Geophysical Research Abstracts,
Vol. 11, EGU2009-10148-1, 2009
EGU General Assembly 2009

Feasibility study for Geo-Stationary satellite observation of tropospheric pollutants

K. Sagi (1,2), P. Baron (2), E. Dupuy (2), K. Suzuki (3), K. Kita (1), R. Imasu (4), and Y. Kasai (2)

(1) Ibaraki, Mito, Japan (08nm318a@mcs.ibaraki.ac.jp), (2) National Institute of Information and Communications Technology (NICT), Tokyo, Japan, (3) Tokyo Gakugei University, Tokyo, Japan, (4) Center for Climate System Research University of Tokyo, Tokyo, Japan

Geostationary Earth Orbit (GEO) satellites are useful to monitor variations and transport of tropospheric pollutants because of the achievable time resolution (1-2 hour) and horizontal resolution, and because they can perform day and night observations. The Japan Society of Atmospheric Chemistry (JSAC) and the Japanese Space Exploration Agency (JAXA) initiated concept studies for a geostationary satellite to observe pollutant species in Asia1). Instruments operating in three distinct spectral domains: ultraviolet/visible (UV/VIS), thermal infrared (TIR), and microwave are considered for this project. We present the sensitivity studies for a TIR instrument.
The necessary trade-off between the signal-to-noise ratio (SNR) and the frequency resolution is a key factor in the definition of the instrumental design. The purpose of this study is to determine the instrumental frequency resolution needed to optimize the trade-off between the sensor parameters (SNR) and the scientific requirements of the project (“Detection of ozone variations in the boundary layer, and tropospheric CO measurements). The scientific requirements in terms of minimum precision (or error) values are 10% for ozone in the boundary layer and 20% for CO tropospheric column.
The forward calculation and the retrieval simulations, including a complete error analysis, were performed using the AMATERAS model developed within the NICT-THz remote sensing project2). Retrieval calculation and error analysis are based on the optimal estimation method2). Two scenarii are used for the simulation: an Asian background case and a city polluted case.
O3 can be retrieved in the boundary layer with a maximum error of 14% for a frequency resolution = 0.2 cm-1and an instrumental SNR = 600, in the Asian background case.
TIR is not the optimal frequency domain for observing tropospheric CO with good sensitivity, but is adequate to measure the altitude abundance profile and the day and night variations of CO at 2000 cm-1. The frequency resolution used must be better than 0.2 cm-1 (SNR = 40) or 0.1 cm-1 (SNR = 20) in polluted conditions, in order to achieve an error level of less than 20%.

1) http://www.stelab.nagoya-u.ac.jp/ste-www1/div1/taikiken/eisei/eisei2.pdf
Japanese version only. English version will be available in March 2009.
2) Baron, P., Mendrok, J., Kasai, Y., Ochiai, S., Seta, T., Sagi, K., Suzuki, K., Sagawa, H., and Urban, J., “AMATERASU: Model for Atmospheric TeraHertz Radiation Analysis and Simulation”, Journal of the National Institute of Information and Communications Technology, 55, 109–121 (2008).