

EXP. 1

Fast pool ($f_f^\#$)

Slow pool ($f_s^\#$)

$k_{f,LT}^\#$ $k_{s,LT}^\#$

$Q_{10_fast}^\#$ Temperature effect $Q_{10_slow}^\#$

k_f^*

k_s^*

$$k^* = k^\# \cdot Q_{10}^{\frac{T_h - T_l}{10}}$$

CO₂

Global mineralization dataset

Optimization

Different temperatures share the same f within the same trial

Best-fit model

EXP. 2

Fast pool ($f_f^\#$)

Slow pool ($f_s^\#$)

$k_{f,LT}^\#$ $k_{s,LT}^\#$

$Q_{10_fast}^\#$ Temperature effect $Q_{10_slow}^\#$

k_f^*

k_s^*

$$Q_{10_fast} = Q_{10_slow}$$

CO₂

Global mineralization dataset

Optimization

Different temperatures share the same f within the same trial

To test the importance of M1

EXP. 3

Fast pool ($f_f^\#$)

Slow pool ($f_s^\#$)

$k_{f,LT}^\#$ $k_{s,LT}^\#$

Q_{10_obs} Temperature effect Q_{10_obs}

k_f^*

k_s^*

$$Q_{10_obs} = Q_{10_fast} = Q_{10_slow}$$

CO₂

Global mineralization dataset

Observed mean Q_{10} under different temperatures (Q_{10_obs})

Different soil share the same Q_{10}

To test the importance of M2

$f_f^\#, k_{f,LT}^\#$
 $f_s^\#, k_{s,LT}^\#$

$f_f^\#, k_{f,LT}^\#$
 $f_s^\#, k_{s,LT}^\#$

M1: Intrinsic temperature response; M2: Extrinsic environmental constraints.

[#]These parameters were optimized within each trial.