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気象庁における南鳥島 C-130H 輸送機による温室効果ガスの観測
JMA aircraft observation for greenhouse gases using a cargo aircraft C-130H to Minami-torishima

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Japan Meteorological Agency (JMA) started a long-term aircraft observation of greenhouse gases as one of the operational atmospheric monitoring activities in 2011. In cooperation with the Ministry of Defense, a cargo aircraft C-130H is used for the flask sampling observation during a roundtrip flight to Minamitorishima (MNM) once a month. The air samples are collected during a cruising flight at about 6 km as well as a descending to MNM. After the flight, we measure 4 trace gas concentrations of carbon dioxide (CO2), methane (CH4), carbon monoxide (CO), and nitrous oxide (N2O). Before the regular observations, preliminary observation flights using the C-130H were made in 2010 to evaluate a new flask sampling equipment and a high-precision measuring system with the collaboration of Meteorological Research Institute (MRI). In this presentation, the details of newly developed instrumentations for JMA aircraft observation and their performances are introduced.

Air samples are pressurized into the flasks by a manual diaphragm pump to an absolute pressure of about 0.4MPa. To minimize the drifts of trace gas concentrations in the flasks, we specially prepared a 1.7-L titanium flask of which internal surface is coated by silica. The storage tests for the flask samples during several days were repeated to ensure the stability of trace gases until analyses. To avoid the contamination of cabin air, sample air was taken from an air-conditioning blowing nozzle upstream of the recirculation fan. Specially coordinated flights at a low altitude of 1000ft over MNM were made using the C-130H to compare with the ground-based measurements from the MNM monitoring system operated by JMA. From these comparison experiments, it was confirmed that our aircraft sampling procedure was suitable for the precise measurements of trace gases.

JMA/MRI developed a new automated measuring system consisting of a conventional NDIR analyzer (Licor, LI-7000) for CO2 as well as recently advanced spectroscopy instruments of WS-CRDS analyzer (Picarro, G2301) for CH4, VURF analyzer (Aero-Laser, AL5002-AIR) for CO, and off-axis ICOS analyzer (Los Gatos, N2O/CO Analyzer) for N2O. A lot of test runs using standard gases and natural air indicated that higher-precision analyses could be easily achieved rather than before, in stead of the complicated GC systems, although relatively larger amount of sample air is required.

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