

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

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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

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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: “Jockel et al. (2010) showed that . . .”; L23: “assume here that. . .”; L26: “from the large”

P14, L27-28: “The small local maximum at 80 south is related to . . . where small land areas in the land sea mask generate local ^{222}Rn 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): “ ^{222}Rn lower than 1000 Bq m⁻²”, “ $^{222}\text{Rn}[\text{mBq}/\text{m}^2]$ ” — 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 ^{222}Rn 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?

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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.

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