Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-568-AC2, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Processes controlling the seasonal variations of ^{210}Pb and ^{7}Be at the Mt. Cimone WMO-GAW global station, Italy: A model analysis" *by* Erika Brattich et al.

Erika Brattich et al.

hongyu.liu-1@nasa.gov

Received and published: 28 November 2016

We thank reviewer #2 for helpful comments. Below please find our itemized replies.

1) How about the actual precipitation at Mt. Cimone in Figure 4? The difference between actual, modeled, and GPCP precipitations would support that wet scavenging is the main reason controlling 7Be seasonal variations shown in Figure 8. Please notice the precipitation comparisons in Figure 4 (ij), which shows that the model precipitation is generally lower than that of GPCP, meaning that the modeled wet scavenging processes perhaps is lower than the reality. This weak modeled wet scavenging seems to be very significant for the 7Be concentrations shown in Figure 8.

Reply – We thank the reviewer for pointing this out. We have revised the text as follows: "The MERRA precipitation is generally lower than that of GPCP at two gridboxes (except for summer, Figure 4ab), but in good agreement at the other two gridboxes (Figure 4cd). Large differences between the MERRA precipitation and that locally observed at the station are instead present. While the daily mean observed 2005 precipitation is 0.81 mm, which is close to the corresponding precipitation (0.73 mm) in MERRA at the "ij" grid (i.e., a negative bias of -0.08 mm); the model bias is positive and much higher (0.31 – 1.28 mm) at adjacent grids. This bias may very well reflect again the fact that the observed surface precipitation is localized, whereas the satellite and MERRA precipitations correspond to a much larger scale (about 200 km)."

2) One section can be added to illustrate the model results of this study in comparison with historical model studies. Those model studies may include as follows: 7Be: Brost, et al., J Geophys Res, 96, 1991; 210Pb: Feichter,et al., J. Geophys. Res., 96, 1991; Lee, H. N., et al., J Geophys. Res., 109, D22203, 2004, doi: 10.1029/2004JD005061. 7Be/210Pb: Koch et al., J Geophys. Res, 101(D13), 1996.

Reply – Thanks for the suggestion. Since our focus is on the model analysis of observational data from a single station (versus global simulations of 210Pb, 7Be, and 7Be/210Pb), we have decided to cite these historical model studies in various places of the text.

3) The WMO-GAW station, Mt. Cimone (44°12' N, 10°42' E, 2165 m asl, Italy) is quite close to the Alps stations, such as Jungfraujoch (46.32°N, 7.59°E, elevation 3580 m asl) and Zugspitze (47. °N, 11.0°E, 2962 m a.s.l.) in the model grids. How about the general results of the model and observation comparisons for those two stations in 2005? I believe these comparisons will support the conclusion that coarse of the model runs is one of the reasons for the worse 7Be comparisons.

Reply – Unfortunately, we cannot compare the results of our simulations with the observations from Jungfraujoch and Zugspitze stations in 2005. We own only the Mt.

Cimone data, and the observational data from other stations are not publicly available.

4) For Figure 8, I am confused that without the wet-scavenging process, the 210Pb concentration is even lower than that of observed from January to July. The convection uplift of 222Rn seems does not support the summer 210Pb maximum but on the contradictory. How about the sensitivity experiments with case of 7Be/210Pb in Figure 8? Why do you show the sensitivity test for ji-1 grid rather than the ji grid in this figure?

Reply - The model result without scavenging is not lower than that observed from January to July. Since the simulation without wet scavenging resulted in concentrations far higher than those obtained in the standard simulation and in other sensitivity experiments, the results from that simulation are plotted on a different scale (see the right y-axis of Figure 8). As discussed in the manuscript, the model simulation without convection results in larger 210Pb concentrations in the free troposphere due to the compensating effects of convective transport and scavenging. We have not reported the 7Be/210Pb ratios from sensitivity experiments since the ratio is not affected by scavenging. We have chosen to show the sensitivity tests for grid "ij-1" rather than "ij", since at the former a better comparison between the observed and simulated 210Pb and especially 7Be activities was found. Also see Figures 5-6 and their discussions.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-568, 2016.