Geophysical Research Abstracts
Vol. 13, EGU2011-10768, 2011
EGU General Assembly 2011

Performance analyses of future space-borne infrared instruments to monitor air quality

Pasquale Sellitto (1), Pierre Dauphin (1), Gaëlle Dufour (1), Maxim Eremenko (1), Jean-Marie Flaud (1), and Vincent-Henri Peuch (2)

(1) Laboratoire Inter-universitaire des Systèmes Atmosphériques (LISA), UMR7583, Universités Paris-Est et Paris Diderot, CNRS, Créteil, France (pasquale.sellitto@lisa.u-pec.fr), (2) Météo-France, Centre National de Recherches Météorologiques, Toulouse, France

Air quality (AQ) monitoring from space is a topical task in modern geosciences. Presently, different thermal infrared (TIR) sensors flying at low earth orbit (LEO) have demonstrated their capabilities in detecting relevant trace gases concentration, e.g. the ozone, with a good sensitivity in the lower troposphere [1]. Despite these encouraging results, LEO instruments are not well adapted to monitor small scale and short term phenomena, owing to their unsatisfactory revisit time. From this point of view, a more satisfactory concept might be based on geostationary (GEO) platforms. Unfortunately, current GEO missions are mainly tailored on meteorological parameters retrieval and do not have sufficient spectral resolutions and signal to noise ratios (SNR) to infer information on trace gases in the lowermost troposphere.

In this work we compare different satellite TIR sensors to trace out some guidelines for the design of future missions dedicated to AQ monitoring and to evaluate the impact of different instrumental characteristics on modeling and forecast of AQ. Pseudo-observations for different seasons have been generated by means of a dedicated simulator, whose core is the KOPRA radiative transfer code (http://www-imk.fzk.de/asf/ame/publications/kopra_docu/). Simulations with a chemistry and transport model have been used as the target state of the atmosphere. Different configurations have been considered, including existing instruments, e.g. the IASI, future planned missions, e.g. the IASI-NG and the MTG-IRS, and finally some parameters have been varied to define new instrument adapted for AQ. Then ozone profiles and partial columns have been derived from the pseudo-observations by means of the KOPRAFIT retrieval module, embedding an altitude-dependent Tikhonov-Phillips regularization algorithm [2]. The role of the different technical specifications have been explored by considering the concurrent role of parameters like the spectral resolution and the SNR in the tropospheric ozone retrieval accuracy and vertical resolution in terms of the number of DOFs. Both ozone concentration profiles retrievals, spanning from the troposphere to the stratosphere, and 0-12 km and 0-6 km ozone partial columns have been analyzed. A statistical characterization of the comparison between different configurations has been performed and the results are here critically discussed.

REFERENCES:

[1] Dufour, G., Eremenko, M., Orphal, J., and Flaud, J.-M.: IASI observations of seasonal and day-to-day variations of tropospheric ozone over three highly populated areas of China: Beijing, Shanghai, and Hong Kong, Atmospheric Chemistry and Physics, 10, 3787-3801, doi:10.5194/acp-10-3787-2010, 2010.

[2] Kulawik, S. S., Osterman, G., Jones, D. B. A., and Bowman K. V.: Calculation of altitude-dependent Tikhonov constraints for TES nadir retrievals, IEEE Transactions on Geosciences and Remote Sensing, 44(5), 1334-1342, doi:10.1109/TGRS.2006.871206, 2006.