

Interactive comment on “A new version of the CNRM Chemistry-Climate Model, CNRM-CCM: description and improvements from the CCMVal-2 simulations” by M. Michou et al.

Anonymous Referee #1

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Overview

The paper presents a new version of the global 3d chemistry-climate model CNRM-CCM. Based on the results of the recent model intercomparison and validation activity CCMVal-2 the model has been substantially modified, especially the radiation scheme and the coupling between GCM and chemistry module. Results of a transient model simulation covering the period 1960-2006 show that several deficiencies of the previous model version have been improved by the applied changes.

The manuscript is clearly written and the figures are well prepared. I only have a few remarks and minor suggestions (see below). After taking these comments into account

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I recommend this paper for publication in GMD.

General comments

In the new model version some fundamental modifications have been implemented, e.g. a new radiation scheme or the coupling between GCM and chemistry code. Such changes can have manifold impacts on the model performance, and disentangling the exact cause-and-effect relationships is not always easy due to complex feedback mechanisms. In section 4 the authors state that they “did not conduct a step-by-step analysis of what caused the differences between both models”. Nevertheless I would like to encourage the authors to add a more detailed discussion about possible reasons for the differences. Currently the paper is very much “show&tell”, i.e. a subset of diagnostics from CCMVal-2 is reproduced including the new model simulation and the changes between both model versions are described in the text. I am sure that in several cases good and conclusive explanations can be found, even without a detailed step-by-step analysis.

My second major comment refers to statistics. The paper doesn't say anything about the statistical significance of the presented differences between both model versions, it is simply checked whether the model results are within the standard deviation of the observational/reanalysis data or not. In some cases the differences between the models are rather small. Furthermore, the study is based on one single model simulation. So in my opinion it would be worth to lay a bit more stress on statistics.

Specific comments

p1131, l2: “... assessment of ozone depletion ...”

p1131, l14: “. . . to assess the capability of CCMs to reproduce . . .”

p1131, l15: The future evolution of stratospheric ozone cannot be reproduced.

p1131, l16: “The evaluated processes cover ...”

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p1132, l25: "climatologies"

p1133, l19: "zenith angles"

Section 2.2: In the CNRM-ACM model only the 3-d ozone field was used for radiative calculations. The new radiation scheme considers 6 additional gases. Are those 3-d fields now also provided by the chemistry model or does the radiation scheme use climatologies?

p1137, l12: The QBO was not assimilated in the CNRM-CCM simulation, e.g. by a relaxation of the zonal winds in the equatorial stratosphere ("nudging"). Why?

p1138, l21: "Grooß and Russell"

p1139, l8: "Grooß and Russell"

p1140, l1: "S. Dohmse (2011)"

p1141, l5 ff: The term "cold bias" is often exclusively used for the temperature error in the UTLS region.

p1141, l27 ff: Is the discussion of temperature biases related to the period 1960-1980 or to the period 1980-2001? Please clarify.

p1143, l9: "... help to evaluate ..."

p1143, l15: "... extracted from those in ..."

p1145, l13: "As the number of ... is rather ..."

p1146, l12 ff: Here the authors discuss rather small improvements between both model version concerning the tropical tropopause temperature. It would be very interesting to see if those improvements are statistically significant or not. This comment refers to Sect. 3 in general.

p1147, l1: "... the models' H2O..."

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p1147, l19: coherent → consistent ?

p1147, l23: "Extra-tropical tropopause pressure..." ?

p1147, l24: H2O

p1148, l22: "At 200 hPa, the model mean ..."

p1148, l28: The authors state that HNO₃ for CNRM-ACM is not further analyzed, nevertheless it is shown in Fig. 9. Why?

Figures: I was a bit confused that the results for the new model CNRM-CCM are shown in black. I would highlight the new model version in red.

Fig. 9: There are some strange gray bars in the O₃ and H₂O plots – what do they mean?

Supplement: The authors might put all figures that are discussed in the text, but not shown, in a supplementary document.

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