Methane cycle model output

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Project
» Understanding the drivers and climate sensitivity of open ocean methane emissions to the atmosphere (Open Ocean Methane)

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Coverage

Spatial Extent: **Lat**:0 **Lon**:0

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Understanding the drivers and climate sensitivity of open ocean methane emissions to the atmosphere (Open Ocean Methane)

NSF Award Abstract:
Methane is a potent greenhouse gas with a global warming potential thirty times larger than carbon dioxide. In addition to human emissions methane has many natural sources to the atmosphere, which could be amplified by future climate warming. Methane emissions from the vast open ocean are relatively small but their sensitivity to climate change is highly uncertain. This is because the processes that supply methane to surface ocean waters are not well understood. To improve our understanding of the open ocean methane cycle, this project will use a computer model to interpret a large database of methane concentration measurements. First, the model will be used to determine the dominant biological source of methane within surface waters. Candidates include production during algae growth, production in the guts of small animals, and bacterial decay of organic matter. Each of these processes would produce a different surface methane pattern, allowing the model to distinguish between them. Second, the model will quantify the supply of methane from the seafloor in low oxygen zones of the ocean, and determine whether this methane is consumed by bacteria before escaping to the atmosphere. This is important because low oxygen zones will likely grow as the climate warms. Leakage of methane from these regions could therefore act as a feedback on climate change.

The global model developed in this project will simulate the open ocean sources and sinks of methane, including in situ aerobic methanogenesis in surface waters, diffusion from anoxic sediments, oxidation in the water column, and exchange with the atmosphere. Data will be assimilated to optimize model parameters, and ultimately determine the balance of sources and sinks that is most consistent with the observed ocean methane distribution. Aerobic methane production will be formulated as function of phytoplankton growth, zooplankton abundance, and organic matter recycling, to determine which mechanisms best explains the pattern of surface methane supersaturation. The oxygen dependence of sedimentary methane sources and bacterial methane oxidation will be optimized to best match the observed plumes that spread laterally from suboxic waters and upwell towards the surface. The resulting optimized model will then be used to predict future perturbation of the open ocean methane source in response to ecosystem changes and ocean oxygen loss.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2241744

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