

Interactive comment on “Numerical simulation of tropospheric injection of biomass burning products by pyro-thermal plumes” by C. Rio et al.

Anonymous Referee #1

Received and published: 3 December 2009

General comments: The manuscript describes an adaptation of a mass flux scheme designed to represent convection within the boundary layer to simulate convective plumes induced by vegetation fires. In general, the text is well written and the adapted mass flux scheme for pyro-convection and its implementation within a 3d large scale transport model, in spite of the discussed discrepancies with previous studies and observations, seems to be promising. I'd recommend the publication after the points below are properly addressed.

Specific comments:

P18660-L7: mixing of what?

P18661-L7: add a sentence explaining why the observed excess of CO₂ should not be

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associated to convective transport of boundary layer CO₂ by 'natural' cumulus convection.

P18661-L1: Change 'condensation' to 'condensation of water vapor'.

P18661-L14: This statement does not apply to the Tropics in general. On deforestation areas of South America and Africa, for example, the atmospheric condition is not permanently too dry and stable and the predominant burnt biome is dense forests.

P18661-L18: The ECMWF model does not include pyro-convection to estimate the injection height of emissions either GFEDv2 inventory has this information. So, I think this statement is out of context of the discussion.

P18661-L19: Explain what do you meant with 'off-line'.

P18663-L9: Combustion heat needs definition and reference.

P18663-L10: Check units of the heat flux (F).

P18664-L10: Change 'environmental values' to 'environmental mean values'

P18664-Eq. 5: The 2nd term of right side must me wrong, check it.

P18664-Eq 5 and 6: Define in the text the gravity acceleration 'g' and delete it from Eq. 5

P18665-L09: Explain how you specify the diffusion coefficient (K) and the height 'h' within that you assume the diffusion process dominates.

P18664- Section 2.2: How do you treat the cloud microphysics in this model? There is not any information, e. g., about the how autoconversion is parameterized in this pyro-convection model.

P18665- L 16: Change 'air specific heat' to 'specific heat of air'. P 18668-L21: Trentmann et al. (2002) discusses ATHAM simulations for the Quinault fire not Chisholm.

P18669-L5: C is combustion heat not combusting heating rate.

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P18670-L16: Since the top of boundary layer in S. Africa case is at 1500 m and the plume reaches 2700 m, seems inappropriate to use the expression 'plume being trapped in the boundary layer'. Perhaps 'in the low troposphere' would be more accurate.

P18671-L17and18: This finding was reported by several previous works and needs appropriated references to them.

P18673-18674-Section 4.1: An active burning area of 2 km² represents an extremely large fire and seems not be a realistic hypothesis. From the presented discussion and Fig 7, one can deduce that the authors treat an ensemble of thousand fires inside a coarse grid box (5 x 5 degrees?) as a only one 'gigantic' fire. Obviously, each fire has your own plume rise which is determined by the local environment condition and the actual fire characteristics. Additionally, the net vertical smoke distribution in the environment of ensemble of fires is not the same as that one produced by the 'gigantic' fire. This hypothesis must be better justified or explained.

P18674-L 8-9: Discusses which observations were used to derive the map of emissions and its temporal and spatial resolution

P18674- Section 4.2: How does your model deal with the smoldering phase emission?

P18675-Section 4.3: It'll be important if the authors explained better how they actually derive the source emission on vertical. Even better if a figure with the vertical distribution of CO2 emission field is provided.

Technical corrections:

At several places, change 'cloudy liquid water' to 'cloud liquid water'.

P18672-L6: Change 'left' to 'right'.

Caption of figure 6: delete the letter 'n' of the word 'ration'.

Caption of figures 9, 10: change 'concentration' to 'mixing ratio'.

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