GOSAT-2 science plan and recent progress in sensor development for CO_2 monitoring over mega-cities from space

*Ryoichi Imasu¹, Tsuneo Matsunaga², Tatsuya Yokota²

1. Atmosphere and Ocean Research Institute, The University of Tokyo, 2. National Institute for Environmental Studies

Greenhouse gases Observing Satellite (GOSAT) was launched on January 23, 2009, and it has provided worldwide scientists with high quality observational data for more than 7 years. The primary purpose of the mission is to reduce the posterior error in inversion analysis of CO₂ source/sink strengths by about 50% in some sub-continental scales (several thousand kilometers square). As have already showed by previous studies (e.g., Takagi et al., 2011), the original purpose has been accomplished on a project basis. Based on these successful results, its successor, GOSAT-2 has been designed and developed to be launched in FY2018. At the same time, the science team of the project started discussion on its scientific objectives to be summarized as "Science Plan". Most important obligation for the project to the scientific community is the continuity of the observational data connecting from GOSAT project with the same or, hopefully better quality. The improvement of signal-to-noise ratio (SNR) of TANSO-2 Fourier transform spectrometer/GOSAT-2 ensures the continuity, and furthermore observable regions could be expanded toward higher latitudes and the region size of inversion analyses is expected to be able to be smaller. Its scientific objectives can be classified into four categories for CO₂; 1) fusion of bottom-up and top-down approaches in budget analyses, 2)up grading of prediction performances of land-ecosystem models and coupling to the inversion models, 3) improvement of detectability of hotspots, and 4) contribution to REDD+ by providing the relevant community with desired data. As for CH₄, 1)detection of changes in emissions from wetlands attributing to global warming, 2)watching the gas leaks from pipelines, 3)monitoring the emission from agricultural sources, and 4)investigations on the long-term trend of increasing rate of atmospheric concentration. Recently, satellite sensors of which instantaneous field of view (IFOV) is narrow enough to resolve emission sources in mega-cities have been developed (e.g., CLAIRE/GHGsat). However, their calibration accuracies are not necessarily better than preexisting sensors. One possible way to apply these sensors to monitor small emissions with useful accuracy is combining the sensors with well calibrated sensors such as GOSAT-2 on radiance or higher product level basis. In this point of view, GOSAT-2 sensors are expected to keep the highest performance of accuracy.

Keywords: GOSAT-2, science plan, mega-city