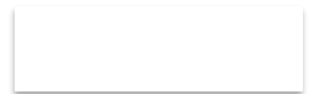
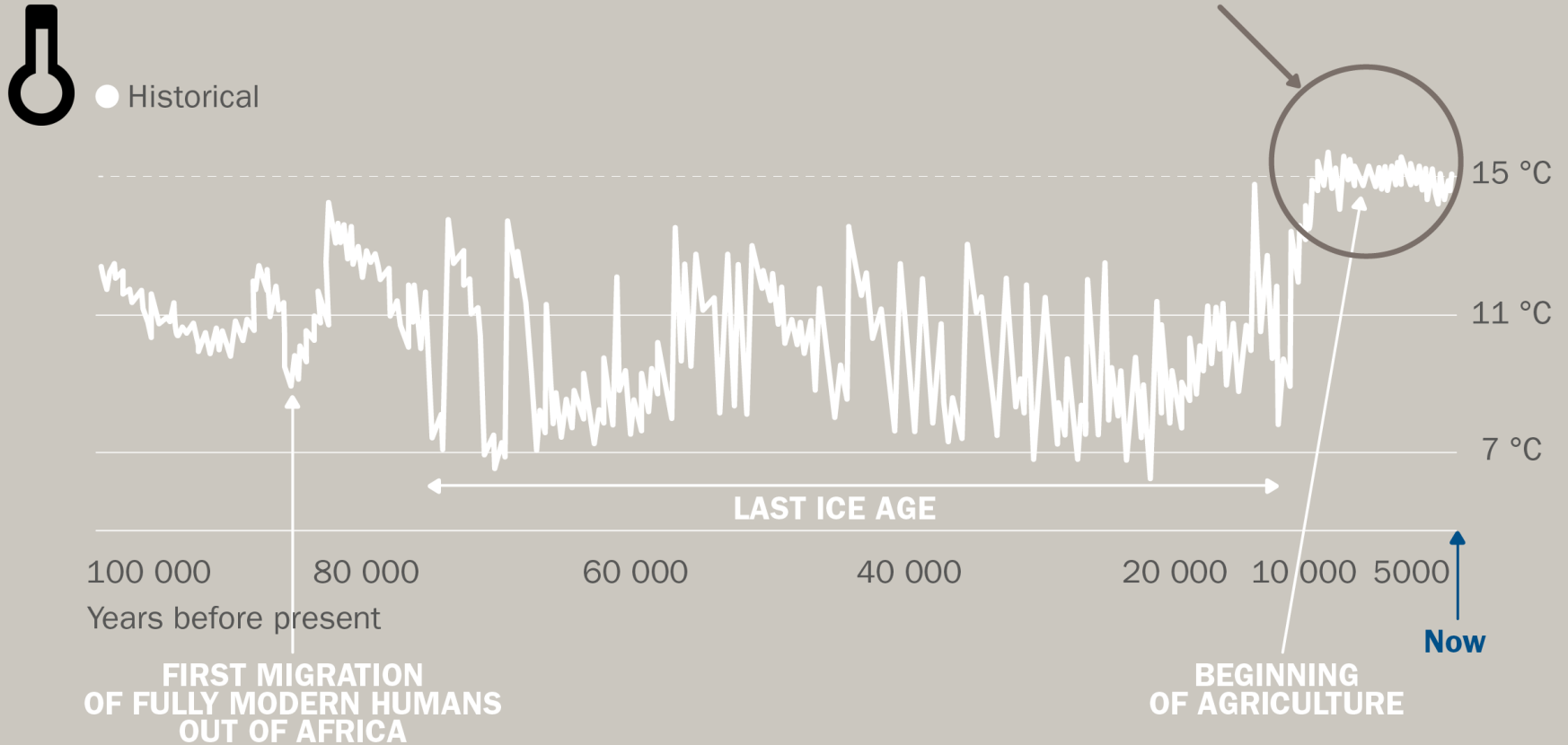




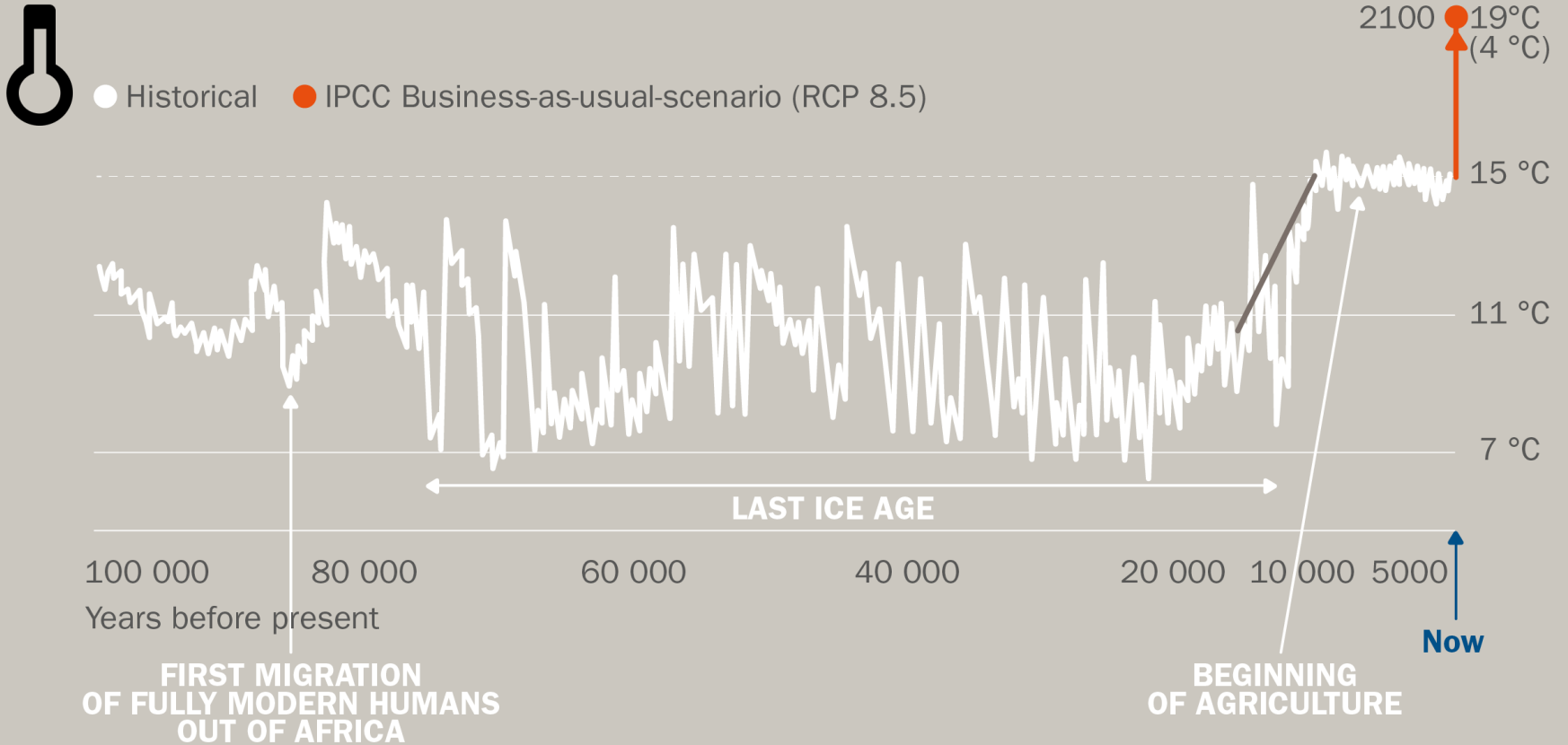
Klimaendringer – havperspektivet...

Cecilie Mauritzen
Oseanograf, Meteorologisk institutt

Global temperature: Extraordinarily stable last ten millennia



With business-as-usual we add another 4 °C



IPCC har konkludert med at 2 graders oppvarming er grensen for «ufarlige» klimaendringer. Mange enkeltforskere hevder at grensen bør ligge på 1.5 grader C.

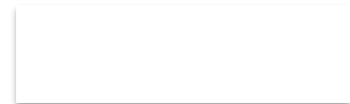
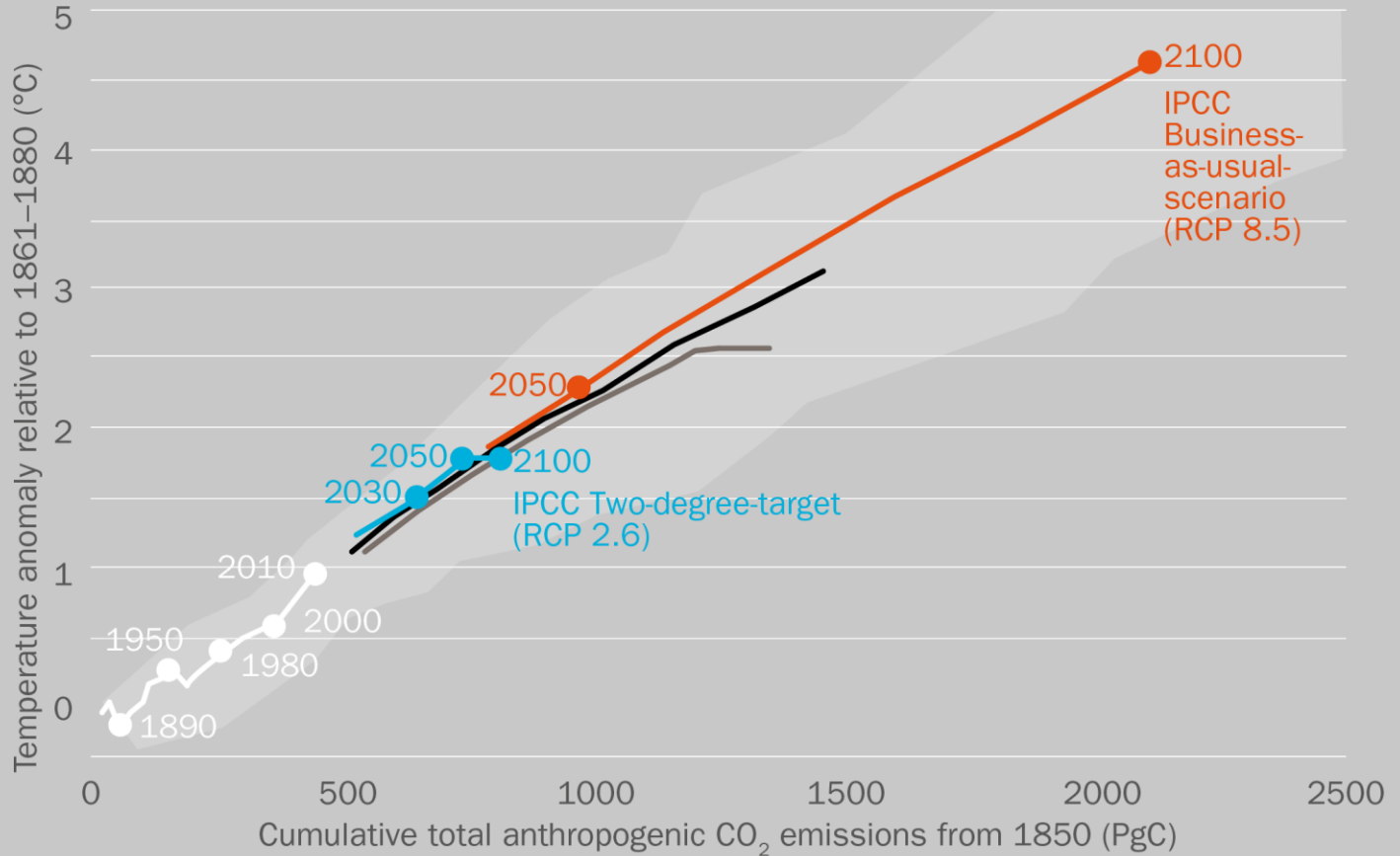
Hvordan unngår vi 2 graders oppvarming?

IPCCs femte hovedrapport kom endelig med en vurdering av dette

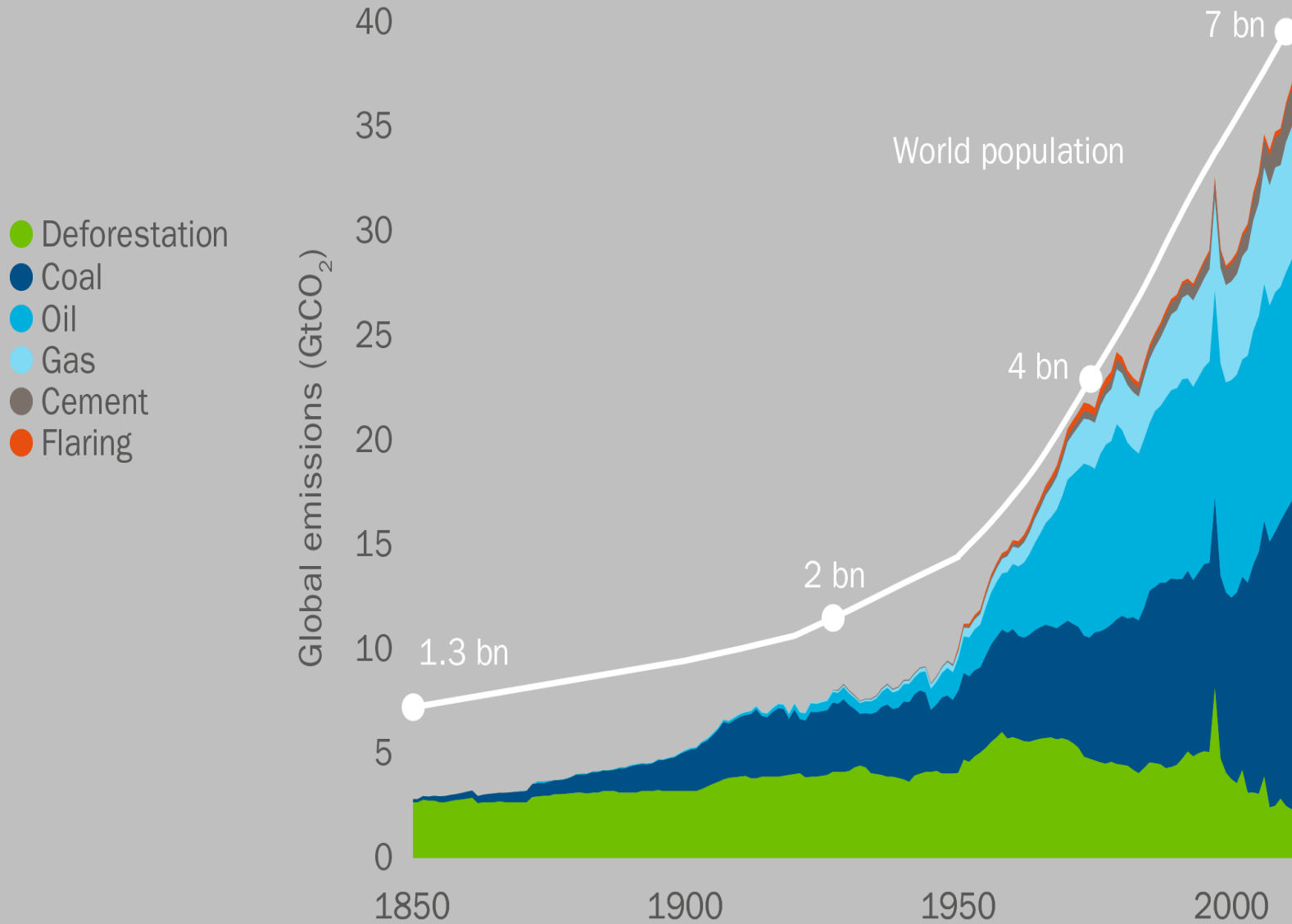
There is a fairly linear relationship between accumulated CO₂ emissions and global temperature rise.



- RCP 4.5
- RCP 6.0
- Historical
- Range



CO₂ – a question of fossil fuels. And people....



1962



EACH DAY HUMBLE SUPPLIES ENOUGH ENERGY TO MELT 7 MILLION TONS OF GLACIER!

This giant glacier has remained unscathed for centuries. Yet, the petroleum energy Humble supplies—*converted into fuel—could melt it at the rate of 80 tons each second!* To meet the nation's growing needs for energy, Humble has applied science to nature's resources to become America's Leading Energy Company. Working wonders with oil through research, Humble provides energy in many forms to help heat our homes, power our transportation, and to furnish industry with a great variety of valuable chemicals. Stop at a Humble station for new Enco Extra gasoline, and see why the "Happy Mowing" Sign is the World's First Choice.

HUMBLE
OIL & REFINING COMPANY
America's Leading Energy Company





AP / December 13, 2017, 10:16 AM

Sea ice melting at fastest pace in 1,500 years, Arctic Report Card finds

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NEW ORLEANS -- Permafrost in the Arctic is thawing at a faster clip, according to a new report released Tuesday.

Water is also warming and **sea ice is melting** at the fastest pace in 1,500 years at the top of the world.

The **annual report** released Tuesday by the National Oceanic and Atmospheric Administration (NOAA) showed slightly less warming in many measurements

Credit: National Snow and Ice Data Center

[High-resolution image](#)

January is 47,700

(square miles) per

e.

Key risks in a changing climate (IPCC 2014)

Breakdown of
Infrastructure due to
extreme weather

Ill-health, disturbed
livelihoods due to
inland flooding

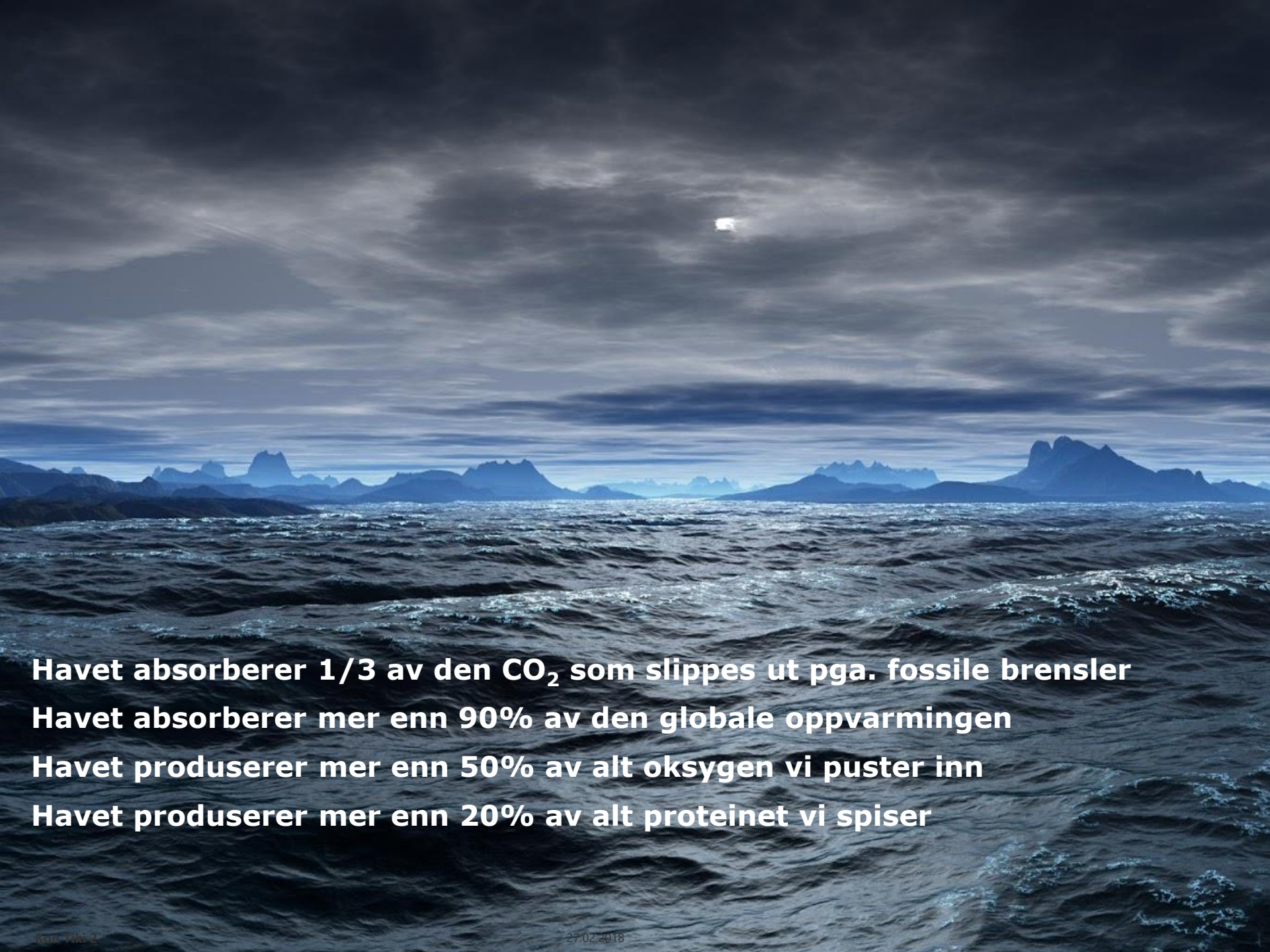
Mortality due to
storm surges,
flooding, heat waves

Breakdown of food
systems due to
extreme weather,
droughts, flooding

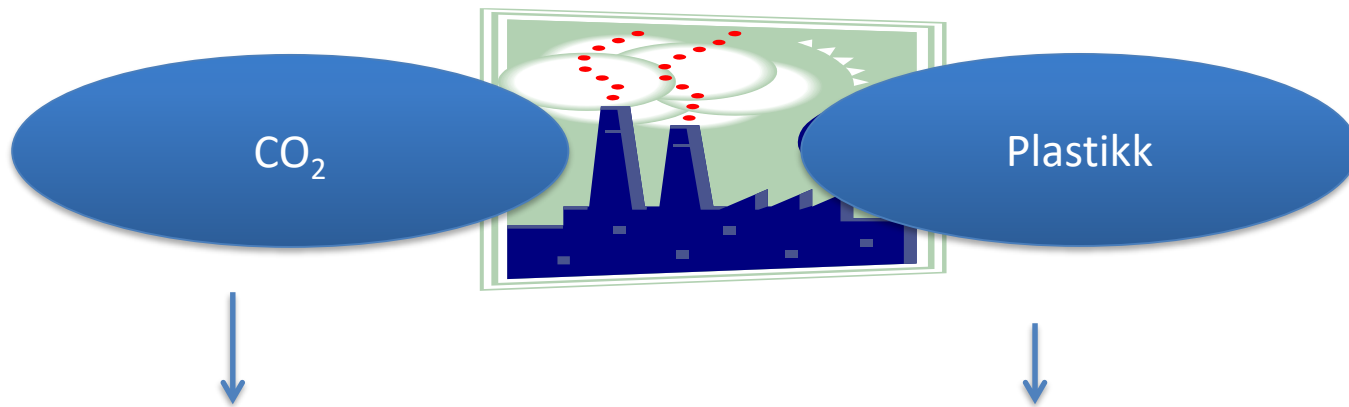
Loss of rural
livelihoods due to
insufficient access to
drinking and
irrigation water

Loss of terrestrial
ecosystems

Loss of marine
ecosystems



Havet absorberer 1/3 av den CO₂ som slippes ut pga. fossile brensler
Havet absorberer mer enn 90% av den globale oppvarmingen
Havet produserer mer enn 50% av alt oksygen vi puster inn
Havet produserer mer enn 20% av alt proteinet vi spiser

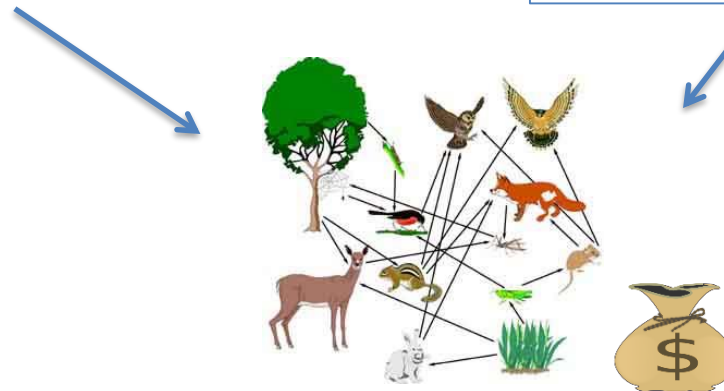


Klimaendringer i havet

- Oppvarming
- Forsuring
- Oksygenreduksjon

Plastikk i havet

- Direkte forurensning
- Nedbrytning til mikroplastikk
- Aggregering av miljøgifter
- Blir konsumert (tar opp plassen som maten skulle hatt)



Voldsomt stress på økosystemene, biodiversiteten og de marine verdier

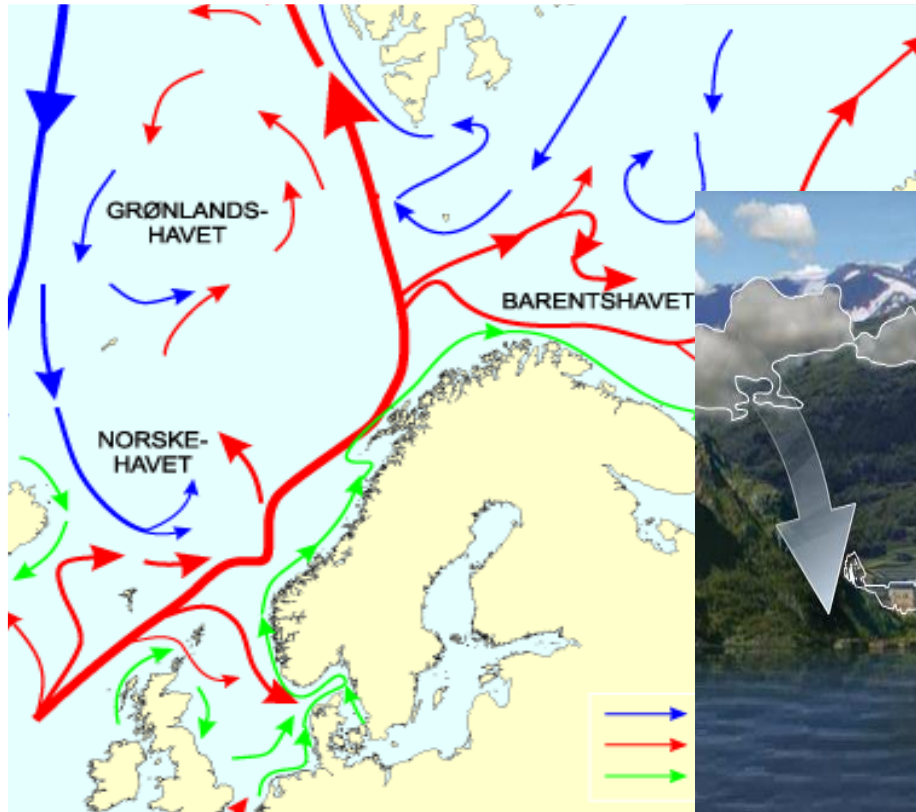


UNITED NATIONS ENVIRONMENT PROGRAMME

Marine Litter: A Global Challenge



Forurensing: Store møter små systemer



Forurensningsloven
Forurensningsdirektivet
EUs Vanddirektiv

<http://www.miljodirektoratet.no/old/klif/sedimenter/animasjon/index.html>



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Ta havet inn i klimaforhandlingene | Cecilie Mauritzen

CECILIE MAURITZEN FORSKNINGSSJEF, KON TIKI 2-EKSPEDISJONEN OG HOVEDFORFATTER FOR FJERDE OG FEMTE HOVEDRAPPORT FRA FNS
KLIMAPANEL

OPPDATERT: 10.DES. 2015 21:45 | PUBLISERT: 10.DES. 2015 21:45

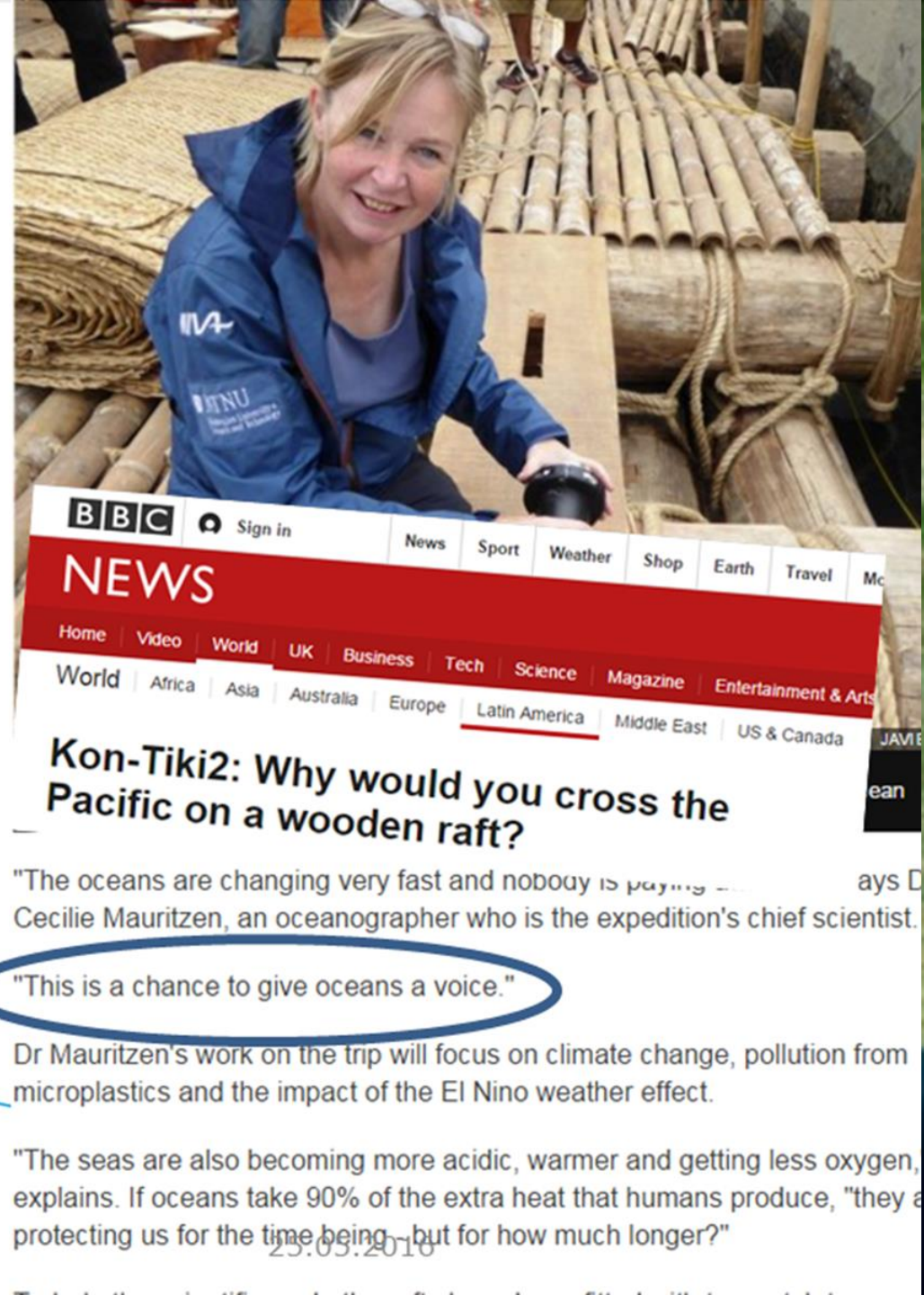


KON-TIKI Fra Peru til Påskeø



Kon-Tiki
2015/2016
Expedisjon
Torgeir Hig
2 flåter:
Tupac Yupa
Rahiti Tane

March 10



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Kon-Tiki2: Why would you cross the Pacific on a wooden raft?

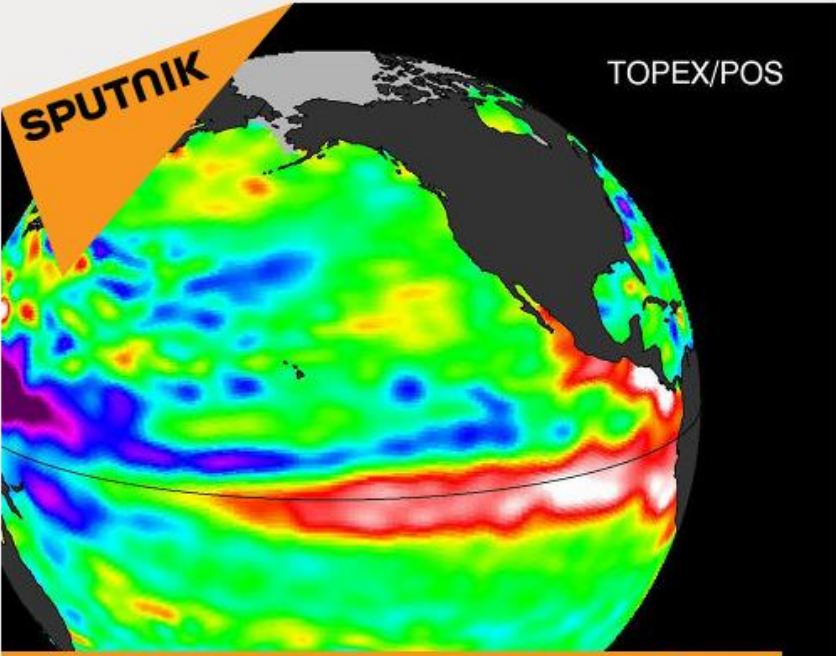
"The oceans are changing very fast and nobody is paying attention," says Dr Cecilie Mauritzen, an oceanographer who is the expedition's chief scientist.

"This is a chance to give oceans a voice."

Dr Mauritzen's work on the trip will focus on climate change, pollution from microplastics and the impact of the El Nino weather effect.

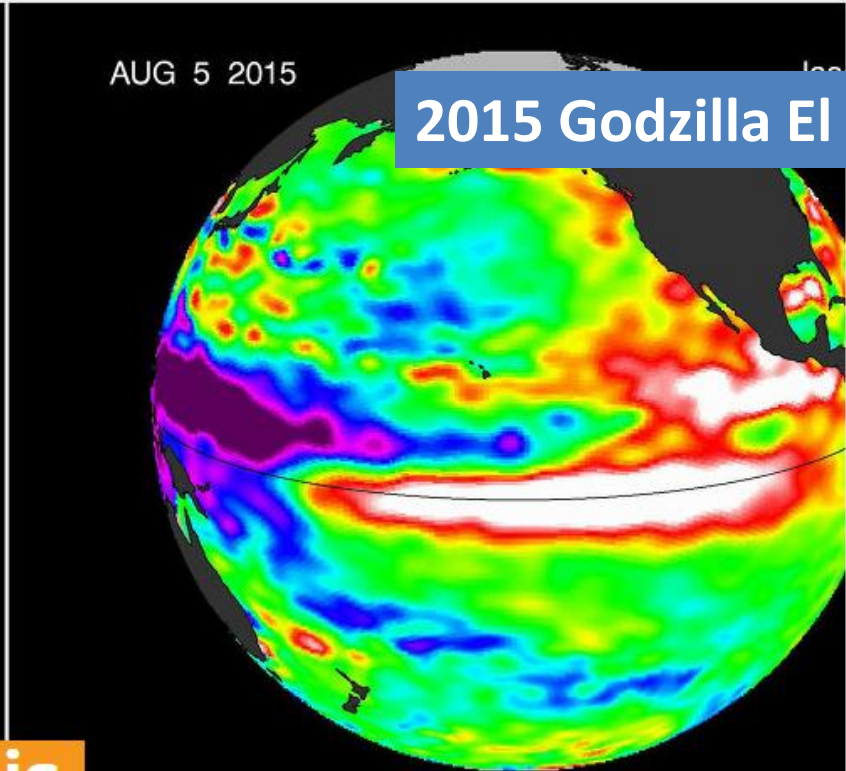
"The seas are also becoming more acidic, warmer and getting less oxygen," explains. If oceans take 90% of the extra heat that humans produce, "they are protecting us for the time being, but for how much longer?"

25.05.2016



TOPEX/POS

California Bracing for Biggest El Niño Ever This Fall
TOPEX/Poseidon 1997



AUG 5 2015

2015 Godzilla El Niño

Jason-2 2015
© AP Photo/ NASA

WORLD 03:48 15.08.2015 (updated 12:16 15.08.2015) [Get short URL](#) 1 3151 10 1

With ocean temperatures warming, scientists predict a record-breaking El Niño to hit California this year. Worse still, this "Godzilla" El Niño could be only the first in a series which become increasingly worse.

According to the National Weather Service's Climate Prediction Center, current computer models estimate that this year's El Niño could be the strongest since record-keeping began in 1950.

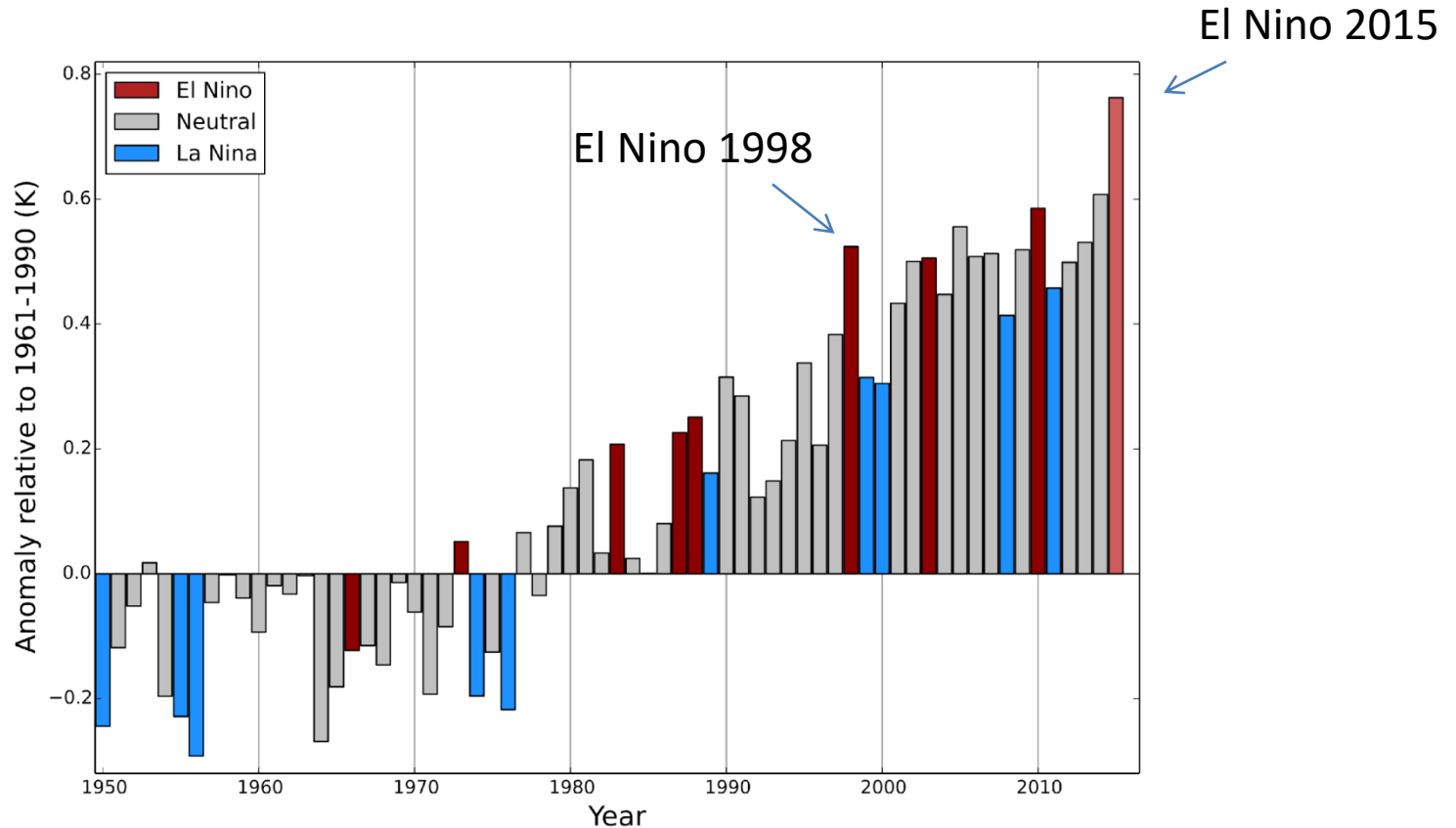
"This definitely has the potential of being the Godzilla El Niño," said Bill

NEWS

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- 19:01 Rolling in the Deep: Underwater Robots to Study Indian Monsoon

Global average air temperature 1950-2015

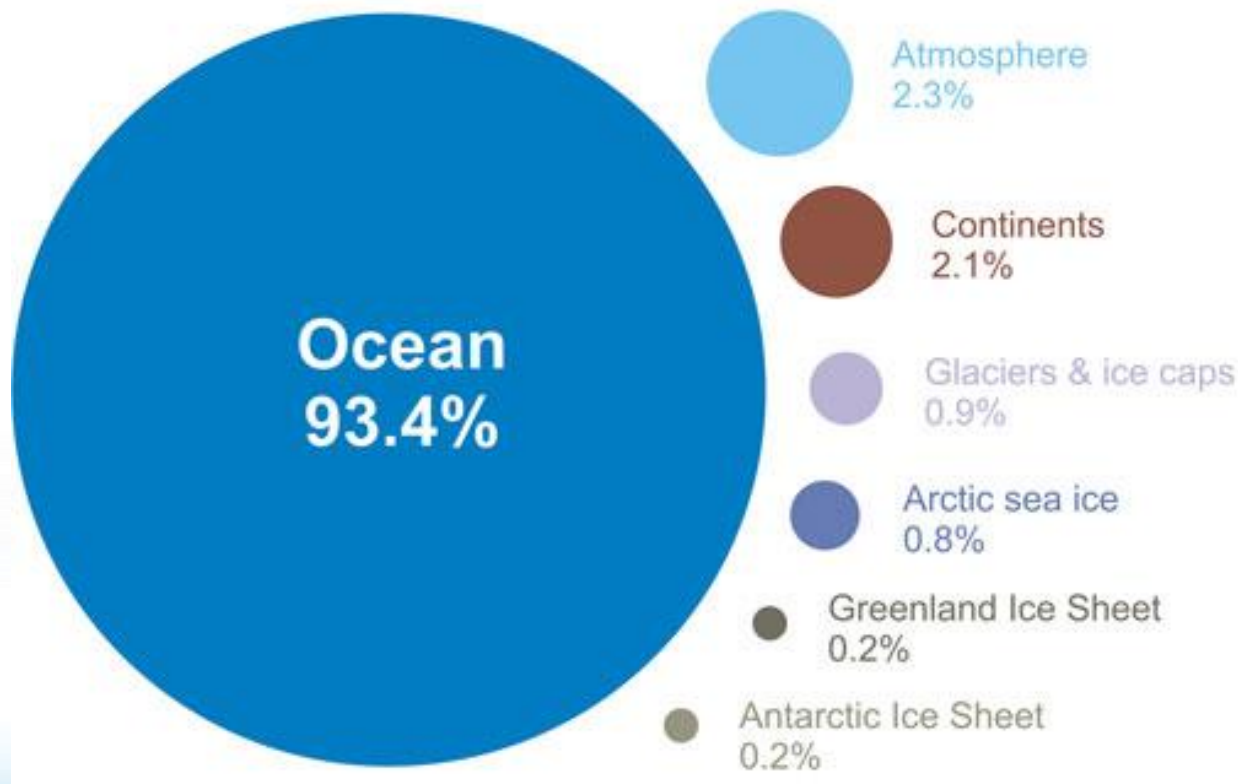


Global annual average temperatures anomalies (relative to 1961-1990) based on an average of three global temperature data sets (HadCRUT.4.4.0.0, GISTEMP and NOAA GlobalTemp) from 1950 to 2015. Bars are coloured according to whether the year was classified as an El Niño year (red), a La Niña year (blue) or an ENSO-neutral year (grey). Note uncertainty ranges are not shown, but are around 0.1°C.

Klimaendringer - Hva skjer i havet?

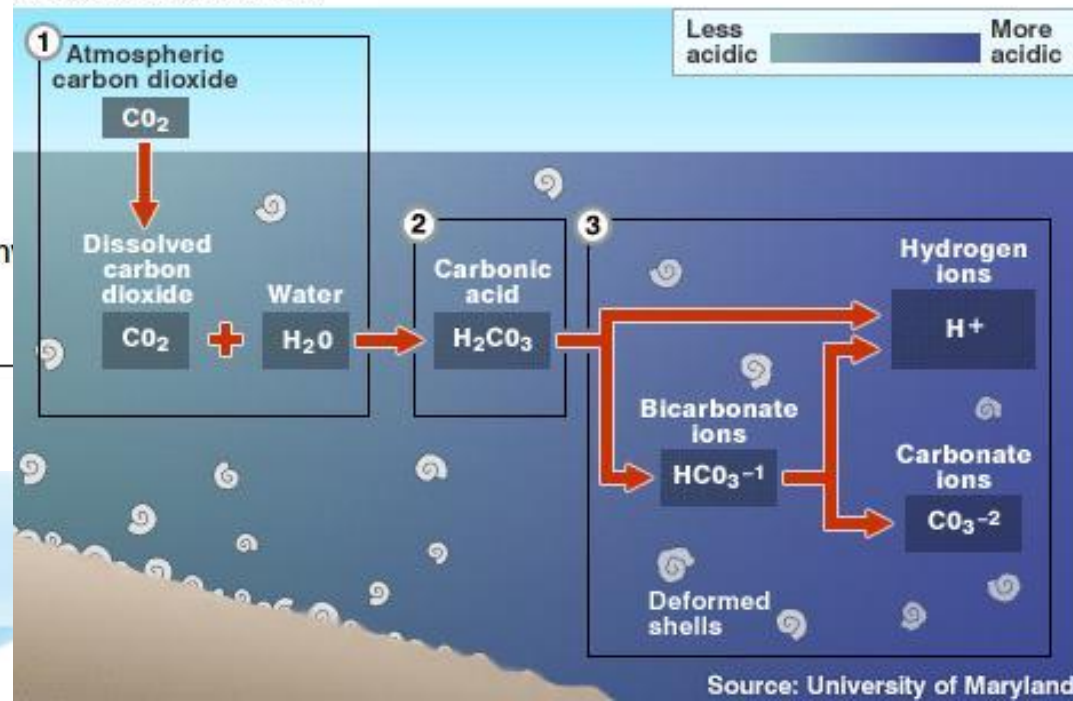
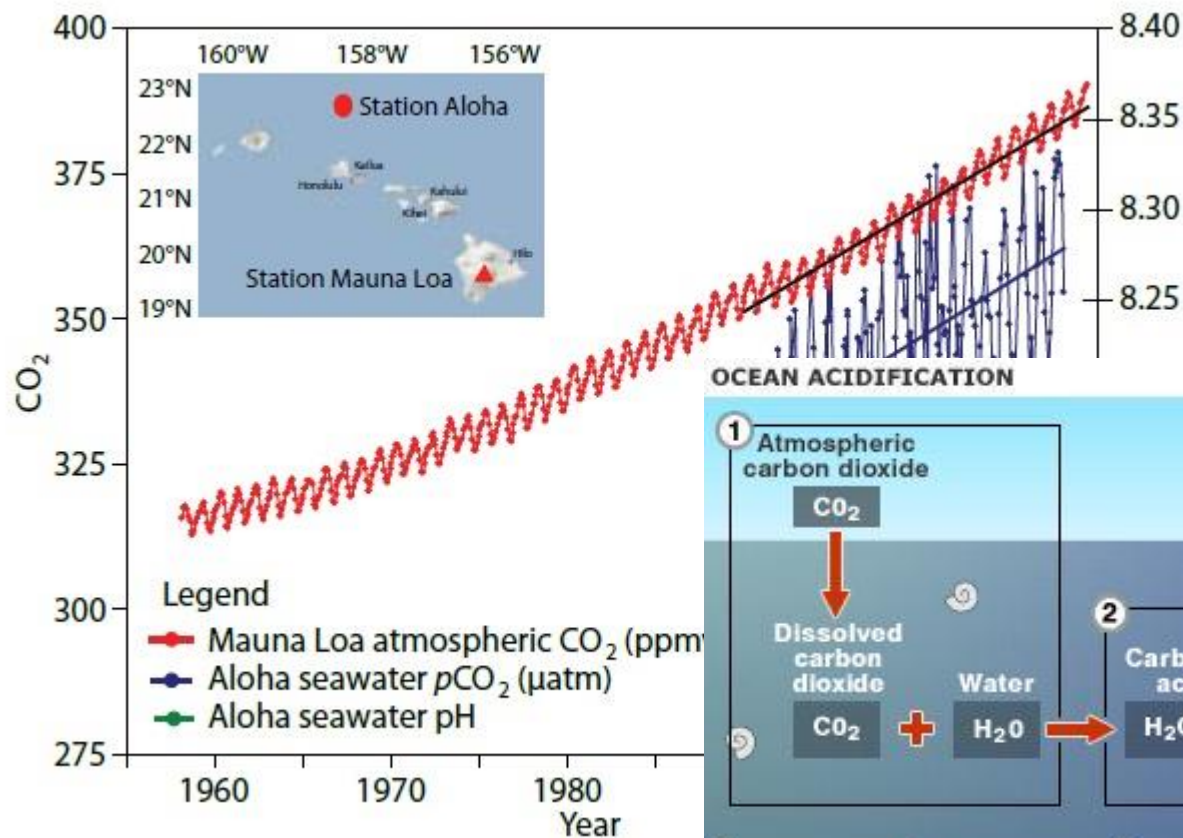
1) Oppvarming

Where is global warming going?



Klimaendringer - Hva skjer i havet?

2) Forsuring

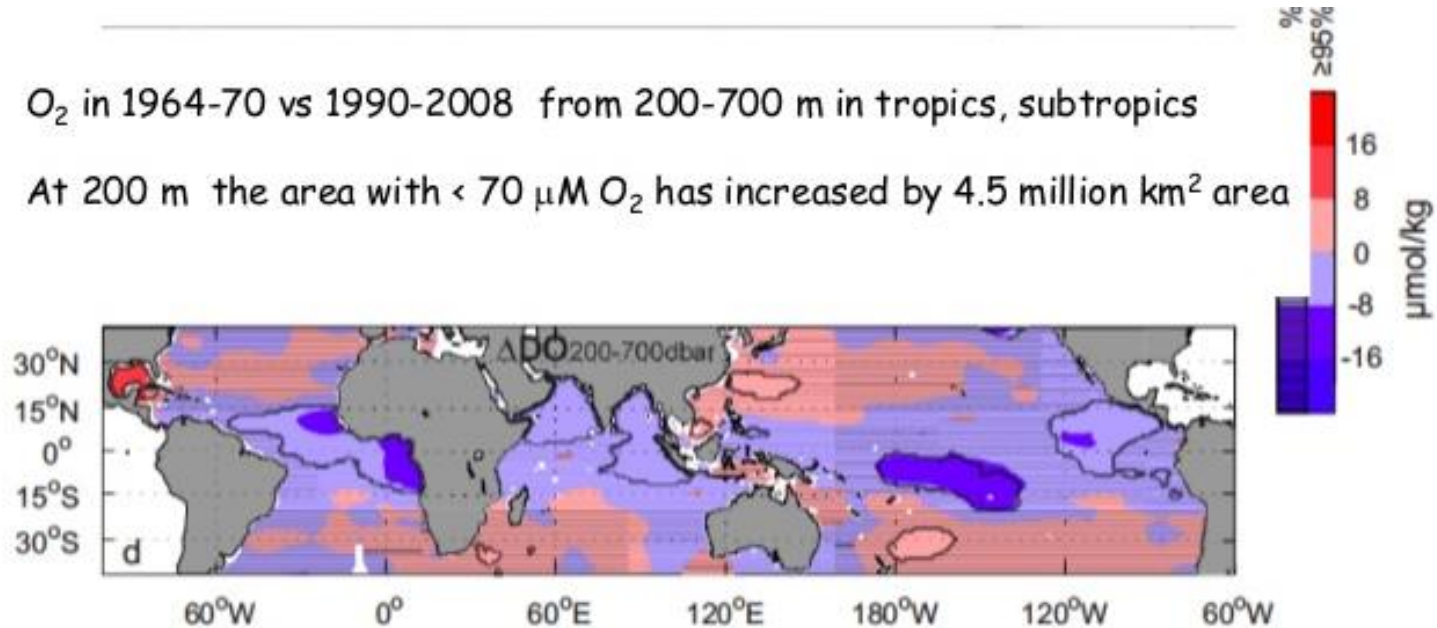


Klimaendringer - Hva skjer i havet?

3) Reduksjon av oksygenivået

O_2 in 1964-70 vs 1990-2008 from 200-700 m in tropics, subtropics

At 200 m the area with $< 70 \mu\text{M } O_2$ has increased by 4.5 million km^2 area



Stramma et al. 2010

Økosystemtjenester – Norges største skattekiste?

Økosystemtjenester = alle goder og tjenester vi får fra naturen. Fra den blå skogen får vi:

1. Høyt artsmangfold
2. Matfat og skjul for mange arter
3. Fiskeri
4. Alginatproduksjon
5. Renser havet
6. Lokalsamfunn
7. Bølgedemping
8. CO₂-fangst
9. Oksygenproduksjon



Mangrove

A photograph of a mangrove forest. The trees have thick, gnarled trunks and a dense network of prop roots extending into the water and soil. The water is dark and still, reflecting the trees.

Saltmyrer

A photograph of a salt marsh. The foreground is dominated by tall, green reeds and grasses. In the background, there is a body of water reflecting the sky.

**Den blå
skogen**

Sjøgress

A photograph of sea grass underwater. The grass blades are long and green, with some purple flowers. The water is clear and blue.

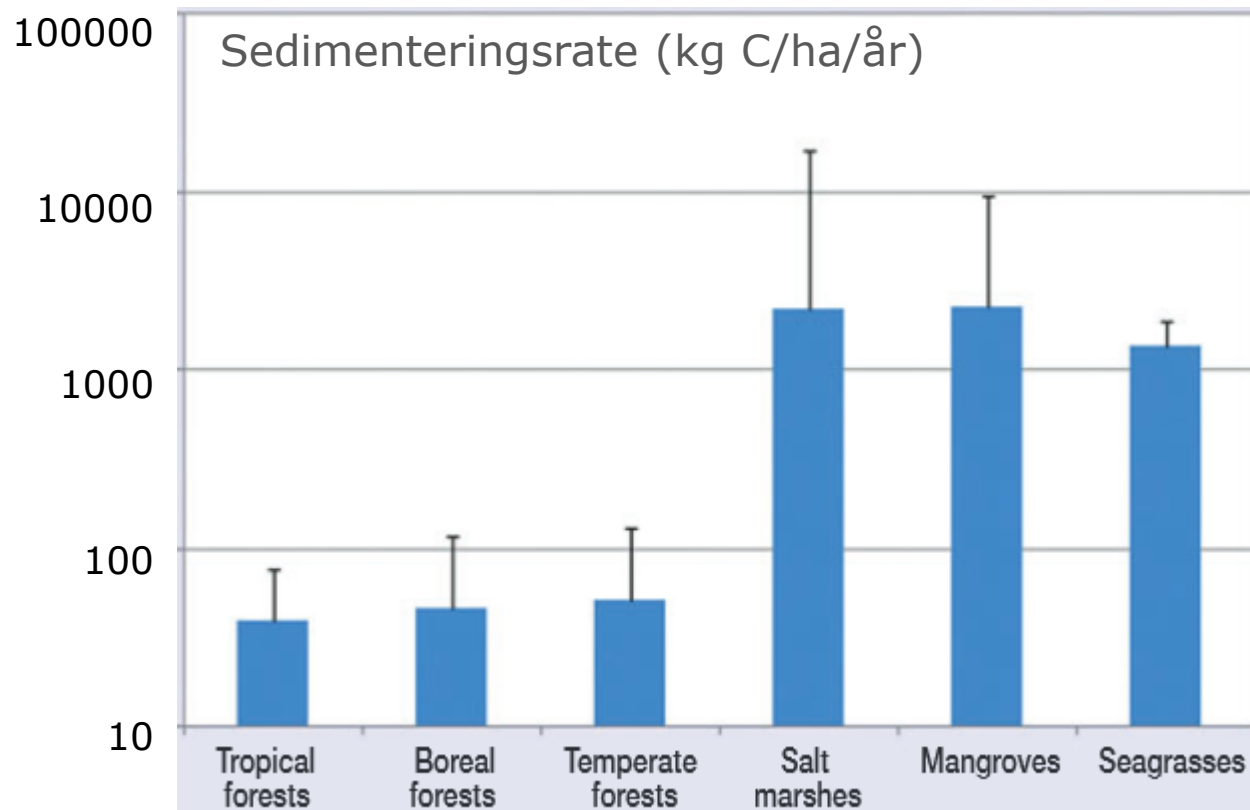
Tareskog

A photograph of a kelp forest underwater. The kelp blades are long and brownish-green, with some purple flowers. The water is clear and blue.

Marine vs. terrestriske økosystemer

«Til tross for relativt liten global utstrekning er vegeterte kystøkosystemer uforholdsmessig viktige i **karbonfangst** – når det sammenlignes med terrestriske skoger»

Hillary Kennedy, Univ. of Bangor, UK



McLeod m.fl. 2011

Tarens trusler

- Kråkebollebeiting
- Overgjødsling
- Økning i havtemperatur
- Overfiske (kaskadeeffekter via små fisk, beitedyr, opportunistiske alger)
- Forsuring av havet
- Introduserte arter (stillehavssøsters)
- Sykdommer (slimsopp)
- Fysiske inngrep (utbygging, utfylling, mudring)

Beregnet tap av fisk (tonn/år)

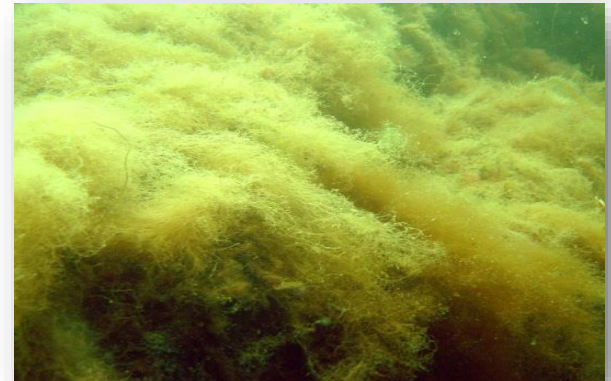
- Sukkertare i Sør-Norge (50 000)
- Tareskog i Midt- og Nord-Norge (300 000)

Kilde: Havforskningsinstituttet



Drøbakkråkebolle

(Strongylocentrotus droebachiensis)



Trådformede alger

«Alt henger sammen med alt»

SCIENCE IS NOT AN ALTERNATIVE FACT



Takk for meg!

- Klimaendringene er ikke bare «ett av mange» problemer i verden – de henger tett sammen med de andre store globale samfunnsproblemene (befolkningsvekst, fattigdom, sult, vannmangel, konflikt osv)
- Havet demmer opp for de største klimaendringene – det tar opp mye av oppvarmingen og CO₂-utslippene.
- Dessverre fører dette til store endringer i havet: forsuring, oppvarming, oksygenreduksjon.
- Havet er under press fra mange hold (klimaendringer, forurensning, ressursforbruk++).
- Norge er avhengig av et «friskt» hav. Derfor er vi avhengig av globale dialoger som fungerer.