

Carbon Exchange Dynamics in Coastal and Marine Ecosystems

Summary

Project Leader

Papakyriakou, Tim N.

This project's goal is to understand how climate change will affect the air-sea exchange of climatically relevant gases (carbon dioxide-CO₂, dimethylsulfide-DMS, and nitrous oxide-N₂O). Oceans exert considerable influence on climate through their role on the global cycling of climatic active gases. For example, the world's oceans are nature's largest sink for CO₂ and they globally account for a significant proportion of the natural emissions of the greenhouse gas nitrous oxide (N₂O), and the vast majority of dimethyl sulfide (DMS) production. DMS is the largest source of sulfate in the marine environment, and once in the atmosphere the compound can trigger the formation of aerosols that serve as cloud condensation nuclei. While greenhouse gases (CO₂ and N₂O) act to warm the atmosphere, the increased production of DMS may have a cooling effect on climate by increasing back-scattered solar radiation. Our understanding of the effect that a changing Arctic climate and sea ice regime will have on the air-sea (and sea ice) exchange of these trace gases is currently somewhere between partially understood and mostly unknown, and hence important feedbacks that involve sea ice and the cycles of climate-active gases are currently not represented in general circulation models. A requirement of this project is to parameterize those processes affecting the distribution of dissolved CO₂, N₂O, and DMS in surface waters of the Arctic, and their exchange with the atmosphere. Newly developed parameterizations are being implemented into a coupled atmosphere-sea ice-ocean biogeochemistry models to learn how the ocean's response (physical, biogeochemical and biological) to climate change and variability will affect the atmosphere-ocean cycling of these climate active gases within the Arctic, and in turn how these regional processes may affect the global budgets of these gases.

People

Network Investigators

Levasseur, Maurice - Québec-Océan

Miller, Lisa - Fisheries and Oceans Canada - Institute of Ocean Sciences

Papakyriakou, Tim N. - University of Manitoba

Steiner, Nadja - Fisheries and Oceans Canada - Institute of Ocean Sciences

Thomas, Helmuth - Dalhousie University

Collaborators & Research Associates

Barber, David G. - University of Manitoba

Ehn, Jens - University of Manitoba

Michaud, Sonia - Fisheries and Oceans Canada - Maurice Lamontagne Institute

Mundy, CJ (Christopher John) - Institut des sciences de la mer de Rimouski

Rysgaard, Soren - University of Manitoba

Sørensen, Lise Lotte - Aarhus University

Tremblay, Jean-Eric - Université Laval

Wang, Feiyue - University of Manitoba

Post-Doctoral Fellows

Else, Brent - University of Manitoba

Geilfus, Nicolas - University of Manitoba

PhD Students

Brown, Kristina - University of British Columbia
 Galindo, Virginie - Université Laval
 Gourdal, Margaux - Université Laval
 Irish, Victoria - University of British Columbia
 Mortenson, Eric - University of Victoria
 Mørk, Eva - Aarhus University
 Sievers, Jakob - Aarhus University

Masters Students

Burgers, Tonya - University of Manitoba
 Mol, Jacoba - Dalhousie University
 Stammers, Chris - Centre for Earth Observation Science (CEOS)
 Zhang, Rui - Centre for Earth Observation Science (CEOS)

Technical Staff

Davelaar, Marty - Fisheries and Oceans Canada - Institute of Ocean Sciences
 Hodge, Alex - Sitka Scientific
 Lemes, Marcos - University of Manitoba
 Lizotte, Martine - Université Laval
 Luque, Sebastian - Memorial University of Newfoundland
 Simpson, Kyle - Fisheries and Oceans Canada - Institute of Ocean Sciences

Project Staff

Wiley, Emmelia - University of Manitoba

Partners

Aarhus University
 Aboriginal Affairs and Northern Development Canada - Northern Scientific Training Program
 Canada Excellence Research Chairs
 Circumpolar Flaw Lead (CFL) System Study
 Dalhousie University
 Environment Canada - Canadian Centre for Climate Modelling and Analysis
 Fisheries and Oceans Canada - Institute of Ocean Sciences
 Fisheries and Oceans Canada - Pacific Region
 German Research Foundation
 Greenland Institute of Natural Resources
 IPY Federal Program Office
 Université Laval
 Université Libre de Bruxelles
 University of Manitoba
 University of Victoria

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