Monday, October 8
Oral Session 1
10:50–12:30

11:30–11:50

A SIMPLE SOLUTION TO THE OPEN-OCEAN "MISSING" BACKSCATTERING ENIGMA

The optical backscattering coefficient is the only tool that currently allows us to monitor and understand the open-ocean dynamics of marine microscopic particles with the required high-vertical and temporal resolutions. This is because backscattering can be measured from satellite and in-situ autonomous platforms (e.g., profiling floats). However, these observations are critically limited by an incomplete mechanistic understanding of what particles generate the backscattering signal. To achieve this understanding, optical models are employed. The simplest of these models – the homogeneous sphere – severely underestimates the measured backscattering and the missing signal has been attributed to sub-micron particles. This issue is known as the open-ocean "missing" backscattering enigma. Here, we show that a slightly more complex optical model – the coated sphere – can accurately predict the measured backscattering in the open ocean and provide a simple solution to the enigma. We parameterised and validated the coated-sphere model by using more than 150 coincident measurements of particle size distribution (0.59-60 µm) and optical backscattering collected across the Atlantic Ocean, through a variety of trophic regimes including mid-ocean gyres. In stark contrast to the homogeneous sphere, the coated-sphere model suggests that most of the backscattering comes from particles >1 µm. Additional size-fractionation experiments independently confirmed the smaller-than-expected contribution of sub-micron particles to the optical backscattering. Our results demonstrate that the structural complexity of particles is critical to move towards a complete understanding of the open-ocean backscattering. Only then, we will achieve the full potential of optical backscattering observations for investigating ocean biogeochemistry.

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