

Review of “Monitoring European anthropogenic NO_x emissions from space

The authors describe the application of the DECSO inversion algorithm to obtain NO_x emissions from the TROPOMI instrument over Europe, then compare the results with various emission inventories. The comparisons are done by country, over several megacities and some large point sources. The paper is mostly well organized, though in few places some plot descriptions are rather abruptly inserted. There are few issues that should be resolved before publication. First, while both the DECSO approach and the TROPOMI instrument are well described elsewhere, a bit more information here would be very helpful (see my comments for lines 117 and 195). Moreover, as the method description is so short, one would expect more example and analysis in an ACP paper, but the authors present country totals, three megacity maps and four large point source time series in the main body of the paper. The seems a bit light for ACP and I have suggested additional areas to analyze. Finally, while the authors describe how DECSO error estimates are generated, they are only presented in a very broad sense and I have requested that the DECSO errors be included in tables and plots.

Major revisions

Lines 188-189: The authors state that agricultural emissions are excluded in CAMS-REG and in DECSO. For all DECSO emission retrievals? Are they also excluded in NEC, LRTAP and E-PRTR? Please clarify and justify this exclusion.

Line 208: Please explain why the DECSO total emissions agree better with CAMS-REG than with the NEC and LRTAP. Could it be due to the higher spatial resolution provided by CAMS-REG?

Line 226: Authors should expand this section over not just Europe’s largest cities but also large industrial areas, such as the Ruhr and Po valleys. And move the Serbian example into this section. Greater London, Greater Amsterdam and Istanbul would also be interesting.

Line 221: Why not add CAMS-REG emissions to this plot?

Line 250: The time series plot (S1) is very interesting. Please provide similar plots for the other cities/regions analyzed and put them in the main body of the paper, not in a supplement.

Line 278: The differences between the various emission sources are not small at all. Does the DECSO uncertainty encompass the CAMS values? See comment on for line 323.

Line 304: In all four cases DECSO shows much more temporal variability than the other two emission estimates. Please present possible sources for this difference in variability. Maybe the temporal resolution? Or is DECSO measuring emissions not included in CAMS? Please comment.

Line 323: This table and the preceding section would greatly benefit from some error analysis. The authors describe how DECSO uncertainty values are generated and present general error estimates in the discussion section, but errors should be included in the table and on the plots.

Minor changes

Line 54: it **only** provides

Line 55: biases, especially

Line 63: events, for example (**omit like**)

Line 88: please explain what persistency from the analysis means

Line 117-118: Please define and reference TM5-MP model and provide an equation (or equations) that shows how the model and satellite data are combined.

Line 118: in the **satellite L2** file.

Line 142: Please expand a bit on why this assumption is valid.

Line 174: Please provide the temporal resolution of the CAMS and E-PRTR emissions.

Line 195: Please provide a short description of the TROPOMI instrument: launch date, spectral and spatial resolution, swath width and the characteristics of the NO₂ product (frequency used, expected error).

Line 281: In what country is the Belchatow power plant located?