# Emission factors and isotopic characteristics of $N_2O$ from diesel heavy-duty vehicles

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Nitrous oxide ($N_2O$) is an approximately 300 times stronger greenhouse gas than carbon dioxide and a major ozone-depleting gas in the stratosphere. Automobiles are one of the anthropogenic sources of $N_2O$ because it is produced from nitrogen oxides (NOx) by side reactions in exhaust gas aftertreatment systems [1,2]. Strict NOx regulations may therefore lead to increased $N_2O$ emissions. In this study, we aimed at quantifying $N_2O$ emissions from diesel heavy-duty vehicles (HDVs) compliant with the latest regulation in Japan and identifying the $N_2O$ production processes on the basis of isotopocule ratios.

Exhaust gas from the vehicles were collected using a chassis dynamometer and a constant volume sampler. Emissions of NOx and $N_2O$ per distance traveled or engine work were calculated using their concentrations measured with an infrared gas analyzer. Additional gas samples were collected in 1L stainless steel canisters and measured for $N_2O$ isotopocule ratios using a GC-IRMS system.

While NOx emissions were significantly reduced in HDVs that comply with the latest regulations of 2016, $N_2O$ emissions were clearly increased. This suggests that the SCR control system, which aims to reduce NOx emissions to obey stricter regulations, may promote $N_2O$ production. The $\delta^{15}N^{bulk}$ of $N_2O$ in HDVs averaged -4.7‰ (n=6) for urea-SCR vehicles and -17.9‰ (n=4) for hydrocarbon (HC)-SCR vehicles. The $N_2O$ from urea SCR systems is thought to be mainly produced from $NH_3$ on the oxidation catalyst at the final stage of the SCR [3]. The difference in $\delta^{15}N^{bulk}$ between urea-SCR and HC-SCR suggests different origin of $NH_3$. More detailed results will be shown in the presentation.

References

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