

インドネシア・ジャカルタ大都市圏周辺における温室効果ガス・大気汚染物質の総合観測プロジェクト

Comprehensive monitoring project of greenhouse gases and air pollutants around Jakarta megacity in Indonesia

*西橋 政秀¹、向井 人史¹、寺尾 有希夫¹、橋本 茂¹、Rizaldi Boer²、Muhammad Ardiansyah²、Bregas Budianto²、Gito Sugih Immanuel²、Adi Rakhman²、Rudi Nugroho³、Nawa Suwedi³、Agus Rifai³、Iif Miftahul Ihsan³、Anies Marufatin³、Albert Sulaiman³、Dodo Gunawan⁴、Eka Suharguniyawan⁴、Asep Firman Ilahi⁴、Muharam Syam Nugraha⁴、Ronald Christian Wattimena⁴、Bayu Feriaji⁴、Thomas Lauvaux⁵、小田 知宏⁶

*Masahide Nishihashi¹、Hitoshi Mukai¹、Yukio Terao¹、Shigeru Hashimoto¹、Rizaldi Boer²、Muhammad Ardiansyah²、Bregas Budianto²、Gito Sugih Immanuel²、Adi Rakhman²、Rudi Nugroho³、Nawa Suwedi³、Agus Rifai³、Iif Miftahul Ihsan³、Anies Marufatin³、Albert Sulaiman³、Dodo Gunawan⁴、Eka Suharguniyawan⁴、Asep Firman Ilahi⁴、Muharam Syam Nugraha⁴、Ronald Christian Wattimena⁴、Bayu Feriaji⁴、Thomas Lauvaux⁵、Tomohiro Oda⁶

1. 国立環境研究所、2. ボゴール農科大学、3. インドネシア技術評価応用庁、4. インドネシア気象気候地球物理庁、5. LSCE、6. USRA/NASA

1. National Institute for Environmental Studies, 2. Bogor Agricultural University (IPB), Indonesia, 3. Agency for the Assessment and Application of Technology (BPPT), Indonesia, 4. Meteorological, Climatological, and Geophysical Agency (BMKG), Indonesia, 5. Laboratory for Sciences of Climate and Environment (LSCE), France, 6. Universities Space Research Association/NASA Goddard Space Flight Center, USA

The emission increases of greenhouse gases (GHGs) and air pollutants in megacities have been recognized as one of the important issues as a concern for health and climate change. Jakarta, the capital city of Indonesia, including suburban cities (Bogor, Depok, Tangerang, and Bekasi; locally known as “Jabodetabek”), has a population of 32 million people and has been listed as the second largest megacity in the world and the largest megacity in Southeast Asia. Several air quality monitoring campaigns were conducted in Jakarta. However, previous studies lacked continuous high-accuracy monitoring stations due to the limitations of environmental monitoring budgets and experts. We present here a new interdisciplinary project to expand our current understanding of the interactions between emissions, air quality, and regional/global climates.

To estimate the amount of anthropogenic emissions from Jakarta megacity and compare with city activities, we developed a ground-based comprehensive monitoring system of GHGs and air pollutants controlled remotely in addition to automated start-and-stop operations during power failures. Monitoring systems were installed at Bogor (center of Bogor city), Serpong (Jakarta suburb), and Cibereum (mountainous area) in 2016–2017. Each monitoring system consists of system control/data acquisition units controlling multiple instruments and collecting continuously and continuous monitoring instruments of CO₂, CH₄, CO, NO_x, SO₂, O₃, aerosol concentrations (PM_{2.5}, PM₁₀, BC) and the chemical components (NO₃⁻, SO₄²⁻) of PM_{2.5} and PM₁₀, and meteorological parameters. Flask sampling of air is also performed automatically once a week to analyze N₂O, SF₆, and carbon isotopes (¹³C, ¹⁴C) in CO₂ in NIES and to validate the continuous measurement data of CO₂, CH₄, and CO.

The results show that the daytime values of CO₂, three hours averages from 12 to 15 local time, at Bogor and Serpong are 6.8 and 7.1 ppm higher than Cibereum, respectively. These features are also presented in the other species, i.e., CO, NO_x, SO₂, PM_{2.5}, PM_{10-2.5}, and BC. Moreover, we found 5–10 ppm lower

values of CO₂ during daytime at Bogor and Serpong in December and January, mid-rainy season in Jakarta, compared with the other months and frequent and extremely high CH₄ enhancements during nighttime (i.e., 3 to 5 ppm) at Serpong.

We present here the temporal variability observed at three monitoring sites and some preliminary results based on high-resolution CO₂ simulations using Weather Research and Forecasting model coupled to Chemistry (WRF-Chem).

キーワード：温室効果ガス、大気汚染物質、都市観測、インドネシア

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