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Geoscientific Model Development Discussions

Interactive comment on "Climate Assessment Platform of Different Aircraft Routing Strategies in the Chemistry-Climate Model EMAC 2.41: AirTraf 1.0" *by* Hiroshi Yamashita et al.

Anonymous Referee #2

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Review on "Climate Assessment Platform of Different Aircraft Routing Strategies in the Chemistry-Climate Model EMAC 2.41: AirTraf 1.0" by Hiroshi Yamashita et al.

This paper presents a development of "module" adapted to the climate chemistry model ECHAM5/MESSY in order to calculate the climate impact of aircraft routes. Only one part of the module needed has been included in the model and presented in this paper: the part generating the route and only in the case of great circle (simple) or time-optimal route (optimisation). From these two routing the module calculates fuel use, and some emissions (H2O and NOx only), these parameter are assessed with real data. The module is tested over one winter day data over the North Atlantic corridor. In its present form I unfortunately cannot recommend the publication of the paper in

Geoscientific Model Development for several reasons that I will be listing. I would strongly recommend the editor to request a severe revision before publication. The time optimal calculation module may be of interest for modellers. The optimisation module description as well as the size of the population to be included in the optimisation to converge toward optimal time may be presented in a revised paper.

1) My first problem is the presentation of the subject within most of the article (title, abstract and even structure of the manuscript). The focus seems to be in the "optimal routing for climate impact reduction" when you check the paper, however the reader is disappointed as the presented module is not doing that at all – only optimising for travel time. The manuscript needs to be reshaped completely to acknowledge that fact. 2) I am also extremely disappointed in the fact that a part of the paper is dedicated in presenting and comparing "great circle routing" calculations. This is nothing new, and no advance in modelling or science presented. This part should be cut down and removed from the discussion. The more important difference could come from the fact the earth is not a perfect sphere or maybe taking into account flight altitude. The table 4 is comparing calculation with decimal and no-decimal data when the difference is in the decimal value. 3) Concerning the "optimisation routing" for flying time the validation over the North Atlantic is interesting but what would happen with a case of congested space or restricted space (military)? Please do tests in different part of the world or at different season. 4) Moreover I am unsure of the complete philosophy of the inclusion of the "optimisation" module in the ECHAM5/MESSY model. I understand well the impact of local weather and composition on the impact the aircraft routing will have on climate change. However I am short in understanding the need of the online optimisation as I don't see the effect of "climate optimal routing" on the climate model – would a simple offline calculation not enough to determine this potential "climate optimal routing" (the day the full module will be ready) as well as making the "optimisation" easier to be adapted to other climate-chemistry model output? 5) Finally I am unhappy with the fact that the only simple "time optimal routing" (optimising only for one variable) the weather situation if fixed for the entire flight. What would happen in the case

of multi optimisation when you have to trade-off between time, fuel use, and different emissions? Could you comment on the impact on contrail formation from long flights? “-For all routing options, local weather conditions provided by EMAC at t = 1 (i.e. at the departure day and time of the aircraft) are used to calculate the flight trajectory. The conditions are assumed to be constant during the flight trajectory calculation-“making the model as simple as an offline module but complicated as an inside module of an already complex model?

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