Ilmastonmuutos

- Globaali tila
- Suomi
- Päästöt
- Näkökulmia Suomeen

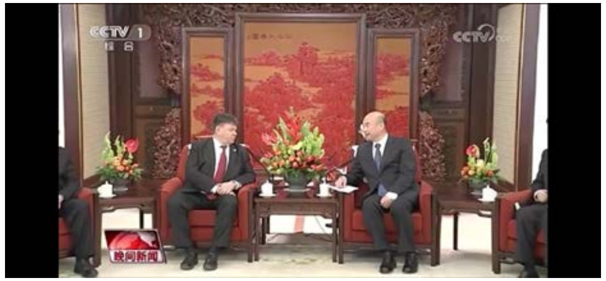
Prof. Petteri Taalas
Secretary-General

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

Petteri Taalas



Secretary General of the WMO 2016-19, 2020-23

- Historical reform, enhanced efficiency: Integrated Earth observations, multihazard services
- Engagement of private sector & academic sector, development & UN partnerships

Director at the WMO Development & Regional Activities 2005-7

Director General of the Finnish Meteorological Institute 2002-15, 700 staff, ~80 M€/year

- Doubling of external funding, tripling of scientific publications
- Very high customer & staff satisfaction, best public sector organization in Finland
- Modern weather, marine & climate services and atmospheric science

Professor & scientist 1986-2002: climate, atmospheric chemistry, satellites, Arctic/Antarctica

Climate expertise

- Leader of numerous atmospheric science programs of European Commission, NASA, EUMETSAT, Finnish Academy
- IPCC delegate of Finland, chair of IPCC group 2008-2015
- Opening speaker at COP 22-27
- European of the year 2021/Readers Digest: climate science communication

Chairman of EUMETSAT Council 2010-, 500 staff, ~400 M€/year

- Effective management of Council meetings, New polar satellite programme (~1.5 B€)

Univ. of Eastern Finland, Chairman of the Board 2009-15, 2800 staff, 15000 students, 260 M€

- Merging of two universities & a new semi-private administrative model

Fortum energy company, board member 2014-16, advisory board 2011-, 11000 staff, 6100 M€

- Emphasis on low carbon energy solutions, business in ~10 countries

PhD & MSc Helsinki Univ/meteorology, management training Uni. Pierre & Marie Curie etc.

Military service at Naval Academy, reserve captain

English, Finnish, Swedish, German, French, Russian

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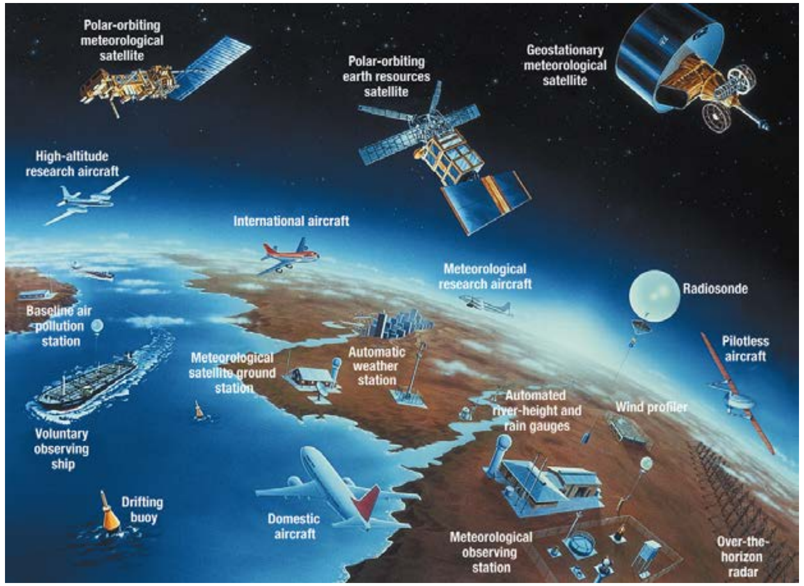
UNIVERSITY OF EASTERN FINLAND

EUMETSAT

FMI Fortum

World Meteorological Organization



- UN Specialized Agency on weather, climate & water
- 193 Members, HQ in Geneva
- 2nd oldest UN Agency, 1873-
- Coordinates work of > 300 000 national experts from meteorological & hydrological services, academia & private sector
- Co-Founder and host agency of IPCC (1st World Climate Conference)
- WMO SG UNSG Guterres' Climate Core Group Member (1/4)

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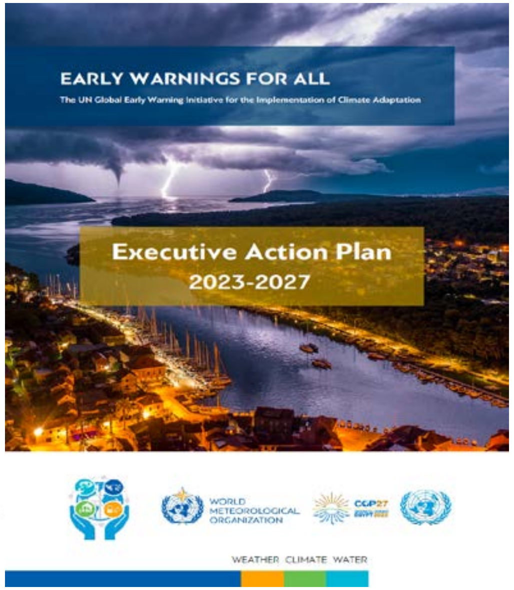
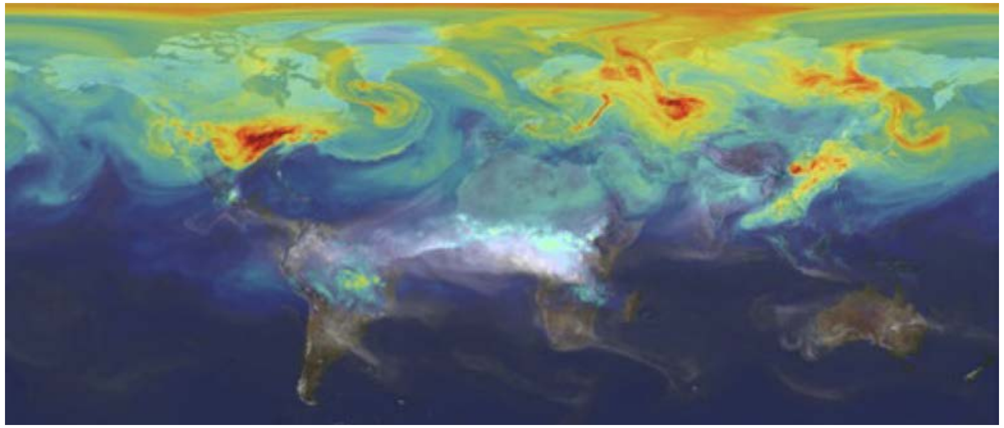
Key initiatives of WMO

1. **Early warnings for all**: only half of 193 Members have proper early warning services in place. Therefore the impacts of weather extremes are more damaging (human lifes & economy) than in advanced countries. Need to invest 1.5 B$ 2022-27 in basic observing systems, EWS capacity building & water resource monitoring/services.

2. **New way of monitoring of CO2, CH4 & N2O cycles in the real atmosphere**. The current way of following of emissions and sinks may be erroneous. There is and opportunity to create a system, where ground-based & satellite data and modelling tools are used for following of the greenhouse gases behavior in real atmosphere.

3. **International high resolution climate modelling program**. The current calculations of future climate by 2100 is based on 20-30 km horizontal resolution climate models, which is not enough for proper simulation of weather extremes, changes in rainfall patterns or melting glaciers, like Antarctica. There is a need to create a (virtual) centre with largest possible supercomputing resources and 100 leading experts to improve the situation.





Launch at COP 27 of the Early Warning for all Plan with more than 10 Heads of State and CEOs

Sharm el Sheikh COP 27

Microsoft President Brad Smith

Engagement of UNSG's office, COP-28 president, UNDRR and IFRC in the EWA planning

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Biggest risks for global economy 2023-2033

World Economic Forum 2023

	2 years	10 years
1	Cost-of-living crisis	Failure to mitigate climate change
2	Natural disasters and extreme weather events	Failure of climate-change adaptation
3	Geoeconomic confrontation	Natural disasters and extreme weather events
4	Failure to mitigate climate change	Biodiversity loss and ecosystem collapse
5	Erosion of social cohesion and societal polarization	Large-scale involuntary migration
6	Large-scale environmental damage incidents	Natural resource crises
7	Failure of climate change adaptation	Erosion of social cohesion and societal polarization
8	Widespread cybercrime and cyber insecurity	Widespread cybercrime and cyber insecurity
9	Natural resource crises	Geoeconomic confrontation
10	Large-scale involuntary migration	Large-scale environmental damage incidents

Risk categories: Economic | Environmental | Geopolitical | Societal | Technological

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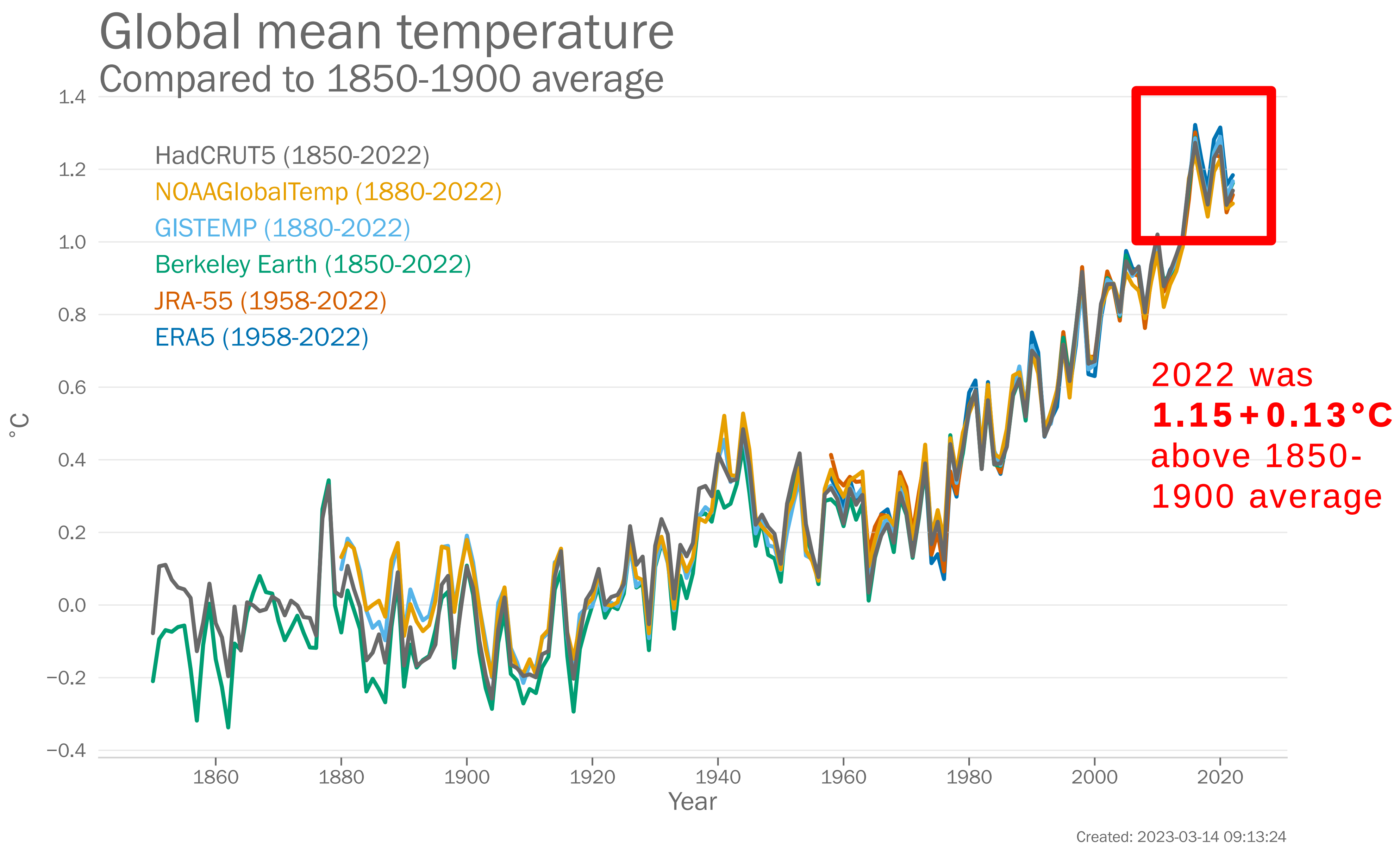
Last eight years were the warmest on record



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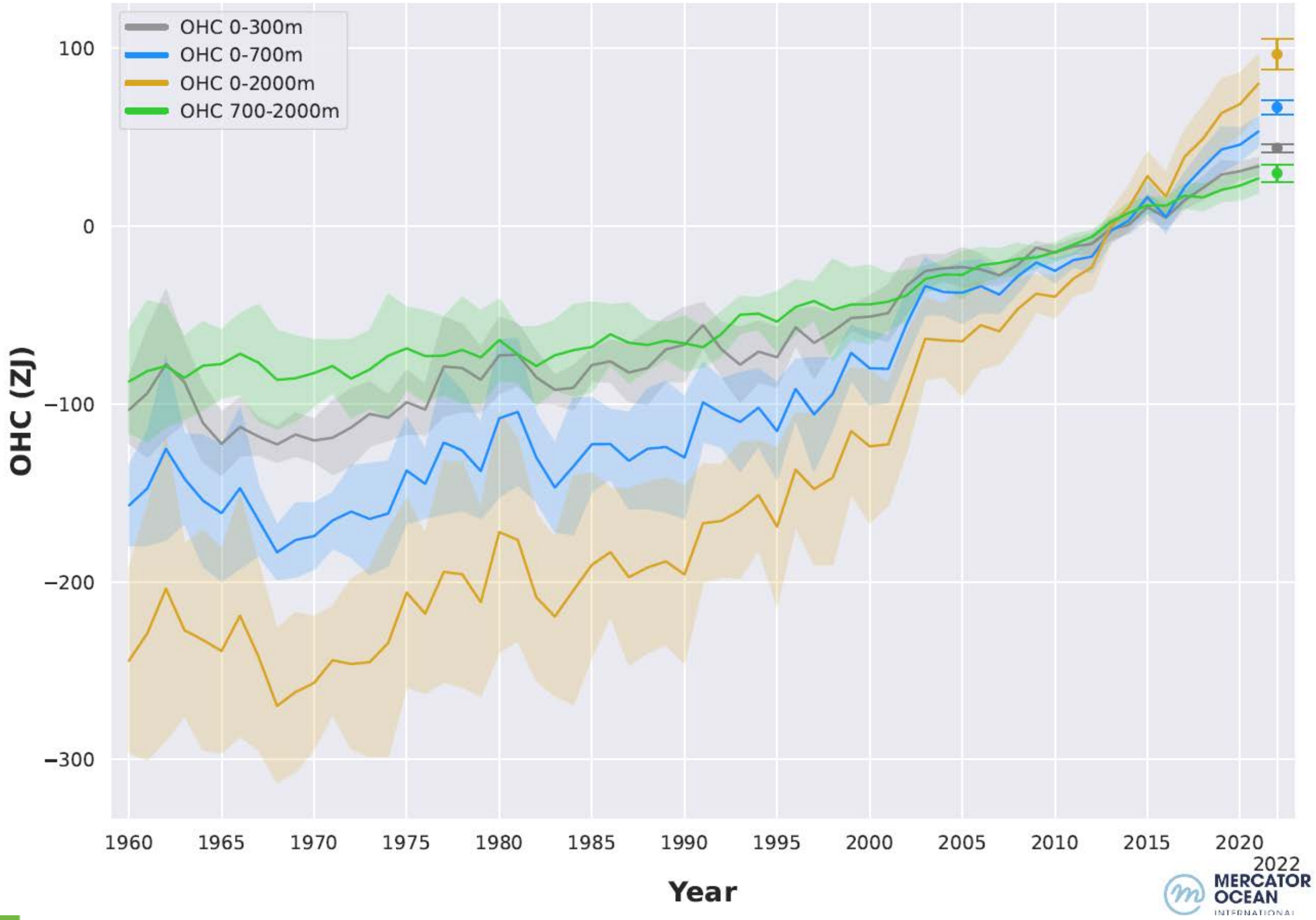


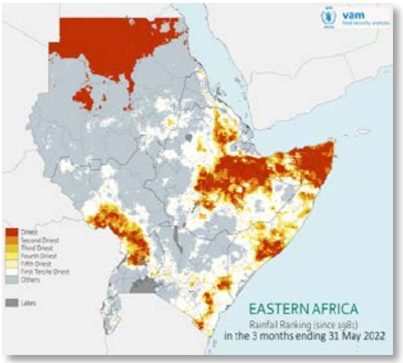
Provided by Karina von Schuckmann

Ocean Heat

- Ocean heat content reached a record high in 2022
- Heat continues to accumulate in the climate system
- Reflected in continued sea level rise

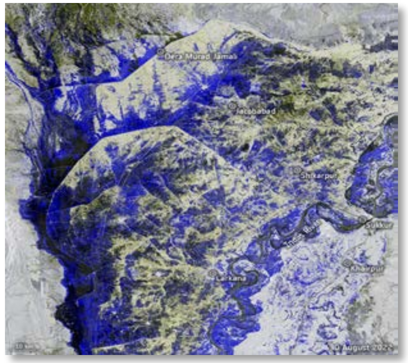
Top 5 high impact events in 2022

1



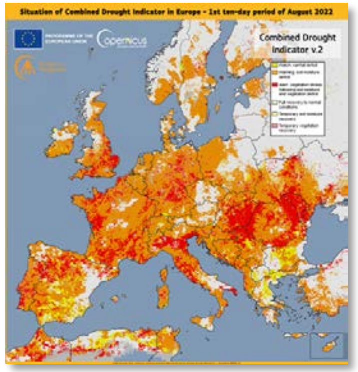
Drought in Greater Horn of Africa

2



Floods in Pakistan

3



Heat, drought and wildfire - Europe

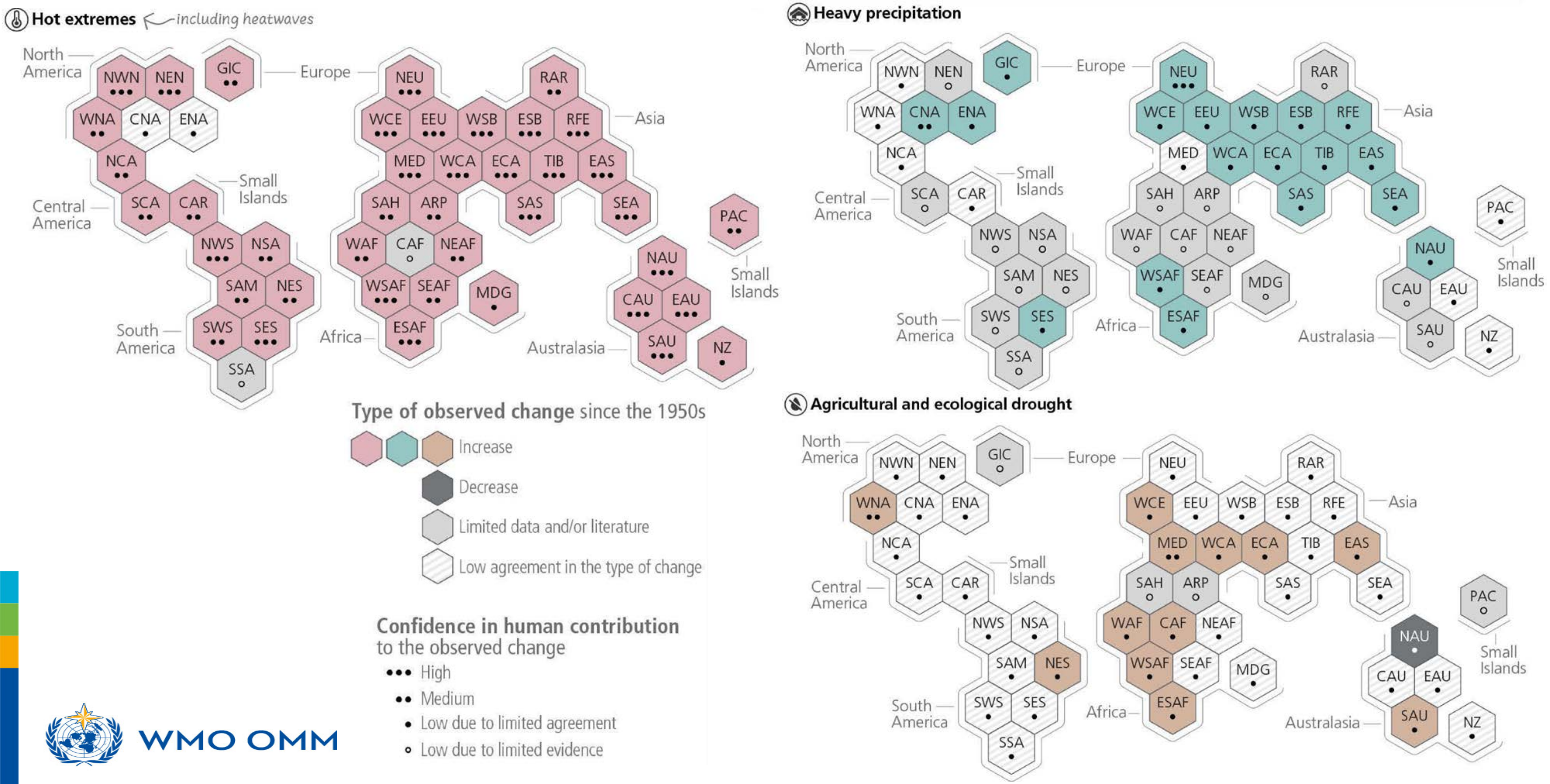
4

Heat, drought and wildfire - China

5

Hurricane Ian USA, Cuba & tropical cyclones Madagascar

Observed impacts on heat waves, flooding and drought



Type of observed change since the 1950s

- Increase
- Decrease
- Limited data and/or literature
- Low agreement in the type of change

Confidence in human contribution to the observed change

- ••• High
- •• Medium
- • Low due to limited agreement
- ○ Low due to limited evidence

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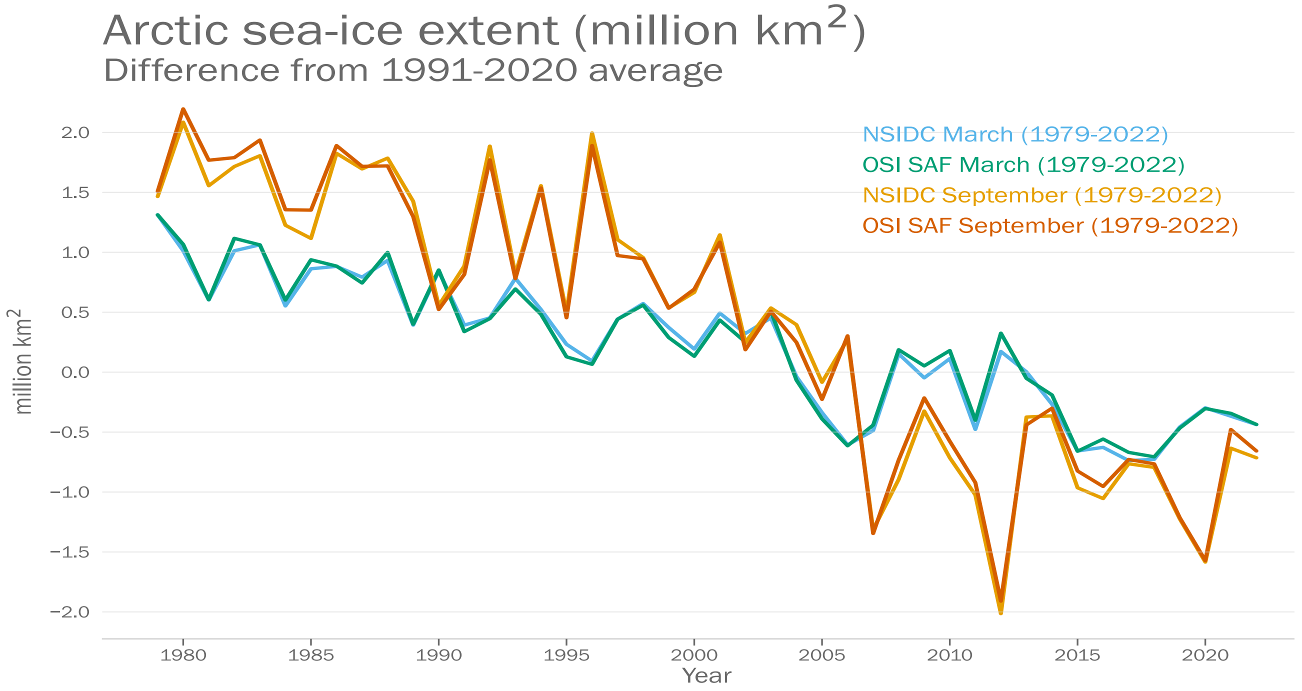
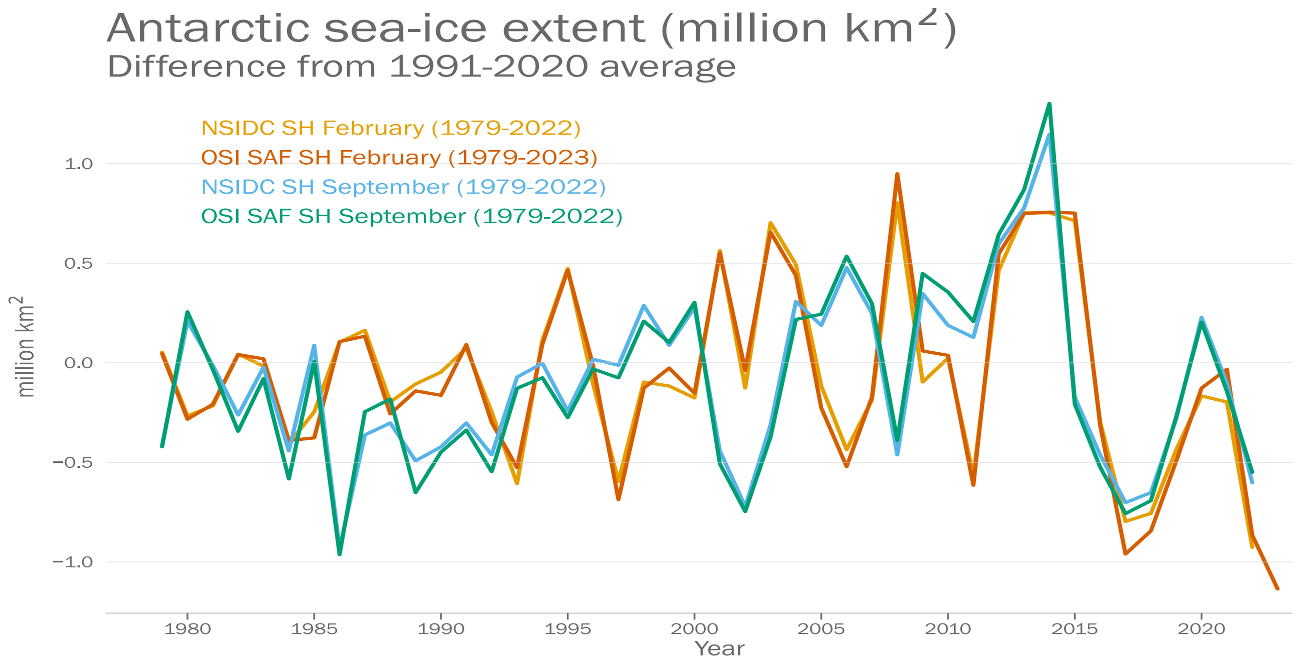


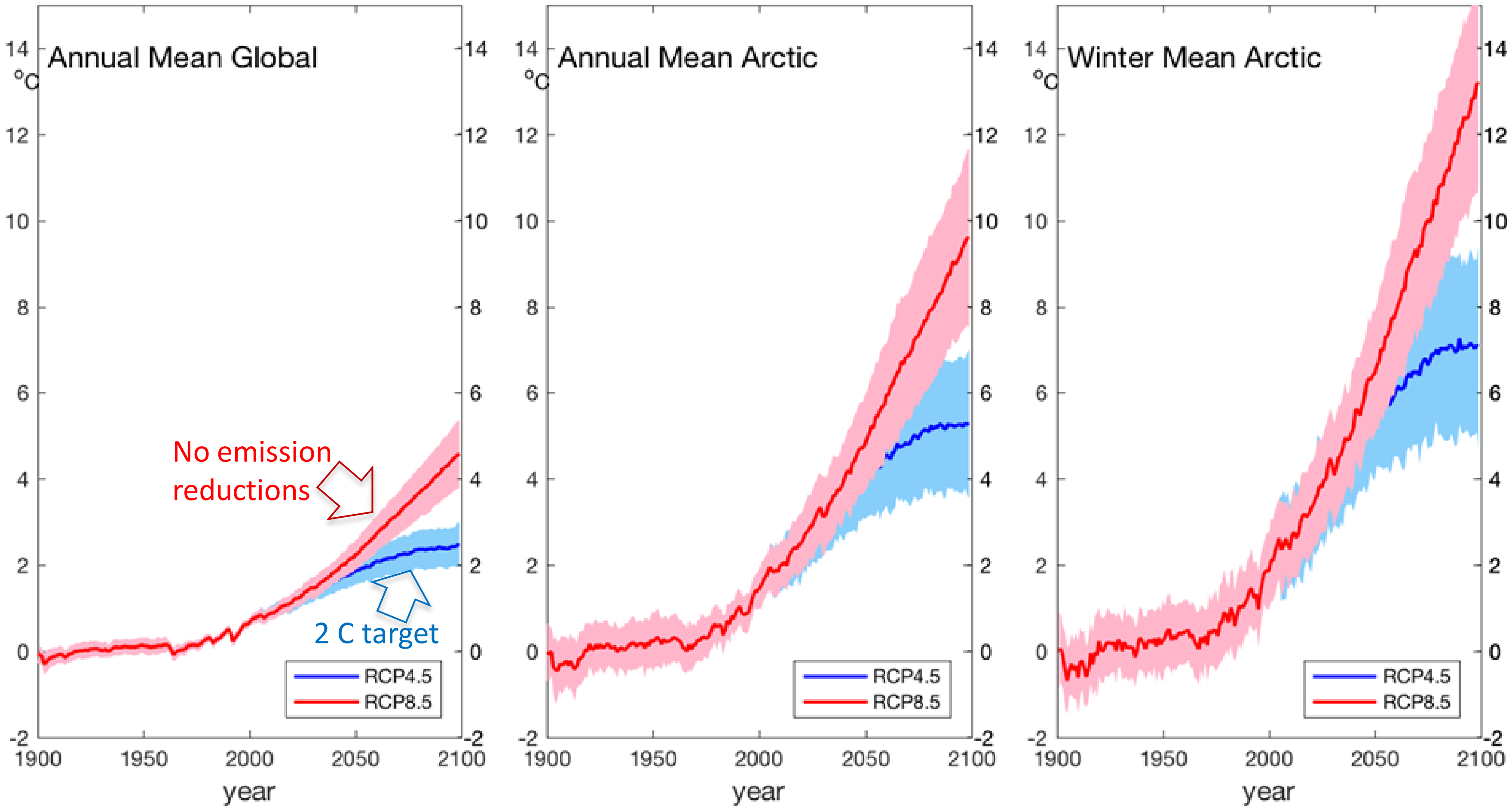


Arctic and Antarctic Sea ice extent

Record breaking low sea ice extent around Antarctica in February 2022

Arctic and global temperatures 1900-2100

Averaged over 36 global climate models
RCP 4.5 (blue)= upper end of Paris COP21 Agreement , RCP 8.5 (red)= business as usual



(modified from AMAP/SWIPA2017)

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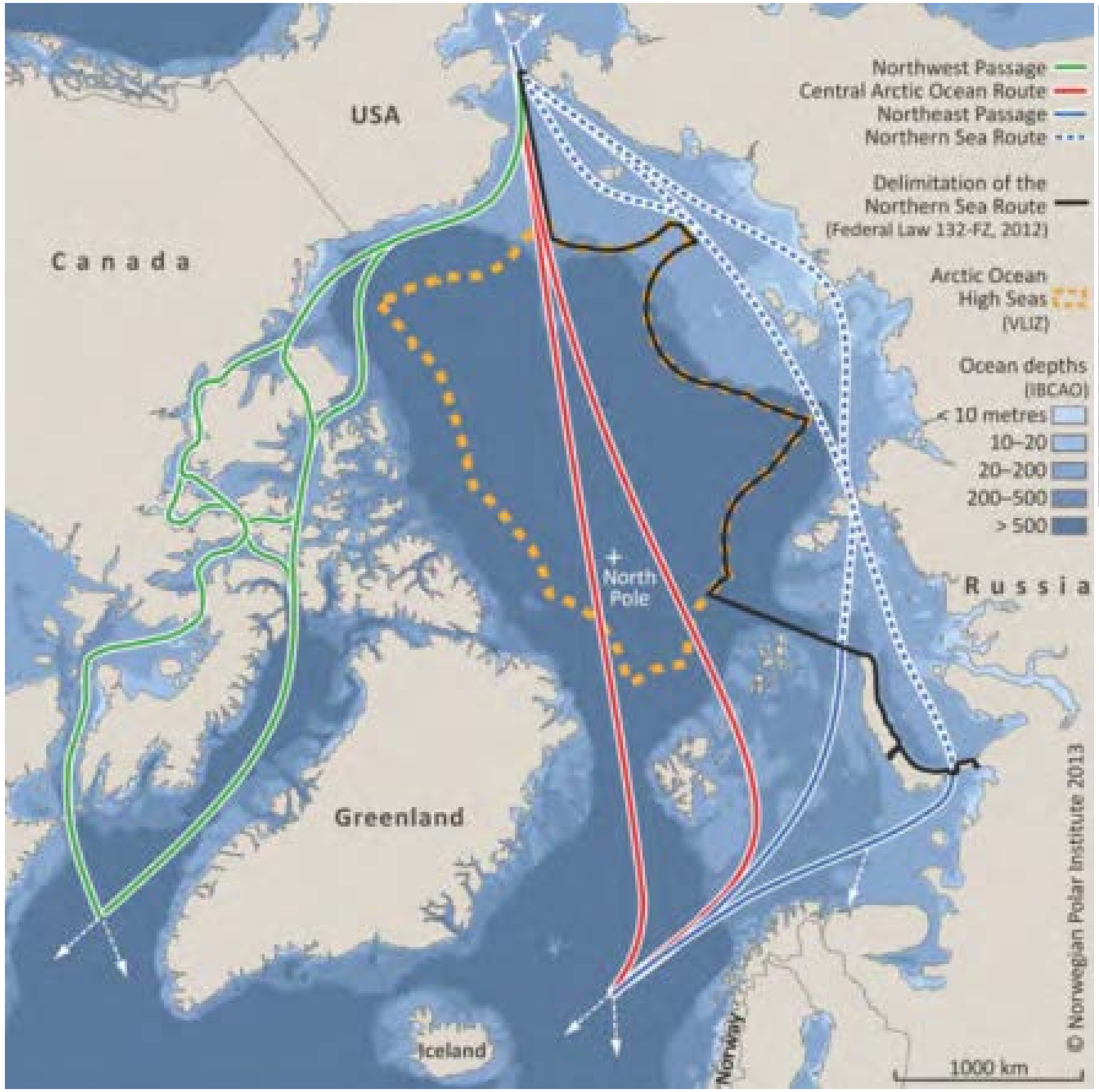
The Northern sea routes



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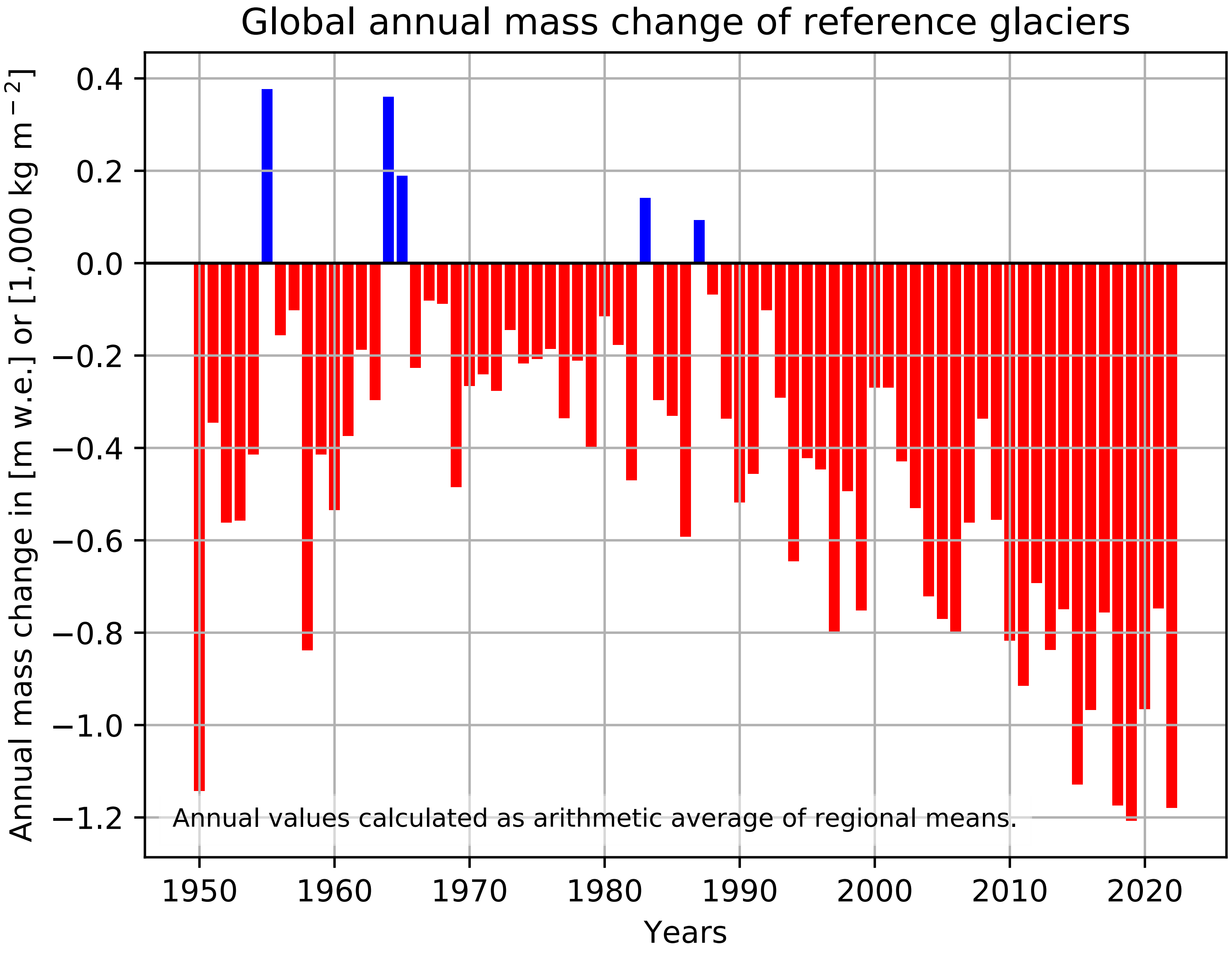
Cryosphere

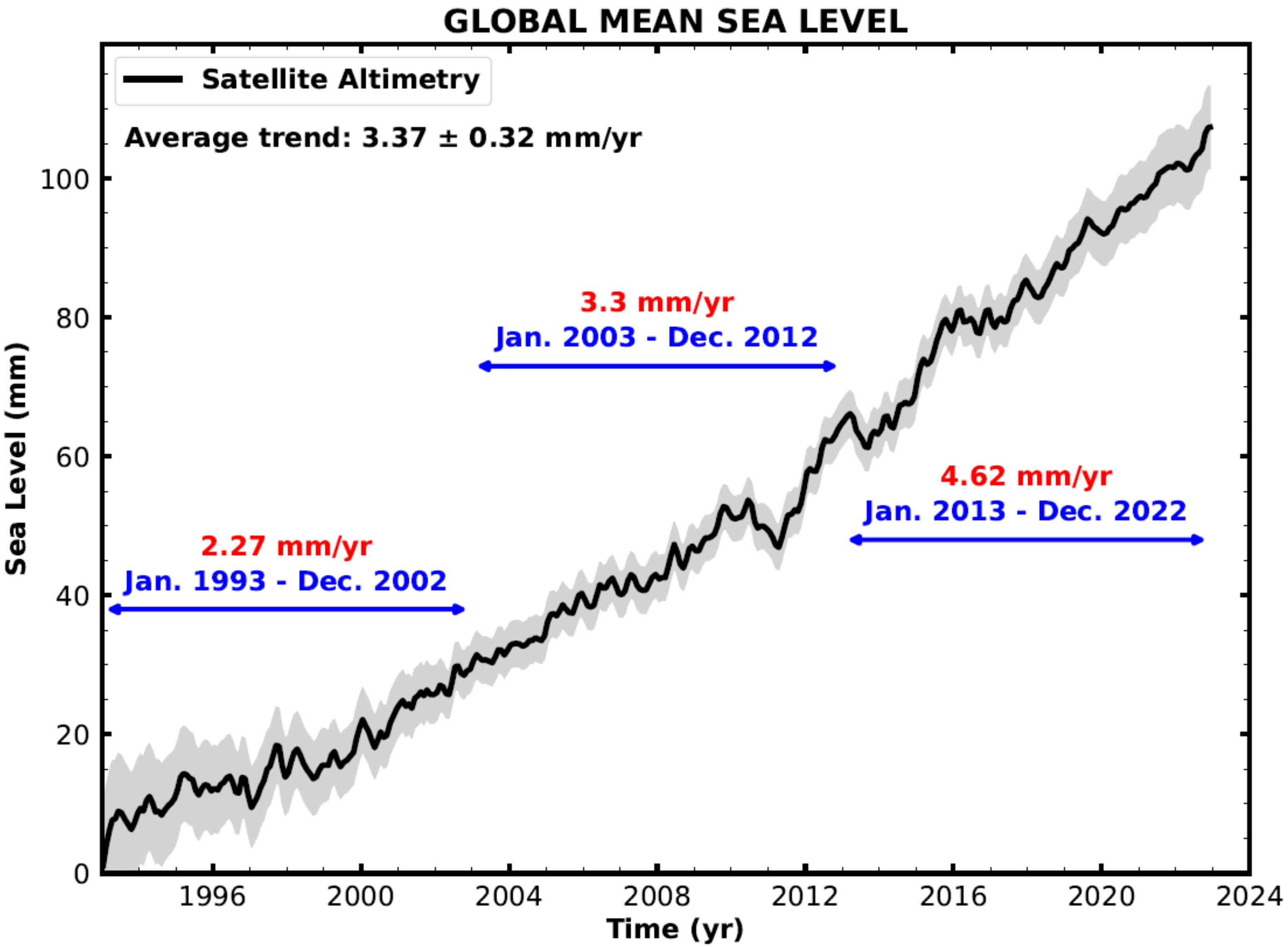
- 2022 was one of the 5 greatest losses on record
- Reference glaciers had a mass balance of -1.18 m water equivalent



WMO IMO-WMO 1873 2023

Global Mean Sea Level

The rate of sea level rise has doubled, reaching a **new record high in 2022**



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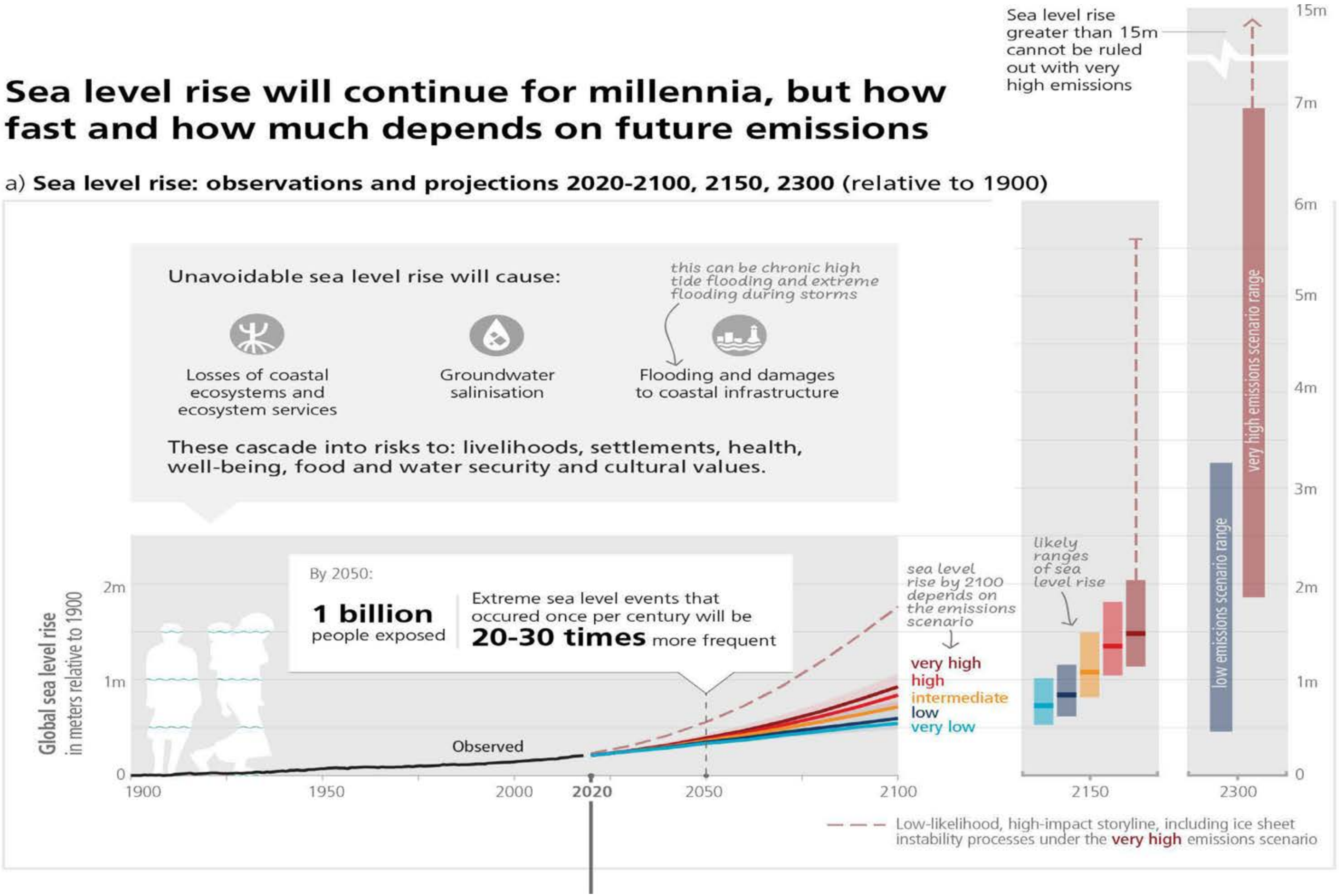
Sea level rise 1900-2300



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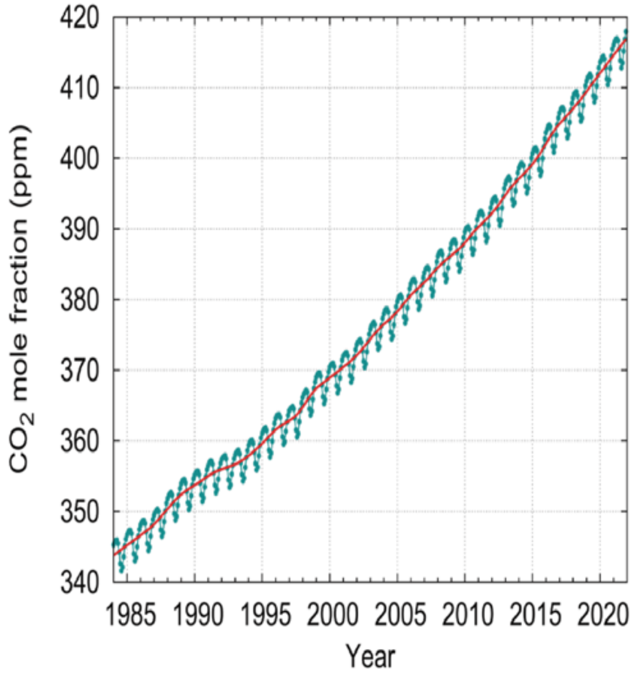
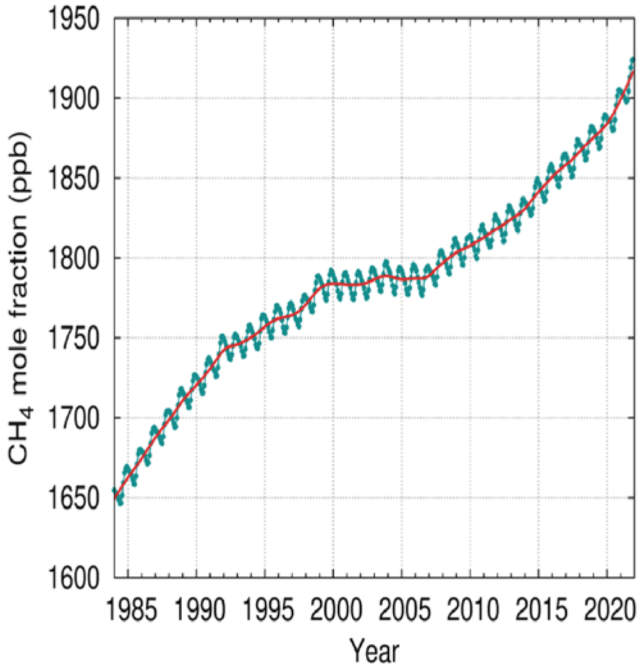
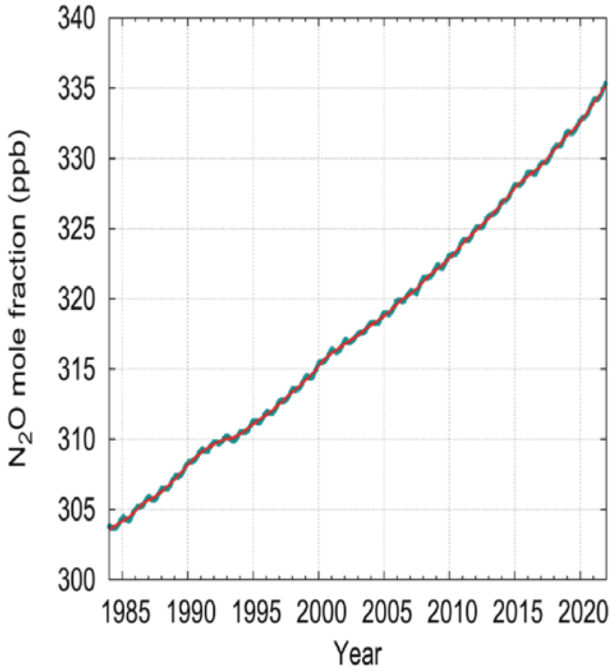
Greenhouse gas concentrations (CO_2, CH_4 and N_2O) continue to rise to new record highs



Carbon dioxide levels **+149%**



Methane levels **+262%**



Nitrous oxide levels **+124%**

of pre-industrial levels (before 1750)

Pallas station

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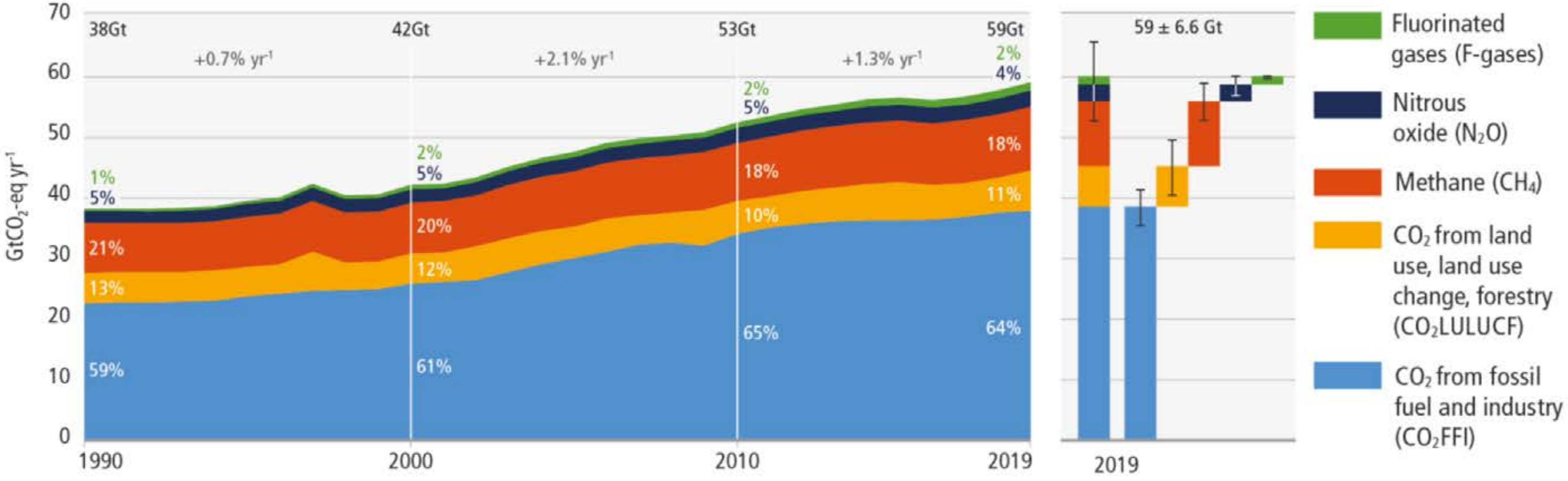
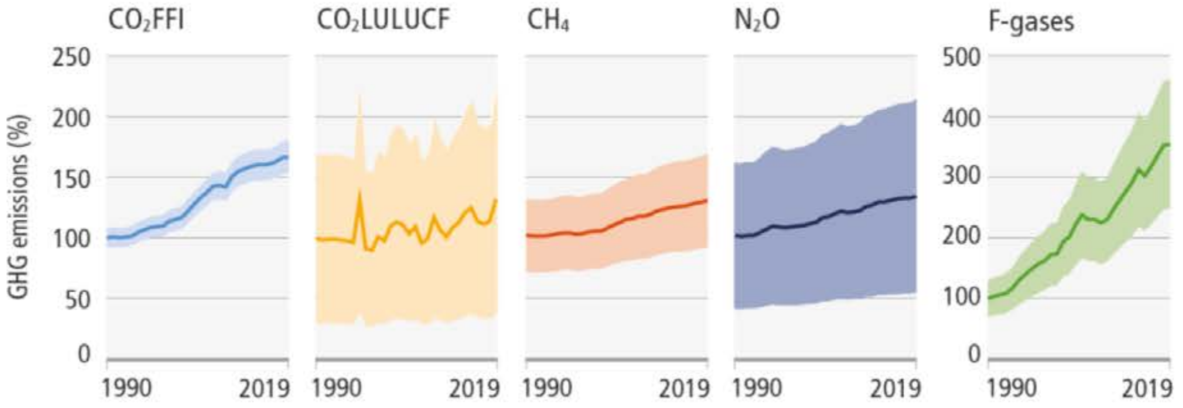
Greenhouse gas emissions 1990-2019

a. Total net anthropogenic GHG emissions 1990–2019



b. Anthropogenic GHG emissions and uncertainties by gas – relative to 1990



	2019 emissions ($GtCO_2$-eq)	1990–2019 increase ($GtCO_2$-eq)	Emissions in 2019, relative to 1990 (%)
CO_2 FFI	38±3	15	167
CO_2 LULUCF	6.6±4.6	1.6	133
CH_4	11±3.2	2.4	129
N_2O	2.7±1.6	0.65	133
F-gases	1.4±0.41	0.97	354
Total	59±6.6	21	154

The solid line indicates central estimate of emissions trends. The shaded area indicates the uncertainty range.

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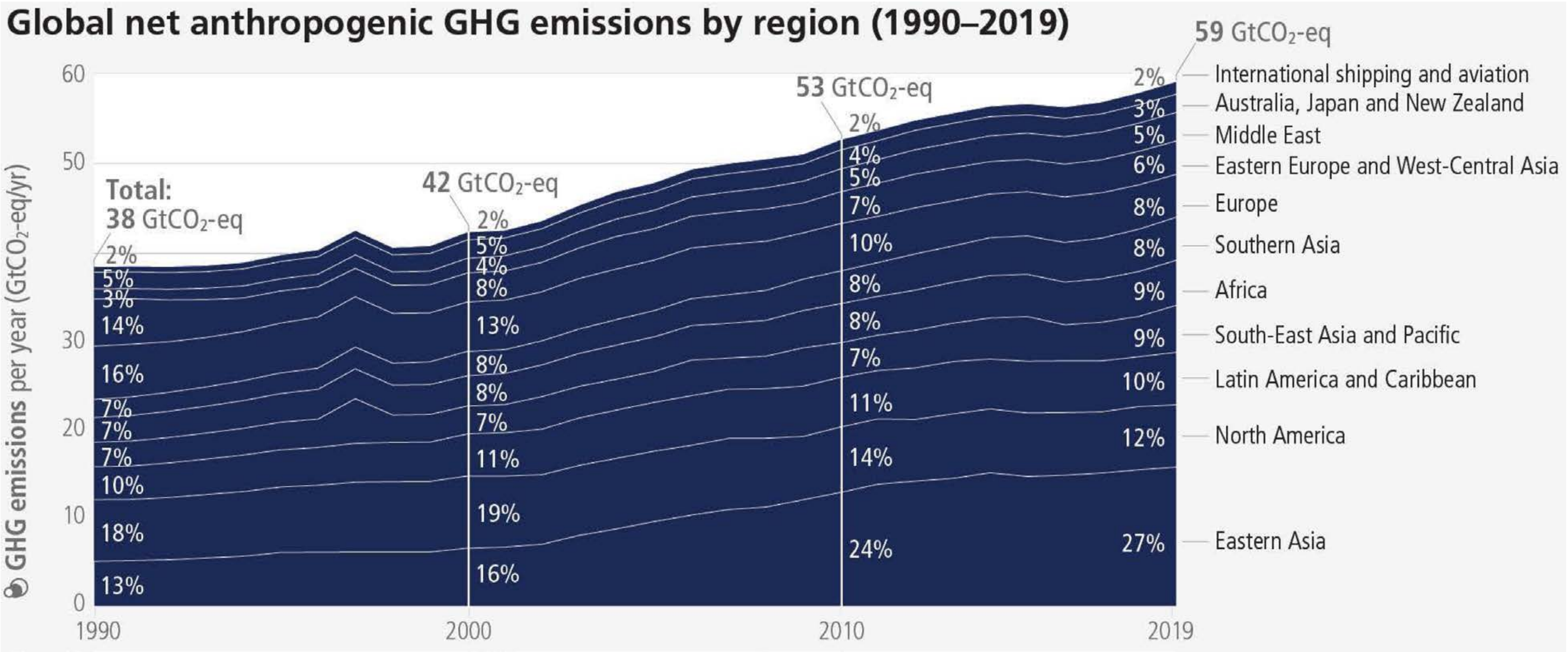
Emissions 1990-2019



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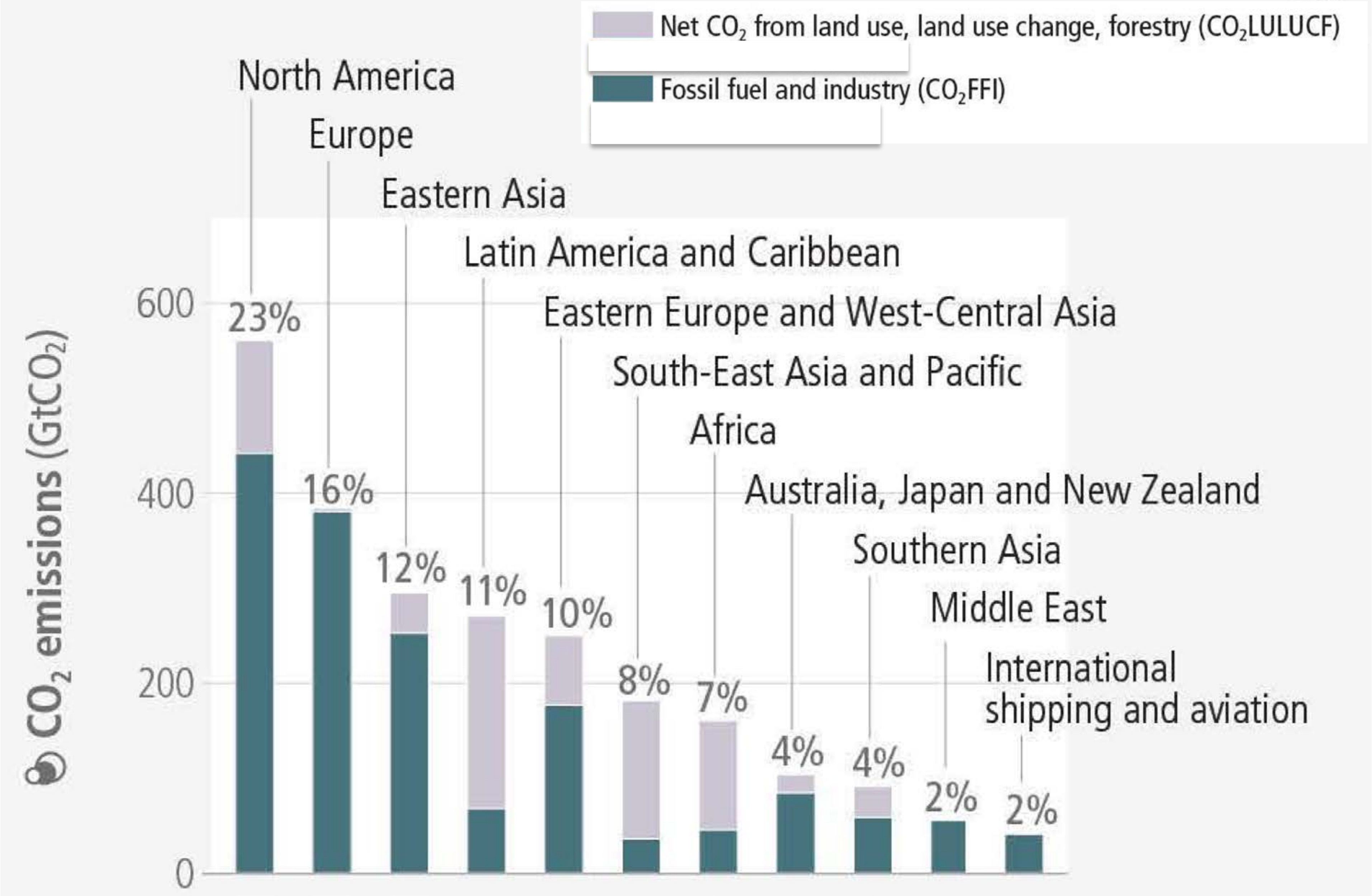
Fossil/land use emissions 1850-2020



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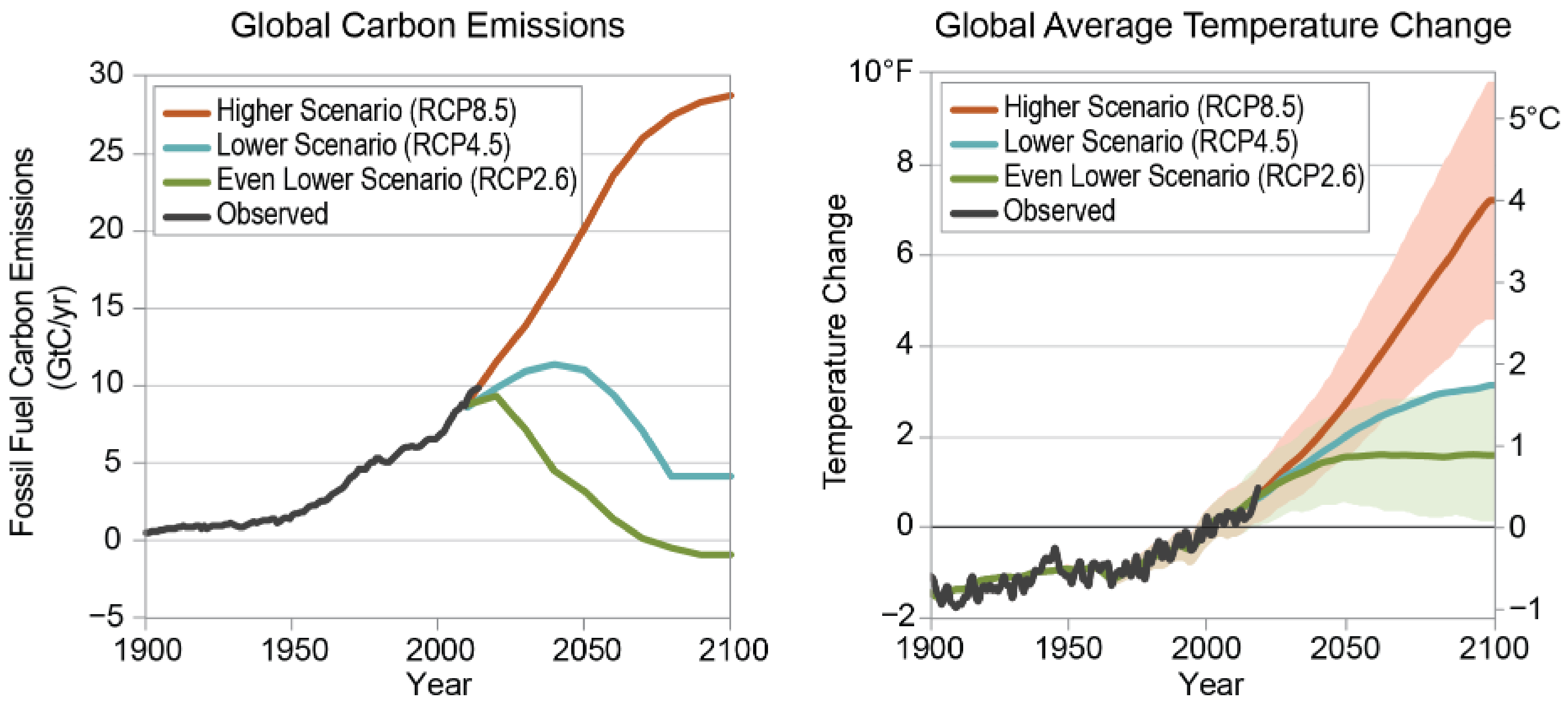
Carbon emissions-temperature



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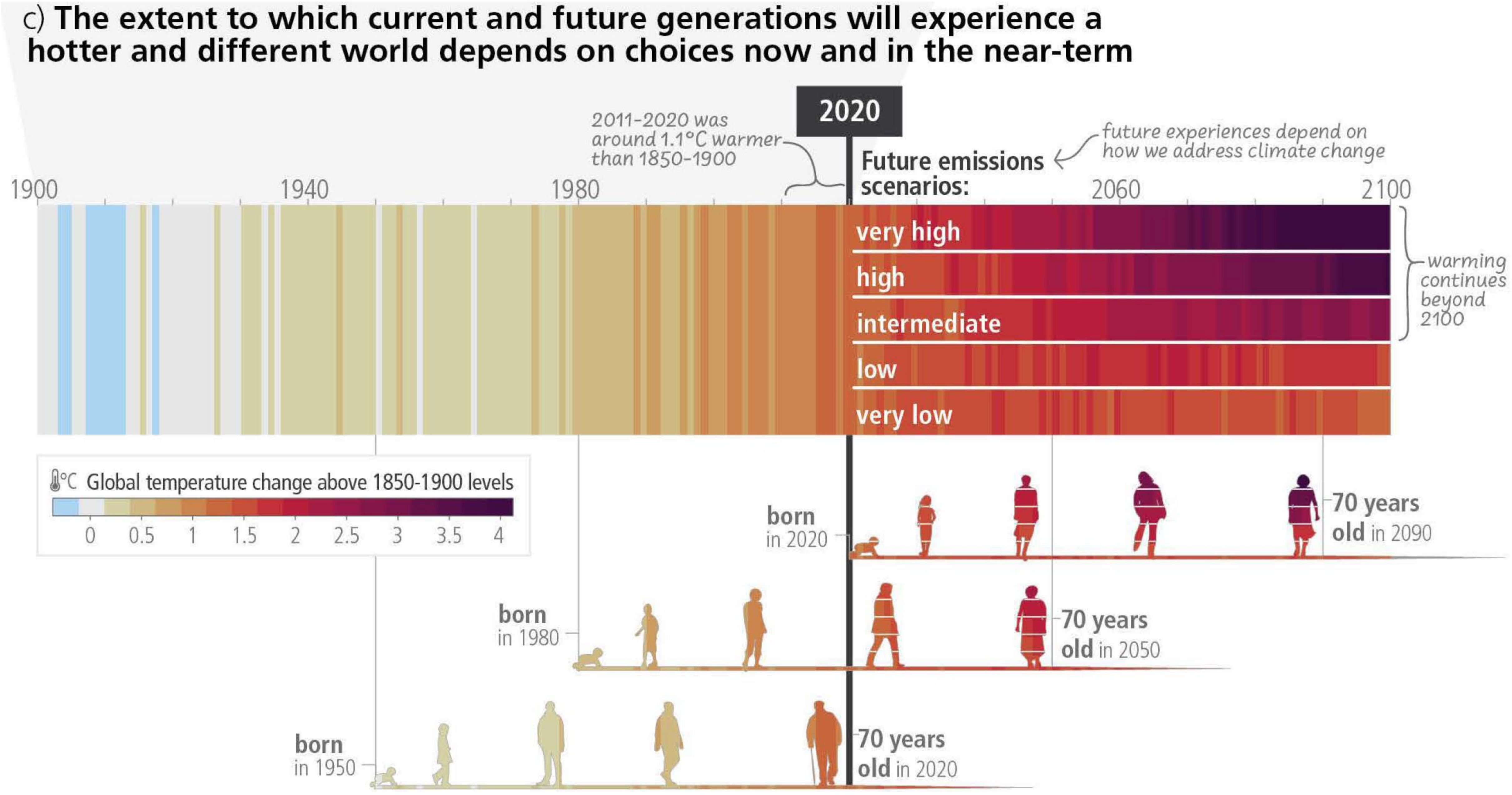
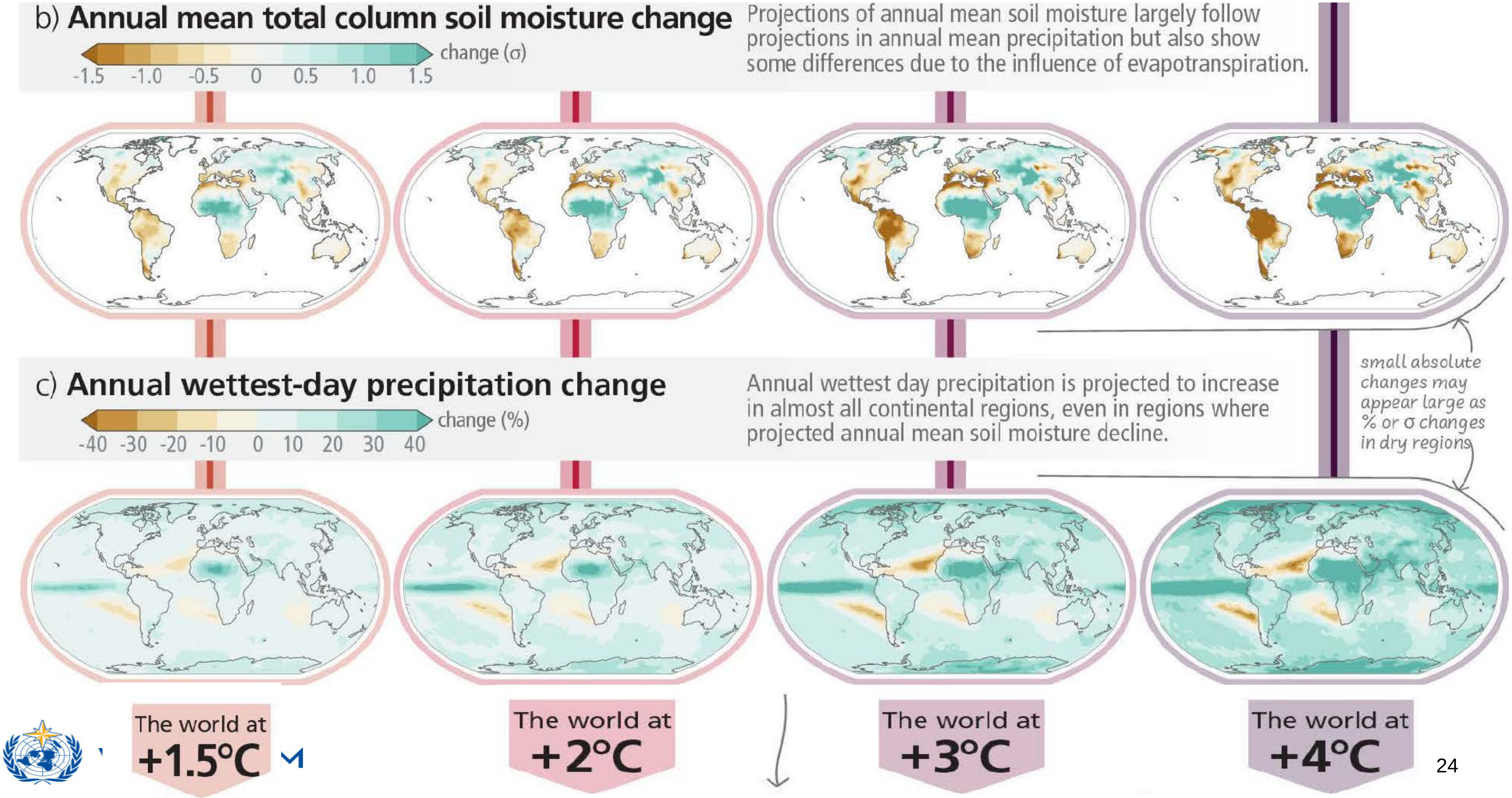
Possible climate scenarios 1900-2100



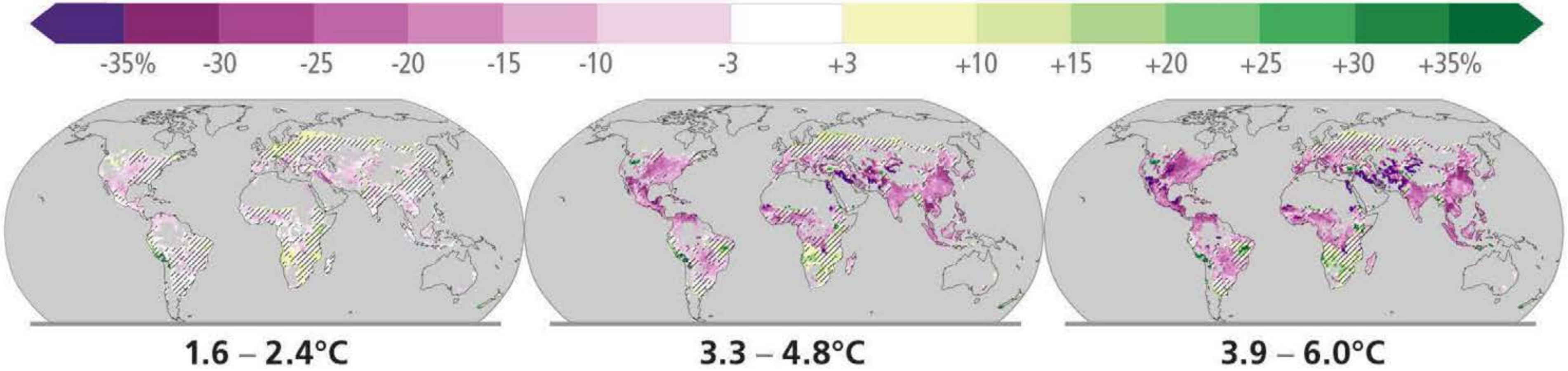
Future soil moisture and precipitation



Impacts on food security, maize & fisheries

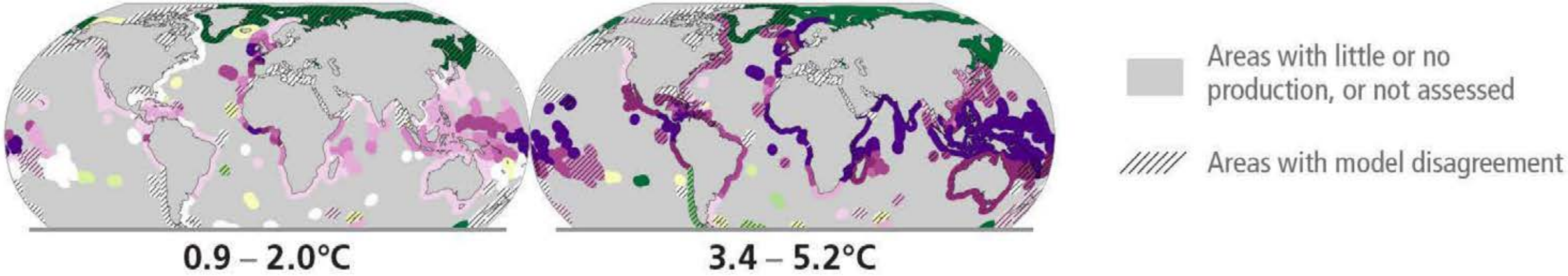
Food production impacts

c1) **Maize yield[4]**
Changes **(%)** in yield



[4]Projected regional impacts reflect biophysical responses to changing temperature, precipitation, solar radiation, humidity, wind, and CO_2 enhancement of growth and water retention in currently cultivated areas. Models assume that irrigated areas are not water-limited. Models do not represent pests, diseases, future agro-technological changes and some extreme climate responses.

c2) **Fisheries yield[5]**
Changes **(%)** in maximum catch potential



[5]Projected regional impacts reflect fisheries and marine ecosystem responses to ocean physical and biogeochemical conditions such as temperature, oxygen level and net primary production. Models do not represent changes in fishing activities and some extreme climatic conditions. Projected changes in thea Arctic regions have low confidence due to uncertainties associated with modelling multiple interacting drivers and ecosystem responses.

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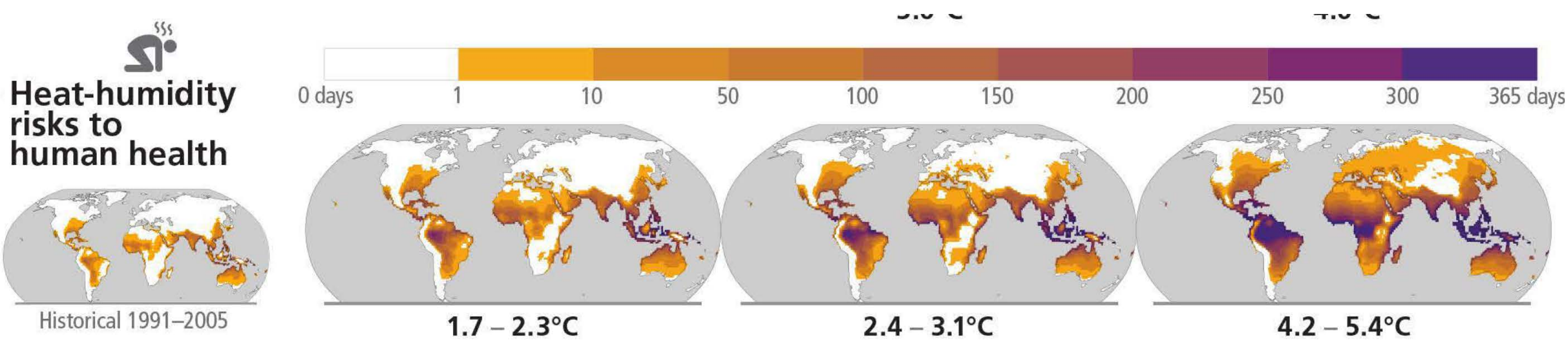
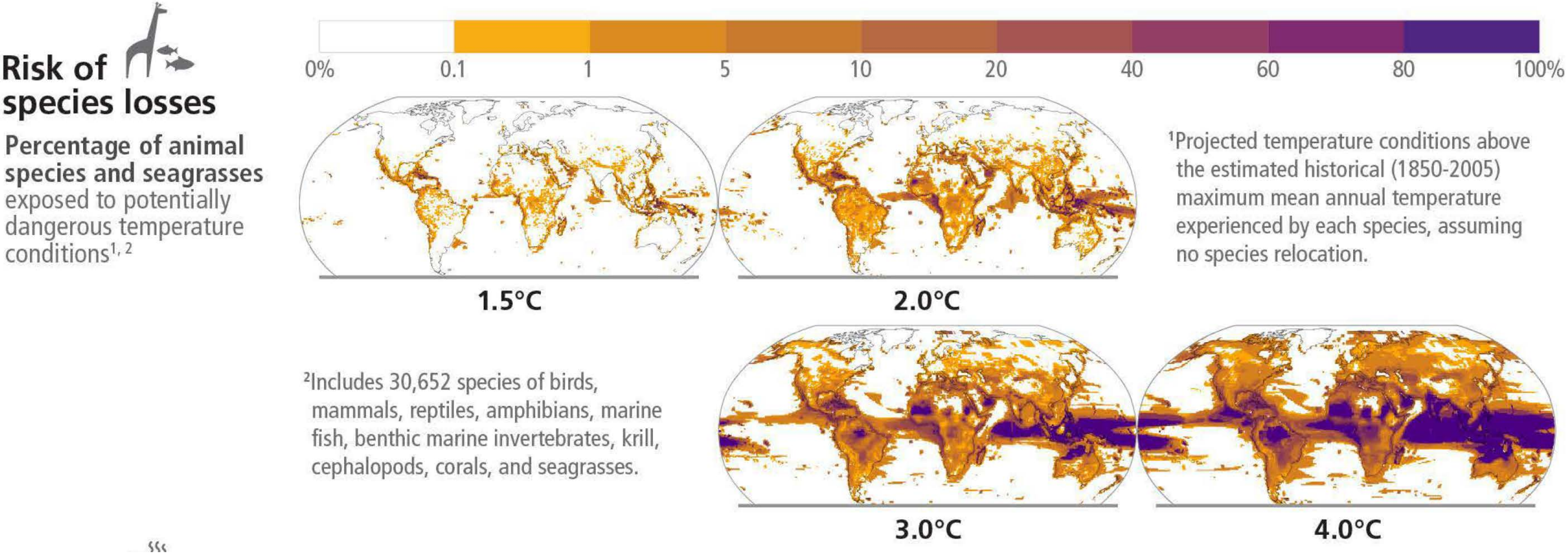
Impacts on health



Days per year where combined temperature and humidity conditions pose a risk of mortality to individuals[3]

[3]Projected regional impacts utilize a global threshold beyond which daily mean surface air temperature and relative humidity may induce hyperthermia that poses a risk of mortality. The duration and intensity of heatwaves are not presented here. Heat-related health outcomes vary by location and are highly moderated by socio-economic, occupational and other non-climatic determinants of individual health and socio-economic vulnerability. The threshold used in these maps is based on a single study that synthesized data from 783 cases to determine the relationship between heat-humidity conditions and mortality drawn largely from observations in temperate climates.

Impacts on species



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Ilmastonmuutos Suomessa?

- **Lämpeneminen** 2 x maailman keskiarvo, talvella 3 x

- **Sademäärät** kasvavat talvipuoliskolla vuotta, vettä/lunta riippuen lämpötilasta, talvikauden lyheneminen => metsien kasvu hyötyy

- **Kesällä helleaaltojen** riski kasvaa

- **Paikalleen jämähtäneiden säätilojen** riski kasvaa:
  - Korkeapaineissa hellettä/kuivuutta ja kylmyyttä talvella.
  - Matalapaineiden reitit samoja päivästä toiseen, jolloin tulvariskien kasvu.

- Voimakkaampi **vaihtelevuus**, jolloin mm. teiden reikiintyminen talvella

- **Meriveden pinnan nousu**, maan kohoaminen kompensoi osittain

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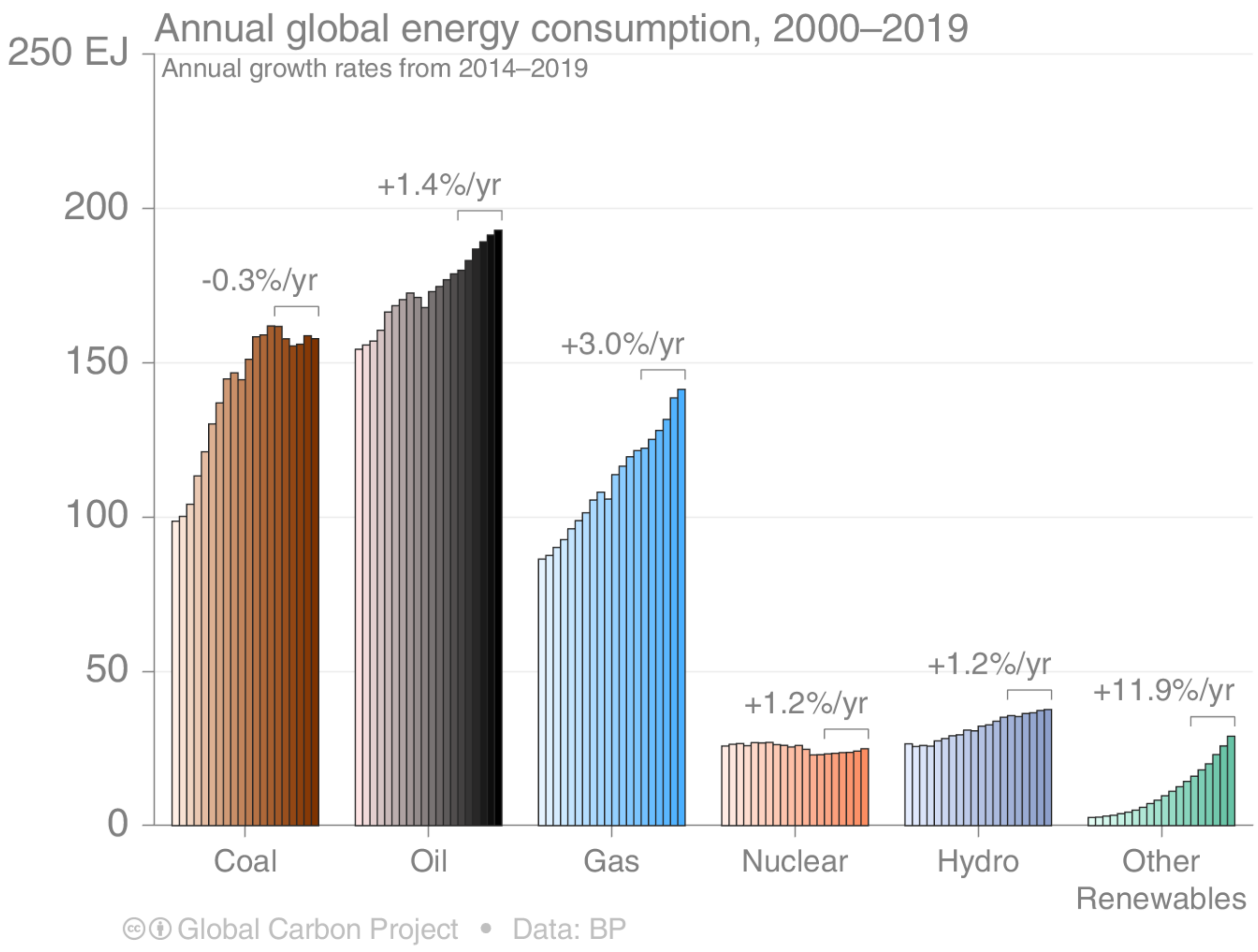
Fossil/other energy use by source

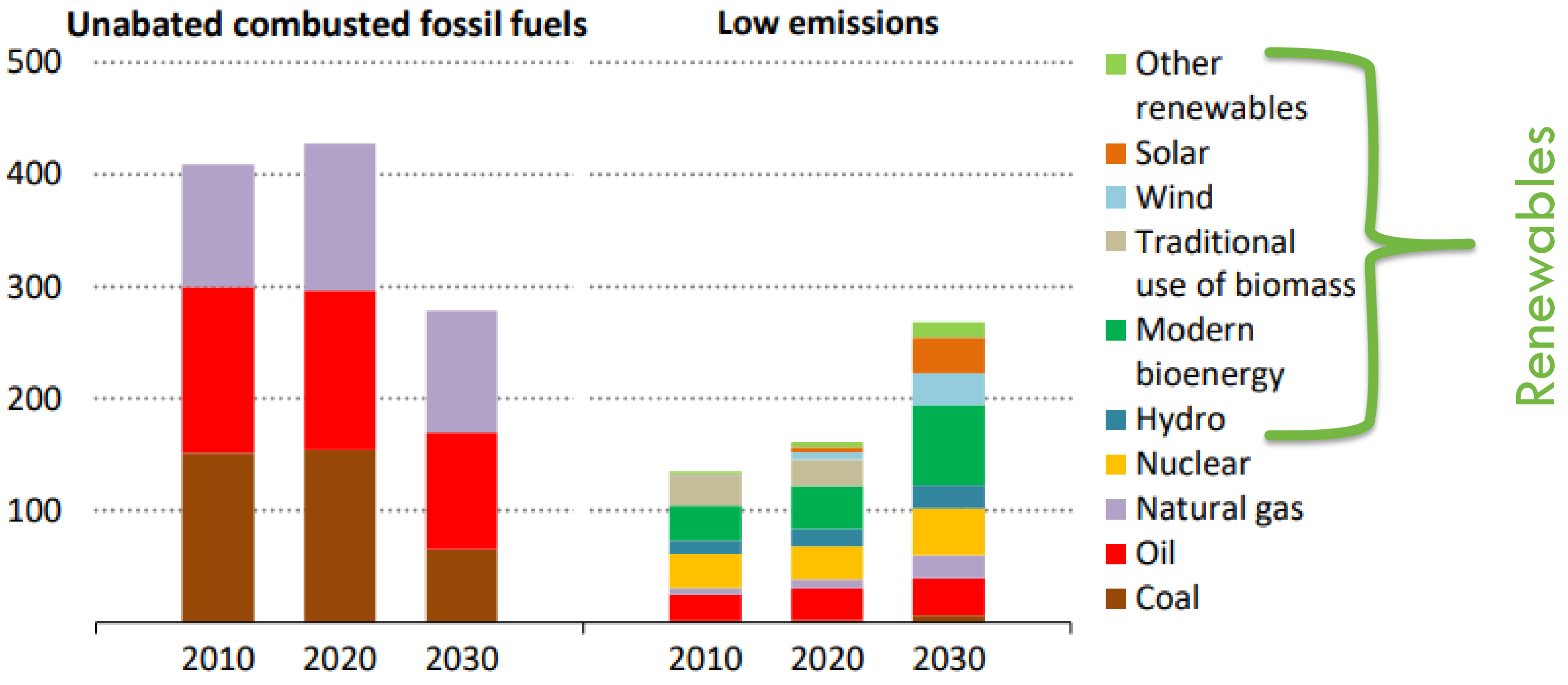
Energy consumption by fuel source from 2000 to 2019, with growth rates indicated for the more recent period of 2014 to 2019



This figure shows "primary energy" using the BP substitution method
(non-fossil sources are scaled up by an assumed fossil efficiency of approximately 0.38)
Source: BP 2020; Jackson et al 2019; Global Carbon Budget 2020

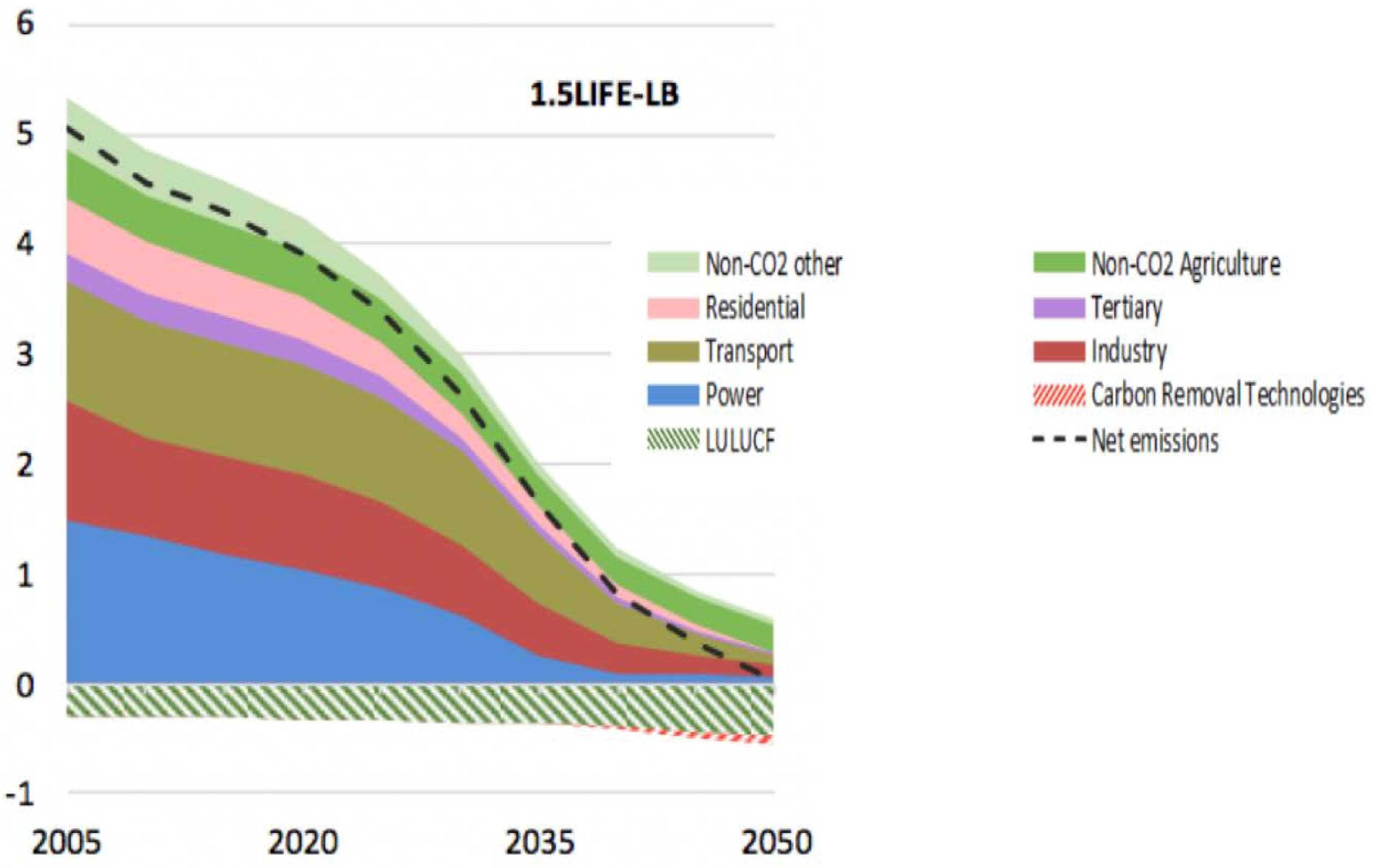
Energy transition for climate mitigation

Supply from low emissions sources needs to **double by 2030**



(IEA)

How to become carbon neutral by 2050?



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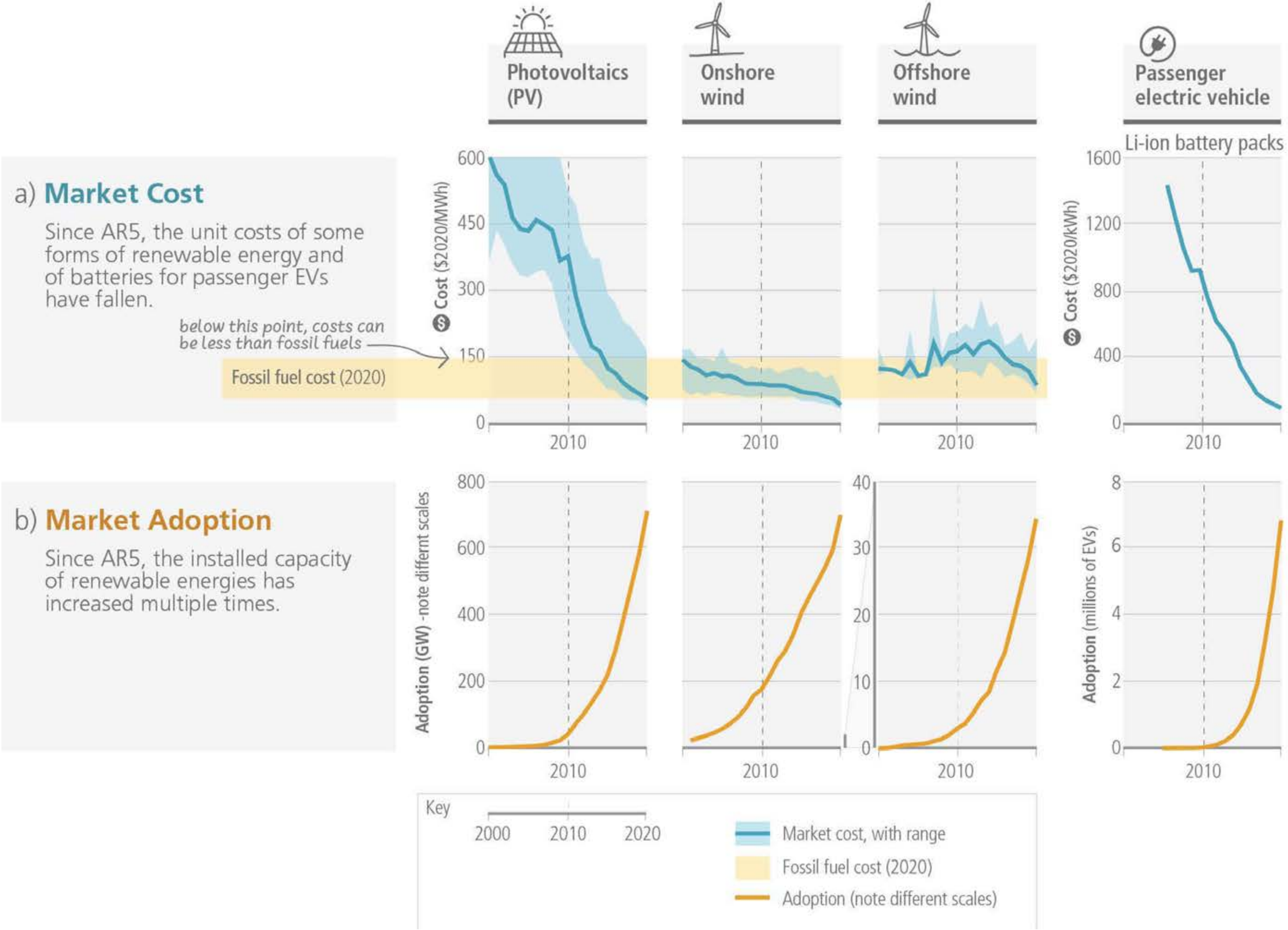
Prices of climate friendly technologies



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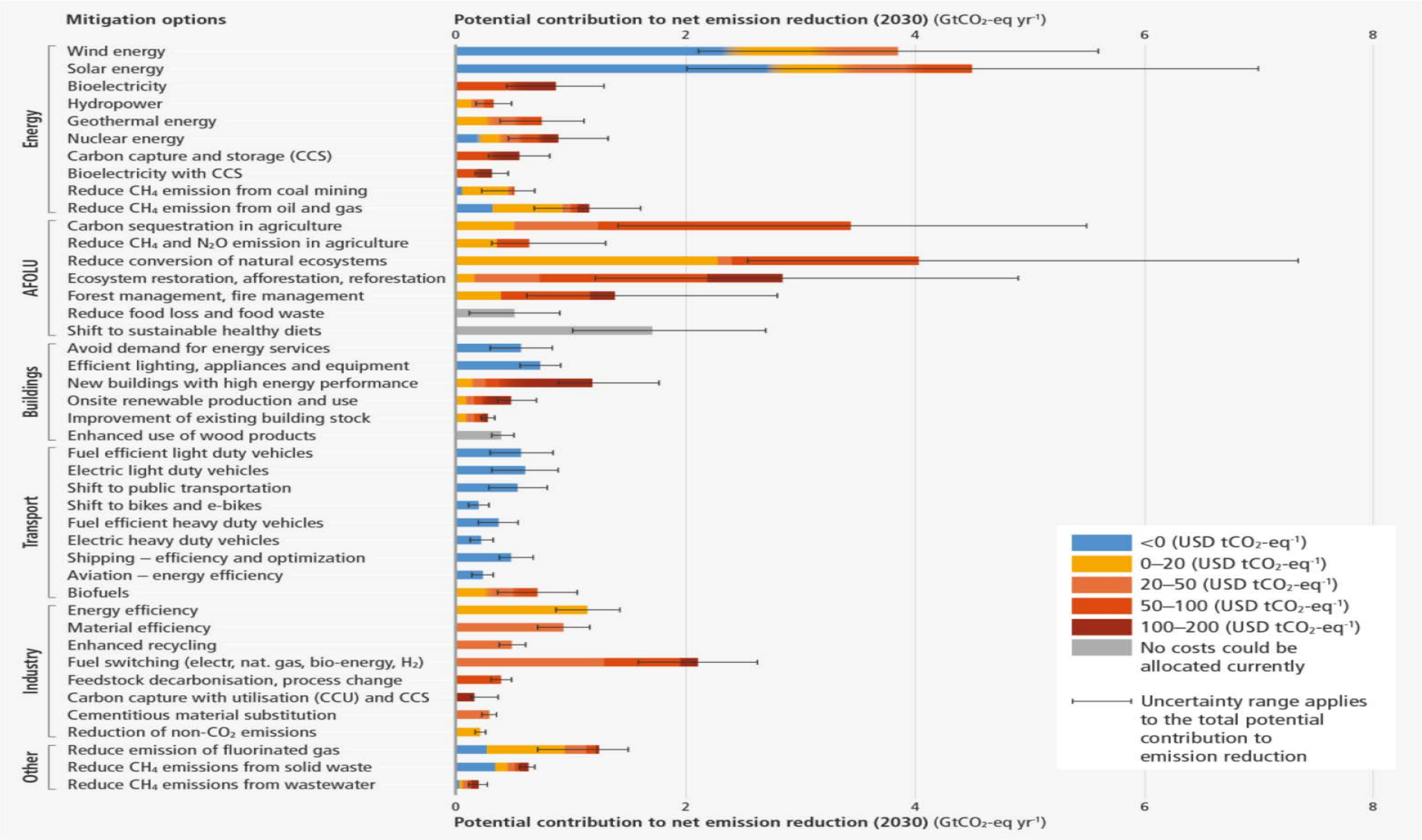
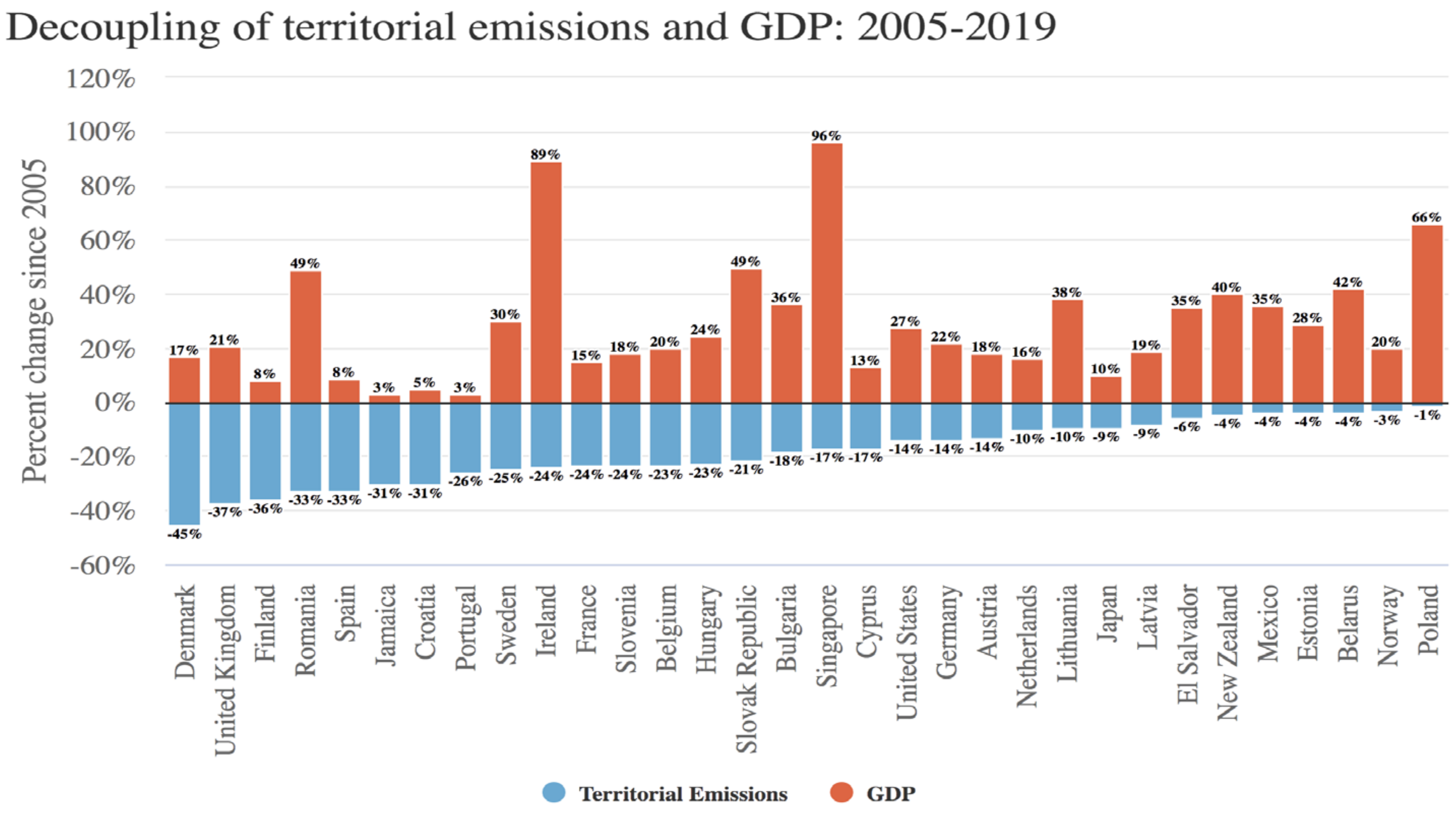
Options for emission reduction/cost efficienies



32 countries have decoupled emissions/GDP growth



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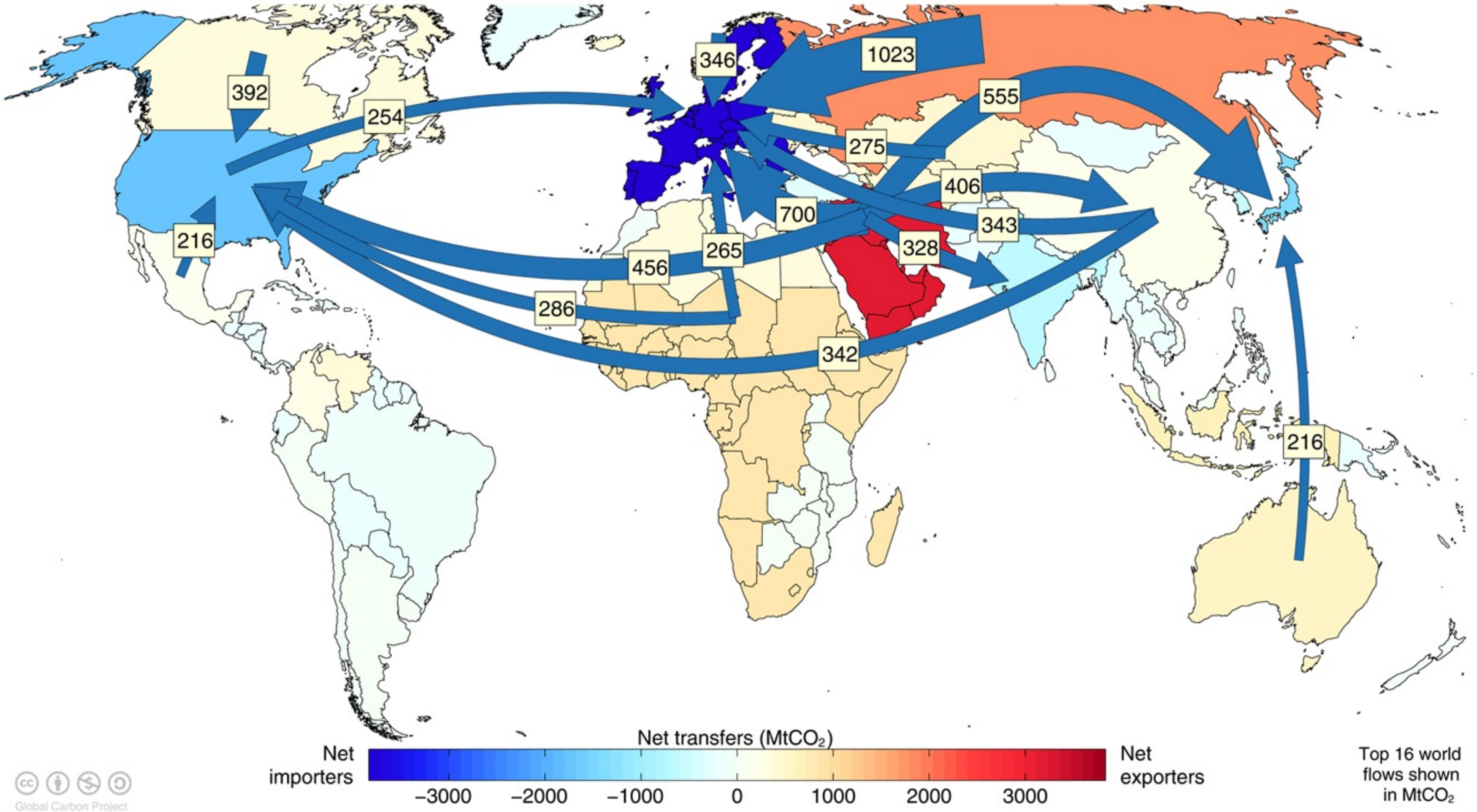
Major flows extraction -> fossil energy

Flows from location of fossil fuel extraction to location of consumption of goods and services

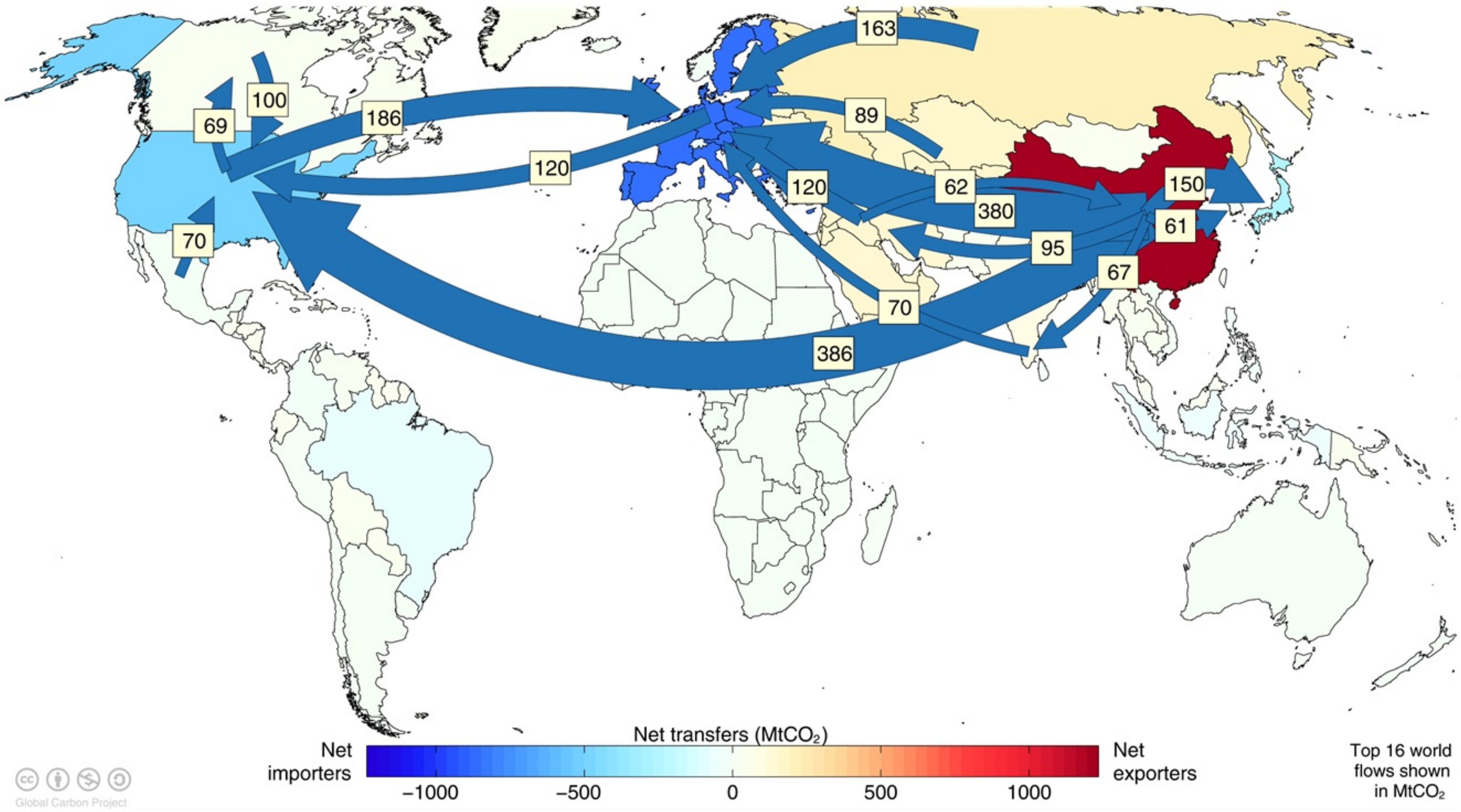


Values for 2011. EU is treated as one region. Units: $MtCO_2$

Source: Andrew et al 2013

Major flows production -> consumption

Flows from location of generation of emissions to location of consumption of goods and services



Values for 2011. EU is treated as one region. Units: $MtCO_2$
Source: Peters et al 2012

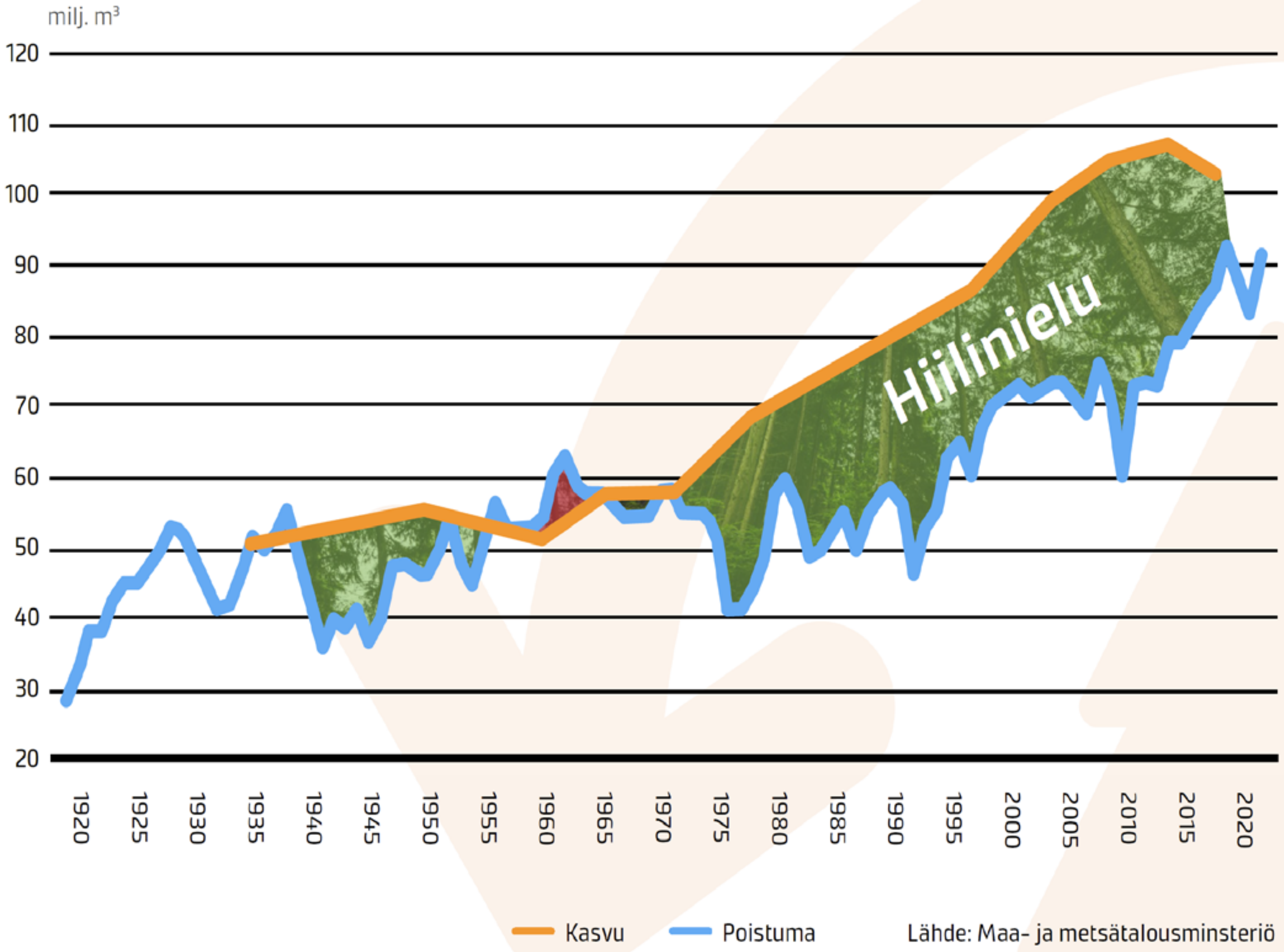
Carbon sink of Finland

Puuston vuotuinen kasvu ja poistuma

Valtakunnan metsien inventoinnin (VMI) 100 vuoden historian aikana puuston määrä, ja puustoon sitoutunut **hiilivarasto on lisääntynyt noin 70 %** ja puuston vuotuinen kasvu on **yli kaksinkertaistunut.**

Vanhat metsät ovat 100 vuoden aikana Etelä-Suomessa lisääntyneet ja Pohjois-Suomessa vähentyneet.

Metsien monimuotoisuudelle tärkeiden rakennepiirteiden kehitys on ollut myönteistä sen jälkeen, kun luonnonhoito tuli osaksi metsänhoitoa 1990-luvulla.



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Suomen perspektiivejä

1. **Ilmastonmuutoksen torjunnasta tulossa globaalia valtavirtaa:** Uusille tuotteille ja osaamiselle on kasvavaa kysyntää. Esimerkkeinä polttoaineet/energia, teknologia, kuluttajatuotteet, rakentaminen, maatalous/ruoka, metsätalous. Myös sopeutuminen: sääpalvelut, ruokaturva, vesivarojen hallinta, metsät/maatalous.

2. **Suomen ilmastopaneeli** on tehnyt aloitteen **2035 hiilineutraaliudesta, minkä Marinin hallitus on hyväksynyt ja se on myös sovittu Suomen EU-tavoitteeksi.** Tavoitteeseen sisältyy metsien hiilinielun säilyminen aiemmalla tasolla, mikä on kansainvälinen erikoisuus. Tätä on myös kritisoitu mm. Prof. Rockströmin toimesta. Metsien merkitystä talouden, työllisyyden ja hyvinvointivaltion rahoituksen kannalta ei ole huomioitu riittävästi.

3. **Suomessa metsien hyötykäyttöön ja maatalouteen liittyy voimakkaita intohimoja.** Näitä on syytä tarkastella myös muista kuin ilmastoperspektiiveistä tasapainoisen kokonaisuuden luomiseksi.

4. **Huomiota (positiivisiin) mahdollisuuksiin Suomen kannalta**: uusi energia, uudet tuotteet, myös jalostusarvojen nostot mm. kaivos- ja metsäraaka-aineille

5. **Suomen EU-politiikan terävöittäminen:** EU:n **ulkopolitiikka ilmastoaihepiirissä, Suomen etujen** parempi valvonta

6. **Biodiversiteetti on uusi kysymys.** On tärkeää spesifioda, mikä on ongelma ja mikä on järkevää politiikkaa. On hyvä erottaa Suomi ja kansainväliset ongelmat. Yleisesti ottaen tarvitaan lisää dokumentaatiota ongelmasta.

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Miten voin vaikuttaa

1. **Liikenne:** sähköautot ja –pyörät, ei-fossiiliset polttoaineet (bio, uusiutuvat, jätteet, vety...), kevyt ja julkinen liikenne

2. **Kulutus:** fossiilienergialla tuotettujen tuotteiden välttäminen (tullit/verot?). Laatua määrän sijaan.

3. **Rakennukset:** lämpöpumput, eristäminen, puumateriaalit, tilankäyttö

4. **Ruokavalio:** soijarehulla tuotetun lihan välttäminen (~mm. Amazonasin hakkuut). 75 % maailman maatalousmaasta tuottaa karjalle rehua.

5. **Päivittäiset valinnat työssä ja vapaa-ajalla**

6. **Politiikka: Raamit asetetaan hallitusten (ja EU:n toimesta)**

7. **Ilmastonmuutos voidaan ratkaista suhteellisen pienillä muutoksilla arkielämään**

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

شكرا لكم
Thank you
Gracias
Merci
Спасибо
谢谢

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale