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Sensitivity analysis of rain characteristics on HTO concentration in drops

L. Patryl[a,*], D. Galeriu[b], P. Armand[a], L. Vichot[c], Ph. Guétat[c]

[a] *CEA, DAM, DIF , F91297 Arpajon, France*

[b] *"Horia Hulubei" Institute for Physics & Nuclear Engineering, RO-077125 Bucharest-Magurele Roumania*

[c] CEA*, VALDUC, F-21120 Is-sur-Tille, France*

Precipitation scavenging coefficients, as the HTO washout rate, are often derived from raindrop intensity and average velocity of drop. In this study, several Drop Size Distribution (DSD) fitted from experimental data are compared to calculate HTO concentration in drop. Variability and uncertainties from each DSD on drop diameter, drop velocity, total surface exchange between air and drops are computed. Gamma, Lognormal and Marshall-Palmer distributions are used with several parameters. Velocity drop calculated from DSD with Andronache, Seinfield and Loosmore equations are close, less than a factor of 2 for a rainfall intensity of 1mm.h^{-1}. According to DSD, there is a factor of 2 to 4 between average velocities due to the drop distribution. From only rainfall intensity, the Chamberlain Empirical equation gives an average velocity higher of a factor of 2.

The total surface exchange between air and drop, which depends of the distribution and the diameter of each drop, range from 5.10^{-2} to $1.8.10^{-1}$ m^2/m^{-3}(air) according to DSD and rainfall intensity. The average time needed by the drops to cross a 10-meter layer range from 3 to 15 s. That can lead to high discrepancy on HTO concentration in drop. By using Chamberlain equation, HTO concentration in each drop is performed for a washout constant of 10^4 s^{-1} and for an air concentration of 1000 Bq.m^{-3}. Results show that the HTO concentration in drop, thus the coefficient scavenging, depends very closely of rain characteristics. More than the choice of velocity drop or diameter formula, the choice of the distribution is important and depends of the rain observed. Assumptions can lead to uncertainty about a factor of 2 to 3 on HTO concentration in drop. Results of this study have to be used to assess the global uncertainties on the wet deposition then on the human HTO doses.