Polonium-210 and Lead-210 as tracers of particle export and attenuation on the first EXPORTS cruise at Station PAPA

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The EXPORTS (EXport Processes in the Ocean from Remotely Sensed Imagery) Program focuses on linking remotely sensed properties to the processes that control the export of ocean primary production from surface waters to depth. Here we present preliminary results from the naturally-occurring radionuclide pair 210Po/210Pb as part of the first NASA supported EXPORTS cruise in the NE Pacific at Station PAPA (August-September 2018). 210Po and 210Pb have been used to quantify sinking particle fluxes and their attenuation below the euphotic zone at a seasonal scale. These estimates will be compared to other methods with shorter time scales, 234Th (weeks) and sediment traps (days), with the aim to provide a wider perspective into particle export and remineralization in the upper 500 m of the water column. Remarkable consistency between seawater profiles of 210Po and 234Th sampled over a period of three weeks suggests that the variability in the processes that lead to particle flux was relatively small over the summer. Particulate Carbon (PC) fluxes have been estimated using the PC/210Po ratio on size-fractionated particles collected using in-situ pumps. Overall, we show low PC export fluxes (< 5 mmol C m⁻² d⁻¹) at 100 m decreasing rapidly below the well-lit surface ocean.

**GOAL**

Provide quantitative estimates of sinking particle fluxes and attenuation with depth integrating a seasonal time scale (10² Po half-life = 138 days)

**TYPE OF SAMPLES**

- 3 seawater profiles
- Sized-fractionated (1-5, 5-51, >51 µm) particles (in situ pumps)
- Sinking particles (sediment traps)

**CONCLUSIONS**

- Similar export depth for 210Po and 234Th (surface to 75-125 m) where Po<Pb and Th<U
- Low 210Po fluxes were constant during 3 weeks
- The drop in 234Th flux on September 4th may indicate a recent decrease in particle export and increase in flux attenuation at this station
- 210Po fluxes derived from the water column were at least 3 times higher than those measured with both trap designs
  - Non-steady state & physical mixing not included in 210Po model
  - Does a single profile match particle source funnel for traps?
  - Loss of particles attached to zooplankton when picking swimmers?
  - Due to zooplankton diel vertical migration (particle removal in surface and release at depth)?
- Particulate Carbon (PC) flux at the base of the euphotic zone (110 m = 0.1% PAR) was 3 mmol C m⁻² d⁻¹ in good agreement with 234Th estimates (2.5 mmol C m⁻² d⁻¹)
- Rapid decrease in PC fluxes below the euphotic zone leading to fluxes < 1 mmol C m⁻² d⁻¹ at 500 m
- The attenuation of PC fluxes between 100 and 500 m was 82 ± 8%
- Future work: quantify PIC, PN and bSi fluxes and explore what we can learn from different methods

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