Spatial and temporal variations of particulate organic carbon in the Northwest Pacific

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Introduction

The Northwest (NW) Pacific Ocean is strongly influenced by ocean-atmosphere-land interactions, which may be linked with the North Pacific Gyre Oscillation (NPGO), El Niño/Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO), with implications for biogeochemical and carbon cycling. Here, we evaluate spatial and temporal variations of MODIS particulate organic carbon (POC) over the period of 2003-2016 in the NW Pacific. We also analyze the variations of sea surface temperature (SST) and chlorophyll (Chl), aimed at better understanding the driving mechanisms responsible for the variability of POC in the NW Pacific Ocean.

Spatial Variability

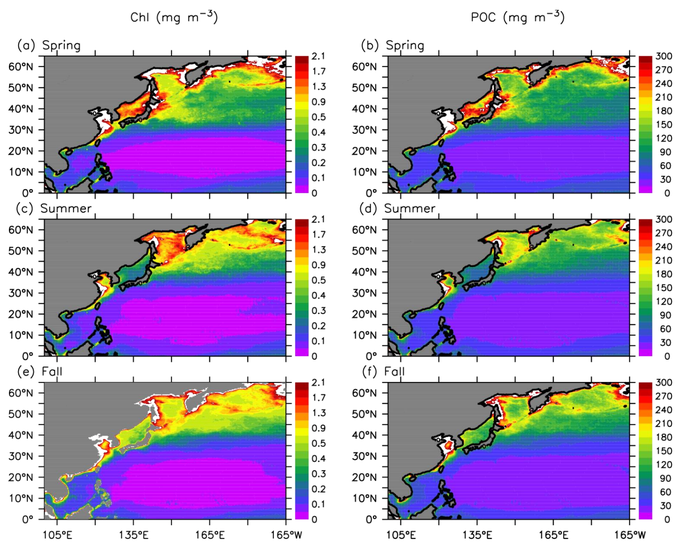

Fig 1. Climatology (2003-2016) of Chl (left) and POC (right) in spring, summer and fall.

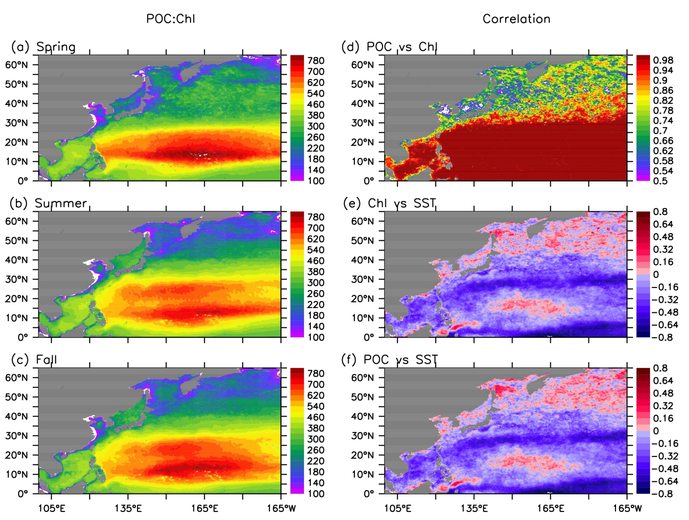

Fig 2. POC:Chl ratio in (a) Spring, (b) Summer and (c) Fall and correlations between (d) POC and Chl, (e) Chl and SST and (f) POC and SST over 2003-2016.

Interannual Variability

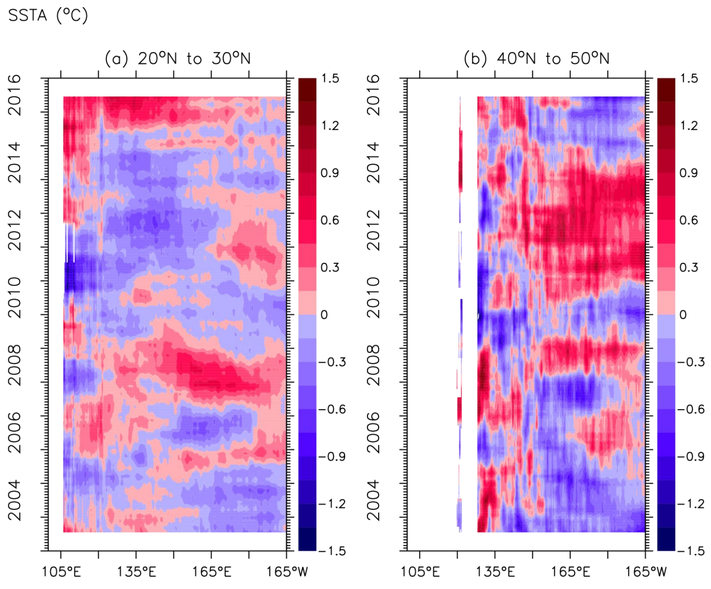

Fig 3. SST anomaly (SSTA) over 2003-2016. The period of 2011-2013 had colder SSTA west of 160°E over 20°N-30°N but warmer SSTA east of 140°E over 40°N-50°N.

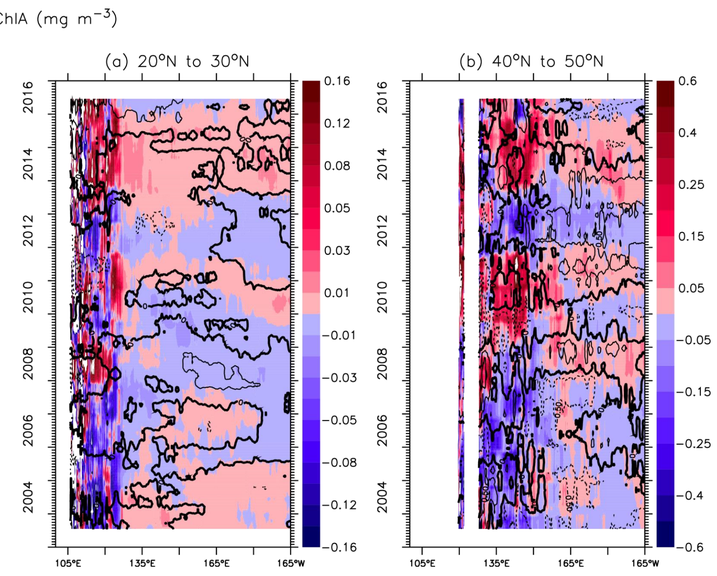

Fig 4. Chl anomaly (ChlA) over 2003-2016. Superimposed black solid (dash) lines denote the positive (negative) SSTA.

ChlA was positive around 2010 and since 2013/14, which was not related to SSTA.

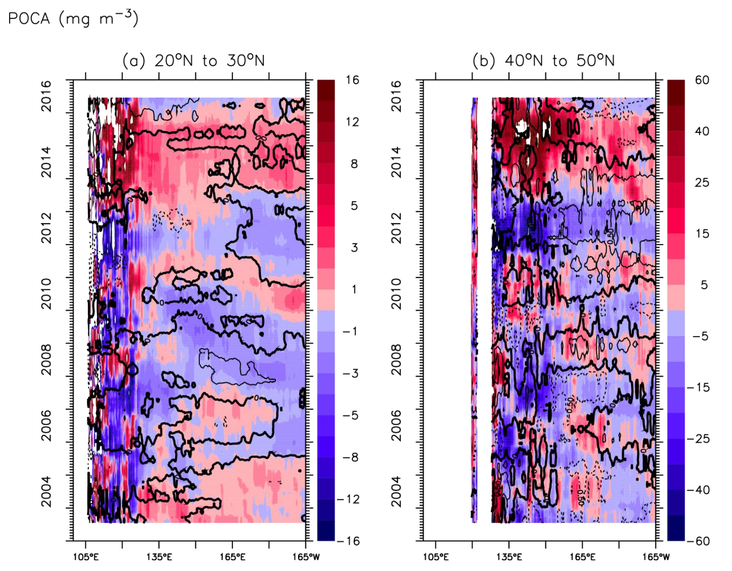

Fig 5. POC anomaly (POCA) over 2003-2016. Superimposed black solid (dash) lines denote the positive (negative) SSTA.

POCA was positive since 2014.

Relationships with climate modes

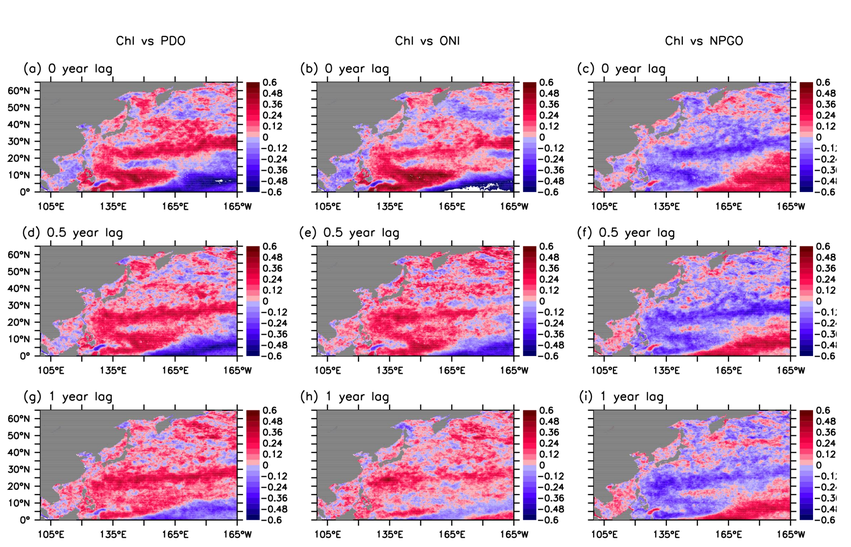

Fig 6. Correlation (r) of Chl with PDO, Oceanic Niño Index (ONI), and NPGO.

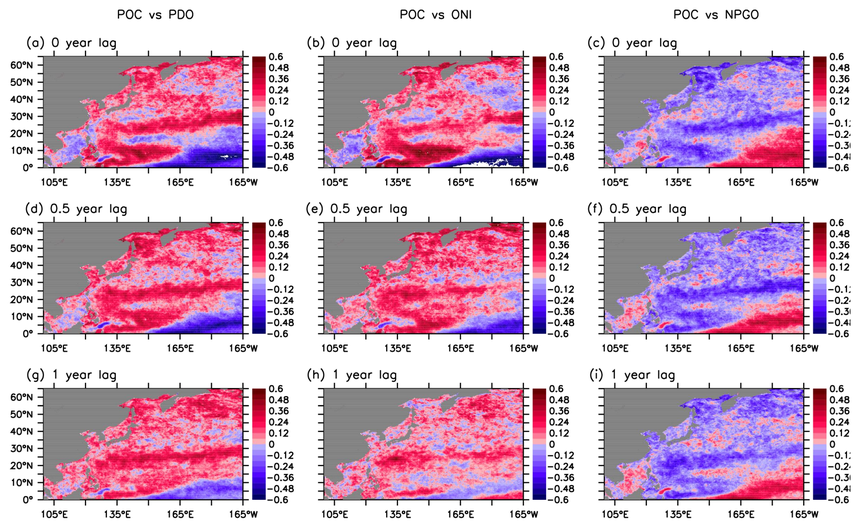

Fig 7. Correlation (r) of POC with PDO, Oceanic Niño Index (ONI), and NPGO.

Summary

- **POC and Chl showed a similar spatial distribution, and the two were highly correlated**
- **POC:Chl ratio was higher in the oligotrophic region (the NPG), indicating transportation of POC from higher productive region**
- **Overall, POC and Chl were negatively (positively) correlated with SST, south (north) of 40°N**
- **POC and Chl showed similar interannual variability, with significantly higher values over 2013-2016**
- **Both POC and Chl had a good correlatio with PDO, ENSO and NPGO**

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