Exchange velocity approach and the role of photosynthesis for tritium transfer from atmosphere to plants

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The continuous efforts dedicated to increase the predictive power of risk assessment for large tritium releases implies transfer complex models based on process level analysis. Tritium transfer from atmosphere to plants and the subsequent conversion into organically bound tritium strongly depend on plant characteristics, seasons, and meteorological conditions, which have a large variability. In order to be able to deal with this large variability and to avoid the expensive calibration experiments also, we propose in this paper a model developed by us, using knowledge from plant physiology, agro meteorology, crop science, and atmospheric physics. The transfer of tritiated water to plants is modelled using resistance approach and including sparse canopy. The canopy resistance is modelled using Jacobs-Calvet-Ronda approach modified in order to be able to include the canopy photosynthesis rate with crop specific parameters given in the WOFOST model data base. Comparisons between various approaches for photosynthesis will be presented, as well as tests with experimental data for stomatal resistances and tritium transfer rates. The same photosynthesis model is used to assess the organically bound tritium production. The experimental data show that the tritium transfer during the night time is higher than it was expected and potential explanations are investigated in this paper considering the partial stomatal closure and high cuticular transfer.

The results presented in this paper are part of an international effort for understanding the processes involved in tritium transfer and for decreasing the assessments uncertainty.