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Geoscientific Model Development Discussions

Interactive comment on "The chemistry CATT–BRAMS model (CCATT–BRAMS 4.5): a regional atmospheric model system for integrated air quality and weather forecasting and research" *by* K. M. Longo et al.

Anonymous Referee #2

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Longo et al. report on the development of the regional chemistry model CATT-BRAMS, based on the BRAMS meteorological core. The model system features an online coupling between meteorology and chemistry, and hence would allow to investigate feedbacks between chemistry and meteorology. They present a modeling system including the necessary software for preprocessing of emissions, initial and boundary conditions, and the chemical mechanism. Two test cases are shown to evaluate model performance. This is a good paper, well structured and concise. All major aspects are covered, and I suggest publication after few questions have been addressed.

General questions and comments:

1) What about aerosols? It does not really become clear whether you treat aerosols at all (as prognostic variables, that is), or not. Sometimes you mention it, but then there is no mentioning of e.g. nitrate, and how it is connected to the gas-phase, or sulfate from the gas-phase, or organic material. This needs to mentioned - either how it is done, or stated explicitly that this is missing.

2) While you mention direct (radiative) effects it does not become clear how much (if any) climate feedbacks are included. Do you have them? Or is there just the provision to include them in future work? (Also relates to the previous question - no aerosols, no climate feedback, probably).

3) Please ensure that the manuscript goes through the English copy-editing process to polish grammar, structure and wording.

Specific comments:

p 1175

l 13: remove "atmospheric" from "atmospheric weather"

l 14: "user defined chemical mechanism(s)" plural. Remove text in brackets.

l 15: "trace gases emissions" -> "trace gas emissions"

l 16: "atmospheric fields" sounds strange. Use something like "interpolation of initial and boundary conditions for meteorology and chemistry" instead.

l 26: "research" singular.

p 1176

l 3: rephrase "the dynamics is forced" to sth. like "transport is calculated based on"

l 9: "the past ten years"

l 12: “cloud resolving models” would need to be on the microscale (<1km) and at least be LES type models. Do you really mean that? Or rather “convection-permitting” models?

whole paragraph: what about aerosols? They need considerable computation time as well, if not even more than gas-phase chemistry? Mention them.

p 1177

l 3: if possible list those “specific developments for the tropics/subtropics” briefly

l 5: “run at horizontal”

l 6: I don’t believe your model is “fully optimized”, as this is not possible unless you write machine code directly. You optimized it, not more, not less. Rephrase.

l 10: “code optimization specifities” -> “details on code optimizations”

p 1180

l 4 and 5: it is “loss term”, not “lost term”.

p 1181

l 7-10: does this mean you speciate VOCs in PREP-CHEM-SRC? If so, where do you get speciation information from? If not, mention that only simple conversions are possible and VOC speciation is done somewhere else.

p 1181

* please briefly mention whether your anthropogenic emissions are emitted only in the lowest layer, or whether you include point sources (e.g. stacks) aloft.

* also, is your plume rise calculated online, that is with the correct meteorology?

* Is MEGAN coupled so that it uses model temperature etc. variables?

p 1183

is rain evaporation possible? Do you release species back to the atmosphere? How do you do that for aerosols? Do you cloud-process them (i.e. do they grow in size)?

p 1185-1186

* isn’t setting up the numerical integrator part of M-SPACK? If so, you did not develop this method in this work, but it has been described somewhere else, probably in Djouad et al. 2002, no? If so, this section is nice but unnecessary, please remove. If you modified it, state the differences.

p 1187

l 1: do all these options have any impact on the result? Or is it only speed? Which one is preferred? Why?

l 10: this is a rule you deliberately set, but it is not enforced by Fortran, i.e. these fields are not “read-only” for other modules. Programmers should be aware about that.

l 12: is this the case on every architecture with every compiler? I doubt that. Either cite work that proves it or remove. (Also for several mentionings further along in the text.)

l 28: I do not understand what sc_p should be, please make a realistic example. Is sc_p a certain species like e.g. no2? Why do you need another index nspecie? Or is it an ancillary field you need to calculate some rate (temperature, pressure)? Or do you only do “chem(nspecie, ngrid)%sc_p(z,x,y)” because you want to avoid sth. like “chem(ngrid)%sc_p(nspecie,z,x,y)”?

Interactive comment on Geosci. Model Dev. Discuss., 6, 1173, 2013.