

Contexte général du changement climatique et impacts en Belgique

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BRAD PITT ERIC BANA ORLANDO BLOOM

A WOLFGANG PETERSEN FILM

TROY

WARNER BROS. PICTURES PRESENTS

A RADIANT PRODUCTION IN ASSOCIATION WITH PLAN B BRAD PITT ERIC BANA "TROY" ORLANDO BLOOM DIANE KRÜGER BRIAN COX
SEAN BEAN BRENDAN GLEESON PETER O'TOOLE MUSIC BY JAMES HORNOR COSTUME DESIGNER PETER HONNESS A.C.E. PRODUCTION DESIGNER NIGEL PHELPS DIRECTOR OF PHOTOGRAPHY ROGER PRATT, BSC SCREENPLAY BY DAVID BENIOFF
PRODUCED BY WOLFGANG PETERSEN DIANA RATHBUN COLIN WILSON DIRECTED BY WOLFGANG PETERSEN

R RESTRICTED
Under 17 requires accompanying parent or adult guardian
Some Material May Be Offensive

A UK/MALTA CO-PRODUCTION

www.troymovie.com

MAY 14

America's Online Keyword: Troy

WARNER BROS. PICTURES

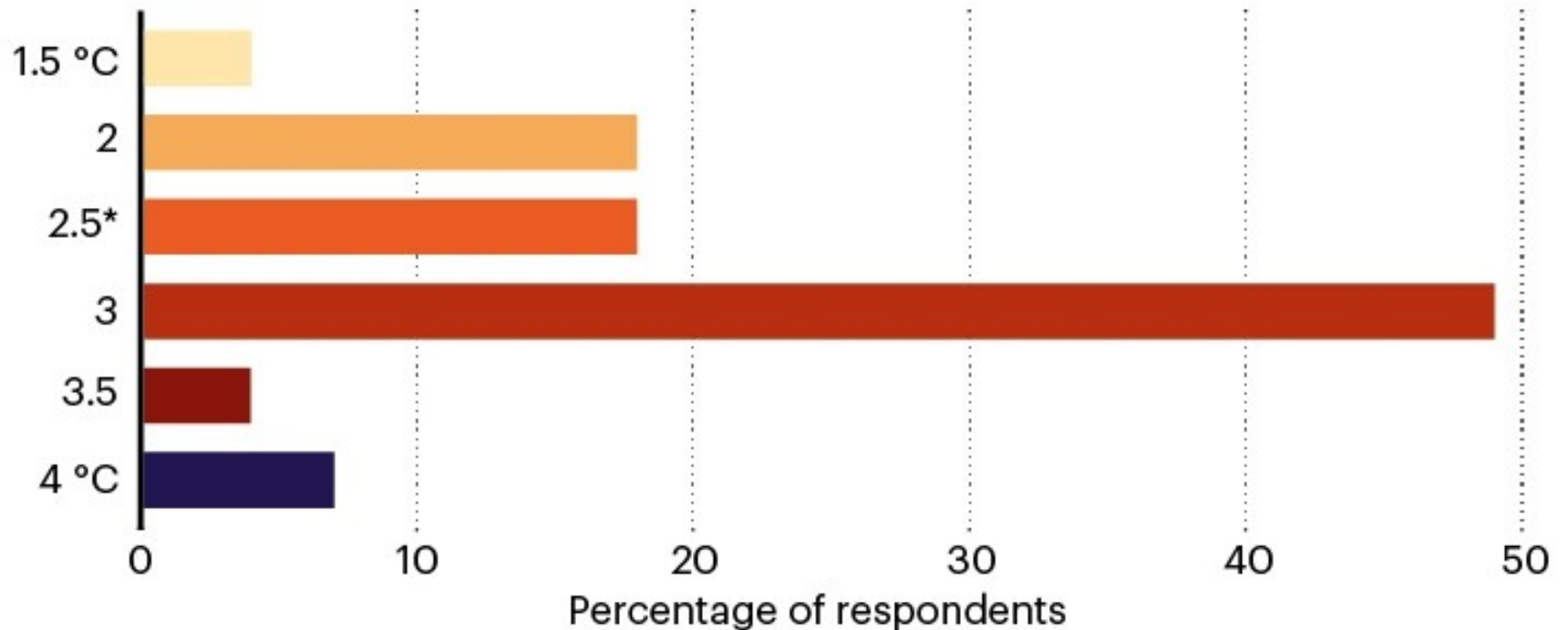


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Scientifique ~ pessimiste?

How much warming above pre-industrial times do you think is likely by 2100?



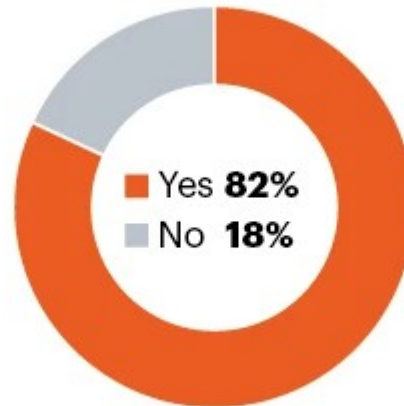
*Includes 2 responses between 2.7 °C and 2.75 °C; 2.5 °C and 3.5 °C were write-in answers.

©nature

Nature's survey from 233 IPCC authors

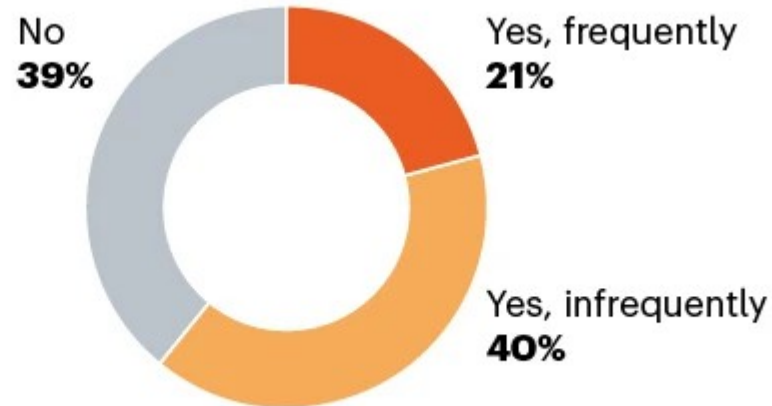
Scientifique ~ pessimiste?

Do you think you will see catastrophic impacts of climate change in your lifetime?



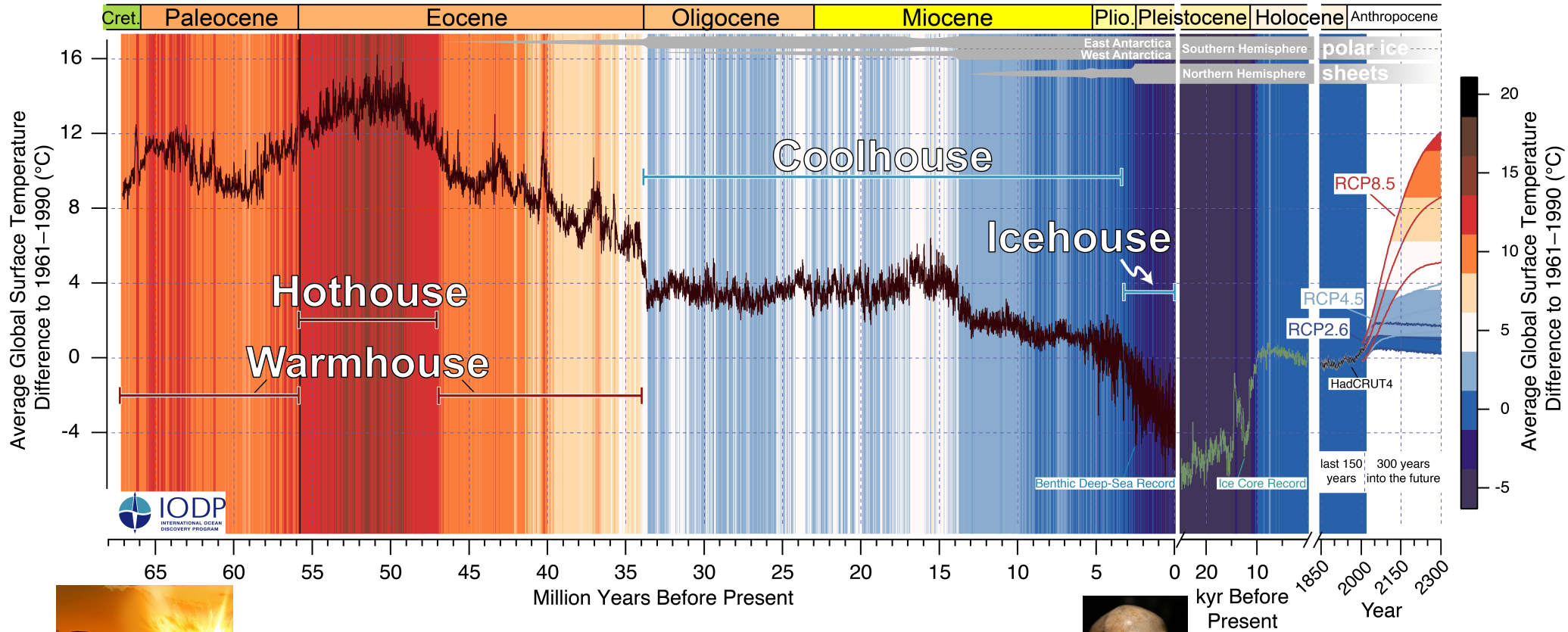
©nature

Do you experience anxiety, grief or other distress because of concerns over climate change?



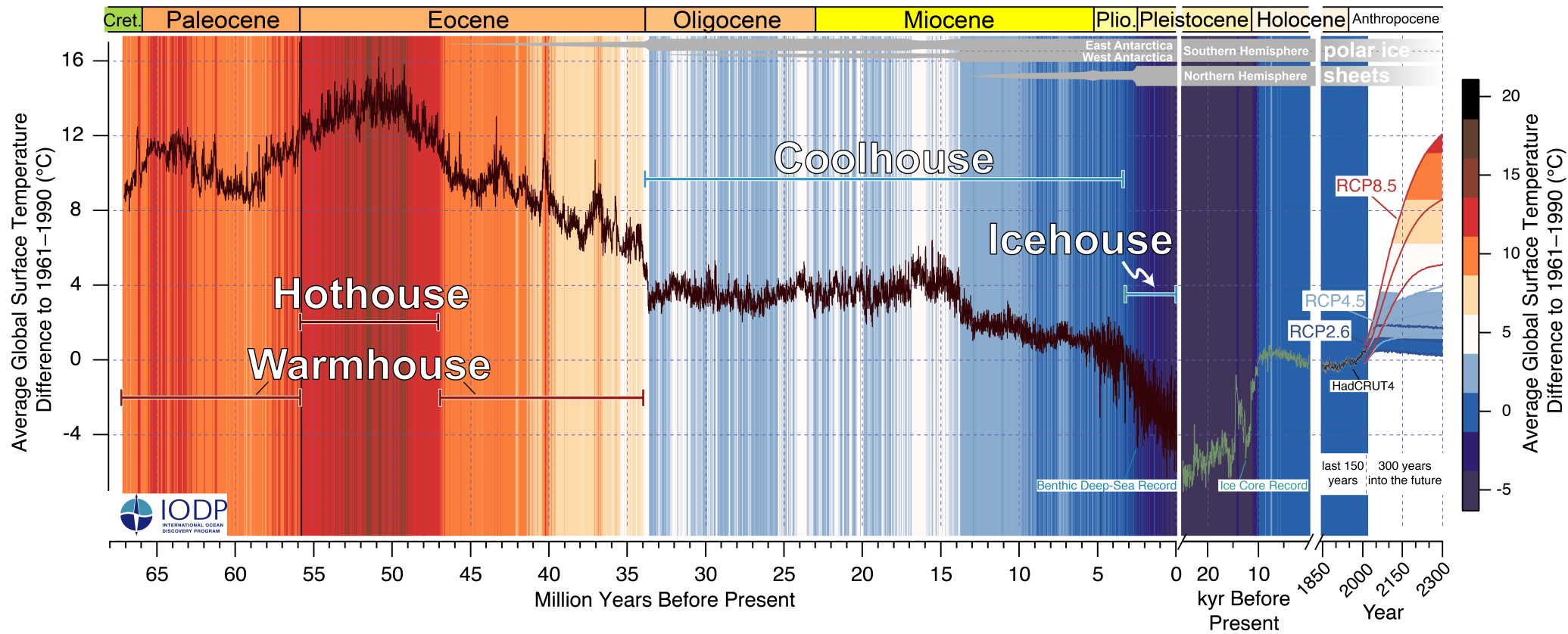
©nature

Il y a des millions d'années...



Homo Sapiens ~ 300 000 years

Où est la pédale de frein ?



12°C de moins en ~ 45 Millions d'années

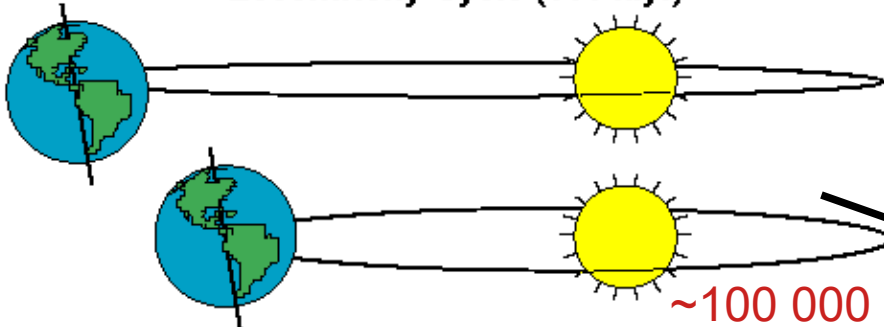


RCP8.5:
12°C de plus en
~350 ans

Pourquoi le
climat a-t-il
varié?



Eccentricity Cycle (100 k.y.)



~100 000 ans
(forme de l'orbite)

Obliquity Cycle (41 k.y.)

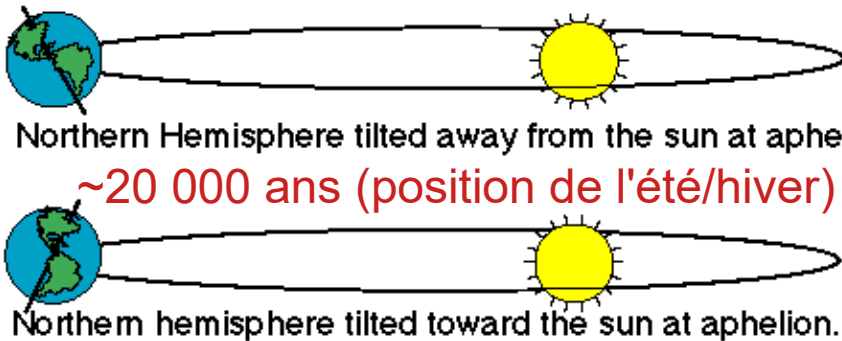


~40 000 ans
(inclinaison)

Normal to Ecliptic

© Scott Rutherford (1997)

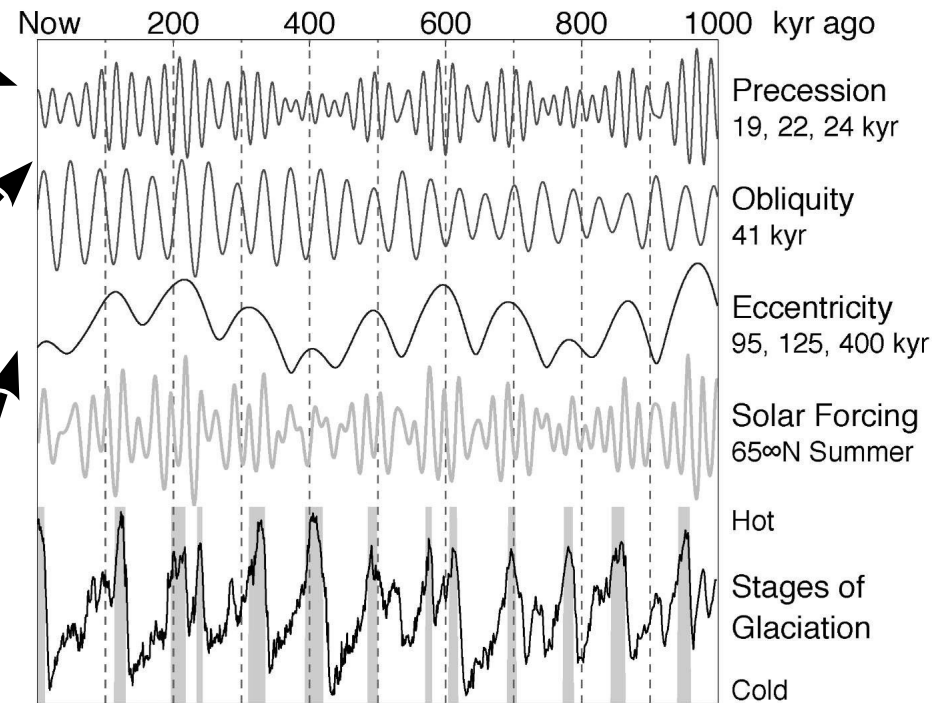
Precession of the Equinoxes (19 and 23 k.y.)



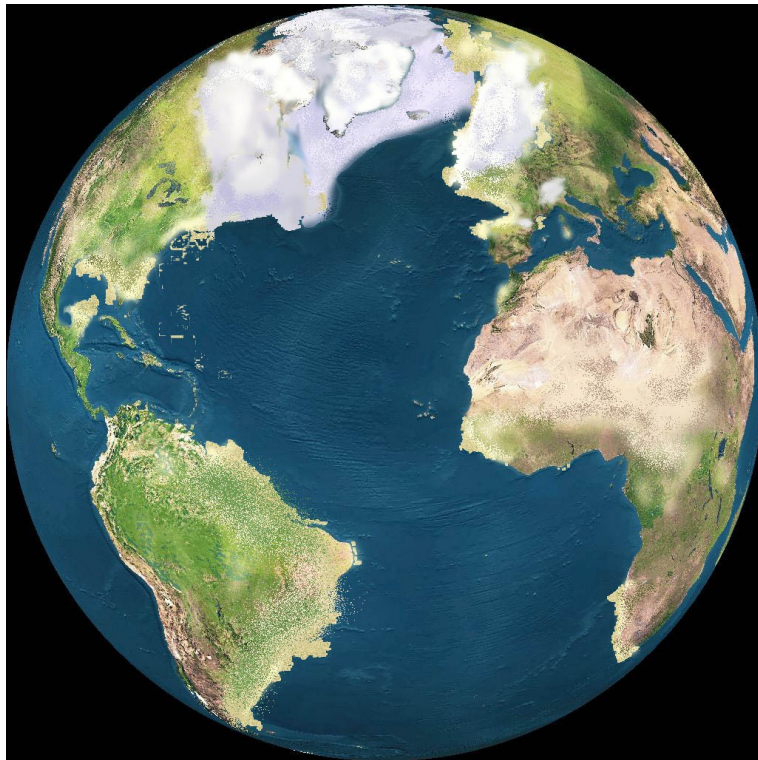
Northern Hemisphere tilted away from the sun at aphelion.

~20 000 ans (position de l'été/hiver)

Northern hemisphere tilted toward the sun at aphelion.



Pourquoi le climat varie



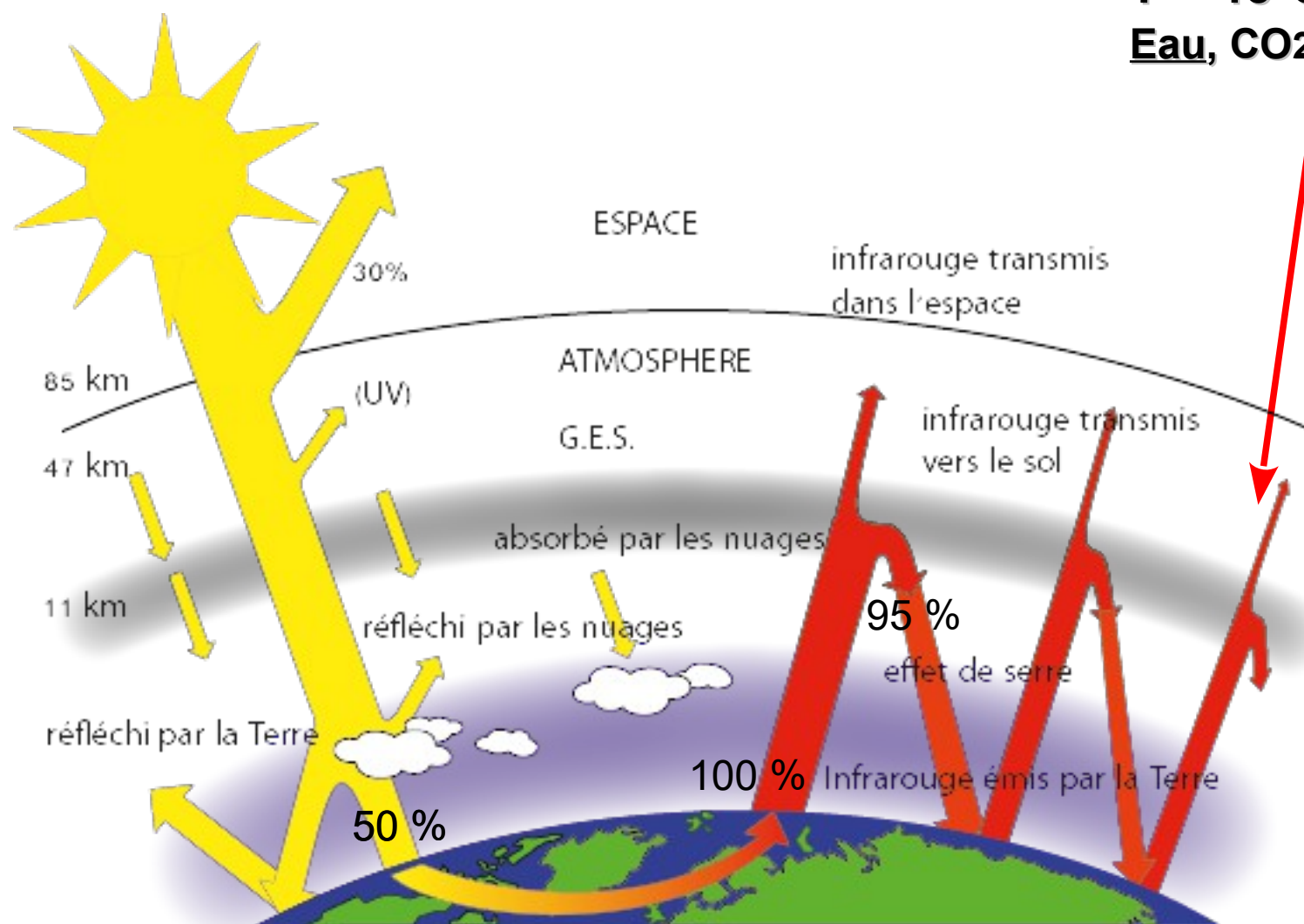
**Il y a ~20000 ans
(T° moy = 10°)**



**Aujourd'hui
(T° moy = 15°)**

Effet de serre

**Sans effet
de serre:** 
T°=-18°C
Eau, CO₂, CH₄...



Effet de serre

Sans effet
de serre:



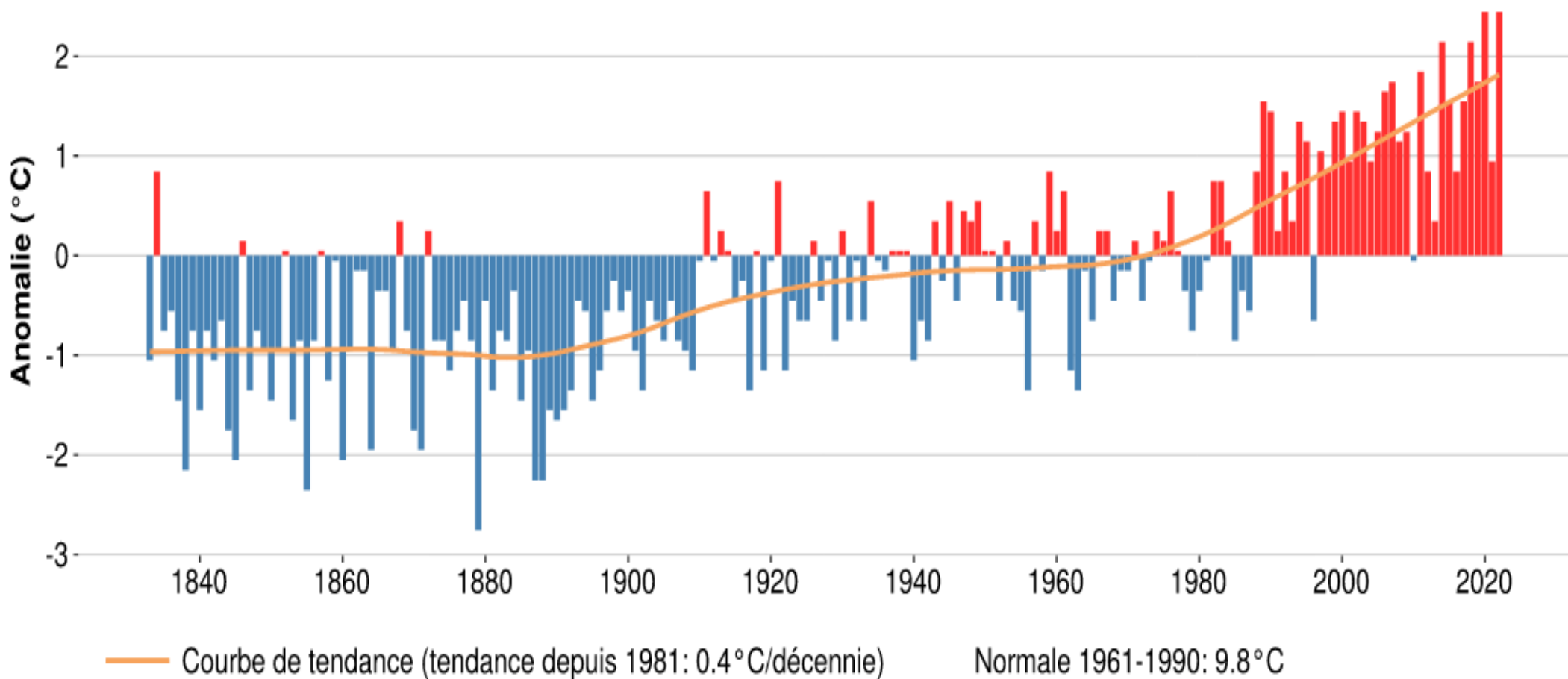
4...

En Belgique aussi ça varie?



Température moyenne annuelle à Bruxelles - Uccle de 1833 à 2022

Anomalie des moyennes annuelles par rapport à la période de référence 1961-1990

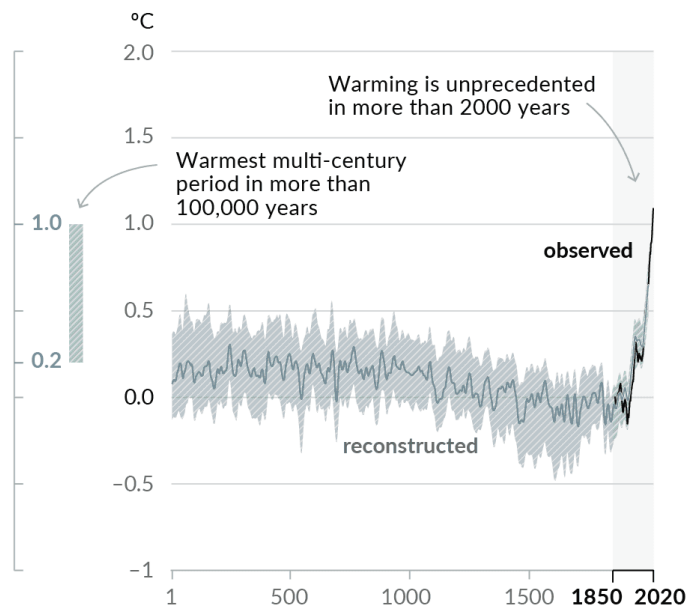


Où en sommes-nous aujourd'hui?

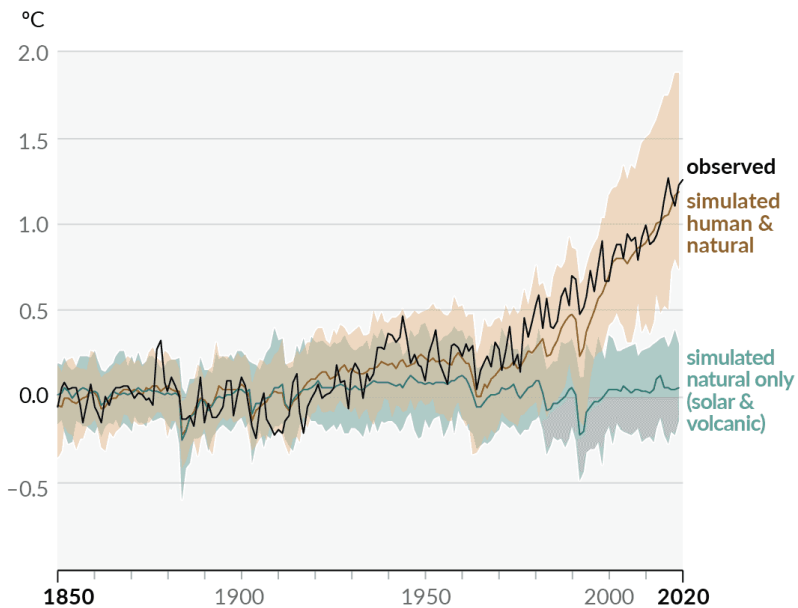
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

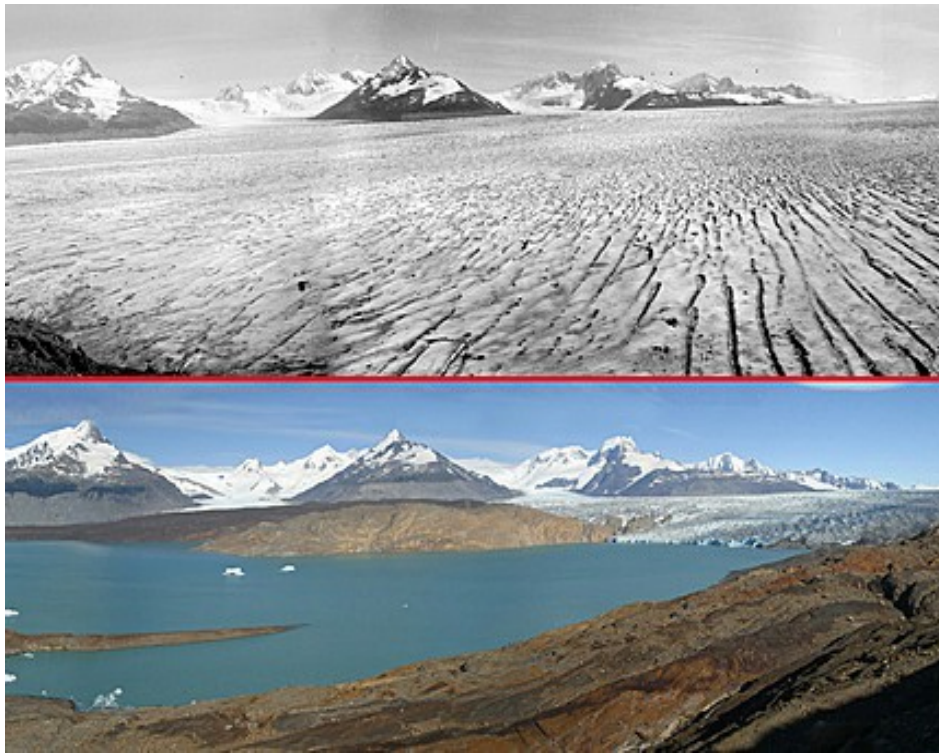
Changes in global surface temperature relative to 1850–1900

(a) Change in global surface temperature (decadal average) as reconstructed (1–2000) and observed (1850–2020)

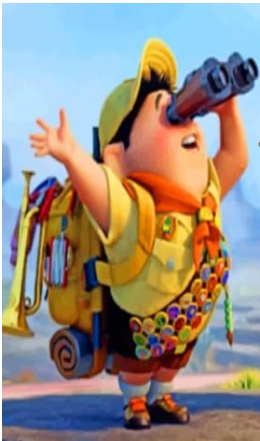


(b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850–2020)





Patagonie



Dés donc, ça fond de partout...

Alpes



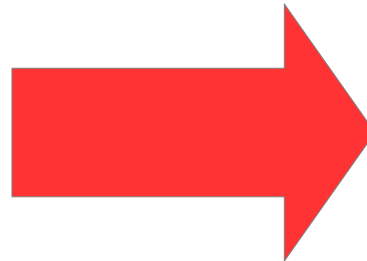
[c] Sammlung der Gesellschaft für ökologische Forschung. Mer de Glace bei Montanvert, Chamonix/Frankreich, vor 1916



[c] Gesellschaft für ökologische Forschung / Wolfgang Zängl. Mer de Glace bei Montanvert, Chamonix / Frankreich, 14.8.2001

Bon et pour le futur alors?

Visions

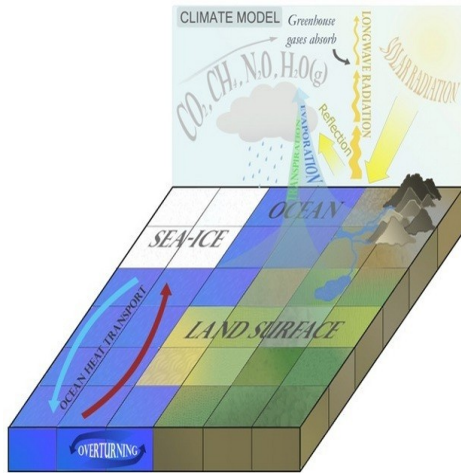


Modèle climatique



Manuel des simulations climatiques - tome 1

Simple



(100 km)



Global

(12.5 km)



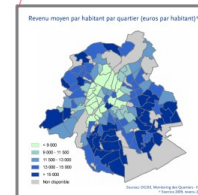
Regional

(4 km)



Regional

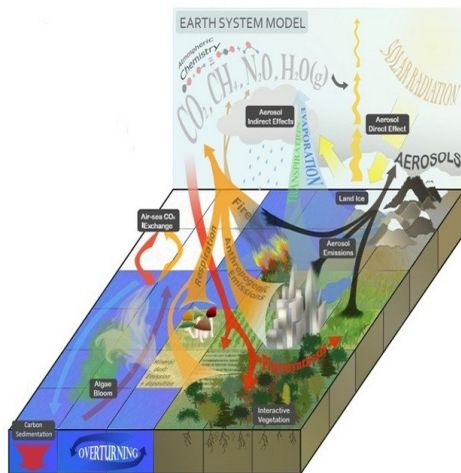
(1 km)



Local



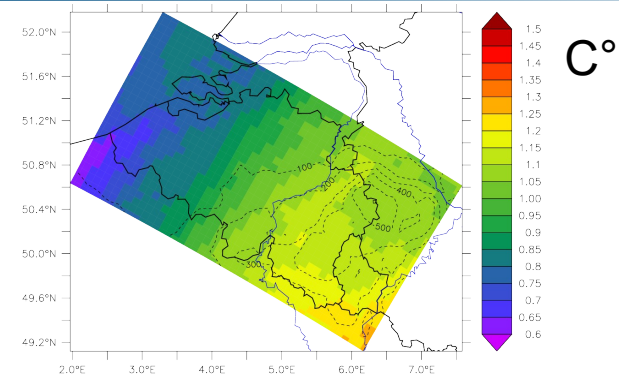
Évolués



Appliqué au présent

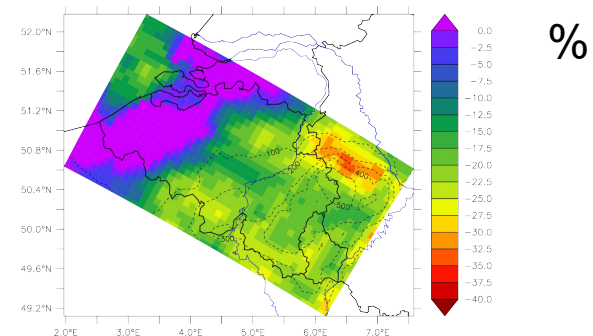
2011-2020 vs 1981-2010

- Températures + 1°C (surtout en été)
et les Tmax ++



Anomalie température en été

- Moins de chute de neige (-20%)



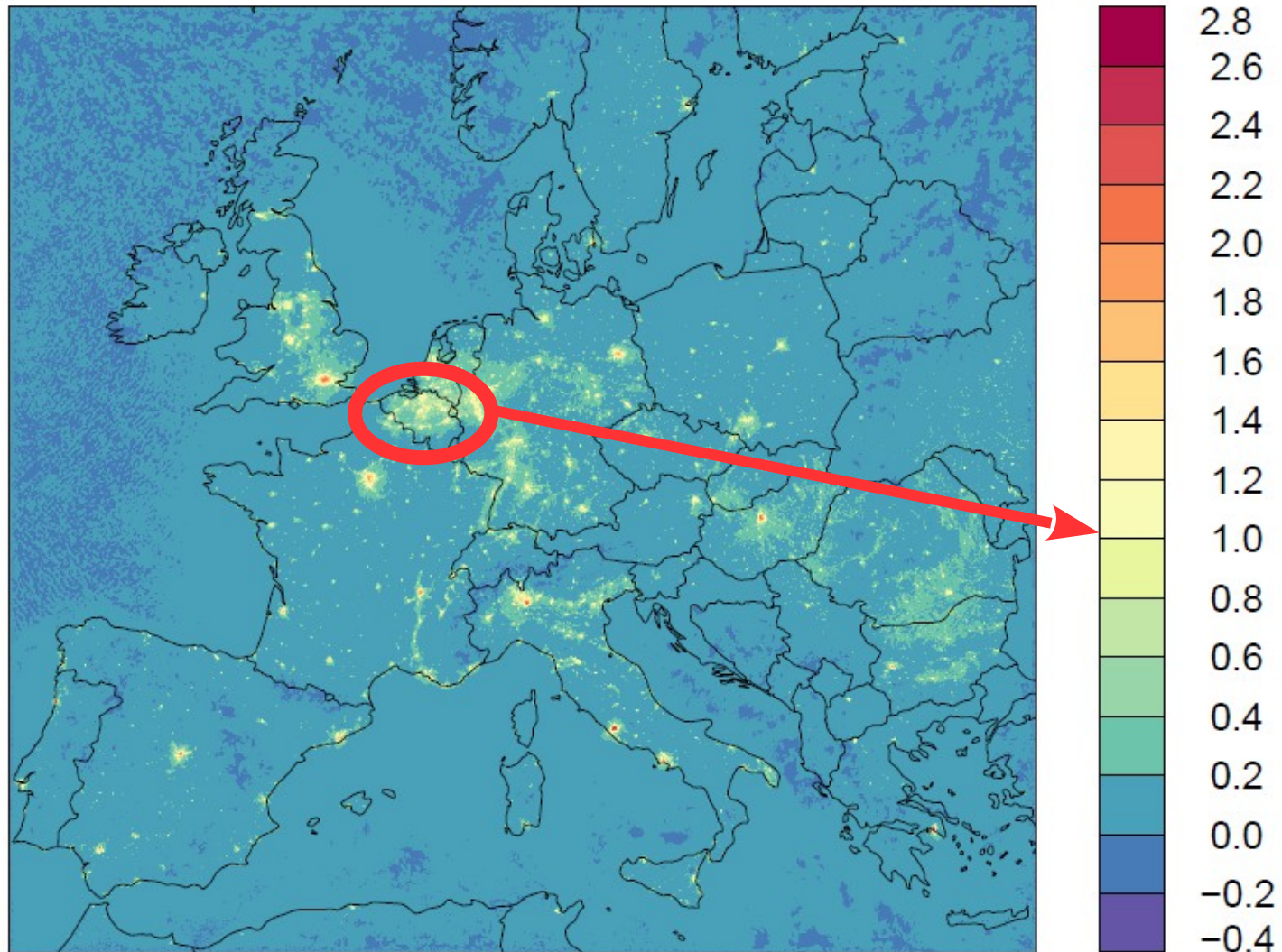
Anomalie chute de neige



Modèle MAR forcé par ERA5

La Belgique: avec ou sans urbanisation

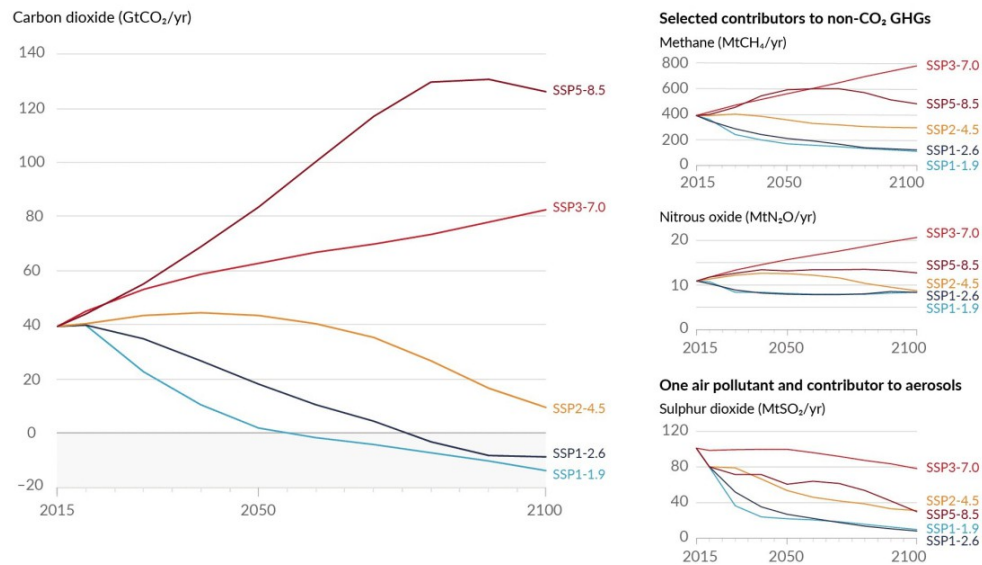
Différence de température (°C)



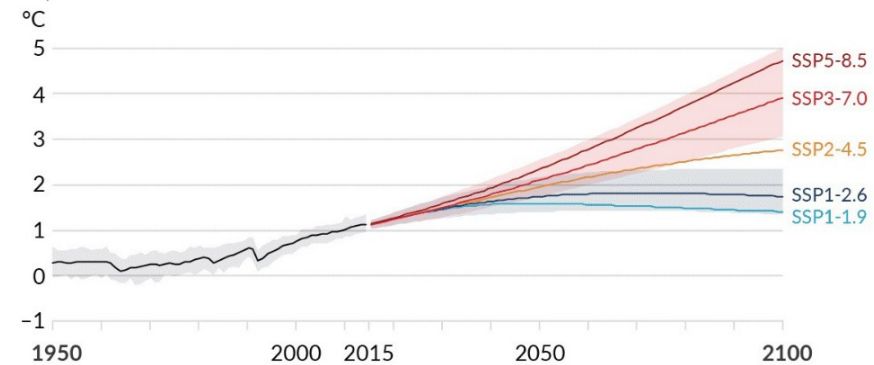
Quels scénarios pour l'avenir?

Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions

(a) Future annual emissions of CO₂ (left) and of a subset of key non-CO₂ drivers (right), across five illustrative scenarios



(b) Global surface temperature change relative to 1850–1900



IPCC, 2021

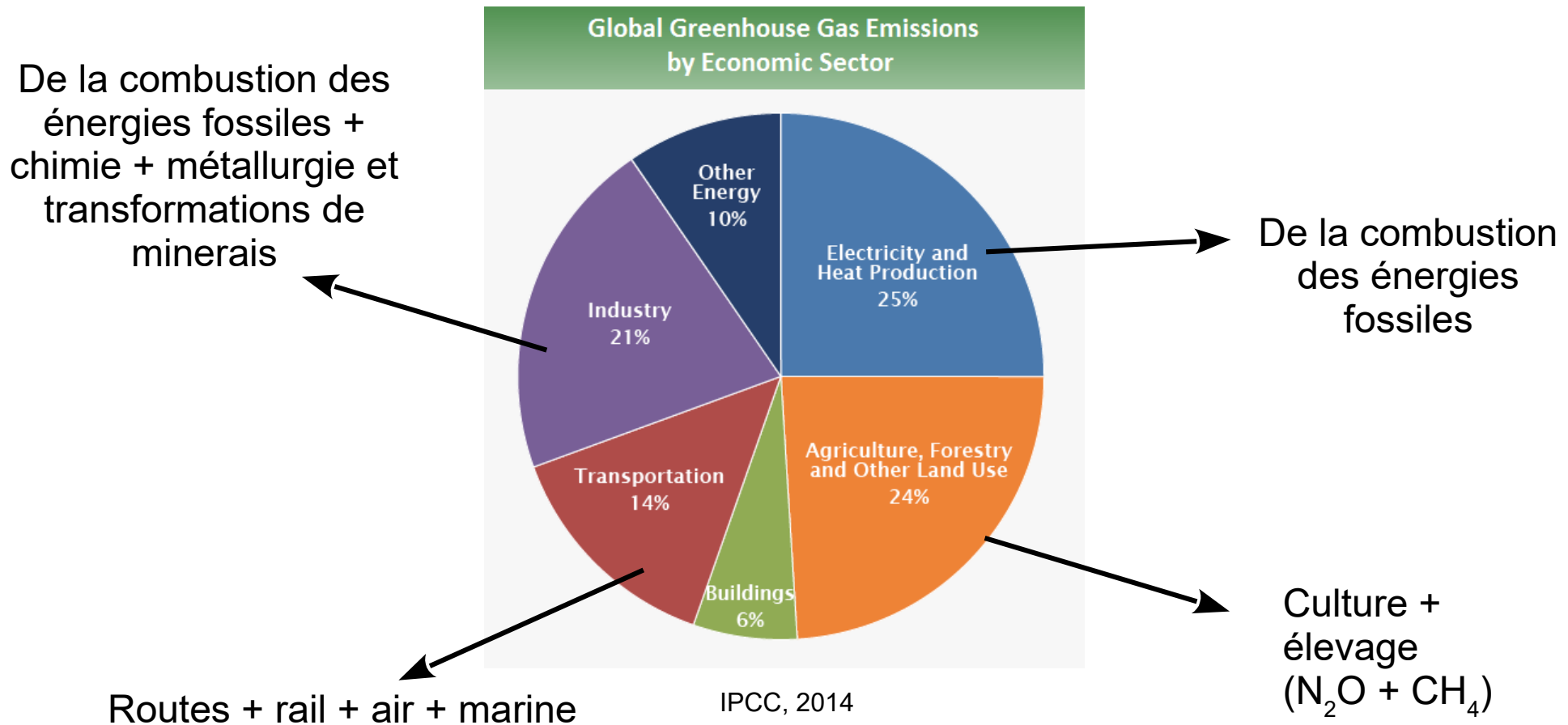
Objectif 1.5°C:

→ Atteindre 0 Giga tonne CO₂/an

→ Retirer 15 Giga tonne CO₂/an

Rappel: les courbes rouges ne montrent **pas** la croissance du bonheur global

Source d'émissions par secteur



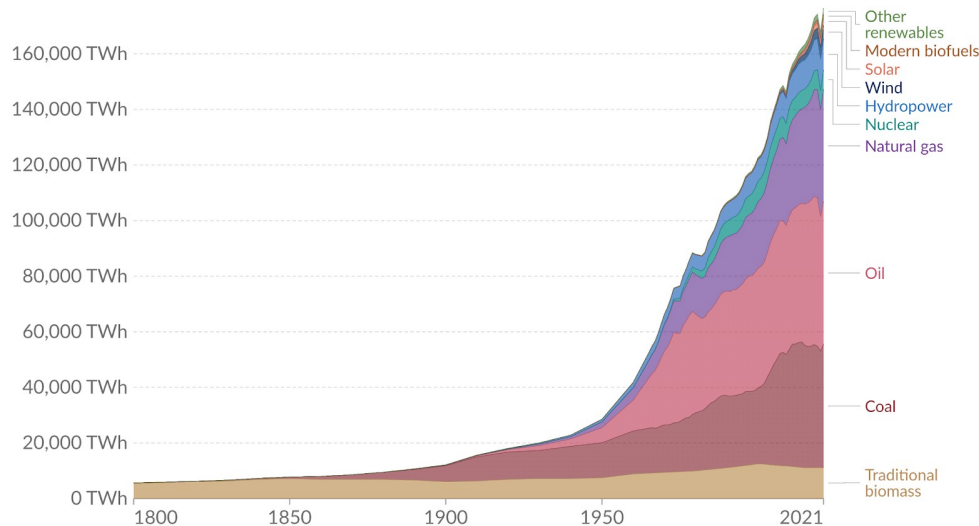
Drogués aux énergies fossiles?



2022: nouveau record

Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.

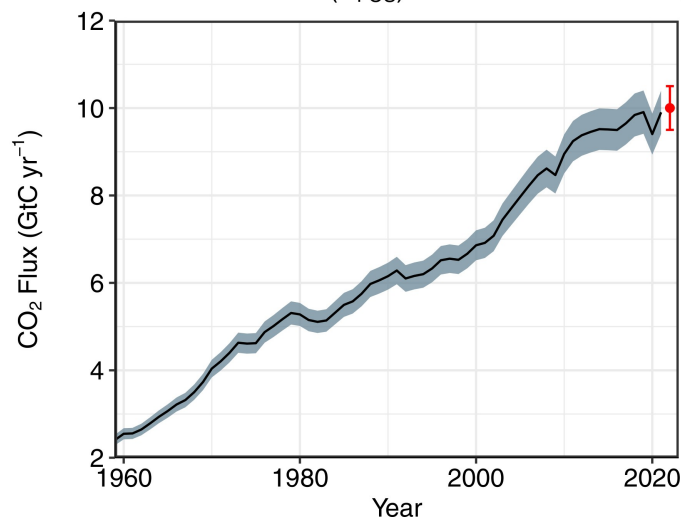


Énergies fossiles ~
Principale source d'émission de CO₂

Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

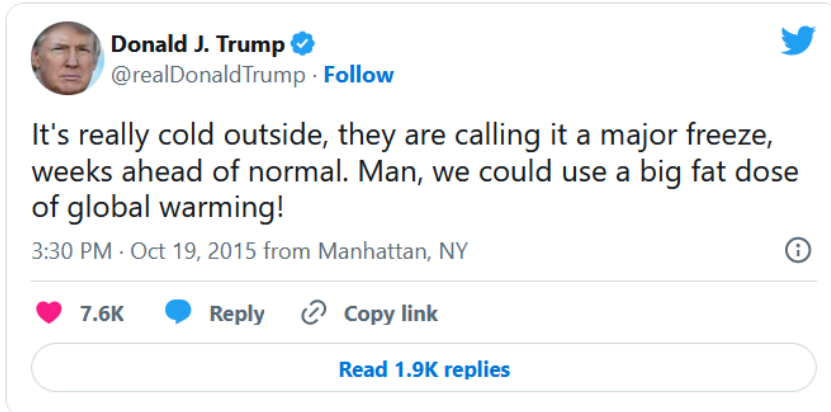
Fossil Emissions (E_{FOS})



1950: 71%, 1991: 77.5%, 2021: 77.1%

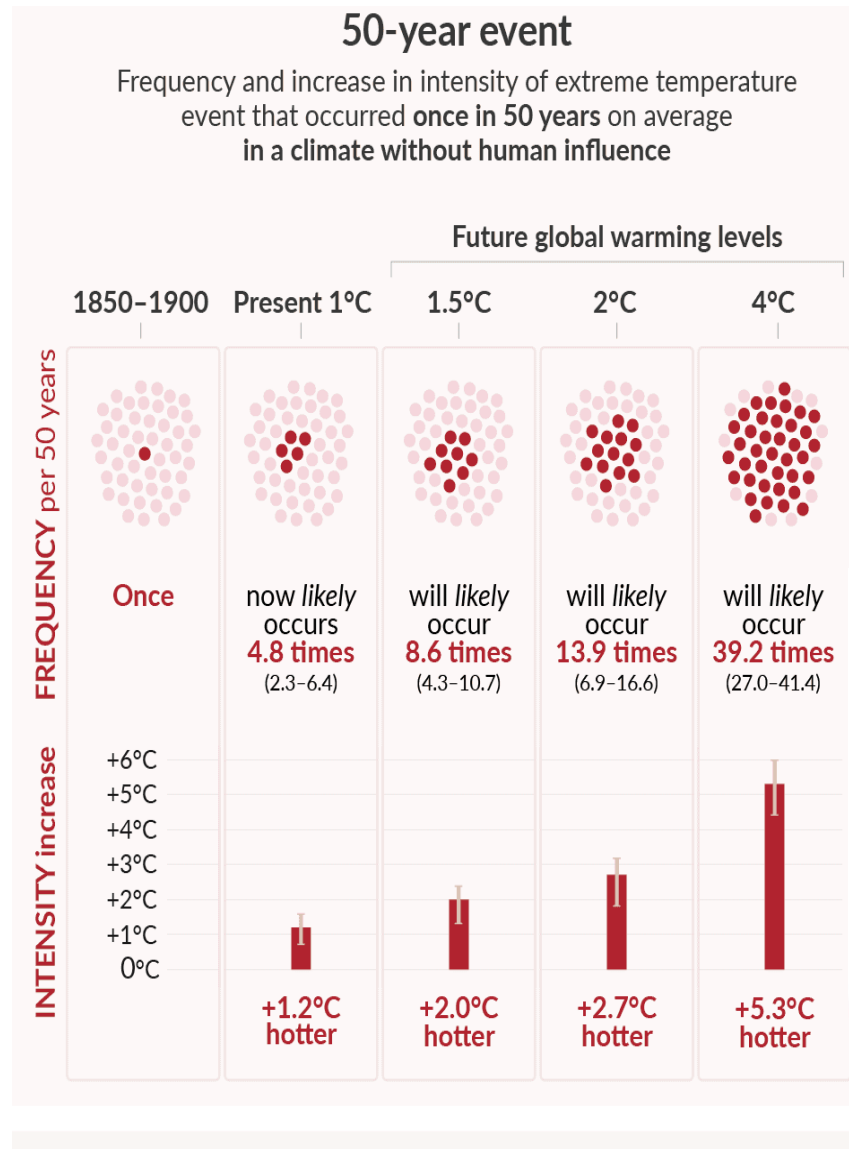
Global Carbon Budget (2022)

Pendant ce temps...



Emmanuel Macron 31/12/2022

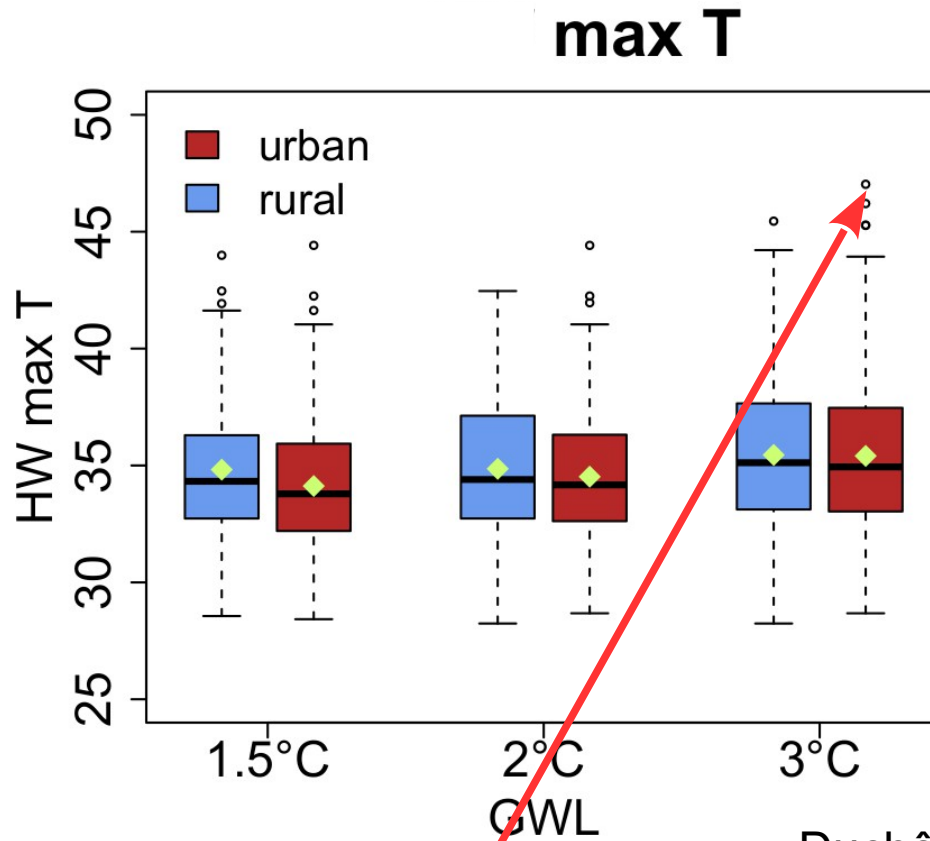
A quoi faut-il s'attendre alors?



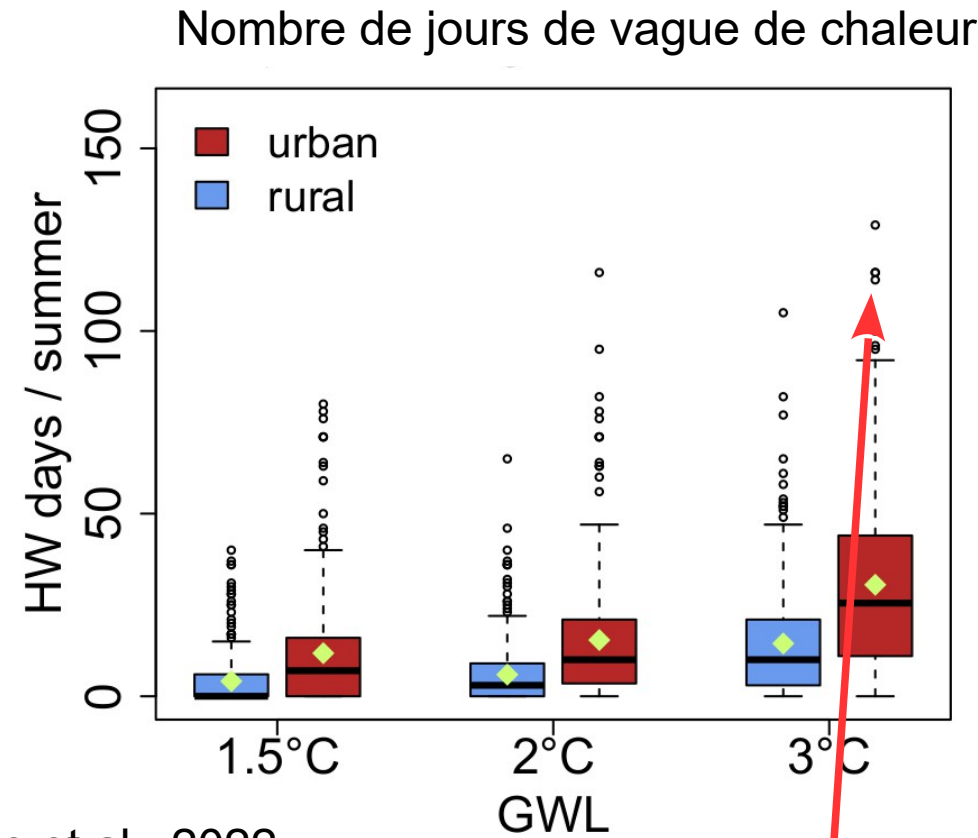
C'est quoi un
été normal à
4°C?



En Belgique aussi?



Duchêne et al., 2022



Extreme max T :
47°C

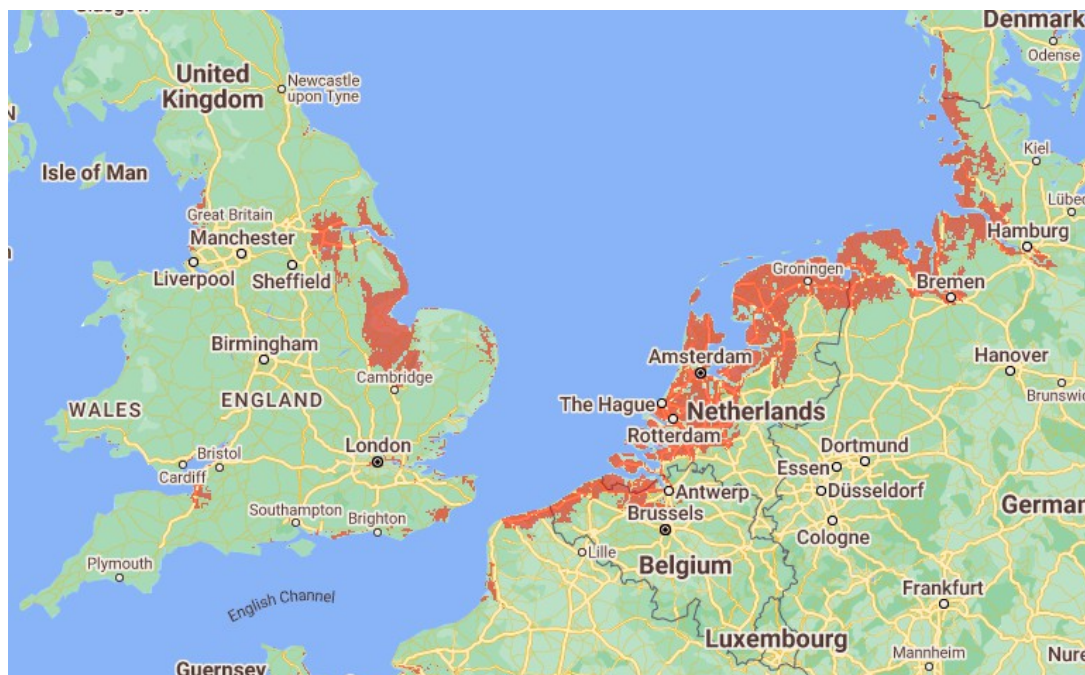
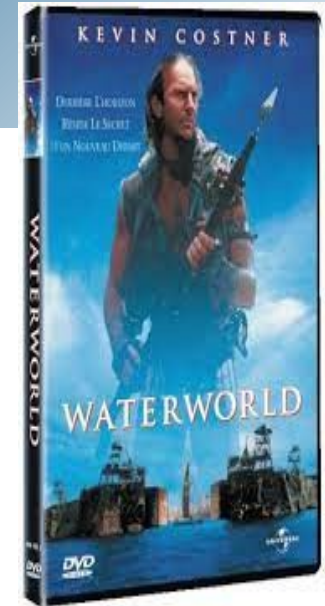
Uccle (25/07/19): 39.7°C

3 Mois !

Et si tous les glaciers fondaient?



Regarde ce que ca donne avec seulement 4 m !



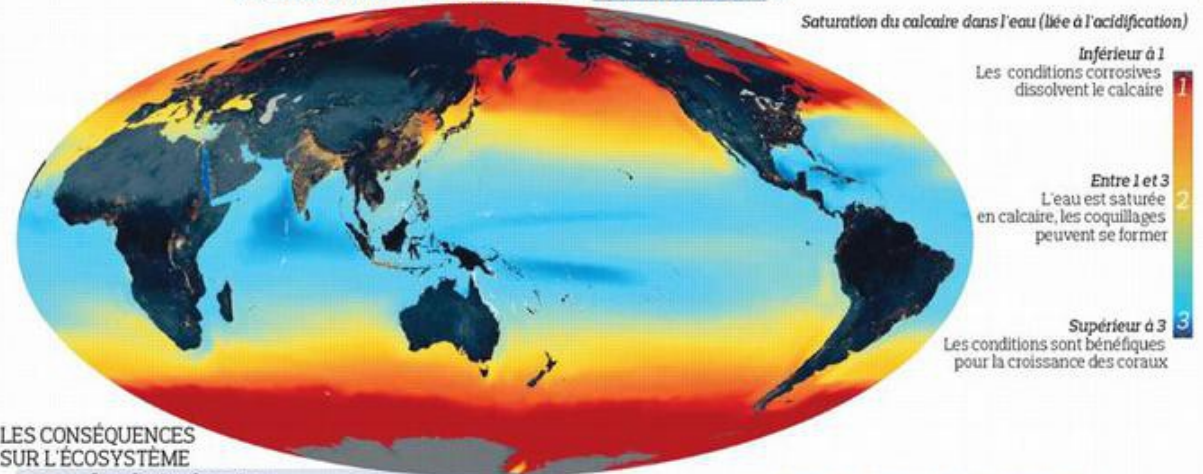
<https://coastal.climatecentral.org/>

Acidification des océans



L'acidification des océans dans un monde avec un taux élevé de CO₂

LE SCÉNARIO PESSIMISTE À L'HORIZON 2100 ...



LES CONSÉQUENCES SUR L'ÉCOSYSTÈME



Le phytoplancton

fabrique beaucoup de calcaire.
Ce sera une moindre source d'alimentation pour la faune



Les coraux

L'érosion des récifs coralliens serait supérieure à leur croissance à partir de 2100



Les mollusques

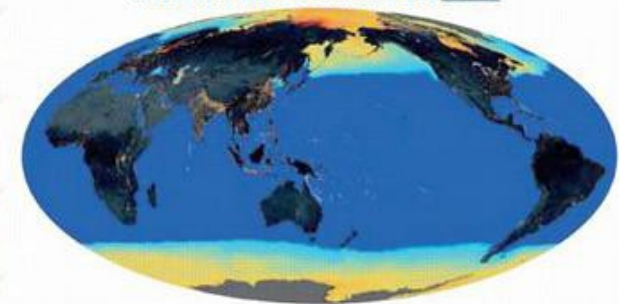
possèdent des coquilles calcaires très sensibles à l'acidification



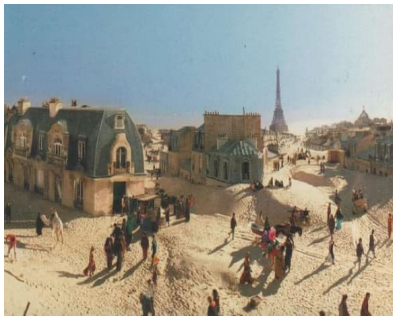
Les plantes subaquatiques

Certaines plantes profitent de l'acidité mais d'autres pas.
La biodiversité en sera affectée

... L'ÉTAT DES OCÉANS EN 1850



Vous avez soif ?

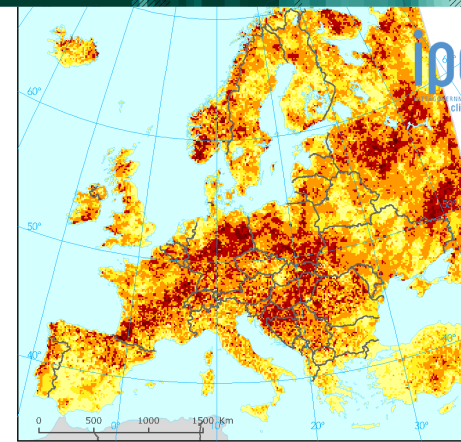
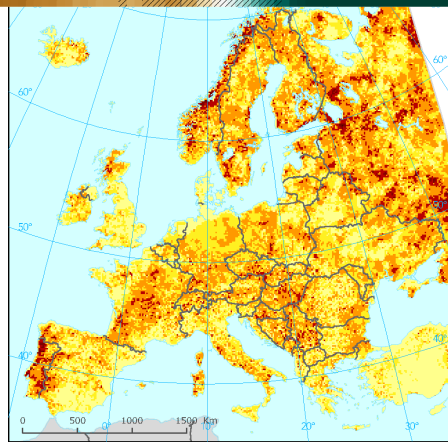
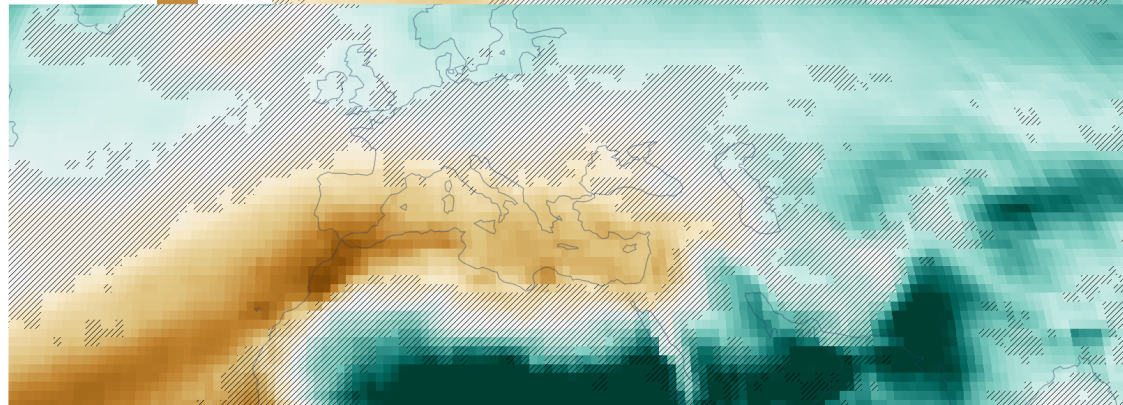
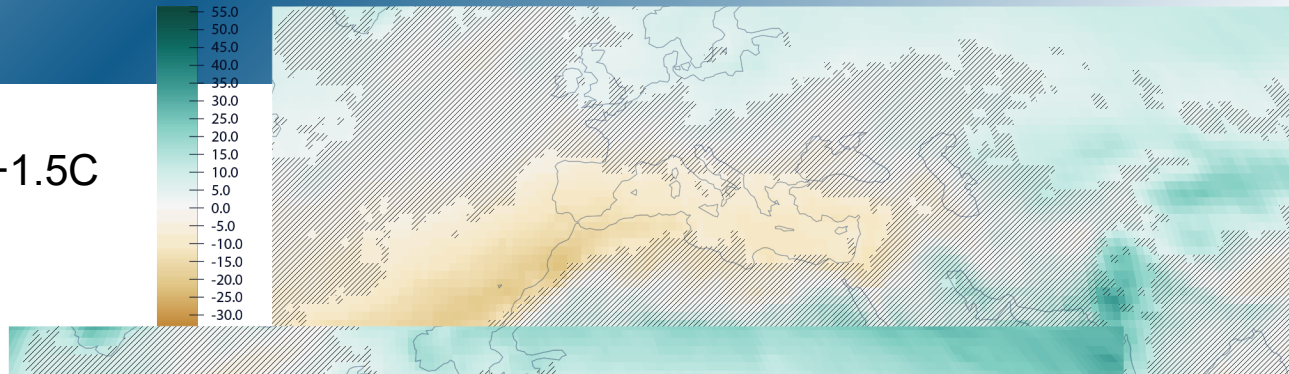
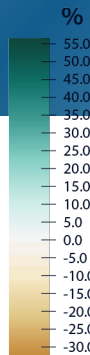
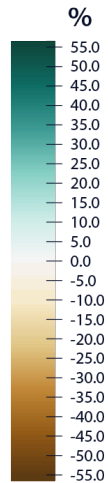


+4C

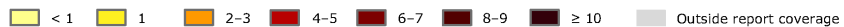


Mad Max Fury Road (2015)

Pluies +1.5C



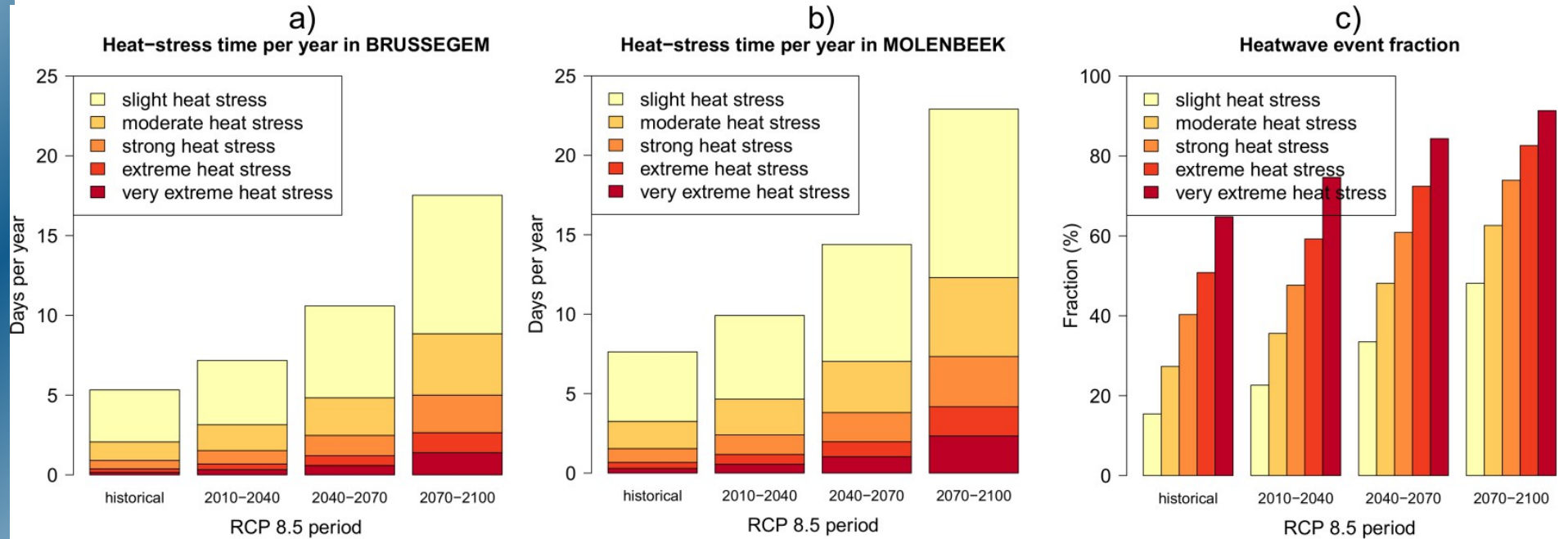
Heat wave frequency for the periods 1961–1990 (left) and 2071–2100 (right)
Based on the IPCC-SRES A2 emission scenario and the DMI climate model



Canicules



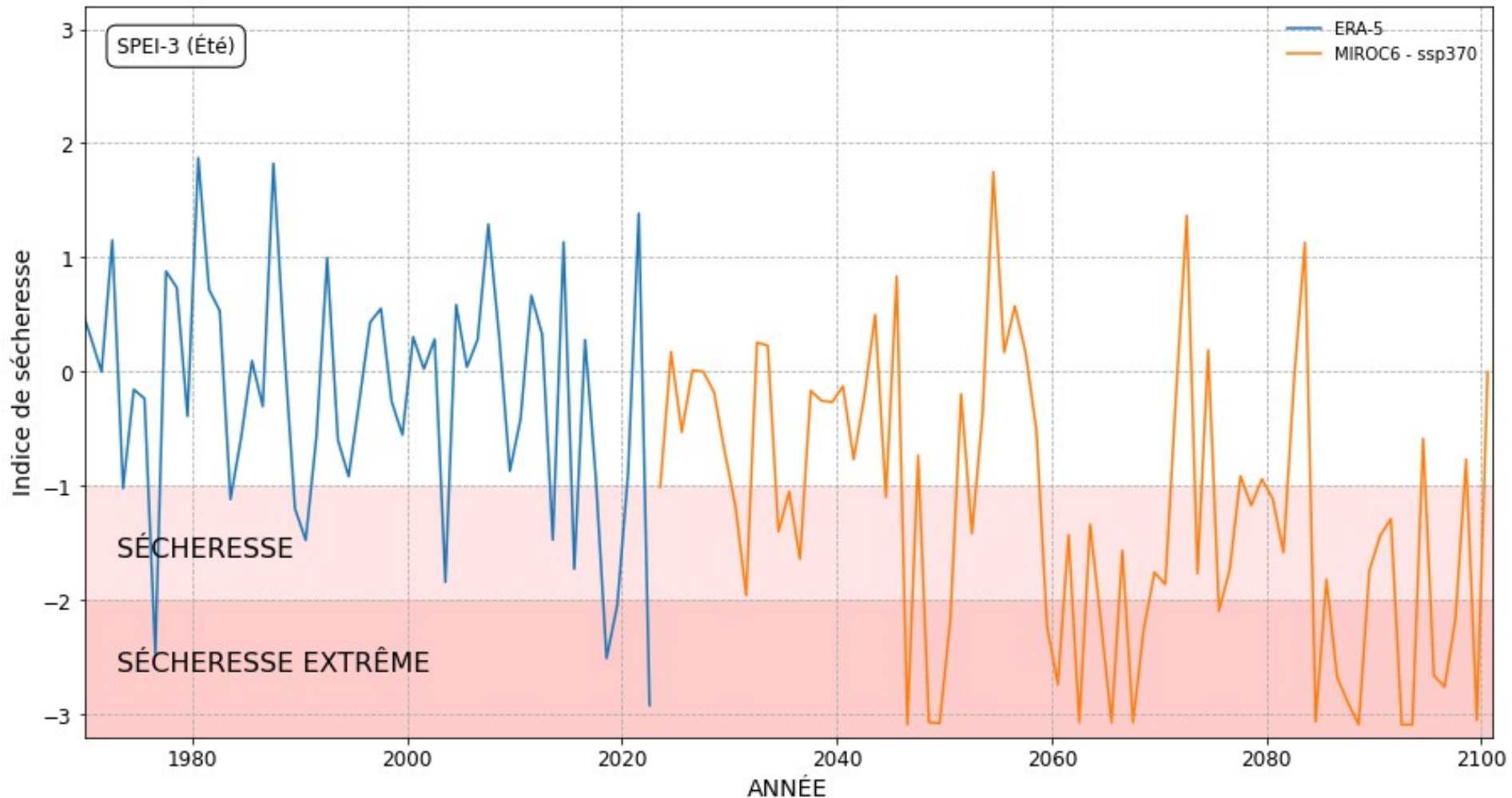
Stress thermique



3 times more !

Sécheresses dans un futur peu coopératif

Évolution de l'indice de sécheresse en Belgique



Evolution du SPEI (Standardised Precipitation-Evapotranspiration) index
Issu du modèle MAR (Liège)

Source: mémoire Baudewyn 2023

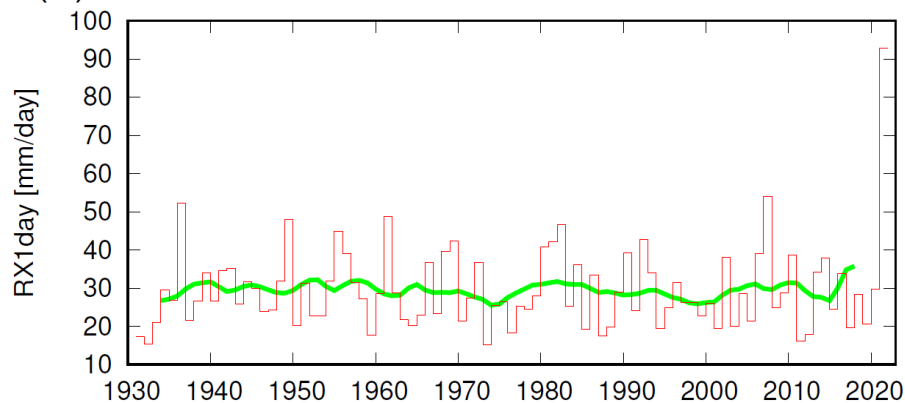
Juillet 2021



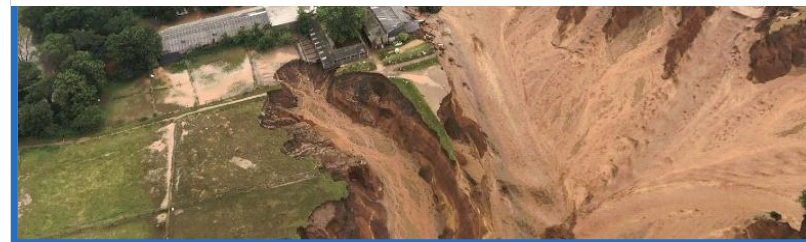
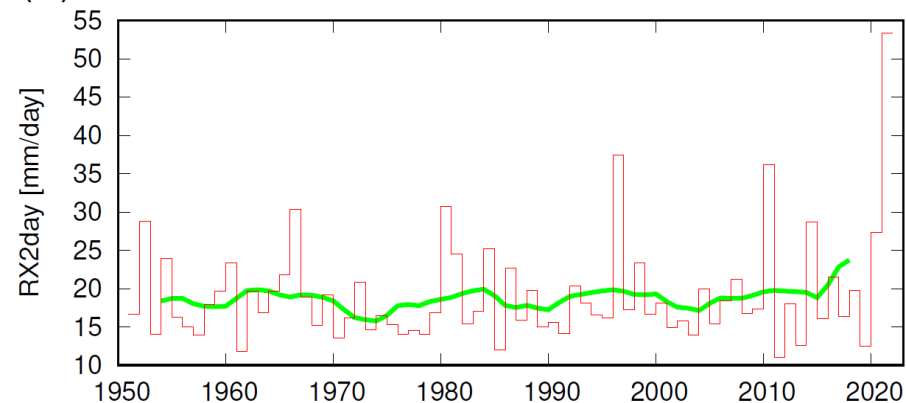
Juillet 2021



(a) Ahr/Erft



(b) Meuse



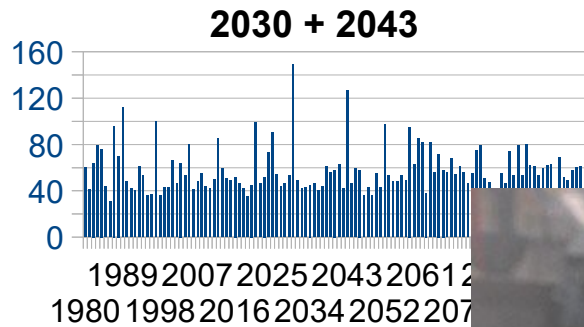
Source: Xavier Fettweis

Juillet 2021
~160 mm/3jrs
Bassin de la
Vesdre

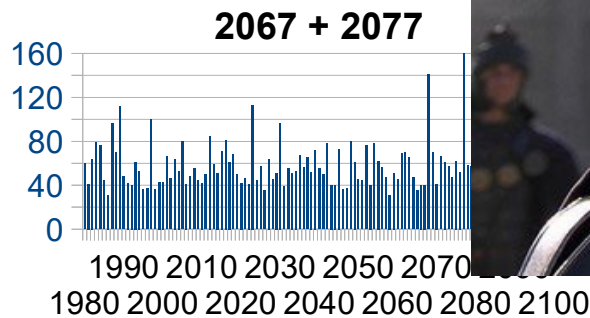
Un tel évènement ne devrait se produire qu'une fois tous les 400 ans en Europe occidentale !

Ca arrivera encore?

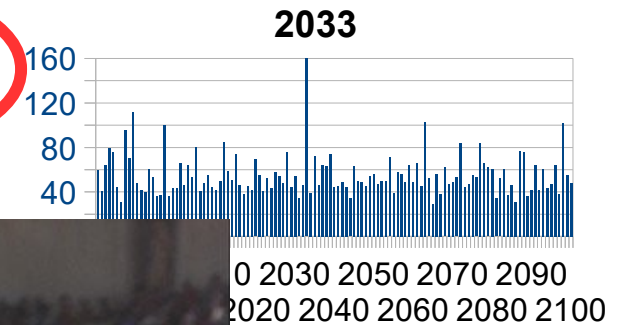
4 scénarios différents...
Une réponse: oui !



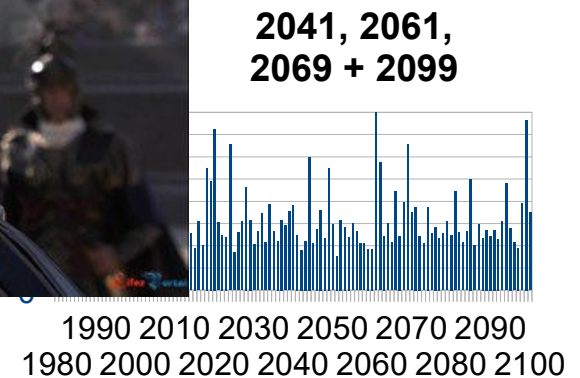
Scénario 1



Scénario 3



Scénario 2



Scénario 4

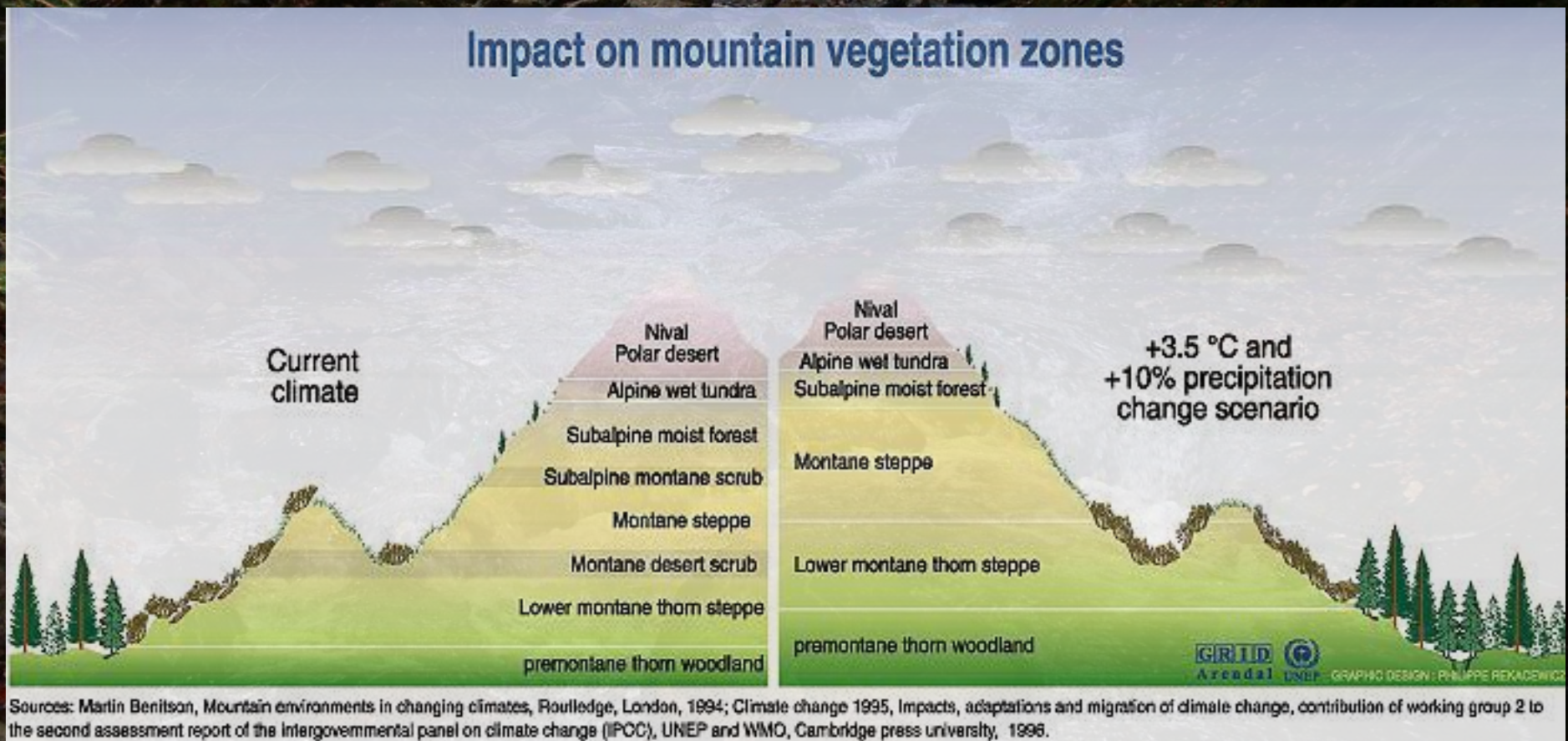
Encore.. et encore.. et encore

Impacts sur la nature

On va avoir un climat plus chaud, donc ...

→ 1. Espèces des régions **chaudes** → vers régions **froides**

→ 2. Espèces des régions froides : réduction ↓.



Impacts sur la nature



Quid du Tétras Lyre ?



Scolytes dans les épicéas ?

Disparition des tourbières dans les Hautes-Fagnes ?

Moins de précipitations en été et plus d'évaporation → assèchement des tourbières
mort de la Sphaigne
boisement de la fagne

Impacts sur la nature



Disparition des Hêtres en Belgique ?

Prochaine étape: les feux de forêts?

Le Fire Weather Index devrait augmenter de 30 à 40% (voir à plus de 40% dans les ardennes) d'ici à la fin du siècle (RCP6.0)

Impacts pour l'agriculture

Aura-t'on besoin de bassines ?

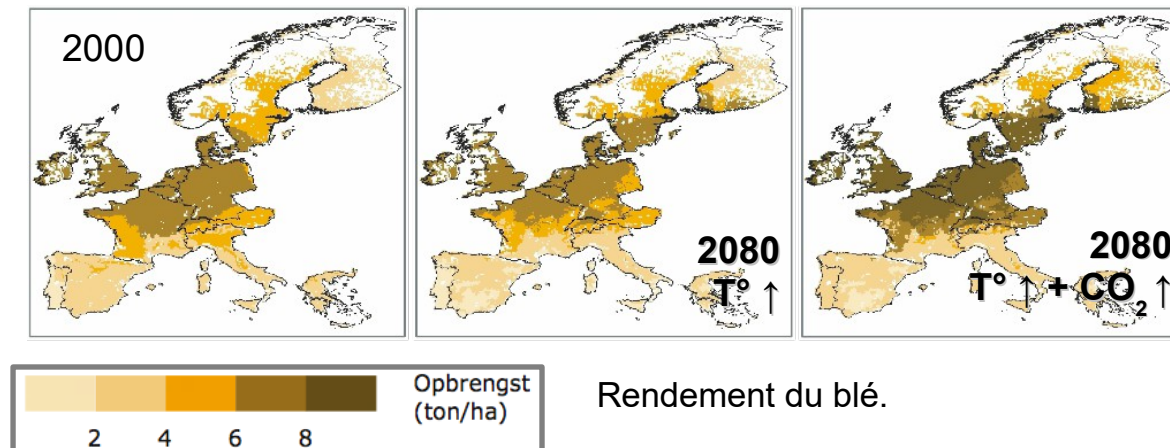
Oui pour l'agriculture (sans adaptation) en retenant l'eau des pluies en hiver mais pas en allant pomper l'eau des nappes.

Le **bilan hydrique sera négatif** par rapport à aujourd'hui!



Et pour le rendement futur?

- ◆ D'ici à 2050 (RCP8.5): rendement ↗ ↗ ↗ 10-20%



- ◆ Les bonnes années...

Les extrêmes ↗ ↗ donc rendements ↘ ↘ les mauvaises années
~ 35% patates et maïs
~ 2-5% volaille, bovins et porcs

Durant la canicule de 2018, la région flamande a perdu 31% des patates, 13% des betteraves et 10% de ses céréales



Sagesse ancienne...



“Voyage entre les extrêmes...”

La “transition” énergétique?

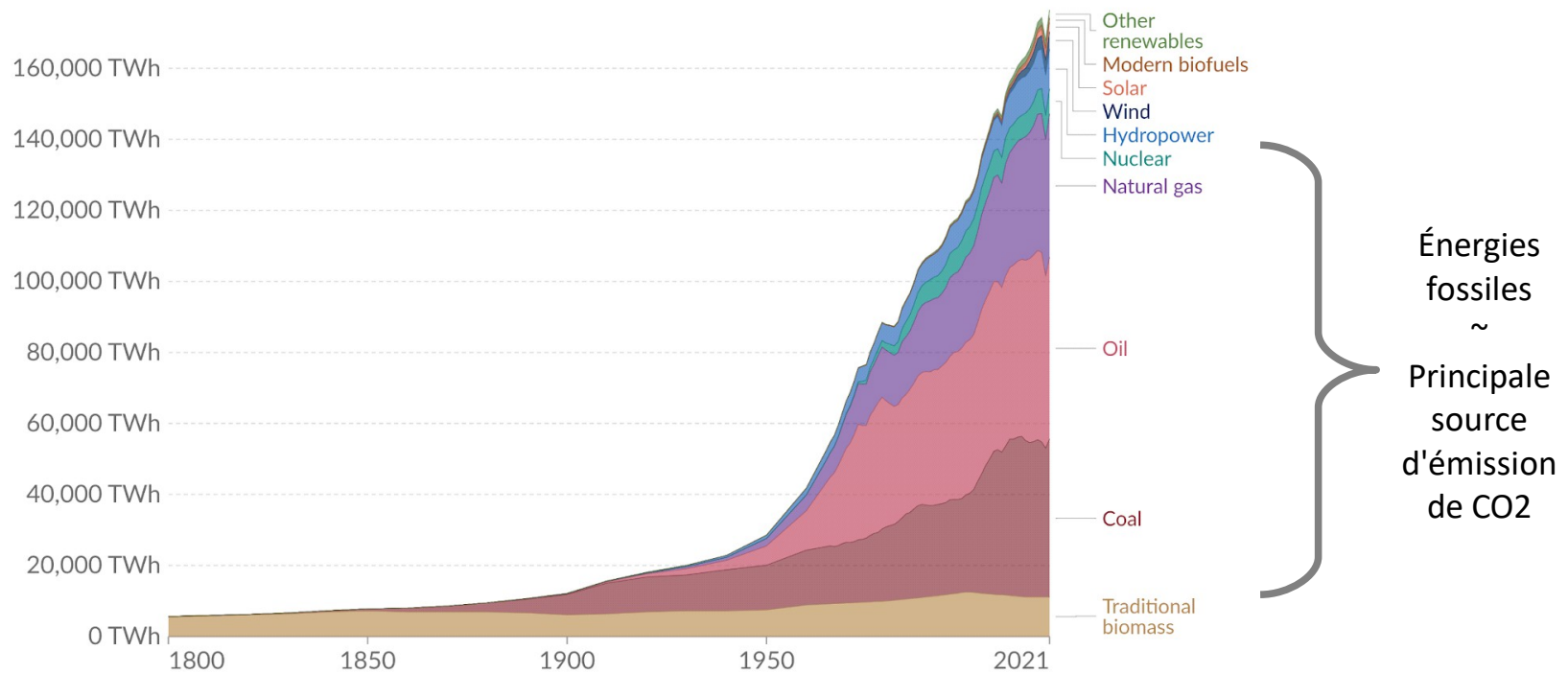


Rappel

Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.

Our World
in Data



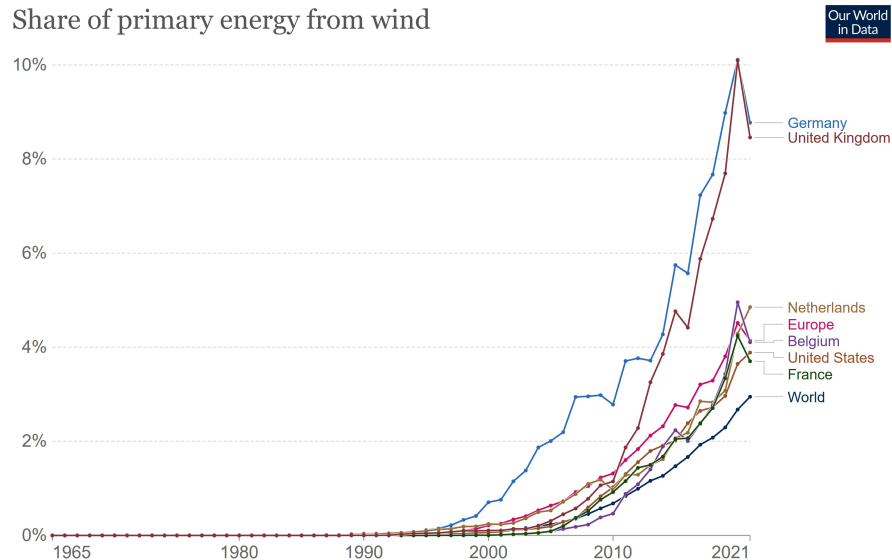
Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

1950: 71%
1991: 77.5%
2021: 77.1%

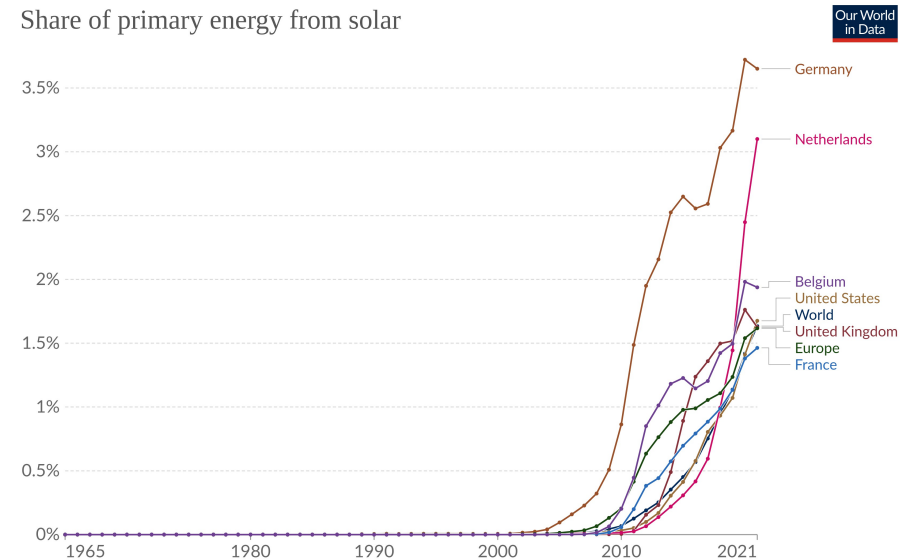
Et les renouvelables alors?

Share of primary energy from wind



Source: Our World in Data based on BP Statistical Review of World Energy (2022) OurWorldInData.org/energy • CC BY
Note: Primary energy is calculated using the 'substitution method', which accounts for the energy production inefficiencies of fossil fuels.

Share of primary energy from solar



Source: Our World in Data based on BP Statistical Review of World Energy (2022) OurWorldInData.org/energy • CC BY
Note: Primary energy is calculated using the 'substitution method', which accounts for the energy production inefficiencies of fossil fuels.



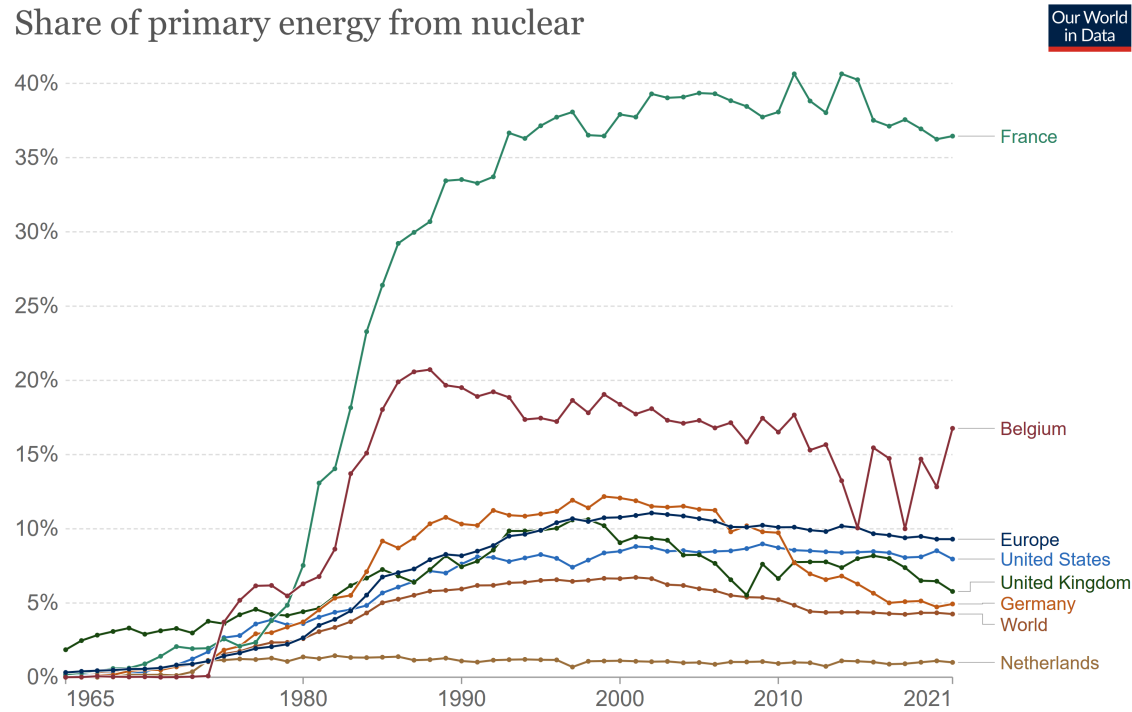
Représentait 4.1% de l'énergie primaire totale en 2021 en Belgique



Représentait 1.94% de l'énergie primaire totale en 2021 en Belgique

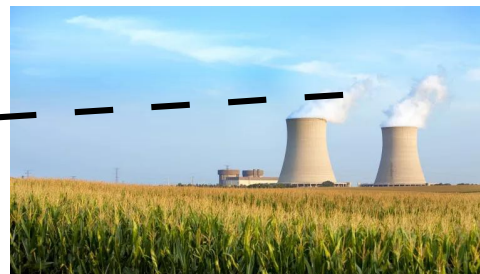
Seulement électricité, transport interne et chauffage
N'inclus pas imports, avions, bateaux...

Pour les curieux



Source: Our World in Data based on BP Statistical Review of World Energy (2022) OurWorldInData.org/energy • CC BY
Note: Primary energy is calculated using the 'substitution method', which accounts for the energy production inefficiencies of fossil fuels.

C'est de l'eau
Pas du CO2



Représentait 16.8% de
l'énergie primaire totale
en 2021 en Belgique

Et **4%** à l'échelle
mondiale

Les débats énergétiques



Thank you!



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Annexes

References

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