

IFEP/MODEL workshop (W1)

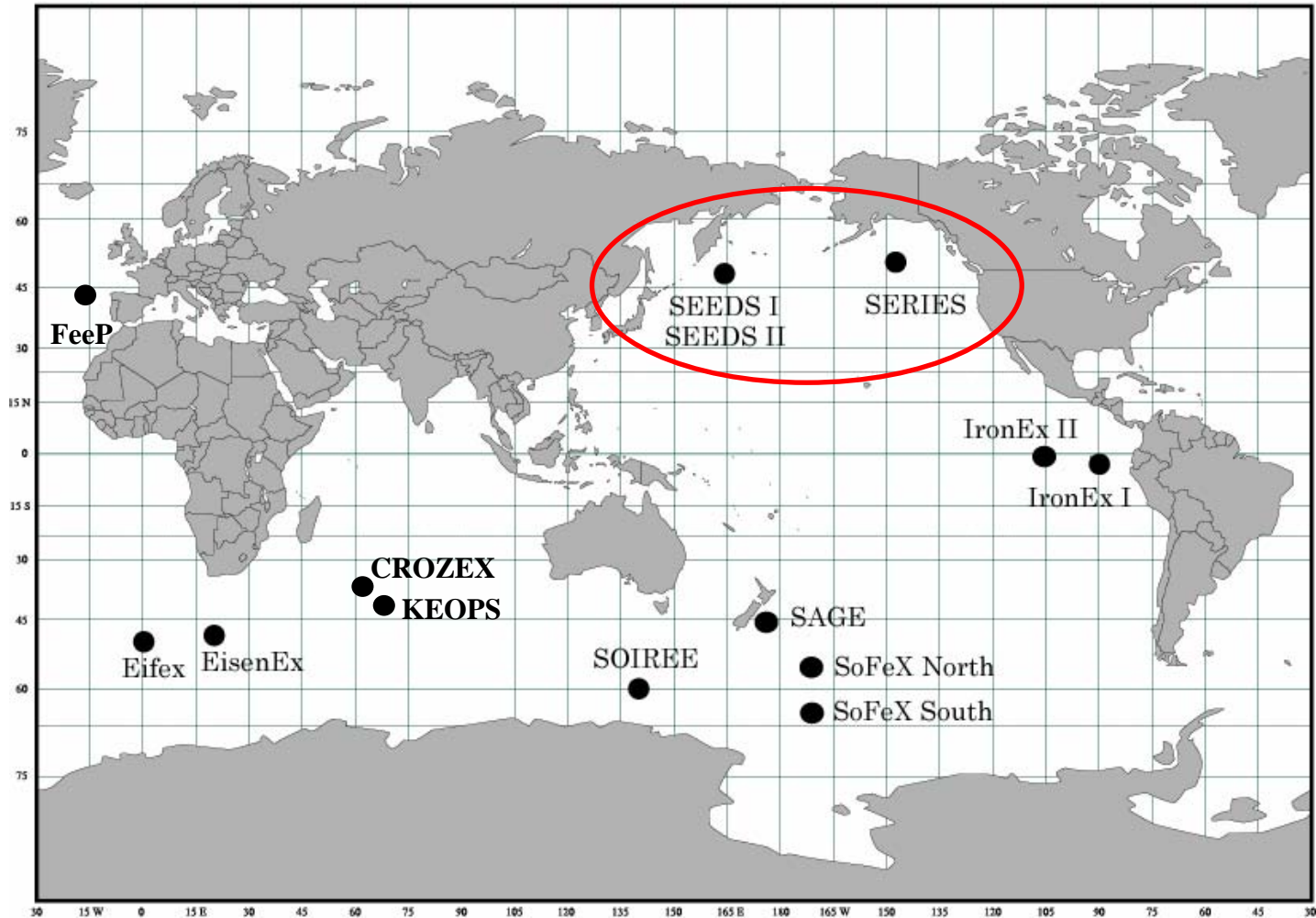
Introduction by convenors

October 13, 2006

Co-Chair

F. Chai & J. Nishioka

Locations of the *in situ* Fe enrichment experiments in the Ocean.



Background

- SEEDS I, II, and SERIES experiments demonstrated that iron is a key factor for regulating phytoplankton growth, phytoplankton species, ecosystem structure and biogeochemical cycles in the subarctic North Pacific Ocean, as other HNLC region.
- There is significant advances for understanding of the roles of iron in ocean ecosystem and iron cycle in the Ocean, which helps development of ocean modeling (biogeochemical cycle model and ecosystem model incorporating iron)
- An Ocean ecosystem model in the subarctic North Pacific, NEMURO, was constructed by Model task team as a PICES activity.

| Year | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------------------------|------------|------------------------|----------|---------|---|----------|---------------|---------------|
| IFExperiment in the N.Pacific | | | SEEDS | SERIES | | SEEDS-II | | |
| IFEP-meeting | Vladiostok | Hakodate | Victoria | Qingdao | Koria | Hawaii | Vladiostok | Yokohama |
| IFEP-WS | | Tsukuba Planning WS | | | Victoria Data synthesis and SEEDS II planning WS | | IFEP-MODEL WS | IFEP-MODEL WS |
| | | | | | | | SEEDS-II WS | |

- The first PICES-IFEP meeting was held in Vladivostok, Russia (PICES VIII)
- Detailed plans for SEEDS, in western subarctic Gyre and SERIES, in Alaskan Gyre, were discussed at an IFEP workshop in Tsukuba, Japan in 2000.
- Data exchanges and coordination of the cruises were done as part of the IFEP activity.
- IFEP-MODEL joint WS at Vladivostok : we locate the workshop as a start of discussion about incorporate iron cycle into ecosystem models, with experimentalists and Modelers.

◆ Summary of last year's workshop
(the report from WS to IFEP and Model task team)

● **Suitable model complexities**

Identify important processes, spatial and time scale, functional group, ...

● **Targets of modeling in PICES**

Specific: mechanisms of difference among iron fertilization experiments (IFE)

General: variability of ecosystem dynamics associated with climate changes in the near future, iron cycle in the Ocean

● **Which observation data, experimental data does model needs e.g., for validation and parameterizations**

● **All participants agree with developing an ecosystem model with iron cycle in IFEP/ Model joint activity**

● **Model intercomparison study with experimental data base of IFEs**

● **Plan for one day full workshop in PICES 15th in Yokohama**

Aims of Workshop in this year

- Enhance communication between experimentalists (field scientist) and modelers working on iron biogeochemistry and ecosystem modeling.
- Provide an opportunity for experimentalist and modelers to share their latest results.
- Discuss and make a recommendation for future iron cycle observation and ocean ecosystem, biogeochemical modeling in the subarctic Pacific

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Schedule of IFEP/MODEL workshop (W1)

9:00-9:10 Welcome and introduction

9:10-9:50 M. Boye, O. Aumont, C.M.G. van den Berg and H.J.W. de Baar (- invited)

9:50-10:15 A. Ooki, J. Nishioka and T. Ono

10:15-10:40 D. Tsumune, K. Lindsay, G. Danabasoglu, S.C. Doney, J. Nishioka, T. Yoshimura, F.O. Bryan and N. Nakashiki

10:40-11:00 *Tea/Coffee Break*

11:00-11:25 F. Chai, L. Shi, M-S Jiang, Y. Chao, F. Chavez and R.T. Barber

11:25-11:50 M. Fujii, and F. Chai

11:50-13:30 *Lunch*

13:30-13:55 A.J. Hermann, T.M. Powell, E.L. Dobbins, S. Hinckley, E.N. Curchister, D.B. Haidvogel and K. Coyle

13:55-14:20 N. Yoshie, K. Sato, Y. Yamanaka and J. Nishioka

14:45-15:30 Discussion

Poster: Debby Ianson, C. Voelker, K.L. Denman, E. Kunze and N. Steiner

Discussion and a proposal from this workshop

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We would like to discuss.....

◆ How can ocean models be improved with detailed iron dynamics to better represent ocean ecosystems, biogeochemical cycles?

e.g. Processes, Ligands chemistry, Formulated equations, Parameterizations, Model complexities....

◆ Discuss and make a recommendation (requests) for future iron cycle observation and ocean ecosystem, biogeochemical modeling in the subarctic Pacific, and other HNLC region.

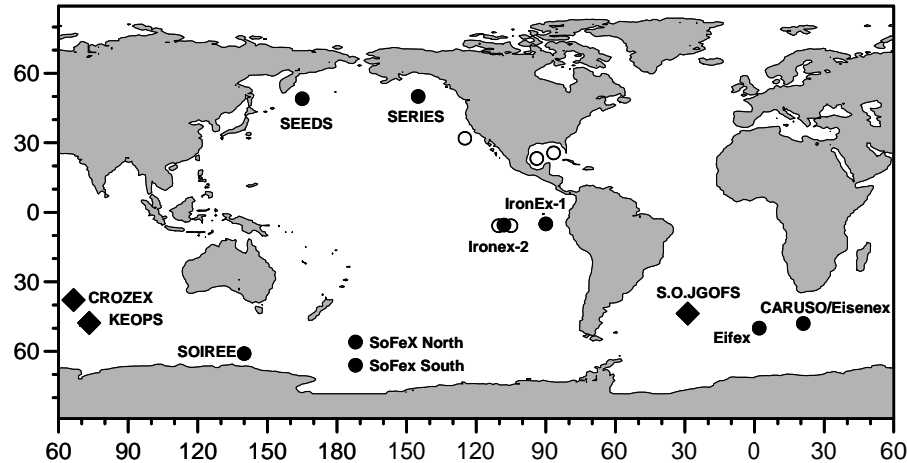
e.g. Which observation data, experimental data does model needs, for validation and parameterizations

◆ Summarize this workshop

IFEP/Model session

Proposal for a SCOR Working Group (submitted to SCOR 2006)

The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling



Objectives

The objectives of the proposed working group are twofold:

1. Data compilation. An international Working Group will be able to set the example (i) for readily making available data, first to colleagues of the given experiment and next to the open access database, (ii) for proper recognition of the original scientist, (iii) for enhancing the slow culture of one discipline to meet the faster data dissemination practices of another discipline, (iv) for re-assuring hesitant scientists about protection of their interests as original data producer.

2. Modeling. The Working Group will in a suite of 2-3 workshops bring together these modelers as well as key experimentalists to compare models, define common standard scenarios for validation and, in general, make available the compiled datasets (objective 1.) to the evolving community of modelers.

◆ Summary of this workshop

(as the report from W1 to IFEP and Model task team)

Experimentalist generously support by their data set to construct the models- construct data base in other international activity-.

Modeler's suggestion to experimentalist for improve experiment and natural observation works.

We conclude this IFEP/MODEL joint WS in 2006, however, we will continue to make communication between experimentalist and modelers working on iron biogeochemistry and ecosystem modeling.

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Report the IFEP/MODEL workshop (W1)

- **Report modeling results that incorporate iron cycle in the N. Pacific ecosystem.**

IFEP/Model session, Invited speaker

Plans for 2006 (proposal for IFEP/Model WS)

IFEP Workshop for *Synthesize in situ* iron enrichment experiments in the eastern and western subarctic Pacific

October 13-21, 2006, Yokohama, Japan

- **Synthesis the results of SERIES and SEEDS2001, SEEDS2004.**
- **Create data base of SEEDS and SERIES.**
- **Report modeling results that incorporate iron cycle in the N. Pacific ecosystem.**

Requests for travel support

Three invited speakers to attend the IFEP Workshop

(Fe ecosystem Modeler, Fe biogeochemist)

From Iron chemistry

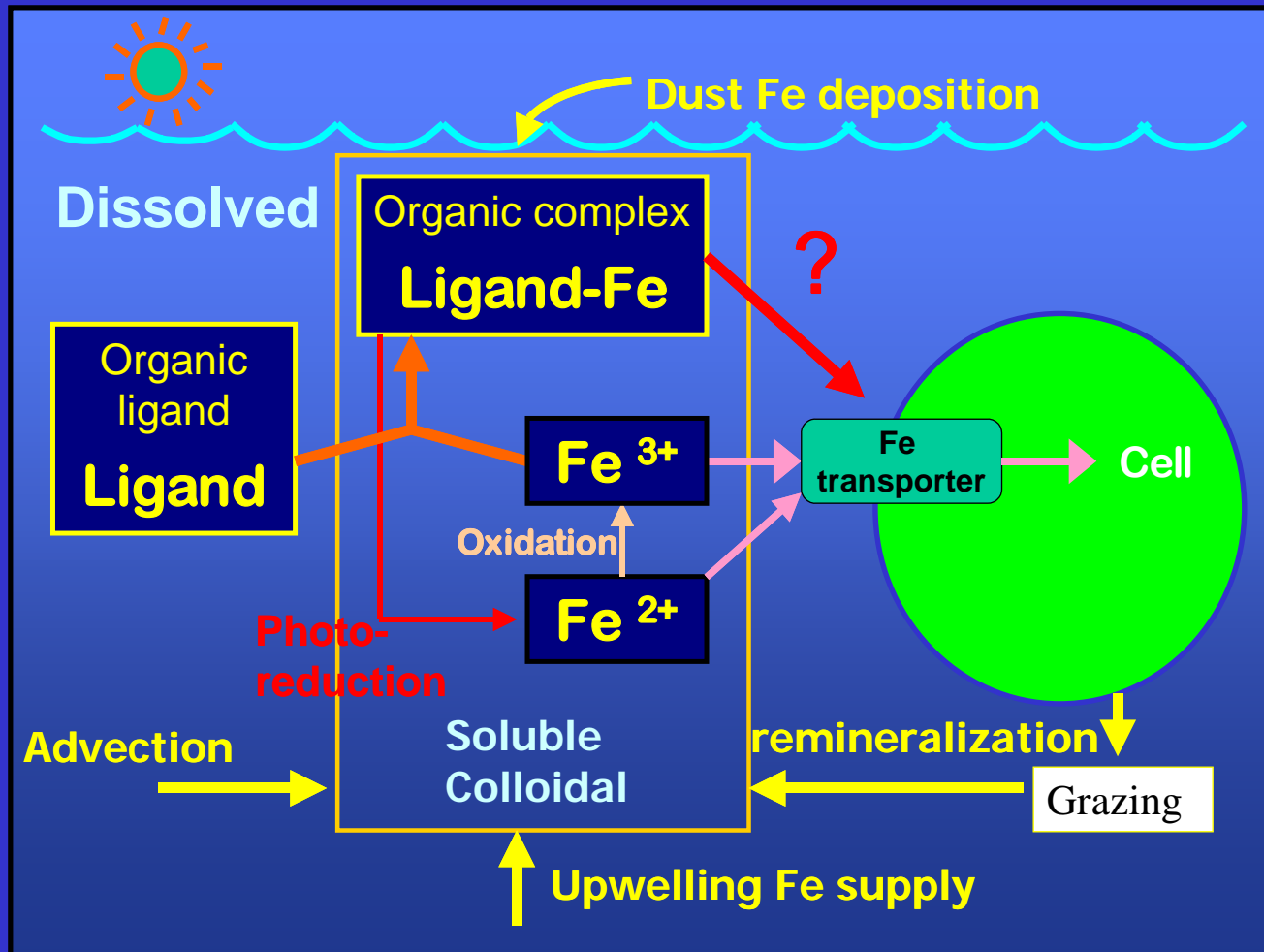
Chemistry of iron is not simple (exceedingly complex). There are still a number of large uncertainties in our understanding of iron chemistry in the Ocean.

From modelers

Ecosystem models need parameterizations representing relatively simple equation of iron chemistry and the observed data for model validation.

◆ What are critical gaps in our knowledge between marine iron cycle and that in the models? Where it is?

e.g. Processes, Formulated equations, Parameterizations, Model complexities



◆ What is Modeler's (observation people) recommendation to experimental and observational data (to Models)?

e.g. Interesting point for modeling, Necessary data, IFEs model comparison etc.

e.g. Quantitative estimation for each processes, Fate of carbon, Export flux, etc.
What is important factor which regulate iron cycle,

◆ What is experimental observational people recommendation to Modeler?

Quantitative estimation for each processes, Fate of carbon, Export flux, etc.
What regulate iron cycle, etc.

Two direction are there.

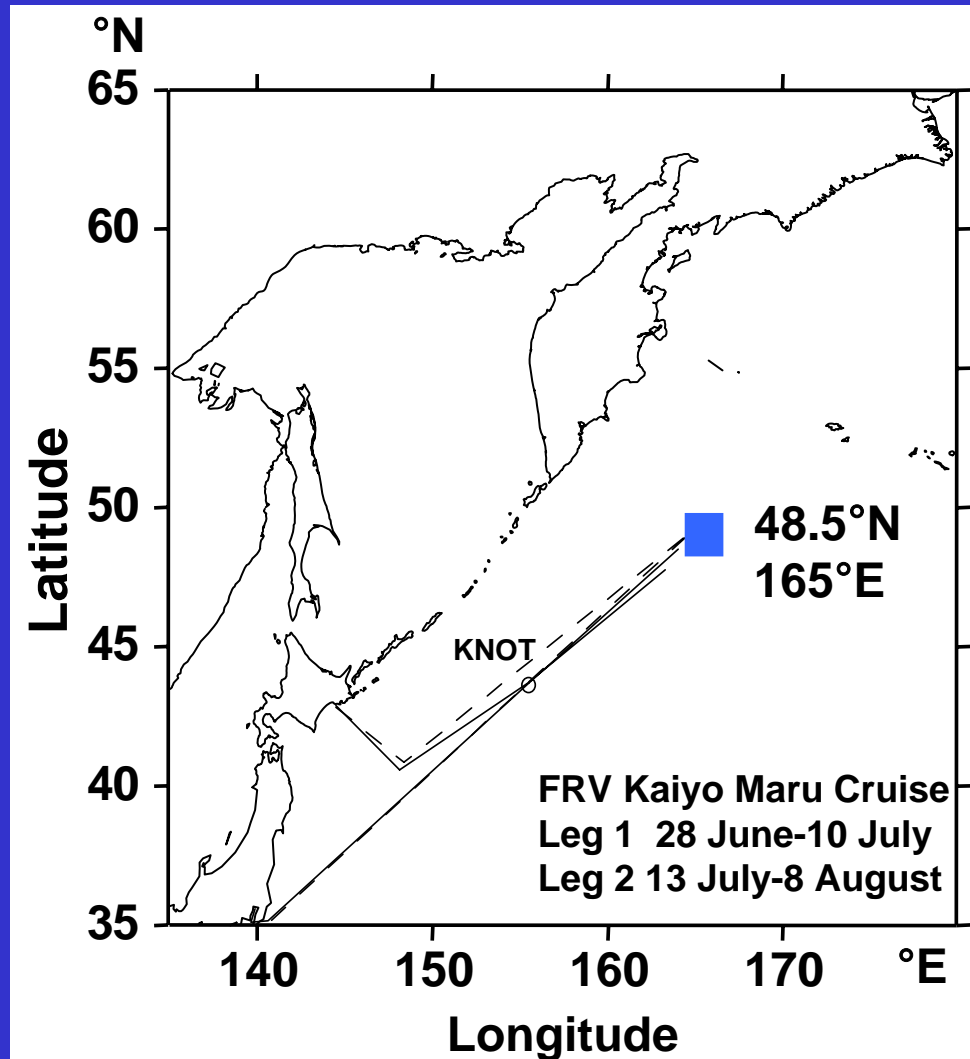
1. **Develop general ecosystem model with Iron cycle**
(Not special! Fe enrichment experiment is special case)
2. Develop global iron biogeochemical cycles model
(represent global iron distribution)

Ultimately, both models should be integrated in near future.

Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study *SEEDS-I (2001)*



Kaiyo Maru





SERIES (2002)

Surface Ecosystem Response to Iron Enrichment Study



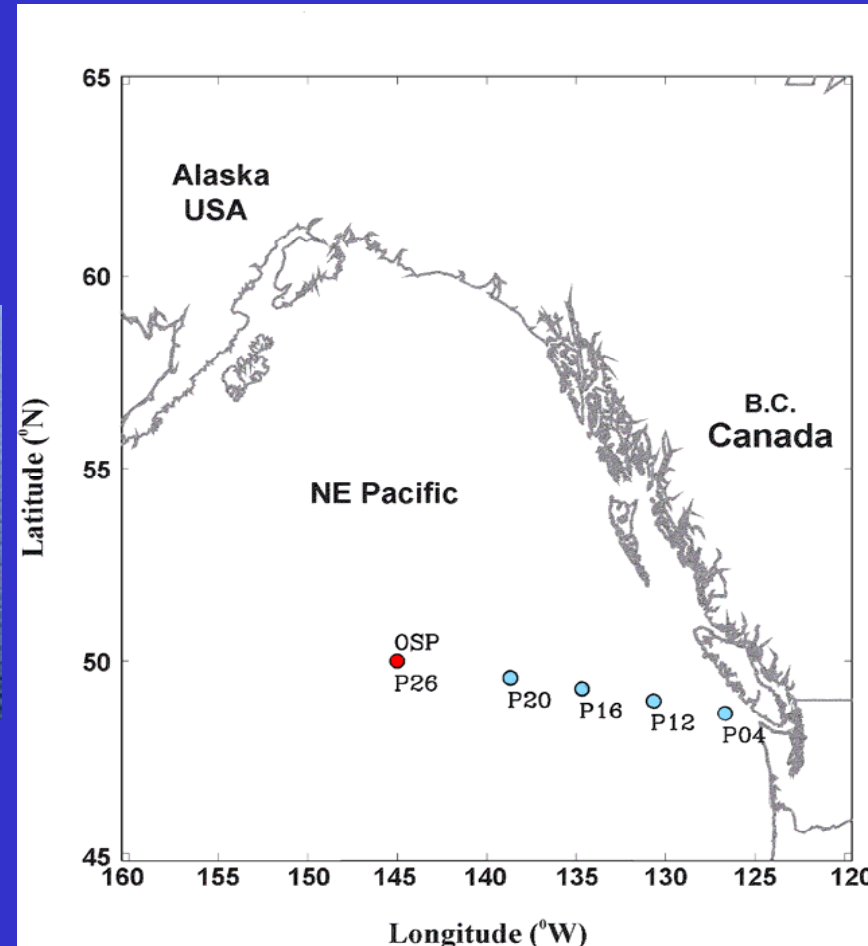
CCGS Tully



Kaiyo Maru



El Puma



***Subarctic Pacific Iron Experiment for
Ecosystem Dynamics Study
SEEDS-II (2004)***

Hakuho Maru



Kilo Moana



Dust Fe deposition

Dissolved

Organic complex
Ligand-Fe

?

Organic
ligand

What is the important factor which regulate global iron cycle in the ocean?

Oxidation

Fe²⁺

Photo-reduction

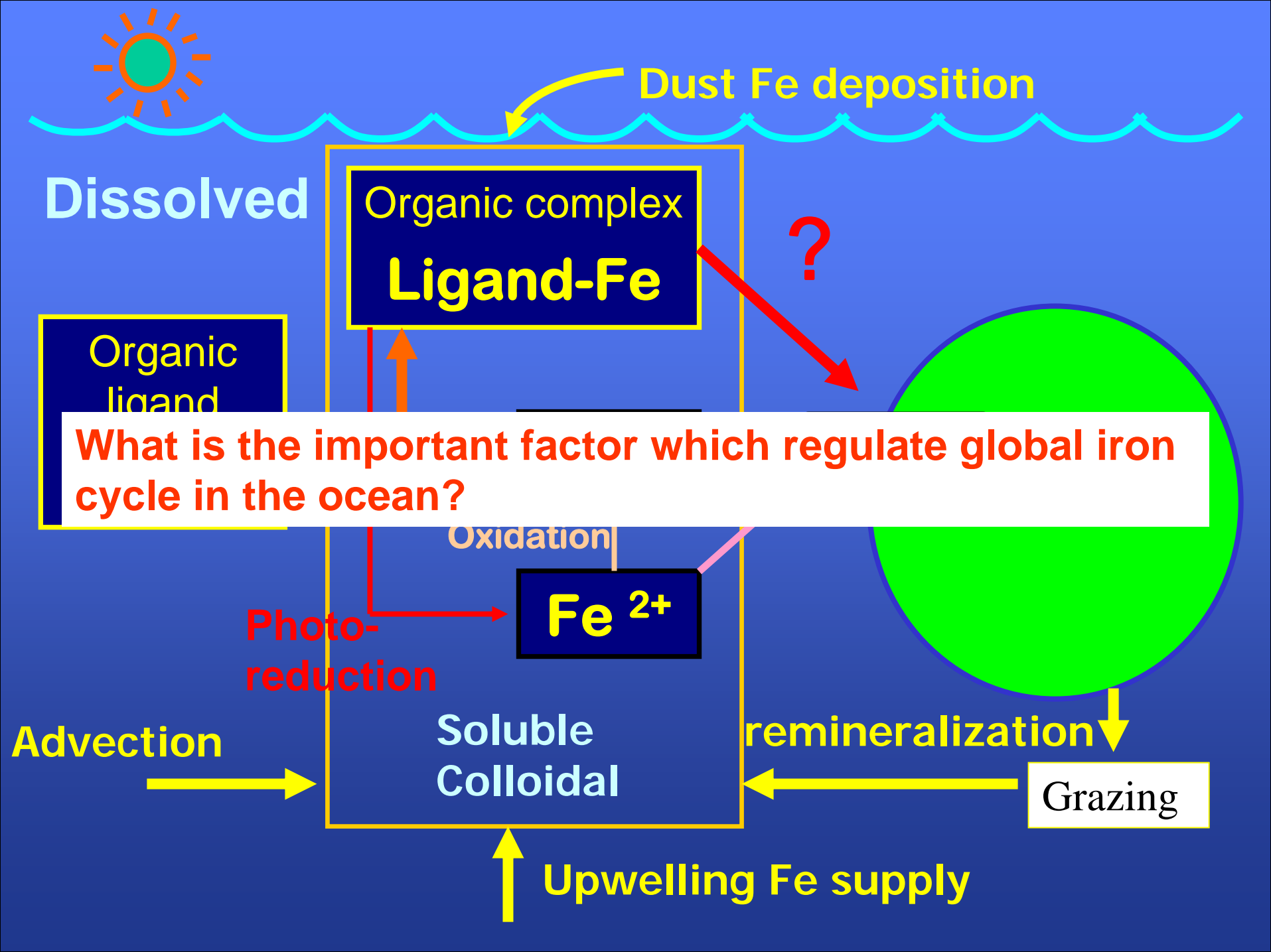
Advection

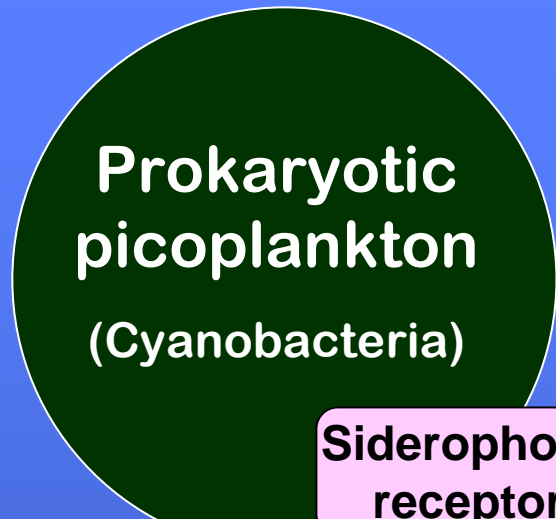
Soluble
Colloidal

reminereralization

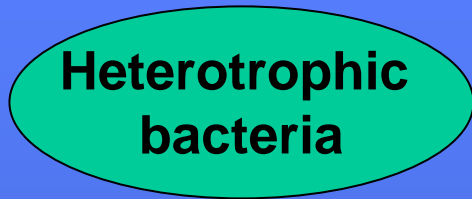
Grazing

Upwelling Fe supply

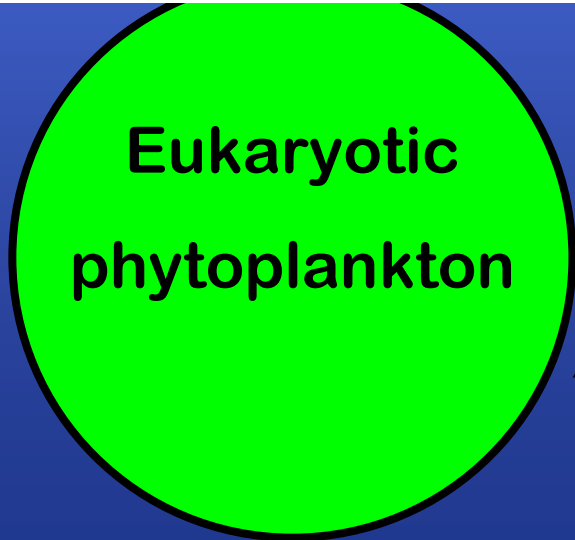




Siderophore
receptor

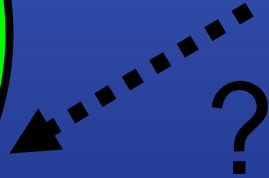
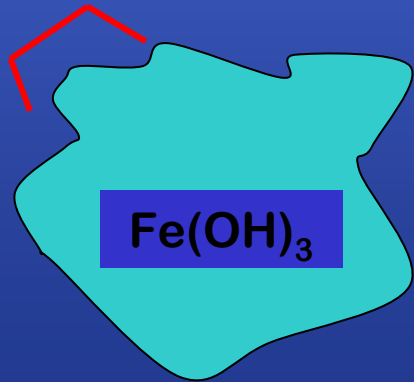


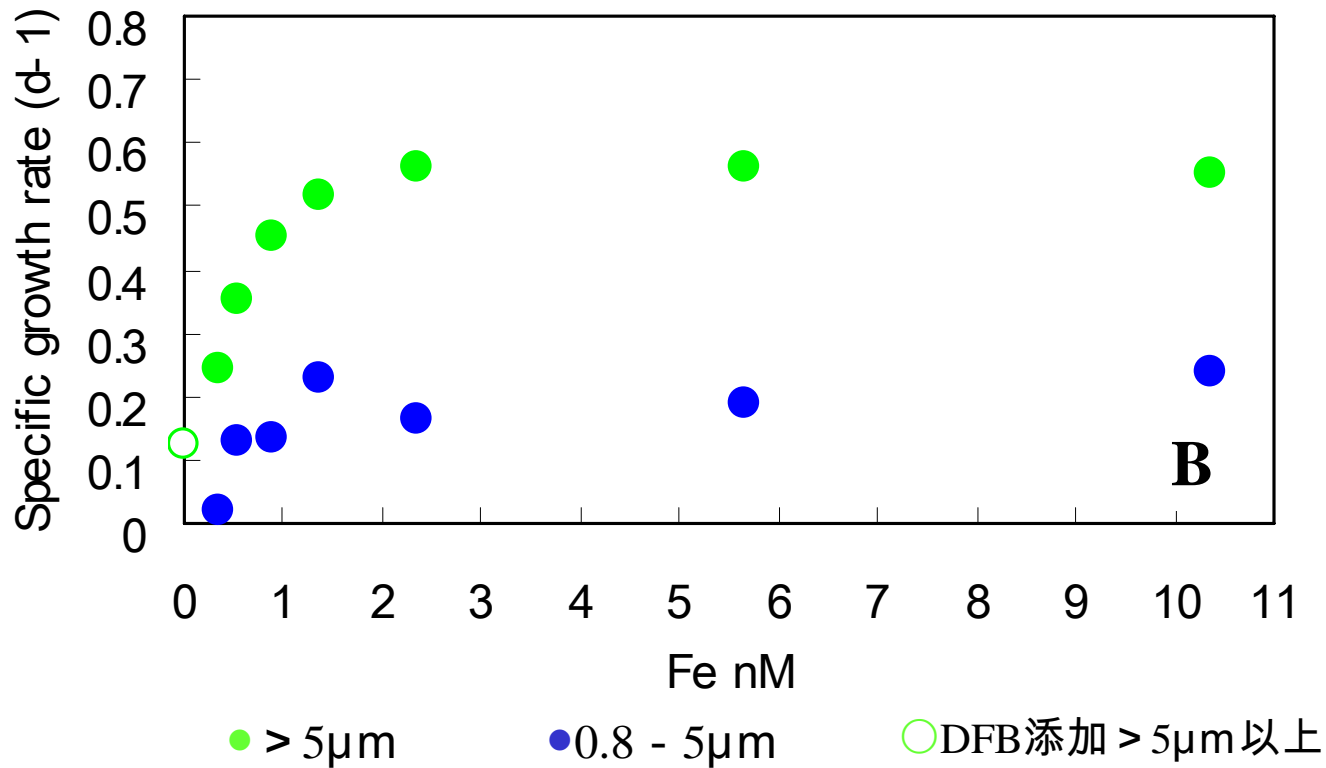
Which functional group's data do you need?
Do you have any suggestion to divide the functional group?
(Size? Species? etc.)



Siderophore – Fe

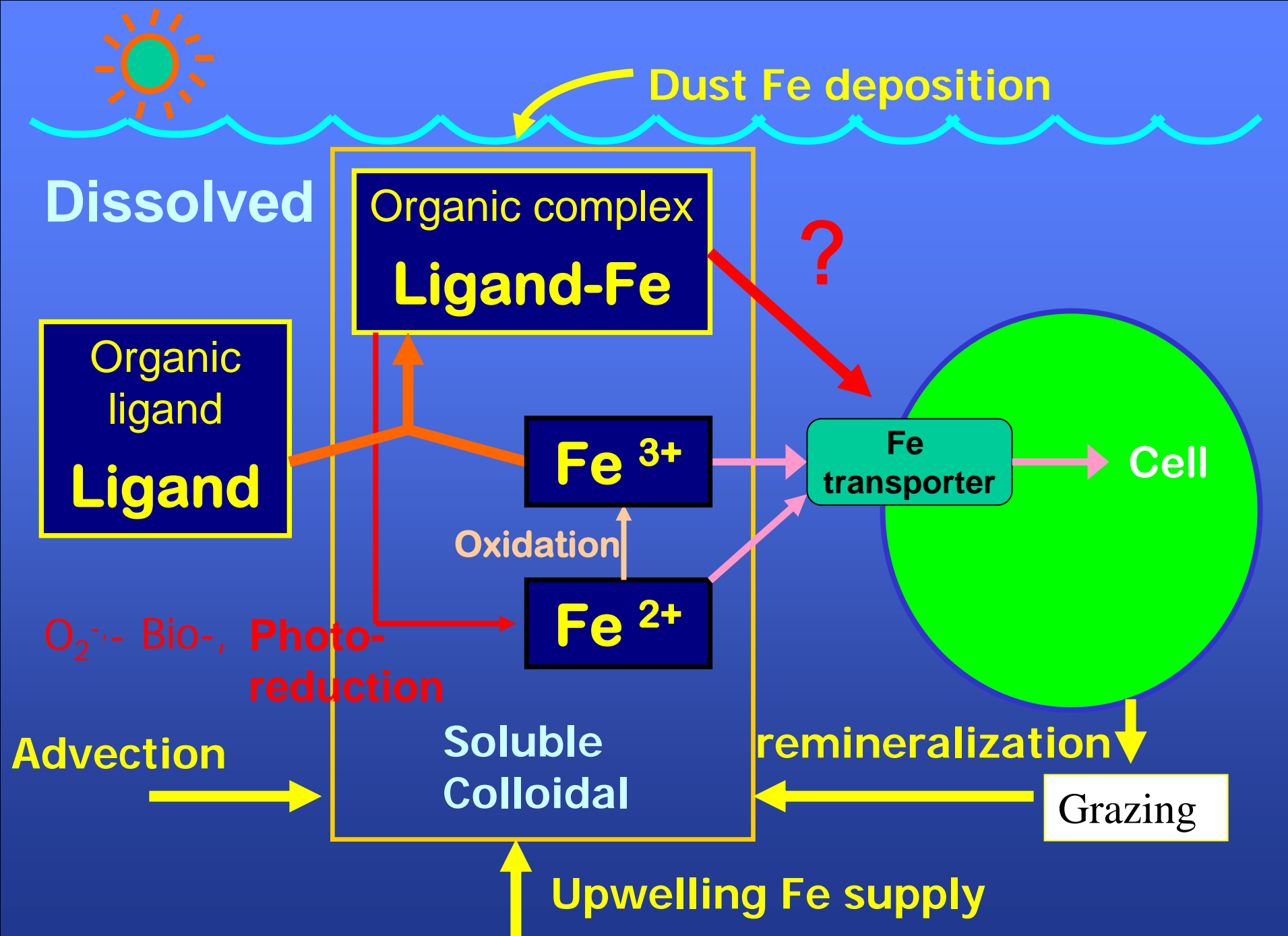
Ligand – Fe





Fe concentration vs Specific growth rate

Responses are different among



◆ Where is uncertainty points for the Ecosystem models?

Where improved understanding, simplifying and parameterizations are needed?

IFEP-AP Meeting agenda

Sun. Oct. 2 15:40-18:00

1 Introduction of a new member

2 Adoption of agenda

3 Report of the IFEP/MODEL Workshop

4 Program of 2005 SEEDS-II Workshop in Tokyo

5 Future IFEP activity plans

5.1 Discuss need for special Symposium/Session of SEEDS, SERIES and SEEDS-II during the 2006 PICES meeting in Japan

5.2 Discuss need for the next joint Workshop with MODEL Task Team

5.3 Discuss need for the synthesis report of IFEP

6 Publications (PICES report, SEEDS and SERIES special volumes)

7 Request for travel supports to the 2006 Symposium/Session

8 Other new business

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Schedule of IFEP/MODEL workshop (W3)

8:30-8:40 Introduction by Convenors

8:40-9:20 Croot (2220) – invited **but cancelled**

9:20-10:00 Yoshie, Yamanaka and Takeda (2526) - invited

10:00-10:20 Coffee Break

10:20-10:50 Kishi, Okunishi and Ono (2551)

10:50-11:20 Pena, Denman, Voelker and Rivkin (2363)

11:20-11:50 Fujii, Yoshie, Yamanaka and Chai (2513)

11:50-12:20 Christian and Voelker (2536)

12:20-13:30 Lunch Break

13:30-14:30 Discussion and development of a proposal for a workshop to compare ecological models describing how plankton ecosystem respond top meso-scale iron enrichment experiment in HNLC waters

We would like to discuss about.....

◆ What is critical gaps in our knowledge of marine iron cycle and that in the models? Where it is?

Processes, Formulate equation, Parameterization

◆ Where is uncertainty points for the Ecosystem models?

Where improved understanding, simplifying and parameterizations are needed?

◆ What is Modeler's recommendation to experimental and observational data?

Interesting point for modeling, necessary data, etc.

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SEEDS II Workshop

Second Iron Enrichment Experiment in the Western Subarctic Pacific

Date: **October 17-18, 2005**

Venue: Ocean Research Institute, The University of Tokyo, Tokyo, Japan

(<http://www.ori.u-tokyo.ac.jp/en/index.html>)

Convenors: A. Tsuda, S. Takeda, M. Uematsu (Univ. of Tokyo) and M. Wells (Univ. of Maine)

Organized by

Ocean Research Institute, The University of Tokyo

Sponsored by

Ocean Research Institute, The University of Tokyo

North Pacific Marine Science Organization (PICES)

SOLAS Japan

WORKSHOP MAIN THEMES

1. To **synthesize the key biological findings** of the SEEDS II
2. To **elucidate the changes in iron biogeochemistry**
3. To determine the **effect of iron** addition on the **production of trace gases**
4. To compare the biogeochemical changes associated with **SEEDS I and SEEDS II**

Schedule

The 1st day:

9:30-9:50

- Background and introduction of SEEDS II

A. Tsuda

9:50-10:20 Chair: K. Johnson

- Patch dynamics

D. Tsumune, Y. Watanabe, A. Shimamoto

10:20-10:50

- Iron and trace metal chemistry

J. Nishioka, K. Johnson, M. Wells, S. Nakatsuka, Y. Sorin, H. Obata

Coffee Break 10:50-11:10

11:10-11:40 Chair: S. Takeda

- Biological responses

H. Saito, K. Suzuki, H. Kiyosawa, A. Tsuda

11:40-12:10

- Carbon and nitrogen budget

I. Kudo, T. Aramaki, T. Ono, Y. Nojiri

12:10-12:40

- Complexity of grow-out experiments: further iron stimulation of communities from an iron fertilized patch

W. Cochlan, M. Wells, C. Trick

Lunch 12:40-14:00

14:00-14:30 Chair: C. Trick

· DMS and DMSP dynamics

M. Lavasseur, I. Nagao, S. Hashimoto

14:30-15:00

· Summary of atmospheric chemistry

M. Uematsu, S. Kato, K. Kajii

15:00-15:30

· The SAGE Experiment: Why was there no bloom?

J. Hall

15:30-16:30 Poster session

16:30-16:50 Chair: A. Tsuda

· Establish the charges for breakout groups, select a Chair and rapporteur for each group, and begin discussions of the key aspects of the findings.

Tentative groups and Chair

1. Patch dynamics (D. Tsumune)

2. Trace metal chemistry (S. Takeda)

3. Biological responses (H. Saito)

4. Gasses (M. Uematsu)

5. Budgets (I. Kudo)

The 2nd Day:

9:30-11:30 Continue the group discussion

11:30-12:15 Suggestions from modelers

M. Fujii (M. Wells), N. Yoshie, D. Ianson

Lunch 12:15-13:45

13:45-15:00 Report from each breakout group

15:00-15:20 Coffee break

15:20-17:00 Synthesis and future plans

Contribution to IFEP/PICES

Listing of planned manuscripts

Publications

International meetings

Etc.

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Plans for 2006 (proposal for IFEP/Model WS)

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- **Create data base of SEEDS and SERIES.**
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