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Potential of the multispectral synergism for observing ozone pollution combining measurements of IASI-NG and UVNS onboard EPS-SG

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Current and future satellite observations offer a great potential for monitoring air quality on daily and global basis. However, measurements from currently in orbit sensors offer a limited capacity to probe surface concentrations of gaseous pollutants such as tropospheric ozone. Using single-band approaches based on IASI spaceborne thermal infrared measurements, only ozone down to the lower troposphere (3-4 km of altitude at lowest) may be observed (Eremenko et al., 2008). A recent multispectral method combining IASI and GOME-2 (both onboard MetOp satellites) spectra, respectively from the IR and UV, has shown enhanced sensitivity for probing ozone at the lowermost troposphere, but with maximum sensitivity around 2 km at lowest (Cuesta et al., 2013). Future spatial missions will be launched in the upcoming years, such as EPS-SG, carrying new generation sensors like IASI-NG and UVNS that will enhance the capacity to observe ozone pollution, and particularly when combining them through a multispectral synergism.

This work presents an analysis of the potential of the multispectral synergism of IASI-NG and UVNS future spaceborne measurements for observing ozone pollution, performed in the framework of SURVEYOZON project (funded by the French Space Agency, CNES). For this, we develop a simulator of synthetic multispectral retrievals or pseudo-observations (referred as OSSE, Observing System Simulation Experiment) derived from IASI-NG+UVNS that will be compared to those from IASI+GOME2.

In the first step of the OSSE, we create a pseudo-reality with simulations from the chemical-transport model MOCAGE (provided by CERFACS laboratory), where real O_3 data from IASI and surface network stations have been assimilated for a realistic representation of ozone variability at the surface and the free troposphere. We focus on the high pollution event occurred in Europe on 10 July 2010. We use the coupled algorithms KOPRA+VLIDORT to simulate the spectra emitted, scattered and absorbed by the surface and atmospheric components and simulate the spectral measurements of IASI and GOME2. These spectra as used to retrieve O_3 profiles that are then compared with the pseudo-reality. These pseudo-observations enable us to estimate the performances and associated errors of the innovative multispectral methodology implemented with IASI-NG (with finer spectral resolution and lower noise than IASI) and UVNS (with lower noise and finer horizontal resolution than GOME-2). In a second step, these pseudo-observations will be used to quantify the improvement in regional air pollution forecasts, when assimilating this new multispectral O_3 product in a second chemical transport model (CHIMERE) independent from MOCAGE.