



HOKKAIDO UNIVERSITY

Title	Marine ecosystem change resulting in carbon emission?
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Relation	地球温暖化による劇変を解明する．平成20年6月24日．札幌市
Issue Date	2008-06-24
Doc URL	https://hdl.handle.net/2115/34399
Type	conference presentation
File Information	Watanabe.pdf



5. Marine ecosystem change resulting in carbon emission?

Moderator:

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Marine ecosystem change resulting in carbon emission?

- In future prediction models, oceanic uptake is so stable with minor feedback from the climate change.

However,

- The polar/subpolar regions with high primary productivity will shrink significantly.
- The replacement of dominant plankton species will change the ocean from sink to source.
- Uncertain mechanisms have to be clarified and quantified as soon as possible.



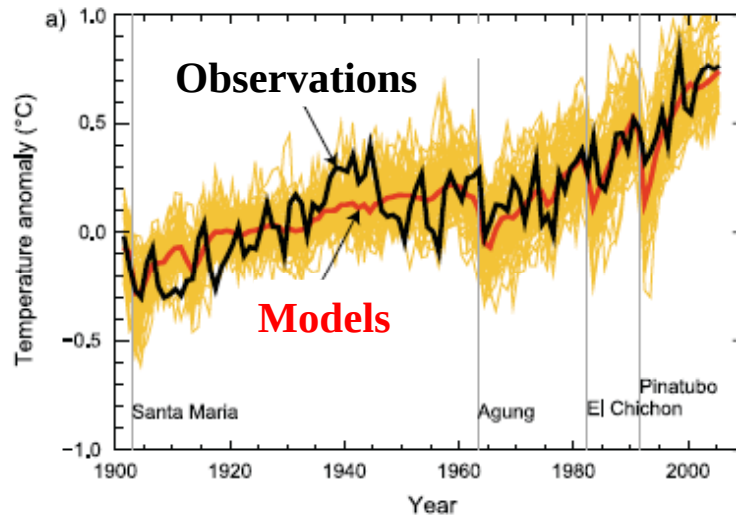
To elucidate the main causes bringing these uncertainties, we here prepare three main questions.

Question 1:

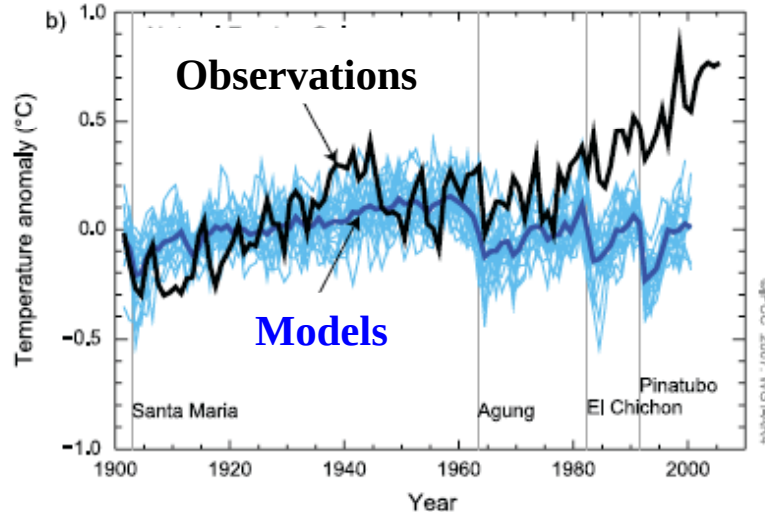
**What factors determine the Earth's natural and anthropogenic changes?
How exactly can we reconstruct/predict these changes?**

**Anthropogenic &
Natural Forcings**

Global Mean Surface Temperature Anomalies



Natural Forcing Only

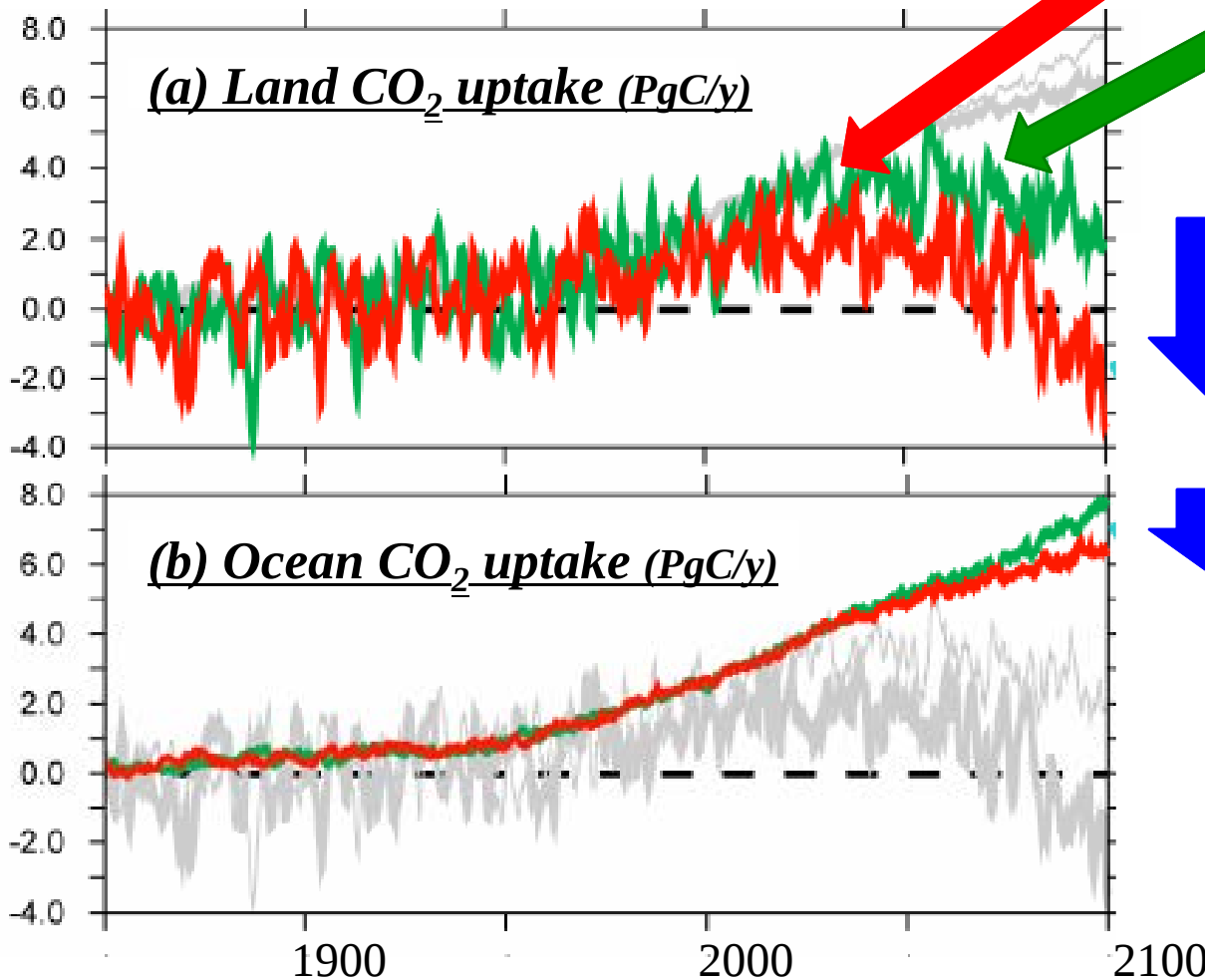


**The future prediction is
more proceeding with
anthropogenic impacts**

Sensitivity for carbon uptake or emission by ocean/terrestrial ecosystem

The Ocean response seems to be so stable.

Feedback by land and ocean



With
climate-ecosystem feedback

Without
climate-ecosystem feedback

Land ~3.5 PgC/y

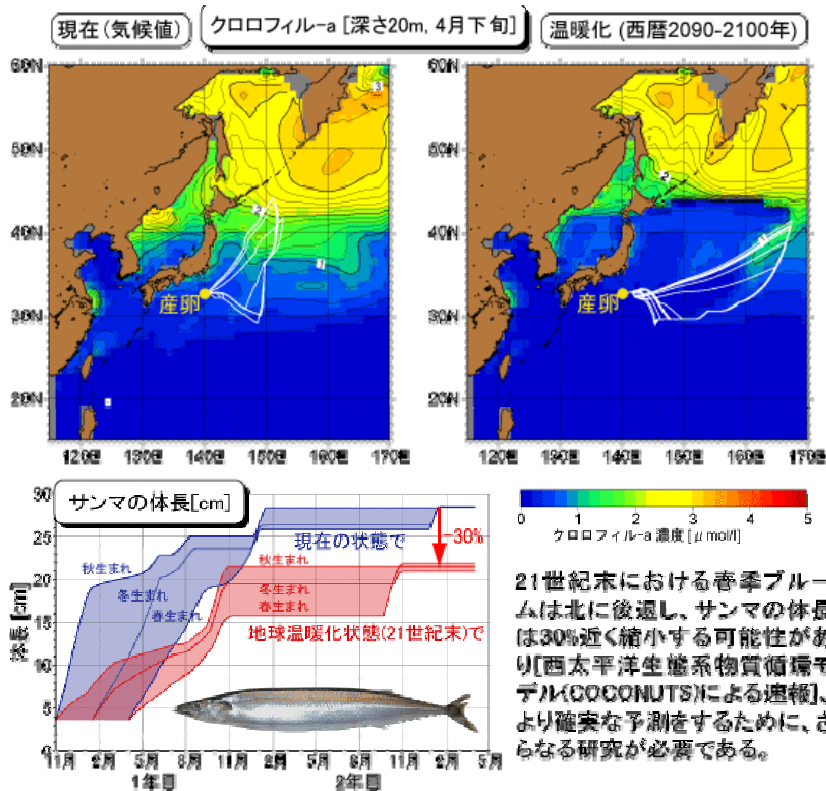
Ocean ~1.5 PgC/y

Question 2:

How could marine ecosystem respond to this climate change?

Based on Regional Modeling

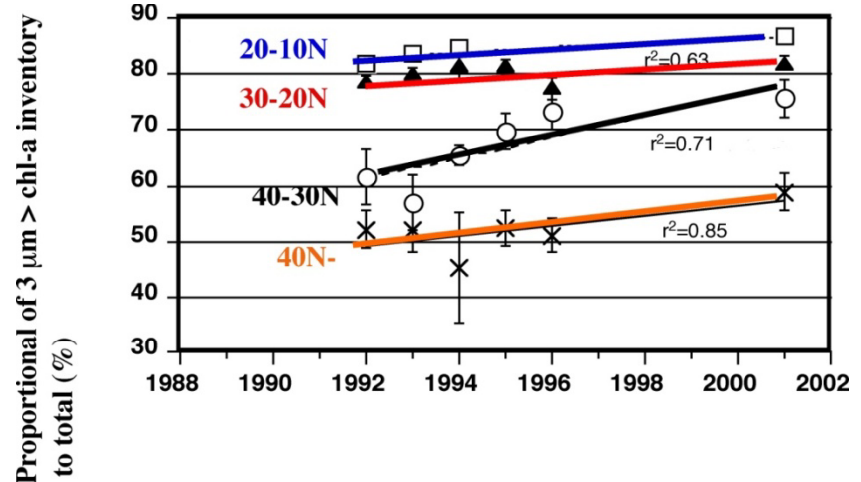
Phytoplankton reduction caused by global warming



Based on investigation

Plankton species change reduces alkalinity and CO₂ is emitted

In the North Pacific Ocean observations in 1990's



Question 3:

What kinds of oceanic feedback effects should we must consider? How large ?

For example

- **Change in aerosol input,**
- **Change in interaction between air and sea**
- **Change in interaction between ocean and land**

- **Change in ratio of nutrients (N/P ratio)**
- **Change in marine ecosystem**
- **Change of flux of DMS and N₂O**
- **Ocean Acidification**
- **etc.**

Presenter:

Dr. Michio Kawamiya

(**JAMSTEC**: Japan Agency Marine-Earth Science and Technology

FRCGC: Frontier Research Center for Global Change

GEMRP: Global Environmental Modeling Research Program

Group Leader)

IPCC report Climate Change 2007 AR4-WG1

Chapter 7: *Couplings Between Changes in the Climate System and Biogeochemistry*

Contributing Authors