

### IPCC AR6 WG1 Report The Physical Science Basis

Rob van Dorland, KNMI Acting Focal Point IPCC Netherlands NNV, TUE, 17<sup>th</sup> of February 2023 Working Group I – The Physical Science Basis





### **Author Team**

234 authors from 65 countries

28% women, 72% men

### 30% new to the IPCC

Review Process 14,000 scientific publications assessed

78,000+ review comments

**46** countries commented on Final Government Distribution



### **Intergovernmental Panel on Climate Change, 2021**

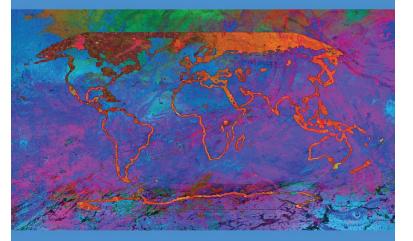
### > Detection observation

- > Attribution cause-effect
- > Projection *future*

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### **Climate Change 2021** The Physical Science Basis

Summary for Policymakers



Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Cha

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[Credit: Yoda Adaman | Unsplash

It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

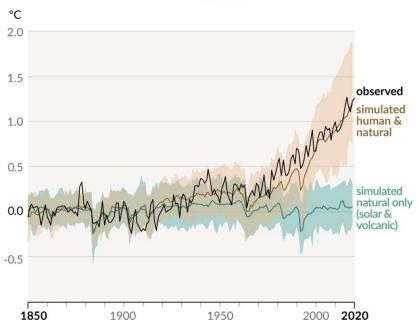
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#### It is unequivocal that human influence has warmed the climate Figure SPM.1



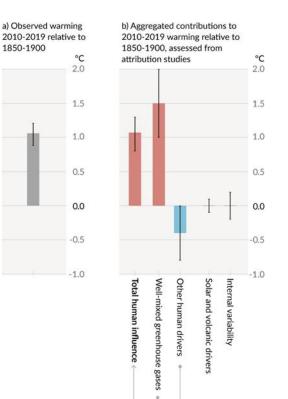
b) Change in global surface temperature (annual average) as **observed** and simulated using human & natural and only natural factors (both 1850-2020)

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#### It is unequivocal that human influence has warmed the climate Figure SPM.2

b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850-2020) °C 2.0 1.5 observed simulated 1.0 human & natural 0.5 simulated natural only 0.0 (solar & volcanic) -0.5 1850 1900 1950 2020 2000



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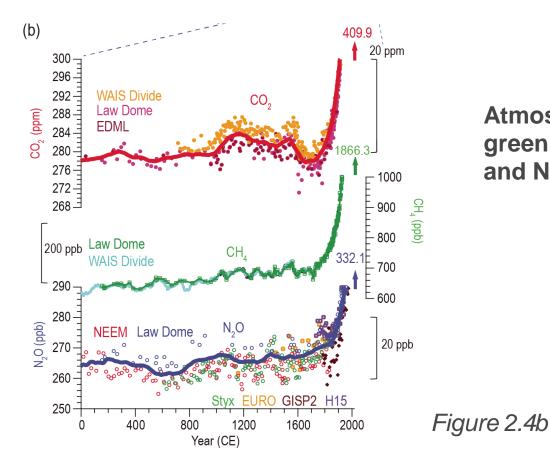
[Credit: NASA]

Recent changes in the climate are widespread, rapid, and intensifying, and unprecedented in thousands of years.





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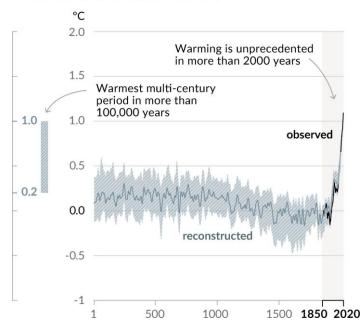


# Atmospheric concentration of greenhouse gases $CO_2$ , $CH_4$ and $N_2O$ in the last 2000 years

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### Human influence has warmed the climate at a rate that is Figure SPM.1 unprecedented in at least the last 2000 years

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



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1850 2020

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Figure SPM.1

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

a) Change in global surface temperature (decadal average) **IOCC** SIXTH ASSESSMENT REPORT (1) as reconstructed (1-2000) and observed (1850-2020) °C 2.0 Warming is unprecedented CO2 Sea level Arctic sea ice Glaciers in more than 2000 years concentration rise area retreat 1.5 Warmest multi-century period in more than 100,000 years 1.0 1.0 observed 0.5 0.2 Unprecedented Highest Fastest rates Lowest level 0.0 in at least in at least in at least in at least 2 million years 3000 years 1000 years 2000 years reconstructed -0.5

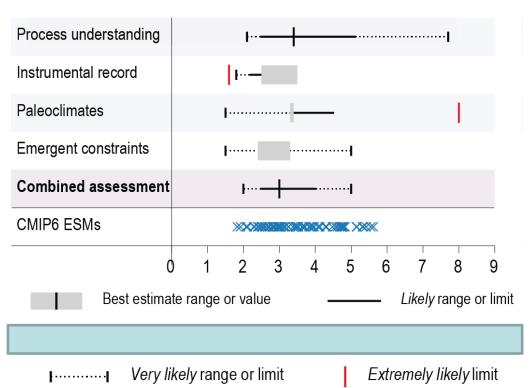
### **Climate sensitivity**

### From observations and feedbacks IPCC AR6, 2021:

- Likely range (67%): 2.5 – 4.0°C
- [AR5: 1.5 4.5°C]
- Very likely range (90%) 2.0 – 5.0°C
- Best estimate: 3°C

[AR5: no best estimate]

#### (a) Equilibrium climate sensitivity estimates (°C)

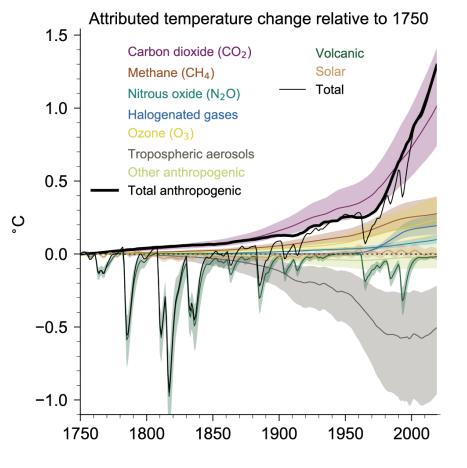


### Figure 7.18a

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#### Attributed global surface air temperature change from 1750 to 2019 forced with radiative forcing of climate drivers.

Shaded uncertainty bands show very likely (5–95%) ranges



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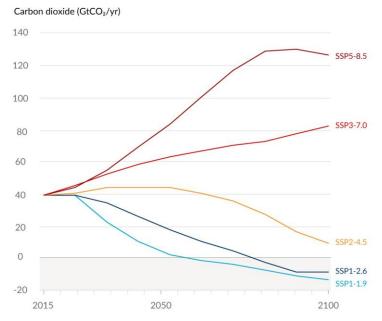
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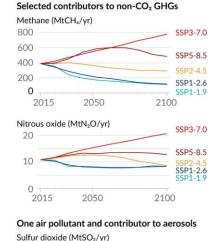
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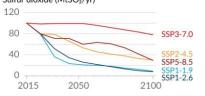
Figure 7.8

### Future emissions cause future additional warming, with total warming dominated by past and future CO<sub>2</sub> emissions

a) Future annual emissions of CO<sub>2</sub> (left) and of a subset of key non-CO<sub>2</sub> drivers (right), across five illustrative scenarios







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Figure SPM.4

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Human activities affect all the major climate system components, *Figure SPM.8* with some responding over decades and others over centuries

°C 5 SSP5-8.5 4 SSP3-7.0 3 SSP2-4.5 2 SSP1-2.6 SSP1-1.9 0 -1 1950 2050 2100 2000 2015

a) Global surface temperature change relative to 1850-1900



[Credit: Shari Gearheard | NSIDC]

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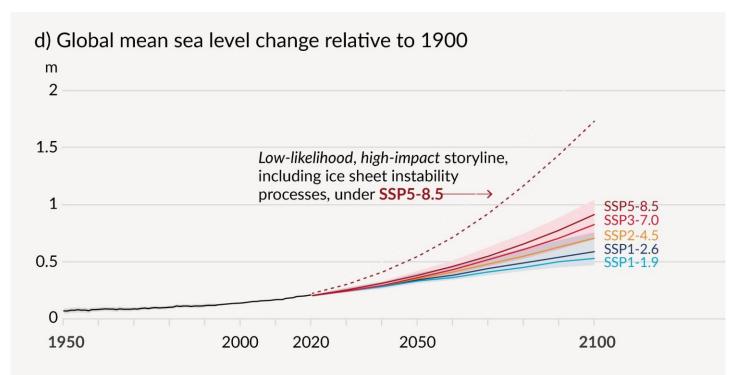
There's no going back from some changes in the climate system. However, some changes could be slowed and others could be stopped by limiting warming.

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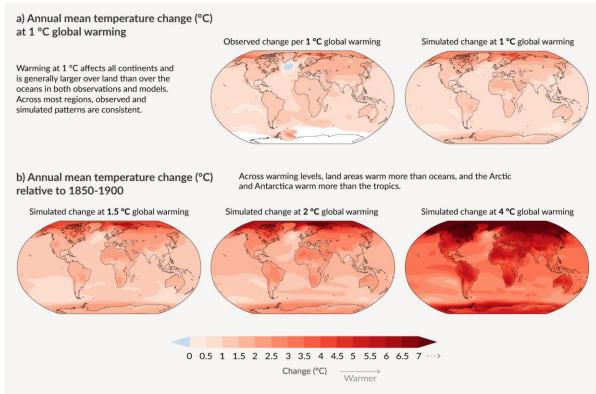
Human activities affect all the major climate system components, *Figure SPM.8* with some responding over decades and others over centuries



## With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Figure SPM.5

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Figure SPM.5

### With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Precipitation is projected to increase over high latitudes, the equatorial c) Annual mean precipitation change (%) Pacific and parts of the monsoon regions, but decrease over parts of the relative to 1850-1900 subtropics and in limited areas of the tropics. Simulated change at 1.5 °C global warming Simulated change at 2 °C global warming Simulated change at 4 °C global warming Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions

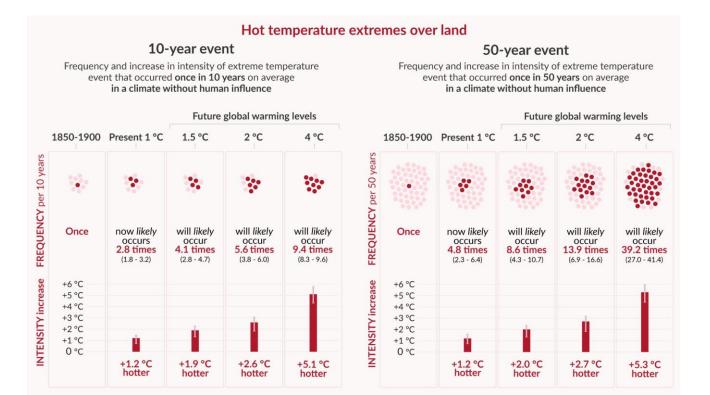
-30 -20 -10 0 10 20 <--- -40 Change (%) Drier Wetter

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### Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

### Figure SPM.6



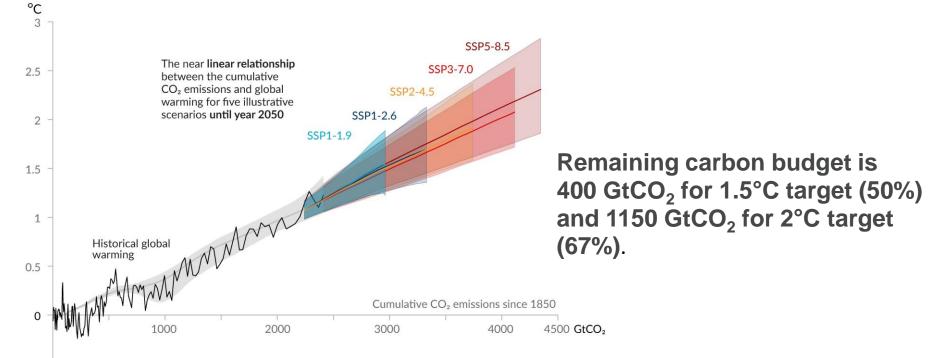
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### Every tonne of CO<sub>2</sub> emissions adds to global warming

### Figure SPM.10

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO<sub>2</sub> emissions (GtCO<sub>2</sub>)



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Figure 7.10

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