Changes in the mass of SOM in the four pools (kg m-2) in a soil layer are given by:

(1)

(2)

(3)

(4)

where *Ia*, (kg m-2 yr-1) is the supply of organic matter to the layer in question from incorporated above-ground harvest residues, *φmes* and *φmic* (m3 m-3) are the meso- and microporosity respectively, ε (-) is the retention coefficient, *kY* and *kO*(yr-1) are reference first-order rate constants for the decomposition of young and old organic matter, *Fp* (-) is a factor varying from zero to unity that reduces OM decomposition rates in the micropore region to account for physical protection, *ku(mes)*and *ku(mic)*(-) are microbial uptake factors and *kt* is a temperature response function (-) which is given by (Ratkowsky et al., 1982; Kätterer et al., 1998):

(5)

where *Ts*is the soil temperature, *Tref*(oC) is a reference temperature and *Tmin* (oC) is the temperature at which the mineralization of soil organic matter ceases.

The microbial limitation factors *ku(mes)*and *ku(mic)* were derived by Wutzler and Reichstein (2013) from a simplification of a microbial growth and organic matter decomposition model:

(6a)

(6b)

where Δz is the soil layer thickness and *Aa*(kg m-3 yr-1) is a composite microbial parameter. The source-sink terms *TY* and *TO* (kg m-2 yr-1) in equations 1 to 4 are included to account for the transfer of organic matter from micropores to mesopores by tillage:

(7a)

(7b)

where *ktill* is a tillage rate constant (yr-1).