Klimatske promjene i eksposom

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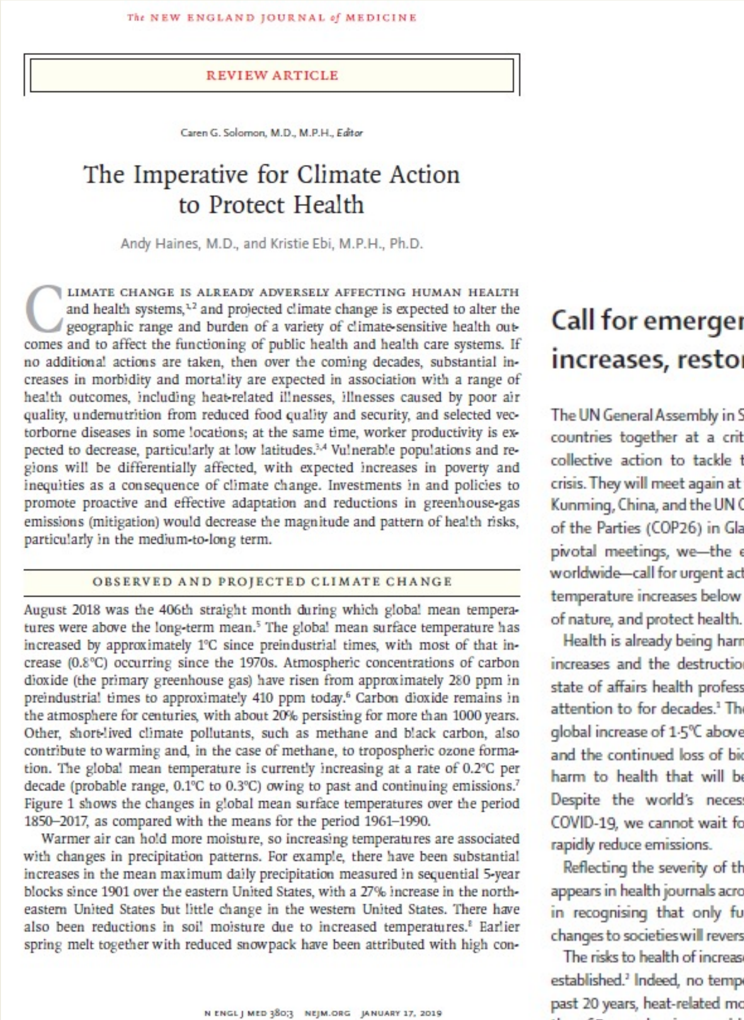


The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

Caren G. Solomon, M.D., M.P.H., *Editor*

The Imperative for Climate Action to Protect Health

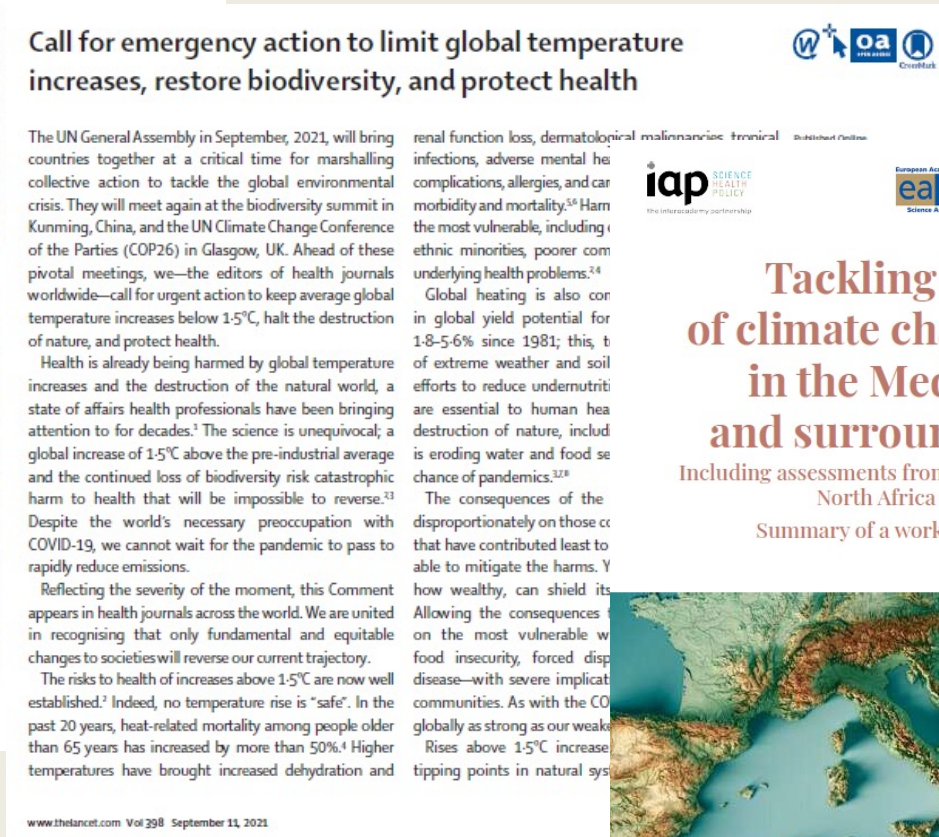
Andy Haines, M.D., and Kristie Ebi, M.P.H., Ph.D.

Climate change is already adversely affecting human health and health systems,[1,2] and projected climate change is expected to alter the geographic range and burden of a variety of climate-sensitive health outcomes and to affect the functioning of public health and health care systems. If no additional actions are taken, then over the coming decades, substantial increases in morbidity and mortality are expected in association with a range of health outcomes, including heat-related illnesses, illnesses caused by poor air quality, undernutrition from reduced food quality and security, and selected vectorborne diseases in some locations; at the same time, worker productivity is expected to decrease, particularly at low latitudes.[3,4] Vulnerable populations and regions will be differentially affected, with expected increases in poverty and inequities as a consequence of climate change. Investments in and policies to promote proactive and effective adaptation and reductions in greenhouse-gas emissions (mitigation) would decrease the magnitude and pattern of health risks, particularly in the medium-to-long term.

OBSERVED AND PROJECTED CLIMATE CHANGE

August 2018 was the 406th straight month during which global mean temperatures were above the long-term mean.[5] The global mean surface temperature has increased by approximately 1°C since preindustrial times, with most of that increase (0.8°C) occurring since the 1970s. Atmospheric concentrations of carbon dioxide (the primary greenhouse gas) have risen from approximately 280 ppm in preindustrial times to approximately 410 ppm today.[6] Carbon dioxide remains in the atmosphere for centuries, with about 20% persisting for more than 1000 years. Other, short-lived climate pollutants, such as methane and black carbon, also contribute to warming and, in the case of methane, to tropospheric ozone formation. The global mean temperature is currently increasing at a rate of 0.2°C per decade (probable range, 0.1°C to 0.3°C) owing to past and continuing emissions.[7] Figure 1 shows the changes in global mean surface temperatures over the period 1850–2017, as compared with the means for the period 1961–1990.

Warmer air can hold more moisture, so increasing temperatures are associated with changes in precipitation patterns. For example, there have been substantial increases in the mean maximum daily precipitation measured in sequential 5-year blocks since 1901 over the eastern United States, with a 27% increase in the northeastern United States but little change in the western United States. There have also been reductions in soil moisture due to increased temperatures.[8] Earlier spring melt together with reduced snowpack have been attributed with high con-



Call for emergency action to limit global temperature increases, restore biodiversity, and protect health

The UN General Assembly in September, 2021, will bring countries together at a critical time for marshalling collective action to tackle the global environmental crisis. They will meet again at the biodiversity summit in Kunming, China, and the UN Climate Change Conference of the Parties (COP26) in Glasgow, UK. Ahead of these pivotal meetings, we—the editors of health journals worldwide—call for urgent action to keep average global temperature increases below 1·5°C, halt the destruction of nature, and protect health.

Health is already being harmed by global temperature increases and the destruction of the natural world, a state of affairs health professionals have been bringing attention to for decades.[1] The science is unequivocal; a global increase of 1·5°C above the pre-industrial average and the continued loss of biodiversity risk catastrophic harm to health that will be impossible to reverse.[2,3] Despite the world's necessary preoccupation with COVID-19, we cannot wait for the pandemic to pass to rapidly reduce emissions.

Reflecting the severity of the moment, this Comment appears in health journals across the world. We are united in recognising that only fundamental and equitable changes to societies will reverse our current trajectory.

The risks to health of increases above 1·5°C are now well established.[2] Indeed, no temperature rise is "safe". In the past 20 years, heat-related mortality among people older than 65 years has increased by more than 50%.[4] Higher temperatures have brought increased dehydration and

renal function loss, dermatological malignancies, tropical infections, adverse mental he
complications, allergies, and car
morbidity and mortality.[5,6] Harm
the most vulnerable, including
ethnic minorities, poorer com
underlying health problems.[2,4]

Global heating is also con
in global yield potential for
1·8–5·6% since 1981; this, t
of extreme weather and soil
efforts to reduce undernutriti
are essential to human hea
destruction of nature, includ
is eroding water and food se
chance of pandemics.[3,7,8]

The consequences of the
disproportionately on those c
that have contributed least to
able to mitigate the harms. Y
how wealthy, can shield its
Allowing the consequences
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communities. As with the CO
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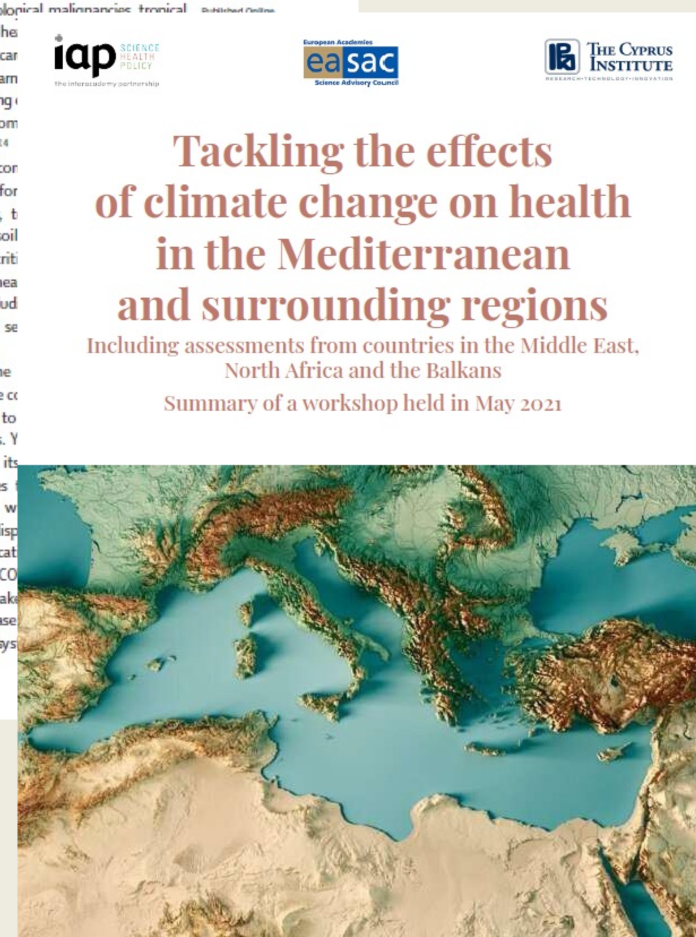
Rises above 1·5°C increase
tipping points in natural sys



Tackling the effects of climate change on health in the Mediterranean and surrounding regions

Including assessments from countries in the Middle East, North Africa and the Balkans

Summary of a workshop held in May 2021

Relevantni klimatski parametri

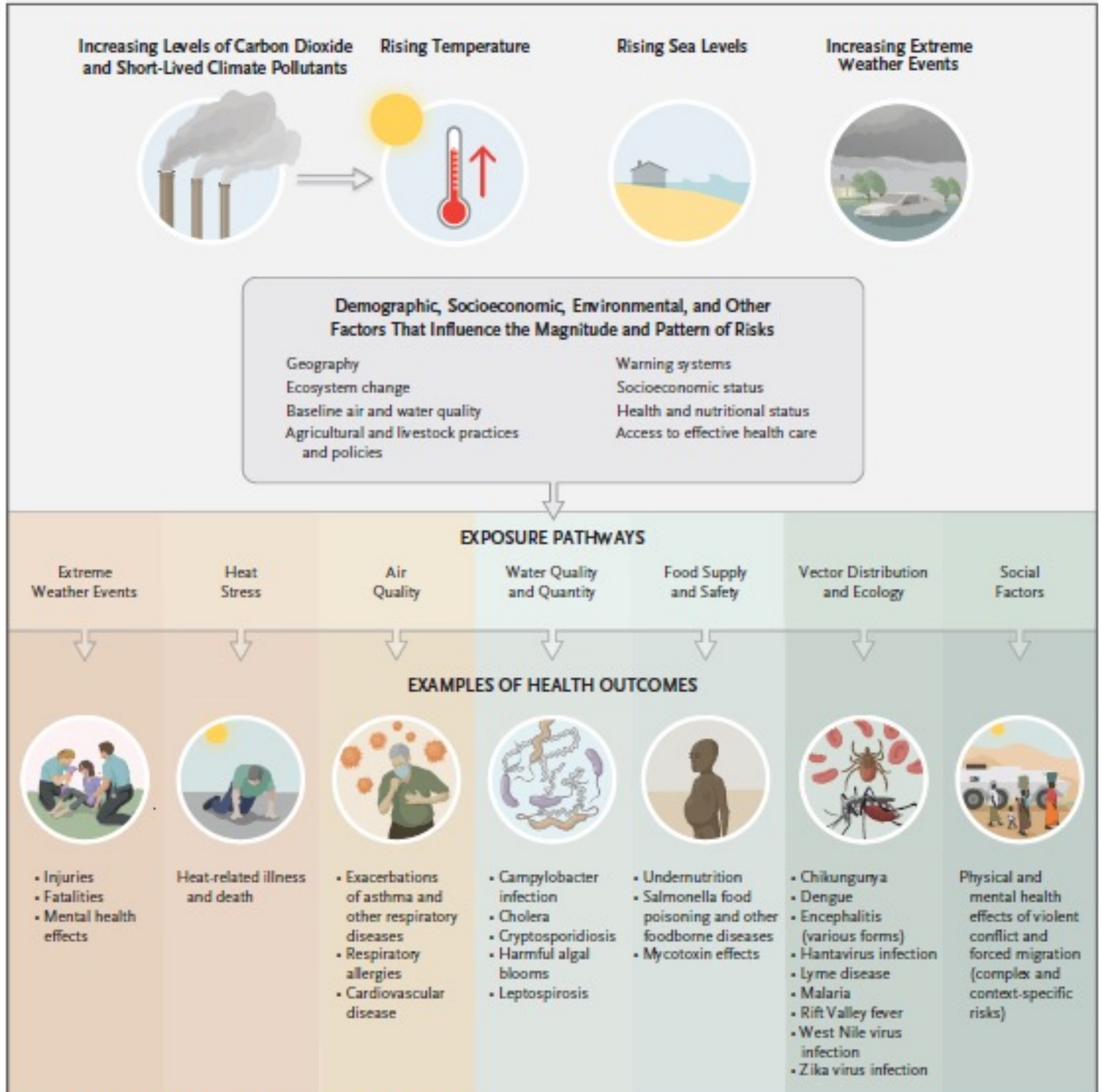
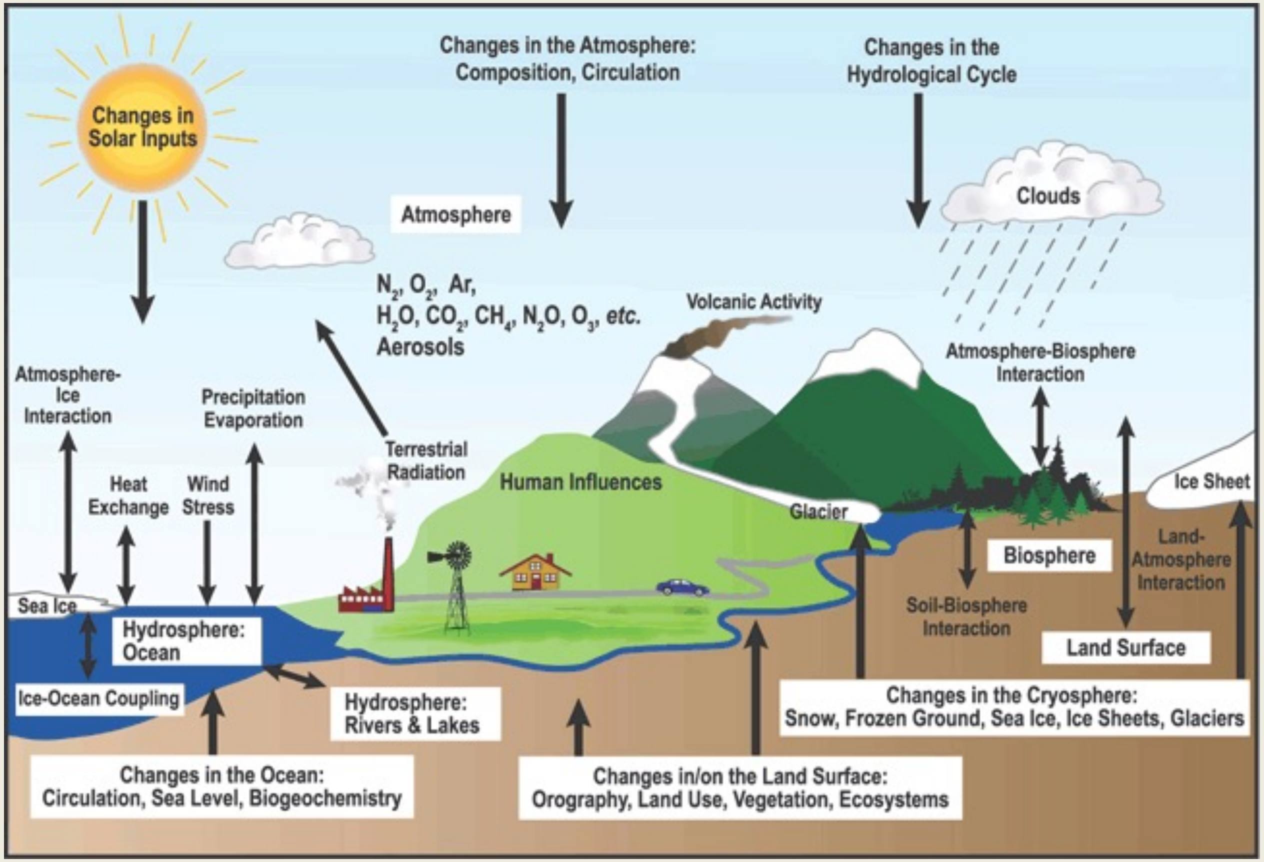


Figure 3. Major Health Risks Associated with Climate Change.

Examples of potential health outcomes and exposure pathways linking climate change with human health are shown, together with factors that can influence the magnitude and pattern of risks. The figure is based on several sources (e.g., Ebi et al.,[3] Smith et al.,[4] the World Health Organization,[16] Hallegatte et al.,[17] and Missirian and Schlenker[18]) and is not intended to be comprehensive.

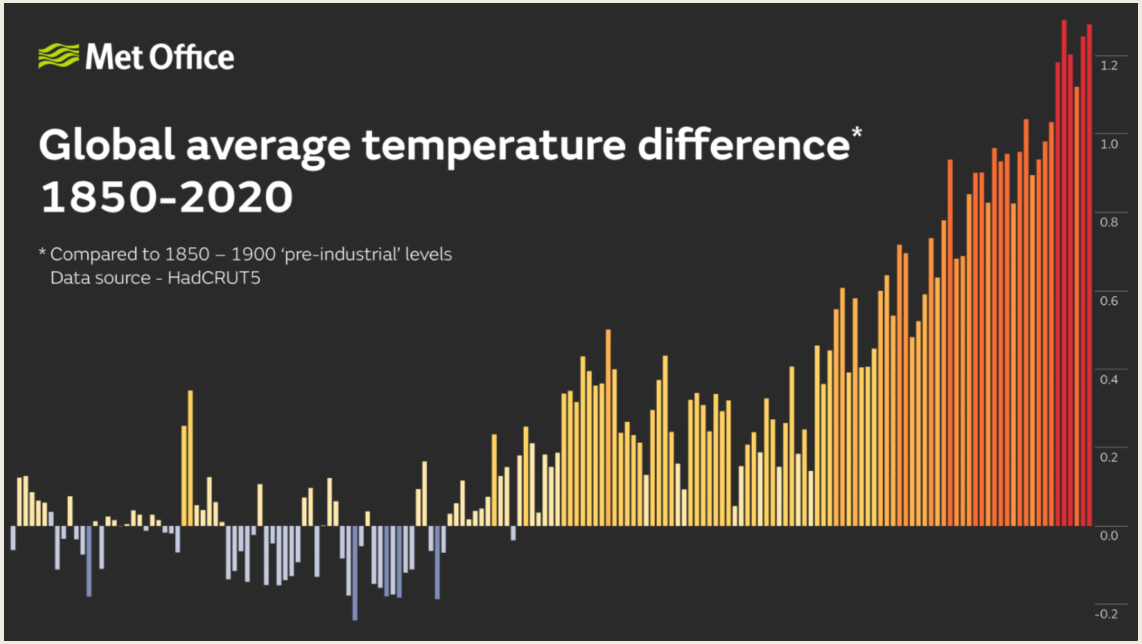
A. Haines, K. Ebi (2019)

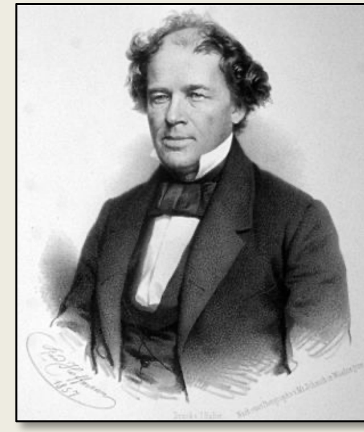
Klimatski sustav



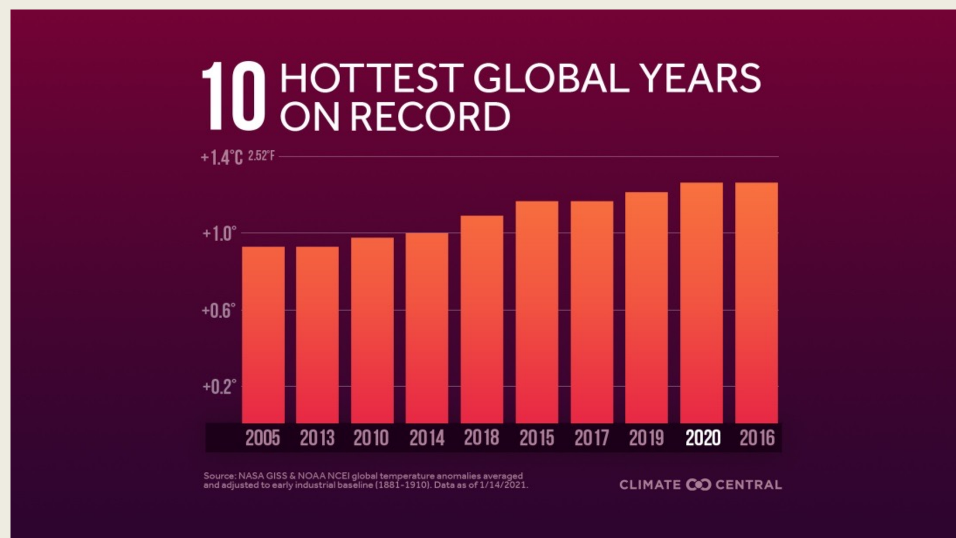
- Atmosfera
- Oceani i mora
- Ledeni pokrov
- Rijeke i jezera
- Podzemne vode
- Kopno
- Biosfera

Opažanje temperature i rekordi



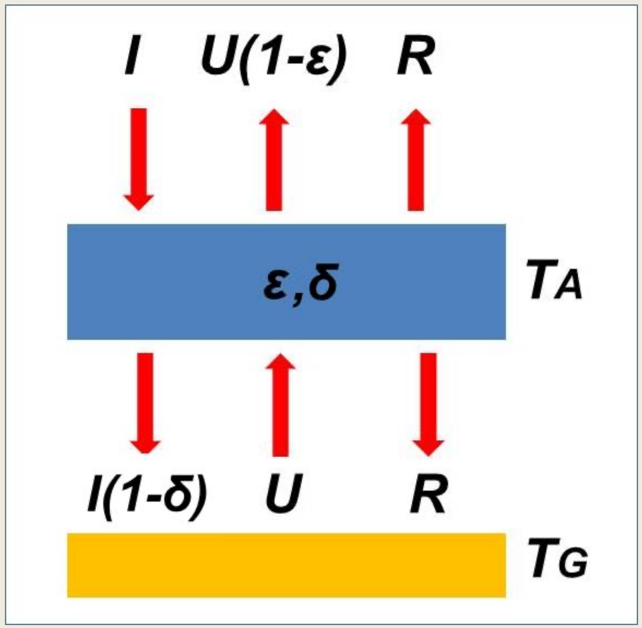


M. F. Maury (1853)



Efekt staklenika i njegove promjene

S. Arrhenius (1896)

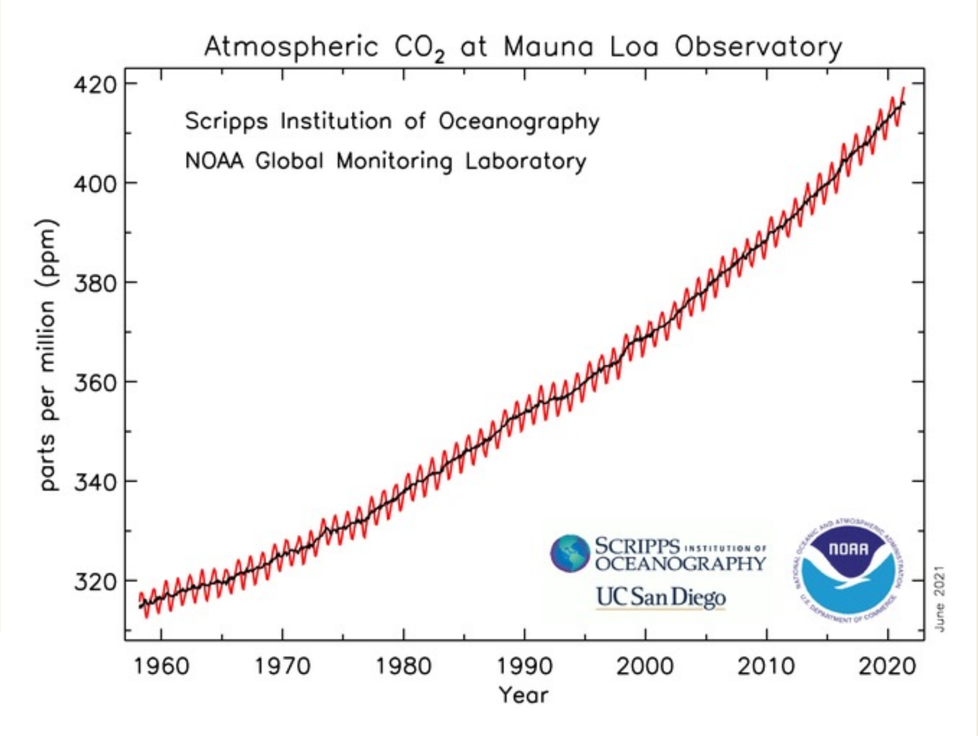


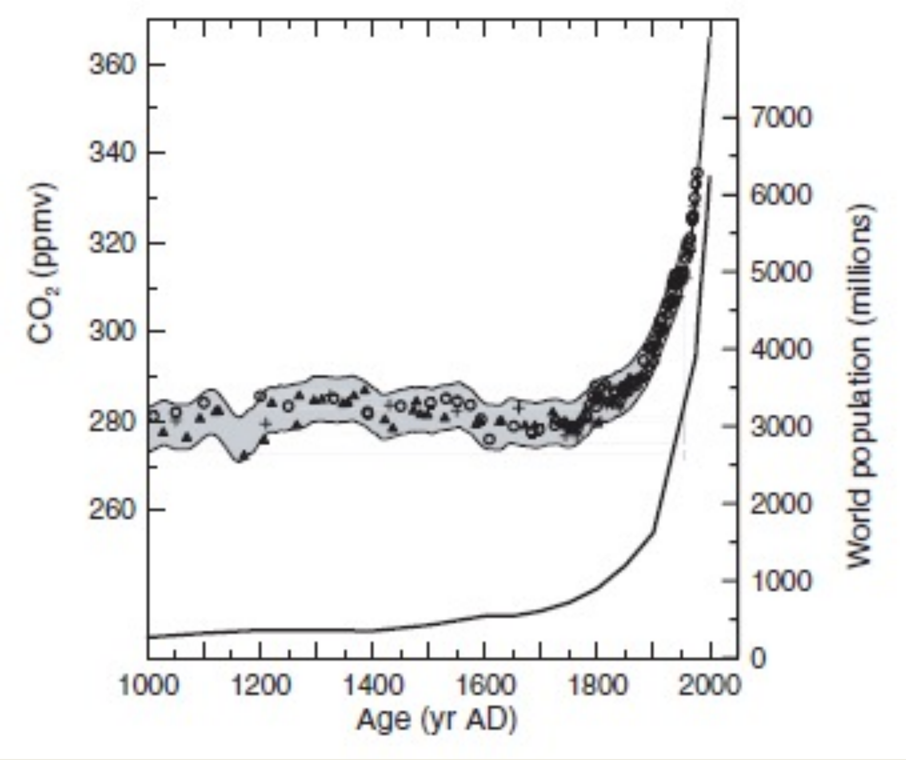
$$U = \frac{I(2-\delta)}{2-\varepsilon}, R = \frac{I(\varepsilon+\delta-\varepsilon\delta)}{2-\varepsilon},$$

$$T_G = \sqrt[4]{\frac{I(2-\delta)}{\sigma(2-\varepsilon)}}, T_A = \sqrt[4]{\frac{I(\varepsilon+\delta-\varepsilon\delta)}{\sigma\varepsilon(2-\varepsilon)}}$$

$$I = 239\ \frac{W}{m^2}, \sigma = 5.67\ 10^{-8}\ \frac{W}{m^2 K^4}, \varepsilon = k_e \rho_e H, \delta = k_d \rho_d H$$

Staklenički plinovi (CO_2…)





J. M. Barnola (1999)

Numeričko modeliranje sustava atmosfera – more

S. Manabe, K. Bryan (1969)

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+w\frac{\partial u}{\partial z}-fv=-\frac{1}{\rho}\frac{\partial p}{\partial x}+F_x$$

$$\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+w\frac{\partial v}{\partial z}+fu=-\frac{1}{\rho}\frac{\partial p}{\partial y}+F_y$$

$$0=-\frac{1}{\rho}\frac{\partial p}{\partial z}-g$$

$$\frac{\partial \rho}{\partial t}+\frac{\partial}{\partial x}(\rho u)+\frac{\partial}{\partial y}(\rho v)+\frac{\partial}{\partial z}(\rho w)=0$$

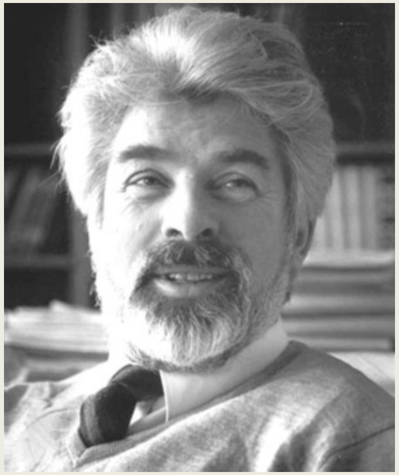
$$p=\rho RT$$

$$C_p\frac{dT}{dt}-\frac{1}{\rho}\frac{dp}{dt}=Q$$

IBM POWER7 775

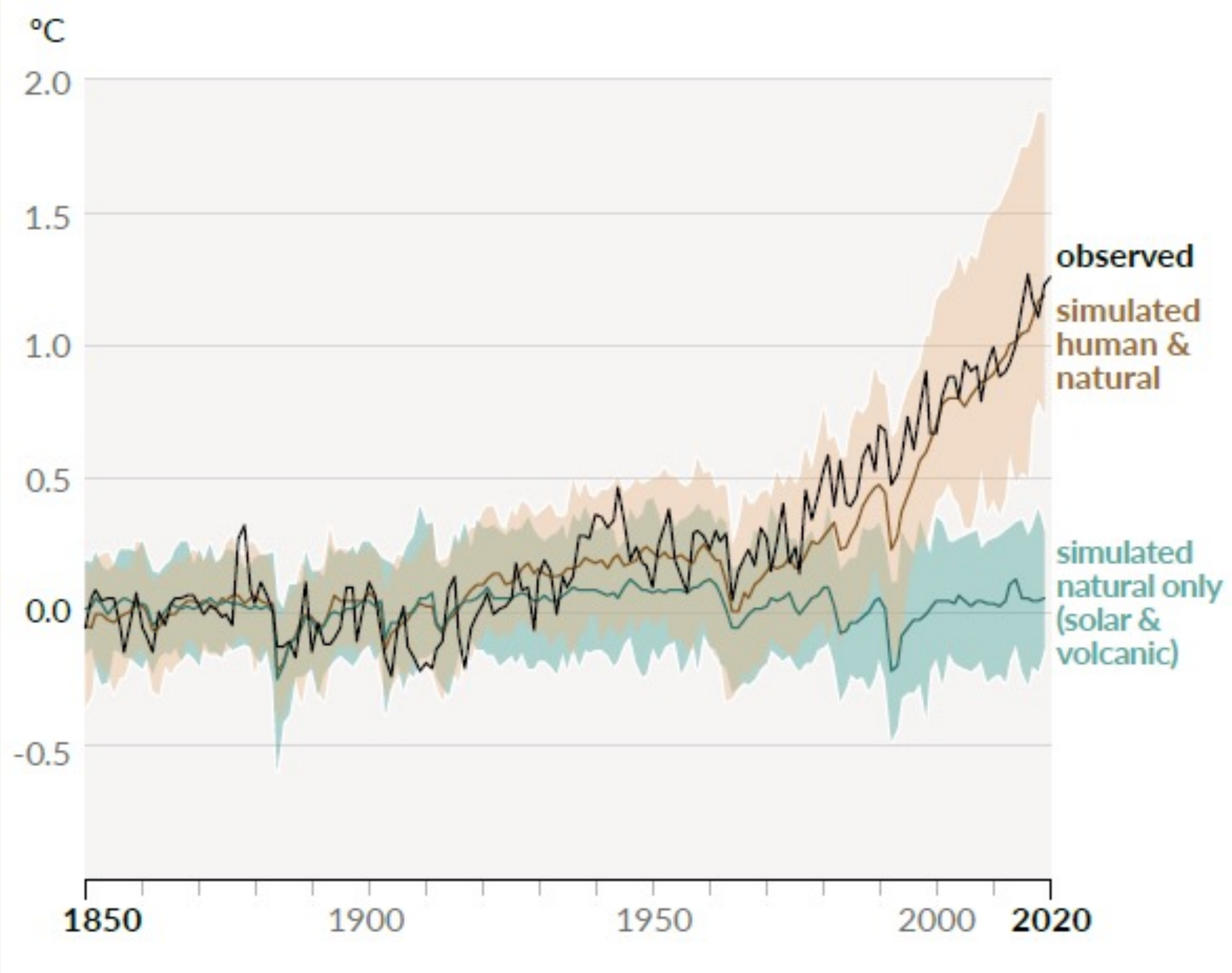
F_x, F_y – *friction*

Q – *heating / cooling*



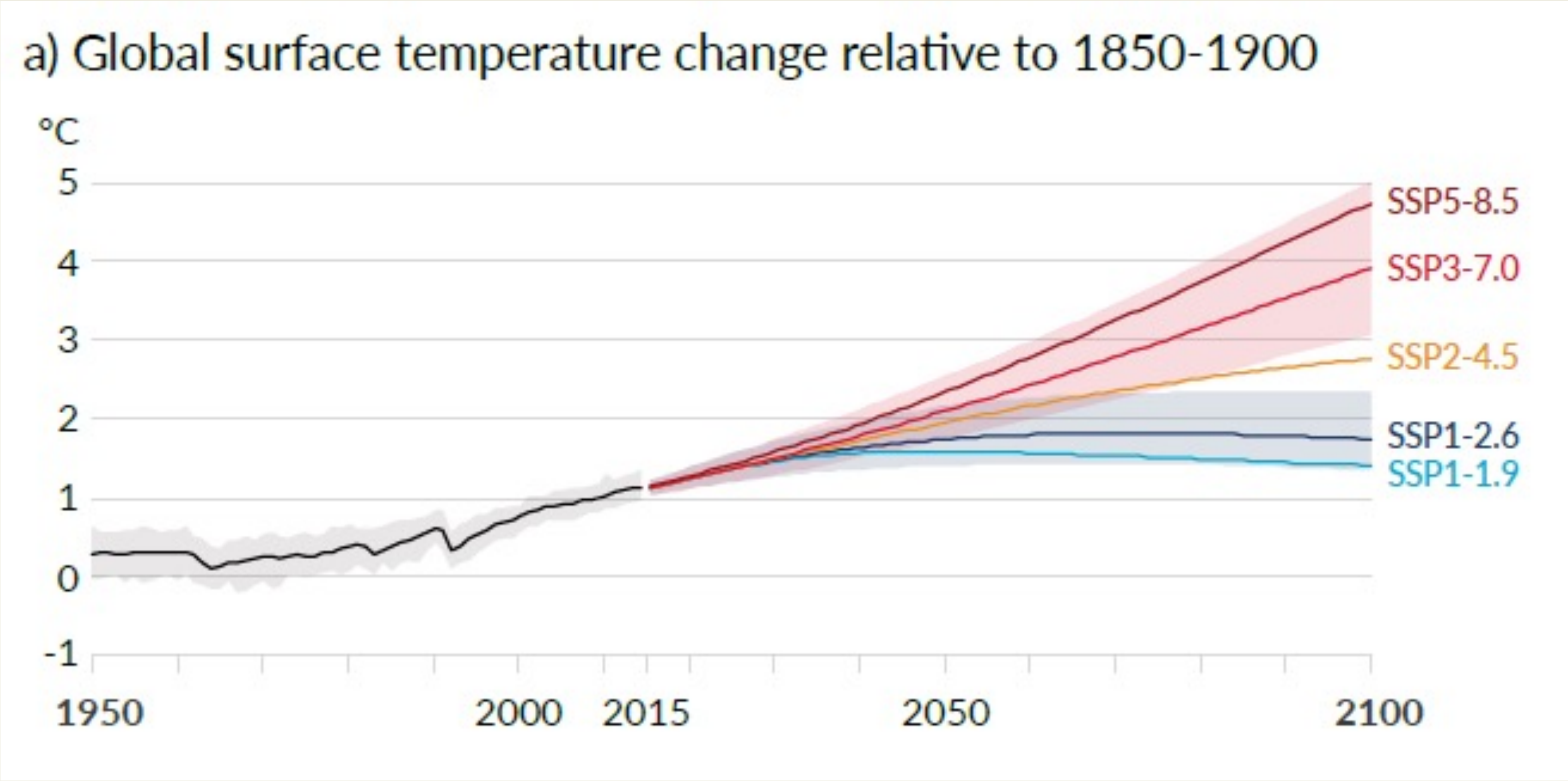
K. Hasselmann
(1976, 1979)

Razlikovanje prirodnih i antropogenih procesa



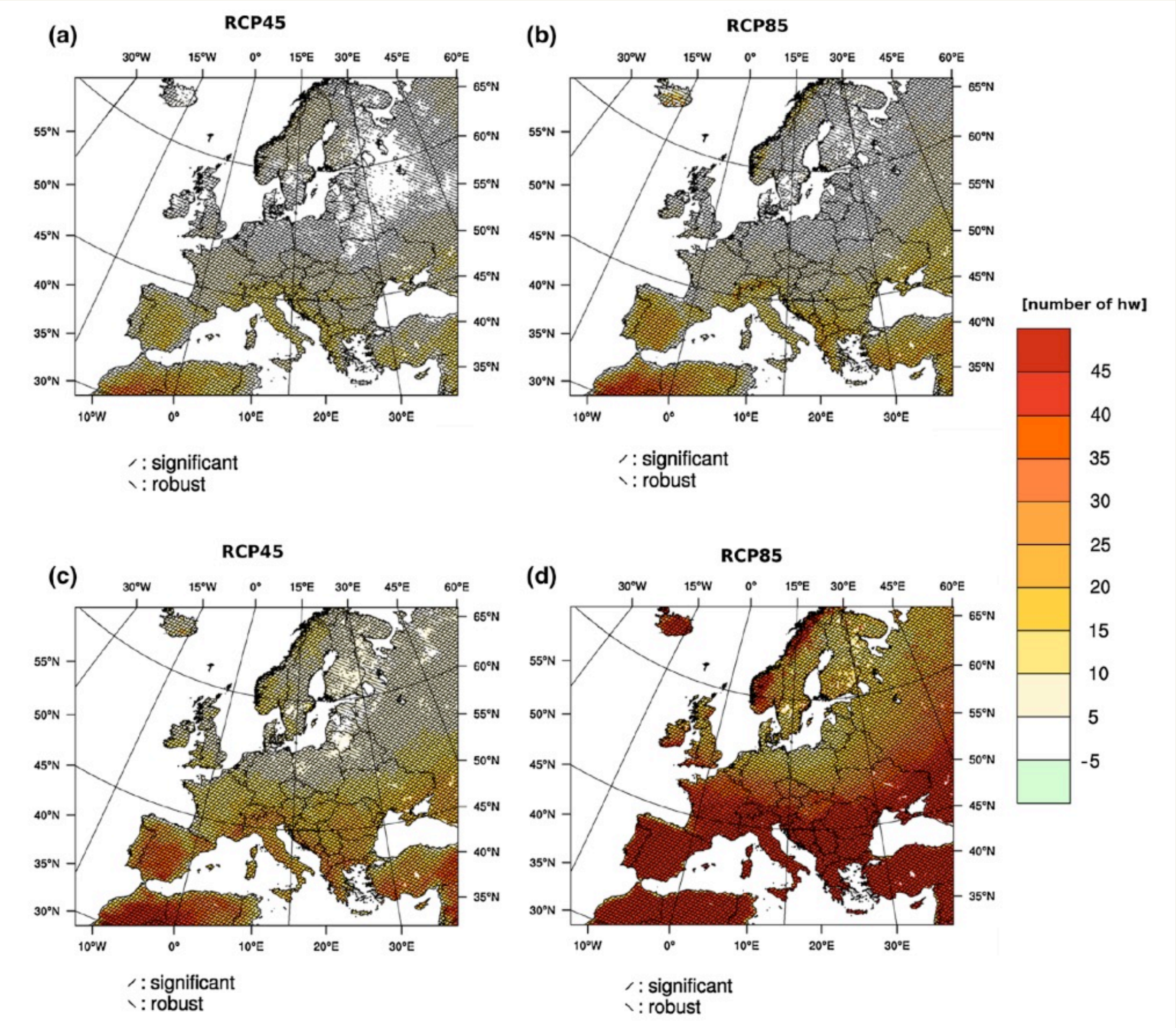
IPCC (2021)

Projekcije globalne temperature



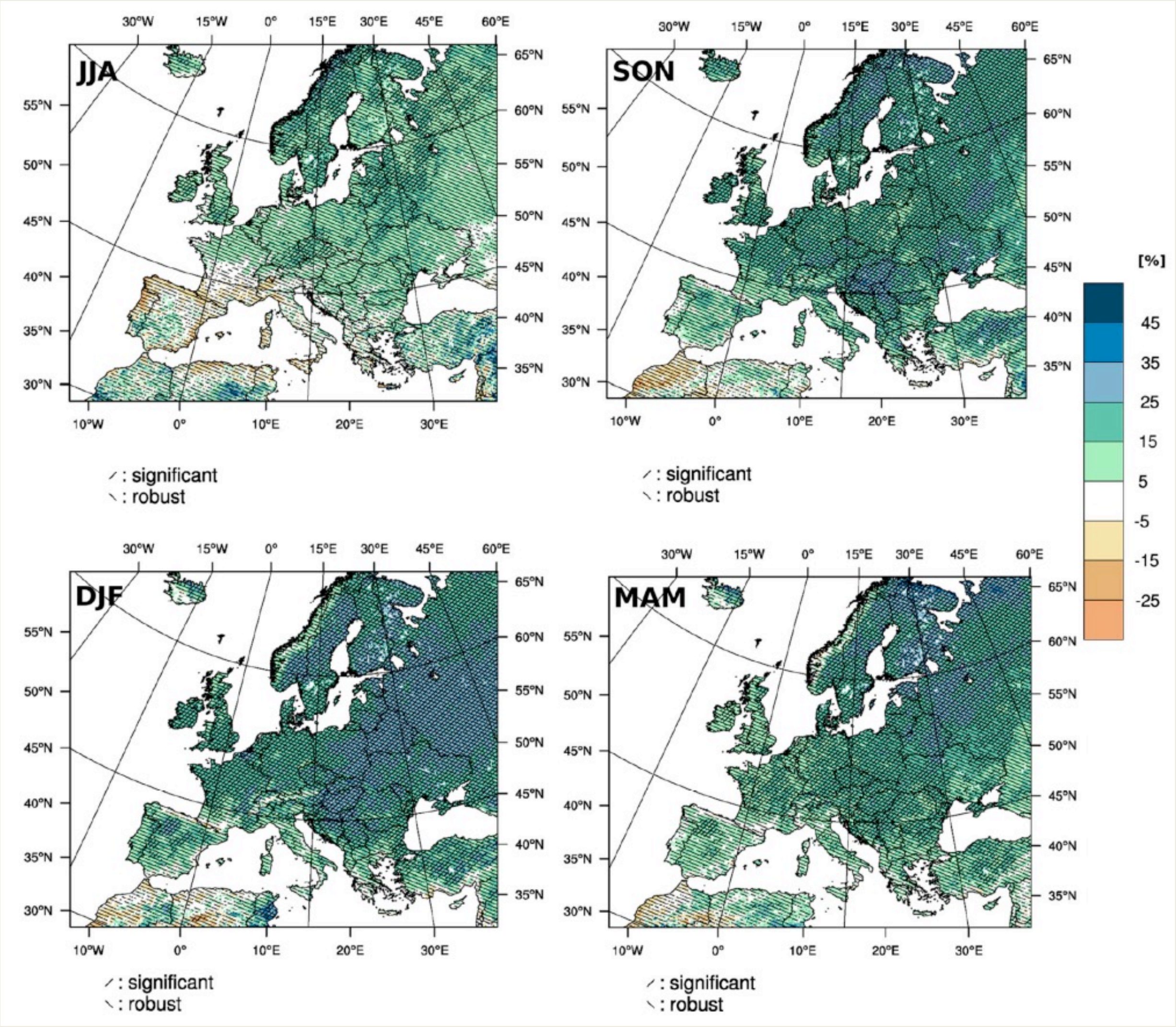
IPCC (2021)

Promjena broja toplinskih valova
(od 1971./2000. do 2021./2050. i do 2071./2100.)



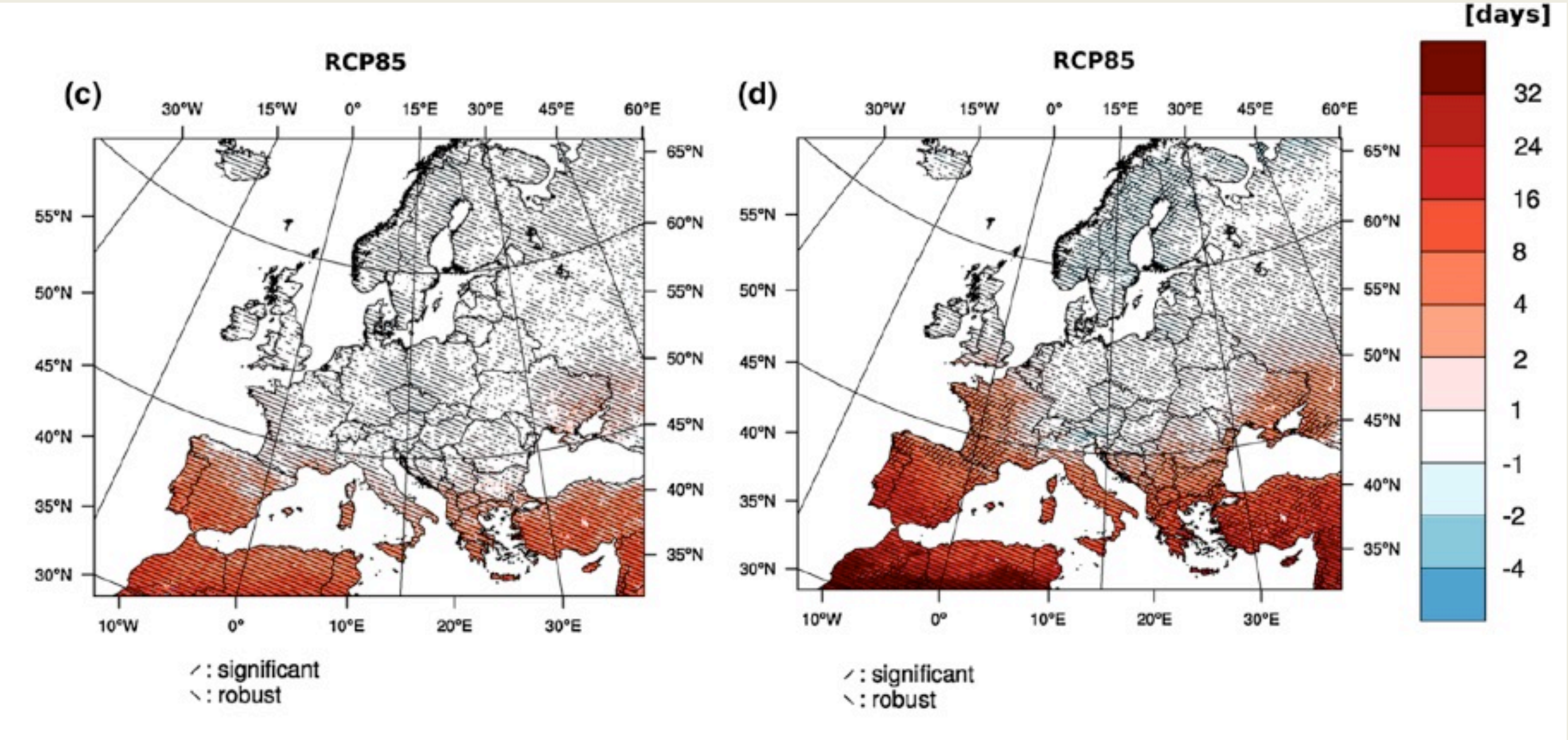
D. Jacob et al. (2014)

Postotna promjena intenzivnih oborina (od 1971./2000. do 2071./2100., scenarij RCP8.5)



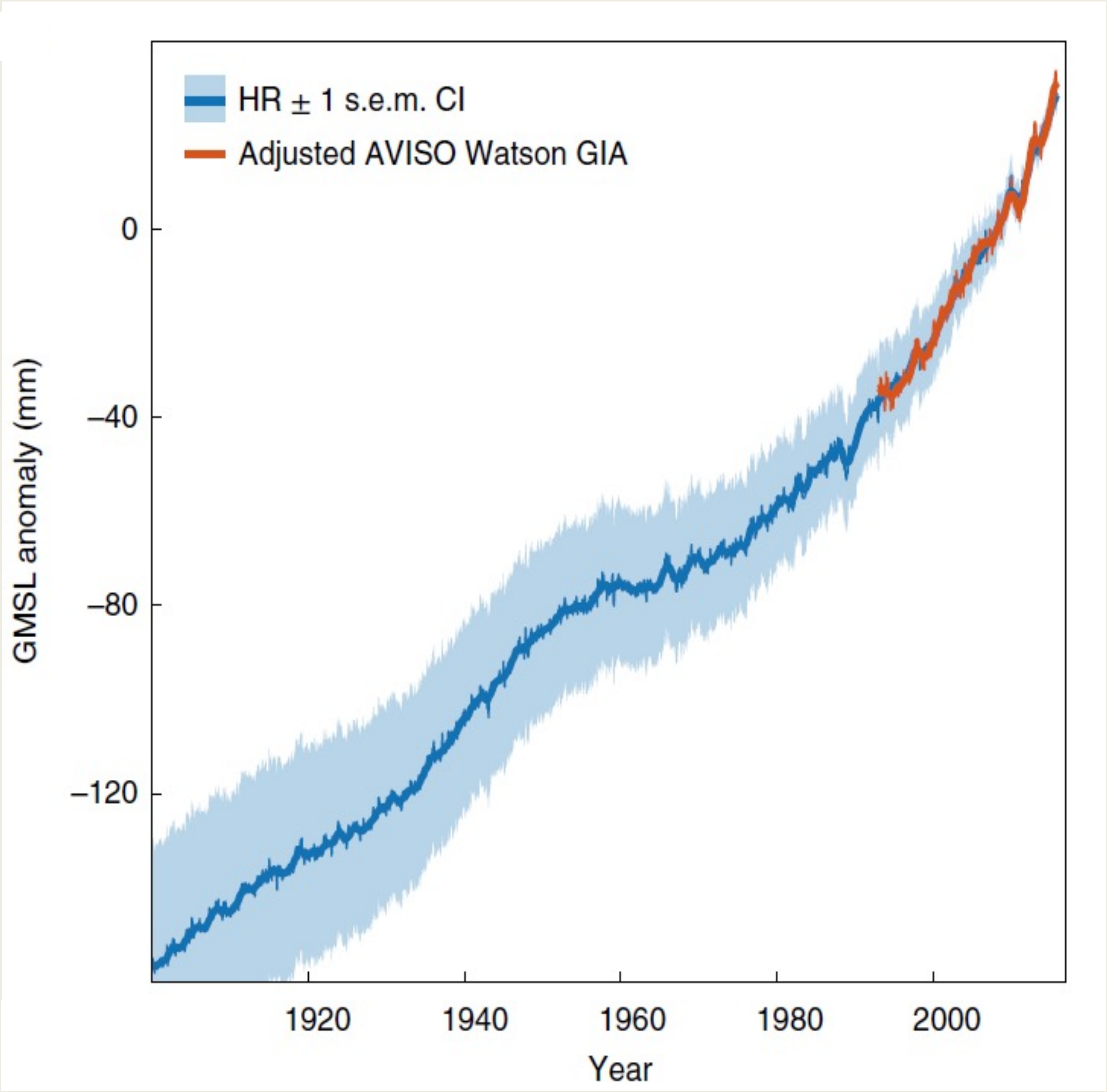
D. Jacob et al. (2014)

Promjena trajanja sušnih razdoblja
(od 1971./2000. do 2021./2050. i do 2071./2100.)



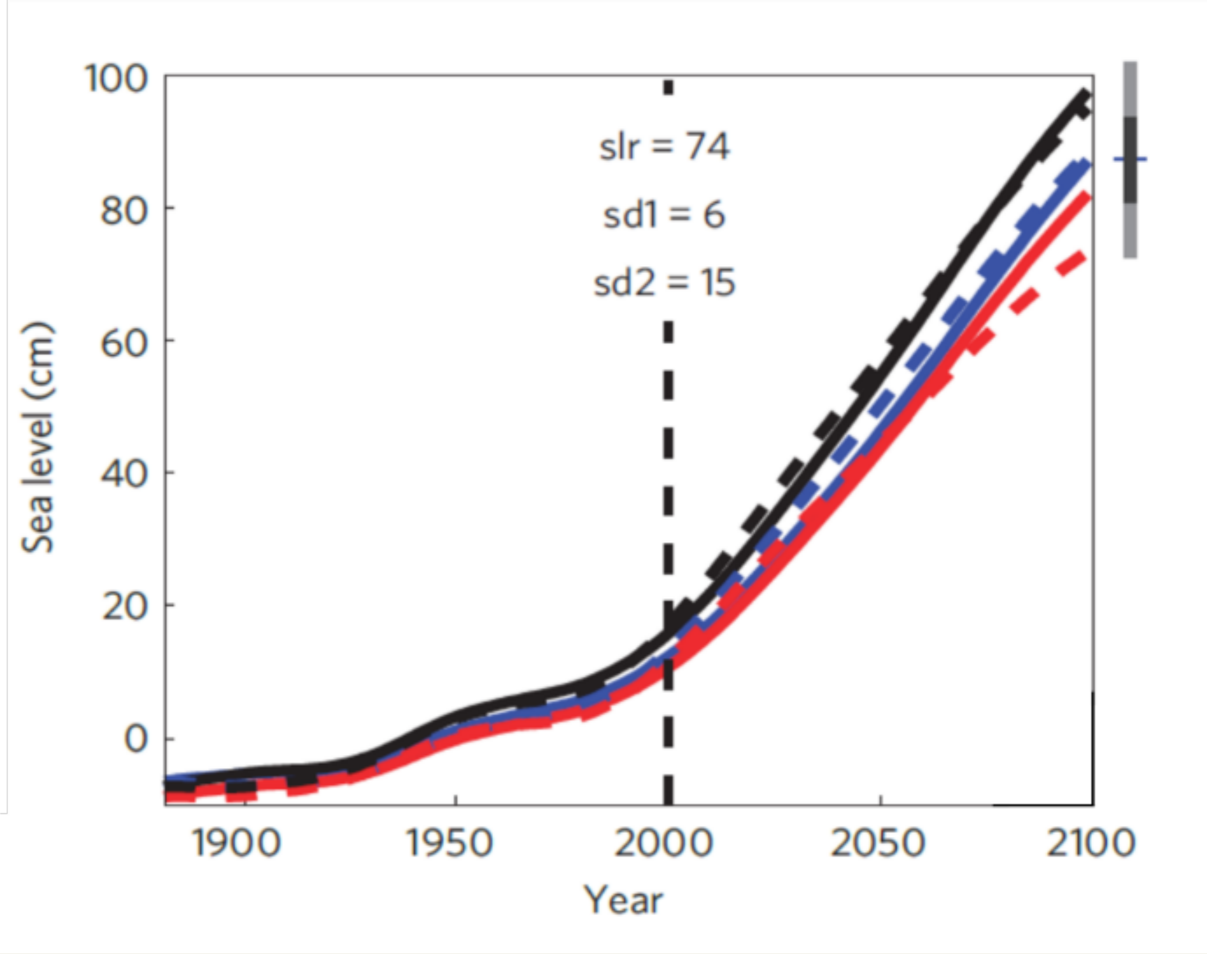
D. Jacob et al. (2014)

Promjene visine morske razine



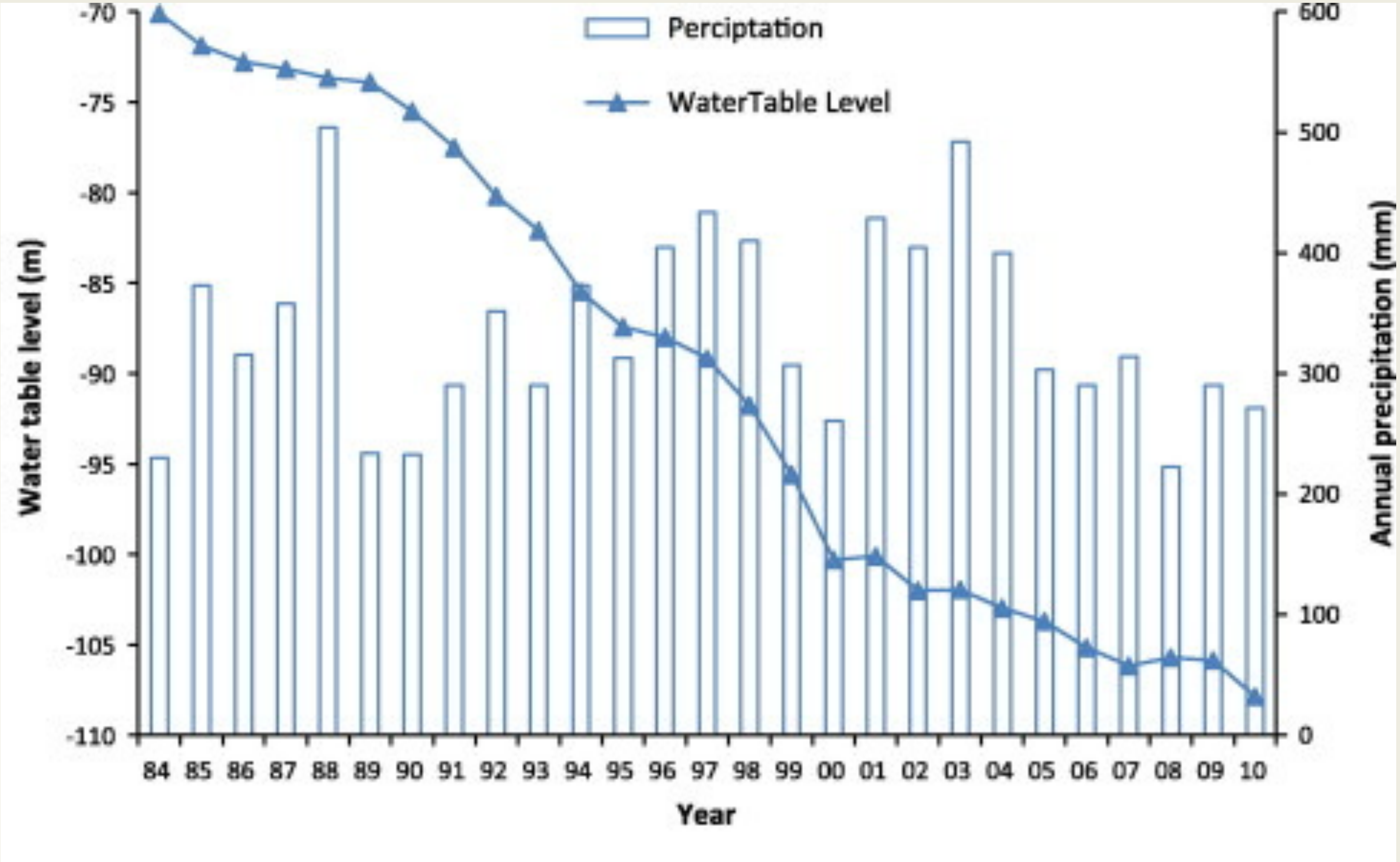
S. Dangendorf et al. (2019)

Projekcija visine morske razine



M. Orlić, Z. Pasarić (2013)

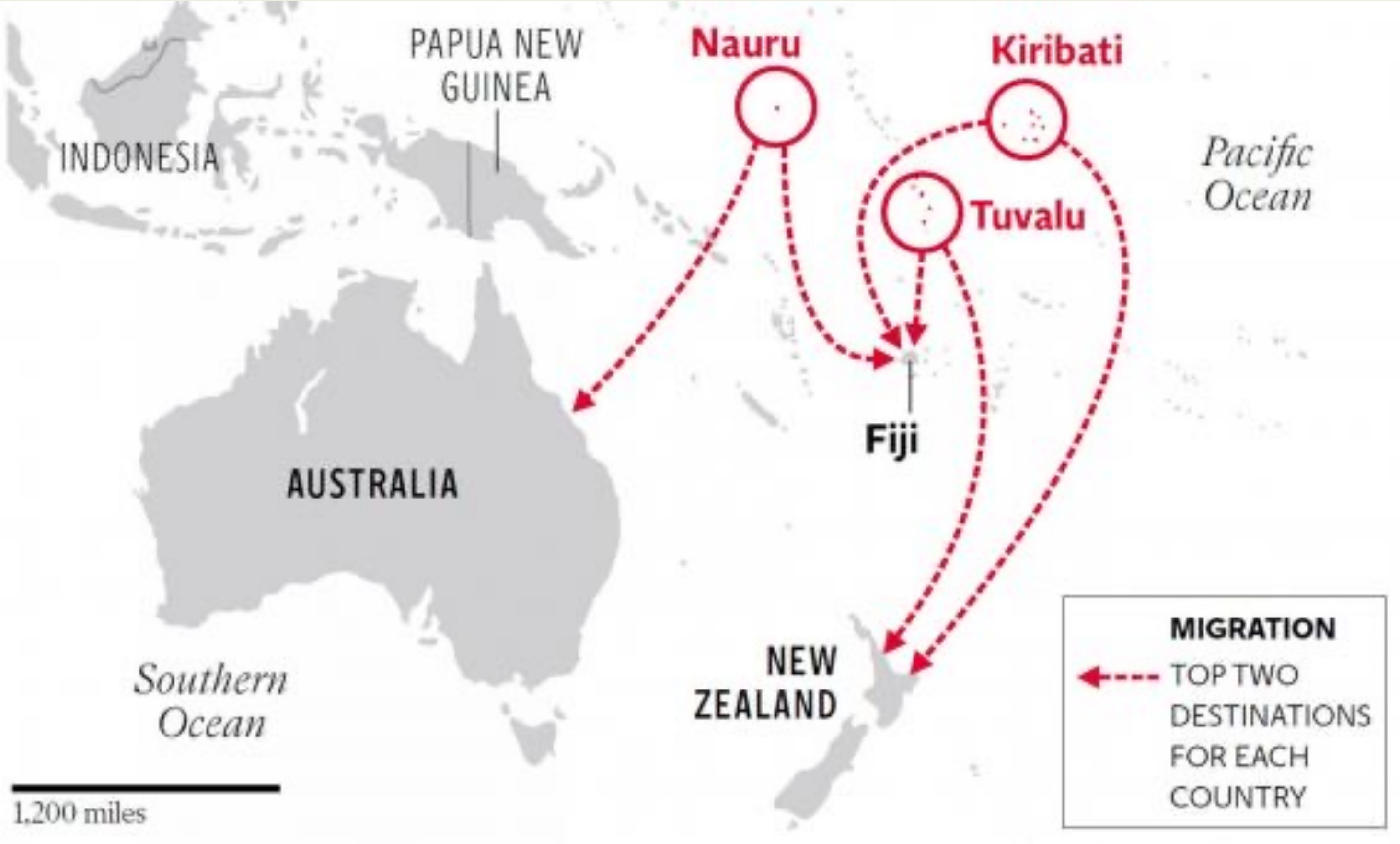
Primjer smanjenog uroda i stihijskih migracija: Oborina i razina podzemnih voda u području Sirije



Source: Authors' elaboration based on ICARDA water table and pluviometry database, 1984 - 2010.

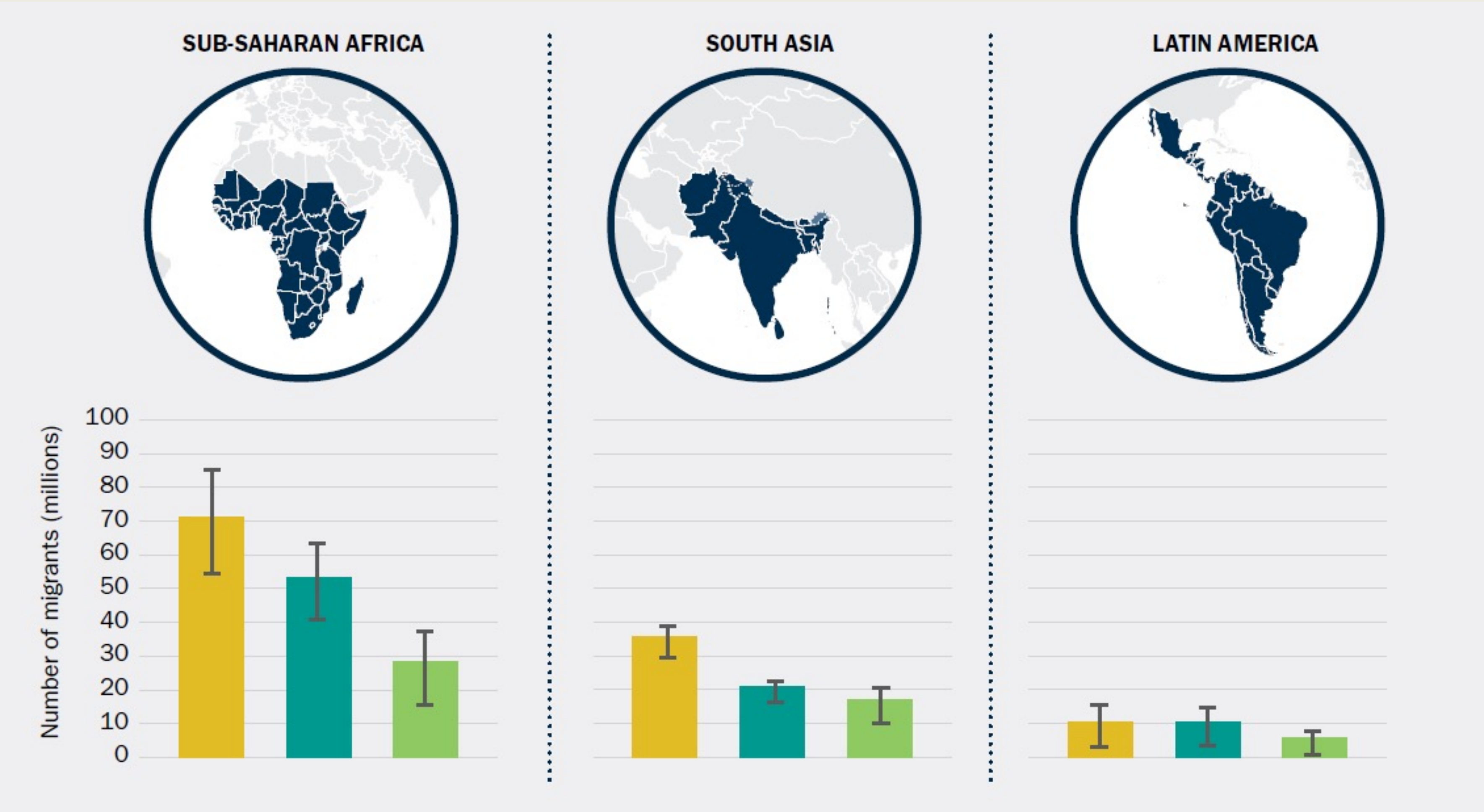
A. Aw-Hassan et al. (2014)

Primjer organiziranih migracija: Podizanje morske razine



T. Bawden (2015)

Očekivane buduće unutarnje migracije povezane sa sušom i podizanjem morske razine



World Bank (2018)

Što mogu učiniti znanstvenici

- Vršiti istraživanja da bi se reducirala nepouzdanost projekcija (*investigation*).
- Istražiti kako se mogu ublažiti klimatske promjene i time izbjegnuti najgori scenariji (*mitigation*).
- Razmotriti mogućnost prilagodbe novim uvjetima života, gdje god je moguće (*adaptation*).

Intergovernmental Panel on Climate Change (IPCC),
Assessment Reports
(1990, 1995, 2001, 2007, 2013, 2021)

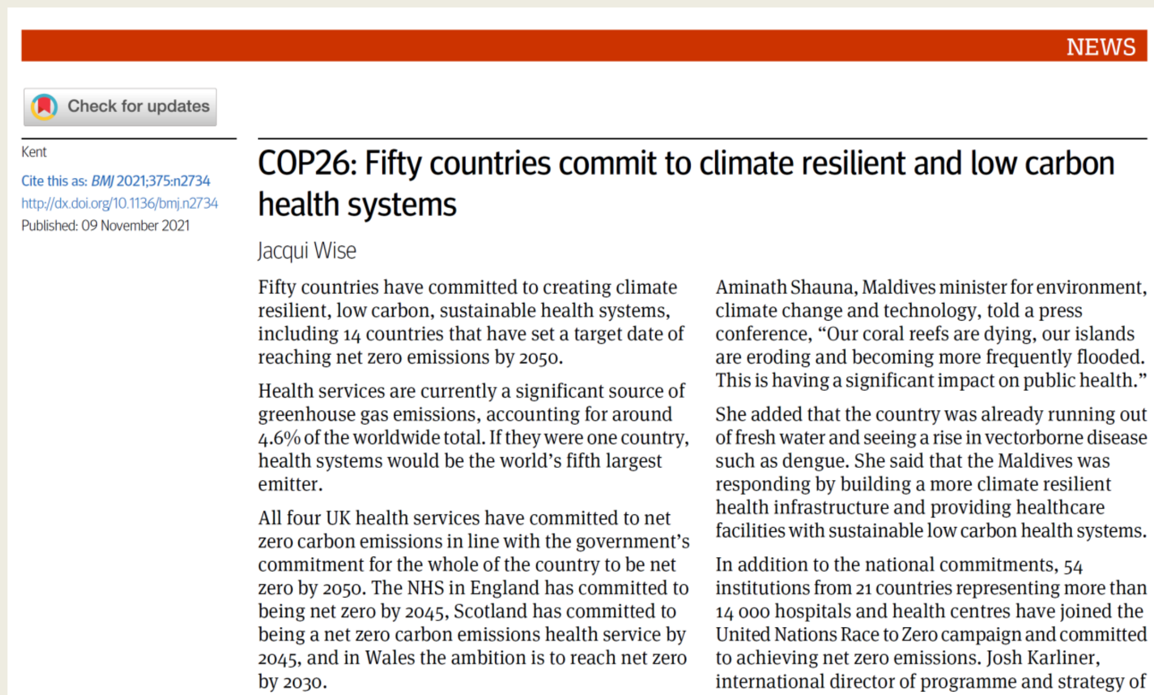
Što mogu učiniti političari

- Razviti politike koje će omogućiti njihovim državama da se prilagode klimatskim promjenama.
- Podržati sudjelovanje svojih država u međunarodnim projektima ublažavanja klimatskih promjena.
- Poticati međunarodnu suradnju koja uvažava činjenicu da su klimatskim promjenama najviše pridonijele razvijene države dok će posljedice tih promjena najviše osjetiti države u razvoju.

Paris Climate Agreement (2015)

Što svatko može učiniti

- Smanjiti upotrebu automobila.
- Koristiti avionski prijevoz samo kad je to nužno potrebno.
- Promijeniti prehrambene navike.
- Paziti na efikasnost zagrijavanja/hlađenja domova.
- Štititi zelene površine.
- Pažljivo ulagati svoj novac (tako da se smanji ugljični otisak).
- Utjecati na političare.



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COP26: Fifty countries commit to climate resilient and low carbon health systems

Jacqui Wise

Fifty countries have committed to creating climate resilient, low carbon, sustainable health systems, including 14 countries that have set a target date of reaching net zero emissions by 2050.

Health services are currently a significant source of greenhouse gas emissions, accounting for around 4.6% of the worldwide total. If they were one country, health systems would be the world's fifth largest emitter.

All four UK health services have committed to net zero carbon emissions in line with the government's commitment for the whole of the country to be net zero by 2050. The NHS in England has committed to being net zero by 2045, Scotland has committed to being a net zero carbon emissions health service by 2045, and in Wales the ambition is to reach net zero by 2030.

Aminath Shauna, Maldives minister for environment, climate change and technology, told a press conference, "Our coral reefs are dying, our islands are eroding and becoming more frequently flooded. This is having a significant impact on public health."

She added that the country was already running out of fresh water and seeing a rise in vectorborne disease such as dengue. She said that the Maldives was responding by building a more climate resilient health infrastructure and providing healthcare facilities with sustainable low carbon health systems.

In addition to the national commitments, 54 institutions from 21 countries representing more than 14 000 hospitals and health centres have joined the United Nations Race to Zero campaign and committed to achieving net zero emissions. Josh Karliner, international director of programme and strategy of