OBSERVING SYSTEM SIMULATION EXPERIMENTS (OSSES) FOR AIR QUALITY APPLICATIONS

R.M.A. Timmermans[a,*], W.A. Lahoz[b], J.-L. Attié[c], V.-H. Peuch[d], R.L. Curier[a], D.P. Edwards[e], H.J. Eskes[f], P.J.H. Builtjes[a,g]

[a] Netherlands Organisation for Applied Scientific Research (TNO), Department of Climate, Air and Sustainability, P.O. Box 80015, 3508 TA, Utrecht, the Netherlands – renske.timmermans@tno.nl
[b] Norwegian Institute for Air Research (NILU), Instituttveien 18, 2027 Kjeller, Norway
[c] University of Toulouse, LA UMR 5560 and CNRM-GAME, URA1357, CNRS – Météo-France , Toulouse, France
[d] ECMWF, Shinfield Park, Reading, Berkshire, RG2 9AX, UK
[e] National Center for Atmospheric Research (NCAR), P.O. Box 3000, Boulder, CO 80307-3000
[f] Royal Netherlands Meteorological Institute (KNMI), P.O. Box 201, 3730 AE De Bilt, The Netherlands
[g] Free University Berlin (FUB), Carl-Heinrich-Becker-Weg 6-10, 12165 Berlin, Germany

THEME: ATMC, Atmosphere, weather and climate.

KEY WORDS: OSSE, data assimilation, air quality modelling, remote sensing, future instruments.

ABSTRACT:

Over the past few years a growing number of space observations focusing on atmospheric composition have become available and this trend will continue with the launch of new satellites (ESA-Sentinels, NASA-TEMPO, KARI-GEMS and JAXA air quality and climate mission) in the near future. To justify the production and launch of these expensive instruments, there is a need for determining the added value of future satellite instruments and their optimal design in an objective way. One methodology that can do so is the OSSE (Observing System Simulation Experiment). Although extensively used in the meteorological community, its use in the field of air quality and climate is still limited and a common approach is desirable.

Based on existing studies and experience in the meteorological community we have identified requirements for each of the OSSE elements for performing a realistic OSSE. These requirements are the following: (1) a realistic nature run to simulate the true state of the atmosphere; (2) an observation simulator including full instrument description, full radiative transfer models or scene-dependent averaging kernels, cloud information, product retrieval scheme, and realistic error and error correlation estimates; (3) a well-established data assimilation model different from the nature run model; (4) model independent results; (5) a calibration run; and (6) a dedicated quantitative evaluation focusing on the driving science questions, and including statistical significance of the results.

Using illustrative examples from existing air quality OSSEs we will present the methodology and the requirements for the application of OSSEs to satellite observations of atmospheric composition.