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Observing system simulation experiments to evaluate the expected added-value of a new generation IASI satellite instrument for lower tropospheric ozone analyses and forecasts

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Tropospheric ozone can adversely impact human health, climate and the ecosystem. Monitoring and legislation are implemented to regulate its concentrations. Air quality (AQ) monitoring from space starts to be regarded as a useful tool to complement with in situ measurements and regional chemical transport models (rCTM) to draw a more comprehensive picture of pollution processes. Important progresses in the field of tropospheric ozone sounding from space have been accomplished during the last decade, especially with thermal infrared (TIR) space-borne instruments. It is now possible to observe tropospheric ozone concentrations from space with a reasonable accuracy. However, limitations remain with the current observation systems in particular to observe ozone in the lowermost troposphere. IASI-NG, that will be part of the EPS-SG (EUMETSAT Polar System-Second Generation) programme, is expected to improve the observation capabilities of AQ in terms of ozone in the lower troposphere.

Observing system simulation experiments (OSSEs) are powerful tools to quantify the added-value of future missions. An OSSE is composed of different elements: (1) one reference atmosphere, usually given by model simulations (the Nature Run); (2) an optimized observation simulator, providing the pseudo-observations; (3) an independent description of the atmosphere (the Control Run); (4) an assimilation system, providing the Assimilation Run. We conduct relative OSSEs, aimed at comparing the contribution of one possible configuration of IASI-NG (IASI-NG/IRS2) and the present IASI instrument, used as a baseline. The spectral resolution and the radiometric noise in the ozone spectral region, for IASI-NG/IRS2, are twice better than for IASI. IASI-NG/IRS2 pseudo-observations are processed using a comprehensive simulator based on the radiative transfer model KOPRA and the KOPRAFIT inversion module. The Nature Run is given by the CTM MOCAGE model, the Control Run is produced with the CHIMERE CTM, and the assimilation system is based on a Local Ensemble Kalman Filter. The objective is to assess the potential improvement bring by IASI-NG compared to IASI to constrain model simulations. The gain of these new observations to improve ozone analysis (and forecast) are quantified especially in the planetary boundary layer for the European domain.