Interannual variations of nutrients and primary production over the southeastern Beirng Sea shelf during spring of 1997,1998,and 1999

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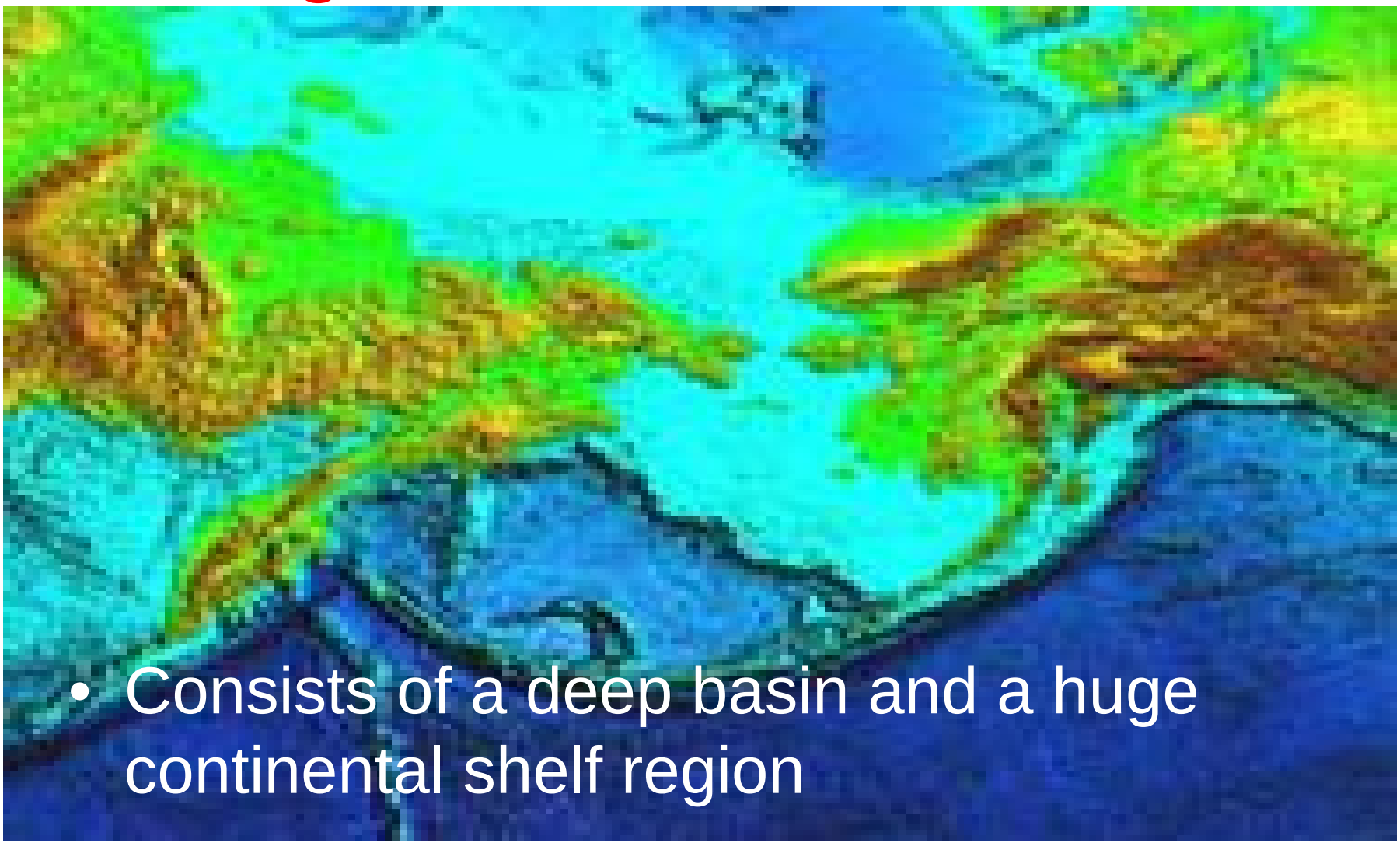
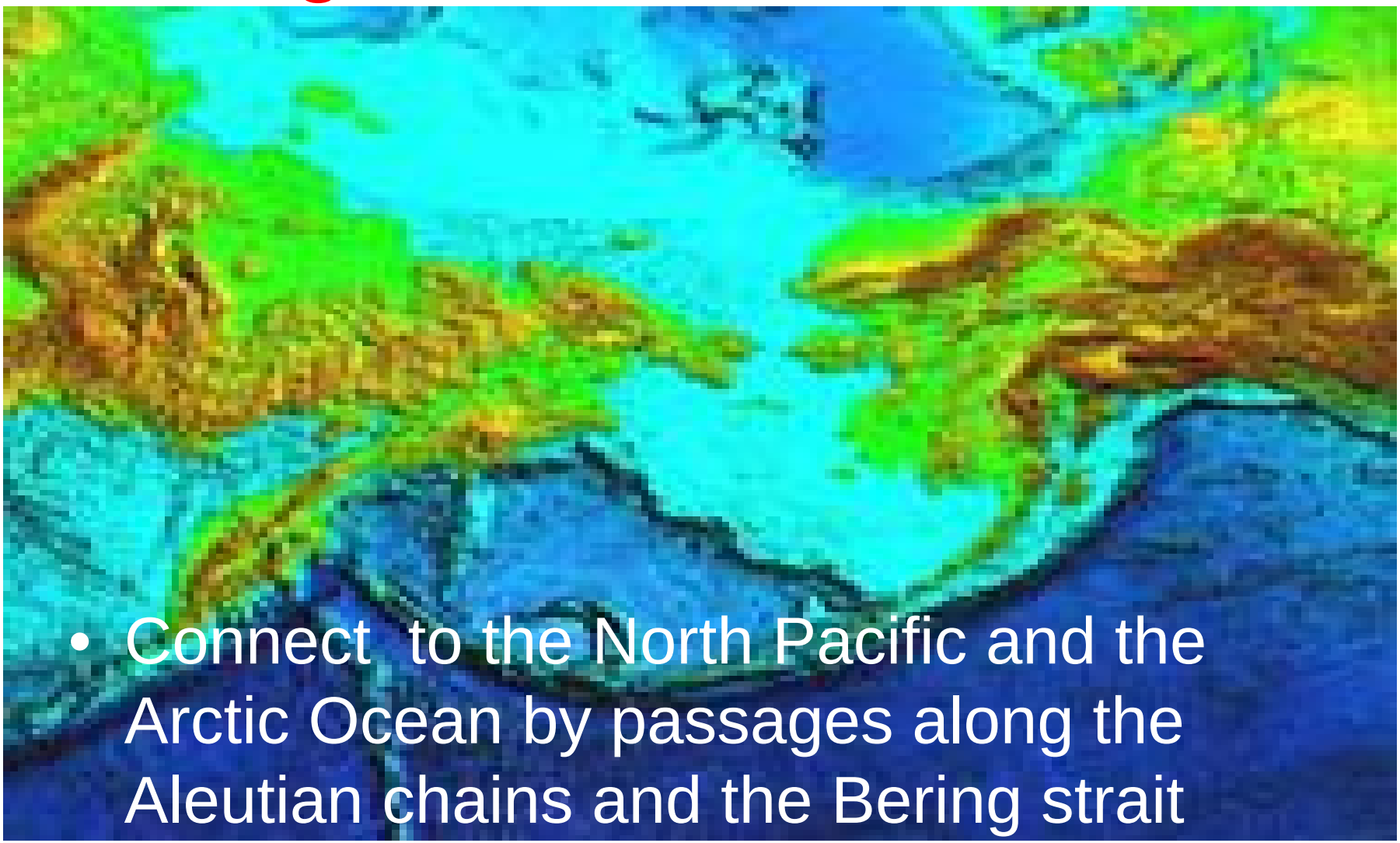
3. Conclusions

Bering Sea: sub-arctic ecosystem



- Consists of a deep basin and a huge continental shelf region

Bering Sea: sub-arctic ecosystem

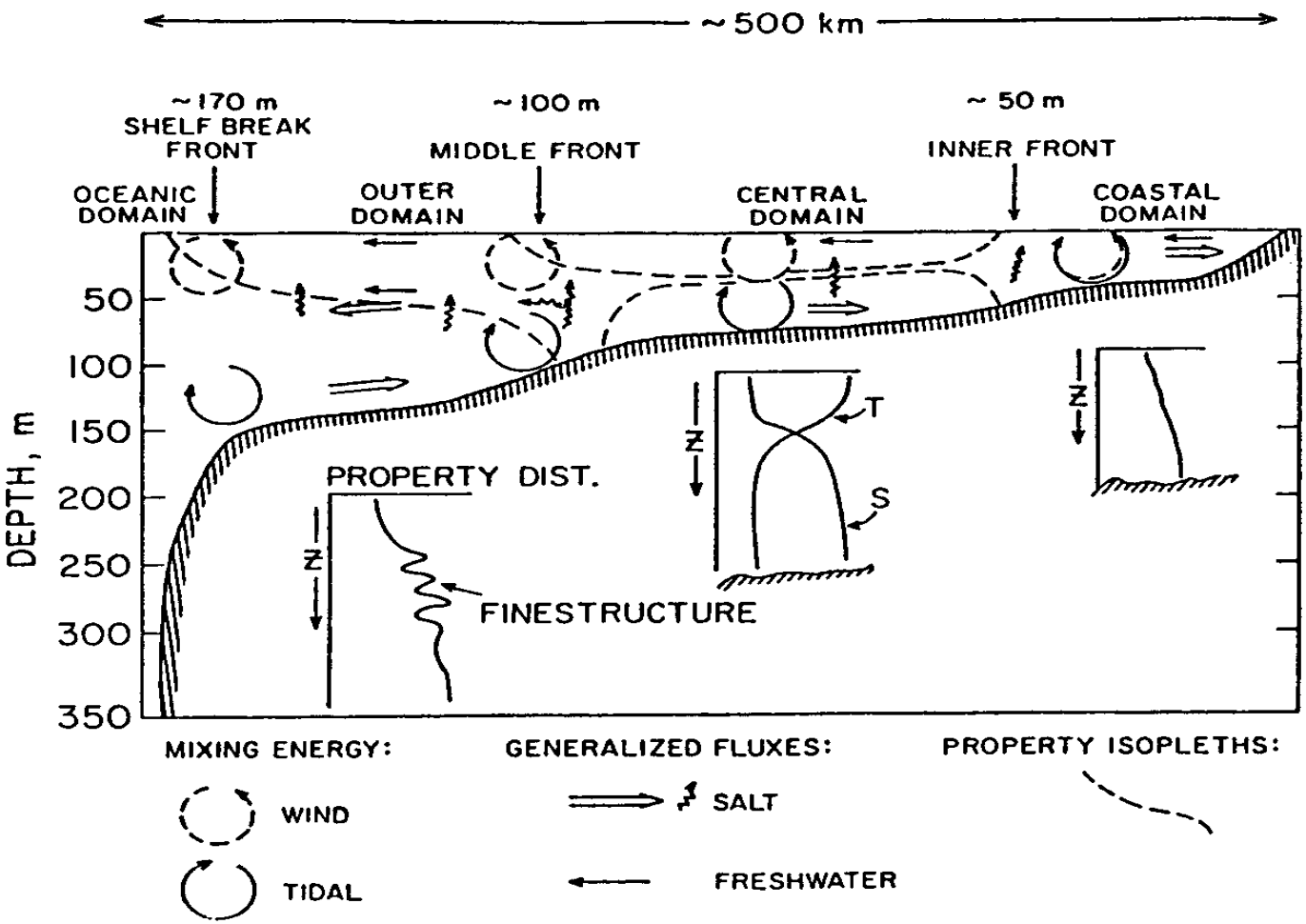


- Connect to the North Pacific and the Arctic Ocean by passages along the Aleutian chains and the Bering strait

Bering Sea: **productive in higher trophic levels**

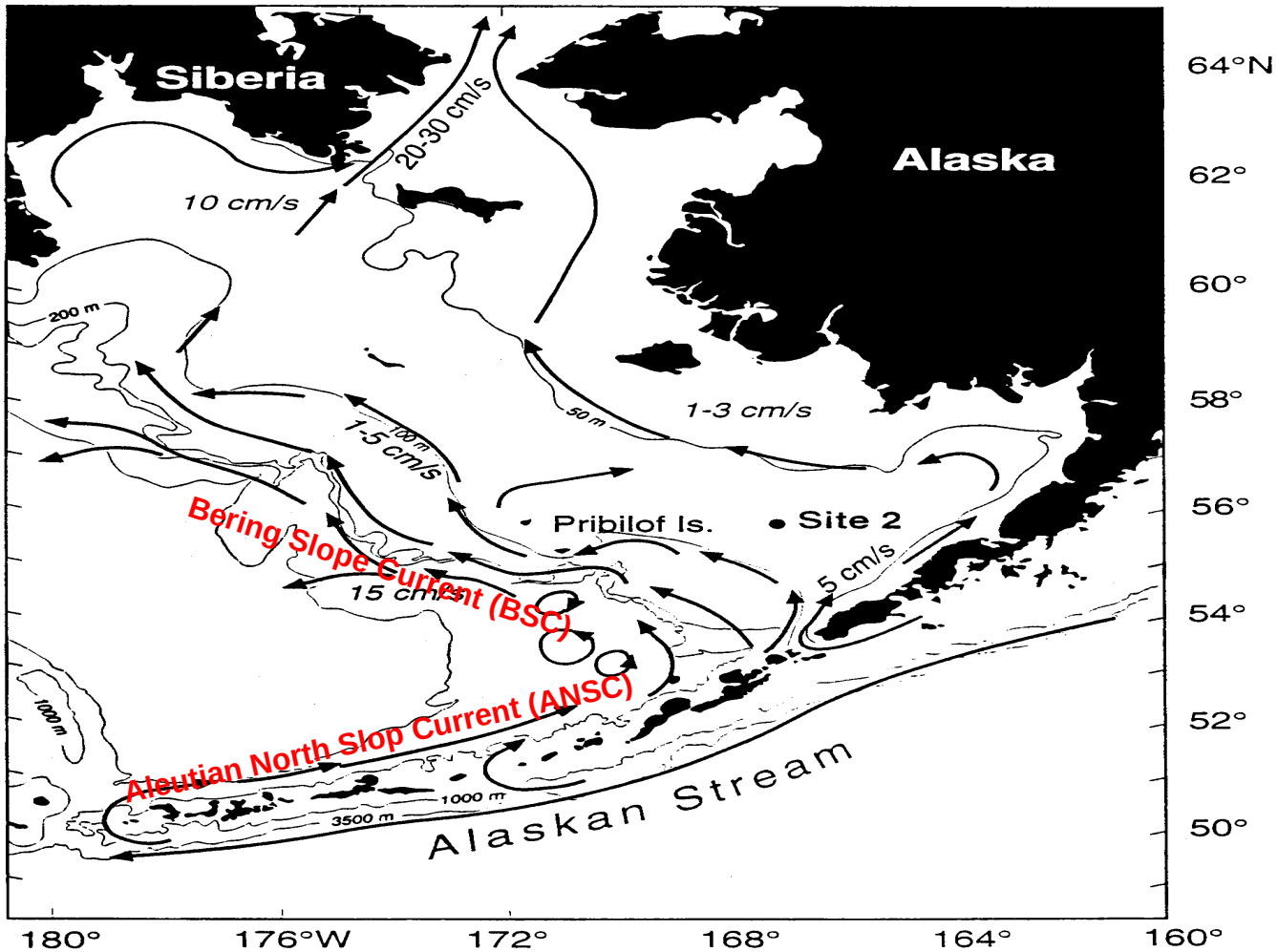
- At least 450 species of fish,crustaceans, and mollusks
- 50 species of seabirds
- 25 species of marine mammals
- Bering Sea fishery contributes over half of the U.S. fishery production
- Bering Sea pollock fishery: the largest single species fishery in the world

Hydrographic domains



Coachman et al. 1986

Surface currents



Stabeno et al. 2001

Sea Ice

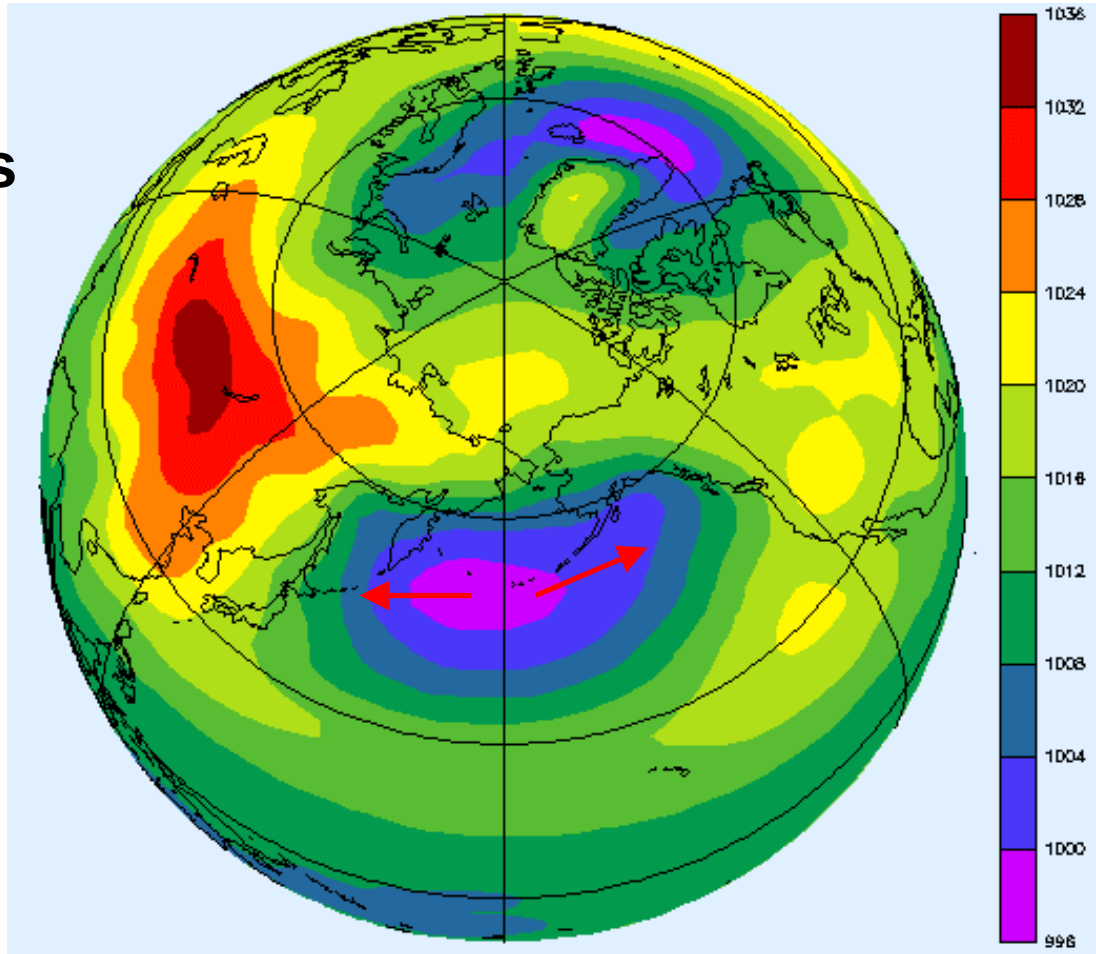
NOAA ship Surveyor in pancake ice in the Bering Sea

Sea Ice

Ice fields in Winter in the Bering Sea

Aleutian Low(AL)

Cold periods
La Nina
AL:west
weak
more sea ice extent



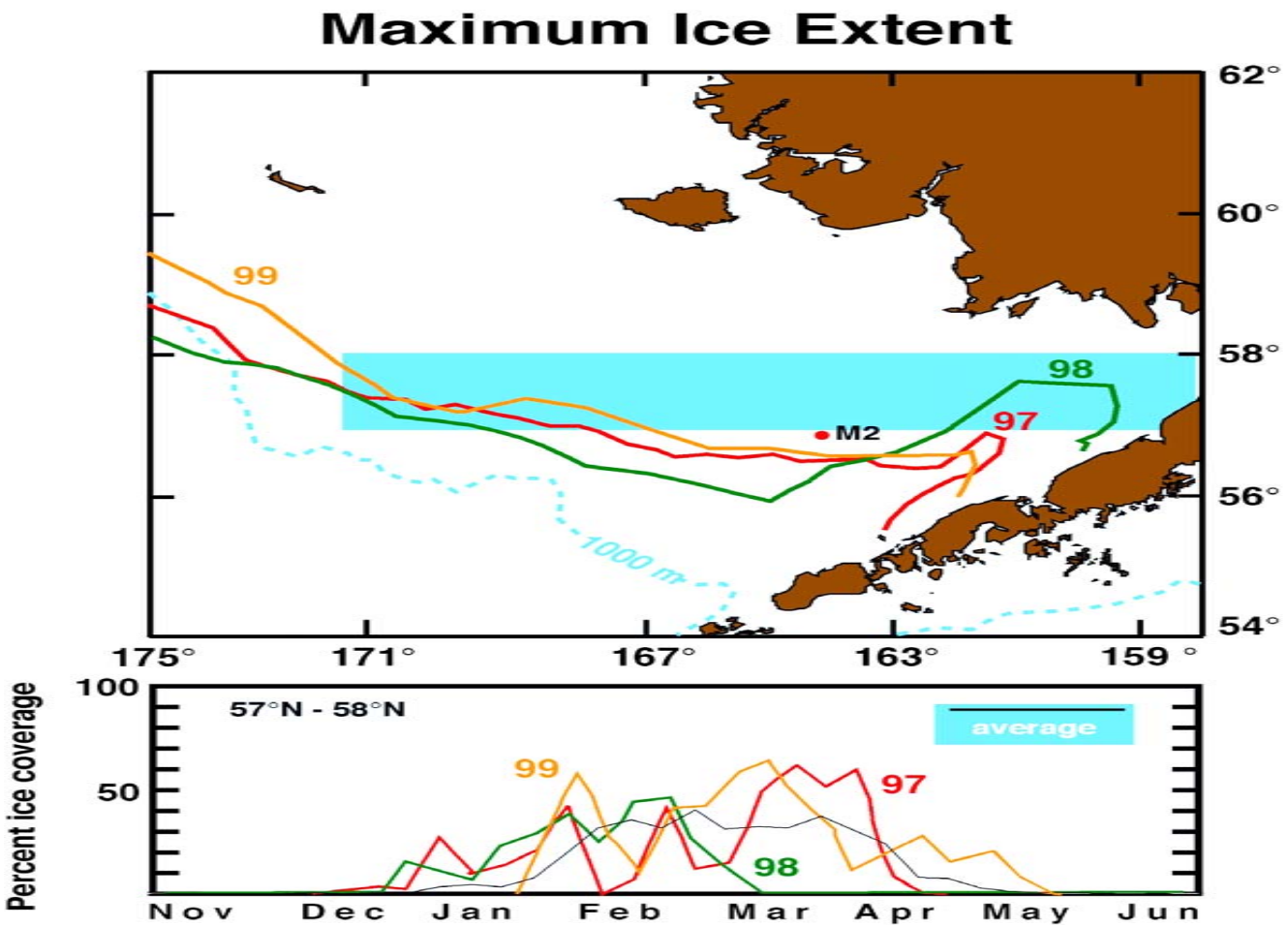
Warm period
El Nino
AL :east
strong
less sea ice extent

January-February Sea Level Pressure Climatology (1958-1997)

Atmospheric conditions

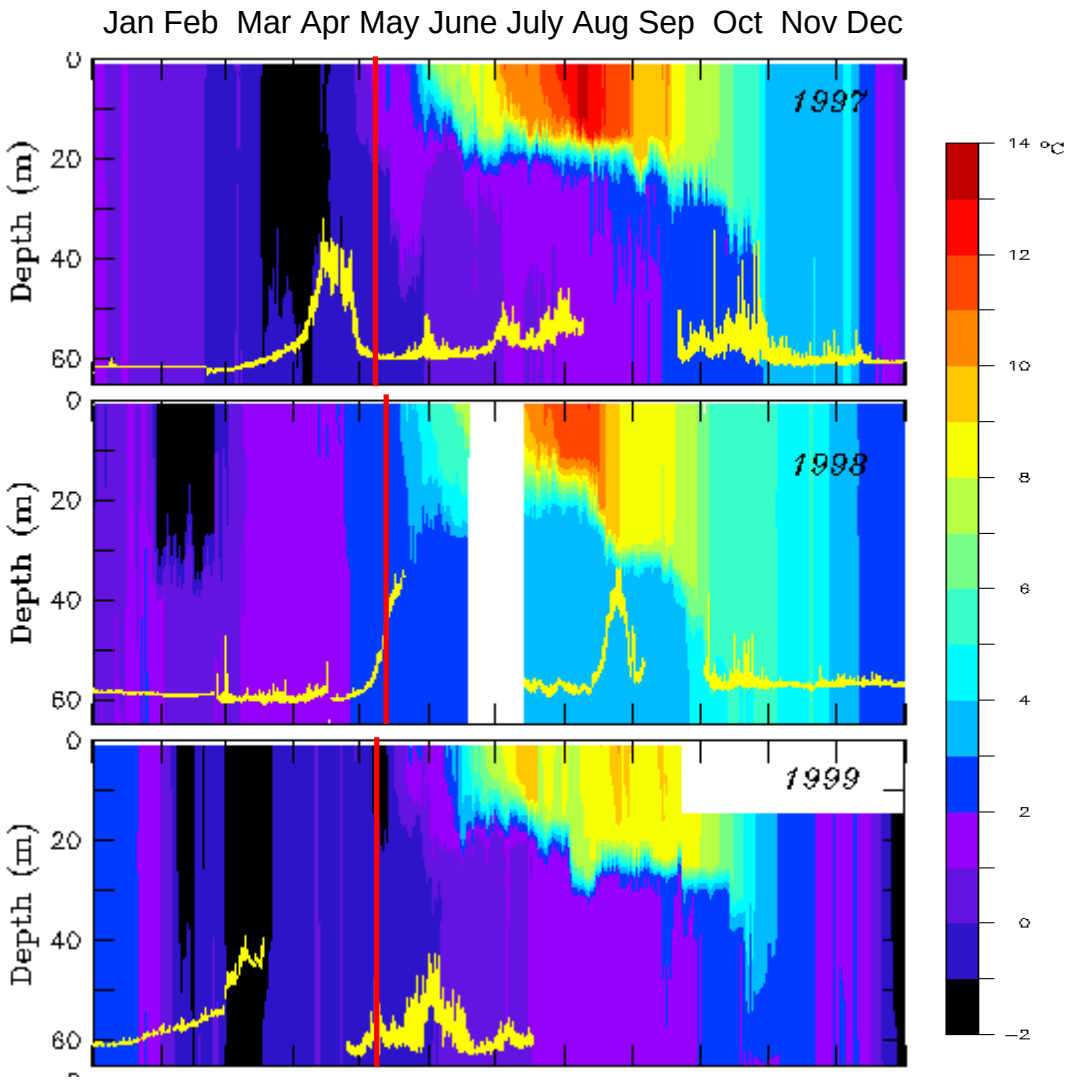
- 1997: El Nino
  - Aleutian Low: stronger than normal
  - Calm wind spring
- 1998
  - Aleutian Low: similar to 1997
  - Strong Wind until June
- 1999: La Nina
  - Strong wind

Sea Ice Extents



Stabeno et al. 2001

Temperatures



Hunt et al. 2002

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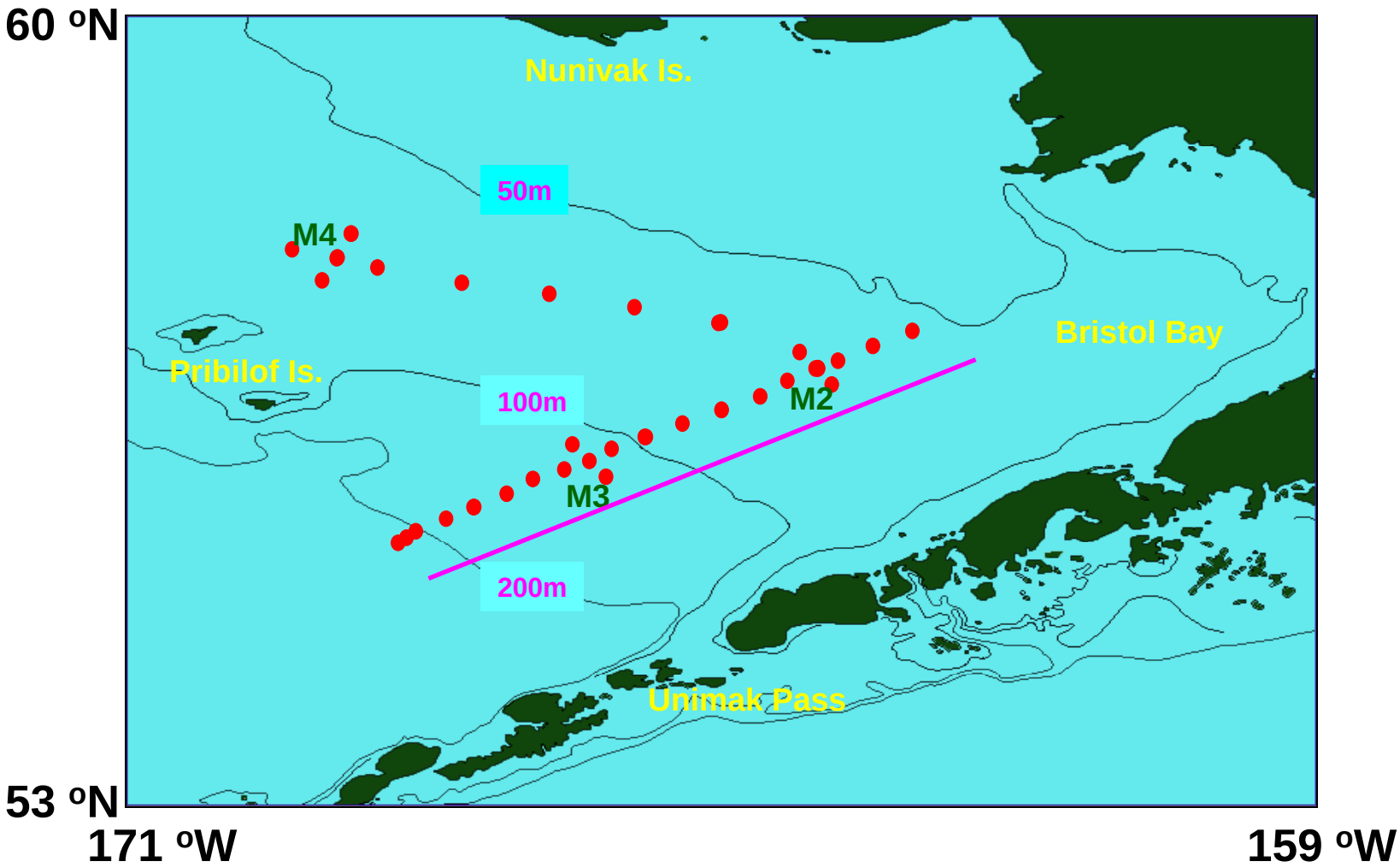
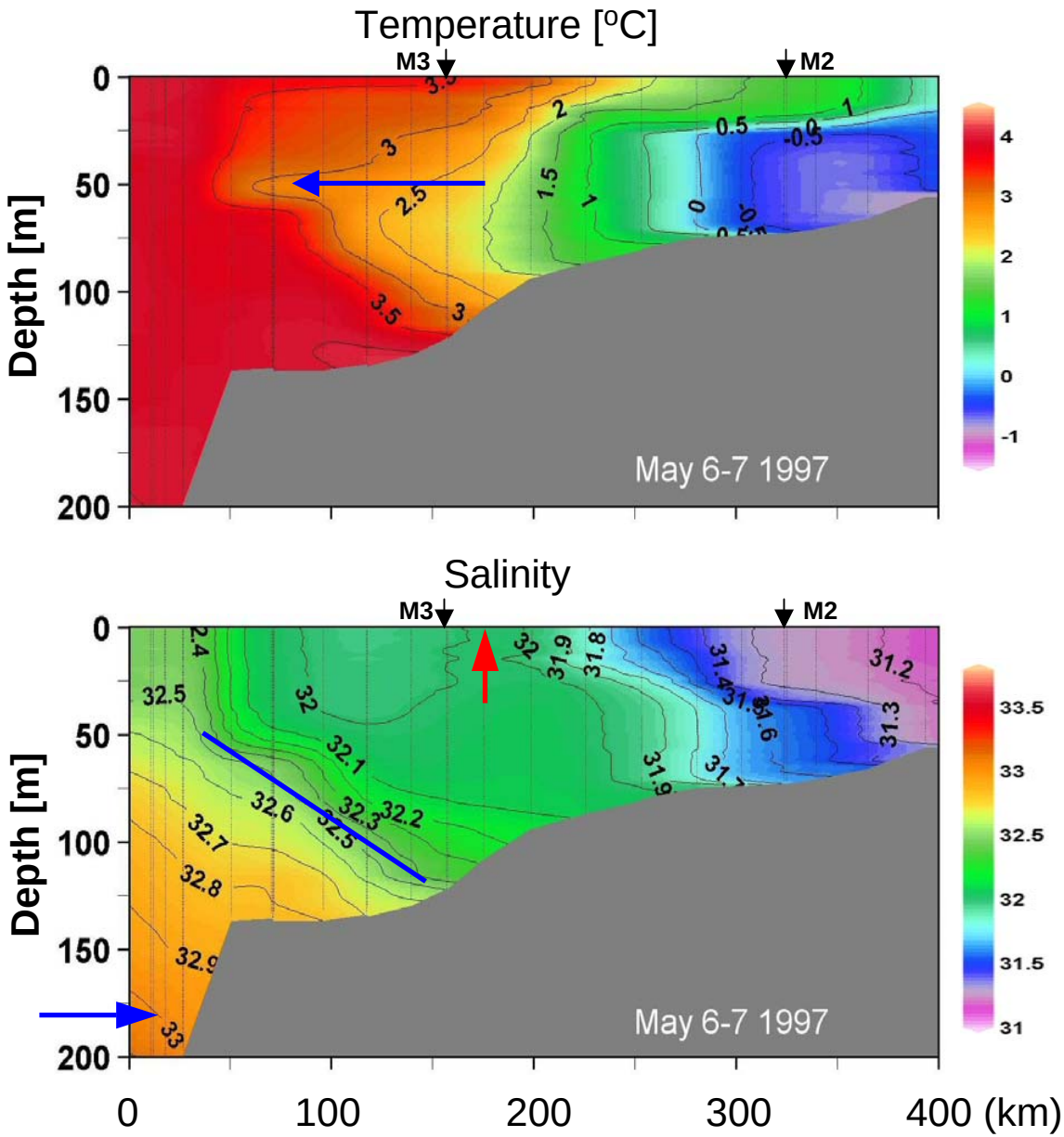
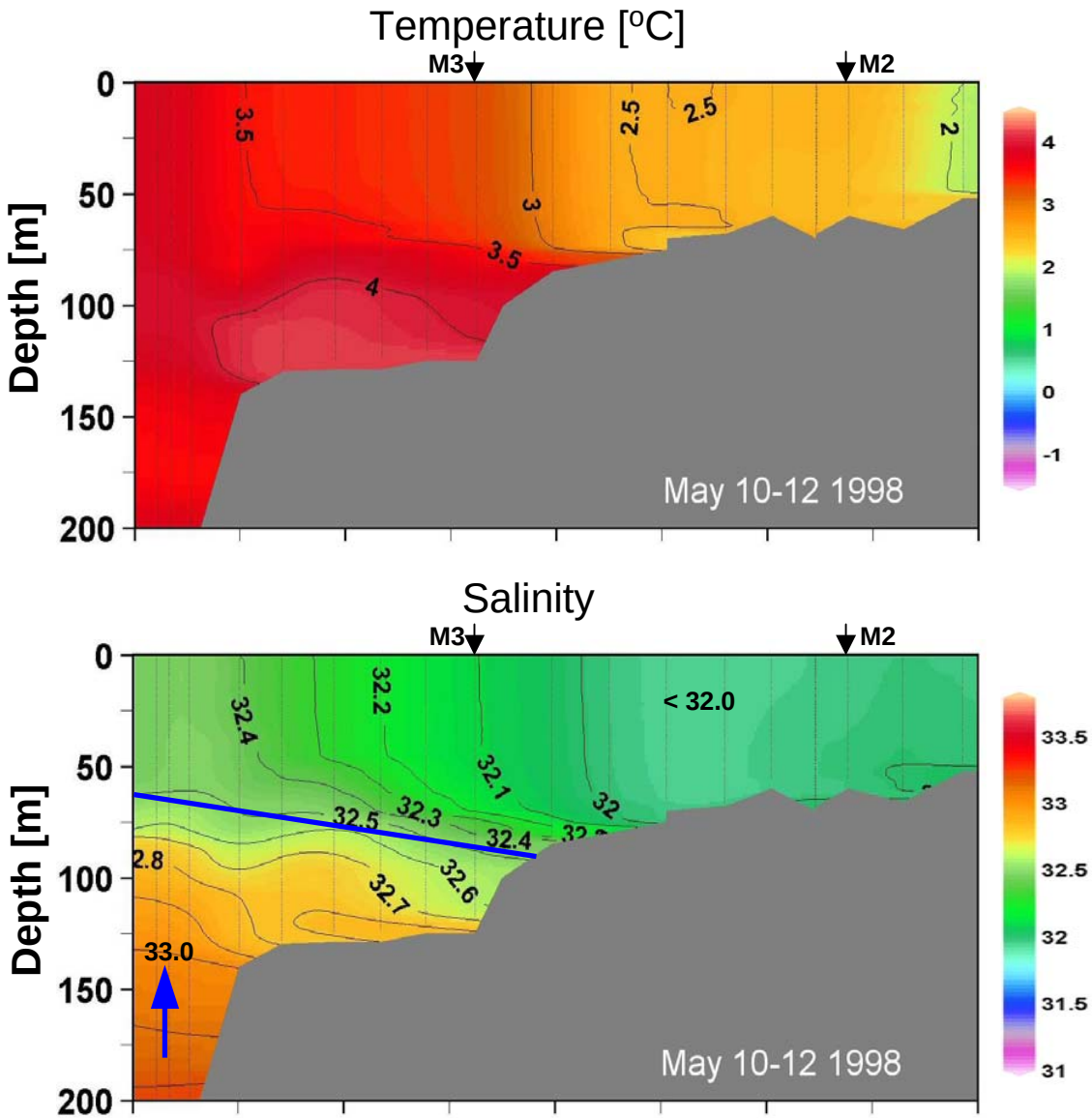
Hydrographic Stations



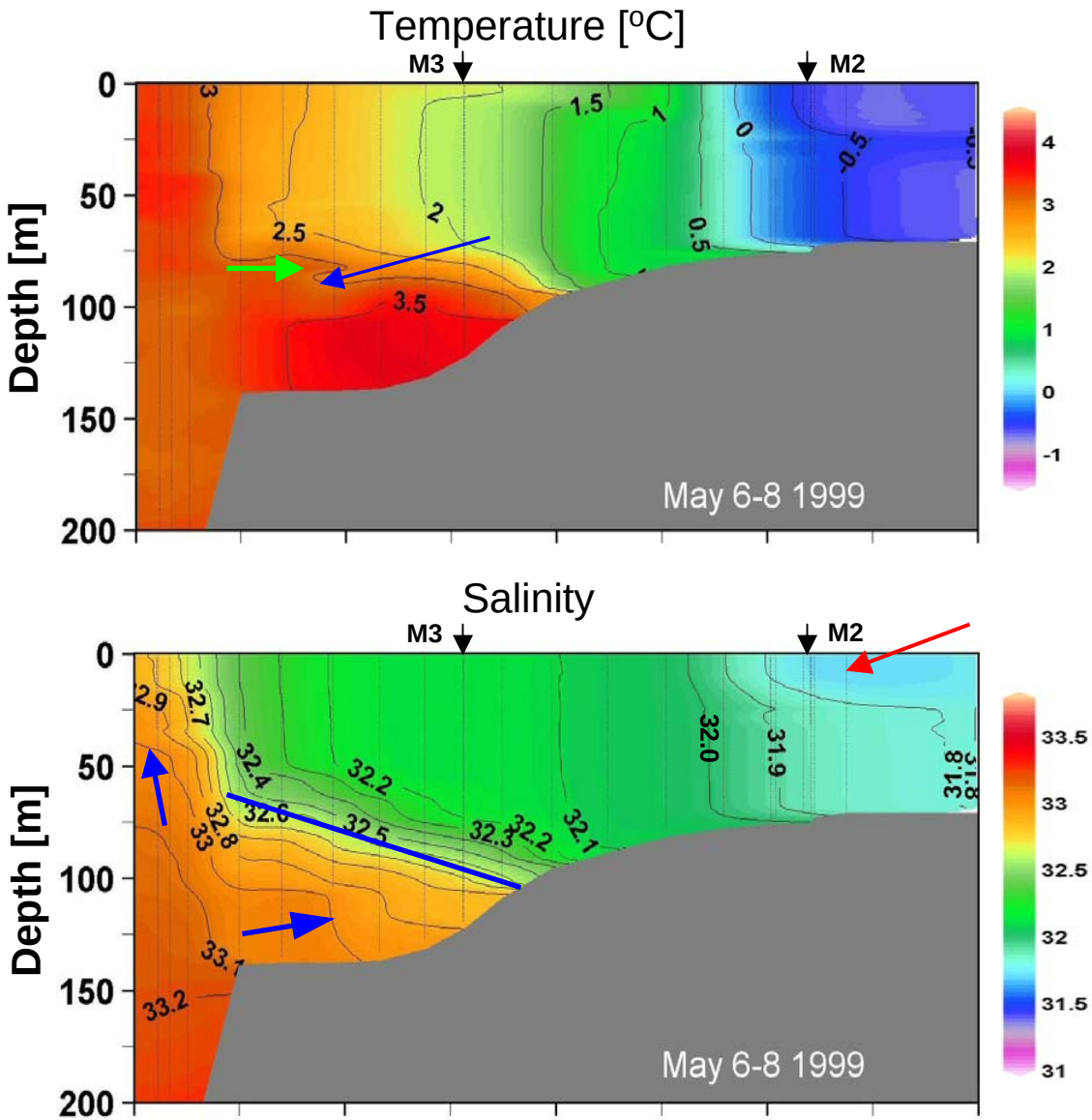
Across Shelf May 1997



Across Shelf May 1998



Across Shelf May 1999



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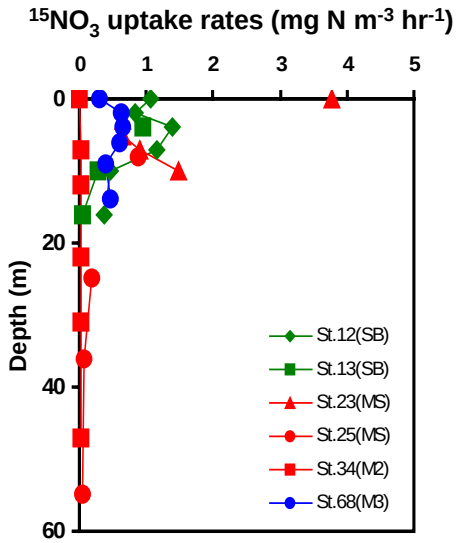
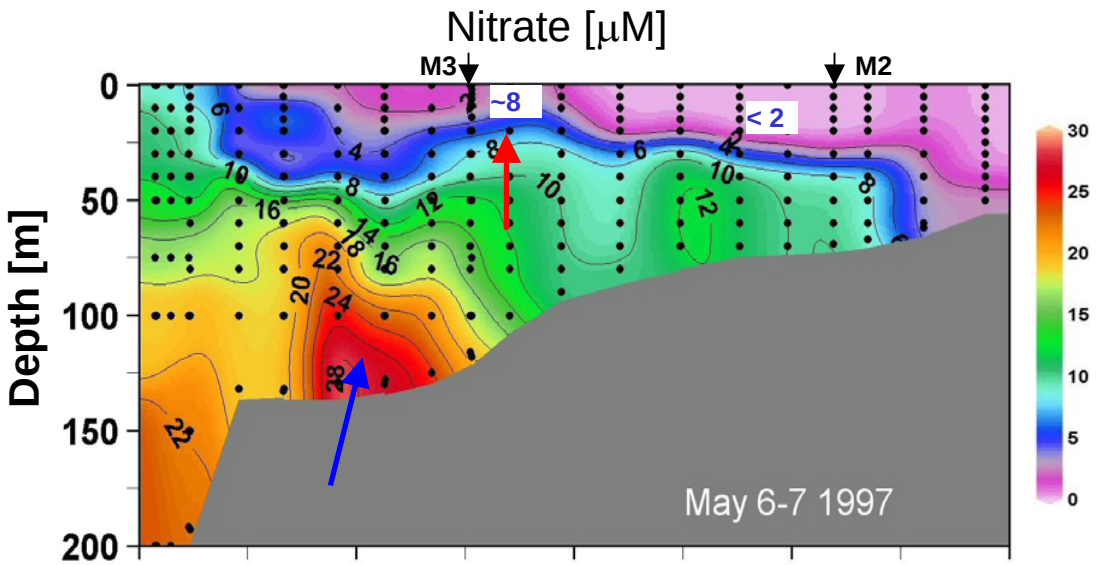
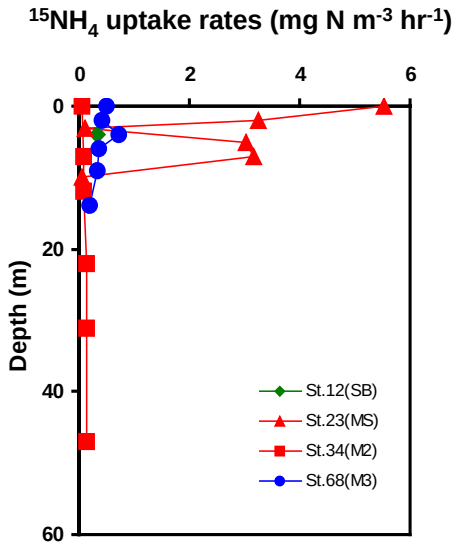
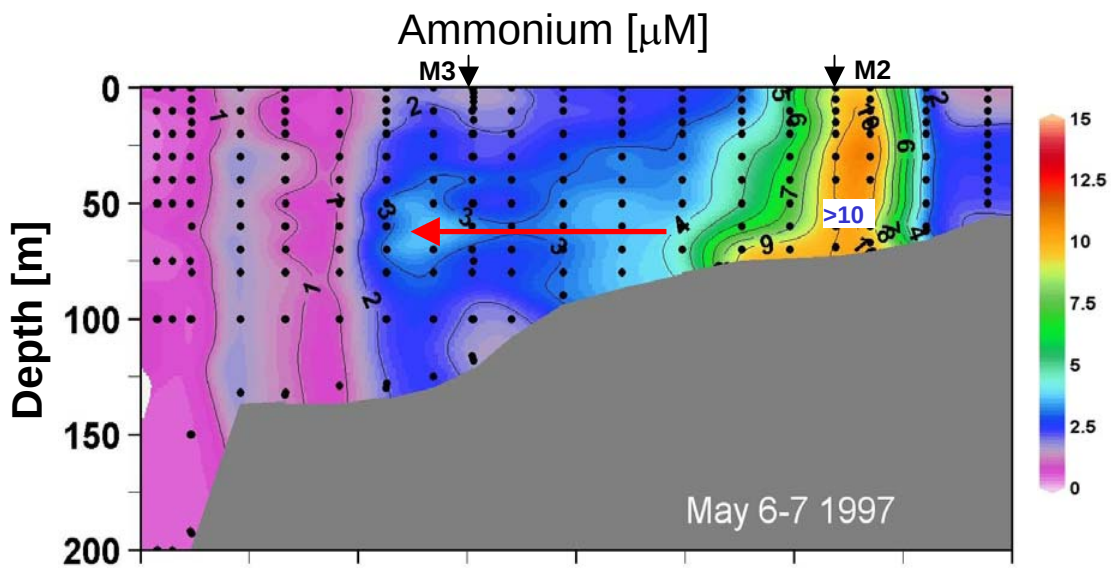
Across Shelf May 1997

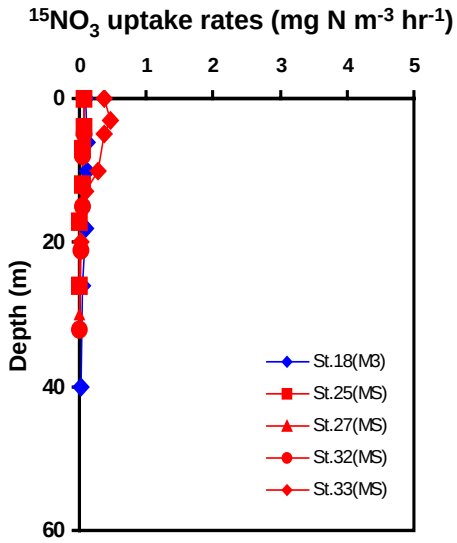


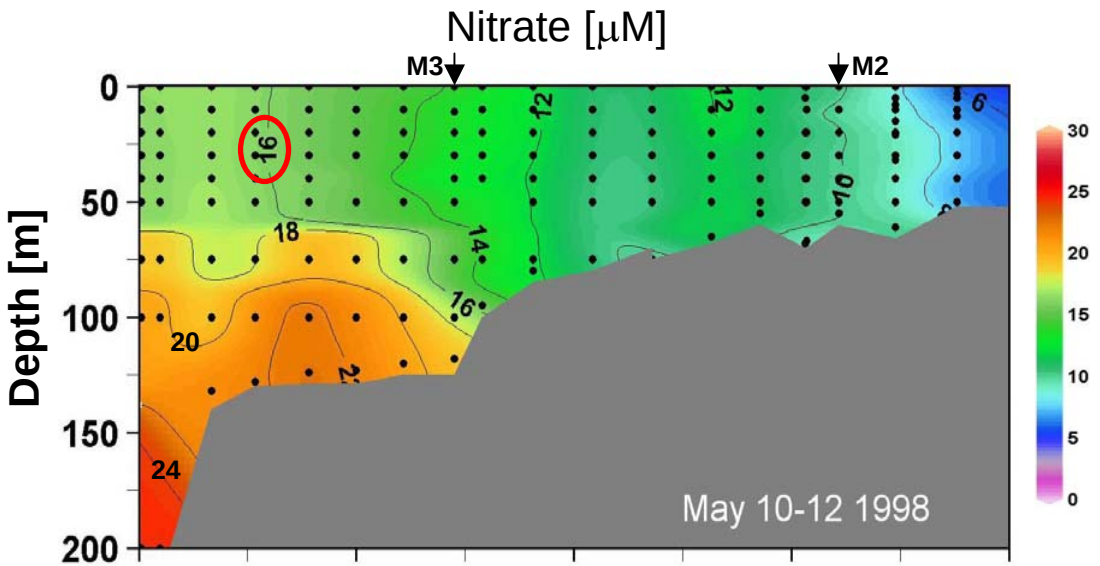


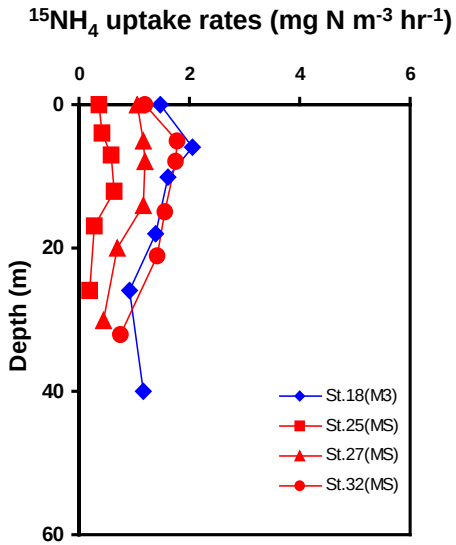


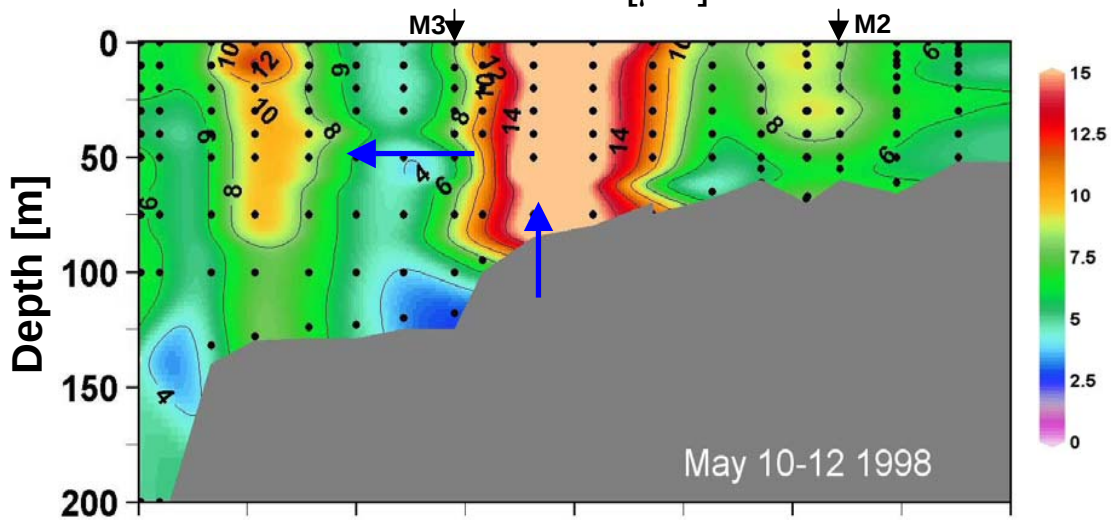


Across Shelf May 1998

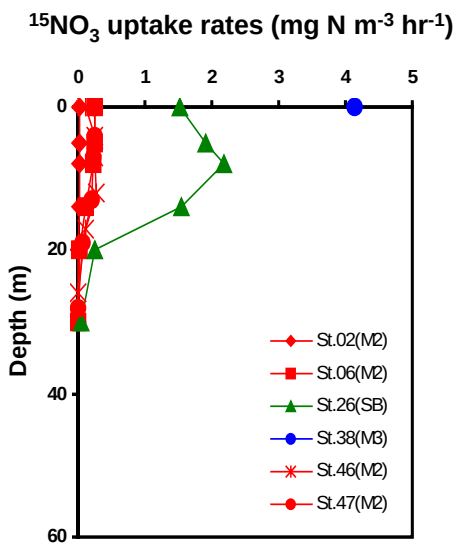


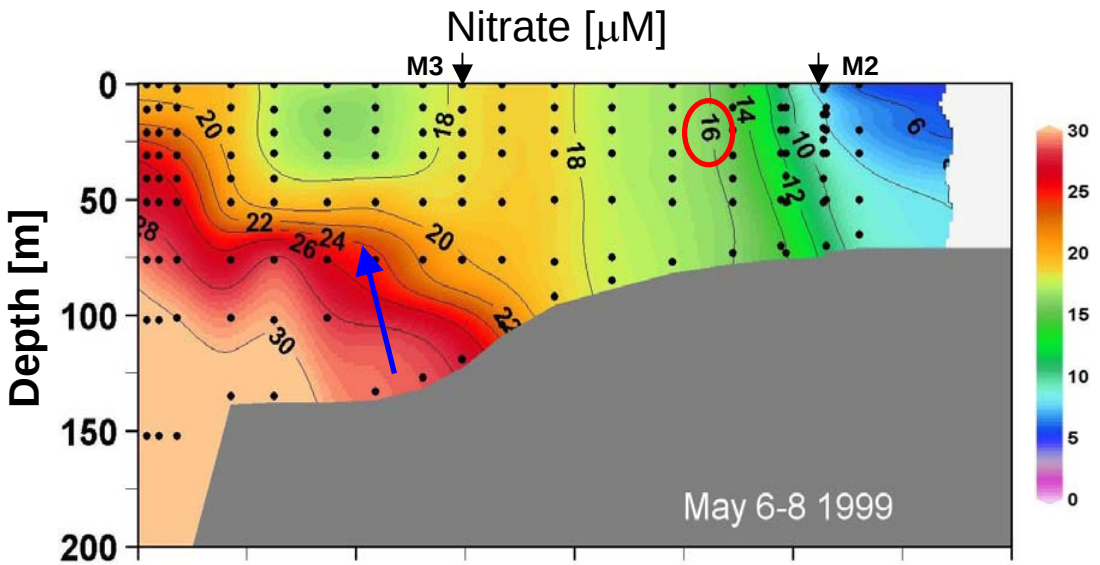


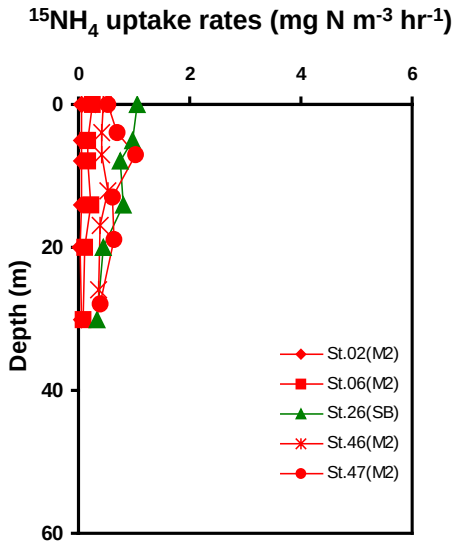


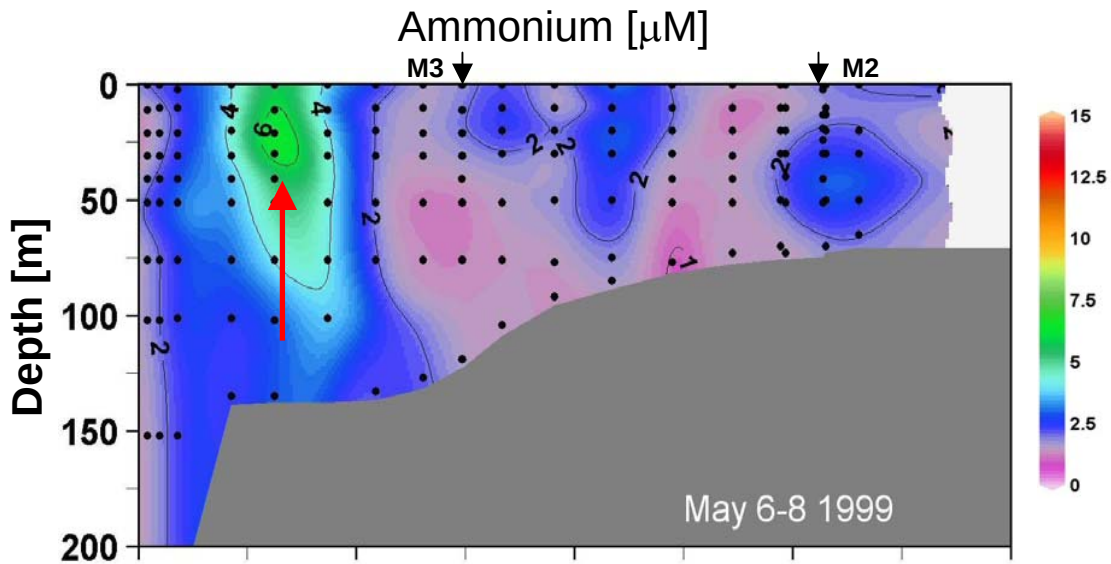


Across Shelf May 1999









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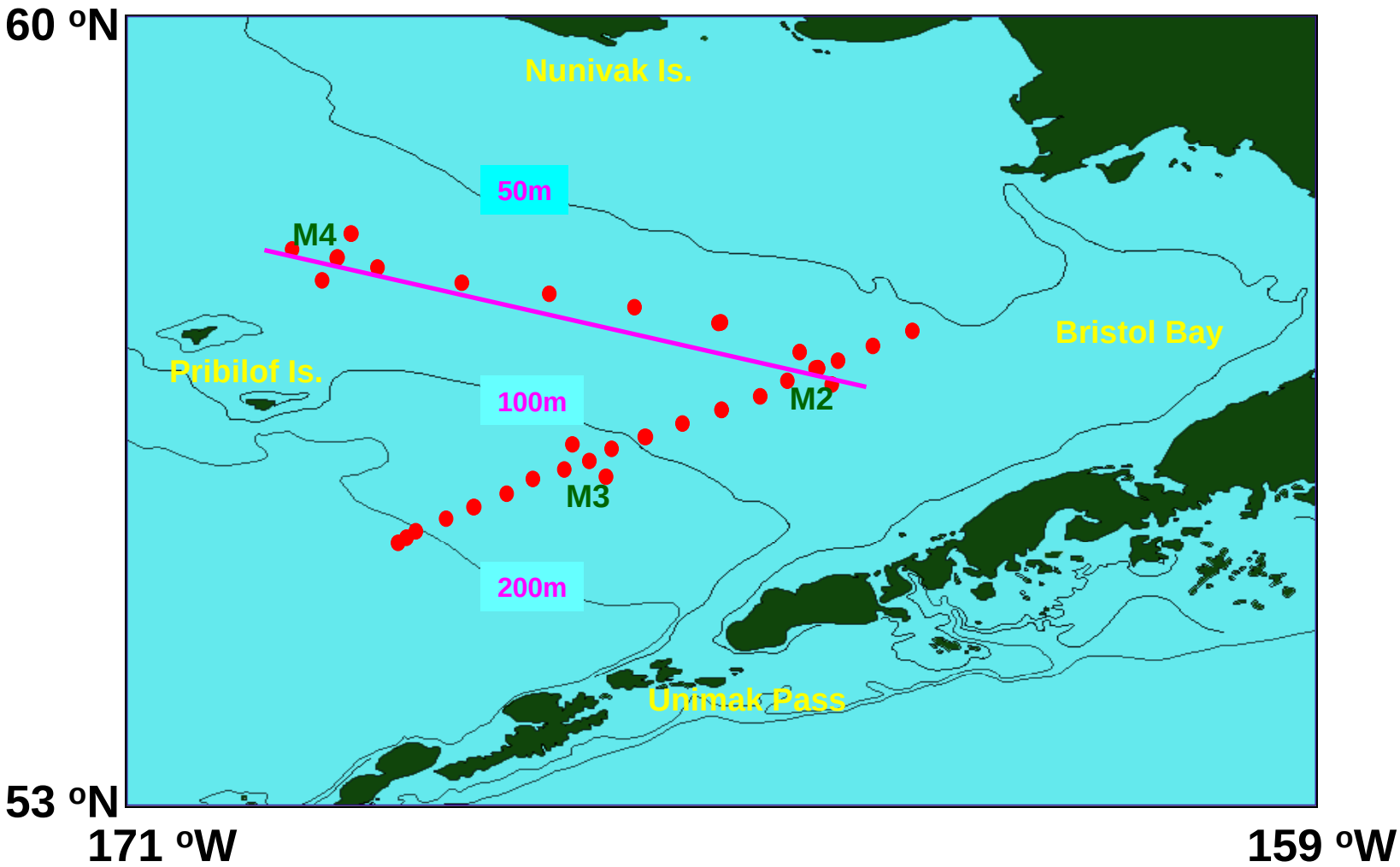

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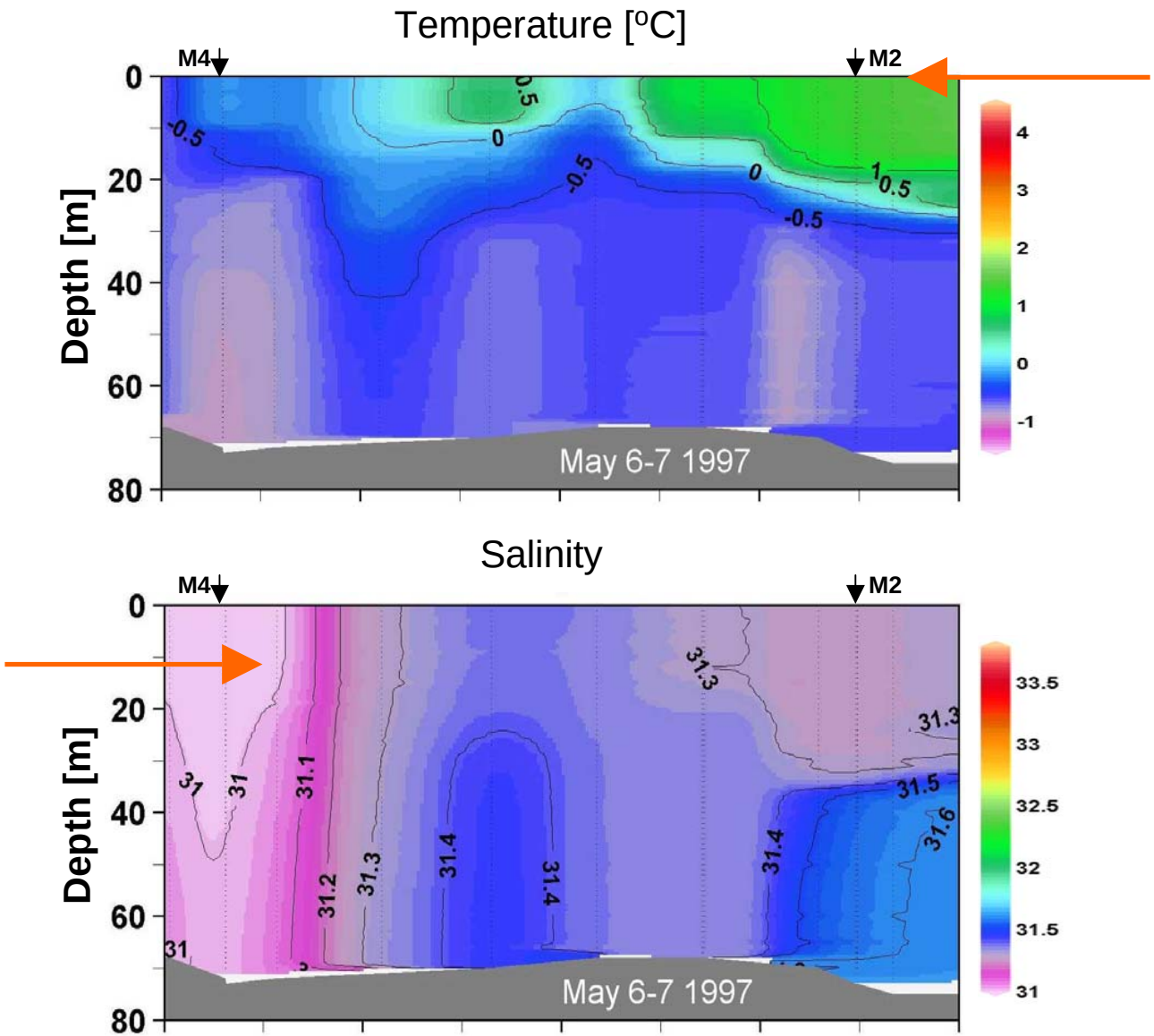
Along Shelf May 1997



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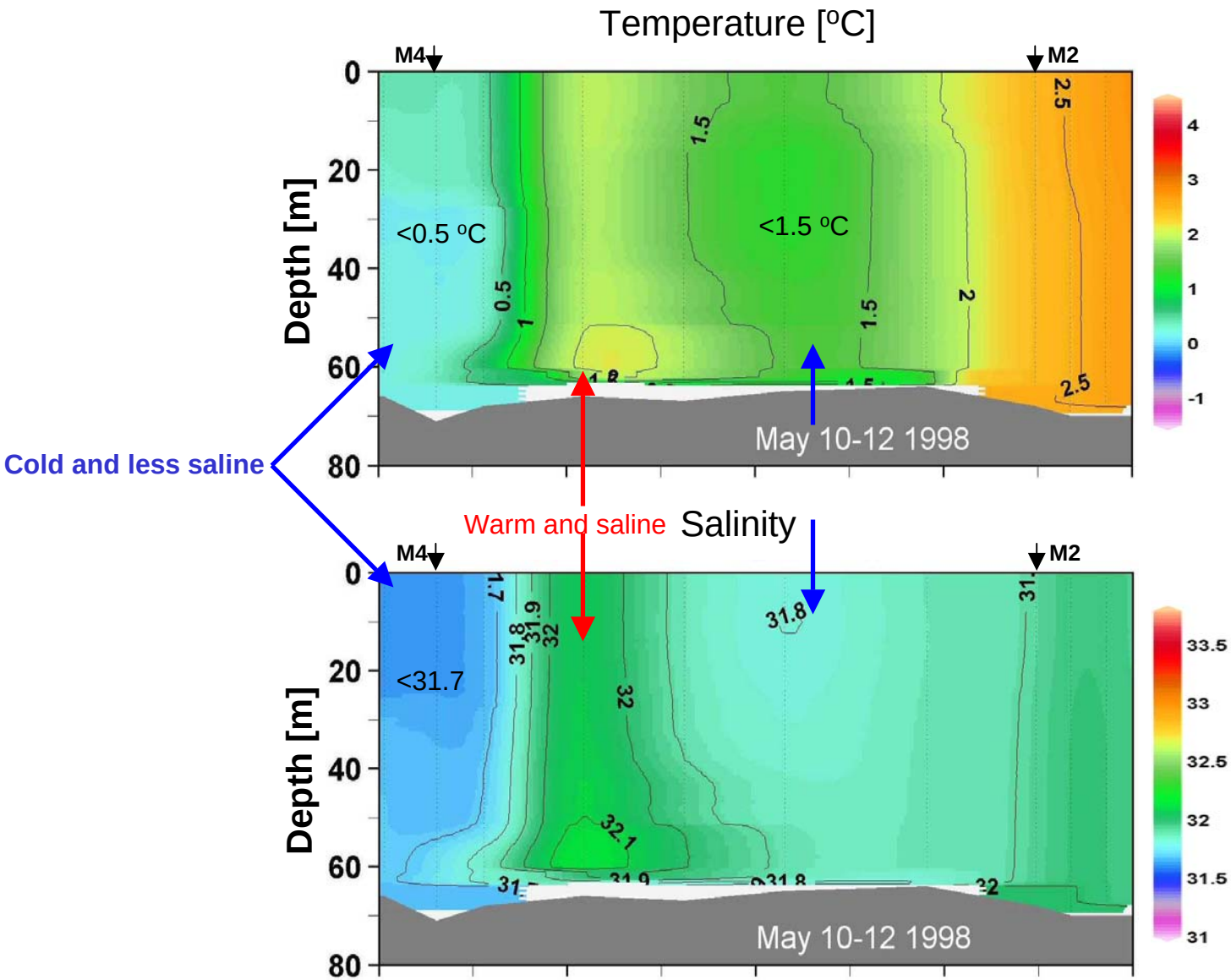

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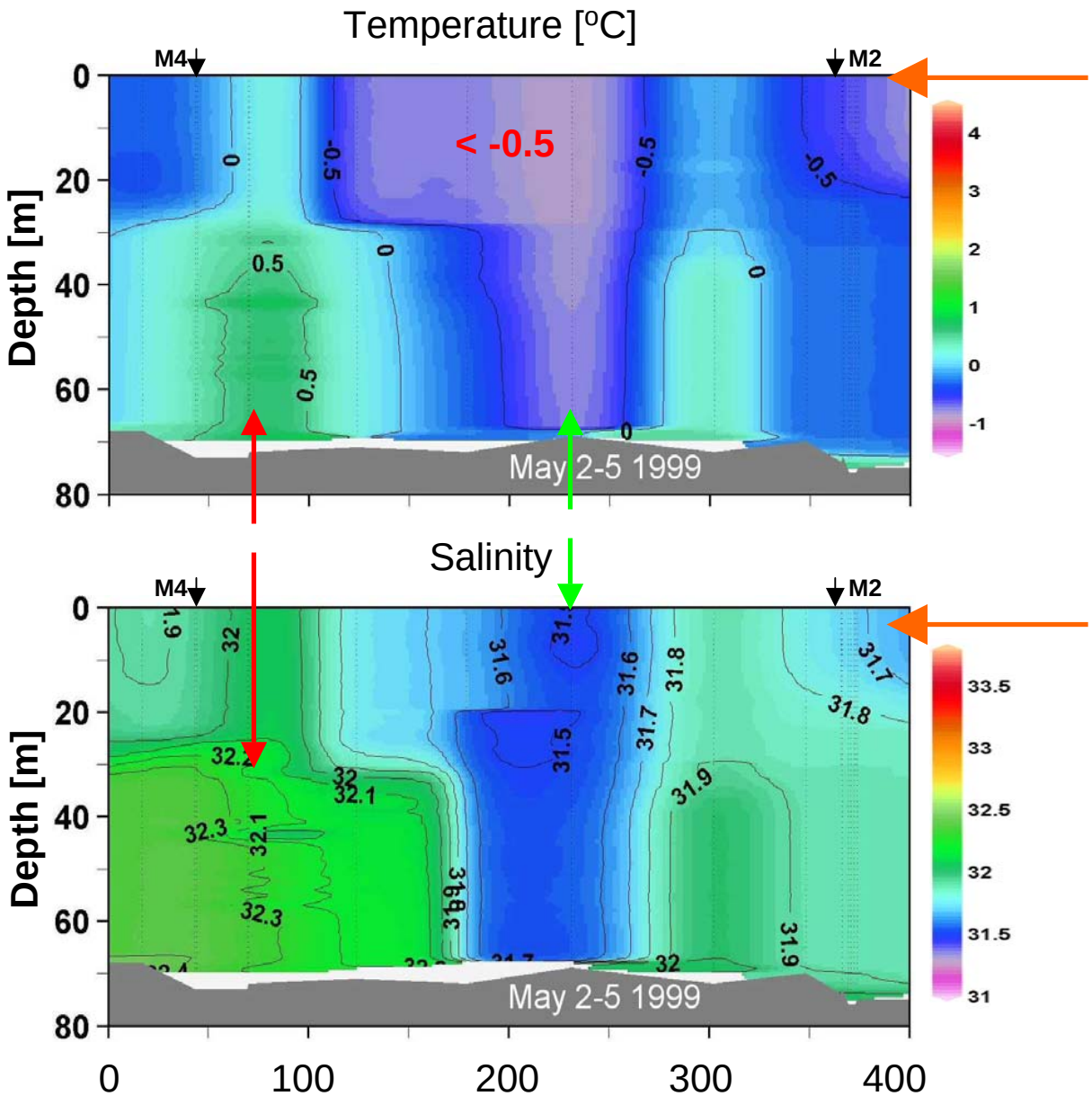

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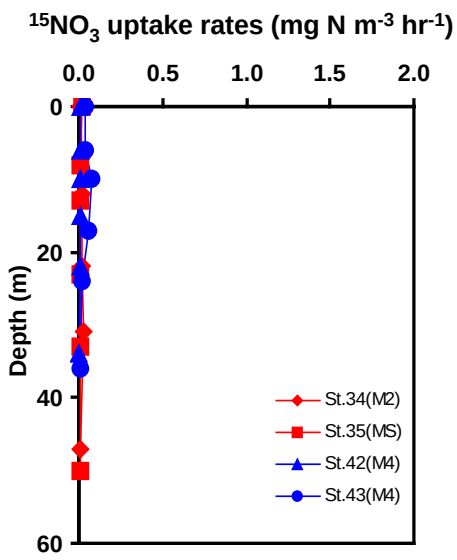

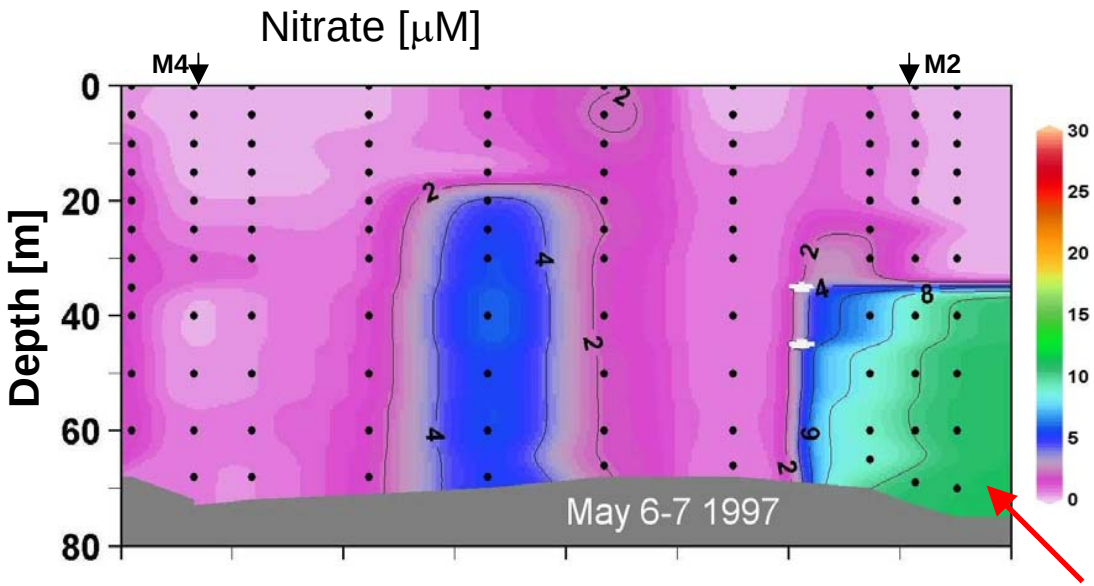

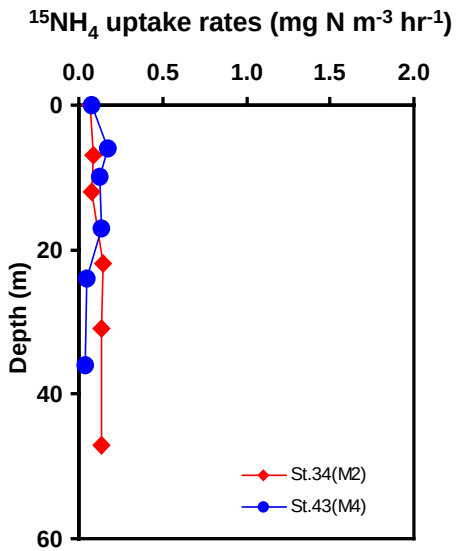

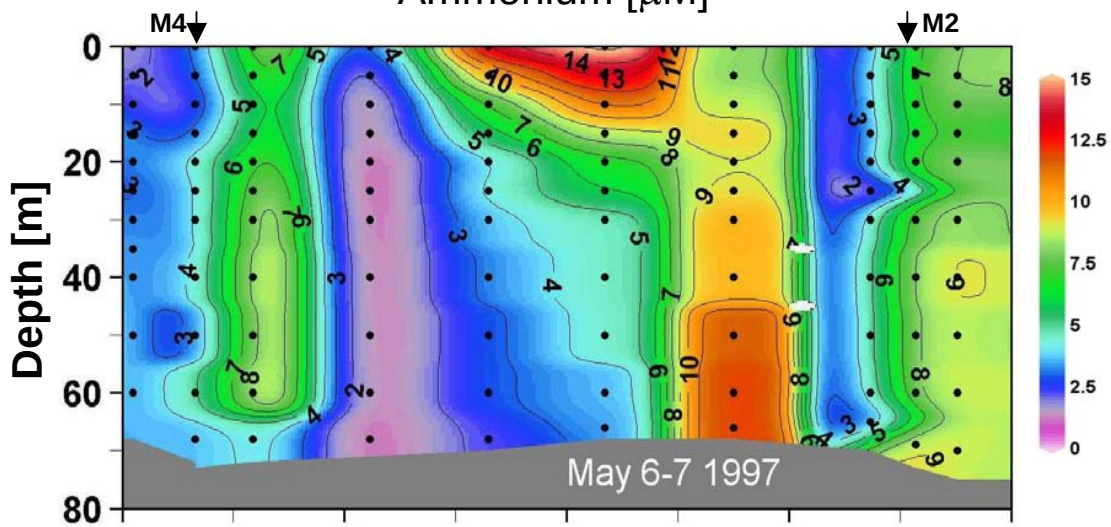

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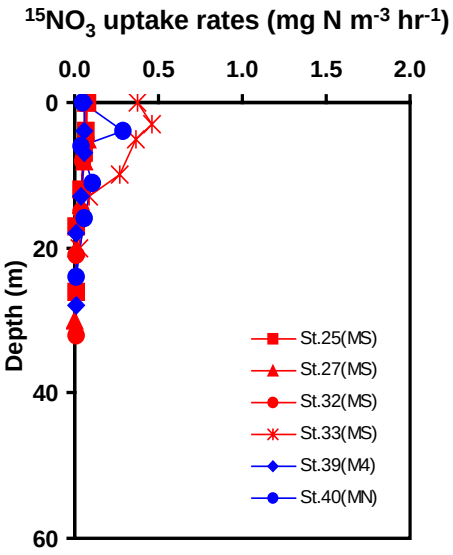

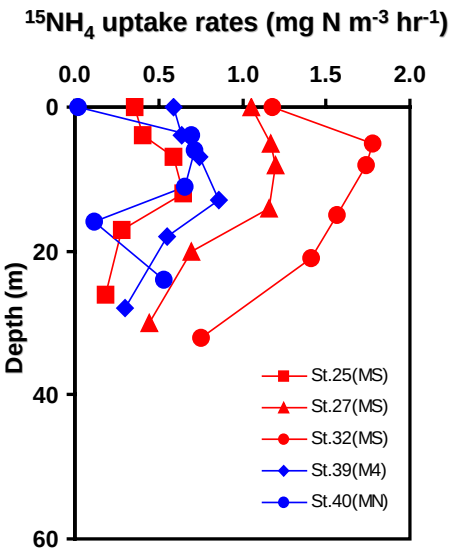

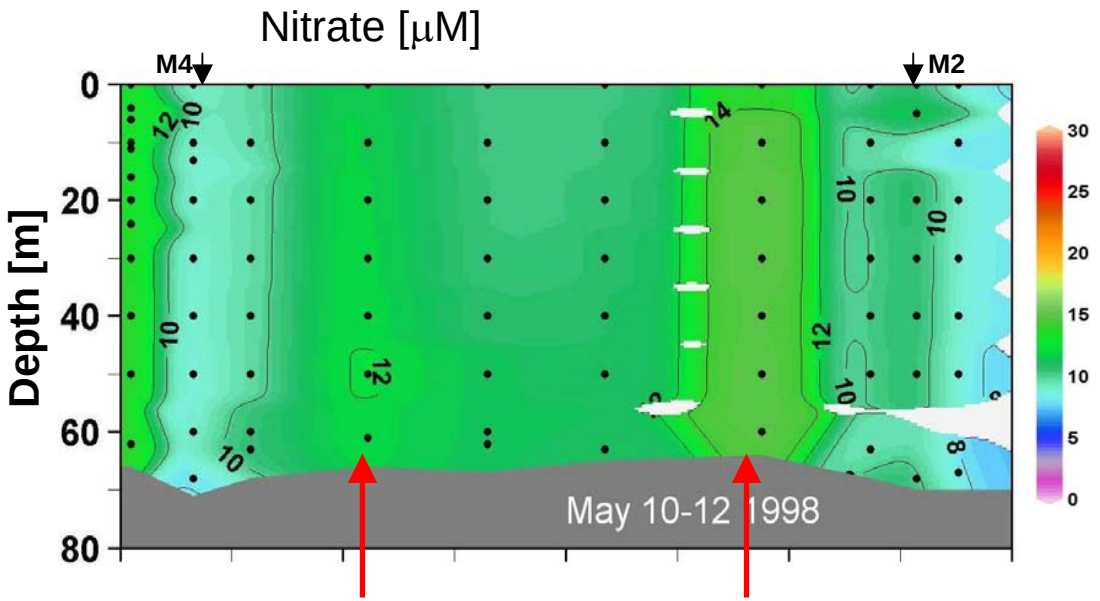

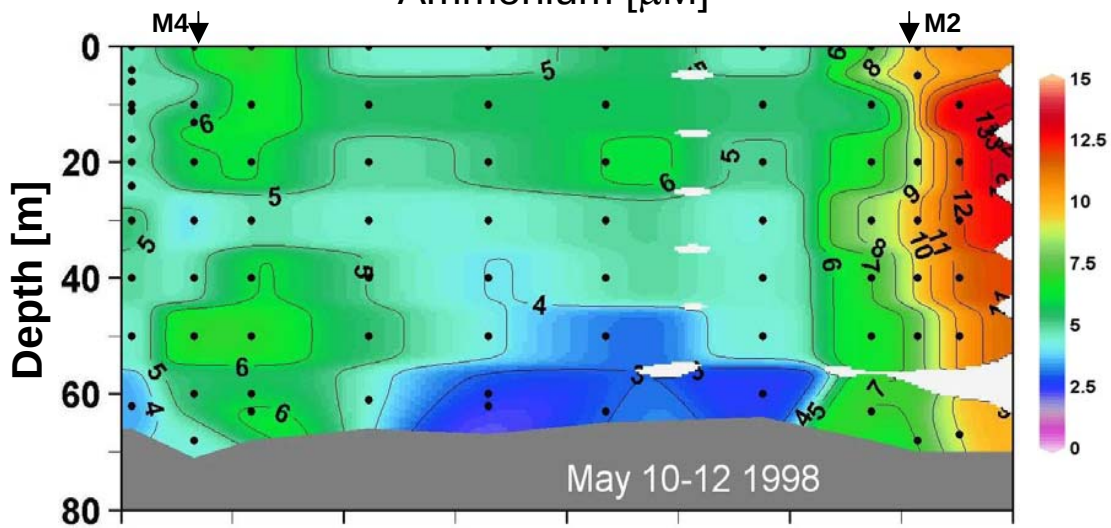

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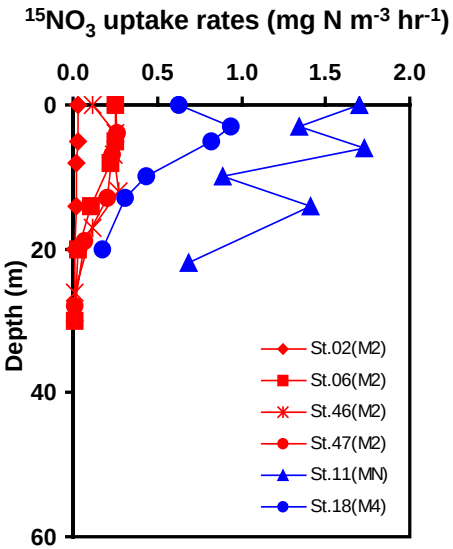
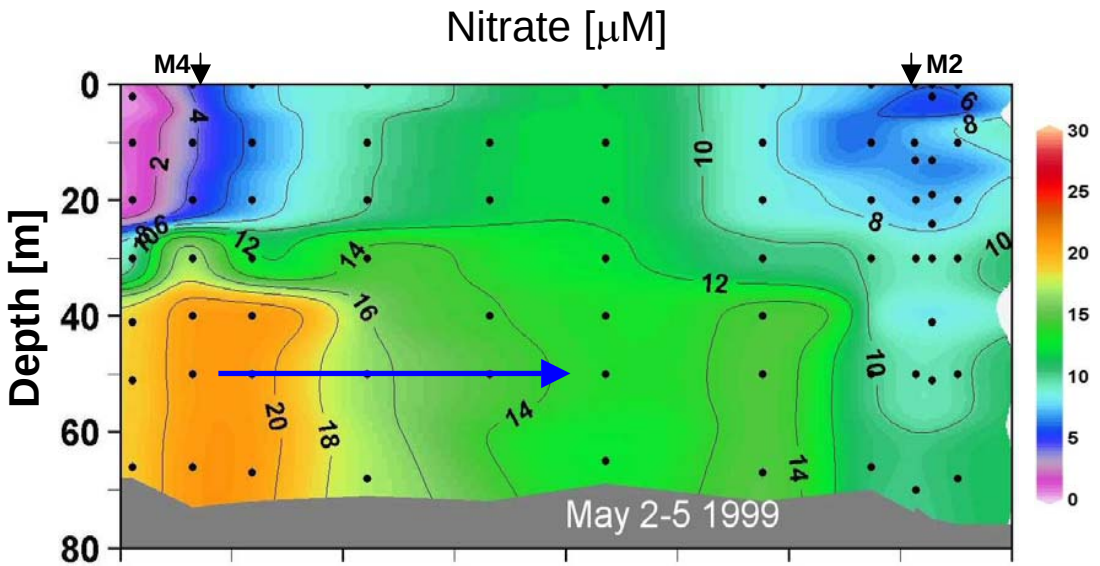
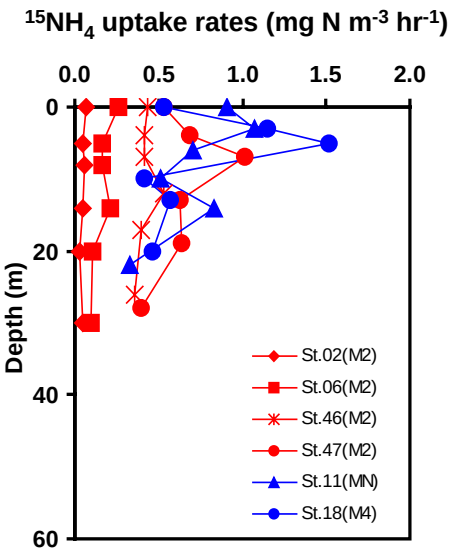
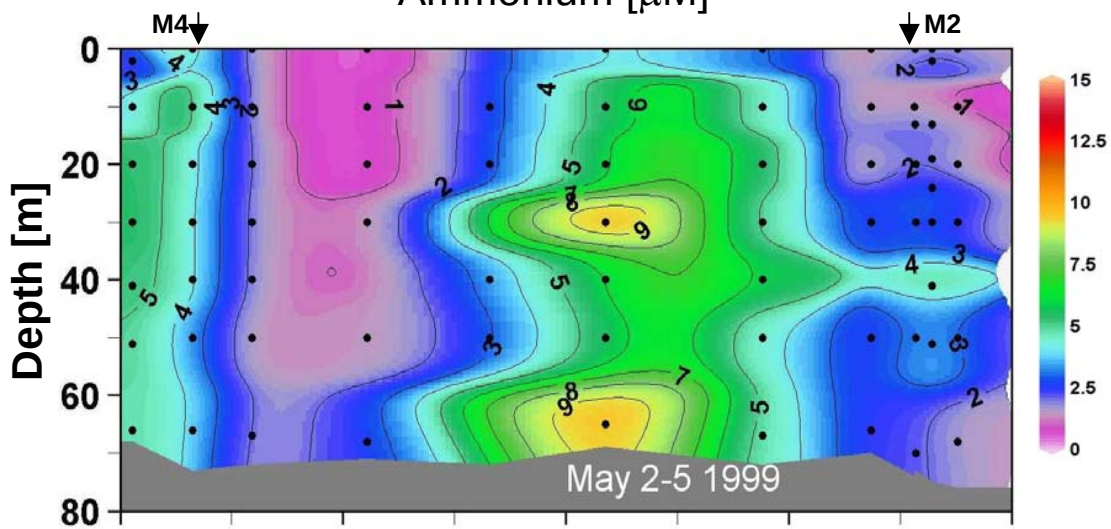
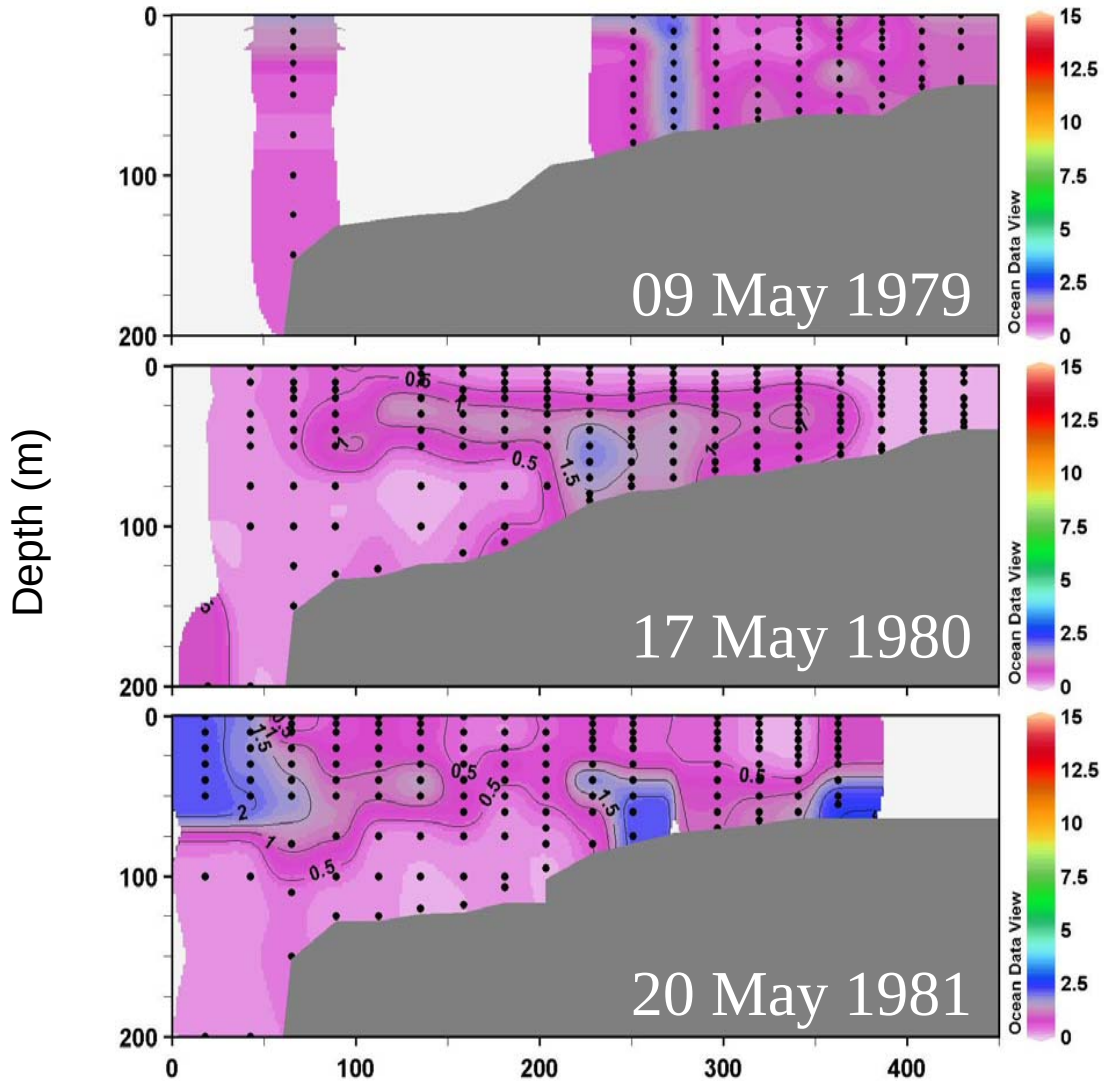




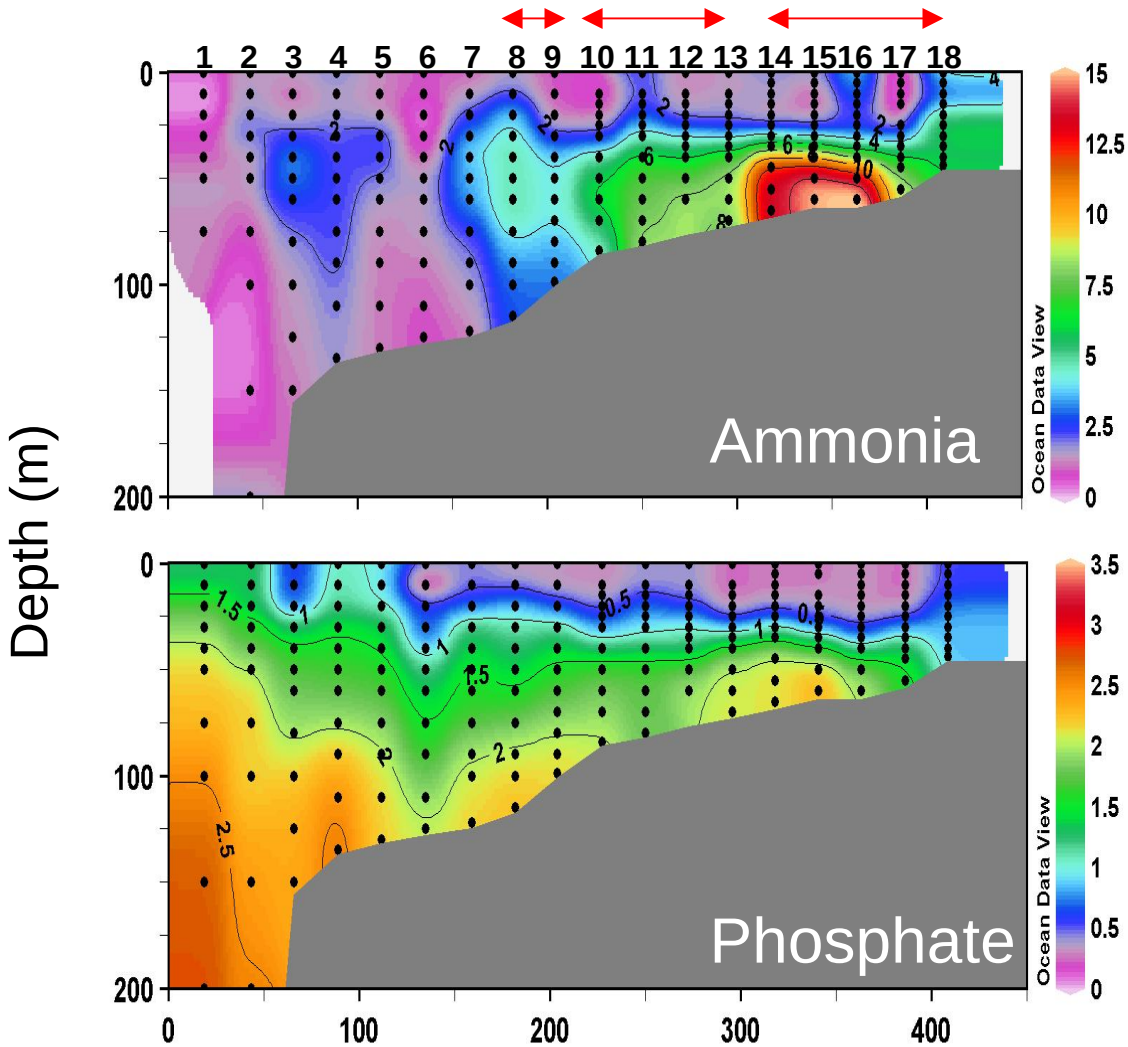


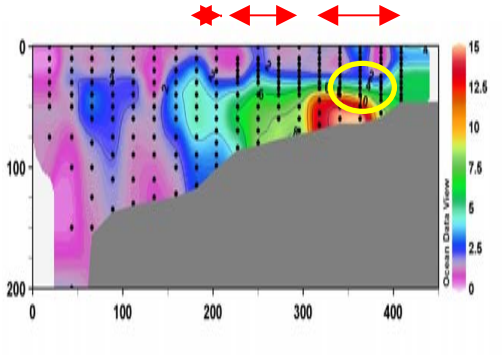


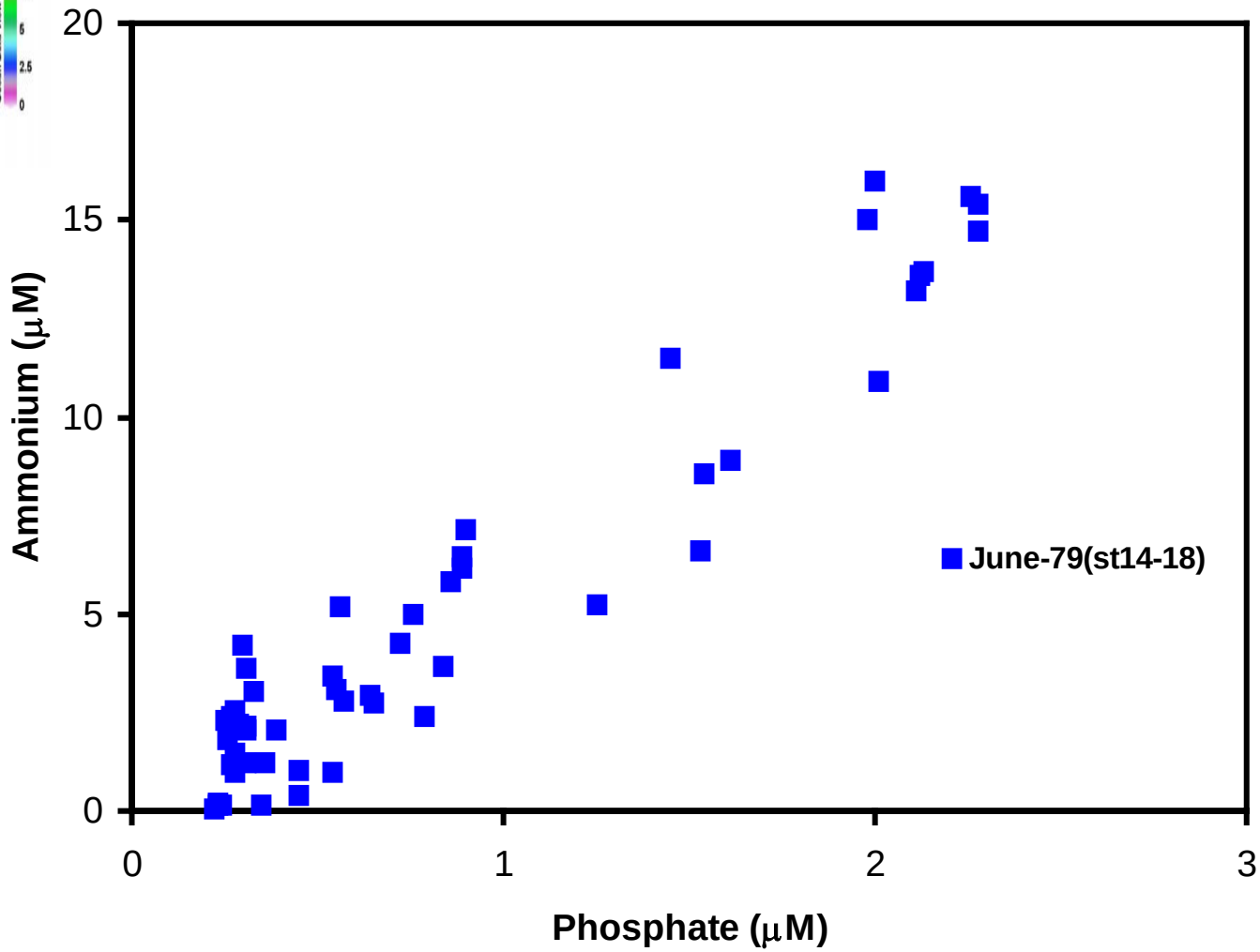
Ammonia during PROBES

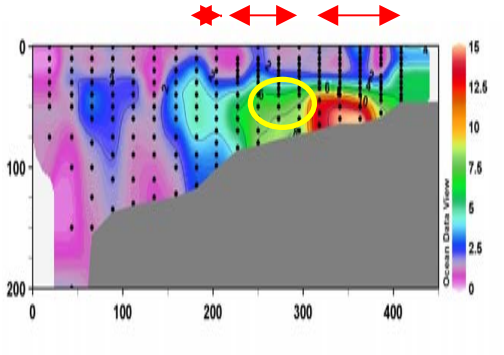


Ammonium vs. Phosphate




0
100
200
0
100
200
300
400
15
12.5
10
7.5
5
2.5
0
Ocean Data View


Ammonium (μM)
Phosphate (μM)
0
5
10
15
20
0
1
2
3
June-79(st14-18)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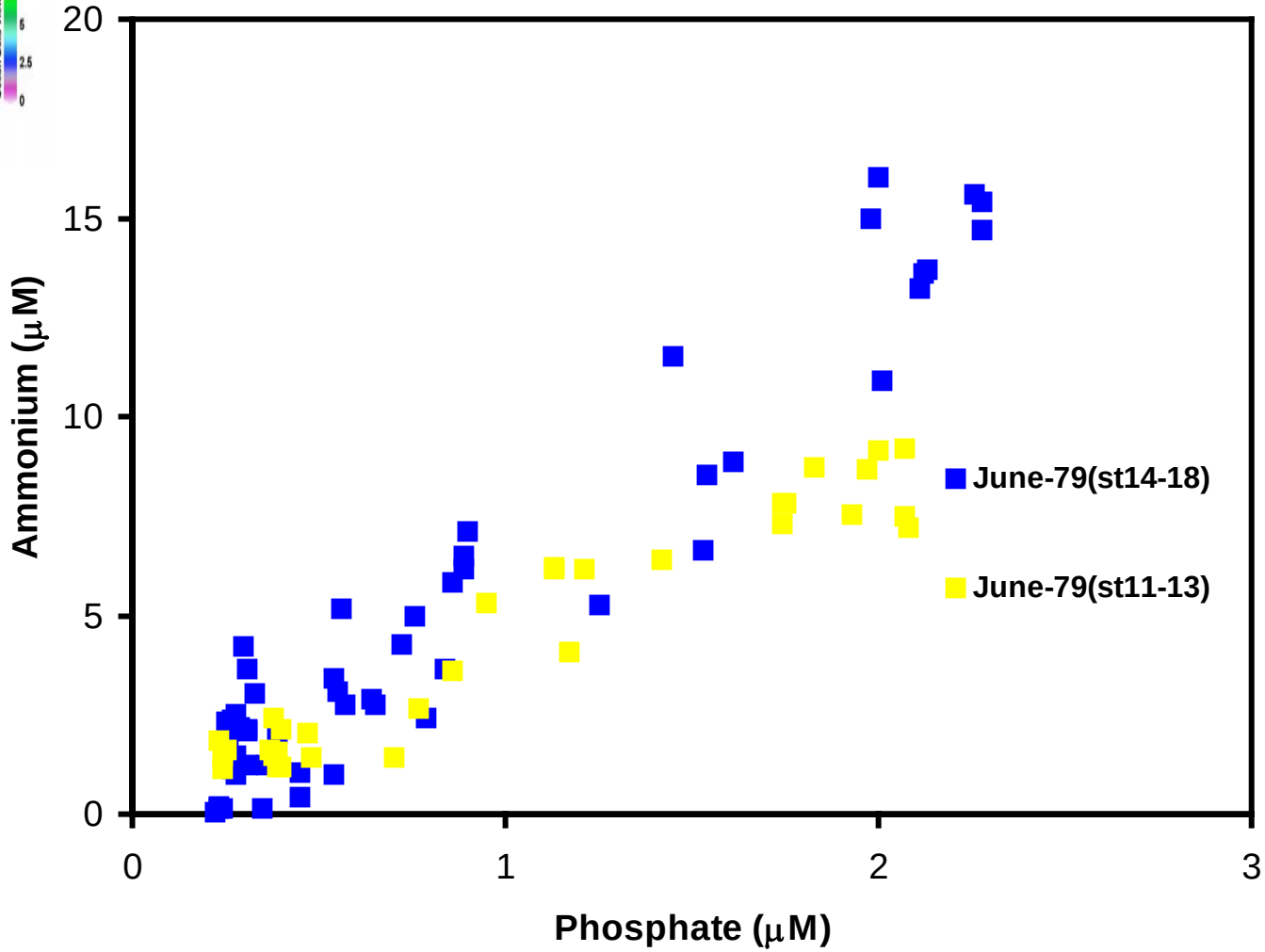
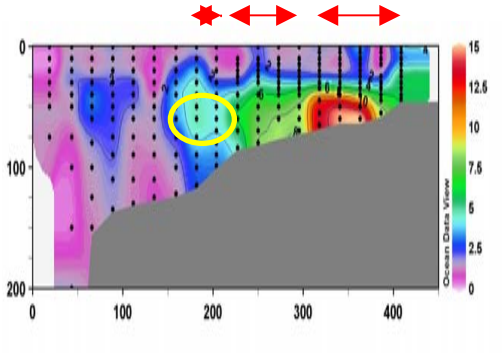
400
15
12.5
10
7.5
5
2.5
0
Ocean Data View


Ammonium (μM)
Phosphate (μM)
0
5
10
15
20
0
1
2
3
June-79(st14-18)
June-79(st11-13)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2.5
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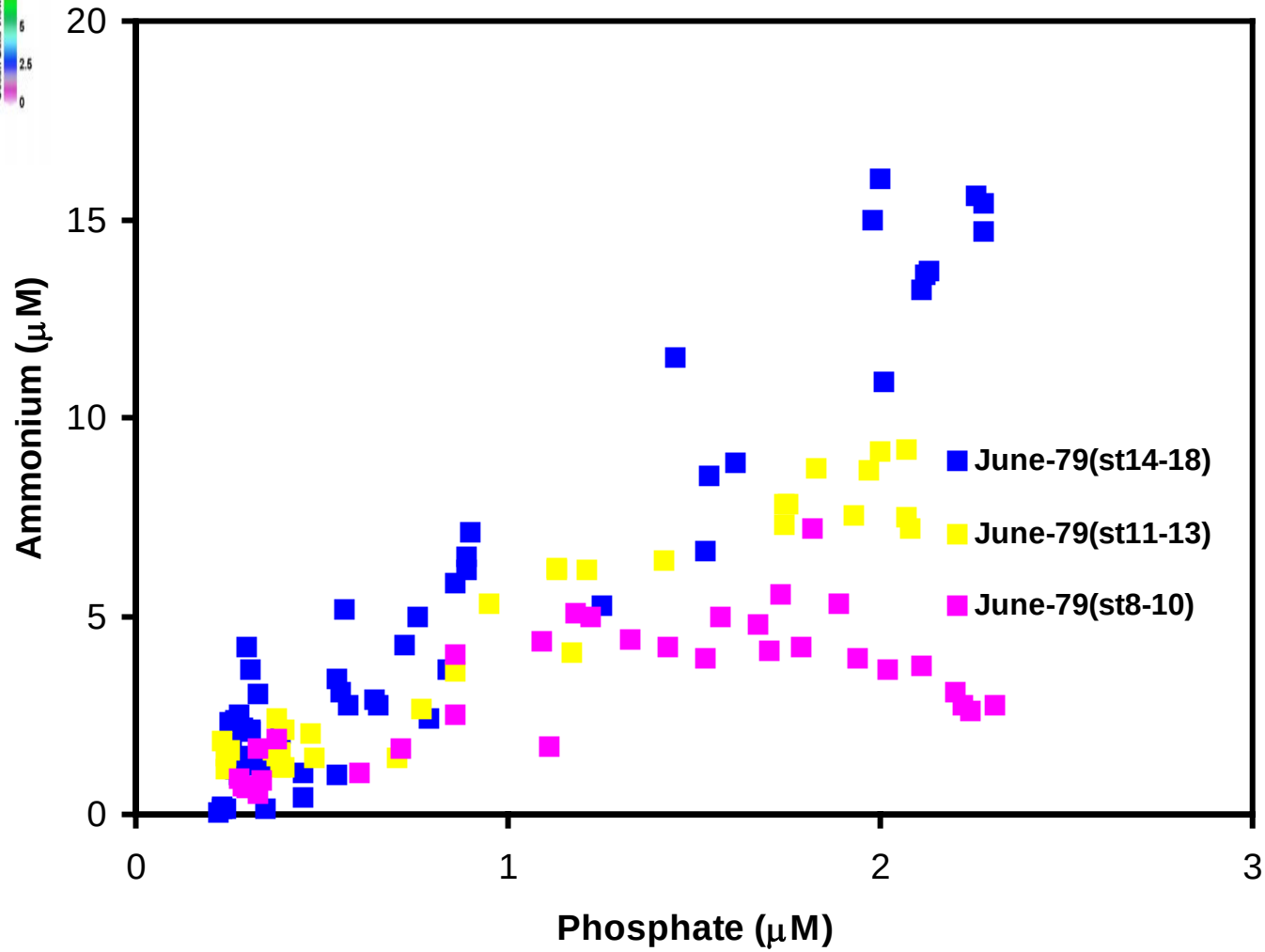
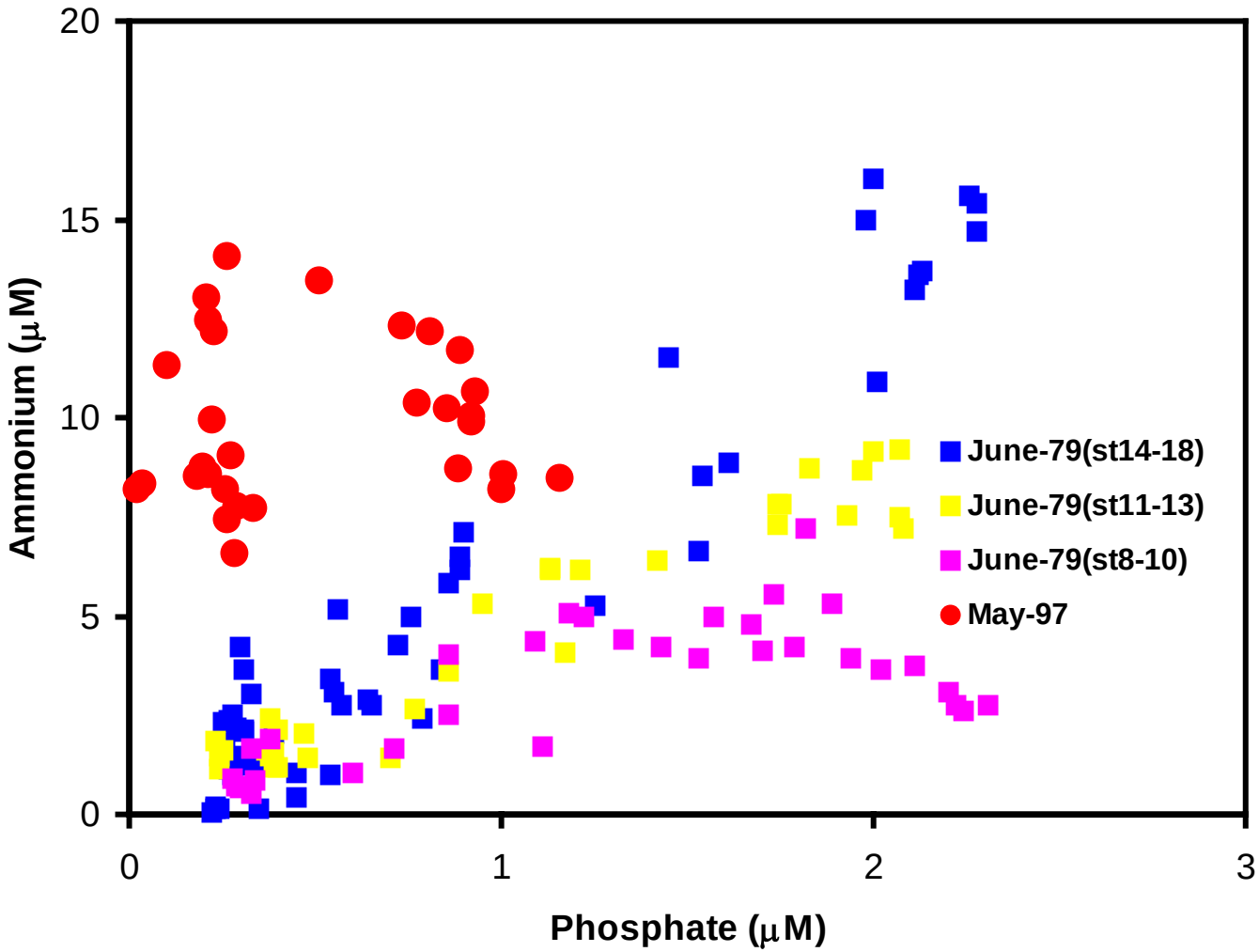
Ocean Data View


Ammonium (μM)
Phosphate (μM)
0
5
10
15
20
0
1
2
3
June-79(st14-18)
June-79(st11-13)
June-79(st8-10)


20
15
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2
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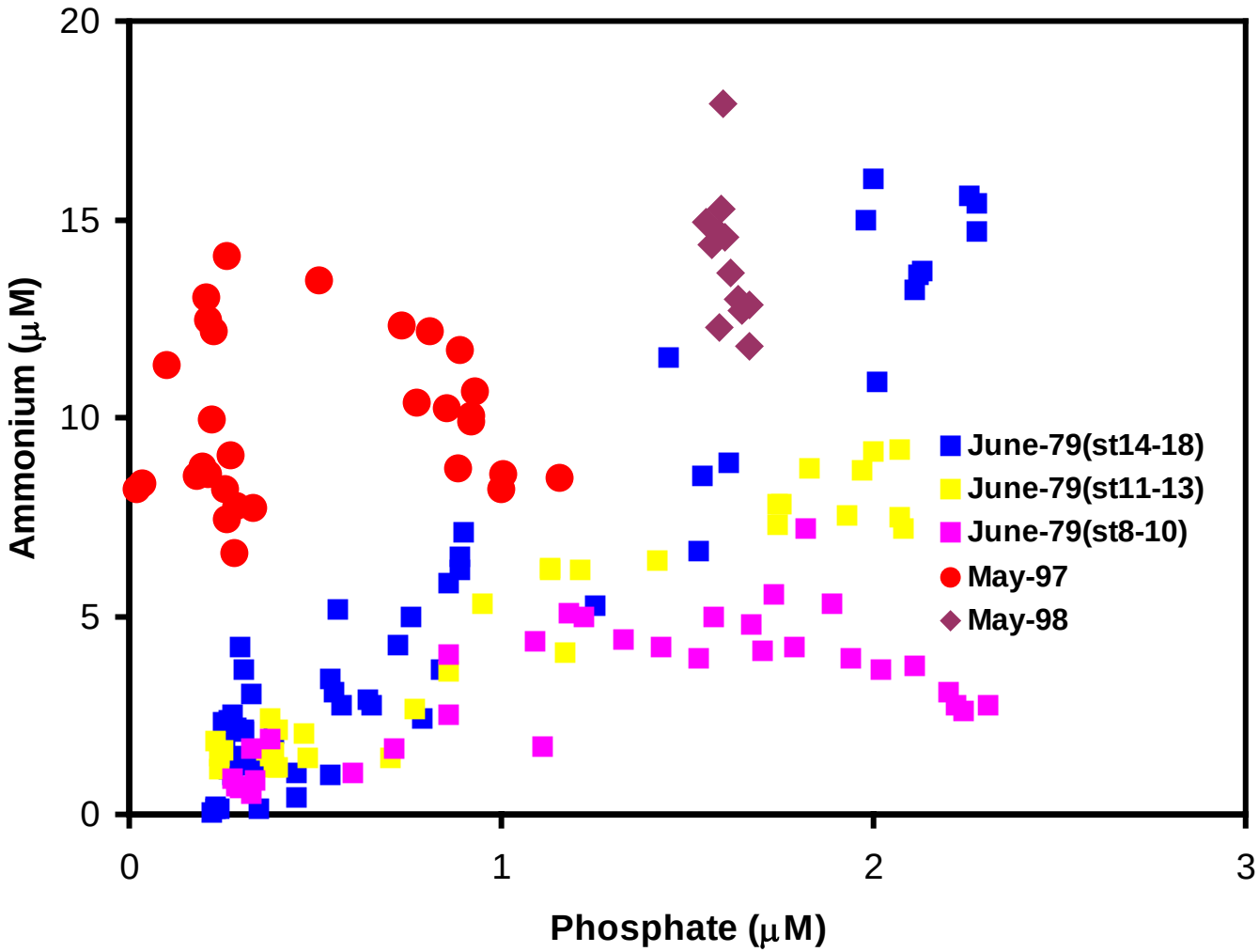
Ammonium (μM)
Phosphate (μM)
June-79(st14-18)
June-79(st11-13)
June-79(st8-10)
May-97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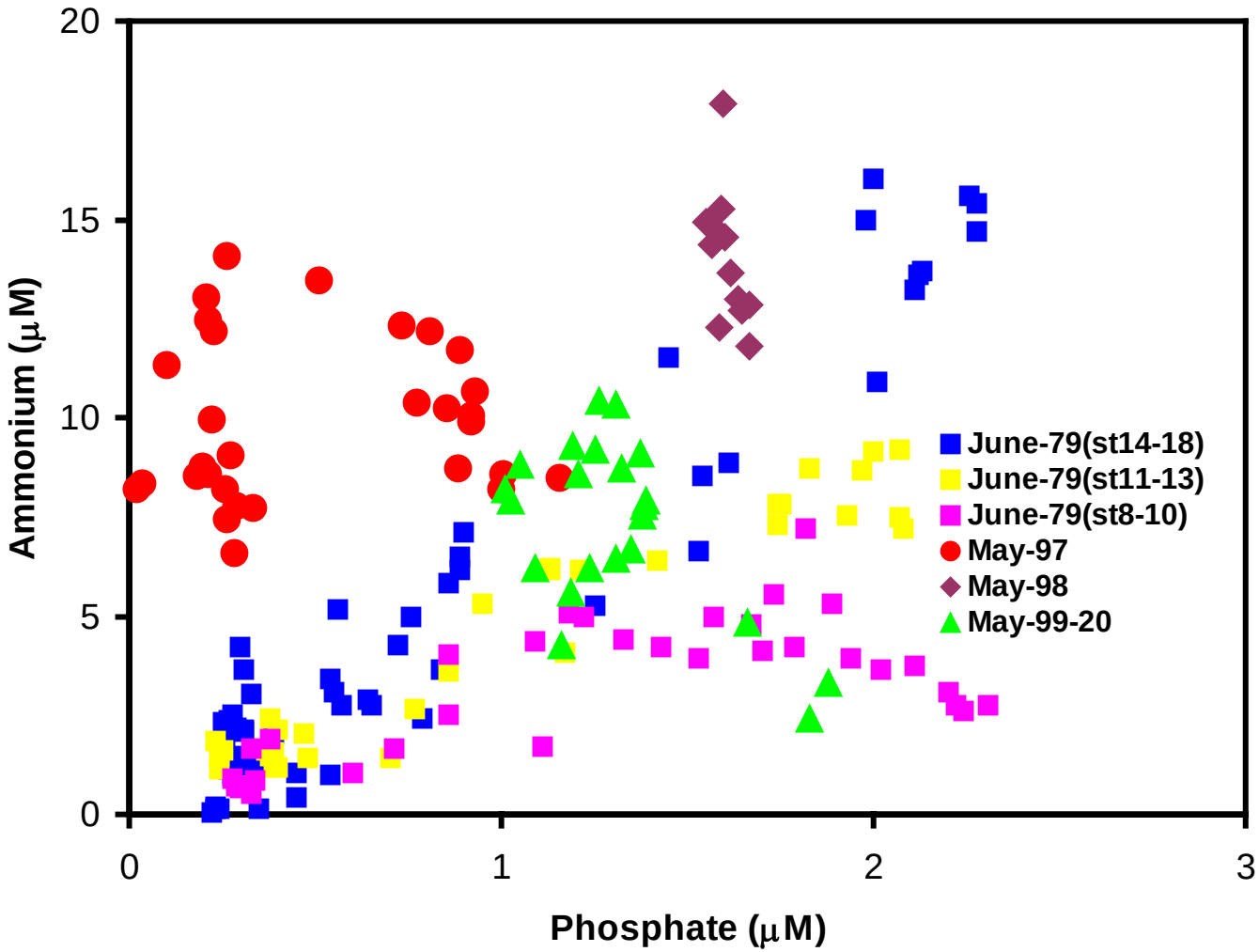
1
2
3
Ammonium (μM)
Phosphate (μM)
June-79(st14-18)
June-79(st11-13)
June-79(st8-10)
May-97
May-98


20
15
10
5
0
0
1
2
3
Ammonium (μM)
Phosphate (μM)
June-79(st14-18)
June-79(st11-13)
June-79(st8-10)
May-97
May-98
May-99-20

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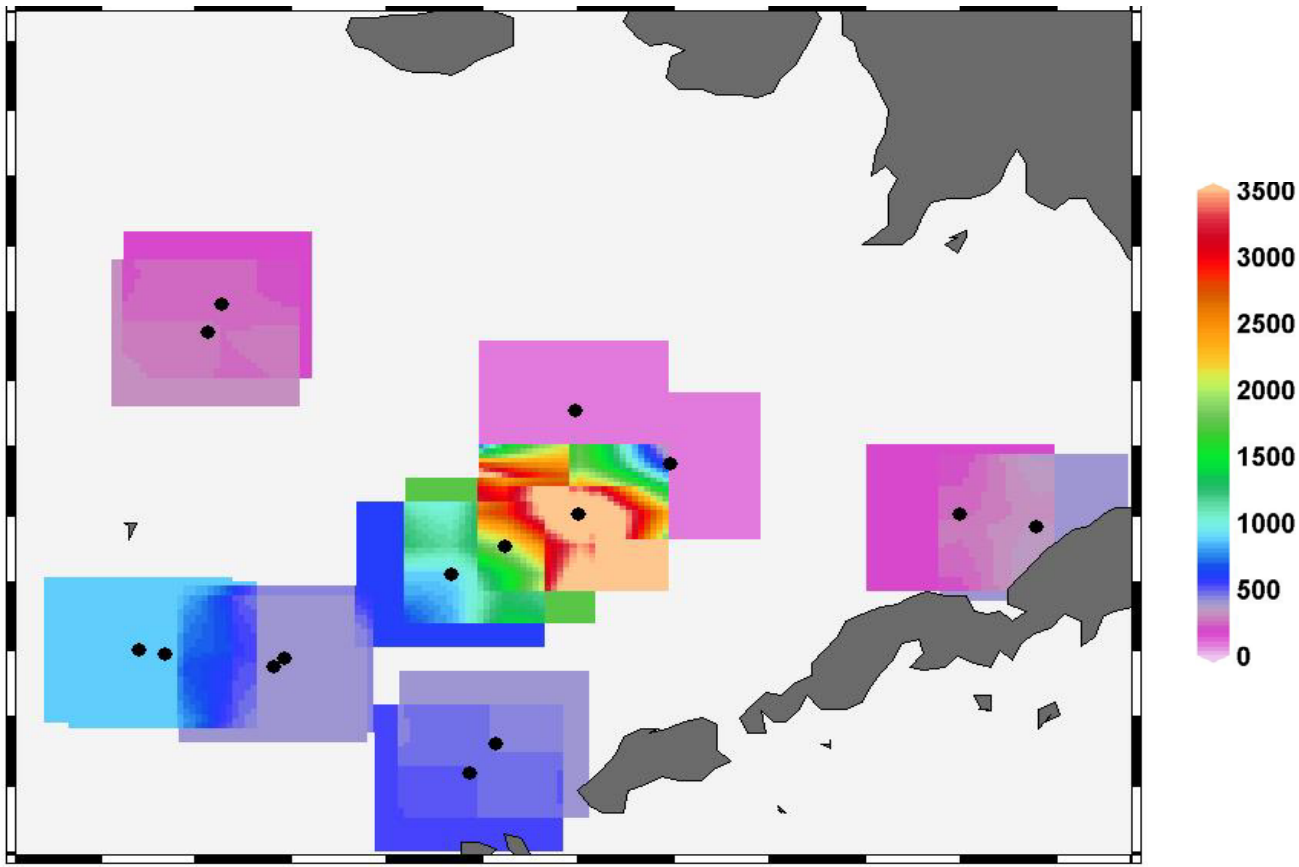
3. Conclusions

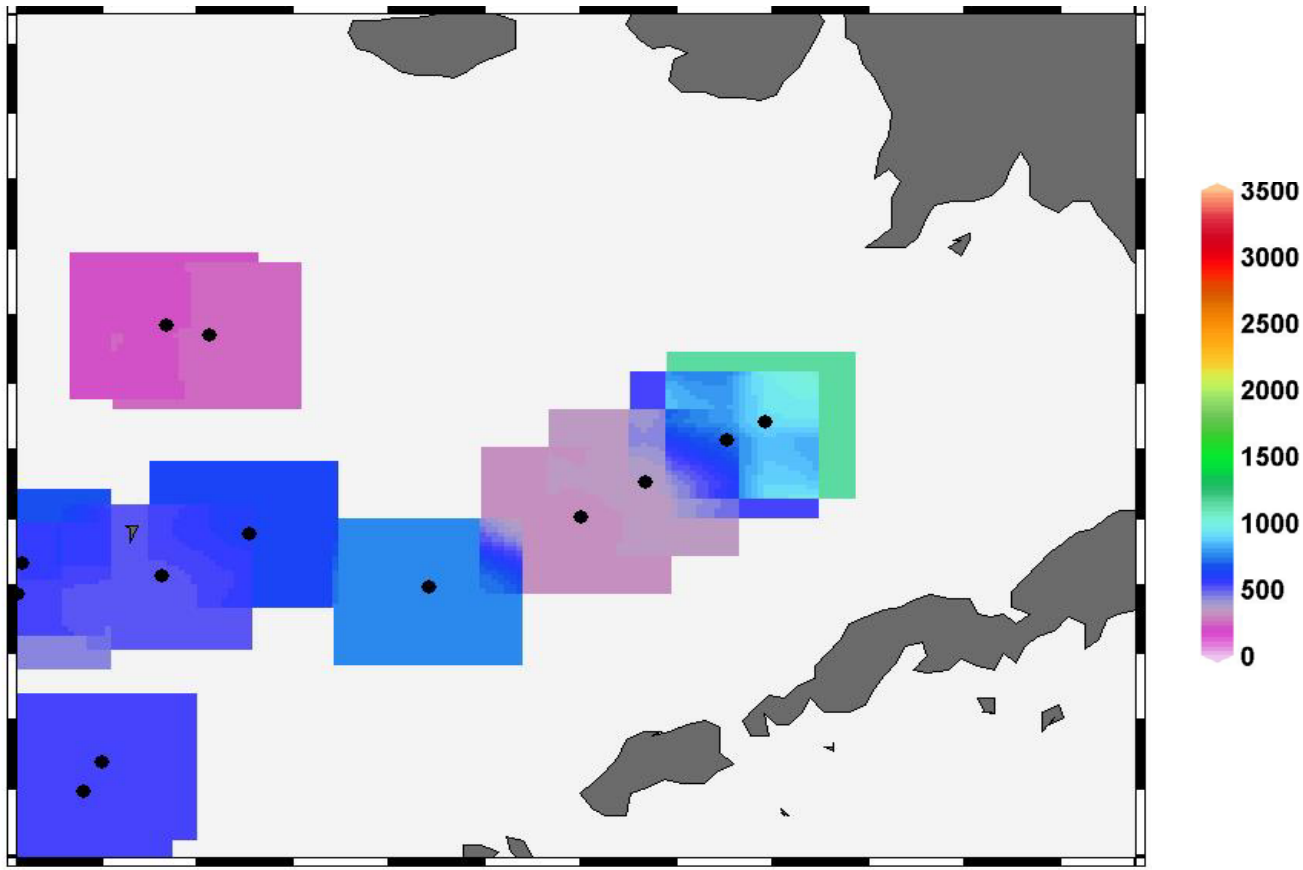
Carbon production:

May 97 (mg C m^{-2} d^{-1})



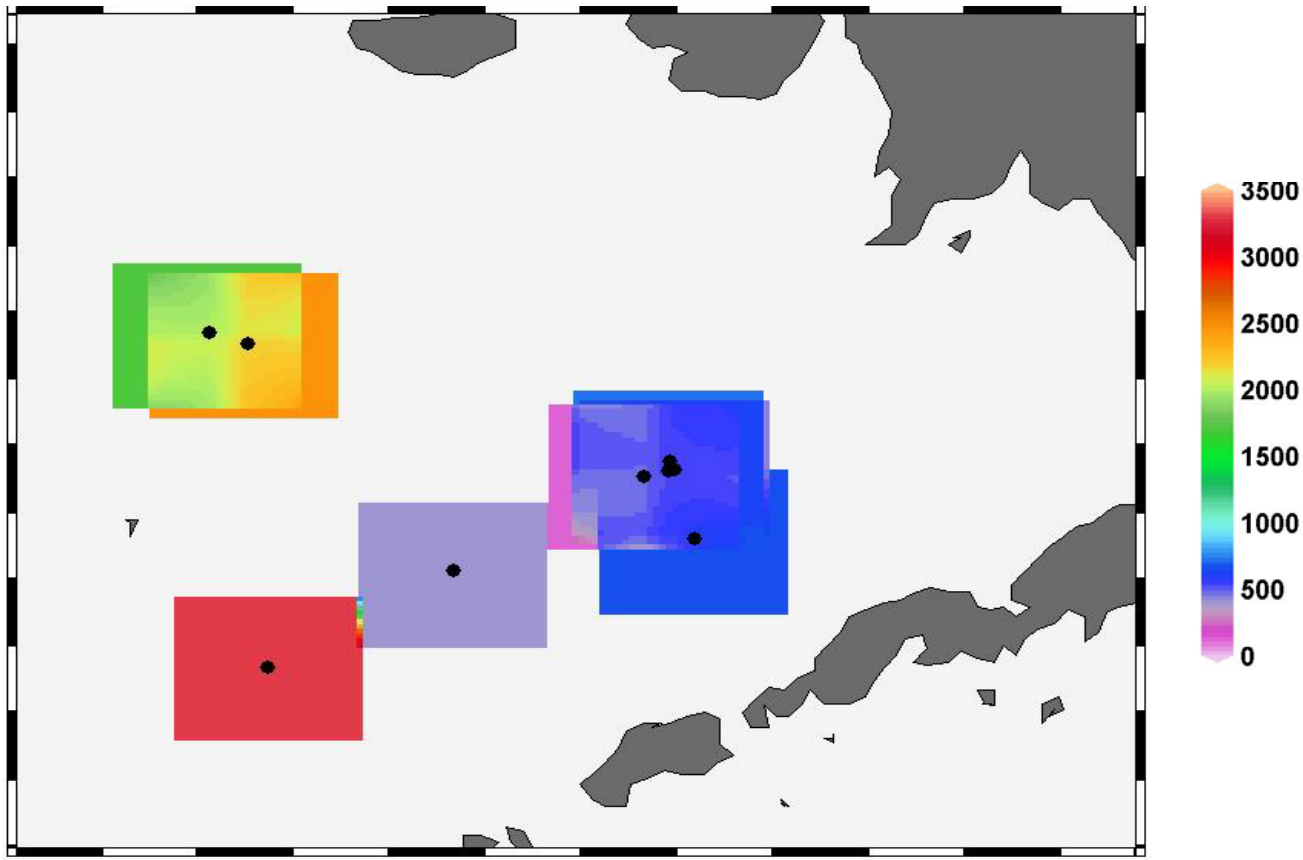
Carbon production:

May 98 (mg C m^{-2} d^{-1})



Carbon Production:

May 99 (mg C m^{-2} d^{-1})



Conclusions

- Large-scale climate and local weather conditions
  - **the timing of advance and retreat of sea ice and wind mixing events**
  - **the distributions of salinity and temperature**
  - **the timing of phytoplankton bloom**

Conclusions

- The distribution and concentrations of nitrate shows strong interannual variations due to
  - **the timing of phytoplankton bloom**
  - **the onshore transport**
  - **the other nutrients (ammonium)**

Conclusions

- High ammonium concentrations in early spring
  - **may come from remineralization, melting sea ice, and enhancement of microbial loop**
  - **reduce nitrate uptake rates**
  - **increase total annual production**

Conclusions

- Offshore transport at mid-depth over the outer shelf
  - **may important in the export of the middle shelf production to the outer shelf and shelf break region**
  - **including regenerated Fe**

Conclusions

- Carbon and Nitrogen uptake rates
  - **show strong interannual variations due to physical conditions and subsequent nutrient availability**
  - **show spatial variations**

Future Study

- Need fine scale study of temporal and spatial distribution of production for better understanding the variation due to the physical fluctuations

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  - **UAF Graduate School**
  - **UAF School of Fisheries and Ocean Science**


Thank you

Conclusions

- Large-scale climate and local weather conditions
- The distribution and concentrations of nitrate shows strong interannual variations
- High ammonium concentrations in early spring
- Offshore transport at mid-depth over the outer shelf
- Carbon and Nitrogen uptake rates