

Temporal Variation of Total Gaseous Mercury around the Korean Antarctic Station, King Sejong, in King George Island

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Abstract

The concentrations of total gaseous mercury (TGM) were monitored in the ambient air of the Korean Antarctic base, King Sejong (KSG) ($62^{\circ}13'S$ $58^{\circ}47'W$) (Fig. 1) from March 2009 to August 2011 at a time-resolution of one hour using an automated analyzer with the atomic absorption spectroscopic technique. Maximum concentration of 9.1 ng m^{-3} has been detected due likely to the pollution from the station. The mean value of TGM during the whole period of observation is $0.8(\pm 0.5) \text{ ng m}^{-3}$ which is within the range of mean values obtained in the Antarctic Stations. TGM shows seasonal variation of high concentration in summer and low concentration in late winter.

Method

- A mercury analyzer (AM-3, Nippon Instrument Co.) driven by atomic absorption spectroscopic technique was installed in the observatory at the base. The air inlet was mounted on the roof ~4 m above sea level. Air was withdrawn through the inlet by a blower at 200 L/min. A tubing is connected to the side of the inlet to draw the air to the Hg analyzer at 1 L/min. TGM is collected on a gold trap for 55 minutes and released by heating gold cartridge at 600°C , which was guided to an atomic absorption detector at which Hg cold vapor was detected at 253 nm. Air sample was analyzed every hour under unmanned condition. Blank run was conducted on a daily basis and calibration of the instrument was made on a weekly basis (Fig. 2).
- TGM concentration was determined using a grand calibration curve obtained from the entire calibration runs for a given period after subtracting the blank peak from sample peaks (Fig. 3).

Results

- Up to 9.1 ng m^{-3} of large concentration of TGM and high frequency of TGM variation were observed at KSG, which indicate local emissions not only from KSG but also from other bases in King George Island.
- Seasonal variation is visible in the observation (Fig. 3) despite large scatter. TGM was high in summer and low in winter (Fig. 4). A similar seasonality has been observed at Cape Point (Brunke et al., 2010, ACP) in South Africa suggesting synoptic phenomenon occurring in the northern part of the Antarctic peninsula.
- ~95% of the data bins less than 1.5 ng m^{-3} with maximum frequency at 1 ng m^{-3} (Fig. 5).
- Overall mean value during the observation period is $0.83(\pm 0.51) \text{ ng m}^{-3}$ which is in the range of the TGM observed at the Antarctic bases (Fig. 6). This suggest King George Island maintains the background TGM concentration in spite of dense Antarctic stations.



Fig. 1

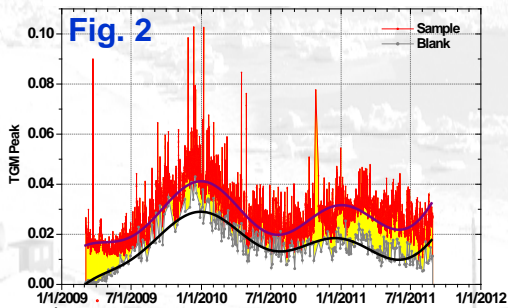


Fig. 2

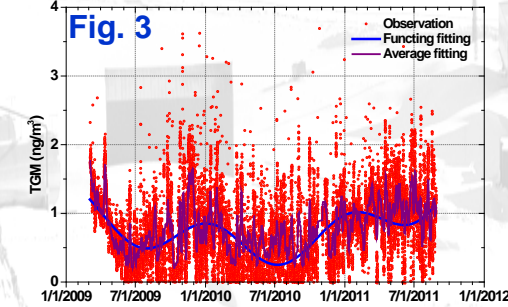


Fig. 3

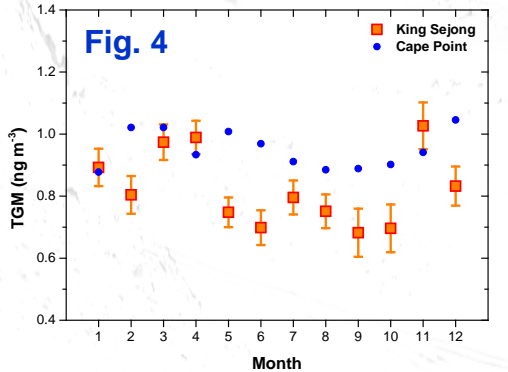


Fig. 4

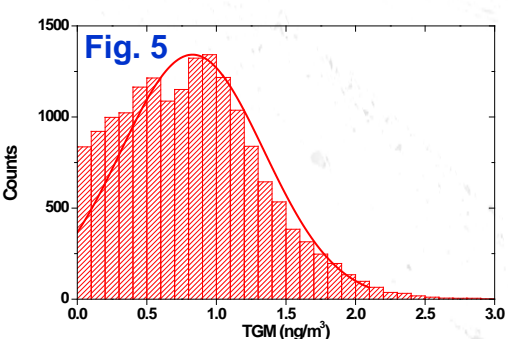


Fig. 5

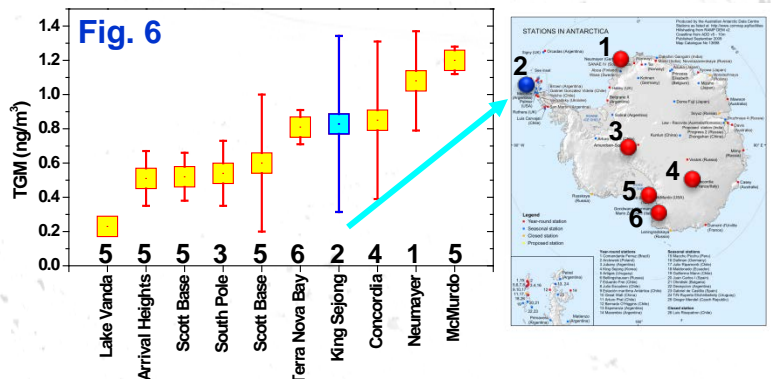


Fig. 6