Tunngasugit to the Arctic SOLAS Program

National Contact
Maurice Levasseur
maurice.levasseur@bio.ulaval.ca

poster by Martine Lizotte & Maurice Levasseur

The PARTNERS

Environment Canada / Environnement Canada
Indian and Northern Affairs Canada / Affaires Indiennes et du Nord Canada
Fisheries and Oceans Canada / Pêches et Océans Canada

Exploring the Creature - Climate Link

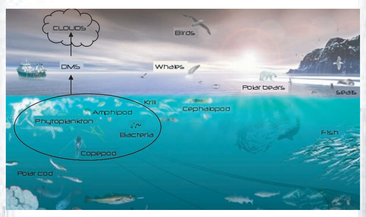
Life on Earth depends on climate
but
Climate may also depend on life on Earth...

What is SOLAS ?

Surface
Ocean
Lower
Atmosphere
Study

Did You Know?

Marginal ice-zones in the Arctic, teaming with marine life, not only represent excellent hot-spots for fishing and mammal hunting for the northern communities but are also associated with high levels of dimethylsulfide (DMS).



Picture adapted from the Norwegian Polar Institute website (http://www.arcticsystem.no)

What is DMS?

DMS is a gas produced by plankton living in the sea. When it ventilates in the atmosphere it participates in cloud formation. Clouds reflect solar radiation thereby COOLING the Earth. This is called the "Parasol Effect"

www.dreamstime.com/vericoloured-umbrela-on-the-snow-thumb8690058

Smell that?

Did you know that DMS is often called the "perfume of the sea"? People commonly associate the characteristic smell of the sea with salt water but, in fact, it is the organisms living in the sea that produce it through DMS.

They do!

Because of its odorous properties, DMS may also act as a homing scent for birds looking to feast on plankton in the sea

http://www.sciencedaily.com/releases/2008/03/080306202513.htm

More Creature-Climate Links

Phytolankton living in the Arctic Ocean not only supply food for fish, mammals and humans alike...
They also remove CO_2 from the atmosphere and transform it into organic matter.

Bacteria living in the Arctic Ocean play a key role in the production of Nitrous Oxide (N_2O).
CO_2 and N_2O are both greenhouse gases that warm the Climate.

No laughing matter...
N_2O is commonly known as the "happy gas" or "laughing gas" used in surgery and dentistry for its anesthetic and analgesic effect.

BUT...
In the natural environment, on top of being a greenhouse gas, N_2O is also involved in the depletion of ozone, a "UV Screen", for the earth.

Arctic-SOLAS scientific activities

RATIONALE

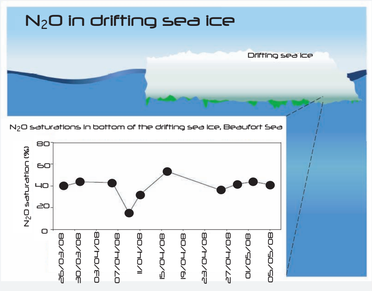
One of the most striking impacts of global warming in the Arctic is the reduction of the annual ice cover, a process which could profoundly alter the structure and dynamic of the pelagic ecosystem and the related production and sea-air flux of climate-active gases such as CO_2, DMS, and nitrous oxide (N_2O).

OBJECTIVE

To determine how variability in sea-ice and water masses in the Arctic influences the ocean-ice-atmosphere exchanges of climate-active gases and particles and the chemical and radiative properties of the Arctic atmosphere.

FOCUS on Science

N_2O in drifting sea ice



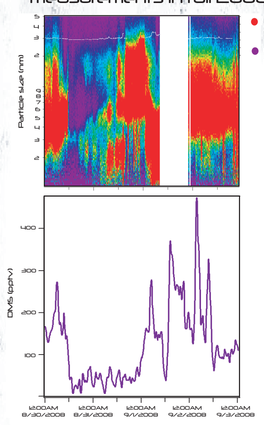
Graphic prepared by K. Randell (U. Laval)

Measuring nitrous oxide (N_2O) in the bottom drifting sea ice in spring 2008.

During springtime, the sea ice could act as a sink for atmospheric N_2O.

PIs: M. Levasseur (U. Laval), M. Scarratt (DFO-IML), H. Xie & M. Gosselin (UQAR-ISMER).

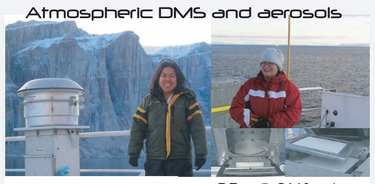
Coupled trace gas & fine particle measurements in fall 2008



PIs: J. Abbatt (U. of Toronto), R. Leaitch (Env. Can.) S. Sjostedt & R. Cheng (U. of Toronto)

Capturing high levels of small particles in association with elevated atmospheric concentrations of DMS using PTR-MS in the Canadian Arctic in fall 2008.

Atmospheric DMS and aerosols



O. Rempillo & M. Seguin (U. of Calgary)

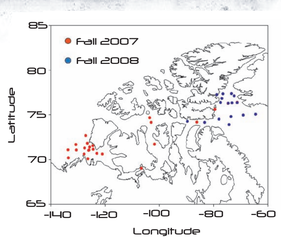
Ship's path in fall 2007 & 2008

Measuring aerosols (high volume samplers & cascade impactors), and atmospheric DMS (Tenax coupled with sulfur chemiluminescent detection).
GOAL: to assess how atmospheric DMS is related to sea-ice conditions and how much fine aerosol sulfate is formed from DMS oxidation in the Arctic.

PI: A.-L. Norman (U. of Calgary)

(Photos: A.-L. Norman/U. of Calgary)

SPOTLIGHT on the study REGION



Graphic prepared by M. Scarratt (DFO-IML)

The VESSEL

(Photo: Martin Fortier/ArcticNet)

Scientific HIGHLIGHTS

Newly formed sea ice, frost flowers, and the CCGS Amundsen in the Amundsen Gulf on December 6, 2007.

Work in the Arctic during autumn freeze-up has confirmed that CO_2 is even more dynamic in very fresh ice than had previously been found in older ice.

PIs: L. Miller (DFO-IOS), T. Papakyriakou (U. of Manitoba)

(Photo: N. Sutherland/DFO-IOS)

J. Matard-Côté (U. Laval)

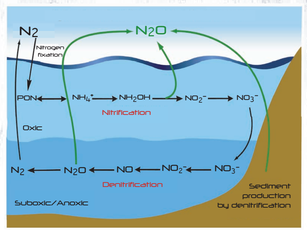
Conducting on-deck incubations to measure the bacterial metabolic rates of DMSP using radio-labelled ^{35}S-DMSP in September 2008.

Distinct water masses in the Eastern Canadian Arctic are characterized by diverse bacterial assemblages that metabolize DMSP differently.

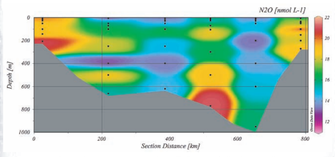
PIs: M. Levasseur, J.-É. Tremblay & C. Lovejoy (U. Laval), M. Scarratt (DFO-IML), R. Rivkin (Memorial U.), M. Gosselin (UQAR-ISMER), Y. Gratton (INRS-ETE),

(Photo: Martin Fortier/ArcticNet)

N_2O production by nitrification and denitrification in oceans



Graphic prepared by K. Randell (U. Laval)



Graphic prepared by C. Lagné (U. Laval)

Measurements of the vertical distribution of N_2O along a SOLAS transect in Northern Baffin Bay reveal distinctive profiles.

PIs: M. Levasseur & J.-É. Tremblay (U. Laval), M. Scarratt (DFO-IML), R. Rivkin (Memorial U.), Y. Gratton (INRS-ETE)