OVERVIEW ON CLIMATE CHANGE

20 FEBRUARY 2025

W. Pieter Pauw

Technology, Innovation and Society (TIS)

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

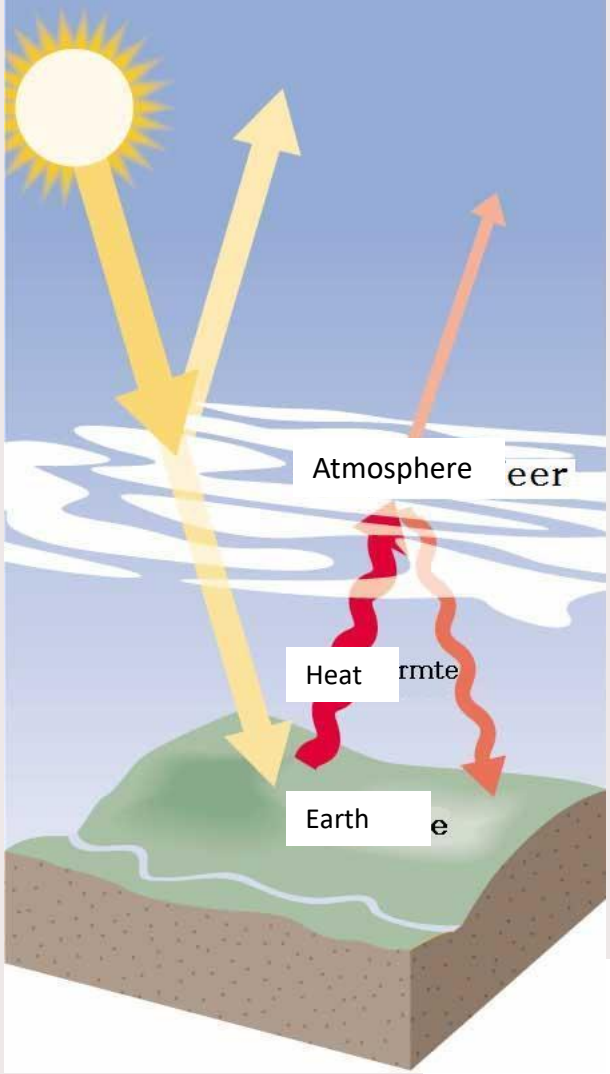
The greenhouse effect

Thanks to the atmosphere, the globe traps heat, due to three factors:

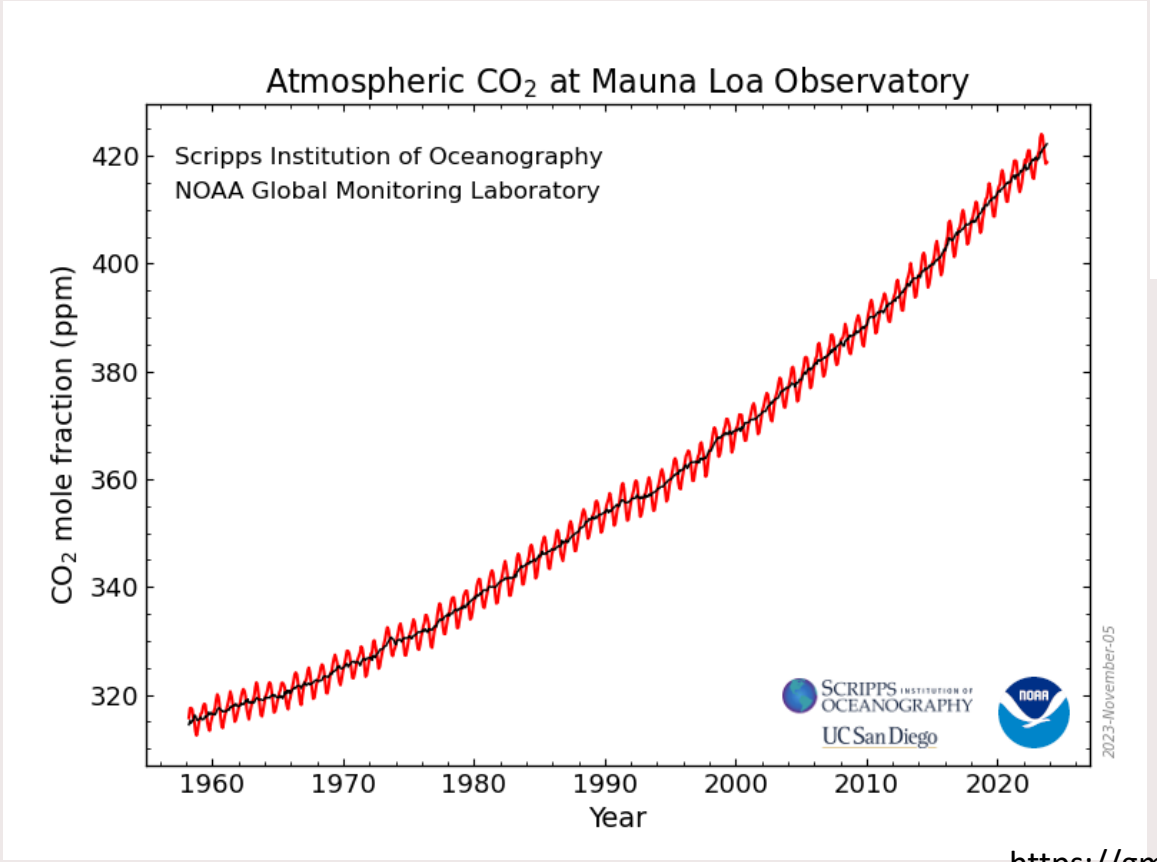
1) Radiation from the sun (high-energetic, UV) which arrives at the earth's surface, loses energy, and is converted into infrared radiation

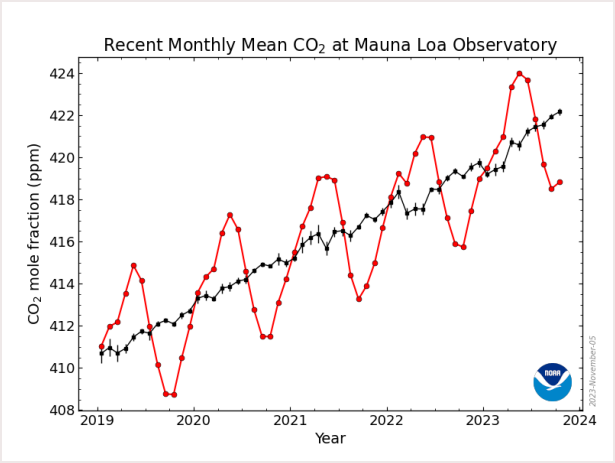
2) Albedo is fraction of sunlight reflected

3) Greenhouse gases absorb the IR (not UV!) and lead to heating



CO_2 concentration is steadily rising

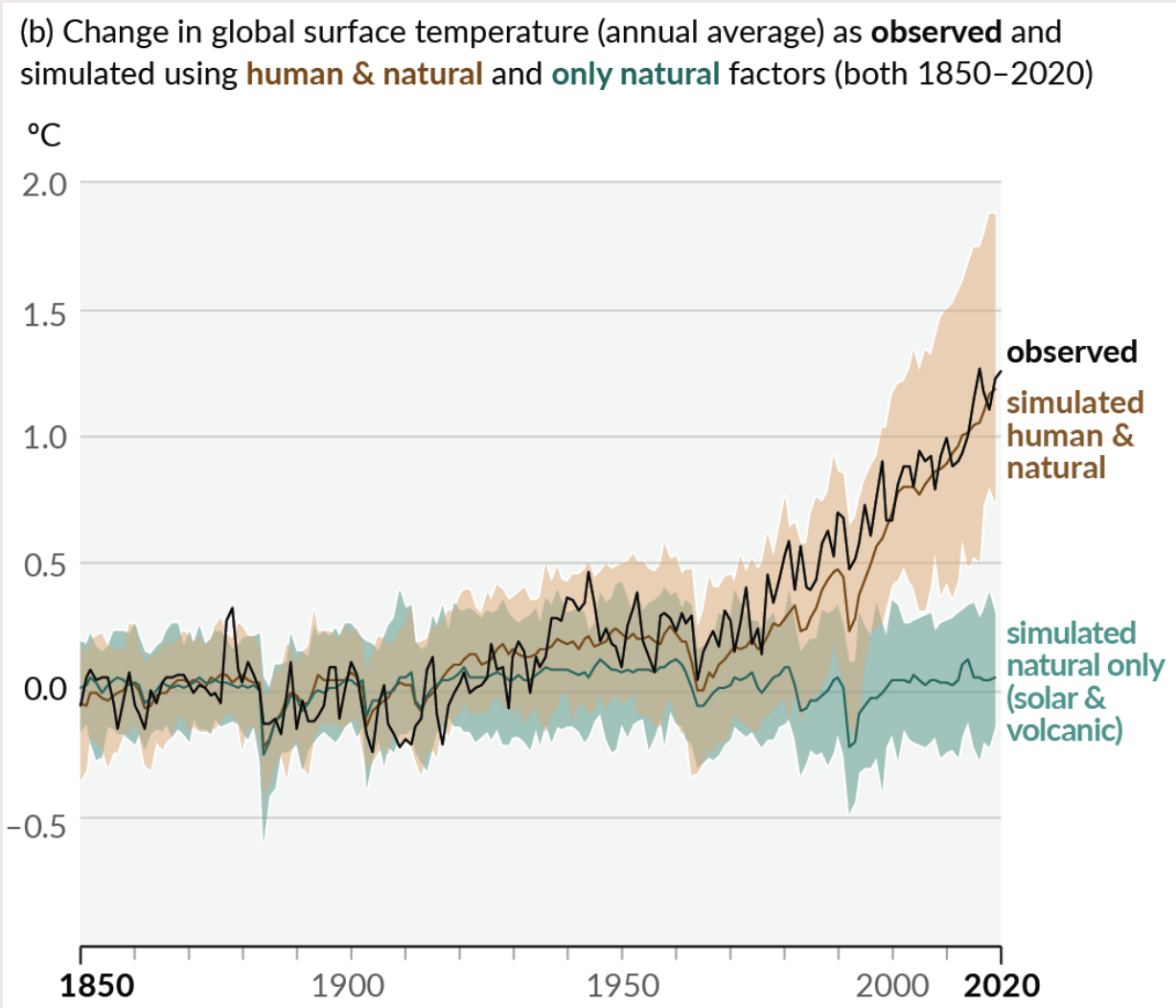




https://gml.noaa.gov/ccgg/trends/

TU/e

Current temperature increase cannot be credibly explained without human-caused greenhouse gases



IPCC AR6 WGI 2021:
Figure SPM.1b

Causal chain is clear

People want to do things, activities

Fulfilling needs: nutrition, communication, shelter, status, happiness

Use of energy through fossil fuels

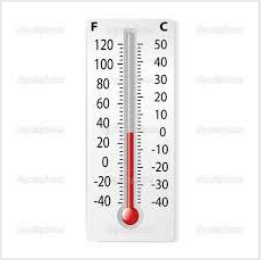
Changing land use and agriculture

Greenhouse gas emissions (tCO_2-eq)

Concentration greenhouse gases (ppm of ppb)

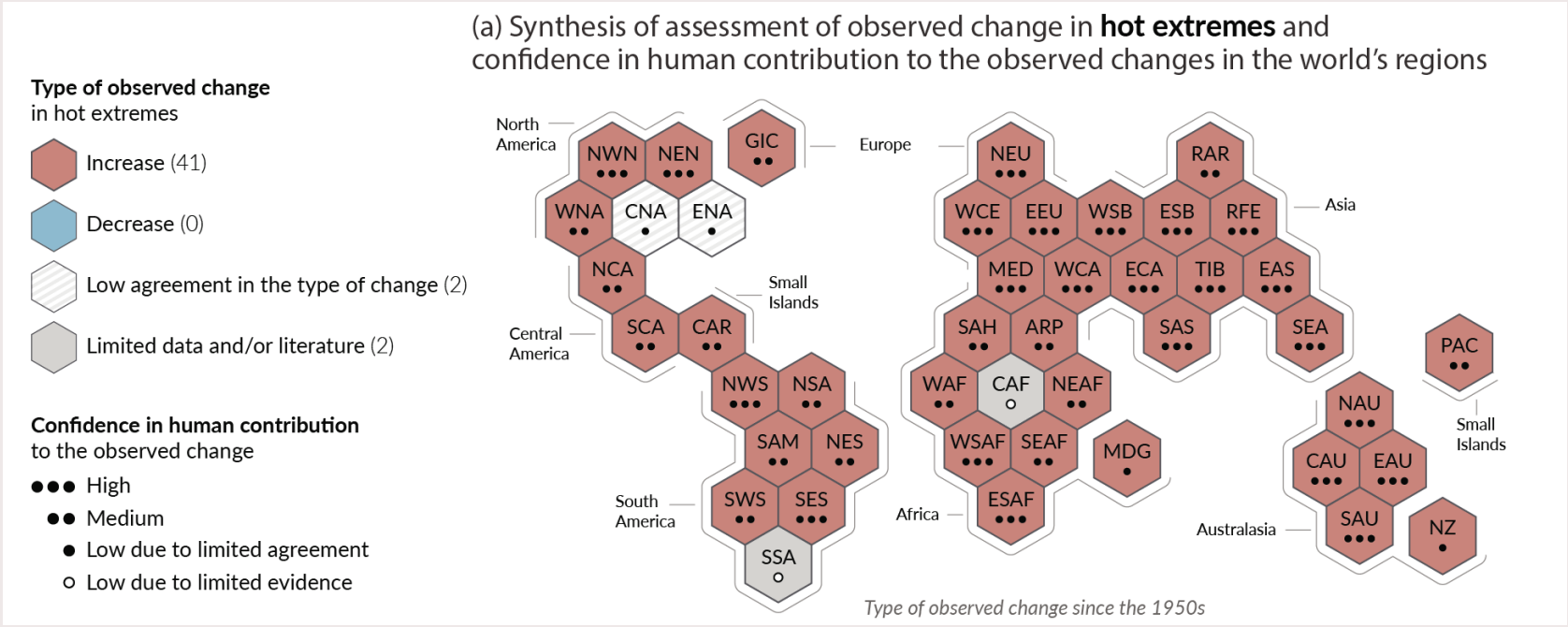
CO_2 CH_4 N_2O HFCs (ppm/ppb)

Radiative forcing (W/m^2)
Temperature (^oC)



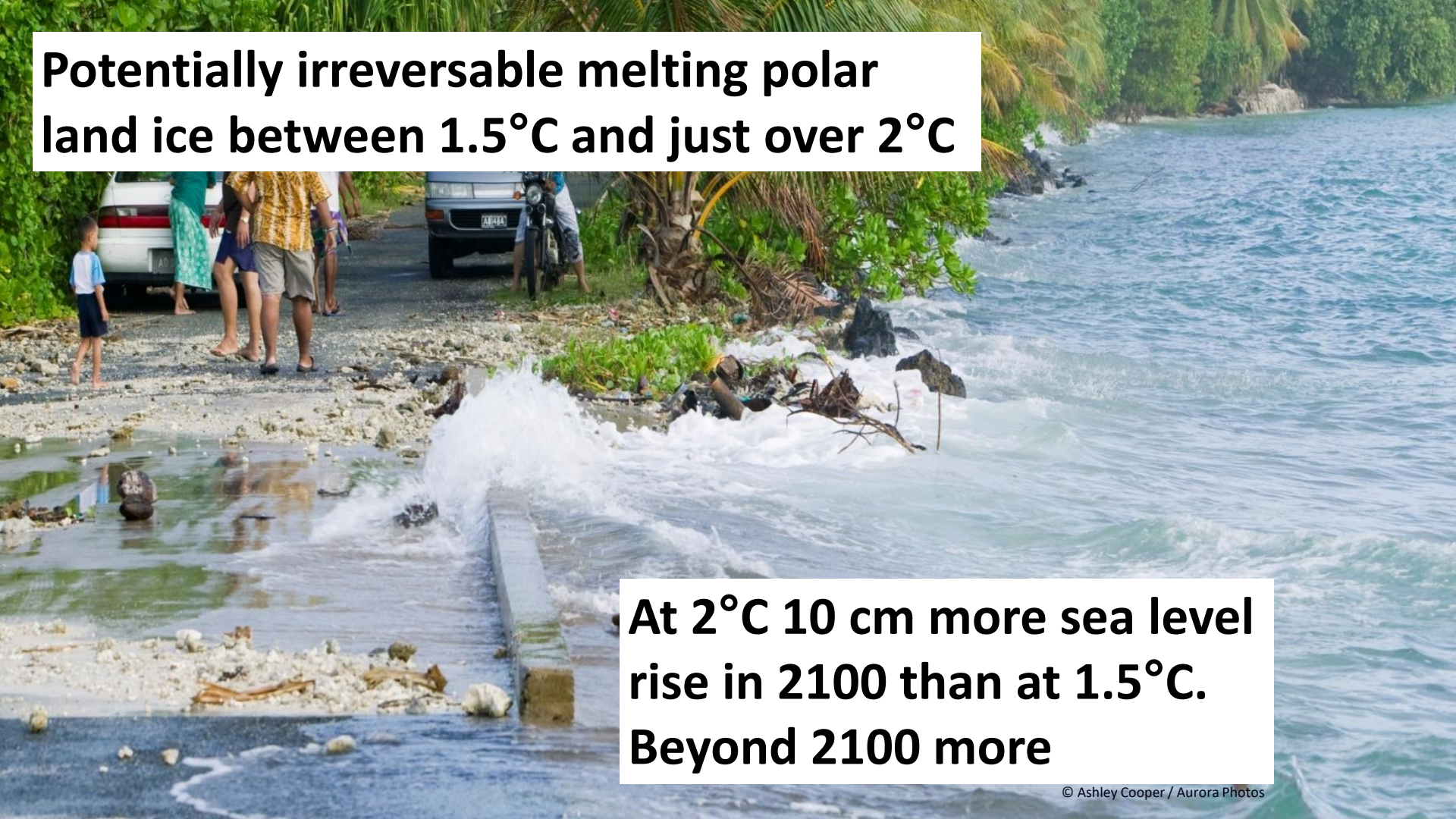
- Sea level rise
- Melting glaciers
- Precipitation patterns
- Stronger hurricanes

We are seeing consequences all over the world



IPCC AR6 WGI 2021: Figure SPM.3


At 2°C warming all warm-water corals gone vs 10-30% left at 1.5°C
Photo courtesyOve Hoegh-Guldberg


Potentially irreversable melting polar land ice between 1.5°C and just over 2°C
At 2°C 10 cm more sea level rise in 2100 than at 1.5°C. Beyond 2100 more
© Ashley Cooper / Aurora Photos


At 2°C: every 10 years completely ice-free North Pole.
At 1.5°C every 100 years
In 2050 hundreds of millions of people more at risk at 2°C compared to 1.5°C

Climate governance:
Key moments in the climate negotiations

1992: UNFCCC, Rio

- Prevent dangerous anthropogenic interference
- Common but differentiated responsibilities and respective capabilities

1997: Kyoto Protocol

- Emission reduction targets for rich countries (by 2008-2012 c. 1990)
- Emissions trading

2009: Copenhagen Accord

- Summit failed: no new treaty
- Two-degrees limit agreed
- Quantification of climate finance (US$100 billion/year by 2020)

2015: Paris Agreement

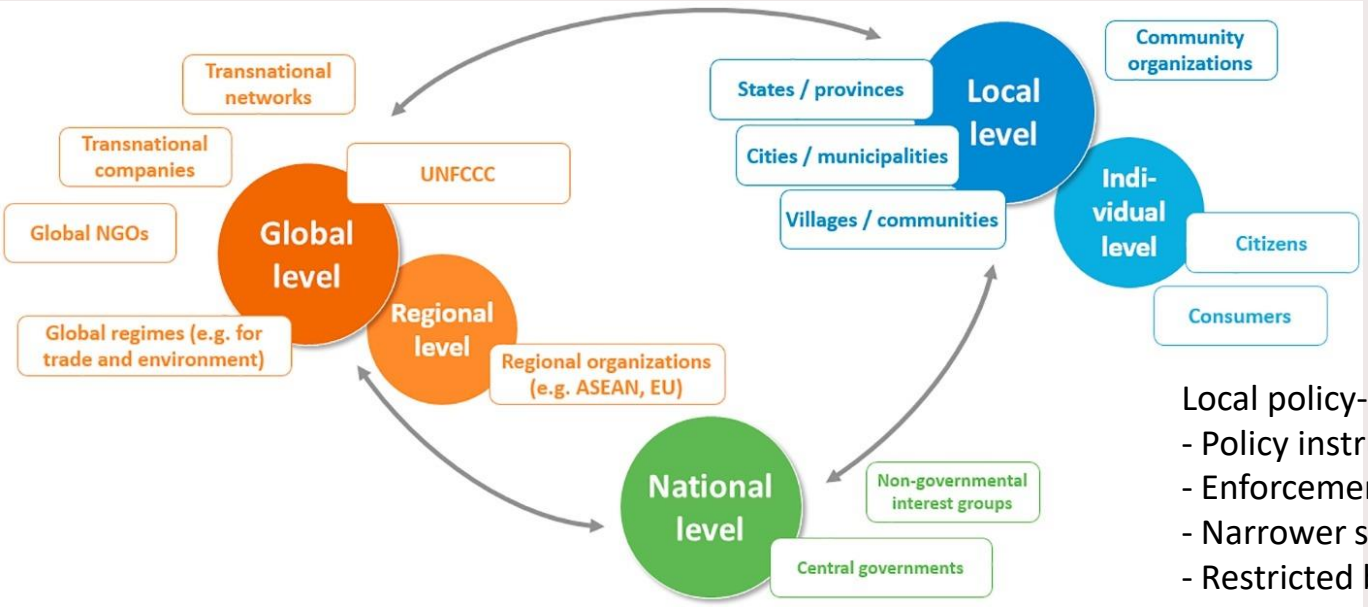
- Top-down approach abandoned
- Universal Nationally Determined Contributions (NDCs)

Climate policy is ‘multi-level’

Global climate governance:

1. providing guidance and signal to actors
2. setting rules to facilitate collective action
3. enhancing transparency and accountability
4. offering support (finance, technology, capacity-building)
5. promoting knowledge and learning

Limited enforcement power



National policy-making:
- Policy instruments
- Enforcement power
- Spending power

Local policy-making:
- Policy instruments
- Enforcement
- Narrower scope
- Restricted budgets and capacity

Figure: Marquardt, Jens, 2017: Journal of Cleaner Production 54:167-175
Oberthür, Hermwille, Rayner, 2021: Earth System Governance 8 (2021) 100104

About Pieter Pauw

Dr Pieter Pauw (1984) is an assistant professor at the Eindhoven University of Technology (TU/e), where he conducts research and provides policy advice on international climate finance and climate policy. Pauw is an Associate at Stockholm Environment Institute and Clingendael Institute. Since January 2024, Pauw is the editor of the renowned journal Climate Policy.

Before joining the TU/e, Pieter worked at the FS-UNEP Centre at the Frankfurt School of Finance & Management and German Development Institute (now IDOS) in Bonn. Pieter did projects in countries including the Netherlands, Ghana, Kenya, Botswana, Cameroon and Zambia.

He published more than 150 scientific papers, book chapters, reports and op-eds and is a lead author of the UNEP Adaptation Gap Report series. Pieter gives interviews to media regularly.