



## Le changement climatique en Europe

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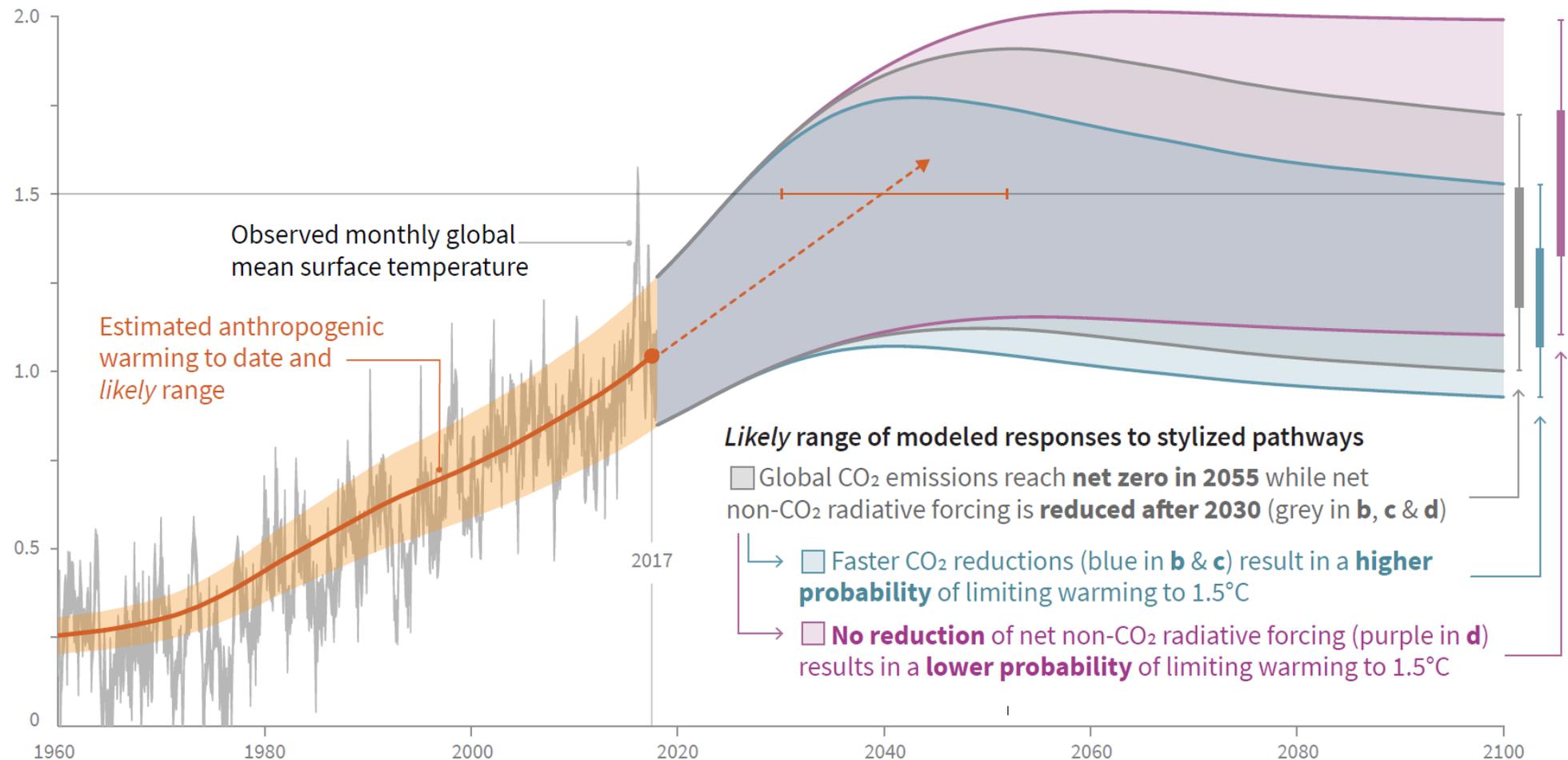


# The global climate change, 1.5°C and 2°C

IPCC, 2018

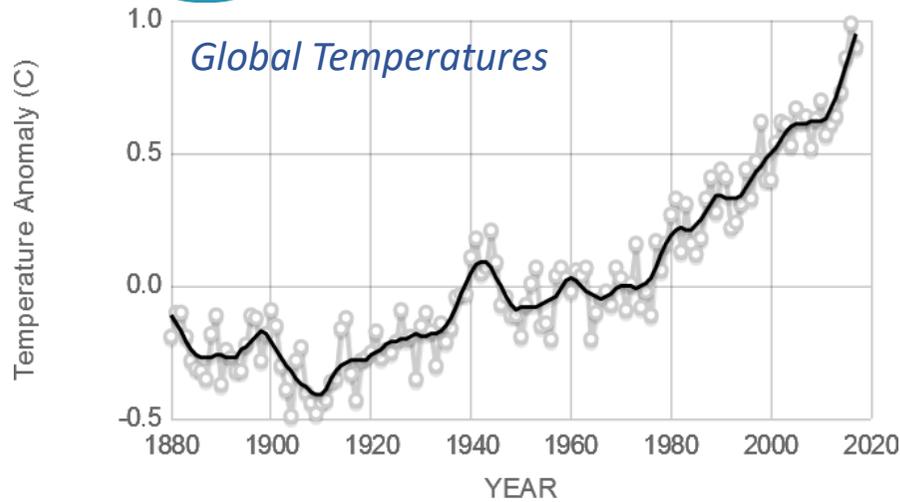
## a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

Global warming relative to 1850-1900 (°C)





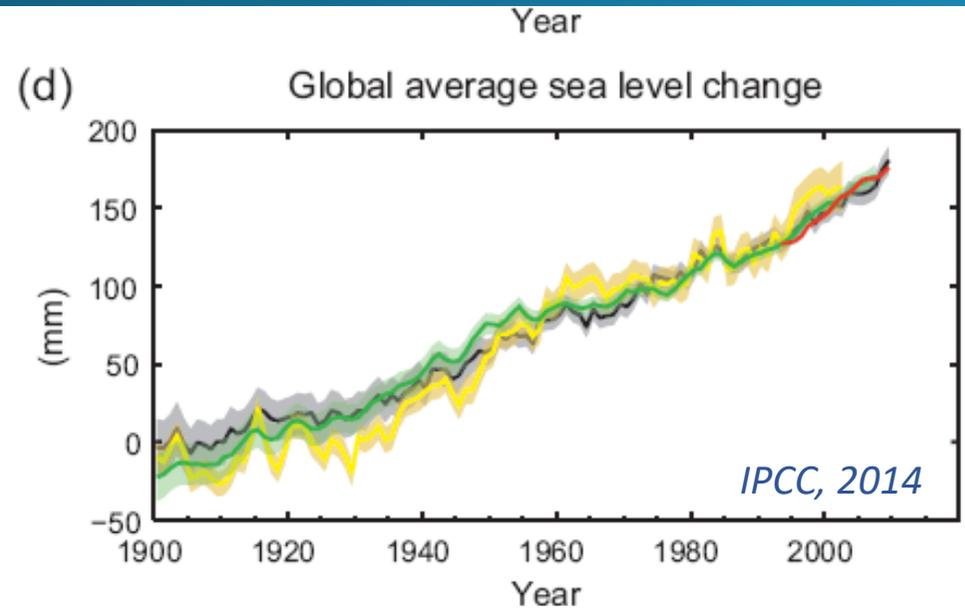
# Multiple lines of evidence of global and regional changes



Source: climate.nasa.gov

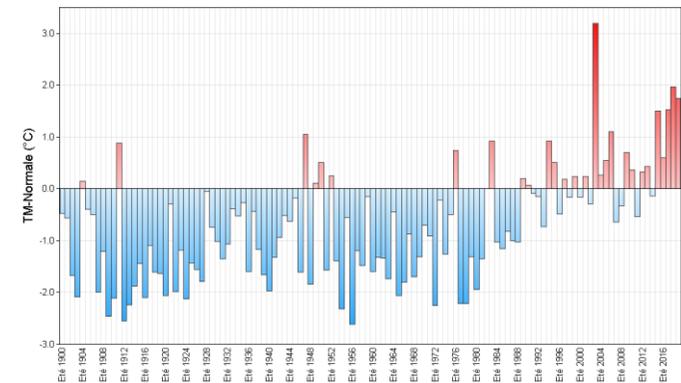


Le Glacier Upsala (sud de la Patagonie, Argentine) en 1928 et 2004 © Greenpeace – [www.les-crises.fr](http://www.les-crises.fr)



Ecart à la moyenne saisonnière de référence 1981-2010 de l'indicateur de température moyenne  
Zone climatique : France

Eté 1900 à 2019



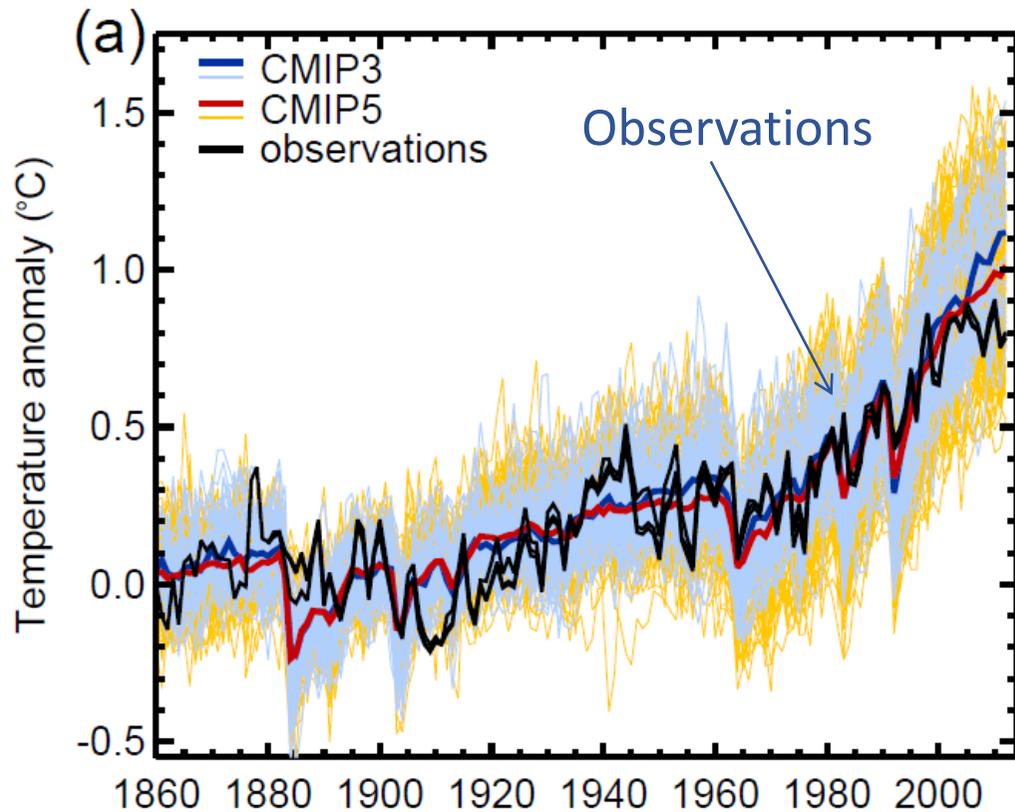
□ Ecart à la normale saisonnière

Summer Temperatures in France (anomalies)

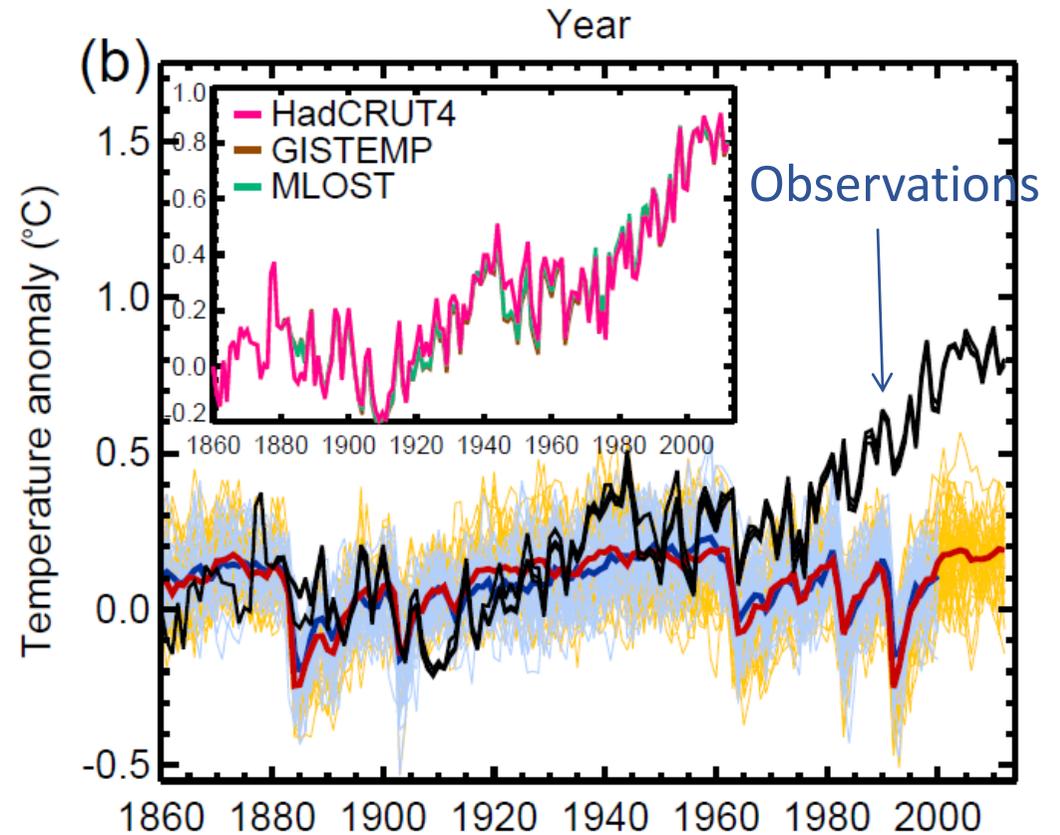


Édité le : 04/09/2019 - Données du : 04/09/2019 à 09:22 UTC

## Simulations with human influence



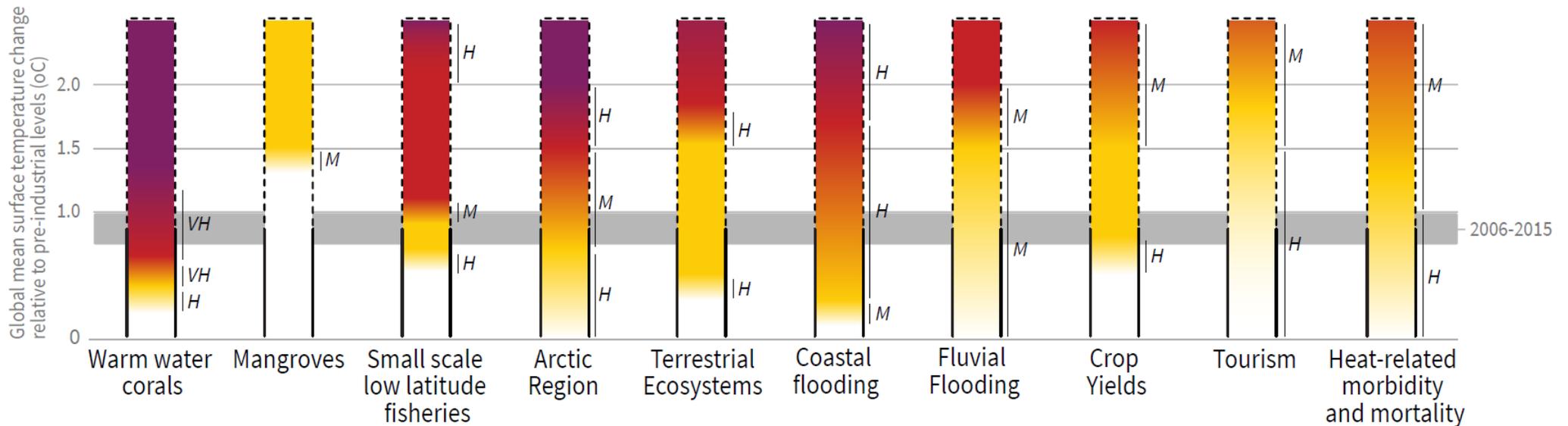
## Simulations without human influence



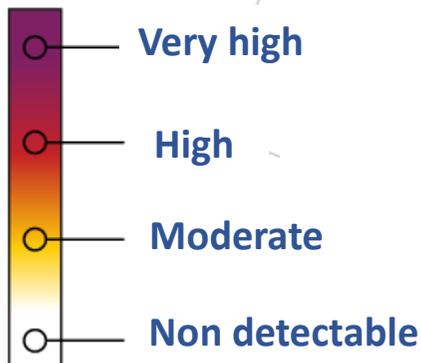


# A multitude of risks with varying intensities as a function of global warming level

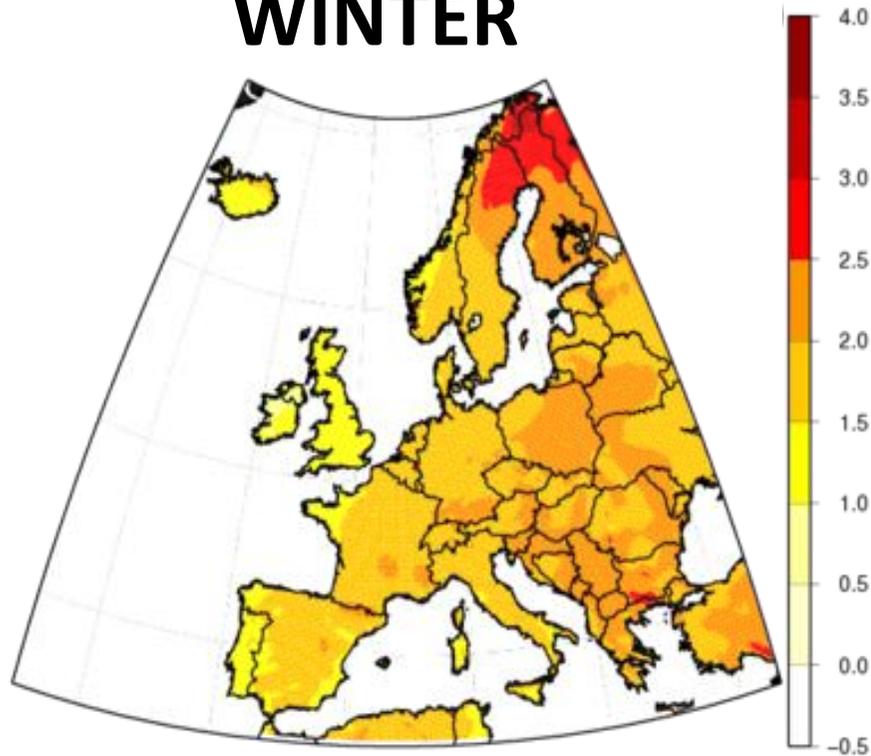
## Impacts and risks for selected natural, managed and human systems



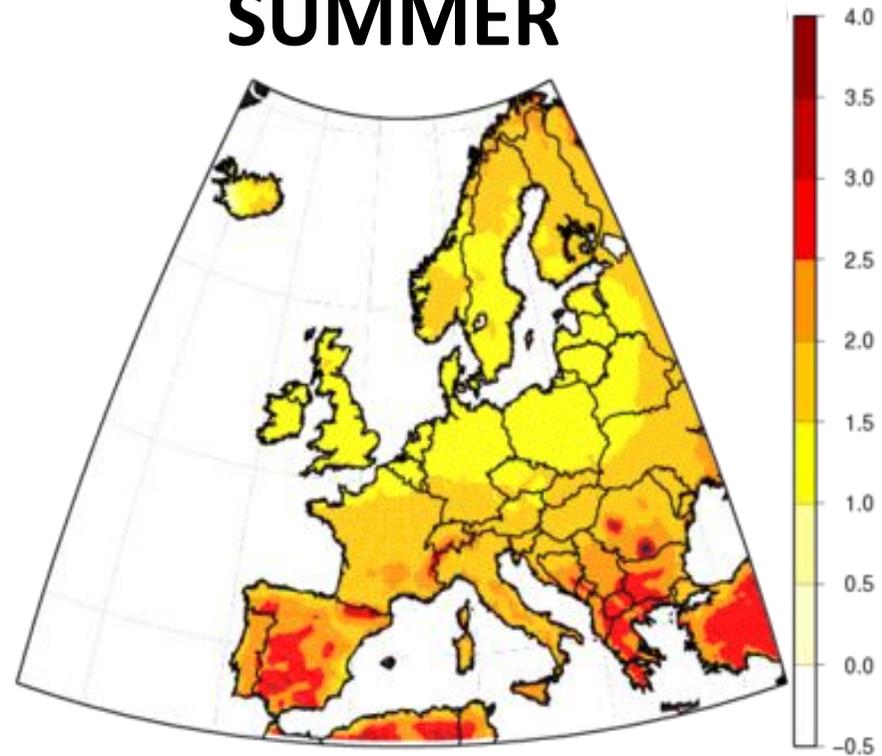
IPCC, 2018



## WINTER

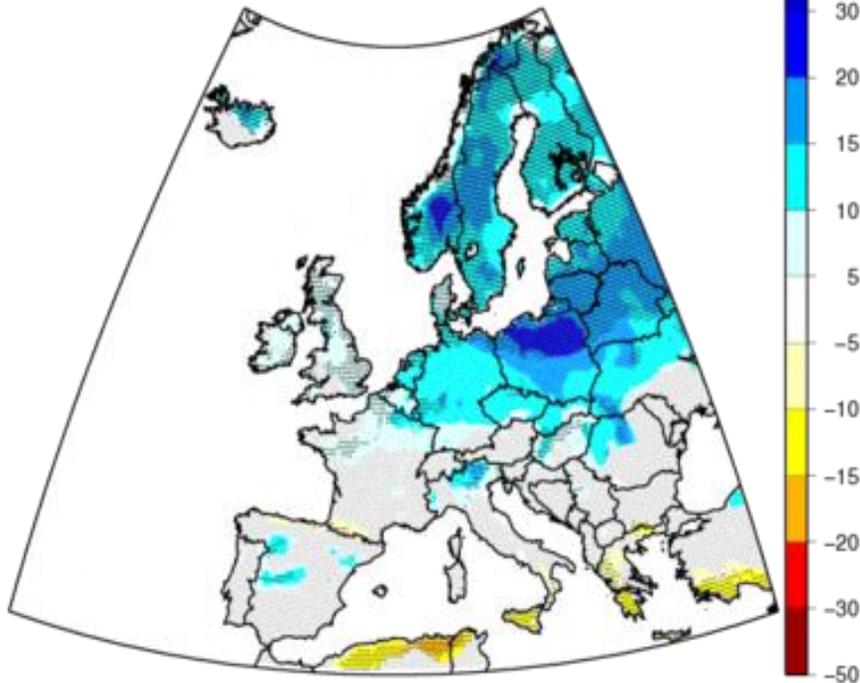


## SUMMER

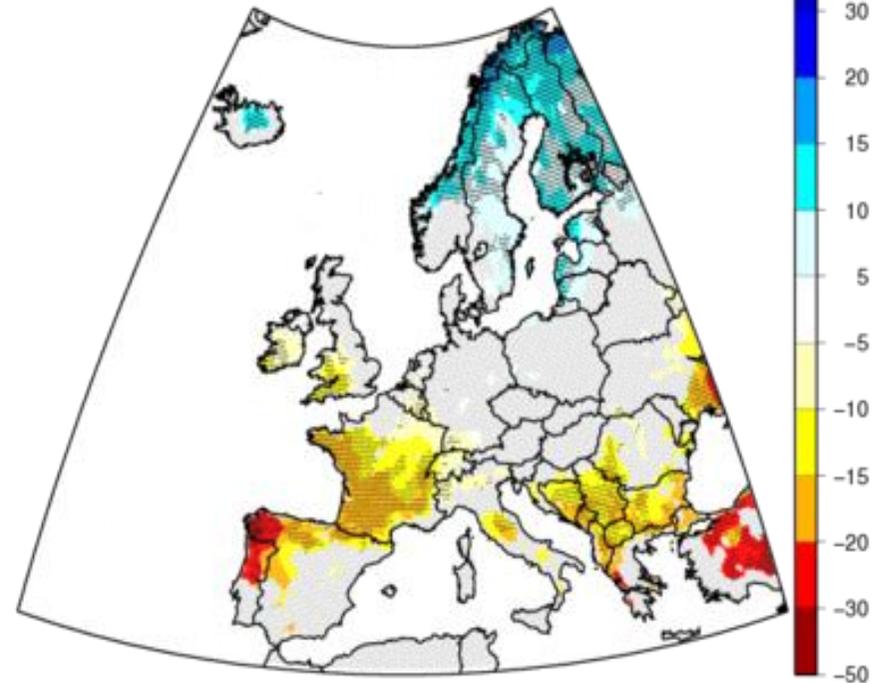


*FP7 IMPACT2C project  
Vautard et al., 2014*

## WINTER



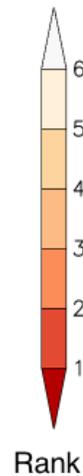
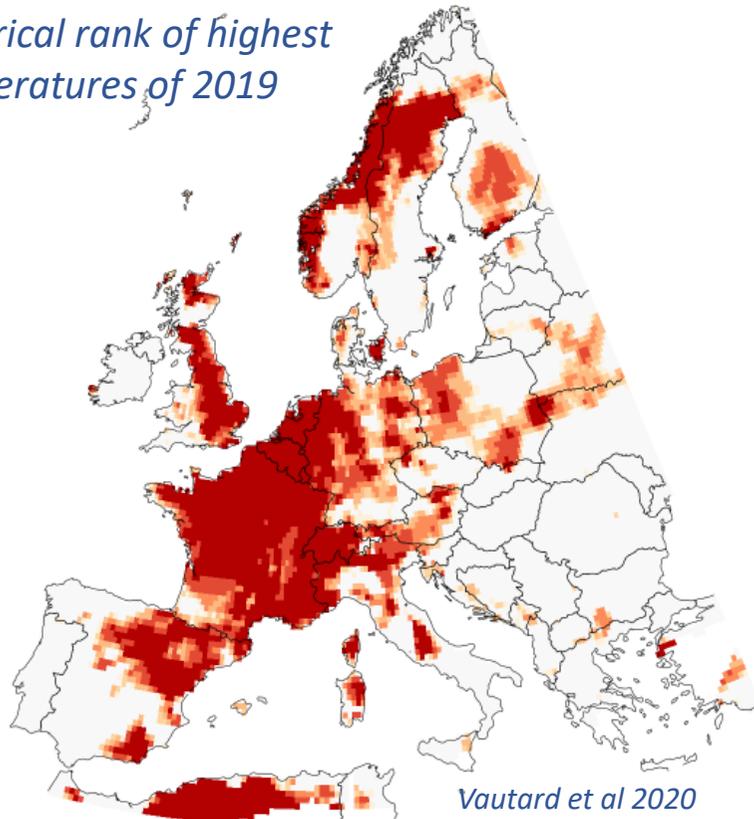
## SUMMER



*FP7 IMPACT2C project  
Vautard et al., 2014*

# Heat waves : recent extreme heat waves in Europe clearly influenced by human activities

*Historical rank of highest temperatures of 2019*



- 2019 heatwave: An event that would have been extremely unlikely without human influence (Return period > 1000 years)
- Such heatwaves would have been 1.5°C to 3°C cooler without climate change [with similar return period]

**In general, recent hot summers (2017, 2018, 2019) to become the norm by the mid century or for a 2°C warming**

- Recurrent summer droughts
- Increased fire risk
- Water resources threatened

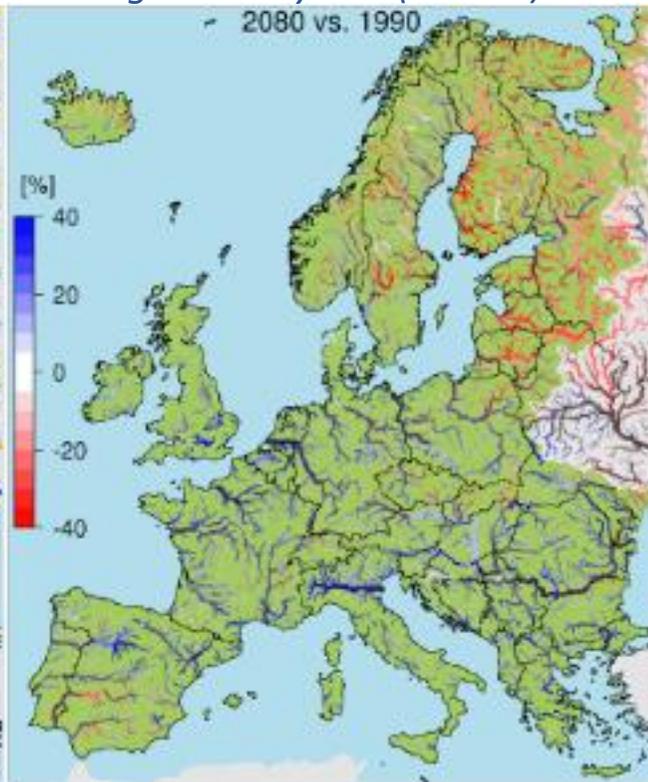
*2019 Heatwave: > 2500 extra deaths in Europe - Deadliest disaster in 2019 worldwide (CRED Report 2019)*

In many areas in Europe extreme precipitation inducing floods already have increased in intensity and frequency (eg ~20% intensity increase in Southern France), and this trend will continue with climate change

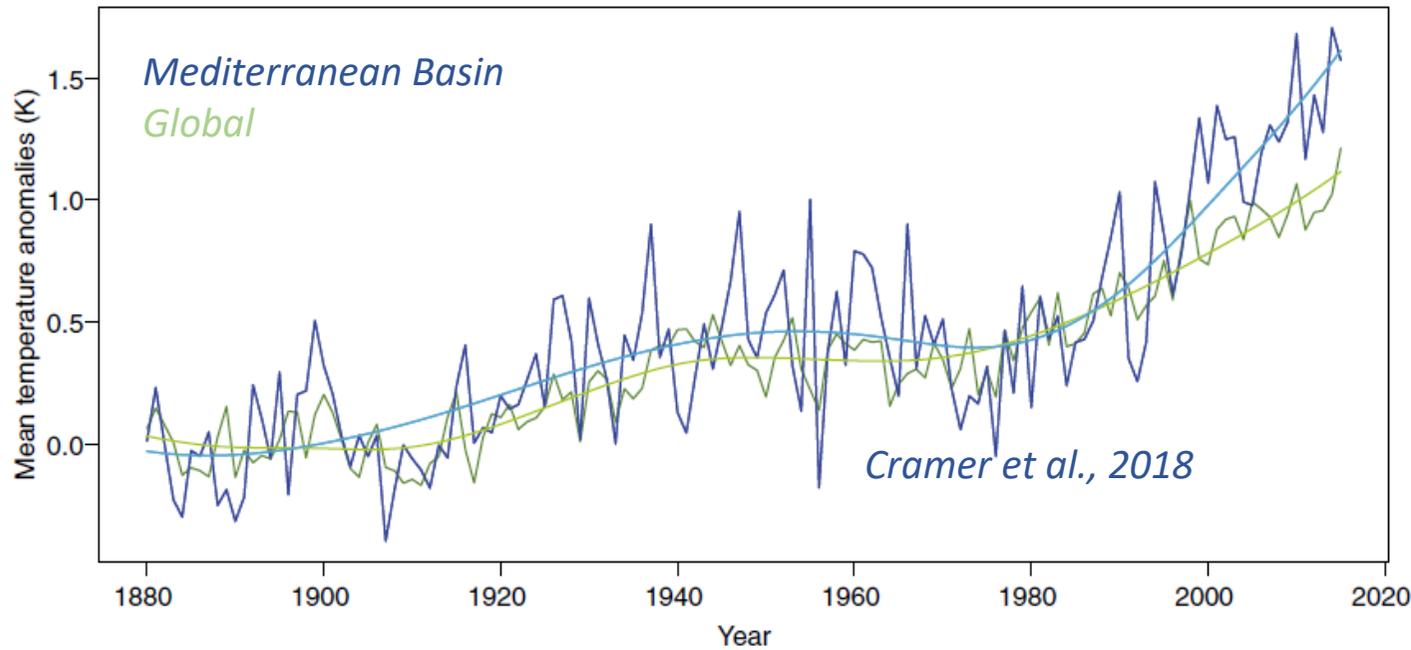
100-year extreme discharge



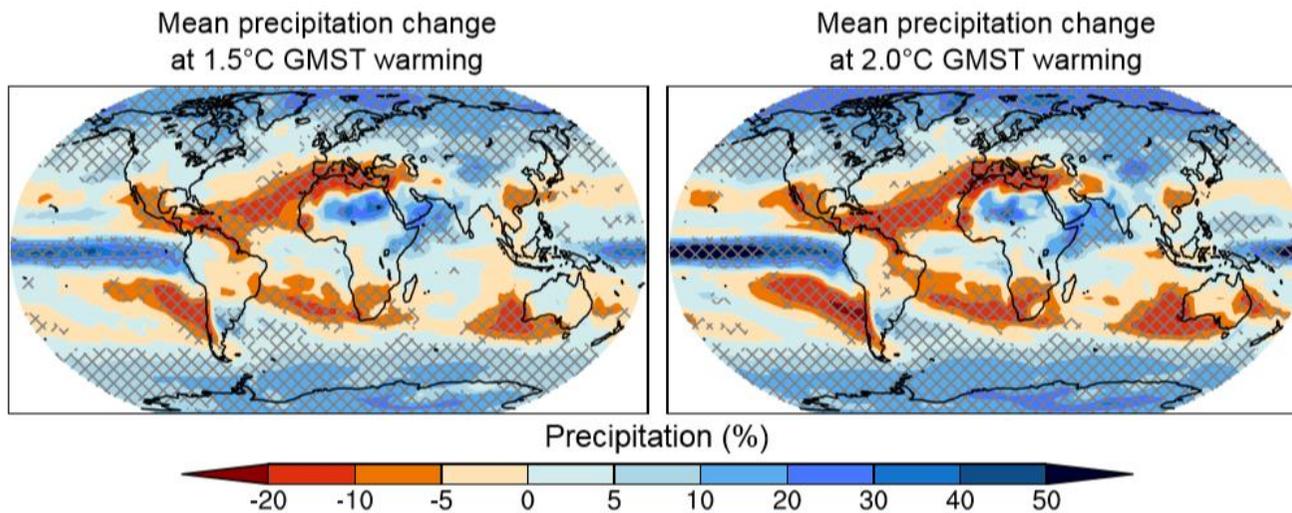
Change in 100 years (RCP8.5)



Projected changes in extreme floods (100-Year) have well identified patterns with increase in most areas and decrease in North-Eastern Europe and in parts of Southern Europe



- Extreme heatwaves to become the norm by 2020
- Chronical deficit of precipitation (winter and summer)
- Strong drought and water resource
- Extreme precipitation leading to flash floods to increase in frequency and amplitude
- Sea level changes





## Conclusions and complements

- **Climate change is already well present in Europe** with many identified and attributed effects (mean temperatures, precipitation, extreme heat waves and precipitation)
- **Human activities will have an increasing effect on many weather and climate phenomena and hazards in Europe:** extreme heat waves, droughts, heavy precipitation and floods, extreme sea levels
- **Climate change will induce a multitude of impacts in Europe affecting many sectors** (water resources, agriculture, energy, tourism, ...) and ecosystems
- **Mediterranean regions will be a hot spot of climate change**, with chronic water resource deficit and increased extreme weather events
- **Global warming will continue in all scenarios until about 2050**, and only strong and immediate mitigation actions (towards carbon neutrality) will allow climate to warm less than 1.5°C and even 2°C and temperatures to be stabilized in the second half of the century.
- **This requires to coordinate both adaptation and mitigation actions**, including consideration for sustainable development (see IPCC 2018 report on 1.5°C warming)



**MERCI - THANKS**

Institut Pierre-Simon Laplace (IPSL)