A global database of size fractionated POC and PIC concentrations compared to satellite-based estimates

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Introduction

•The production and regeneration of particulate organic carbon (POC) and particulate inorganic carbon (PIC) exert control on the ocean's capacity for uptake and storage of atmospheric CO_2.

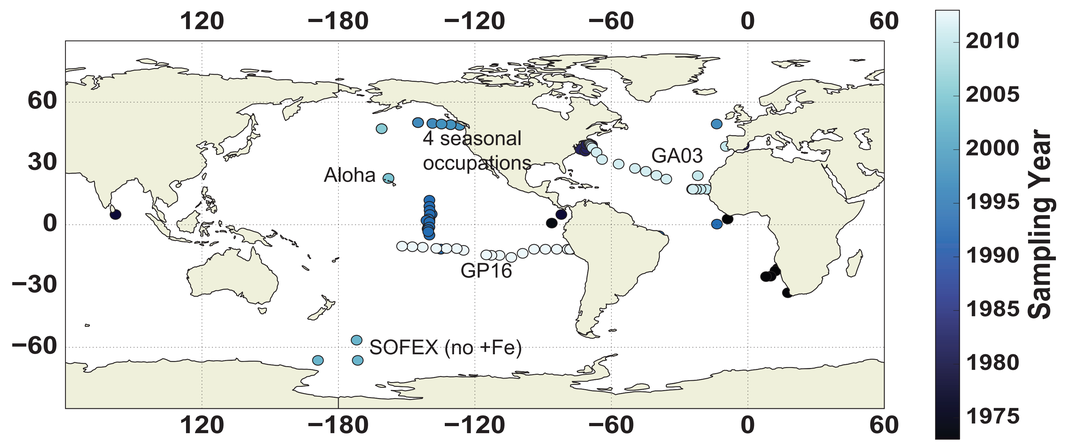
•Recent work (Pavia et al. 2019) has shown that ^{230}Th measurements on in-situ pumped particulate material can be used to deduce regeneration lengthscales of POC - application of this method to PIC dissolution requires knowledge of the particulate size fractionation of PIC relative to ^{230}Th and/or POC

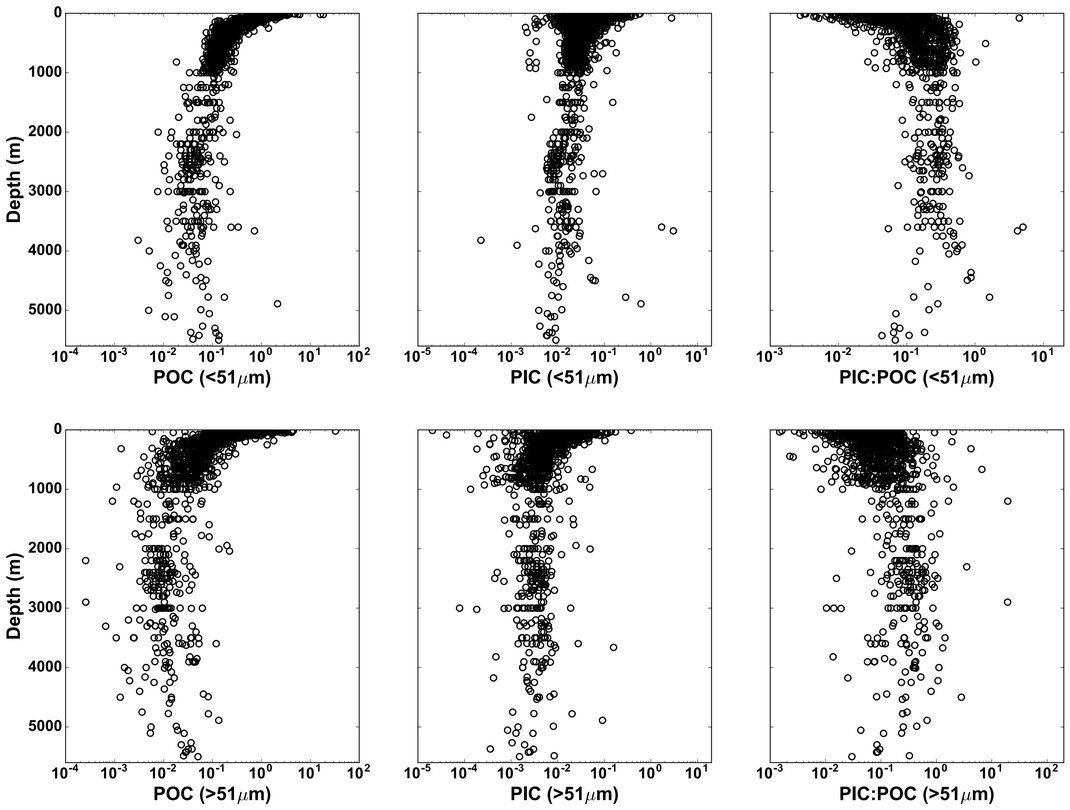
•Satellite-based estimates of surface PIC and POC are calibrated against measurements collected in bottles, which have been shown to differ from measurements collected by in-situ pumps.

•How do satellite estimates compare with surface PIC and POC from pumps?

The Dataset

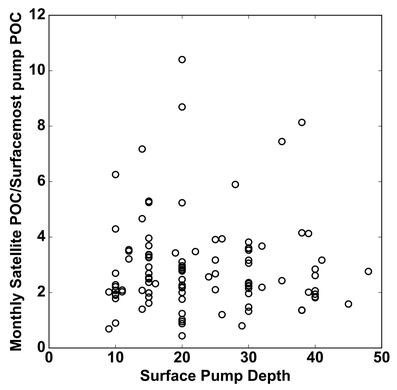
Over 100 stations with samples pumped over sequential >51µm and 0.8-51µm filters for size fractionated PIC and POC profiles





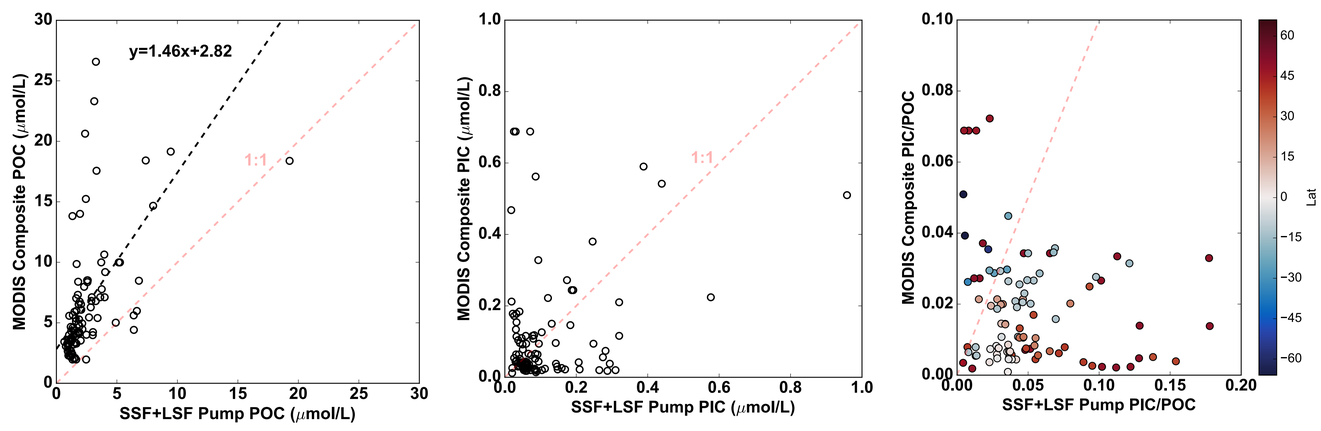
Comparison to Satellite Estimates

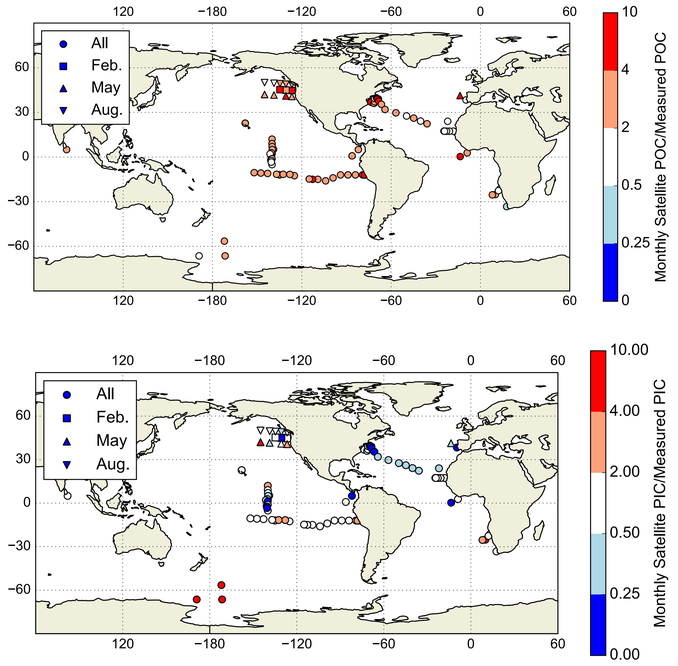
Surface-most PIC and POC measurements collected by in-situ filtration are compared to satellite fields of PIC and POC from MODIS-Aqua. Since many of the in-situ pump data predate satellite observations, they were compared with monthly satellite climatologies for consistency. Thus these plots should capture average seasonal variability, but not interannual variability.



No systematic bias as a function of shallowest observational depth

Satellites systematically overestimate surface pump POC.
Lots of scatter around 1:1 line in PIC but no apparent bias
Overestimation of POC generally leads to underestimation of PIC:POC





No apparent geographic pattern in satellite overestimation of POC. Magnitude of satellite/measured POC in NE Pac seems to be most pronounced in winter

More geographic patterns apparent in PIC. Subtropical N. Atl and Eq. Pac are underestimated, Southern Ocean and Summer N. Pac are overestimated

Thoughts and Future Work

•Satellite POC seems to be overestimating surface POC as measured by in-situ pumps - making PIC:POC export ratios estimated by satellite too low.

•Careful thought about sampling discrepancies between bottle and pump POC are needed - perhaps calibrations using pumped samples too?

•Can size classification from in-situ pumped samples be harnessed to inform next generation satellites (e.g. PACE) with particle size resolution to generate satellite fields of 0.8-51µm and >51µm PIC and POC?