INTERANNUAL VARIABILITY OF SILICEOUS PHYTOPLANKTON FLUXES AND RELATIONSHIPS WITH HYDROGRAPHY IN THE NORTHEASTERN SUBARCTIC PACIFIC, 1982-1986

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ABSTRACT

Time-series flux variabilities of biogenic opal particles were measured during 1982-1986 at pelagic Station PAPA (50°N, 145°W) located just south of the Gulf of Alaska, eastern North Pacific. PARFLUX sediment traps with two week sampling increments were deployed at 1000 m and 3800 m in 4200 m deep water, yielding nearly continuous time-series flux records for four years. The flux data allowed us to examine interannual and seasonal variabilities of siliceous phytoplankton production as well as environmental signals retained within the siliceous shells, which can be used to reconstruct environments.

Seasonal productions of specific groups are defined. The seasonal productions are correlated with environmental parameters. For example, an intense spring phytoplankton bloom associated with increase of light intensity and already available high nutrient levels can be best reflected in the seasonal flux pulses of *Denticulopsis seminae* (Fig. 1), a small-sized (7 x 9 x 25 um) pennate diatom taxon, which is considered to be a productivity indicator. Flux maxima of this taxon also occur in fall with varible timing. Among 18 common to dominant diatom species (Takahashi, 1986) *D. seminae* is the most significant contributor of organic carbon production in the euphotic zone. Similarly, high light and temperature with moderate to low nutrient levels reflect in pronounced production of *Rhizosolenia styliformis* (Fig. 2), a large sized (39 x 1008 um length) summer diatom which is the second most important organic carbon producer. *Coscinodiscus marginatus* (Fig. 3), a winter diatom taxon and the third ranked organic carbon producer, increases its fluxes during late fall/early winter, reflecting conditions with low light, high nutrients and relatively low temperature.

During 1984 and a part of 1985 fluxes of diatoms (Takahashi, 1987b), *silicoflagellates* (Takahashi, 1987a) and radiolarian taxa (Takahashi, 1988) decreased their fluxes significantly (Figs. 1-3). reflecting a significant increased stratification of upper 100 m waters throughout the period. The stratification, especially in early spring (March-April), caused significant reduction of convective nutrient supply. The suppressed siliceous plankton fluxes may be related with the 1982-1983 El Niño, approximately 1.5 years after the low latitude event (Takahashi, 1987b, 1988).

Fluxes of diatoms and silicoflagellates have also been measured at 3500 m at Station C (3900 m depth) located between Station PAPA and the west coast of the North America, 1985-1986 and compared with those at Station PAPA. Species compositions and seasonal flux patterns of most taxa are similar, suggesting that the two stations, 600 Km apart, are within one oceanic province where its ecosystem is essentially the same. However, flux

level at Station C is generally lower than those at Station PAPA and seasonal pulses of flux peaks of many species are preceded by Station PAPA peaks by two to four weeks. These relatively subtle differences can readily be accounted for by hydrographic properties such as σt values. The siliceous plankton shell fluxes are valuable tools in monitoring the surface water conditions.

References

Takahaski, K., Seasonal fluxes of pelagic diatoms in the subarctic Pacific, 1982-1983, Deep Sea Res., 33 (9), 1225-1251, 1986.

Takahaski, K., Seasonal fluxes of silicoflagellates and Actiniscus in the subarctic Pacific during 1982-1984, J. Mar. Res., 45, 397-425, 1987a.

Takahashi, K., Response of subarctic Pacific diatom fluxes to the 1982-1983 El Nino disturbance. J. Geophys. Res., 92 (C13), 14,387-14,392, 1987b.

Takahashi, K., Radiolarian flux and seasonality: climatic and El Nino response in the subarctic Pacific, 1982-1984, Global Biogeochem. Cycles, 1 (3),213-231, 1988.

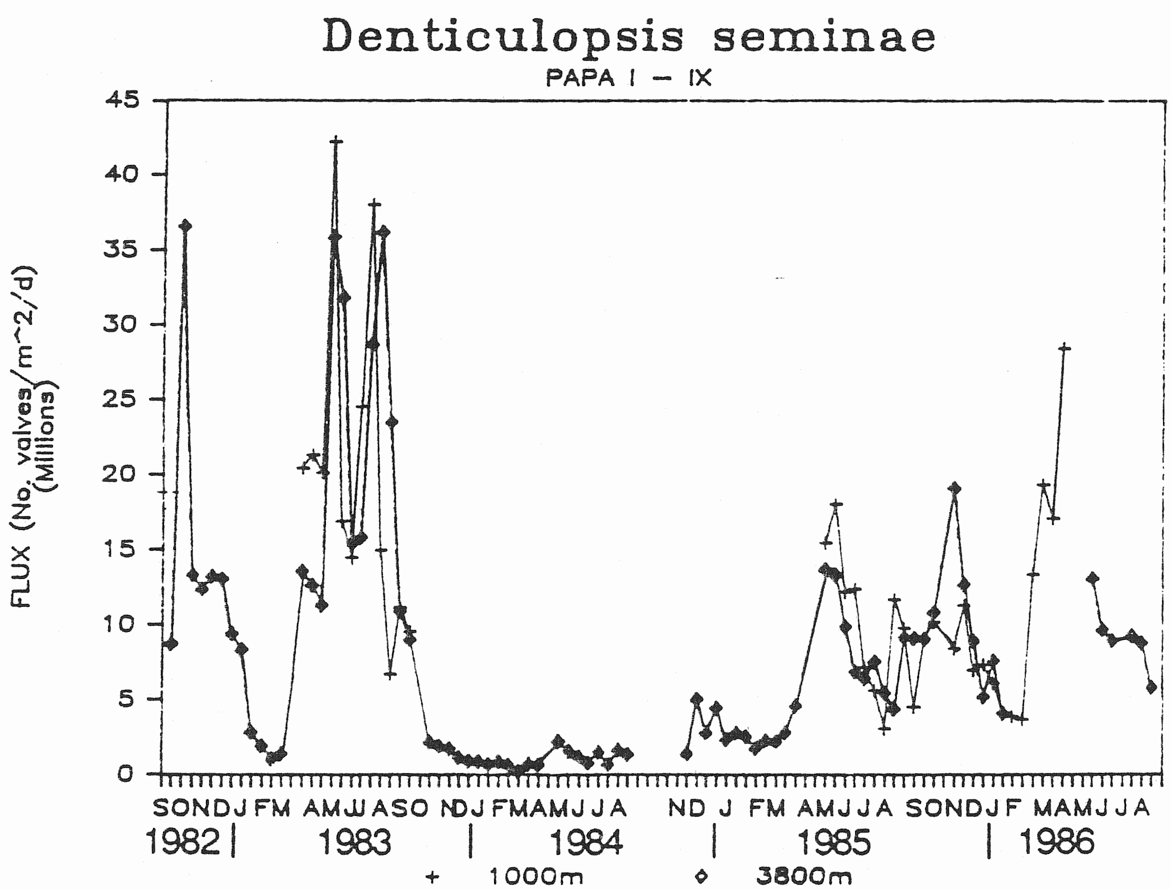

Fig. 1

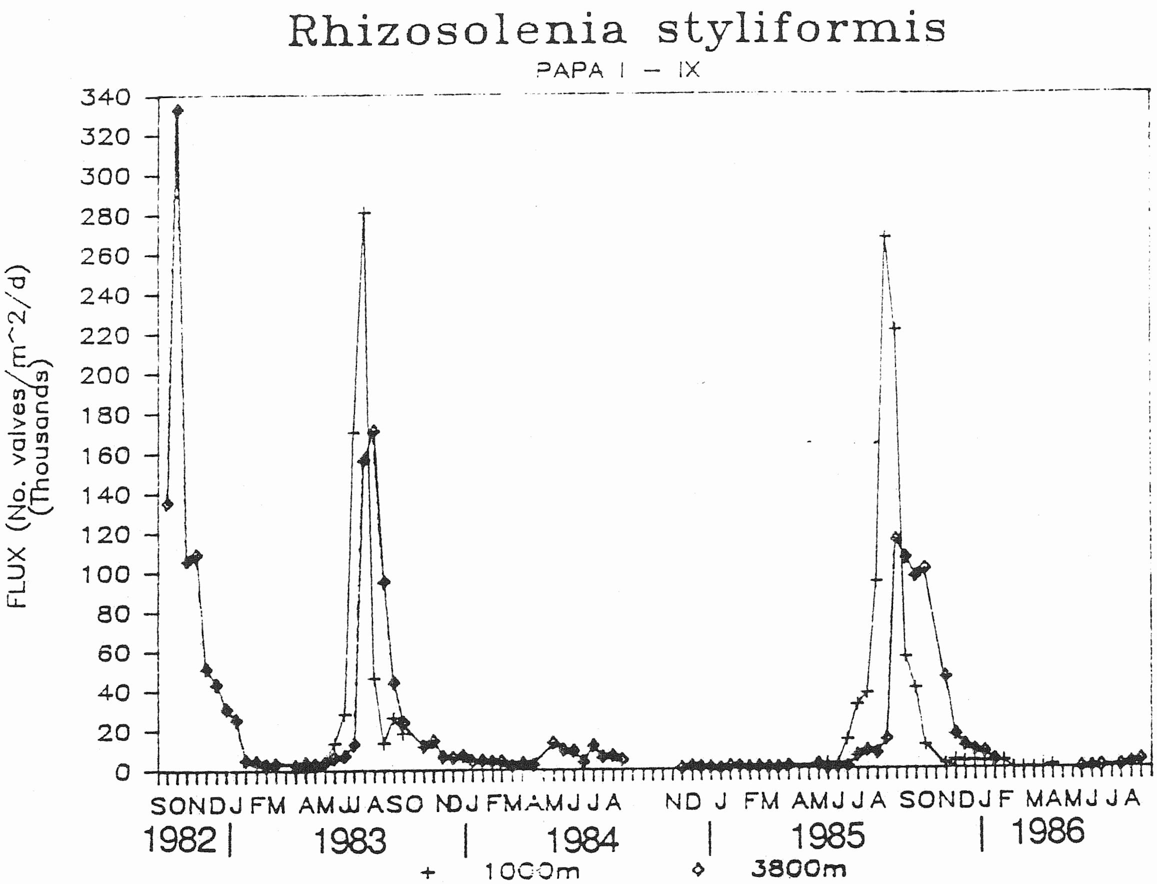
Rhizosolenia styliformis
PAPA I – IX
FLUX (No. valves/m^2/d) (Thousands)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
SONDJ FM AMJJASO NDJ FMAMJJA ND J FM AMJJA SONDJ F MAMJJA
1982
1983
1984
1985
1986
+ 1000m
◊ 3800m

Fig. 2

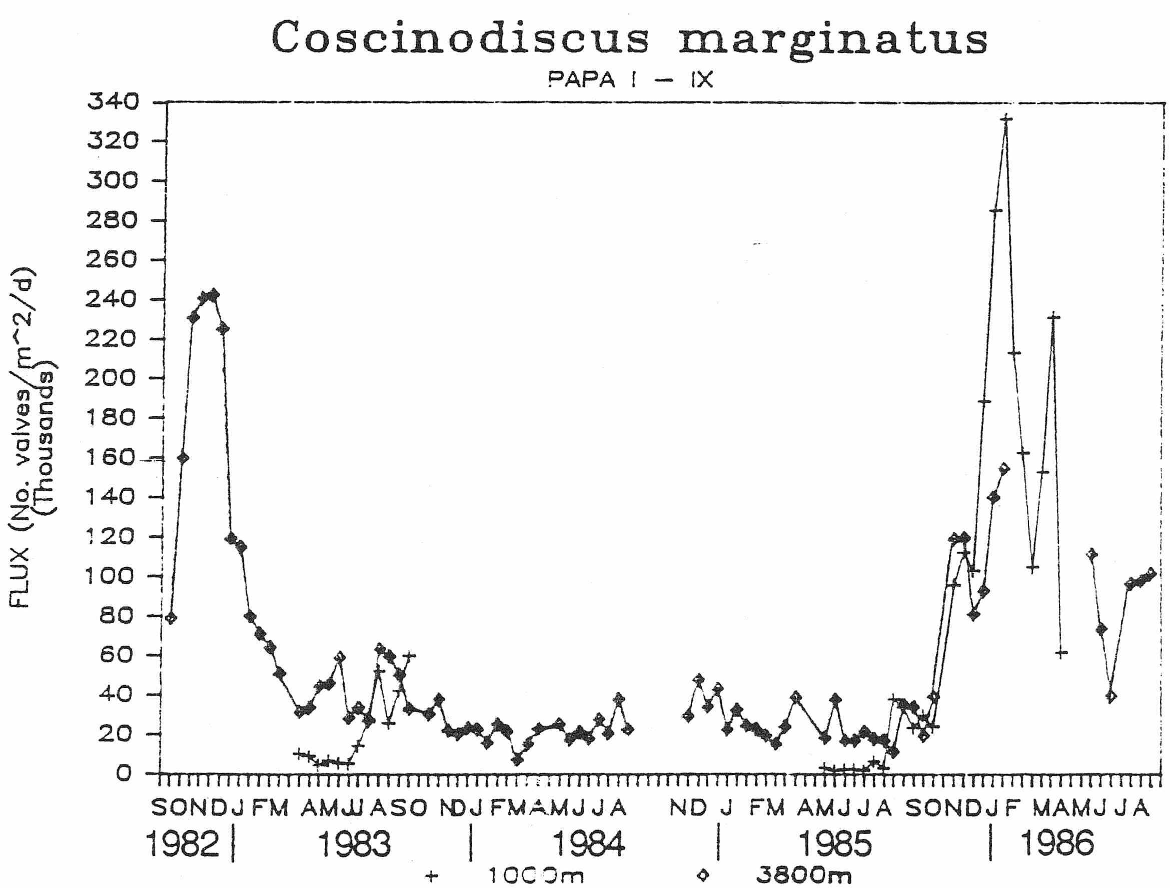
Coscinodiscus marginatus
PAPA I – IX
FLUX (No. valves/m^2/d) (Thousands)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
SONDJ FM AMJJASO NDJ FMAMJJA ND J FM AMJJA SONDJ F MAMJJA
1982
1983
1984
1985
1986
+ 1000m
◊ 3800m

Fig. 3