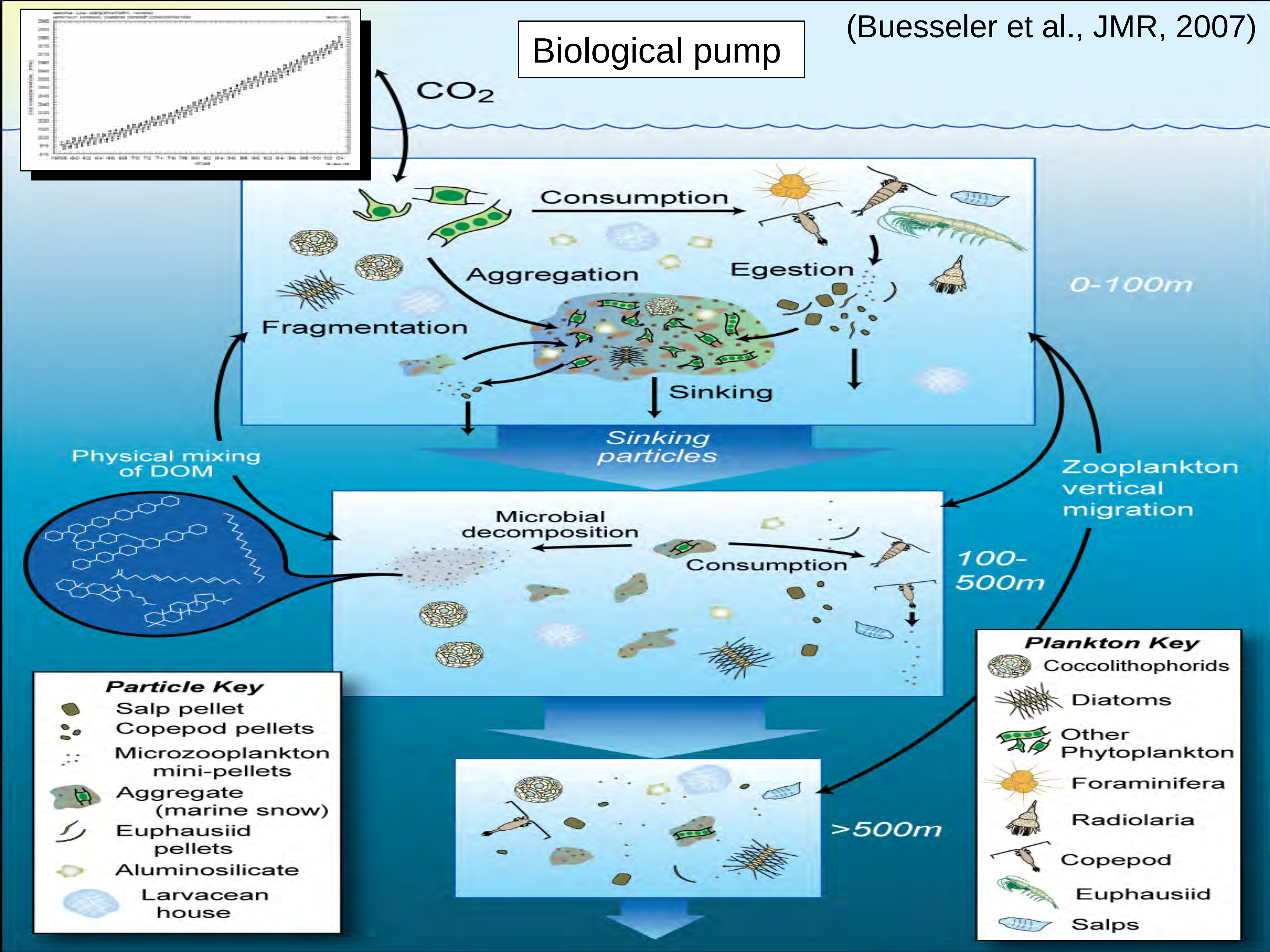
2nd ESSAS OSM in Seattle, May 2011

S1 Comparative studies on Polar and Sub-Polar ecosystems, #7355

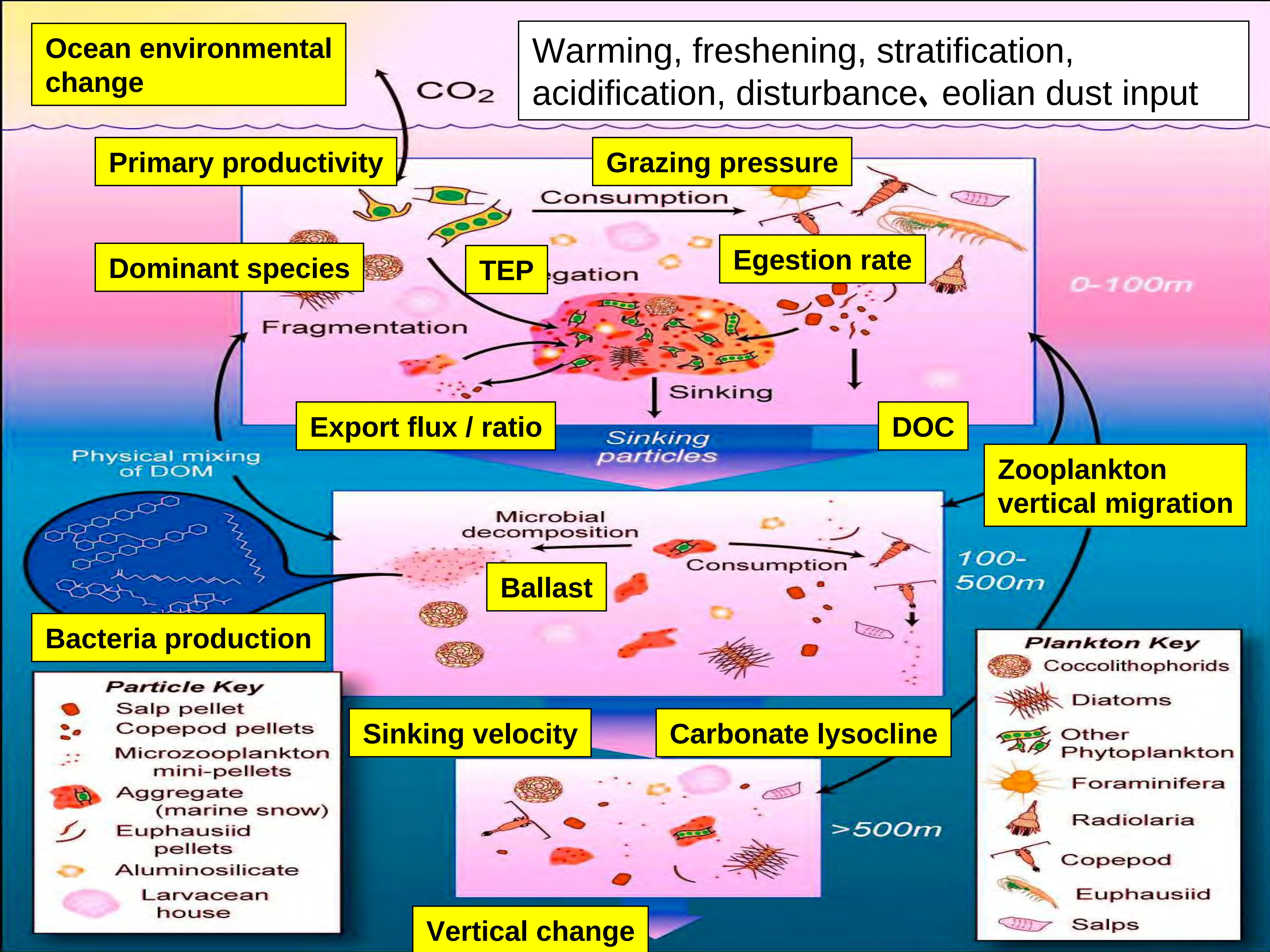
Study of change in marine ecosystems and material cycles by the climate change: Comparative time-series observation in the sub-arctic and sub-tropical gyre

Makio C. Honda,
Kazuhiko Matsumoto, Kosei Sasaoka, Tetsuichi Fujiki, Hajime Kawakami, Masahide Wakita, Minoru Kitamura, Shuichi Watanabe and Toshiro Saino

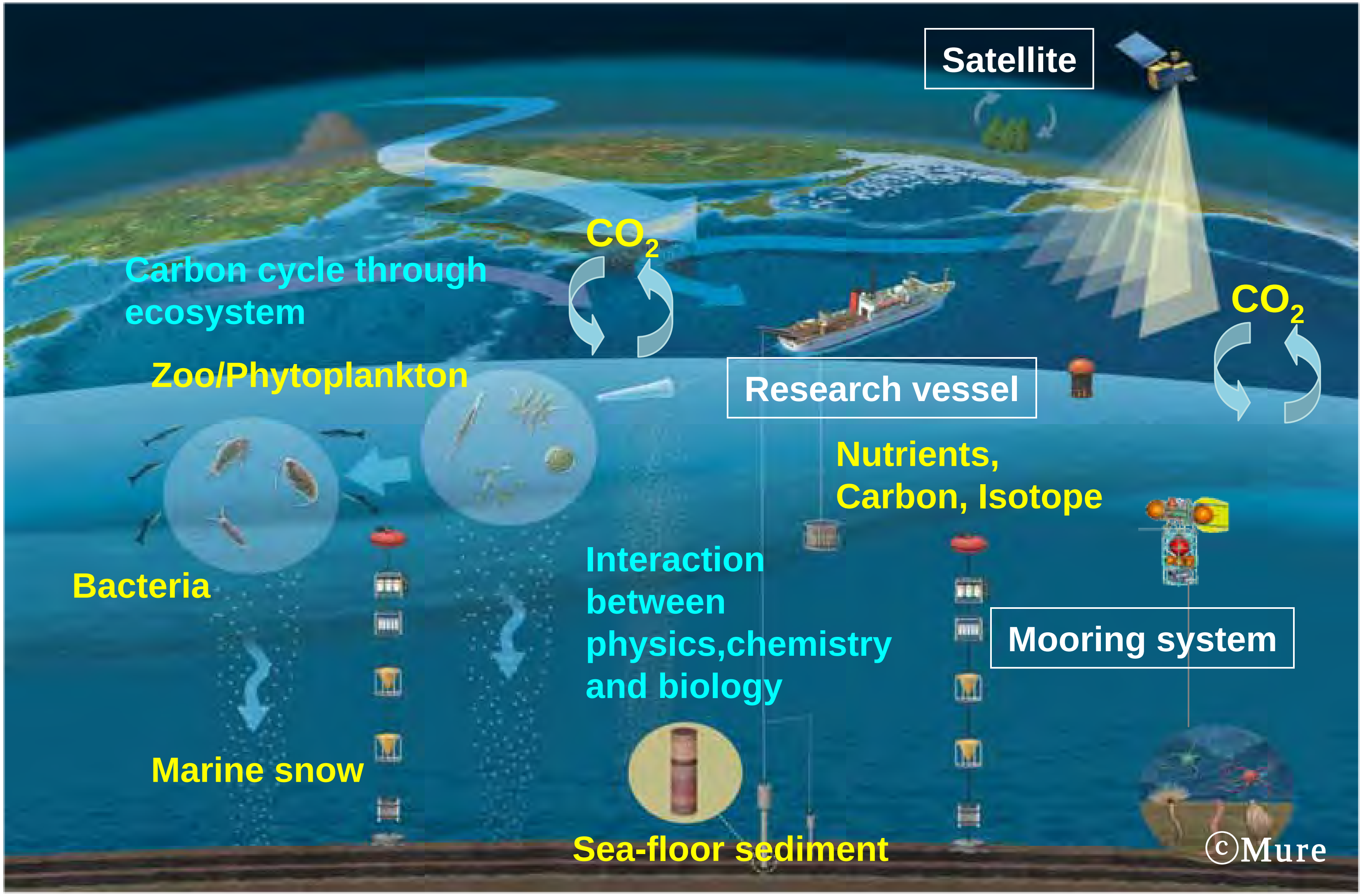
Japan Agency for Marine-Earth Science and Technology



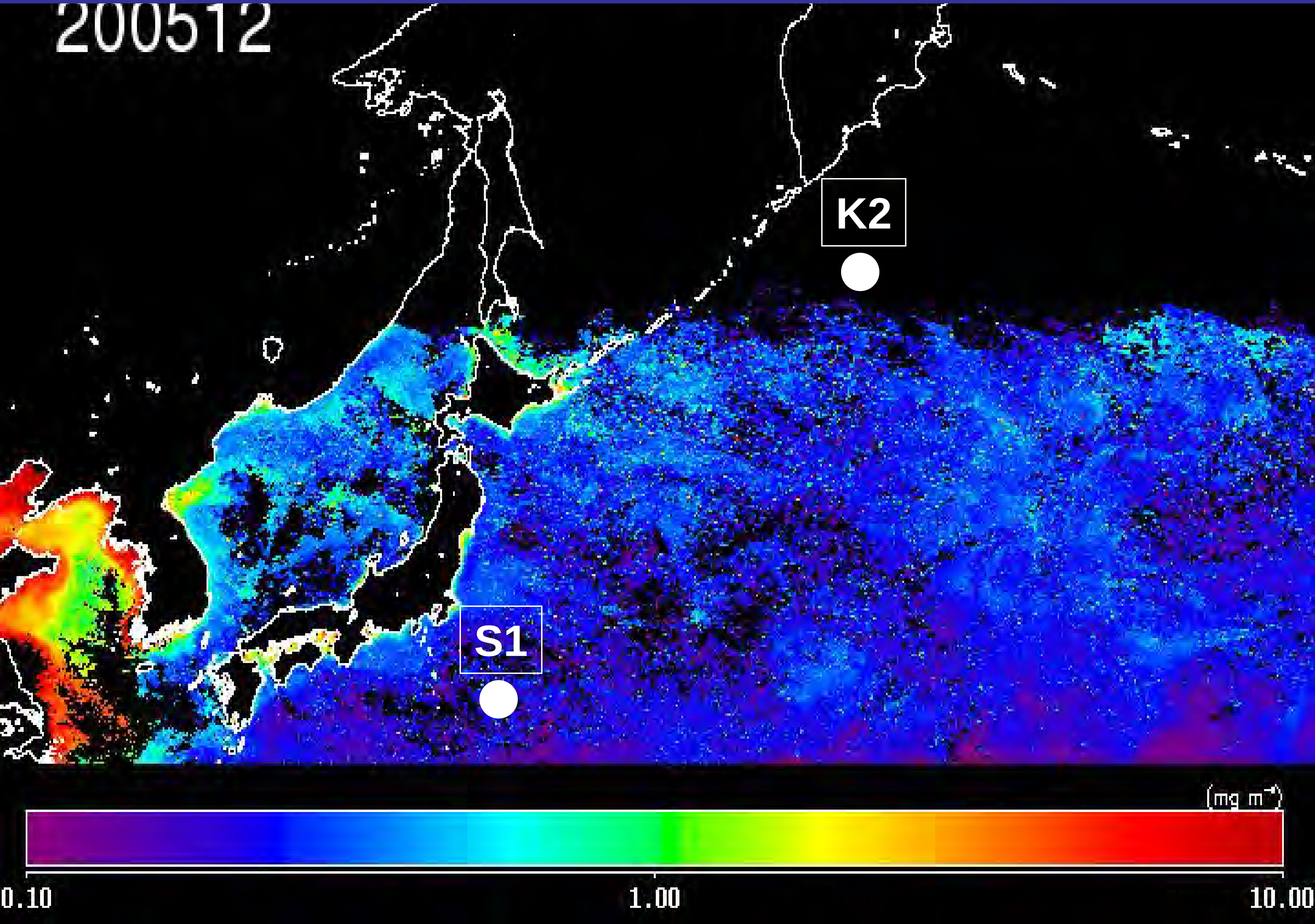
Biological pump
(Buesseler et al., JMR, 2007)
CO_2
Consumption
Aggregation
Egestion
Fragmentation
Sinking
0-100m
Sinking particles
Physical mixing of DOM
Zooplankton vertical migration
Microbial decomposition
Consumption
100-500m
>500m
Particle Key
Salp pellet
Copepod pellets
Microzooplankton mini-pellets
Aggregate (marine snow)
Euphausiid pellets
Aluminosilicate
Larvacean house
Plankton Key
Coccolithophorids
Diatoms
Other Phytoplankton
Foraminifera
Radiolaria
Copepod
Euphausiid
Salps


Ocean environmental change
CO2
Warming, freshening, stratification, acidification, disturbance、eolian dust input
Primary productivity
Grazing pressure
Consumption
Dominant species
TEP
gation
Egestion rate
0-100m
Fragmentation
Sinking
Export flux / ratio
DOC
Sinking particles
Physical mixing of DOM
Zooplankton vertical migration
Microbial decomposition
Consumption
100-500m
Ballast
Bacteria production
Plankton Key
Coccolithophorids
Diatoms
Other Phytoplankton
Foraminifera
Radiolaria
Copepod
Euphausiid
Salps
Particle Key
Salp pellet
Copepod pellets
Microzooplankton mini-pellets
Aggregate (marine snow)
Euphausiid pellets
Aluminosilicate
Larvacean house
Sinking velocity
Carbonate lysocline
>500m
Vertical change

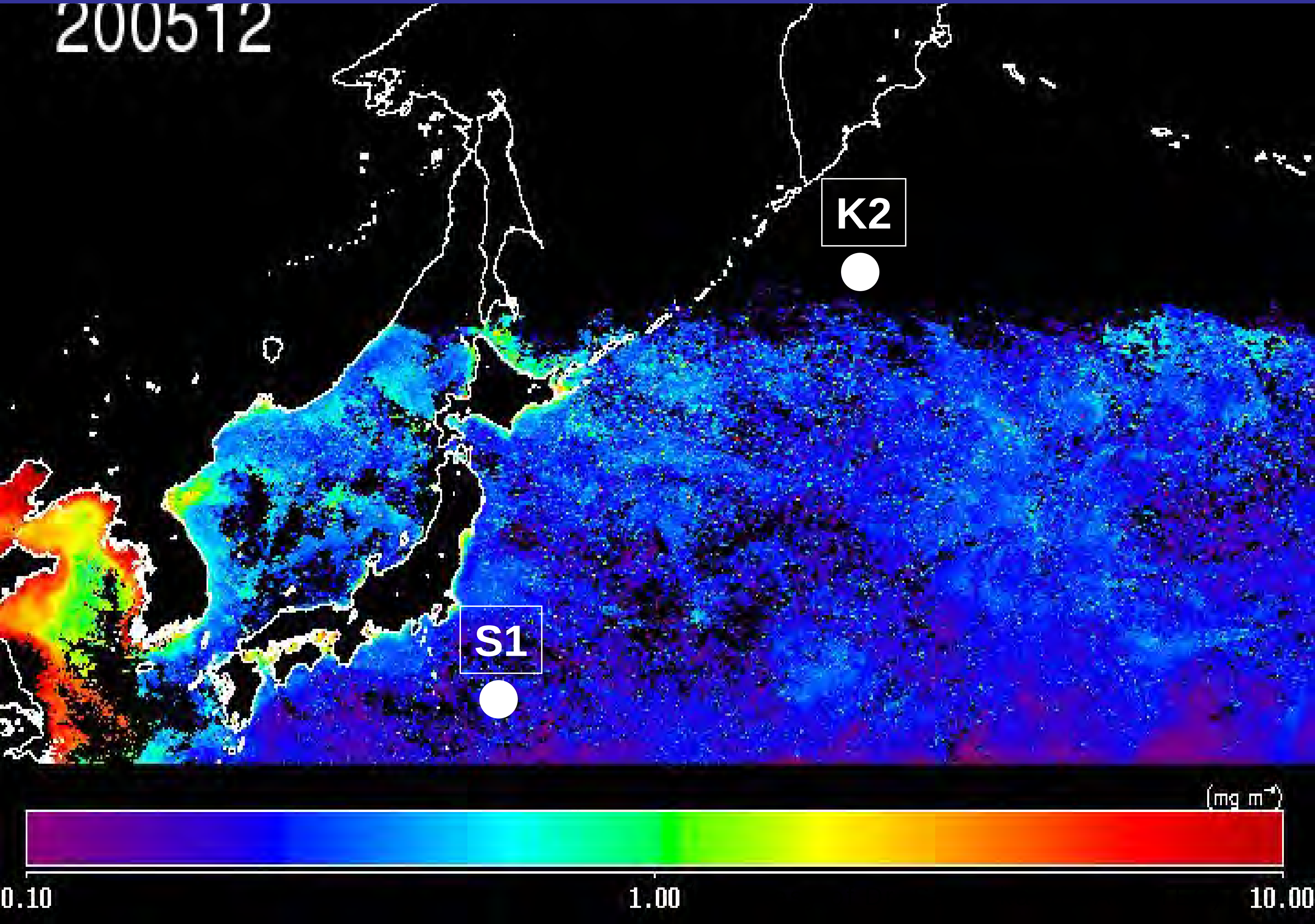
Ship, Mooring system, satellite



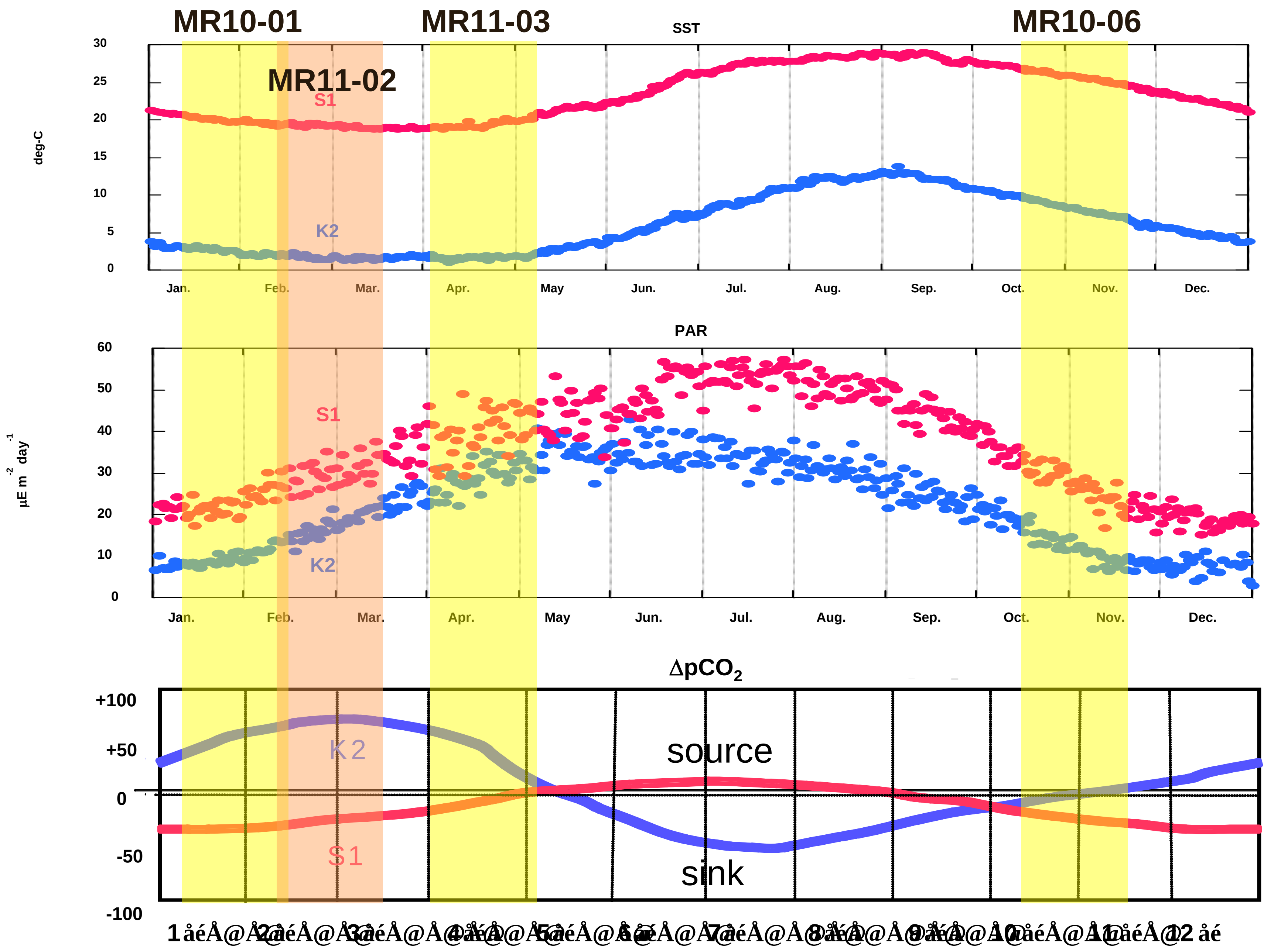
Large seasonal variability



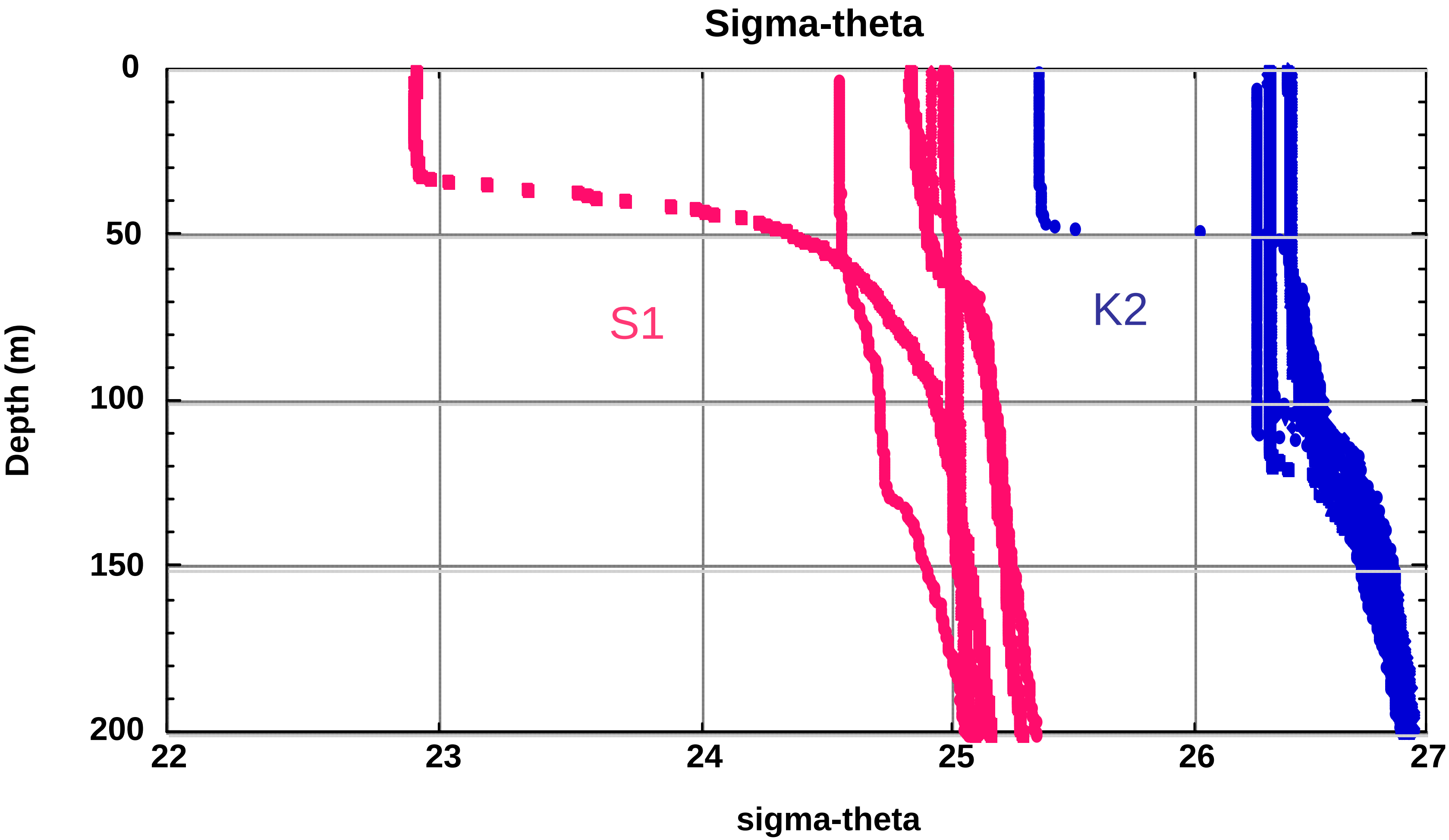
Large seasonal variability



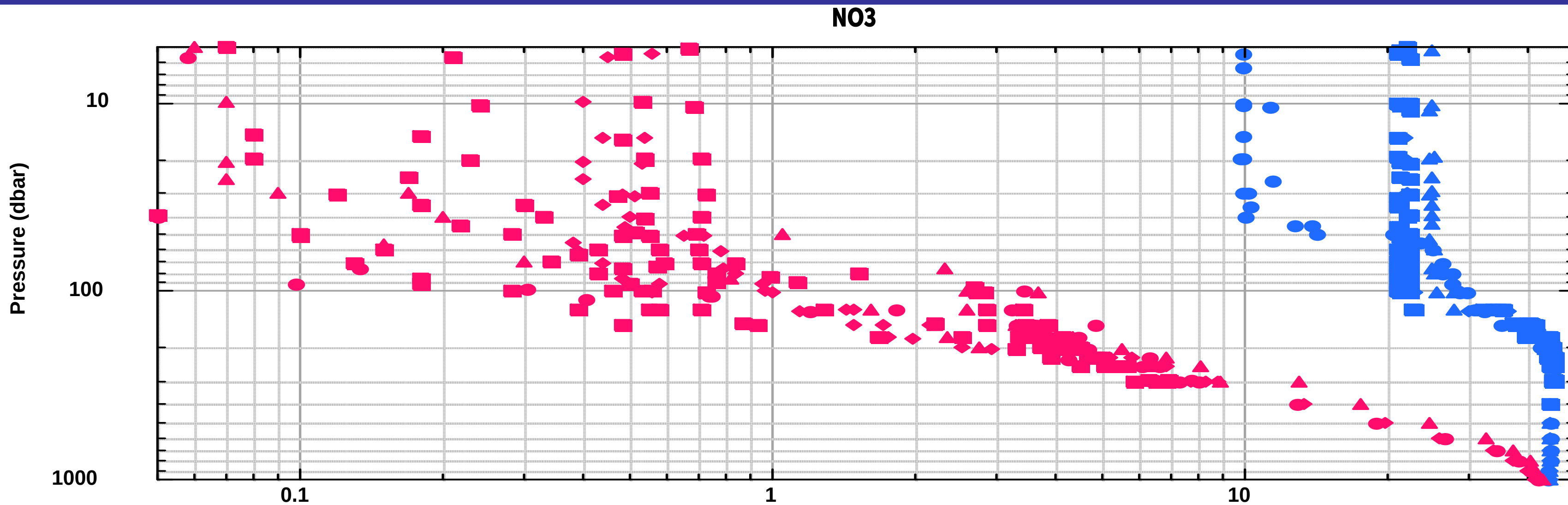
Seasonal scientific cruise



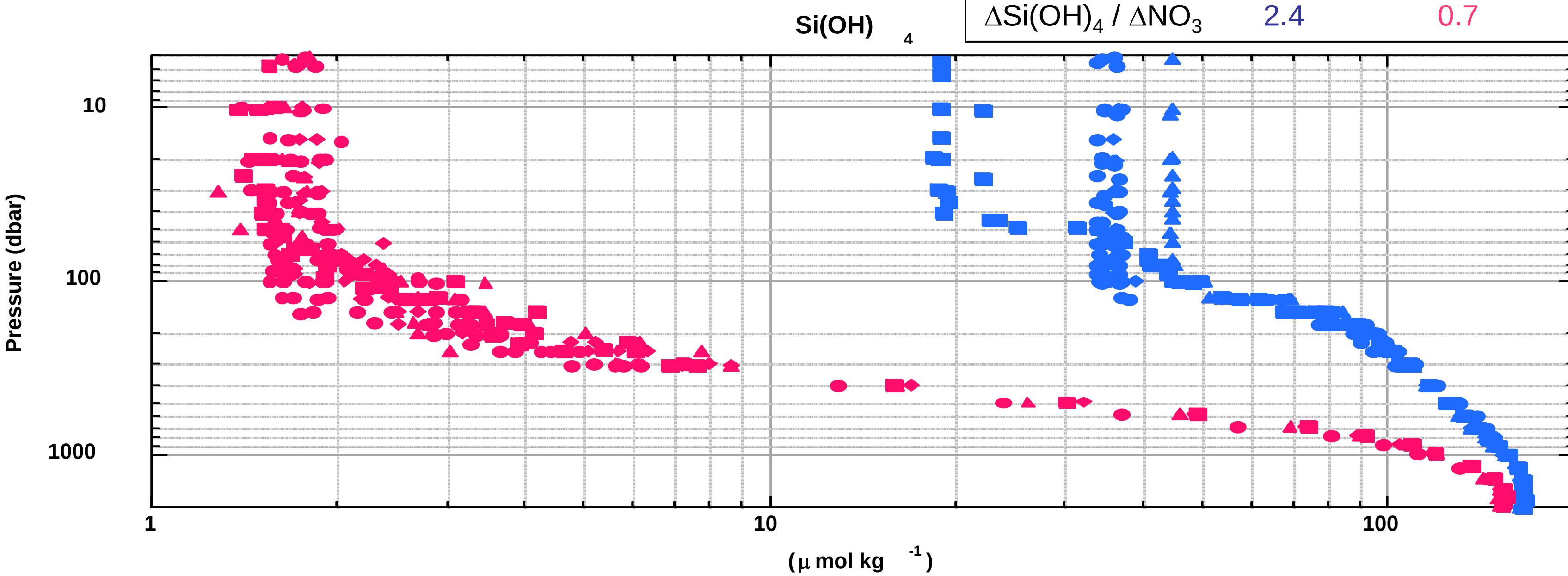
Surfaced Mixed Layer



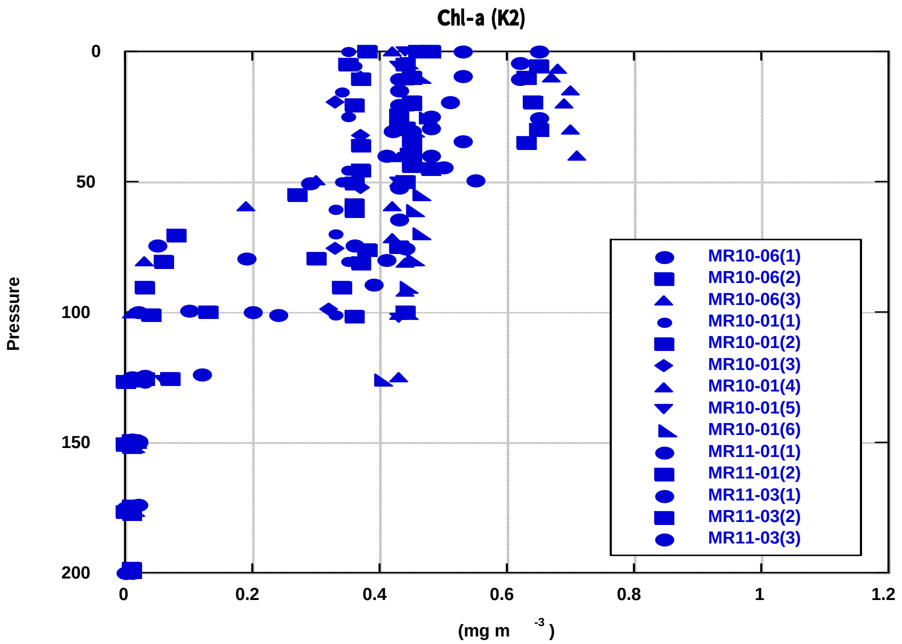
Nutrients (NO_3 and $Si(OH)_4$)



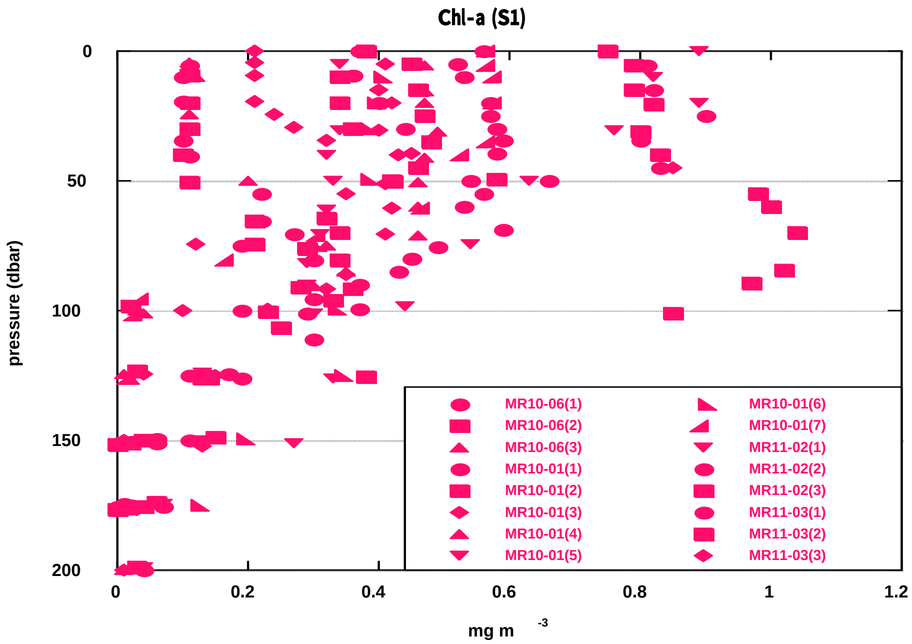
Integrated Nutrients upper 200m		
	K2	S1
Max	Apr.	Apr.
Min	Oct.	Jan/Feb
$\Delta Si(OH)_4$ / ΔNO_3	2.4	0.7



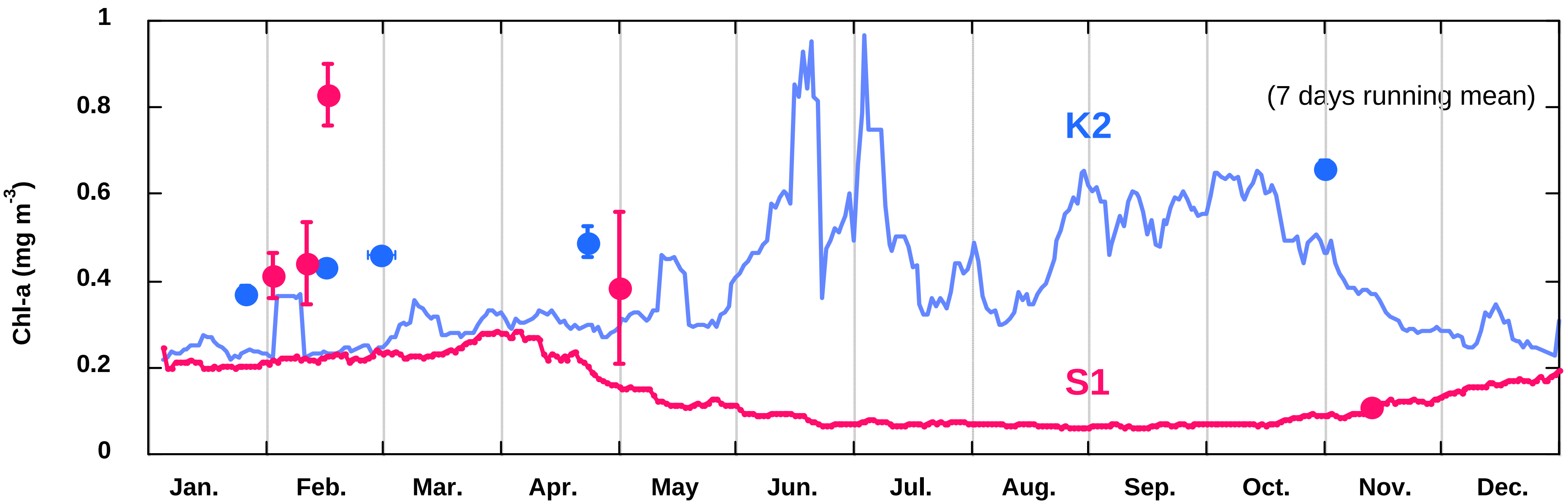
Chl-*a*



Chl-a (K2)
Pressure
0
50
100
150
200
0
0.2
0.4
0.6
0.8
1
1.2
(mg m -3)
MR10-06(1)
MR10-06(2)
MR10-06(3)
MR10-01(1)
MR10-01(2)
MR10-01(3)
MR10-01(4)
MR10-01(5)
MR10-01(6)
MR11-01(1)
MR11-01(2)
MR11-03(1)
MR11-03(2)
MR11-03(3)

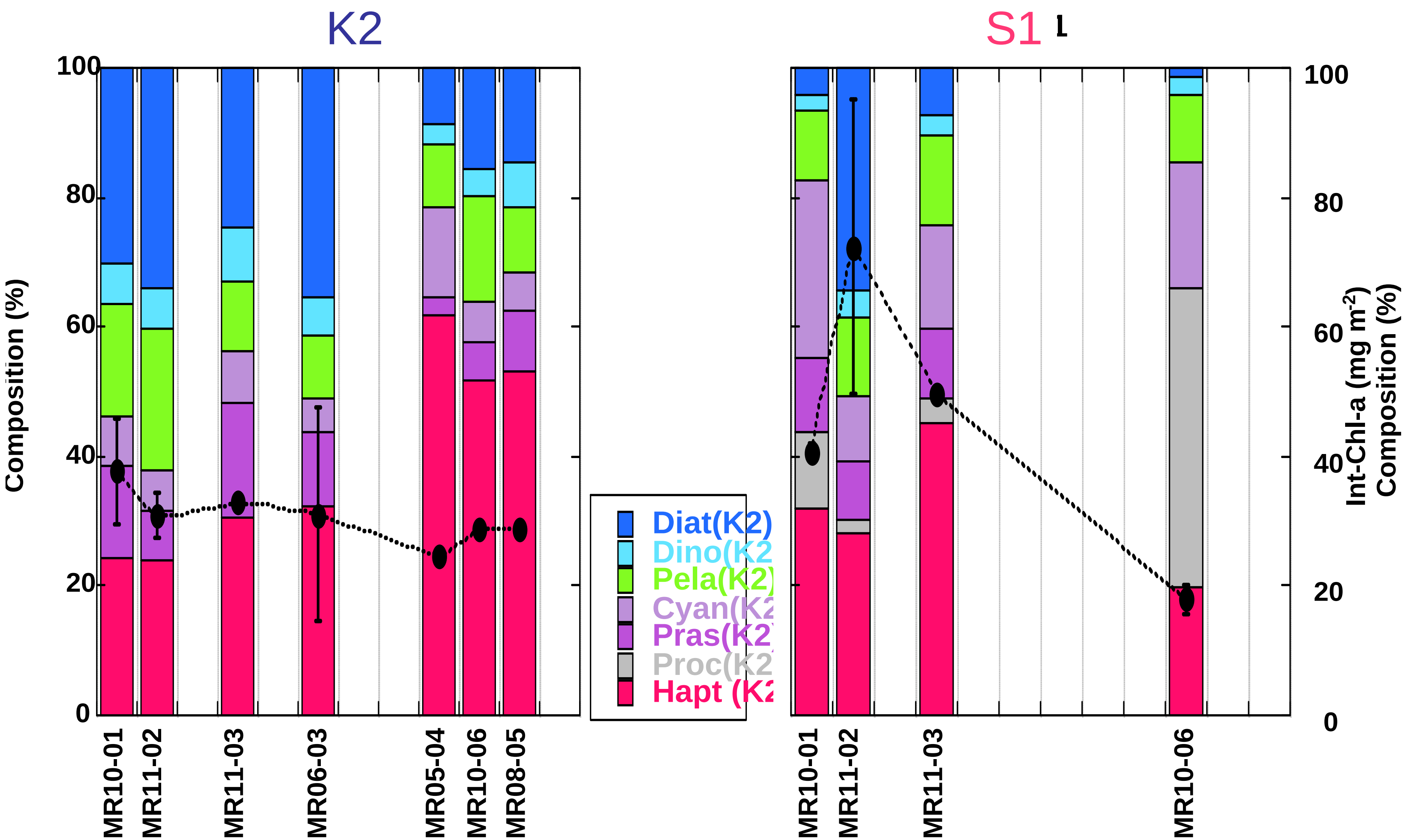


Chl-a (S1)
pressure (dbar)
0
50
100
150
200
0
0.2
0.4
0.6
0.8
1
1.2
mg m -3
MR10-06(1)
MR10-06(2)
MR10-06(3)
MR10-01(1)
MR10-01(2)
MR10-01(3)
MR10-01(4)
MR10-01(5)
MR10-01(6)
MR10-01(7)
MR11-02(1)
MR11-02(2)
MR11-02(3)
MR11-03(1)
MR11-03(2)
MR11-03(3)

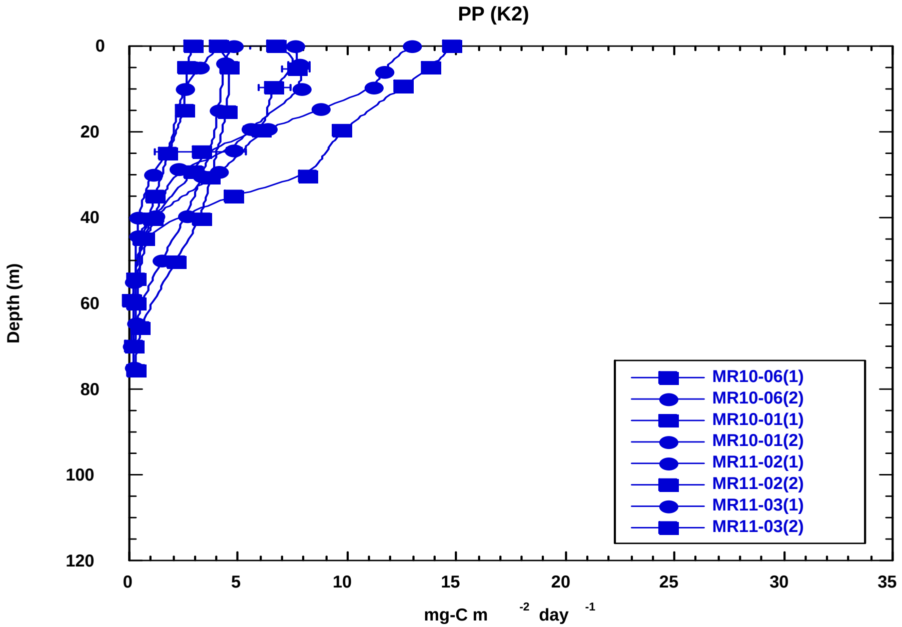


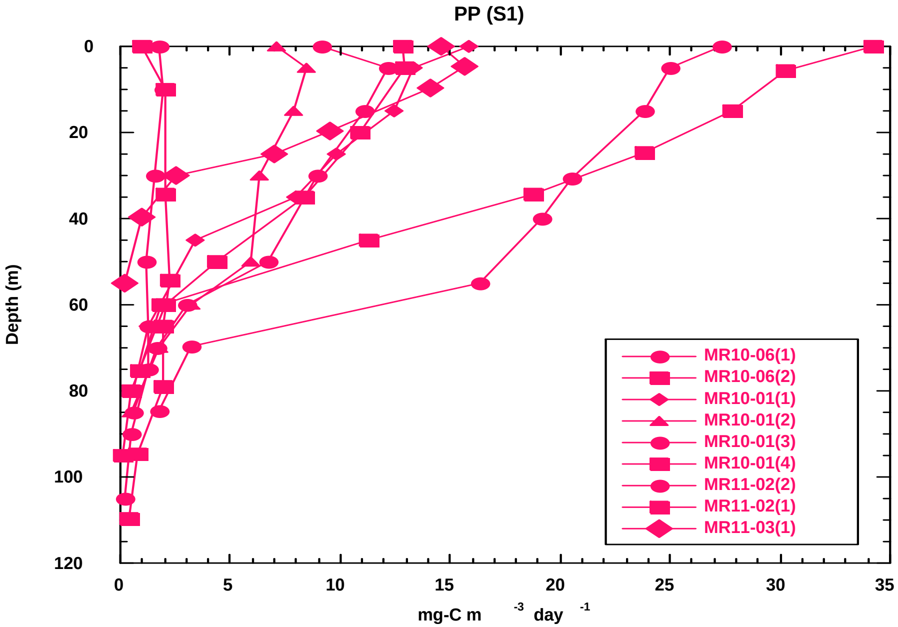
Chl-a (mg m -3)
1
0.8
0.6
0.4
0.2
0
(7 days running mean)
K2
S1
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.

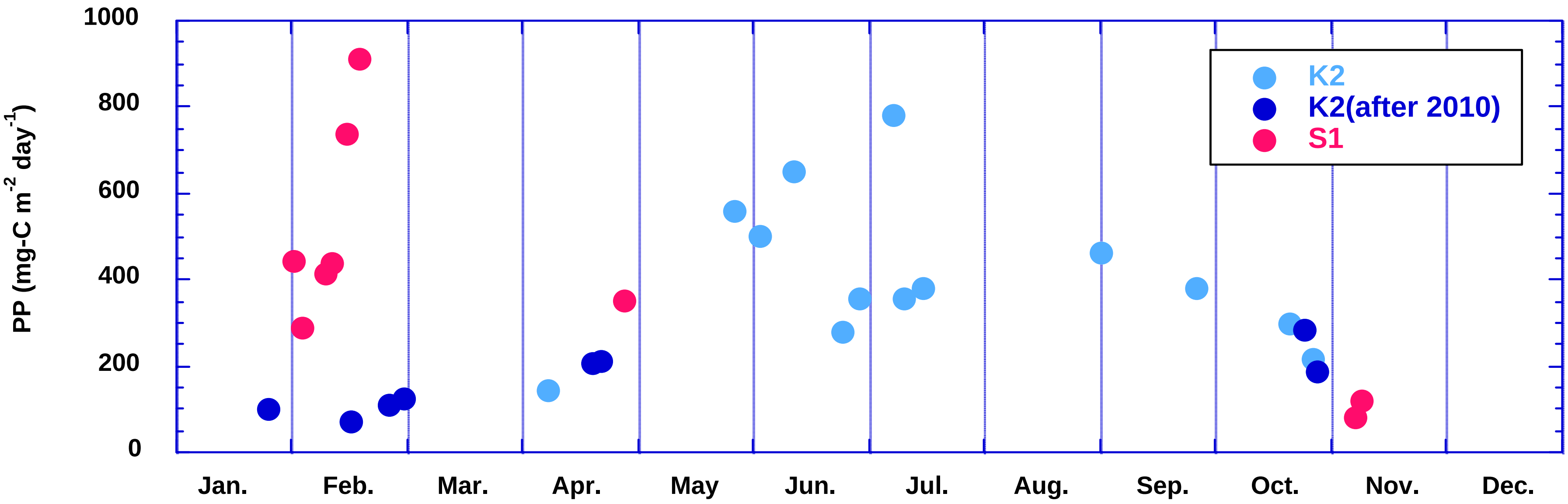
Species of Phytoplankton



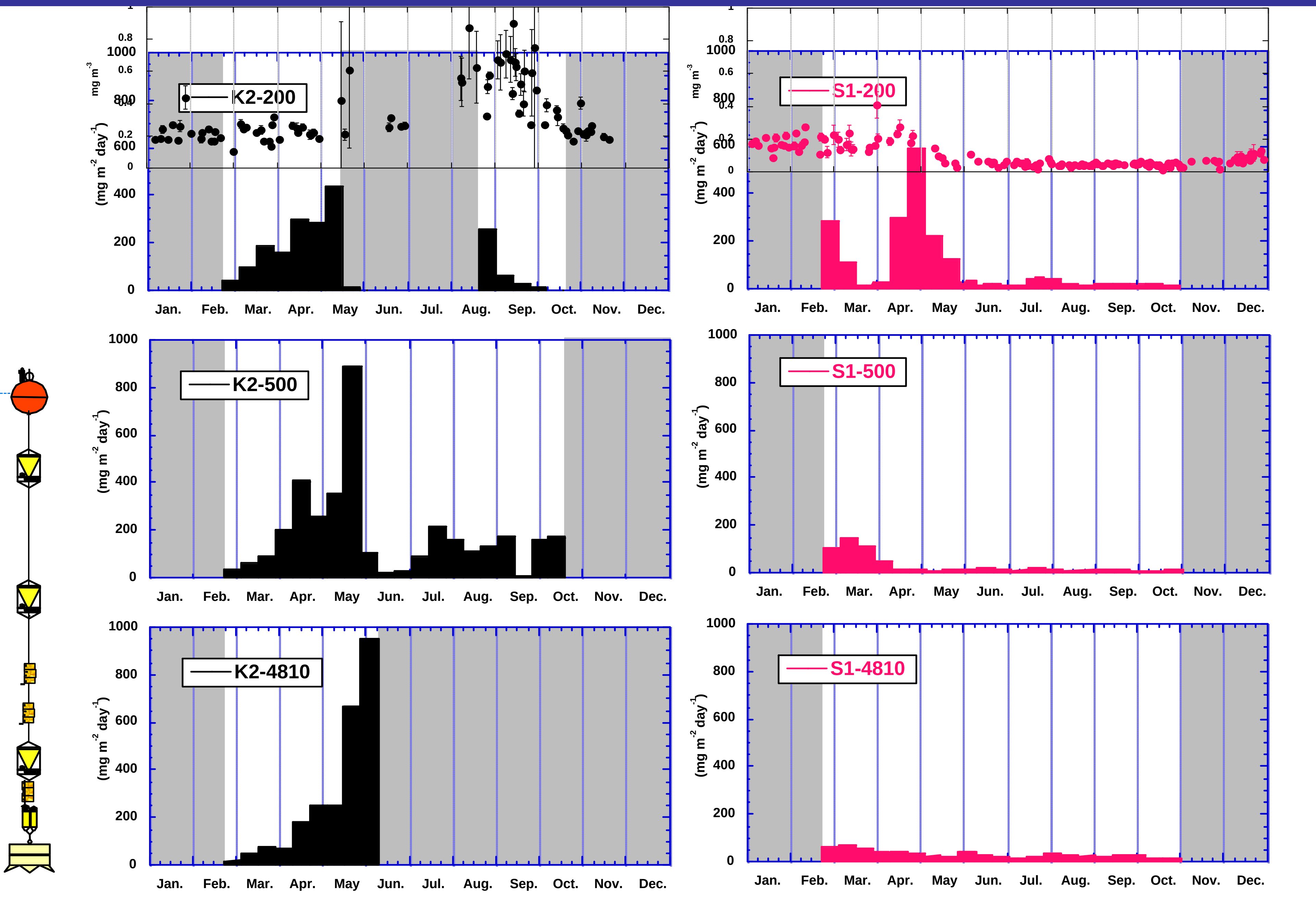
Primary Productivity



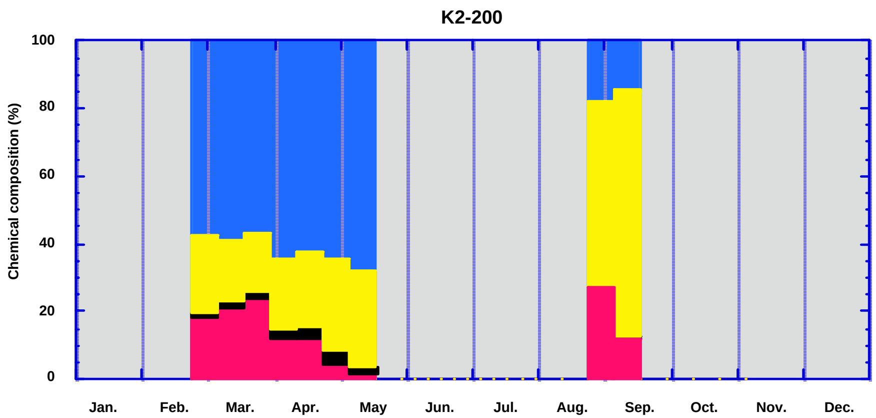


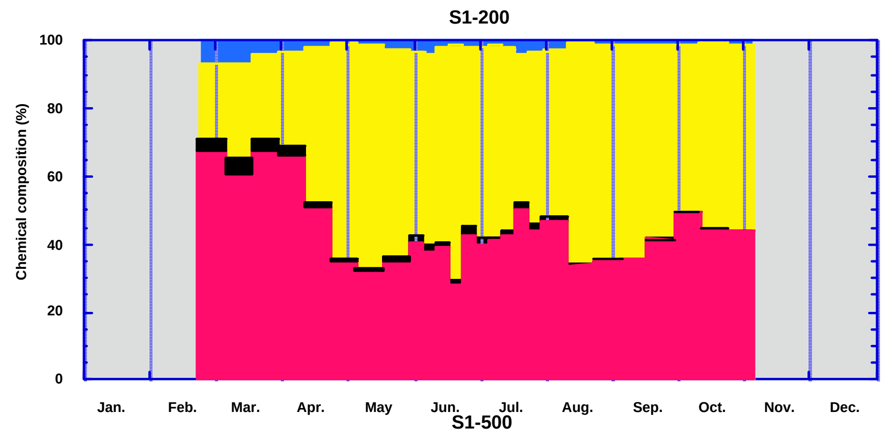


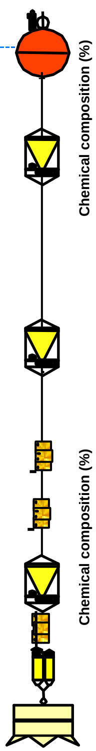
Total mass flux of Sinking particle

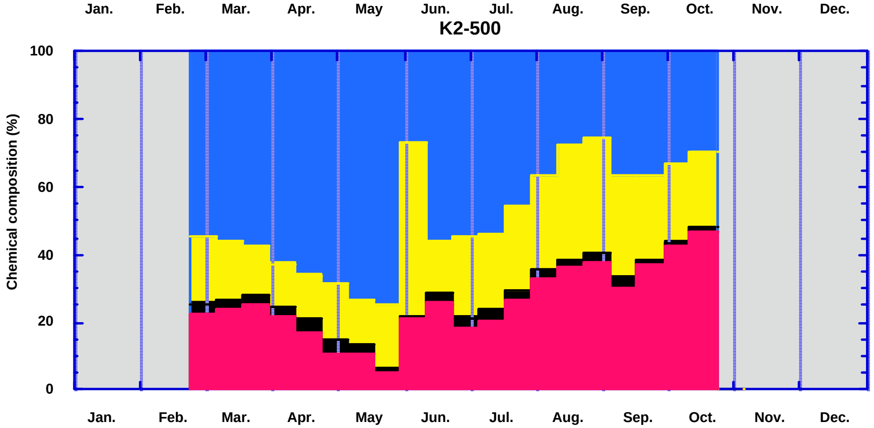


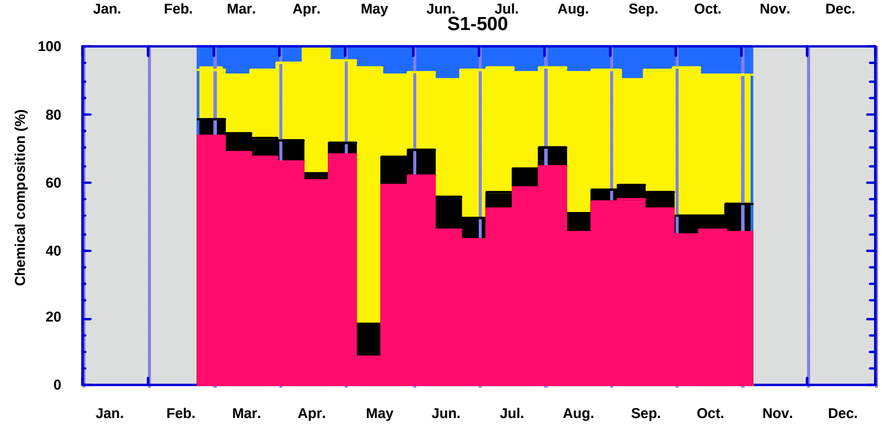
Chemical composition of Sinking particle

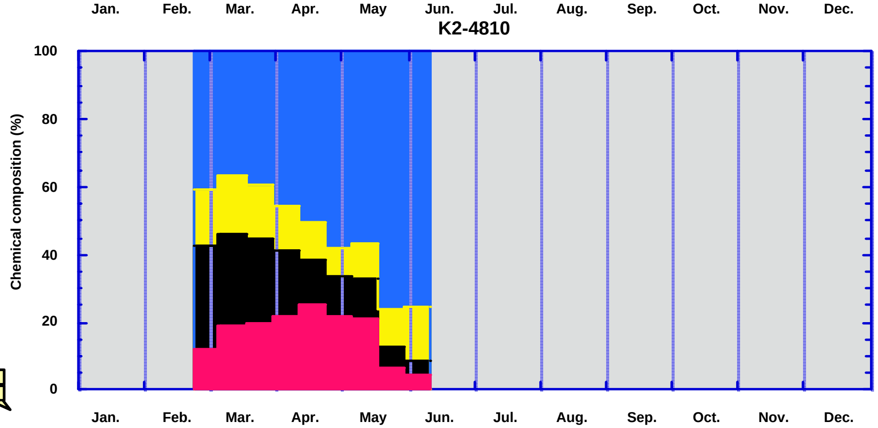


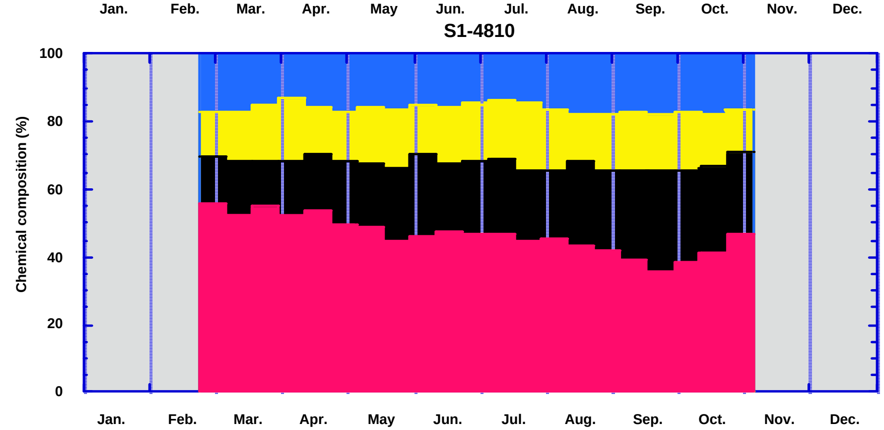












Summary

based on observation during four cruises in autumn, winter and spring

Concentration of nutrients at S1 is quite low.

However abundance of phytoplankton and productivity at S1 is comparable to or higher than those at K2.

On the other hand, seasonal variability and total mass flux in sinking particle at K2 is higher than those at S1.

Major chemical composition of sinking particle at K2 and S1 are opal and $CaCO_3$, respectively, and this is attributed to difference in species of phytoplankton at surface and preservation of $CaCO_3$.

Question

How are abundance and productivity of phytoplankton maintained at S1?

Eddy? Mode water? Aeolian dust?

What controls export efficiency of particulate materials?

Grazing pressure by Zooplankton? Microbial loop?

Has change in biogeochemistry started in the Western Pacific?