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Sensitivity of the Plume Rise Model in the estimation of biomass burning plume injection heights in South America

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This study had the aim to evaluate the new developments on the Plume Rise Model (PRM), embedded into the Brazilian developments on the Regional Atmospheric Modelling System (BRAMS). PRM computes the biomass burning plume injection heights and returns that information to the host model. Then, the atmospheric model releases all the fire emissions at this height. New developments are based on the initialization data used by the PRM, using fire size and fire radiative power (FRP) from remote sensing. The main difference between the two new versions is the conversion parameter (β) used to convert from FRP to the plume convective flux. In addition, a new scheme to generate daily fire emission fluxes is offered using the fire radiative energy (computed from remote sensing) in the Brazilian Biomass Burning Emission Model (3BEM-FRE). Model results using the three versions of the PRM are compared with observed airborne CO and O_3 data from the SAMBBA campaign, which took place in southern Amazonia and Cerrado (savanna-like) regions in September 2012. Results show that improvements in both 3BEM-FRE and PRM models, had a better performance in the vertical and horizontal reproduction of CO and O_3 than the original versions of them, especially in the middle and upper troposphere. Nevertheless, with some difficulty to reproduce the emissions by the end of the campaign, probably due to the cumulus parameterization used, which overestimated the precipitation in the region of study. Also, developments made in the 3BEM model show better agreement with the observed remote sensing data of daily fire emissions than the original version of it in the Amazon region, but with some difficulty in the Cerrado.