Coupling solute and tracer transport to the water fluxes

In WaSiM version 2 the modeling of ideal tracers in included. It is possible to consider radioactive decay, mixing and enrichment (for salts). Only advective transport and mixing is considered, no diffusion is taken into account. This is a useful simplification if diffuse sources like salt from irrigation water or tritium from precipitation is modeled. Salts are modeled using the absolute masses, all other tracers are modeled by their concentrations. The advantage is, that for salts no changes in the masses will occur during evaporation while for evaporating tracers also no changes in their concentrations will occur. The mixing of water volumes with different concentrations is calculated after:

$$c_{mix} = \frac{c_1 V_1 + c_2 V_2}{V_1 + V_2} \qquad \textbf{(2.20.1)}$$

with V_1, V_2 volumes 1 and 2 to be mixed
c_1, c_2 concentrations of the tracer in the volumes 1 and 2
c_{mix} mixing concentration

Radioactive decay is calculated using the half time $t_{½}$, which is converted into a decay constant depending on the model time step. Thus the radioactive decay is computed by:

$$c_i = c_{i-1} \cdot e^{-\Delta t / t_{1/2} \cdot \ln 2} \qquad \textbf{(2.20.2)}$$

with c_i concentration of the radioactive tracer after decay
c_{i-1} concentration of the radioactive tracer before decay (from the last time step)
Δt time step [days]
$t_{1/2}$ half time [days]

There can be considered at maximum 9 tracers at the same time. The tracers are modeled absolutely independent of each other even if the concentrations are very high. This is a limitation as well as the inconsideration of the fact that the suctions and conductivities of salty solutions differ from that of pure water. Also the effects of density on the fluxes are not considered. So the model should not be applied to systems where such effects are expected to be important for the water fluxes.

Note: Solutes transport and concentrations cannot be calculated for multi-layered vegetations in the interception model.