Changing Ocean, Marine Ecosystems, and Dependent Communities

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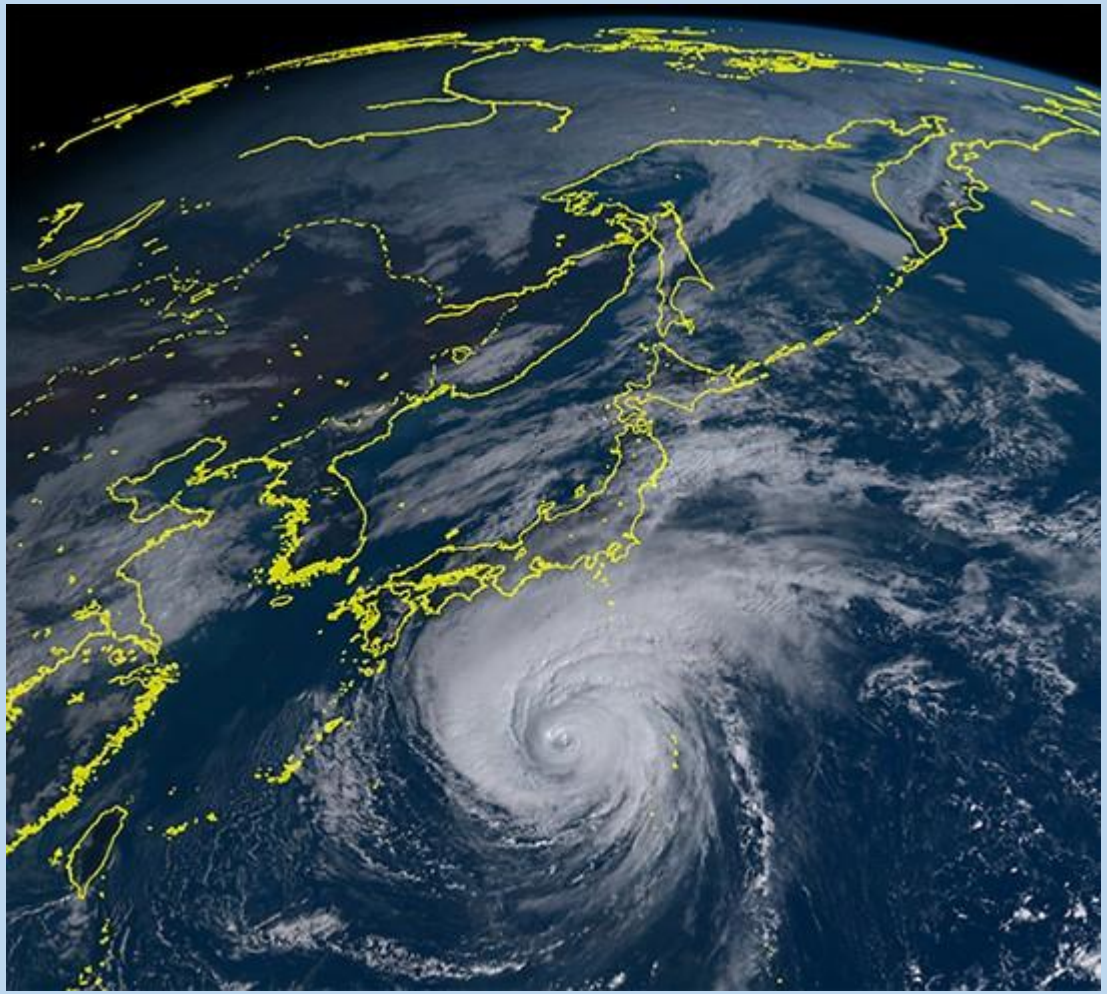
気候変動に関する政府間パネル（IPCC）海洋・雪氷圏特別報告書（SROCC）公表記念シンポジウム
2019年10月15日, 笹川平和財団ビル　11階国際会議場

Super Typhoon No. 19 - Hagibis

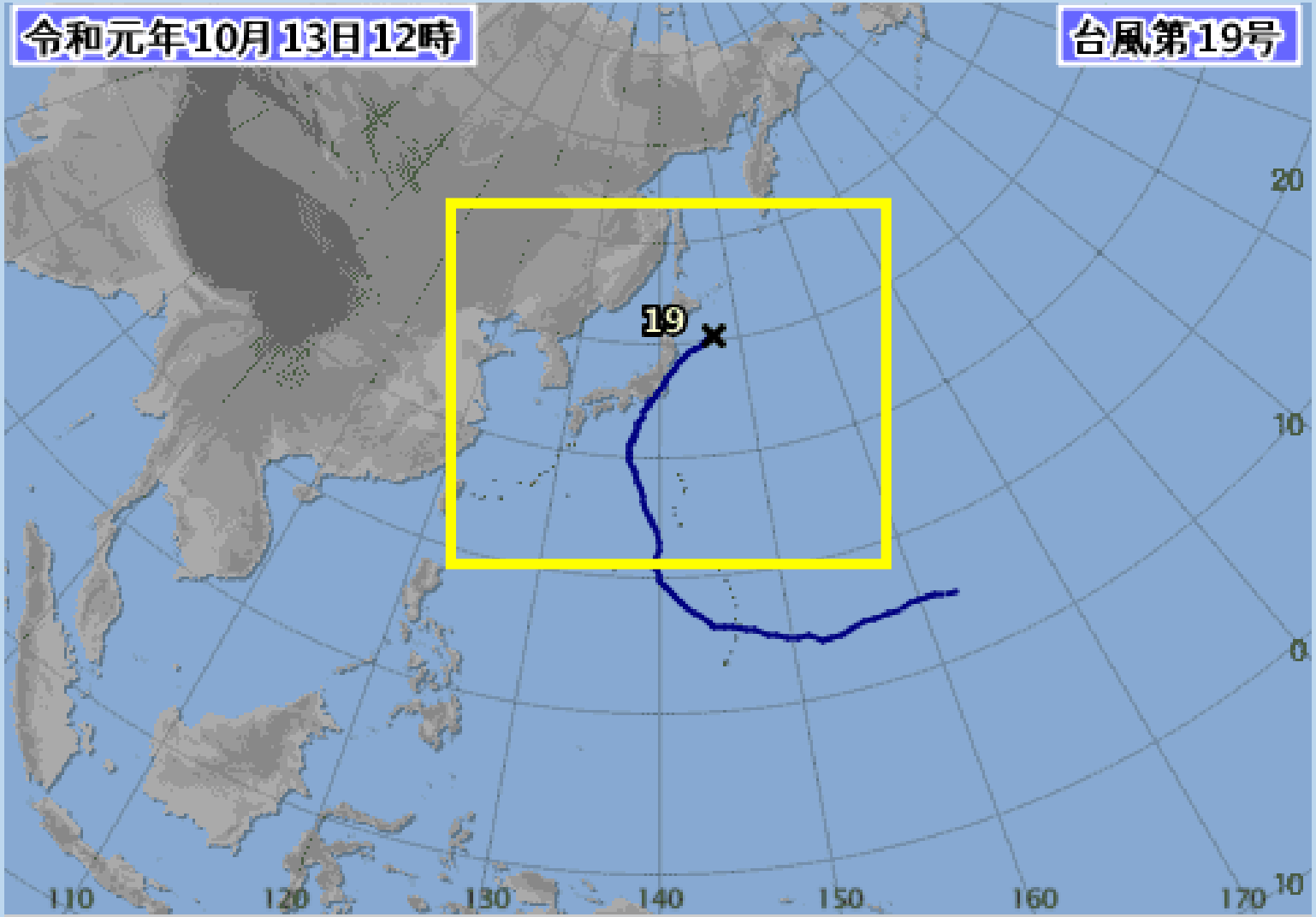


himawari8.nict.go.jp/ja/himawari8-image.htm

…hit Eastern Japan, causing unprecedented damage.

www.asahi.com

Why Typhoon Hagibis was so strong?



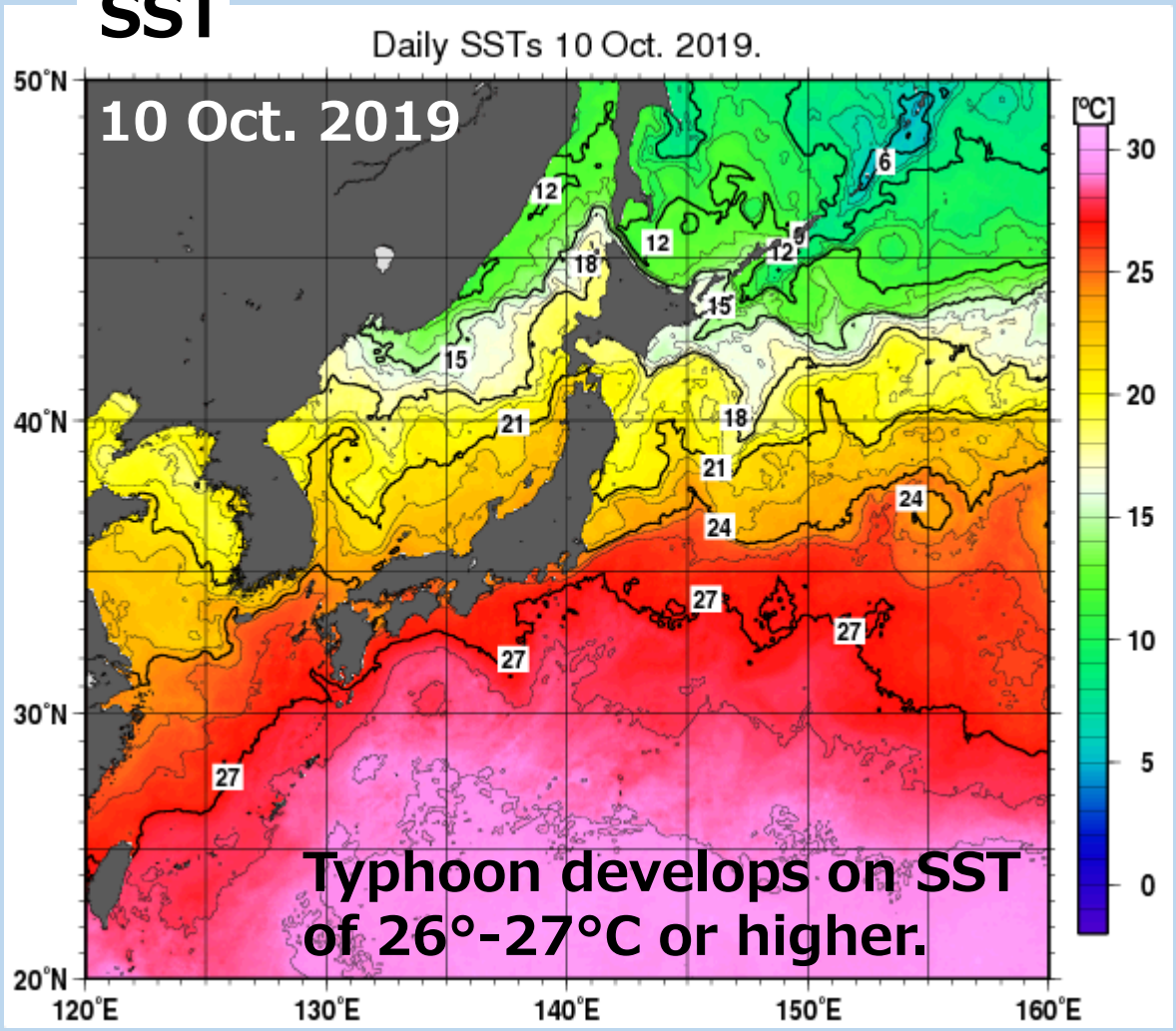
Typhoons in October typically become weakened when approaching Japan due to low sea surface temperature near Japan.

But this time was different.

Modified from the figure on www.jma.go.jp

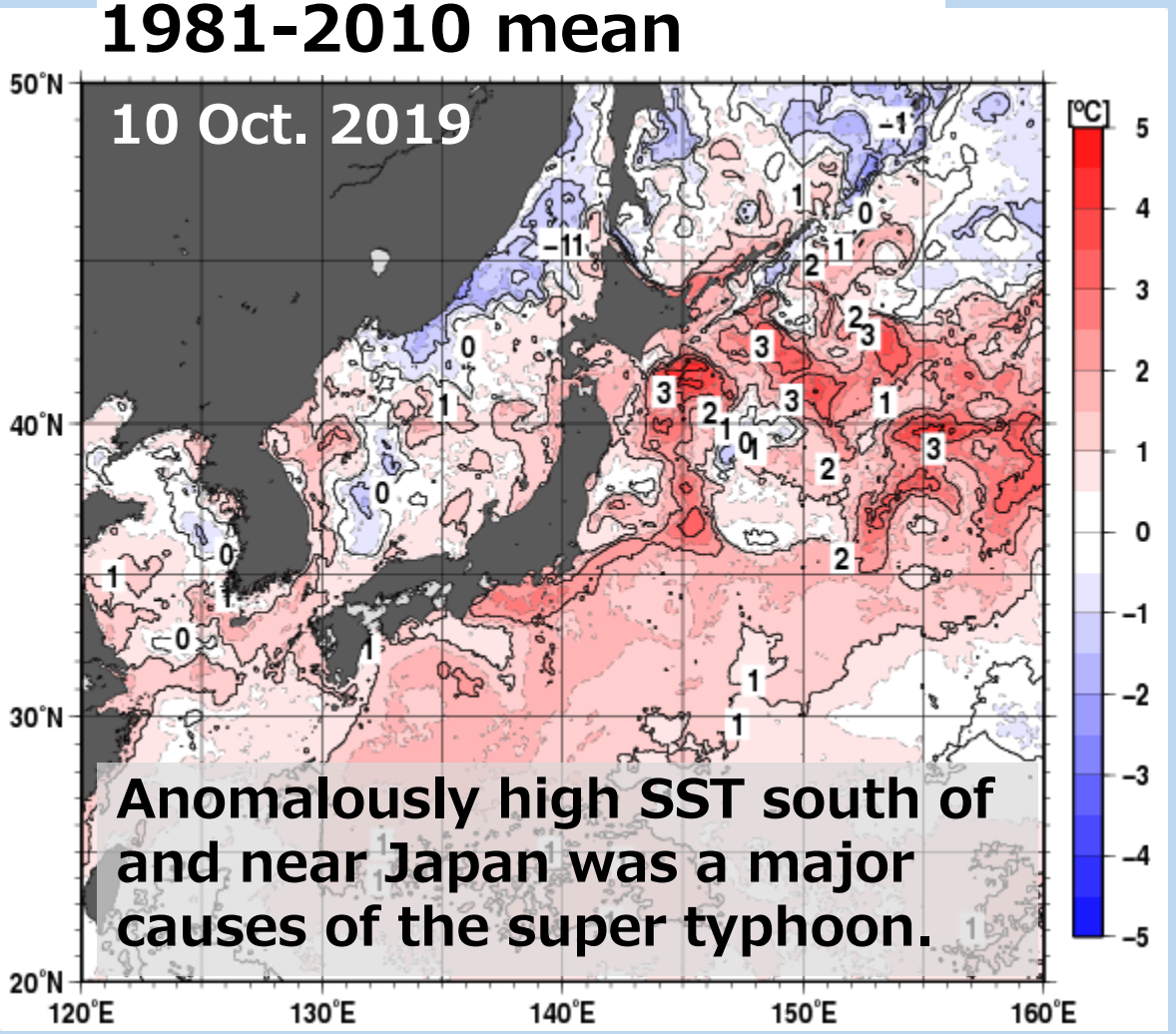
Sea surface temperate (SST) near Japan is anomalously high

SST



Modified from the figure on www.jma.go.jp

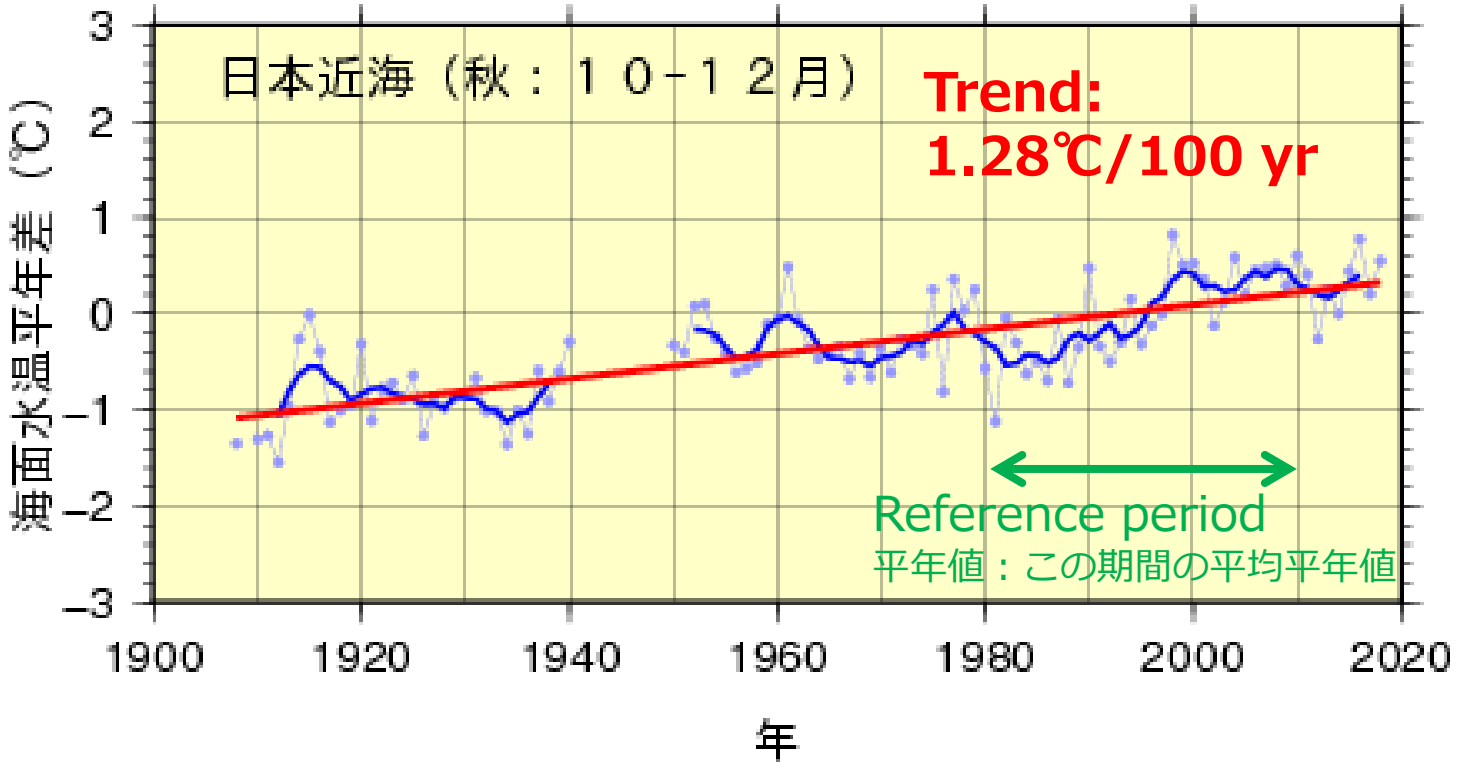
SST anomaly relative to 1981-2010 mean



Modified from the figure on www.jma.go.jp

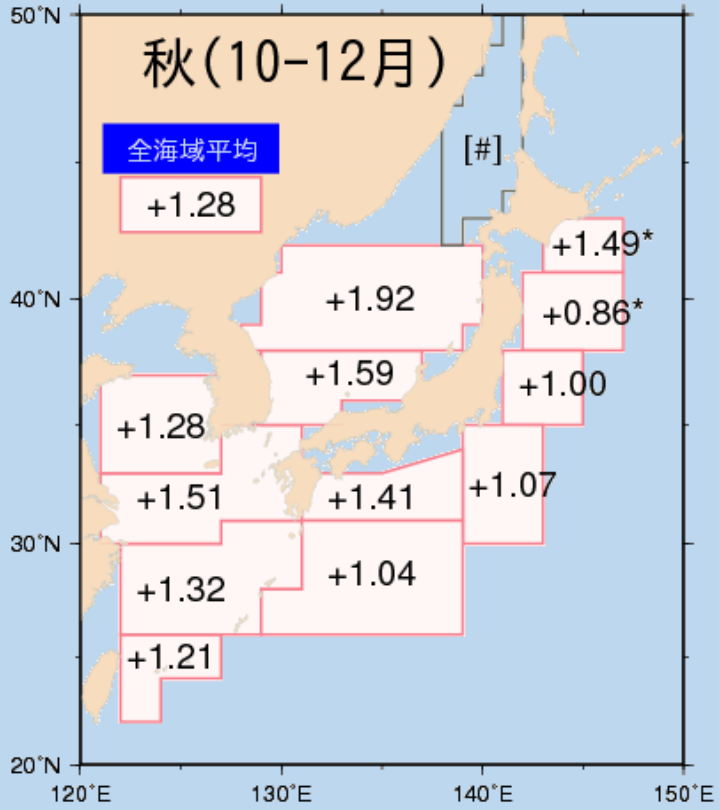
SST variability and long-term change

SST anomaly in Fall (Oct.-Dec.) near Japan



Modified from the figure on www.jma.go.jp

Long-term change:
Trend during 1902-2018
(℃/100 yr) in Fall

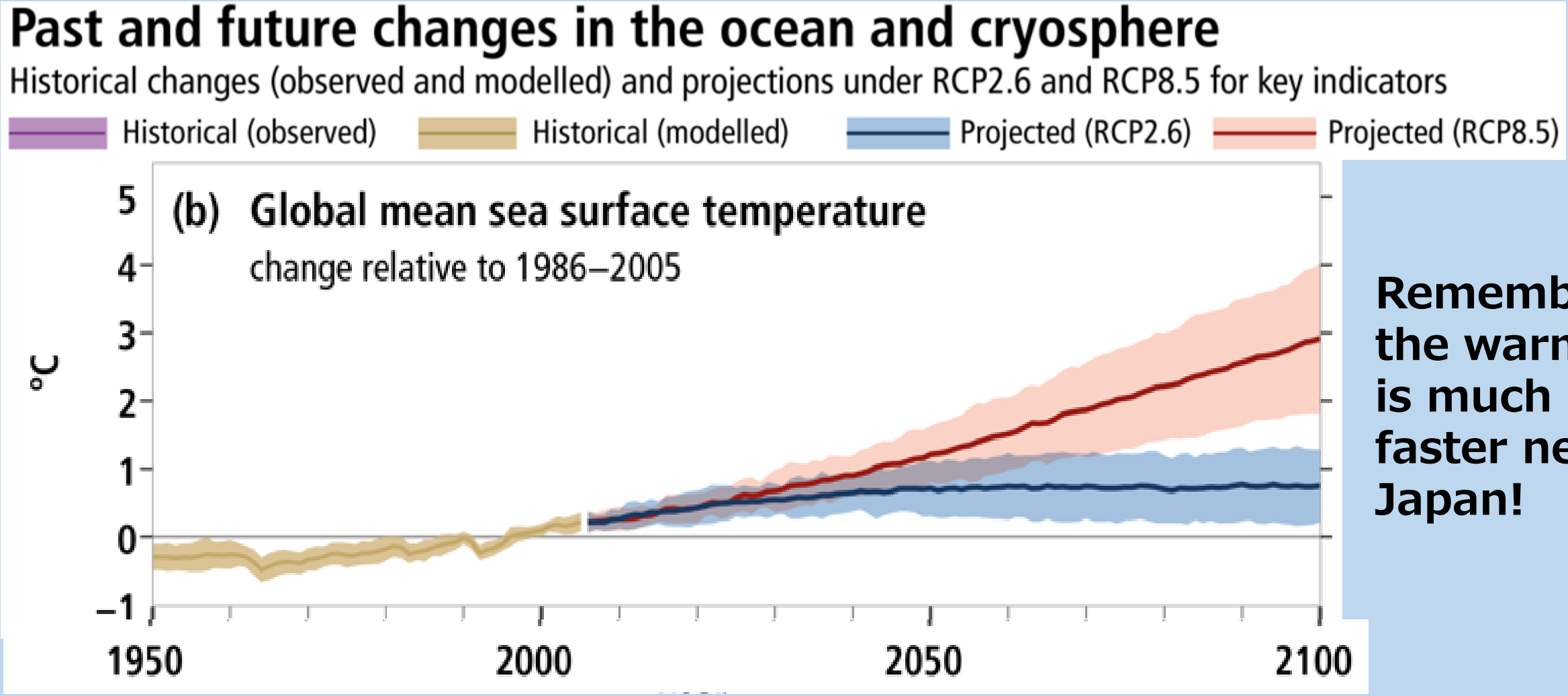


www.jma.go.jp

While year-to-year fluctuations of SST are large, the warming trend increases the probability of SST anomaly occurrence, say, higher than 26-27°C, increasing the risk of stronger typhoon.

Warming trend near Japan is twice as large as the global mean.

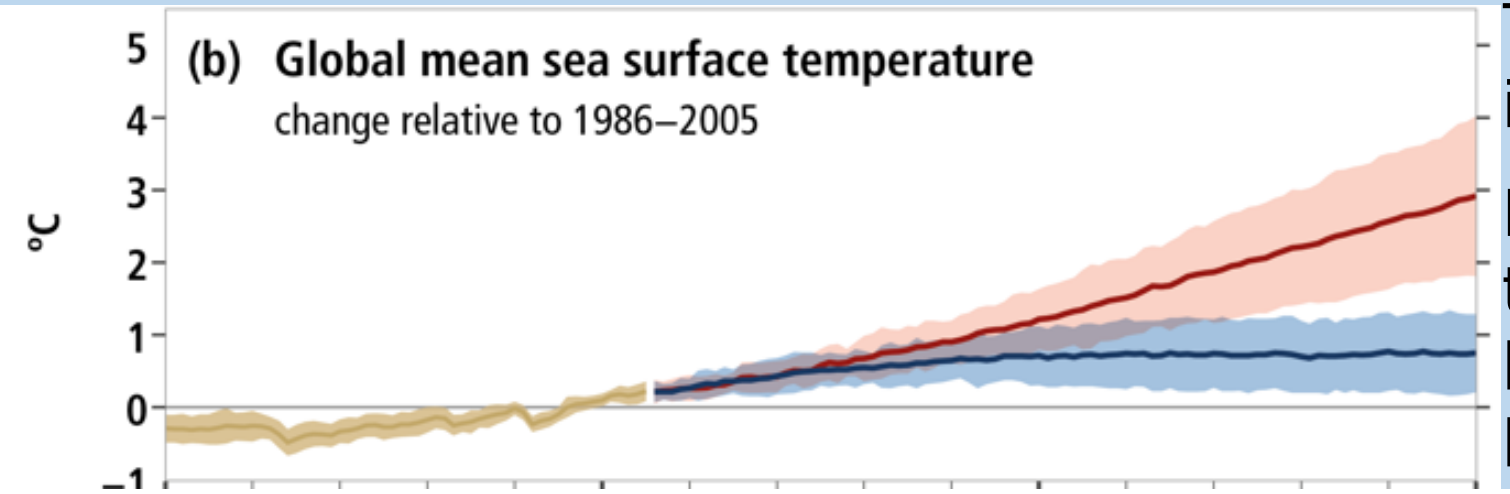
SST warming trend is a consequence of taking the heat from climate change and will continue...

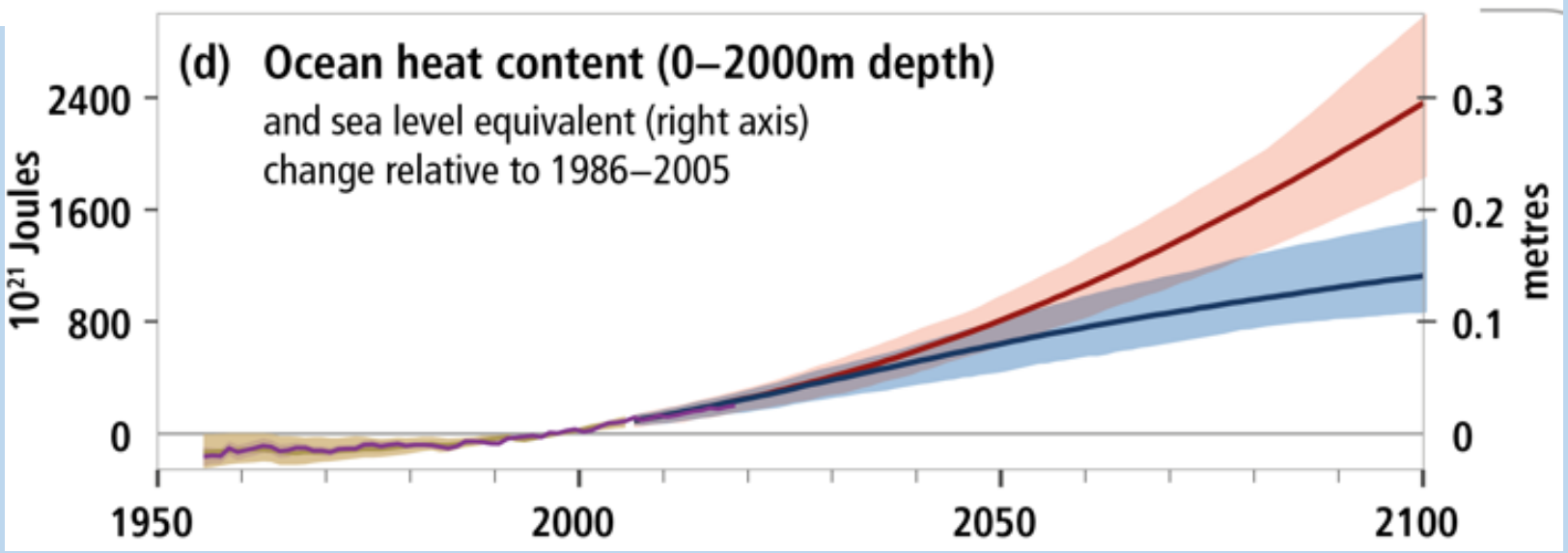


Remember the warming is much faster near Japan!

IPCC SROCC SPM

Where did/will the excess heat go?





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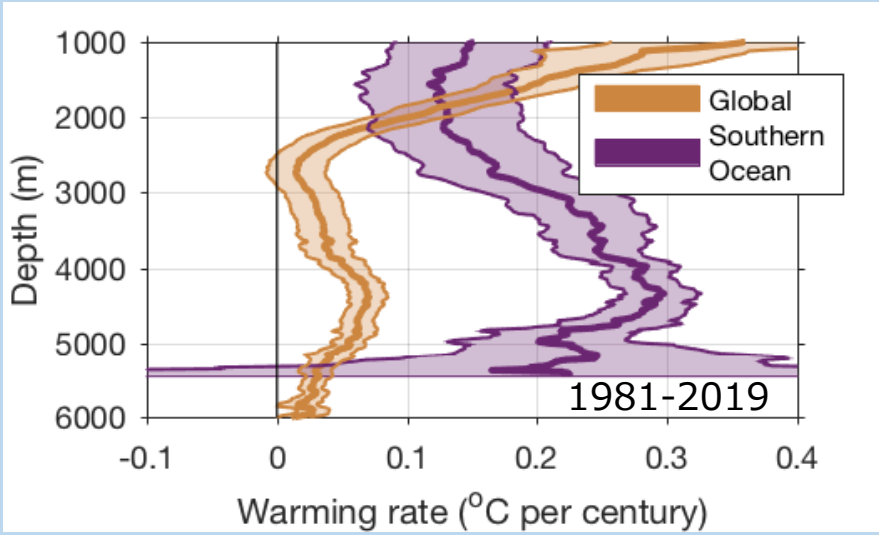
The up-taken heat is distributed in the **whole water column**.

Proper **observations** are needed to understand and help predict how the heat is up taken and how the temperature changes.



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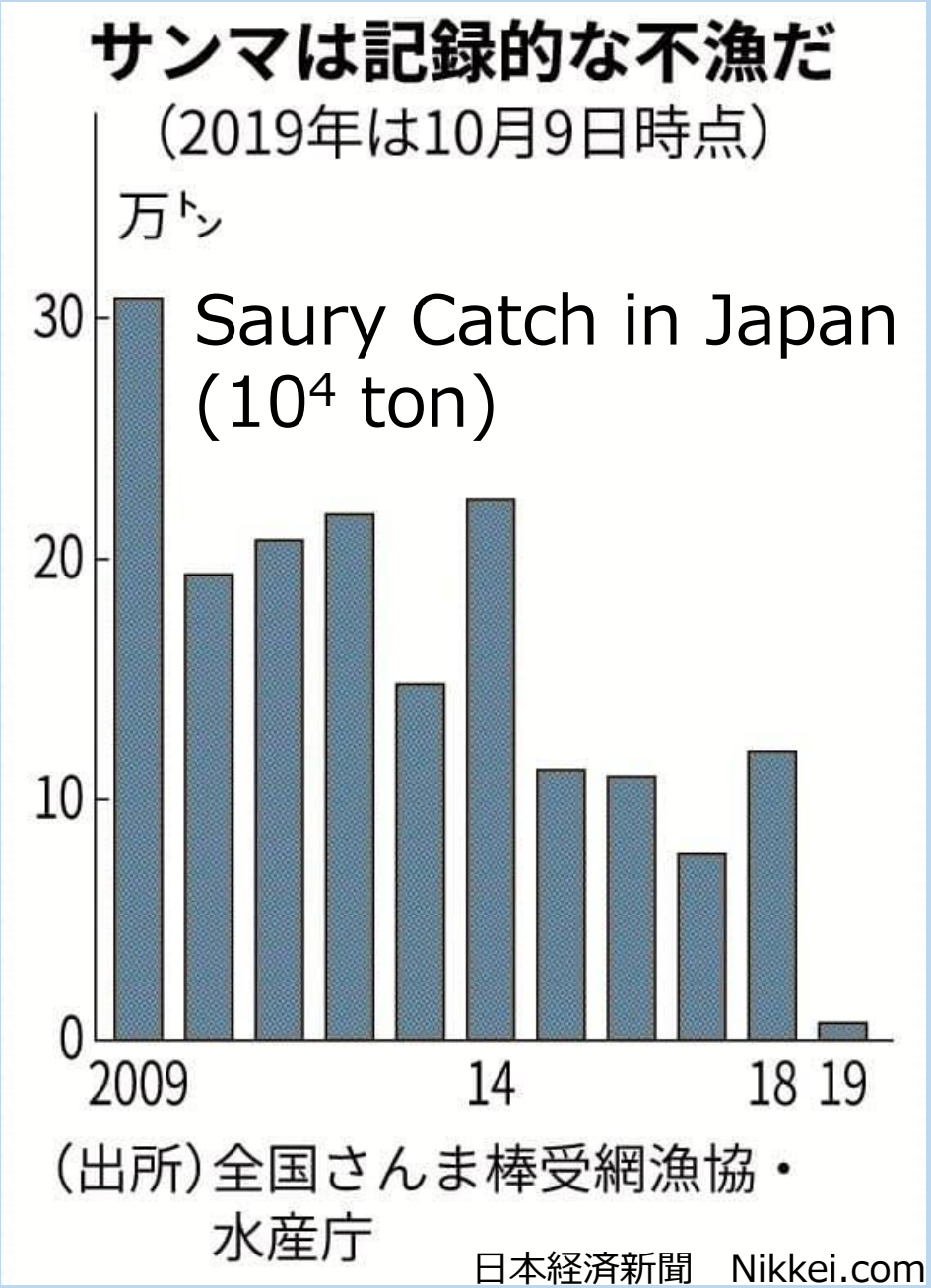
Saury Poor Catch

Warm ocean temperature off Japan is presumably one of major causes,

which is apparently related to the global warming.

The story is possibly more complicated and part of changes in marine ecosystem.



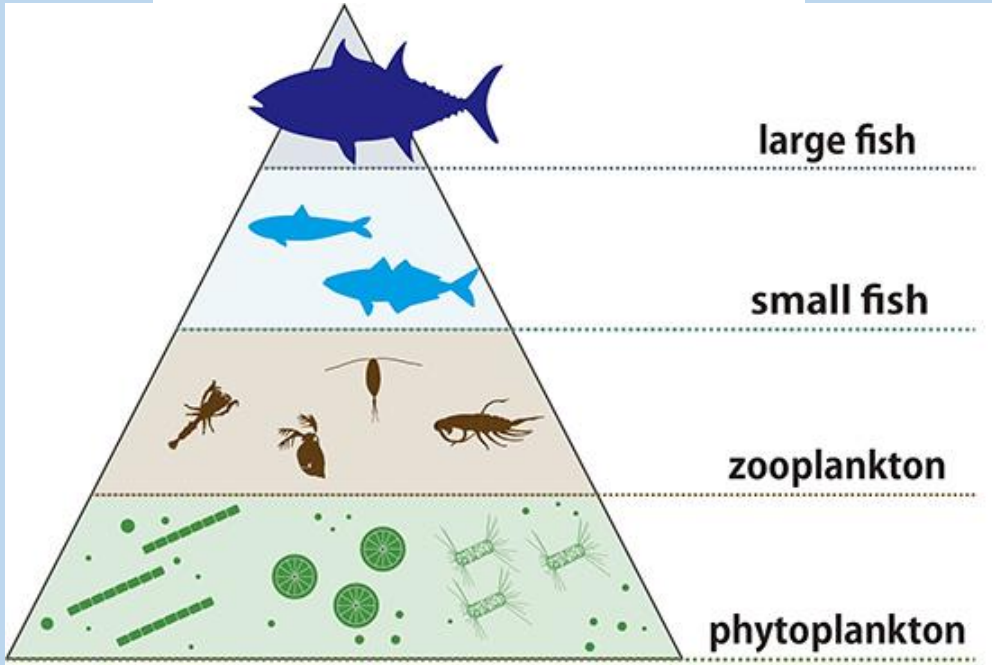
Climate change is causing…

- Warming
- Intensification of the **stratification**,
  - that reduces the supply of **oxygen** and **nutrients**
- Acidification due to carbon uptake

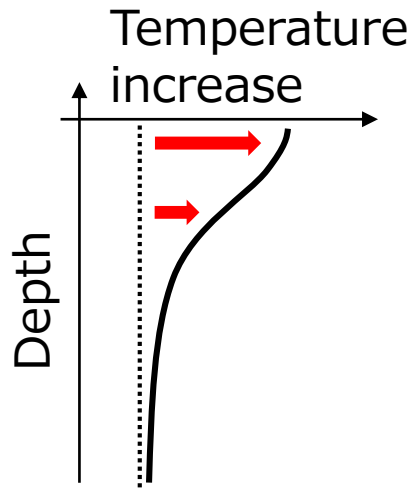
These changes along with human stressors are affecting marine ecosystem through various elements of marine food chain, causing

- Changes in **primary production** and **biomass**
- Shifts in fish populations
- …

Marine food chain



jamstec.go.jp

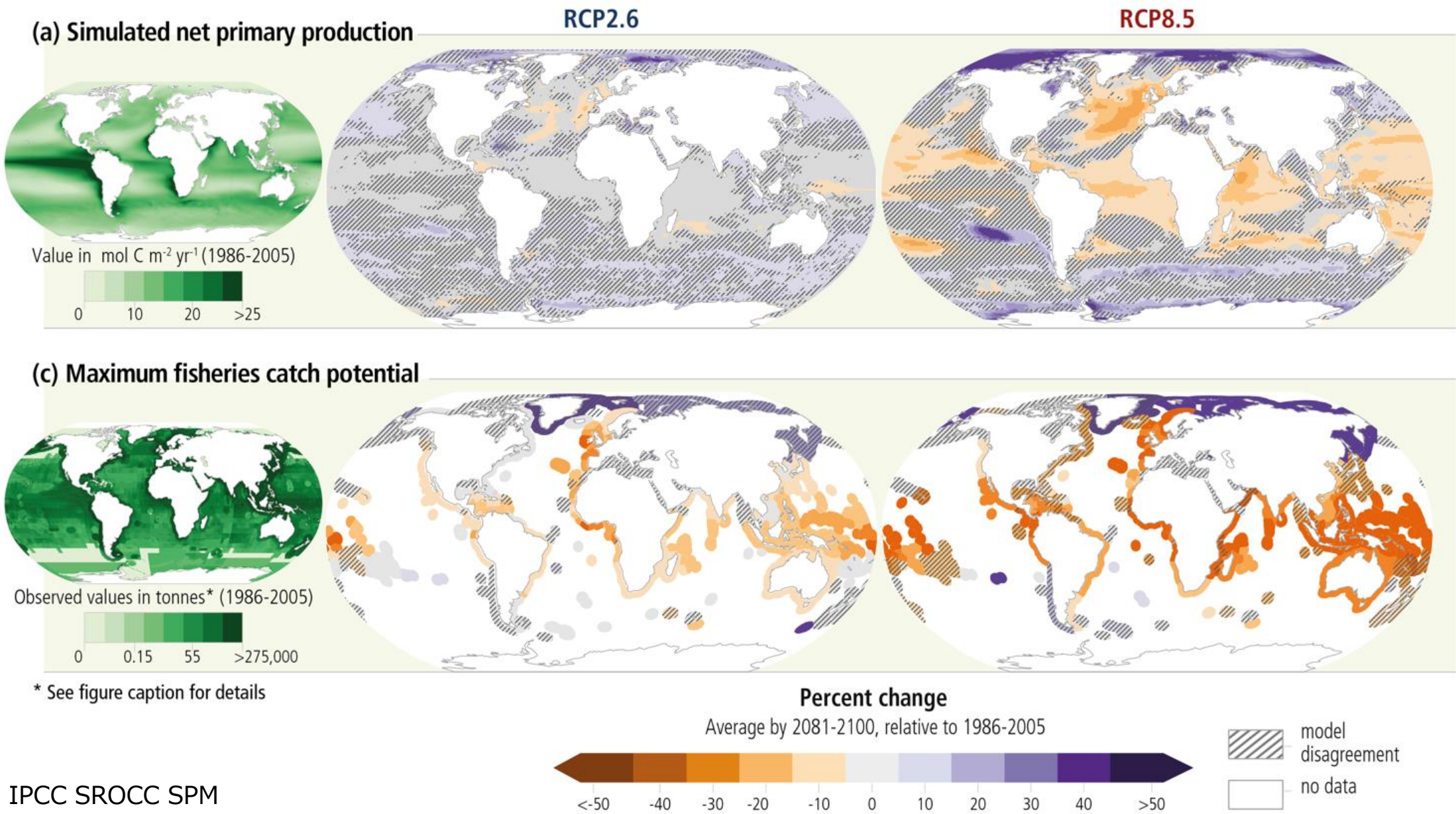


Surface intensified warming strengthens stratification.

↓

Mixing between upper and lower layers is suppressed.

Projected changes, impacts and risks for ocean ecosystems as a result of climate change



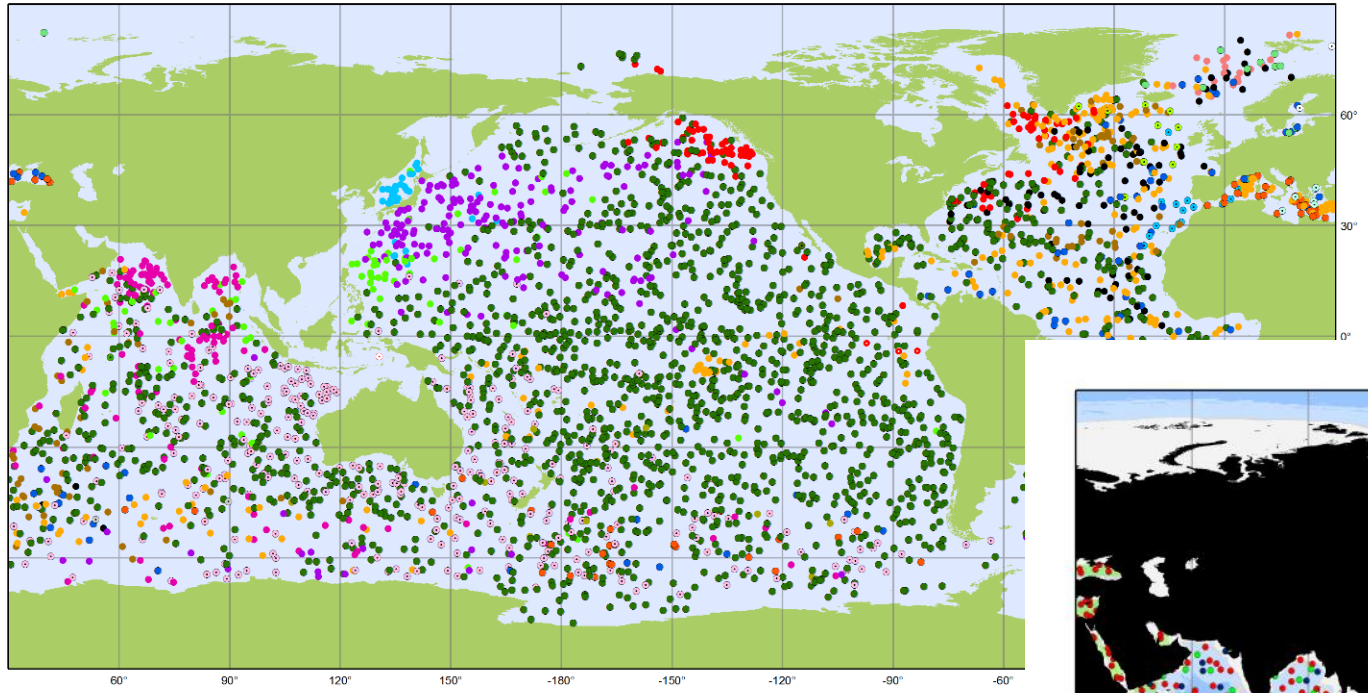
IPCC SROCC SPM

Global
Ocean
Observing
System

GOOS strategy 2030
to deliver the essential information needed for our sustainable development, safety, wellbeing and prosperity

Contributing to **UN Decade of Ocean Science for Sustainable Development (2021-2030)**

Argo: A network of over 3000 profiling floats measuring temperature and salinity of the top 2000 m of the global ocean, maintained for 15 years and contributing to detect ocean changes.

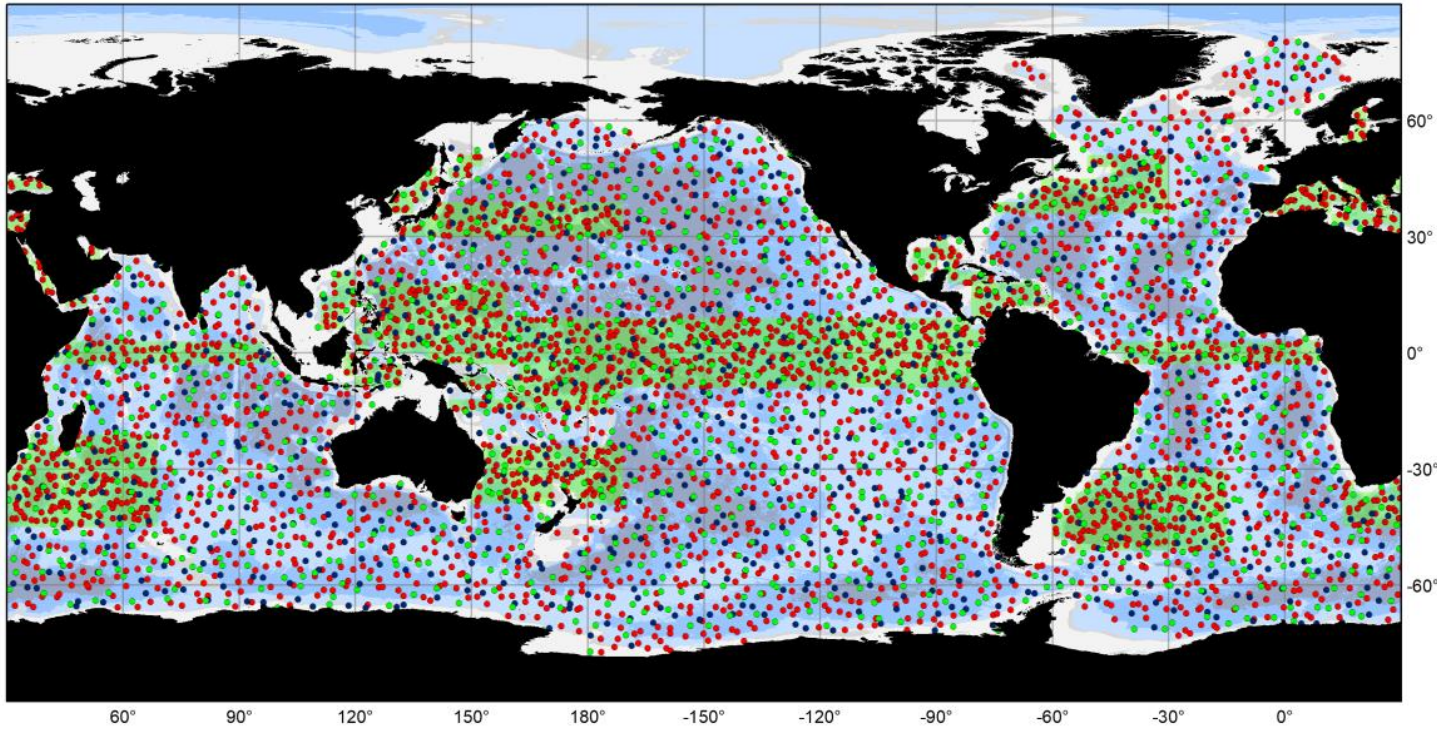


Argo

National contributions - 3852 Operational Floats

Latest location of operational floats (data distributed within the last 30 days)

AUSTRALIA (337)	FINLAND (2)	INDIA (139)	JAPAN (199)	NEW ZEALAND (
CANADA (99)	FRANCE (286)	INDONESIA (1)	KENYA (1)	NORWAY (19)
CHINA (81)	GERMANY (153)	IRELAND (11)	MEXICO (1)	PERU (3)
EUROPE (118)	GREECE (6)	ITALY (69)	NETHERLANDS (21)	POLAND (11)



Argo

Argo 2020 Design 4600 floats

- Core Floats, 2400 — Target density doubled
- Deep Floats, 1200
- BGC Floats, 1000

Generated by www.jcommops.org, 16/10/2018

New phase of Argo Program:

Argo 2020 Design

to measure down to the bottom and to measure biogeochemical properties

for better understanding/prediction of climate change and impacts

Take-home messages

- Carbon emissions from human activities are causing ocean **warming**, **acidification**, and **oxygen loss** with some evidence of changes in **nutrient cycling** and **primary production**.
- Those changes are affecting **weather/coastal phenomena** and **marine ecosystem**, which impacts on our **life** through increasing **disaster risks**, threatening **food security**, etc.
- The changes and impacts are projected to increase over coming decades; **adaptation** actions are required and a **decarbonized** society will help make more time and space for the adaptation.