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Atmospheric transport modeling of natural radionuclides to determine the coupling of the Tahiti station with the general circulation

P. HEINRICH

CEA, DASE/LDG, B.P.12, 91680 Bruyères-le-Châtel, France

philippe.heinrich@cea.fr

Numerical simulations of atmospheric transport of 2 natural radionuclides are carried out to define the capacity of the Tahiti station to detect a pollutant circulating through Pacific Ocean. Tahiti station belongs to the Comprehensive Test Ban Treaty network and measures very low level radioactivity on daily routine. Transport and deposition of terragenic ^{210}Pb and cosmogenic ^{7}Be are simulated first by the general circulation model LMDZ, developed at the Laboratoire de Météorologie Dynamique in Paris. This model calculates over the globe, eulerian large-scale advection based upon finite-volume methods and parameterization of turbulent mixing and convection. Transport is based on mass conservation of the aerosol in the atmosphere, taking into account radioactive decay, dry and wet deposition. Daily-averaged concentrations of ^{210}Pb and ^{7}Be collected at Tahiti station are compared with numerical results for a one year (2004) global simulation. It is shown that time series of ^{7}Be and ^{210}Pb air concentrations are poorly reproduced, due to the insufficient resolution of the model (1.875˚x1.25˚ horizontally and 19 levels vertically), where the Tahiti is not described. The results analysis yields us to study more in details a ^{210}Pb peak recorded in March 2004 over a period of about 7 days, and simulated coarsely by the LMDZ model.

Simulated wind fields are calculated by the mesocale meteorological model WRF using 4 nested grids with resolutions ranging from 50 km to 1 km. The calculated wind fields, validated by those available at the Tahiti station and at airport, show that this maritime station is strongly affected by local breezes.

In order to determine the air origin at Tahiti station, transport simulations are carried

out in a backward model from Tahiti, using FLEXPART, a Lagrangian particle dispersion model, developed at Munich University. Atmospheric dispersion is calculated from WRF calculated winds in the 4 grids. The calculated retroplumes with fine resolution show periods where air is very quickly transported outside Tahiti and periods where air stagnates over Tahiti, which corresponds to the period of the recorded peak. Comparisons of retroplumes between grids with different resolutions allow determining the coupling of the station with the general circulation.