

***Interactive comment on “The diurnal evolution of
²²²Rn and its progeny in the atmospheric boundary
layer during the Wangara experiment” by
J.-F. Vinuesa et al.***

J.-F. Vinuesa et al.

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We would like to thank the reviewer for his comments. We think that we have addressed all the points raised by him and modified the manuscript accordingly.

Point 1:

"Radon can be used as tracer of stability of the boundary layer but also as tracer of continental characteristic of the air mass. In the model of Vinuesa et al, radon advection is determined by the boundary condition, but there is no discussion about this problem of radon advection. The radioactivity equilibrium in the domain of the modelisation is also function of advection."

Because of the periodicity of the boundary conditions in x and y , our model represents an infinite area where radon is emitted uniformly. The day selected for our study showed very little horizontal advection of heat and moisture. However large scale forcings were included (using geostrophic and thermal winds) allowing to account for horizontal advection.

Point 2:

"Radon daughter products are fixed on atmospheric aerosol. Radioactive equilibrium between radon and its progeny depends of the boundary layer stability, but also of the boundary layer condition at ground level. Dry deposition of aerosol particles, depending of particle size, ground rugosity, atmospheric turbulence near ground level; give a negative flux of daughter products at ground level. This parameter, the dry deposition, seems not to be taken into account in the model of Vinuesa et al."

We didn't account for the dry deposition of radon's progeny. We clarified this by adding this information in the description of the simulation.

Point 3:

"In the text, S_o and S_i are concentrations expressed in radioactive activity. It is not clearly explain in the text of the paper."

We added this information in the description of the decaying chain and turbulent dispersion section.

Point 4:

"Results of Vinuesa et al. seem very difficult to apply for experimental applications. Radioactive disequilibrium, between 0,9 and 1 are very difficult to measure and a priori between Radon and ^{218}Po (RaA), near 0.99. In fact ^{218}Po and radon can be considered in radioactive equilibrium and ^{218}Po can be used to measure radon concentration."

Following the first referee's suggestion, we now use more realistic initial concentration conditions that induce relevant and noticeable radioactive disequilibrium (see new figures 15 and 16).

Point 4:

"In conclusion it will be necessary to clarify the paper and discuss about. radon advection, dry deposition of daughter products, and the possible application of the results."

Using the initial conditions suggested by the first reviewer allowed us to enhance the interest of this paper, e.g., the possible comparison with in-situ future measurements, and the application of our results in large-scale modeling studies.

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