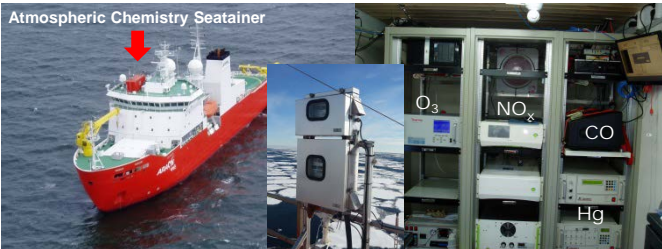


Atmospheric Mercury Speciation and Air-Sea Mercury Flux in the Marine Boundary Layer during the SHIPPO Cruise in 2012



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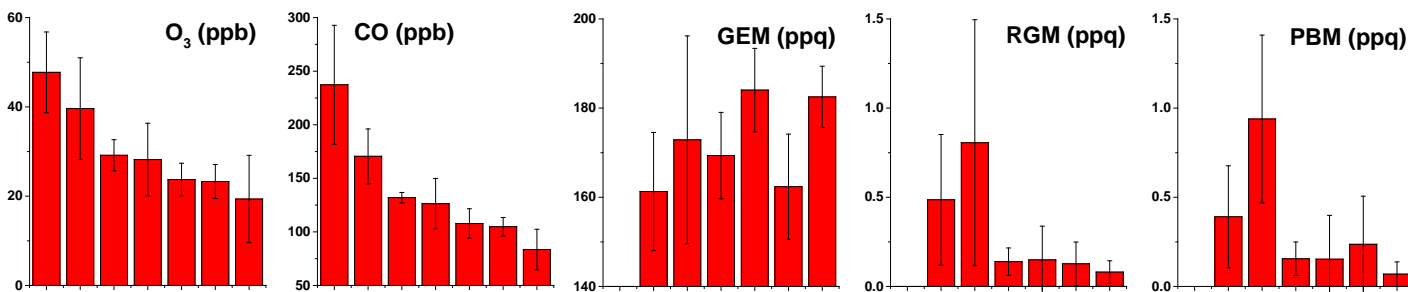
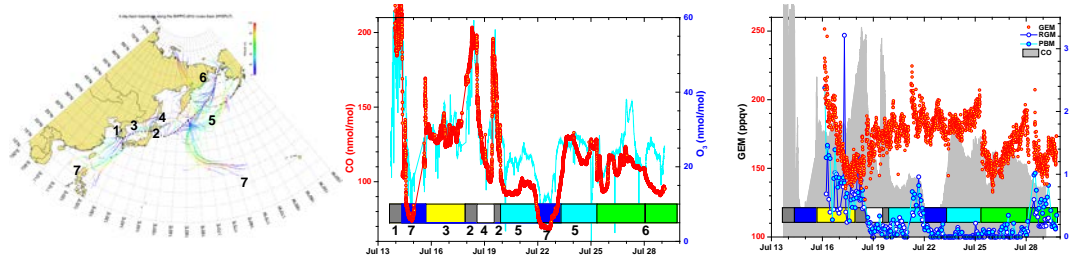
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SHIP-borne Pole-to-Pole Observations

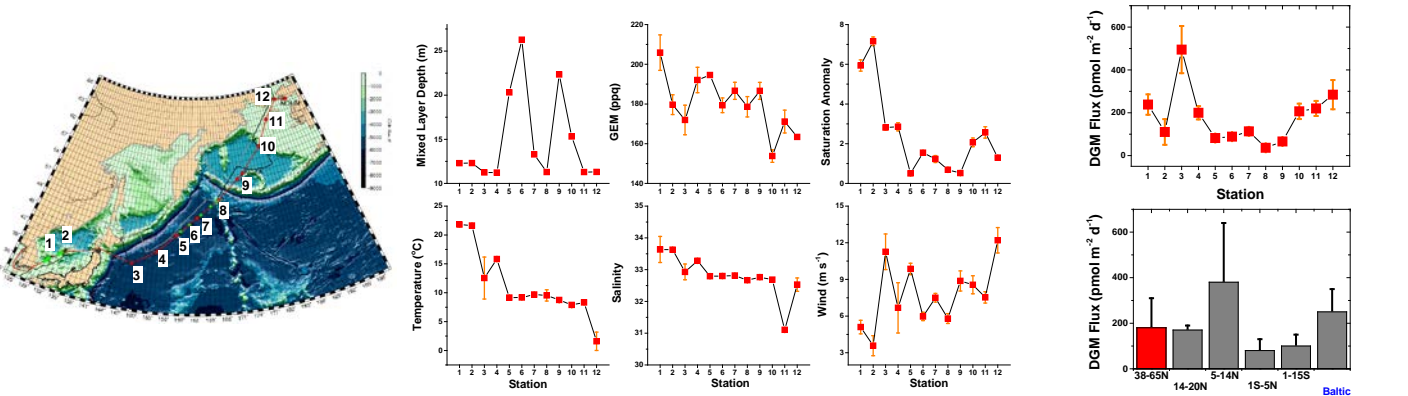
To identify the impact of photochemistry in the marine boundary layer on atmospheric oxidation capacity and climate change and to investigate fluxes of climate-change-inducing substances across the interface of the atmosphere and ocean, we launched the first SHIPPO campaign along the northern route of R/V Araon from Incheon, Korea, to Nome in Alaska, U.S.A., in July 2012 for two weeks.

Atmospheric Variability of GEM, RGM, and PBM



Based on 5-day backward trajectories, CO, and O₃, the air masses encountered during the SHIPPO campaign were divided into 7 groups: air masses 1 for local pollution, 2 biomass burning, 3 the East Sea, 4 western Okhotsk Sea, 5 North Pacific, 6 East Siberia and the Arctic, and 7 Southern hemisphere. Polluted air masses 1 & 2 show high concentration of CO and O₃. Then, their contents tend to gradually decrease with increase of latitude. Atmospheric Hg shows peculiar trend such that gaseous elemental Hg (GEM) was low around the Tsugaru Strait and the Bering Sea while highest reactive gaseous Hg (RGM) and particle bounded Hg (PBM) were observed. The concentration of GEM during the cruise from Busan to Nome, ranged 120 – 320 ppq with mean of ~170 ppq. The ranges of RGM and PBM, on the contrary, were 0 – 4.6 ppq and 0 – 1.2 ppq with an average of ~0.2 ppq and ~0.18 ppq, respectively. Fairly constant level of RGM is an indicative of minor photochemical production though some diurnal variation of GEM has been revealed during the campaign. The concentration of all the three different species tended to decrease as she sailed far from the coast likely due to having less influence by the mercury loaded continental air. The concentration of GEM gradually increased when the air mass coming from the East Asian continent and Japanese Islands.

Sea-to-Air Flux of DGM



To estimated air-sea flux, dissolved gaseous mercury (DGM) in seawater was measured onboard immediately after sampling at hydrographic stations. Together with physical properties of seawater and meteorological parameters obtained in situ, we determined the degree of saturation and the flux of elemental mercury (Hg⁰). The East Sea was ~7.5 times supersaturated with respect to the ambient air above while the N. Pacific and the Bering sea were lower values of 0.5 – 3 with fairly unchanged in saturation. Because of relatively high wind in the N. Pacific and the Bering Sea, the flux densities are seemingly constant at ~ 180 pmol m⁻² d⁻¹ which is comparable to the tropical N. Pacific in 2011 (Soerensen et al, 2014, EST).