GHGs Emissions from vehicles in Seoul megacity, South Korea:

Molar ratios (N_2O:CO_2, CH_4:CO_2) and stable isotopic composition of N_2O ($\delta^{15}N$, $\delta^{18}O$)

JeongEun Kim[a], Jinho Ahn[a,b], Sambit Ghosh[a,*]

[a]*School of Earth and Environmental Sciences, Seoul National University, Seoul 08826, South Korea*
[b]*Center for Cryospheric Sciences, Seoul National University, Siheung 15011, South Korea*
**Now at Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK, USA*

CONTENTS

01. Introduction

Transportation
is one of the largest contributors to anthropogenic greenhouse gas emissions, especially in megacities around the world.

02. Sampling and Measuring

Sampled from Tunnel and SNU

Entry and **exit point** of Tunnel in Seoul (Sang Do Tunnel & Bong Chun Tunnel)

GHGs concentration

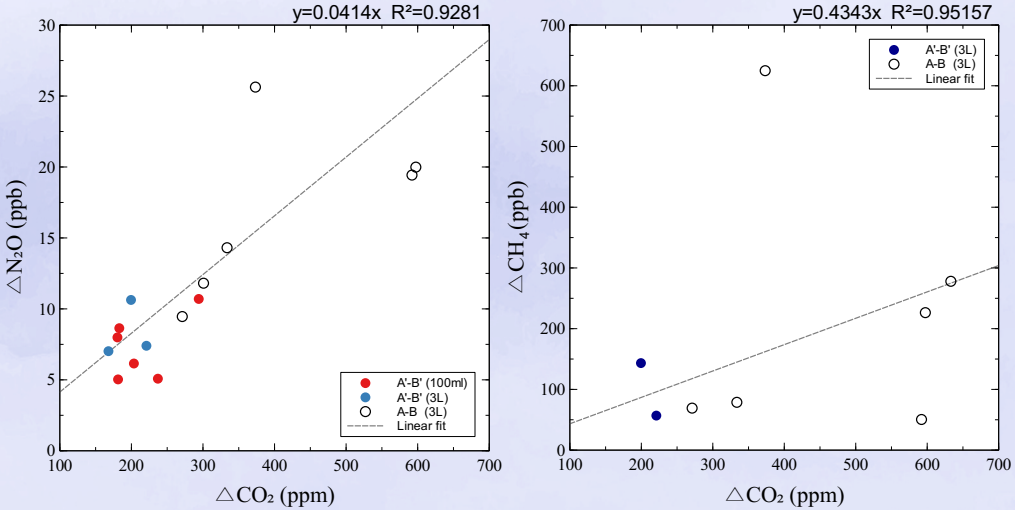
Gas chromatograph
Estimate molar ratio

Stable isotope

IRMS
Calculate by mass balance equation

03. Vehicle Emission molar ratio

N_2O:CO_2, CH_4:CO_2 emission molar ratio



$(4.0 \pm 0.4) \times 10^{-5}$

N_2O:CO_2 - Within a range (1.8-18.7) from previously reported

$(50.5 \pm 0.4) \times 10^{-5}$

CH_4:CO_2 - Significantly greater than Switzerland and USA

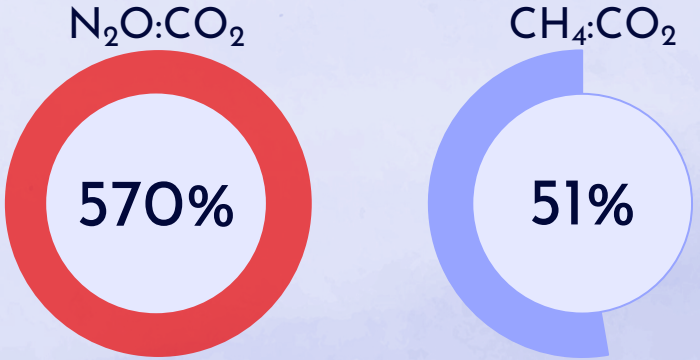
- N_2O:CO_2 – Nitrous oxide is produced as an intermediate during the catalytic reaction of NOx.
- CH_4:CO_2 – From Bus and Taxi fueled by CNG or LPG gas (containing methane mainly)

04. Estimate Vehicle GHGs emissions

In inventory, N_2O was underestimated and CH_4 was overestimated

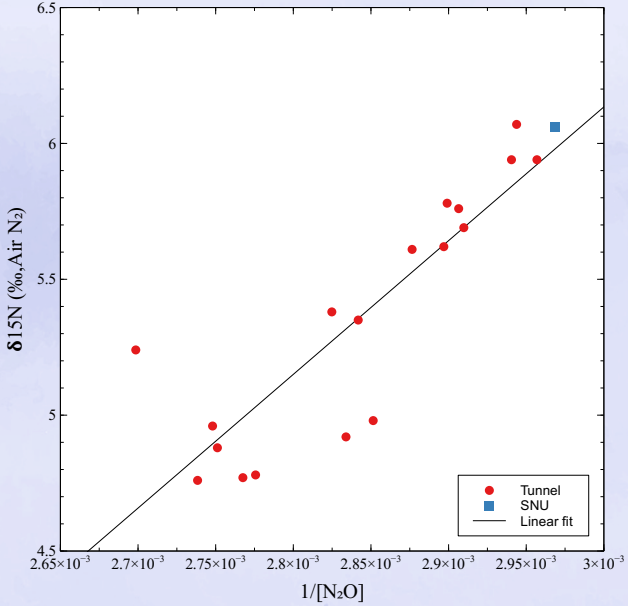
	N_2O:CO_2	CH_4:CO_2	Year
GHGs inventory	0.7	98.2	2019
This study	4.0	50.5	2021

*GHGs emission from inventory calculated by 'emission factor' from IPCC report(1996)

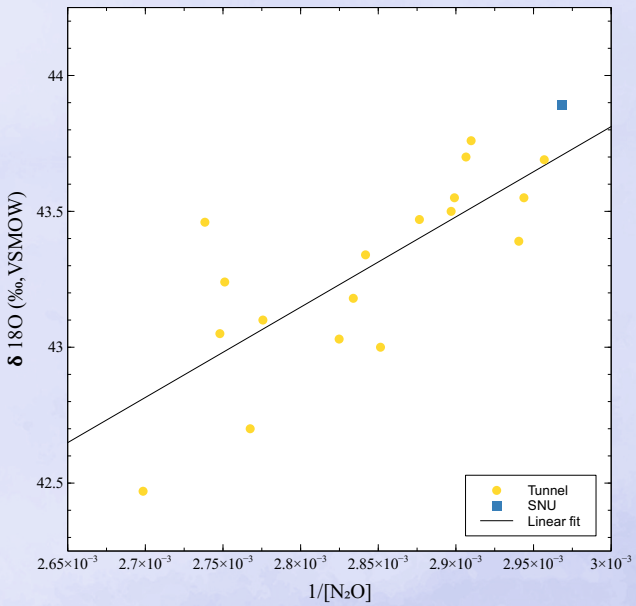


05. N_2O Stable isotopic composition

$\delta^{15}N$_vehicle: -7.1 ± 1.5‰



$\delta^{18}O$_vehicle : 41.2 ± 0.2 ‰



$\delta^{15}N$_N_2O emitted from vehicle is depleted from tropospheric N_2O

06. Conclusion

1. To reduce GHGs emissions, understanding the strength of its sinks and sources is very important.

2. Vehicle emission can calculate by the emission molar ratio from the tunnel air and the **emission factor used to calculate emission in the inventory need to be rediscussed.**

3. **We characterized the N_2O stable isotopic composition** emitted from the vehicles in Seoul (-7.1 ± 1.5 ‰ and 41.2 ± 0.2 ‰ for $\delta^{15}N$, $\delta^{18}O$).

4. N_2O stable isotopic composition also supports the idea that **N_2O is produced through the catalytic converter in the tailpipe.**