

Interactive comment on “ATTILA 4.0: Lagrangian Advective and Convective Transport of Passive Tracers within the ECHAM5/MESSy (2.53.0) Chemistry Climate Model” by Sabine Brinkop and Patrick Jöckel

Anonymous Referee #2

Received and published: 24 March 2019

This paper described and evaluated the updated ATTILA (Atmospheric Tracer Transport in a Lagrangian model) coupled with the EMAC chemistry climate model. The model includes new physical routines for a Lagrangian convection scheme and a formulation of diabatic vertical velocity. New infrastructure submodels were also developed. The authors evaluated the results from grid point simulations (EMAC), EMAC-ATTILA simulations with diabatic vertical velocity and kinematic vertical velocity, respectively, against radon-222 surface and profile measurements. Their result shows an improvement of the tracer transport in the ATTILA with the diabatic (vs. kinematic) vertical

C1

velocity. The documentation and evaluation are very useful, especially for their model users. Generally the paper is well written, but still requires more careful editing (see examples below). I recommend publication after minor revisions.

Minor comments:

P3, L19: “(ECHAM5, Roeckner et al., 2006)”

P3, L20 (and elsewhere): add comma after “i.e.” (or “e.g.”)

P3, L21: remove “MA-“

P4, footnote of Table 1: make it one single line.

P6, L7: “such as for instance” – remove “for instance”.

P11, L23: “were selected similar as by Reithmeier and Sausen (2002)” – do you mean “following Reithmeier and Sausen (2002)”?

P12, L6: “only, if” — “only if”

P12, L12: remove “also”.

P12, L13 and P14, L4-5: correct the unit on P14, and use the same unit.

P12, L24 and P13, L1: Kritz and Rosner (1993) was cited for the 1994 Radon profile data at Moffett Field. Should it be Kritz et al. (1998)?

P12, L26 and P14, L4: remove “of”.

P13, L2: THE 3rd

P14, L9: “advantage that”

P14, L20-21: This is a repetition of what’s said in the first 2 lines of section 3.1, and should be deleted. L22: “Jöckel et al. (2010) showed that ...”; L23: “assume here that ...”; L26: “from the large”

C2

P14, L27-28: “The small local maximum at 80 south is related to . . . where small land areas in the land sea mask generate local 222Rn emissions” – But it appears that Rn emissions in the model is only limited to 60S-60N (see top of page 14). Please clarify.

P15, L12 and Fig. 4 (panel & caption): “222Rn lower than 1000 Bq m⁻²”, “222Rn[mBq/m²]” — the unit is incorrect. Please use “mBq/SCM” (i.e., mBq per standard cubic meter).

P15, L13: “And finally . . .” — “Finally . . .”

P15, L16: remove the symbols

P15, L25-27: Again, these are repeating what's already said in section 3.1

P16, L2: remove “stemming from radioactive decay of radium in soils”

P16, L27: use “upwelling” instead of “up-“ to avoid confusion.

P18, L15, Fig. 16: “The maximum levels of detrainment are between level index 43 and 38” — Are these shallow convection? Isn't it better to use altitude instead of model level index in the plot? What's the quantity shown on the color bar of Fig. 16-18?

P19, L4: during the . . . campaigns

Fig.2: Are the concentrations averaged from the lowest 3 model layers? The caption needs this information. The concentrations at 100hPa are scaled up by a factor of 10, and it needs to be indicated on the panel, e.g., adding a right axis? Also explain what LG(diab) and LG(kin) are, or refer the reader to the text (section 4).

Fig.2-6: Consistently use mBq/SCM as the unit for 222Rn concentrations throughout the paper.

Fig. 5 caption: “Dashed lines” and “The thick dashed lines” are a bit confusing. “The thin dashed lines”? What are the triangles?

Fig.6 caption: what are the circles?

C3

Fig.11: transit time (years)

Fig.12: typo “level)”

Fig.13: “Stippled area” or “NOT stippled area”?

Fig.14: The mass fluxes are plotted in “kg/s”, which is dependent on the model grid-size (surface area). Without this model's grid-size information, other modelers cannot compare their results to this figure. Thus it's necessary to plot the mass fluxes in “kg/m²/s”.

Fig. 15: “net downward mass flux” – remove “downward” since negative values already indicate “downward”. Here it's ok to plot the mass fluxes in kg/s because the areas (30N-90N, 30S-90S) are given.

Suppl. Material: the cover page should use the same title as the one for the main text, and add one paragraph explaining what's included in the supplementary materials.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2018-302>, 2019.

C4