Interactive comment on "Online coupled regional meteorology-chemistry models in Europe: current status and prospects" by A. Baklanov et al.

Anonymous Referee #7

Received and published: 18 July 2013

Review of: "Online coupled regional meteorology-chemistry models in Europe: current status and prospects".

The paper aims at presenting an extensive review of existing efforts with regards to development of on- line atmospheric chemistry models in Europe. I think the paper is potentially a very good source of information for researchers and students and the effort of synthesis and coordination proposed by the authors should be acknowledged. There have been a number of comments in the open discussion to the papers. Given my review is coming very late, I will just add a few points. Overall and after the most constructive points raised in the on-line discussion have been addressed, I think the paper deserves publication in ACP.

Thank you for reviewing our manuscript and providing positive feedbacks.
We have incorporated all your comments and suggestions in the revised manuscript. Please see below our point-by-point replies to the specific comments. Please find all our replies in red colour, following your remarks, which we copied and kept in black.

P12547: Direct effect includes also an increase of radiative diabatic warming due aerosol absorption.
This point has been added in the revised text.

For table 2: LW scattering by large particles like dust could be also relevant.
Longwave Scattering Effects of Mineral Aerosols,Jean-Louis Dufresne, Catherine Gautier, Paul Ricchiazzi, Yves Fouquart, J. Atmospheric Science, Vol. 59, N.12, pp.1959-1966, 15 June 2002.
In the revised version we added: '…and LW scattering for large particle.'

In table 2: precipitation and land surface conditions also affect dry deposition of soluble traces species. Generally the determining role of land use parameterization should be more emphasized beside meteorological drivers.
We agree that this should be better emphasized. This point was also made by other referees. We have made a number of changes, including a change in Table 1 to highlight the importance of land surface parameterizations, changes in the conclusions sections, where this point is emphasized as well.

P12621: Evaluation of methodologies and data
One of the important targets of the paper (and the underlying COST action) is to assess the added value of the on-line approach for NWP. The authors suggest that to demonstrate the benefits of including a feedback, long integration should be performed for statistical significance (note in this case we are getting out of the "episode scale"). I would add that ensemble approaches are also necessary (e.g. varying the initial boundary conditions), even for the study of a one week event. Besides just proving that a model is sensitive to a perturbation by running just a control and a perturbed run, ensemble simulation allow a better characterization of the robustness of the response

to the physical perturbation, as well as quantification of the range of magnitude of this response in a given meteorological situation.

Thank you, we fully agree. Actually, this point was already made on page 12614, line 24 with the statement “or a sufficient number of simulations”, but this was obviously not clear and not sufficient. We have expanded the sentence in the revised text (see below):

“In some cases, judging whether including a given feedback improves model performance or not might only be possible by either integrating over a sufficiently long time, or by running a sufficiently large ensemble of simulations (e.g., with variable initial conditions). This is necessary to distinguish signals from numerical noises and to reliably quantify the magnitude of the response in a given meteorological situation. It requires mature models that are sufficiently close to reality to assure that the improved performance is not a mere compensation for model biases but rather a real improvement.”

Limited area models:

The paper outlines the constraint of boundary conditions for accuracy of chemical field, this can be also a constraint for studying a dynamical feedback since the perturbation is 'lost' in the buffer zone. This might be relevant for longer time scale integration, or in particular geographical/weather situations though.

The reviewer is completely right, once we employ two-way nested models the feedback can be lost when reaching the parent grid. In the section 5.2 we made this clearer and write in the revised paper:

“Nesting techniques allow modelling high horizontal resolution domains from information of parent grids. This can go from regional scale down to the obstacle resolving scale with different nesting approaches applicable for different phenomena as outlined by Schlünzen et al. (2011), Baklanov and Nuterman (2009). They distinguish the time-slice approach that uses steady state boundary values from one-way nesting (coarse models give information to a higher resolved domain) and two-way-nesting (exchange of information between the two domains). They recommend considering the characteristic times of atmospheric phenomena, when deciding for one of the three nesting approaches. In online models, most efforts have been directed to the implementation of one-way nesting approaches (e.g., AQUM, BOLCHEM, COSMO-ART, Enviro-HIRLAM, M-SYS, NMMB/BSC-CTM), though some models also allow the two-way approach (e.g., WRF-Chem, MCCM, and MesoNH). The consistency between nests should be carefully maintained in online models, whereby feedbacks with the meteorology are turned-on. A traditional two-way nesting approach may create many consistency problems due to the non-linear reactive effects of the chemistry between nested domains.”