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Simulation of the atmospheric concentrations of 210Pb and 7Be and comparison with daily observations from 8 surface sites

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The atmospheric transport of the aerosol tracers ^{210}Pb and ^{7}Be is simulated with an atmospheric general circulation model (LMDZ, developed in the 'Laboratoire de Météorologie Dynamique') driven by ECMWF analyses. The large-scale advection is based upon a finite-volume second-order scheme proposed by Van Leer (1977). Deep convection is parameterized according to the scheme of Tiedtke and the turbulent mixing in the planetary boundary layer is based on a classical local closure. Our simulations include dry deposition and wet scavenging parameterized as a first-order loss process according to Giorgi and Chameides (1986). The rate of production of ^{7}Be within the atmosphere is based on the calculation of Lal and Peters (1967). The radionuclide ^{210}Pb is a decay product of the ^{222}Rn inert gas emitted from the continental crust. Two different ^{222}Rn exhalation models are investigated here. We first assume a uniform ^{222}Rn emission of 1 atom.cm^{-2}.s^{-1} from land. Then, the model of Schery and Wasiolek (1998), which takes into account data for soil radium, soil moisture and surface temperature, is used.

Observations from 8 surface stations are compared to results from a one year (2004) global simulation. We find that the model gives a good simulation of observed concentrations and succeeds in reproducing daily variations of ^{210}Pb and ^{7}Be concentrations. Figures of merit in time (FMT), quantifying the overlapping of the predicted and observed time series, are higher than 60% for most of the stations. The lower FMTs are obtained at maritime or high-latitude stations. No significant improvement is obtained when using for radon exhalation the model of Schery and Wasiolek.