

Table S4 Examples for the effects of temperature on biogeochemical processes in CNMM-DNDC model.

Equations	Description
$C_L \frac{\partial T}{\partial t} = \frac{\partial}{\partial z} (K_L \frac{\partial T}{\partial z})$	Heat conduction
$f_{T3} = \frac{I}{1 + \exp(0.2 \times (10 - T_{air}))}$	Effects of low T_{air} on C_3 plant
$f_{T4} = \frac{I}{(1 + \exp(0.3 \times (13 - T_{air}))) \times (1 + \exp(0.3 \times (T_{air} - 36)))}$	Response of C_4 plant to extreme T_{air}
$F_T = -0.0014 \times T_{soil}^2 + 0.0992 \times T_{soil} + 0.00198$	Effects of T_{soil} on decomposition
$F_T = 3.503^{\frac{60 - T_{soil}}{60 - 34.22}} \times \exp(\frac{3.503 \times (T_{soil} - 34.22)}{60 - 34.22})$	Effects of T_{soil} on nitrification
$F_T = a \times 2^{\frac{T_{soil} - 22.5}{10.0}}$	Effects of T_{soil} on denitrifier growth
$F_T = \exp(0.2424 * T_{soil})$	Effects of T_{soil} on CH_4 production
$F_{Ti} = -0.1687 \times (0.1 \times T(L))^3$ $+ 1.167 \times (0.1 \times T(L))^2$ $- 2.0303 \times (0.1 \times T(L)) + 1.042$	Effects of T_{soil} on CH_4 emission

T_{soil} and T_{air} are referred to air temperature and soil temperature, respectively. L represents soil layer.