change 2022:
Impacts, Adaptation and
Vulnerability

Climate Change 2022:
Mitigation of Climate Change

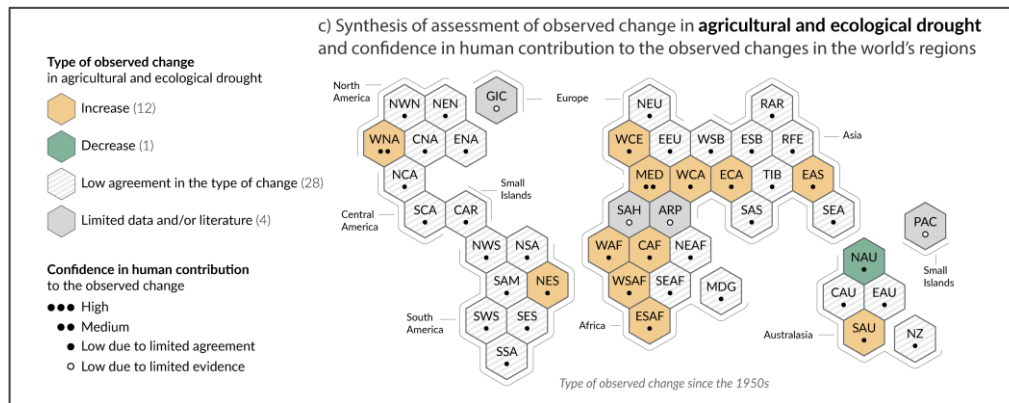
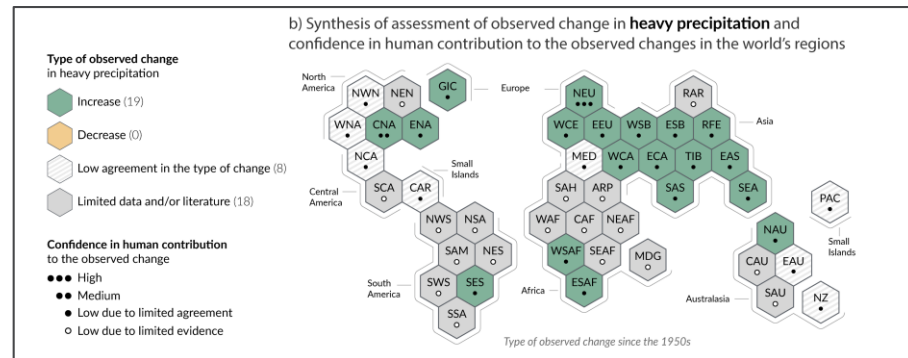
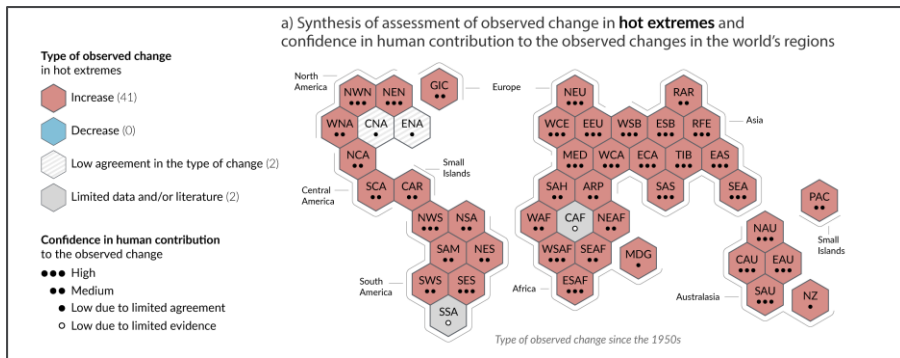
Ocean and Cryosphere in a
Changing Climate

Climate Change and Land

Global Warming of 1.5 °C

Attribution of climate extremes

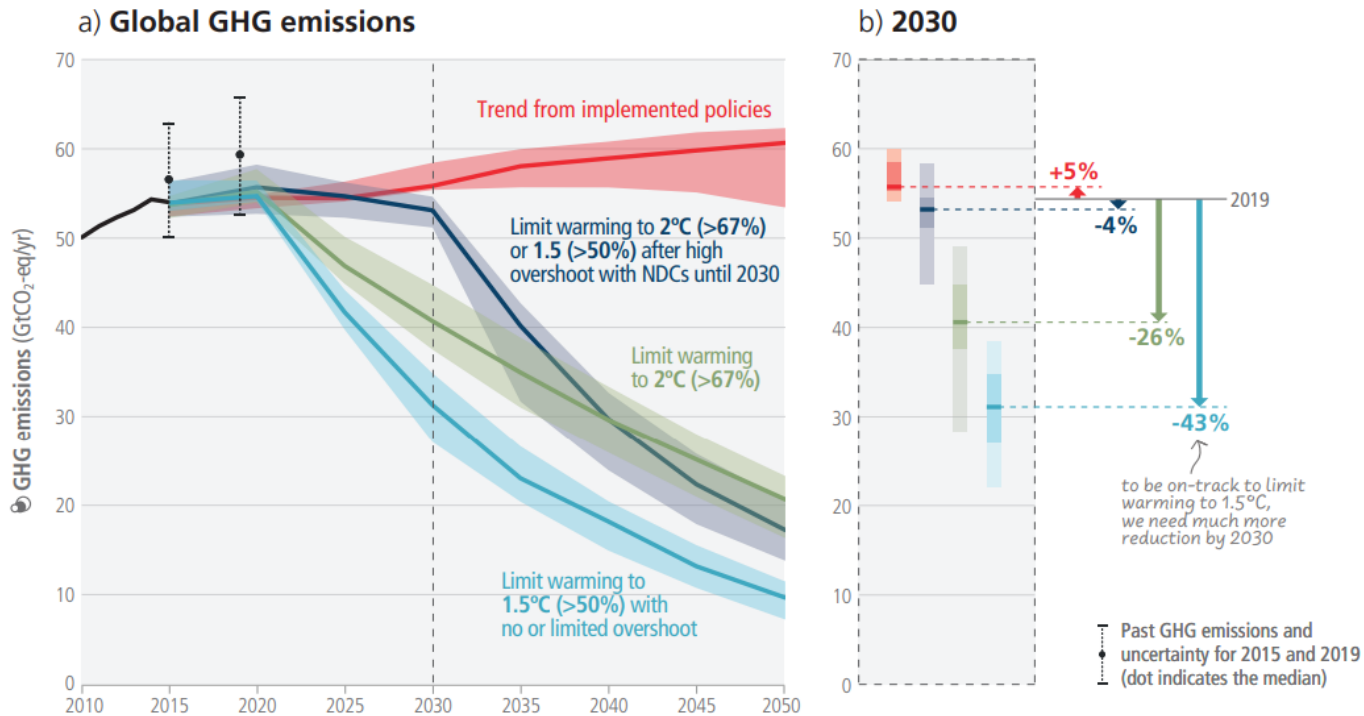
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes



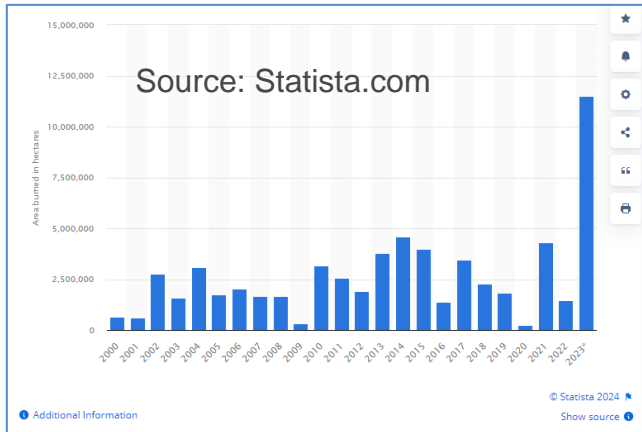
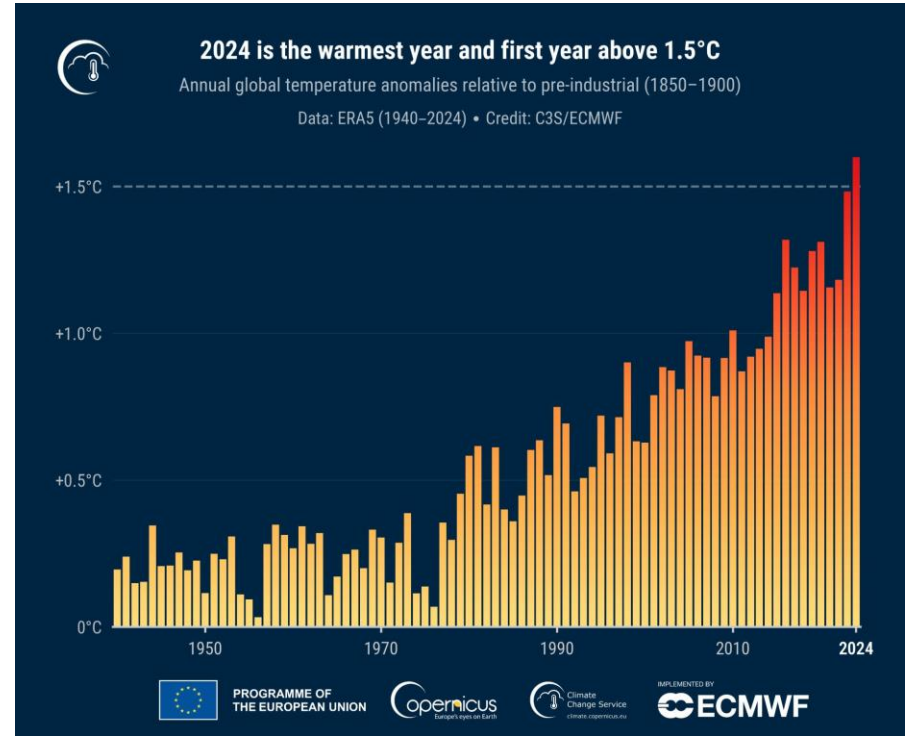
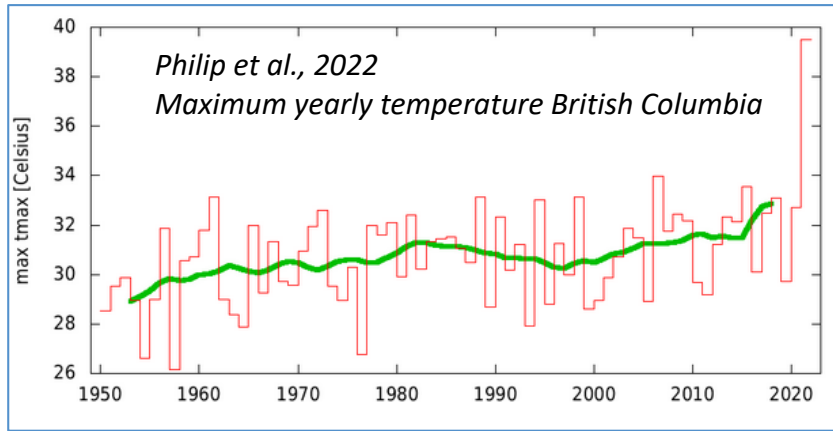
IPCC, AR6 WG1

Scenarios for 2050

Projected global GHG emissions from NDCs announced prior to COP26 would make it *likely* that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C



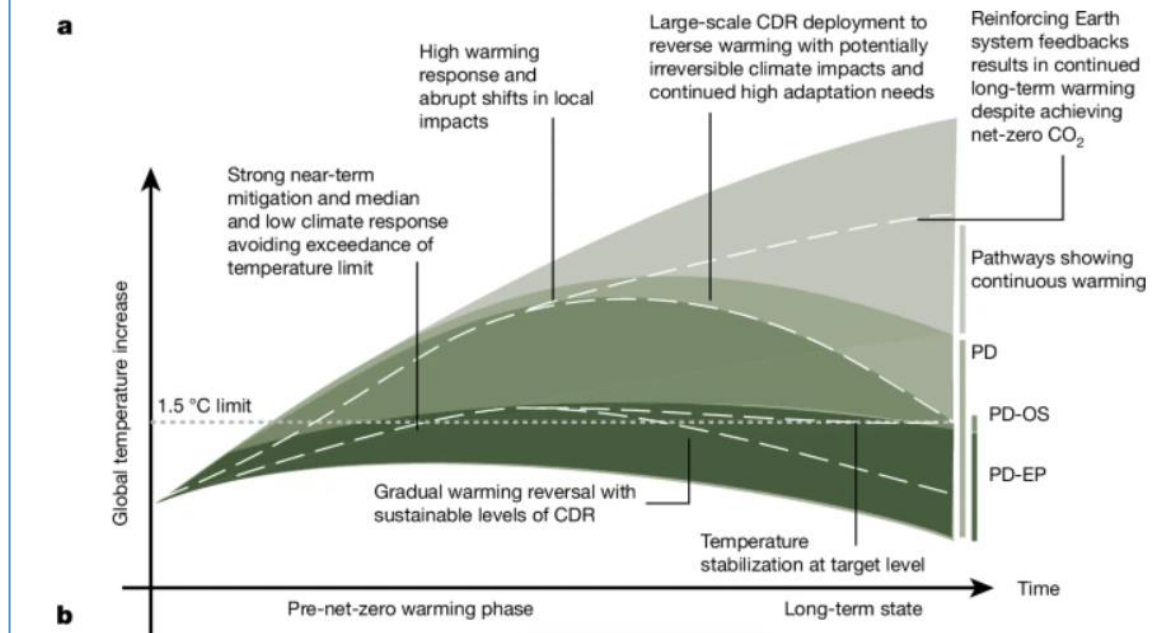
Since AR6, numerous unprecedented events to understand



2023 Fires: Surfaces brûlées au Canada (ha)

Feasibility for an “overshoot” and consequences ?

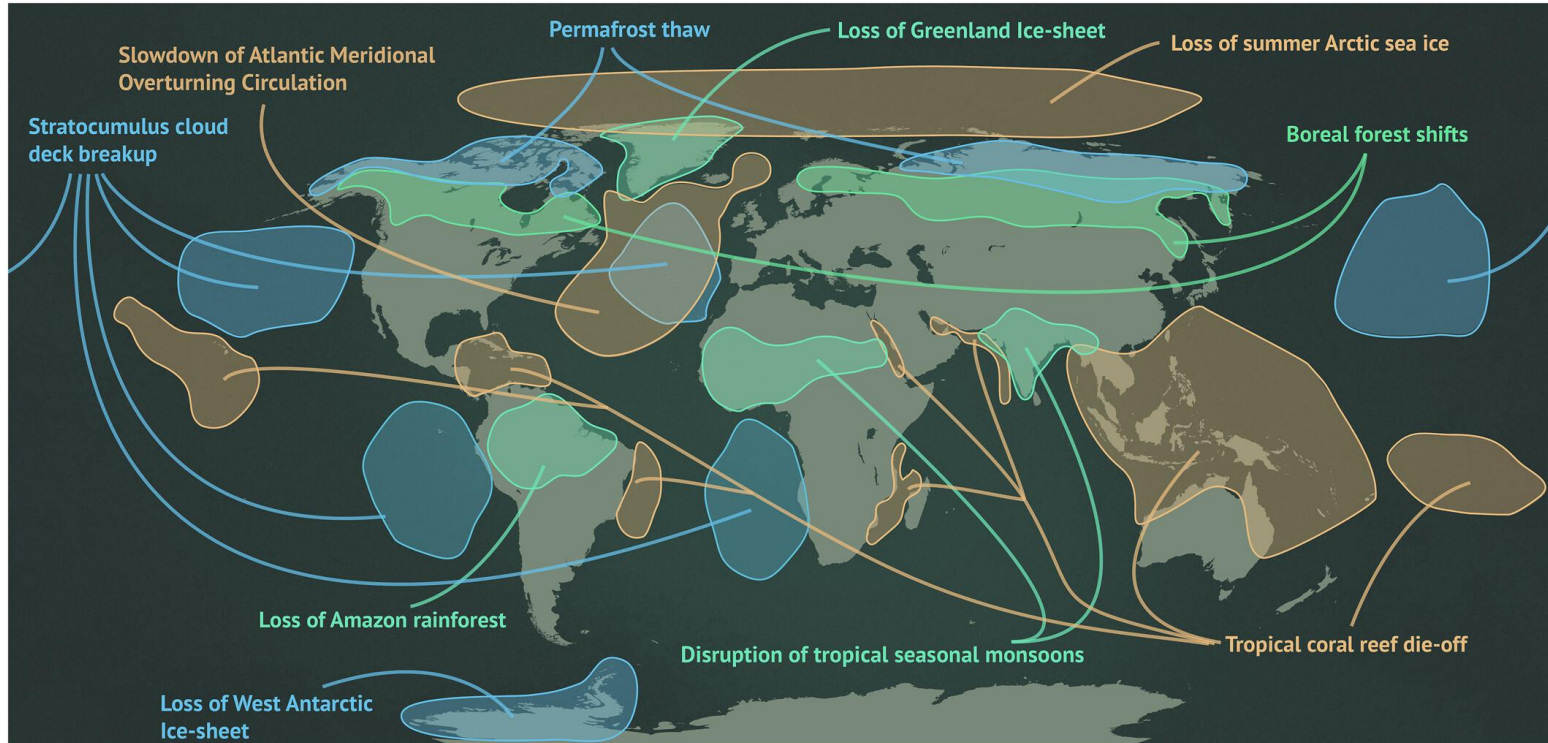
Fig. 1: Illustrative climate outcomes under different conceptual categories of peak and decline pathways.



- Potentially « non collaborative » response of the Earth System to negative emissions
- Economic feasibility
- Irreversible consequences
- What would look like a « net negative » word

Potential abrupt changes and tipping points

Mechanisms and Impacts of Earth System Tipping elements, Wang et al., 2023



European case & Energy : IPCC fact sheets

SIXTH ASSESSMENT REPORT

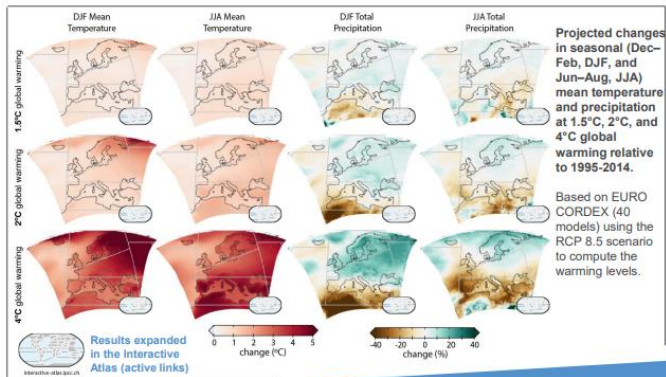
Working Group I – The Physical Science Basis



Regional fact sheet - Europe

Common regional changes

- ⓘ Regardless of future levels of global warming, temperatures will rise in all European areas at a rate exceeding global mean temperature changes, similar to past observations (high confidence).
- ⓘ The frequency and intensity of hot extremes, including marine heatwaves, have increased in recent decades and are projected to keep increasing regardless of the greenhouse gas emissions scenario. Critical thresholds relevant for ecosystems and humans are projected to be exceeded for global warming of 2°C and higher (high confidence).
- ⓘ The frequency of cold spells and frost days will decrease under all the greenhouse gas emissions scenarios in this report and all time horizons, similar to past observations. (high confidence)
- ⓘ Despite strong internal variability, observed trends in European mean and extreme temperatures cannot be explained without accounting for anthropogenic factors. Before the 1980s, warming by greenhouse gases was partly offset by anthropogenic aerosol emissions. Reduced aerosol influence in the recent decades has led to an observable positive trend in shortwave radiation. (high confidence)
- ⓘ Observations have a seasonal and regional pattern consistent with projected increase of precipitation in winter in Northern Europe. A precipitation decrease is projected in summer in the Mediterranean extending to northward regions. Extreme precipitation and pluvial flooding are projected to increase at global warming levels exceeding 1.5°C in all regions except the Mediterranean. (high confidence)
- ⓘ Regardless of level of global warming, relative sea level will rise in all European areas except the Baltic Sea, at a rate close to or exceeding global mean sea level. Changes are projected to continue beyond 2100. Extreme sea level events will become more frequent and more intense, leading to more coastal flooding. Shorelines along sandy coasts will retreat throughout the 21st century (high confidence).
- ⓘ Strong declines in glaciers, permafrost, snow cover extent, and snow seasonal duration at high latitudes/altitudes are observed and will continue in a warming world (high confidence).
- ⓘ Multiple climatic impact-drivers have already changed concurrently over recent decades. The number of climatic impact-driver changes is expected to increase with increasing global warming (high confidence).



<https://www.ipcc.ch/report/ar6/wg1/resources/factsheets/>

SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis



Climate information relevant for the Energy Sector

SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

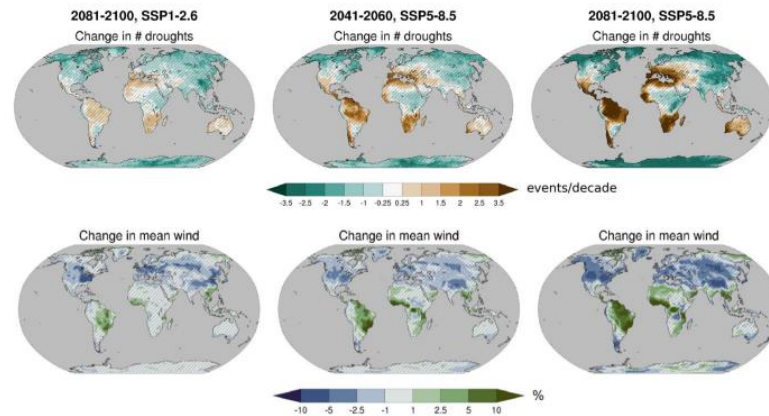
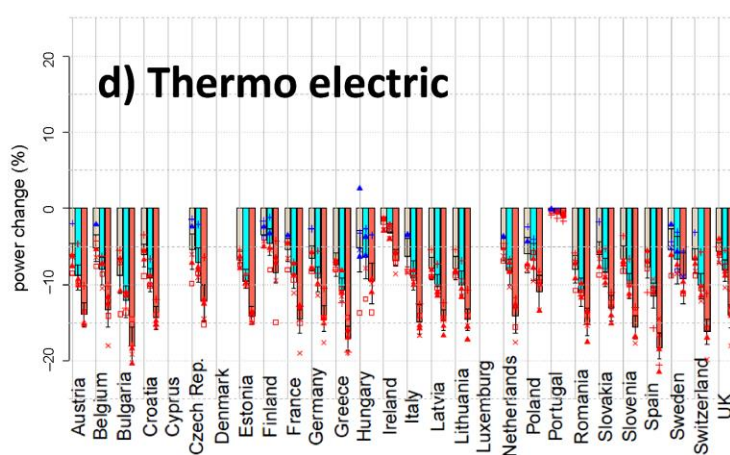
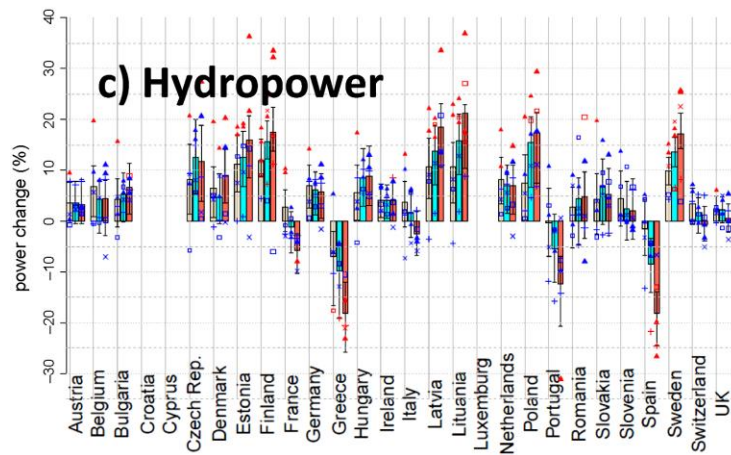
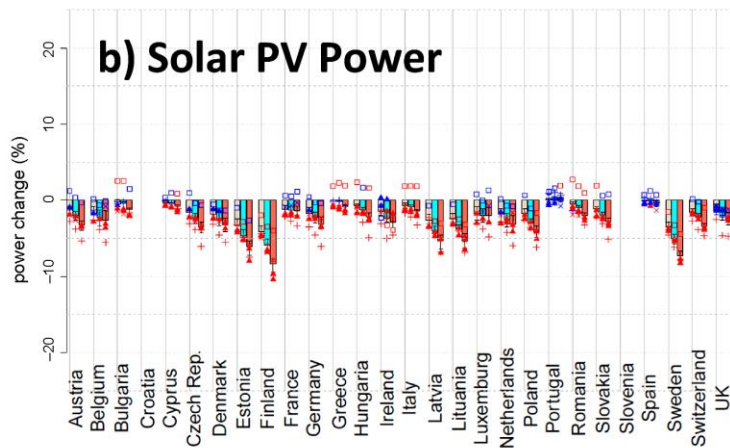
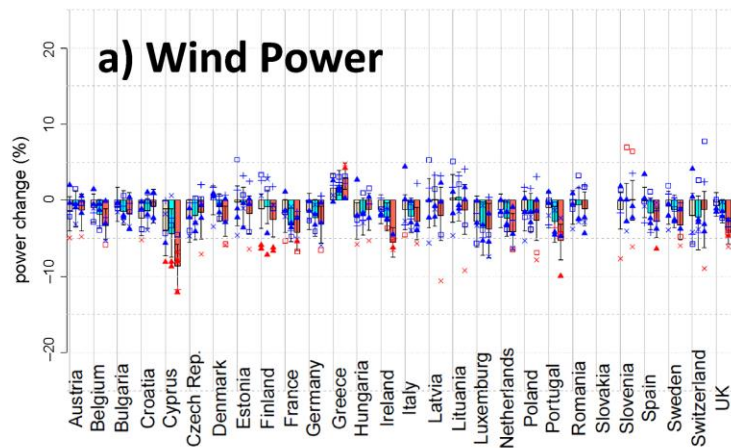


Figure 2: From Figure 12.4, the number of negative precipitation anomaly 4 events per decade using the 6-month Standardized Precipitation Index. For more information on the simple approach for confidence, please refer to the Cross-Chapter Box Atlas.1. See Annex VI for details of indices.

Changes to expect due to climate change for +1.5C, 2C, 3C

Tobin et al., 2018



Information pour l'énergie : Cas extrêmes à prévoir

Use of existing or « boosted » simulations to analyze worst case scenarios

<https://doi.org/10.5194/egusphere-2023-2523>

© Author(s) 2023. This work is distributed under the Creative Commons Attribution 4.0 License.

Abstract


Discussion

Metrics



07 Nov 2023

An extreme cold Central European winter such as 1963 is unlikely but still possible despite climate change

Sebastian Sippel , Clair Barnes, Camille Cadiou, Erich Fischer, Sarah Kew, Marlene Kretschmer, Sjoukje Philip, Theodore G. Shepherd, Jitendra Singh, Robert Vautard, and Pascal Yiou



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Climate Services

journal homepage: www.elsevier.com/locate/cliser



Original research article

How could 50 °C be reached in Paris: Analyzing the CMIP6 ensemble to design storylines for adaptation

Pascal Yiou ^{a,*}, Robert Vautard ^a, Yoann Robin ^a, Nathalie de Noblet-Ducoudré ^a,
Fabio D'Andrea ^b, Robin Noyelle ^a

^a Laboratoire des Sciences du Climat et de l'Environnement, UMR8212 CEA-CNRS-UVSQ, IPSL & Université Paris-Saclay, 91191 Gif-sur-Yvette, France

^b Laboratoire de Météorologie Dynamique, UMR CNRS-X-ENS, IPSL & Université PSL, 75005 Paris, France



**The choices and actions
implemented in this decade will
have impacts now and for
thousands of years**

IPCC AR6 SYR

**Toutes mes présentations disponibles à partir de:
<https://cloud.ipsl.fr/index.php/s/XbjHgTAMt2pxXt5>**