Motivation to look for N₂O gradients in the top 10 meters of the Peruvian upwelling

Coastal upwelling regions contribute substantially to oceanic N₂O emissions (Tingay et al., 2012; Naqvi et al., 2010).

E.g. off Peru, very high surface supersaturations indicate very high N₂O emissions.

High-resolution profiles of N₂O performed during Meteor cruise M91 in December 2012

4 high-resolution N₂O profiles in top 10 meters at different distance to the coast.

Shallow sampling away from ship’s influence

Shallow N₂O gradients exist. Strongest gradient observed on the shelf (bias of factor 1.5).

They correspond to shallow stratification, that was not completely eroded the night before.

Major fraction of Peruvian waters shows favourable conditions for N₂O gradient

High N₂O concentrations are associated with nighttime stratification

Higher N₂O concentrations are associated with stronger N₂O gradients

Conclusions

- Significant shallow N₂O gradients exist offshore Peru.
- Effect: Emission estimates are biased high.
- Suggested cause: Shallow stratification fails to be eroded for at least one night. Such condition is met in majority of Peruvian waters.
- Gradient seems strongest where expected impact on emission estimates is largest: at high N₂O concentrations near the coast.

Open questions

- More shallow profiles needed to verify assumed cause of N₂O gradients, quantify the bias on total emission estimates.
- How much do surfactants reduce outgassing in addition?
- How to measure N₂O underway at <1m and 12 kts?
- How do ultra-high N₂O profiles continue to the surface?

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References


This is an extended abstract and is not intended for publication.