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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Online coupled meteorology and chemistry models: history, current status, and outlook" *by* Y. Zhang

Anonymous Referee #1

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The manuscript by Zhang is intended to give an overview of the history and the current developement status of models taking the feedbacks between climate, chemistry, aerosol, clouds and radiation into account. After a general overview the author restricts himself the five models developed in the US. The contents and capabilities of these five models are discussed in broad detail. Afterewards shortly some case studies are shown and a summary of what is needed as future developments is given in the end.

Although the detailed description of the five models is interesting to read (even as it is a little bit too lengthy sometimes), it does not include any news but just rounds up information that can be optained from individual publications. As it only contains five models restricted to US developments the article contains to few models to be called

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a review article of the current status of online-coupled models. The weak point of this article is the case study section. First of all, for the Caltech unified GCM which is discussed in Sect. 3 no case study at all is shown. For the other models independent case studies are discussed. This does not give any insides answering the question how the models perform in comparison to each other. After reading the very lengthy first 3 sections of the article I expected such a comparison, otherwise I see no reason for putting together a description of this five partly dissimilar models. For the manuscript to be published in ACP it is indispensible to rewrite the case study section completely and give results for all five models for the same case or even better for two or three cases illustrating the performances of the different models in different situations.

In the following major points that should be all addressed within the revisions are discussed:

Major comments:

- The distinction between the introduction and the section 2.1 is not quite clear. To avoid recurrences these two sections should be combined. This would also help to shorten the mauscript. Especially the introduction is too much focused on the work done in the US, whereas an introduction is expected to show an overview of all available scientific developments.

- Section 2.2 includes only the history of the five discussed models, thus the title of the section 2.2 should at least be rephrased from “History of representative online coupled modeles in the US” to “History of the represented online coupled US-models”.
  But as Section 2.2 is focused on these five models it could be combined with Section 3 as the history of the model is closely linked to the capability of the model in the current status.

- In Section 3 all statements that refer to developments not yet ready to use should

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be omitted, as the discussion of futher models is skipped with the argument that these models were still under development. In order to illustrate the somewhat complex structure of WRF/Chem it would be helpful to have a graph showing which aerosol module does work with which gas phase chemistry scheme.

- As already discussed shortly in the introduction, Section 4 does not at all provide the information expected from a models comparison as given in this paper. For Caltech unified GCM no case study at all is shown in the paper. So please remove this model completely from the discussion or include it into the case study section. In regard of the realisation of the case studies, it does not help much to see only short sketches of simulations showing a different case for each model. The paper would provide really new information, if it would show the same case studies simulated with all five models (and diverse different model configurations). As all models have been developed for different purposes it would be quite illustrative to see that different models perform best in different situations. You could take the case studies shown here but simulate them with all five models and compare the results. In addition, the discussion of the results should be much more detailed showing links between the implemented processes and the results.

- Section 5 is out of context, maybe it could be combined with the Section(s) 1/2.1. Otherwise it would be optimal, if the ideas given in Sect. 5 could be based on findings in the case studies section. At the moment Sect. 5 is a list of future developments needed but without any explanations why they are needed. Give reasons what do we gain from each of the demanded developments? If you think it to trivial, delete this section.

Minor comments:

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p. 1834 line 7-9	Give reason why you are concentrating on US models
p. 1835 line 1-4	Different models give different results anyway. Cite only paper that show for the same model that accounting and not accounting certain effects does change the results considerably. Do all the models show the same impact when neglecting the same feedback ?
p. 1835 line 7	rephrase “among multimedia”, e.g. “among different regimes”
p. 1835 line 16-17	“can nucleate many small cloud droplets”: rephrase, e.g. “leads to formation of many small cloud droplets”.
p. 1836 line 2-7	Be more specific. Most of the differences you explain here very laboriously are covered by the differences between CTMs and GCMs.
p. 1836 line 8-22	I did not look in all the citations you are giving here. But I expect from an introduction to include the current status of science throughout the world and you are missing here major european and asian developments. Most of them you are citing in Sect. 2.1, but I think they have to be named and classified here.
p. 1837 line 11	what do you mean by “outputs”?
p. 1838 line 23-29	what are you talking about here, simply the concept of CTMs or of the concept of the socalled “couplers” as OASIS etc. ?
p. 1839 line 8-14	If you want to make this classification you should also include a distinction between models with and without aerosols.

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p. 1839 line 16	How will you measure how “realistic(ally)” a model simulates individual feedbacks ?
Table 1	You are here in a “non US” section, so you should include european and asian major developments. (E.g. Joeckel et al.(Atmos. Chem. Phys., 6, 5067-5104, 2006), Stier et al. (Atmos. Chem. Phys., 5, 1125-1156, 2005), Lohmann et al. (Atmos. Chem. Phys., 7, 3425-3446, 2007), Teyssèdre et al. (Atmos. Chem. Phys., 7, 5815-5860, 2007), ..., and some of the ones mentioned below on page 1840 of your paper).
Table 1	This is the only place where you correctly write “Schlesinger”. Correct the wrong spelling of “Schlesimger” in the rest of the paper and the references.
p. 1841 line 12-16	I do not think that paper published in the 70’s are really “current” status.
p. 1842 line 22	“most representative”: This statement is an inappropriate subjective rating.
p. 1844 line 4-8	This is not a full sentence.
p. 1844/1845	Mention again the WRF/Chem is a mesoscale model.
p. 1845 line 21-24	If you think this notable, how are the chemistry calculations done in the other models? Really on another grid?
p. 1846 line 15	Which “other trace gases”? Provide a list if they are not too many.

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p. 1847 top	Provide a diagram illustrating the possible combinations of chemical solvers and aerosol models. The diagram could also be extended to show dependencies on other processes.
p. 1847 line 20 ff.	You are only talking about US models, so please restrict your statement to the US: e.g. "... have been developed in the US...")
p. 1849 line 10 ff.	You are desribing all other models very detailed, so plaese provide also more details for MIRAGE2.
p. 1849 line 16	Begin a new paragraph here, as the description of the models ends here and a concluding remark starts.
p. 1850 line 2	rephrase "representative"
p. 1853 line 17-24	I do not understand these sentences. Rephrase them.
p. 1858 line 5-8	Please prove this statement by the correct citation.
p. 1859 line 2-5	If MADRID is currently incativated than do not talk at all about it. Your are not discussing whole model systems with the argument that they are still under development. So also do not talk about unfinished parts of the model you are discussing.
p. 1860 line 4-5	This sentence seems not to be useful in this context.
p. 1860 line 7-8	rephrase. This is not the only sentence in Sect. 3, which would be much easier to read, if you would make some more words and elaborate a little bit more.
p. 1862 line 27-28	This is not a full sentence.
p. 1865 line 11	in layer 1 $->$ at the surface
p. 1865 line 11	give height of domain top

Technical corrections:

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p. 1837 line 10	replace the slash by ”or”
p. 1843 line 12	a dash is missing between cloud and radiation
p. 1844 line 5-6	substitute the slashes by words/ write full sentences
p. 1847 line 3/line 12	Use unique spelling “CBM-Z” or “CBMZ”
p. 1847 line 12	Did you introduce the abbreviation TUV ?
p. 1852 line 24	approach ‘$->$ approaches
p. 1852 line 25	“a” sectional approach, delete “for typical applications”
p. 1853 line 12	delete “(i.e. well-mixed)”
p. 1862 line 29	occur $->$ occurs
p. 1863 line 1	drop $->$ drops
p. 1864 line 13-15	rewite as follows: “Clouds barely occur during this episode. Thus the cloud microphysical scheme is turned off which includes that aerosol-cloud interaction and aerosol indirect effects are not simulated.”
Figure 3	enlarge figure, it is not readable.
p. 1866 line 2/line 11/line 16	Qv or $\mathrm{Q_v}$?
p. 1866 line 23	What is the use of the primes ?
everywhere	be consequent, replace MIRAGE by MIRAGE2, CAM by CAM3

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 1833, 2008.

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