# NOAA and University Scientists Study Methyl Bromide and Methyl Chloride Cycling in the Southern Ocean

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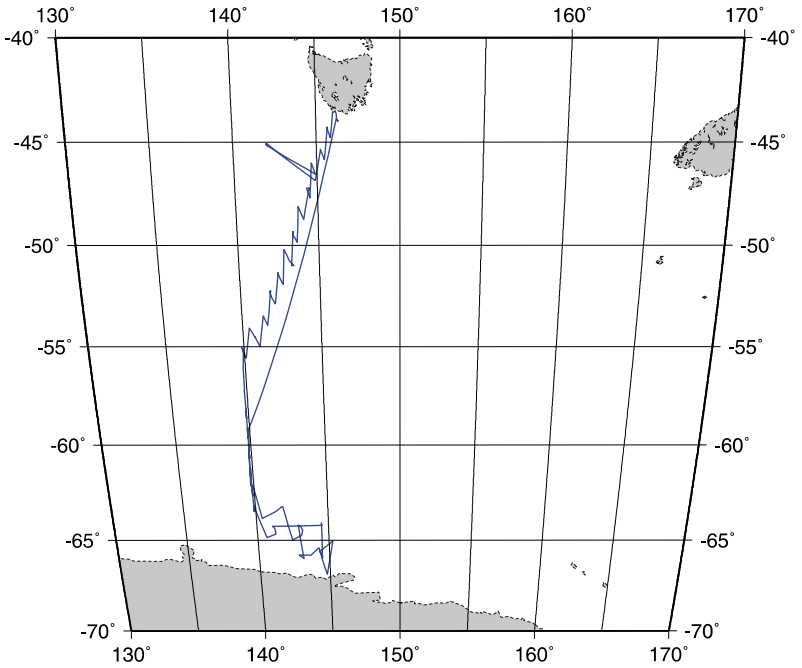
As part of a study supported by both NASA and NOAA, scientists from two NOAA laboratories and the university of California Irvine participated in a research cruise aboard the Australian icebreaker *Aurora Australis*. The ship departed Hobart, Tasmania, Australia on 28 October 2001 and returned on 13 December 2001. The objective of this research effort was to obtain reliable measurements of the uptake of methyl bromide, methyl chloride and other climatically important halocarbons in the Southern Ocean.

Atmospheric methyl bromide ($CH_3Br$), which is of both natural and anthropogenic origin, has been identified as a Class I ozone-depleting substance in the amended and adjusted Montreal Protocol on Substances that Deplete Stratospheric Ozone. Methyl chloride ($CH_3Cl$) is the most abundant halocarbon in the atmosphere and is a naturally occurring compound. The role of the ocean in regulating the atmospheric burdens of these gases is still somewhat uncertain. Methyl bromide and methyl chloride are both produced and destroyed in the ocean through chemical and biological processes. Degradation has been shown to occur at rates that are faster than can be explained by known chemical degradation reactions, and evidence suggests that this additional degradation is bacterial consumption of these compounds. The organisms or reactions that can produce $CH_3Br$ and $CH_3Cl$ at rates sufficient to explain observed concentrations are not known. Recent measurements have shown that, on the whole, the ocean is a net sink for $CH_3Br$ and low latitude regions are a net source of $CH_3Cl$ while the high latitude ocean is a net sink for $CH_3Cl$. Measurement coverage to date has been limited and sporadic, which restricts our ability to map the spatial and temporal variations that are necessary for understanding how the system will respond to perturbations (e.g. Global Warming).

The measurements made during this cruise are designed to help improve our understanding of the role that the oceans play in the cycling of $CH_3Br$ and $CH_3Cl$. Measurements were made of the concentrations of $CH_3Br$, $CH_3Cl$ and a suite of natural and anthropogenic halocarbons in the air and surface water, degradation rates of $CH_3Br$ and $CH_3Cl$ in the surface water, and depth profiles of $CH_3Br$, $CH_3Cl$ and other halocarbons. The combined results from these measurements will be used to constrain the budgets of $CH_3Br$ and $CH_3Cl$ in these waters at this time of year. The relative importance of the biological and chemical processes will be examined for high latitudes. Attempts will also be made to extract relationships between the degradation rates and concentrations measured and satellite measurements in order to develop proxies that can provide global coverage on shorter time scales. At this time, there is insufficient data to examine seasonal and long-term trends in net flux, production, or degradation. Until satellite measurable proxies can be found, additional research cruises are needed to reduce the uncertainty in the global net flux estimate and to map the spatial and temporal variations in the net fluxes, production rates, and degradation rates of $CH_3Br$, $CH_3Cl$ and other climatically important halocarbons.

Deploying CTD/rosette in Buchanan Bay near the Mertz Glacier Tongue, Antarctia.




*Aurora Australis* cruise track departing Hobart on 28 October 2001 and returning on 13 December 2001.