**Appendix D.** Temperature dependence of kinetic properties of Rubisco.

Usually, temperature functions either show weaker correspondence with the experimental data (Harley and Baldocchi 1995) or do not provide accurate modeled temperature responses of Rubisco-limited photosynthetic rate (McMurtrie and Wang 1993). To ensure that our conclusions are not dependent on the choice of temperature dependence function, we explored several alternative functions. The Temperature dependence of Rubisco kinetic parameters ($K_c$, $K_o$, τ) was an Arrhenius function taken from Bernacchi et al. (2001) or was a function based on the $Q_{10}$ concept (Collatz et al. 1991, Sellers et al. 1996). In particular, we used four temperature response functions of Rubisco kinetic parameters, which are outlined below.

a) *Temperature response function one* (TRF1)

TRF2 is used by the community land model version 4 (CLM4), where the partial pressures of oxygen, *O* is considered as 20946Pa. The temperature dependence of $V_{c,max}$ and $J_{max}$ in CLM4 is based on the $Q_{10}$ concept (Collatz et al. 1991, Sellers et al. 1996). The fixed coefficients of the equations are the kinetic properties of Rubisco at 25°C.

$$K_0(T_1) = 30000\left(1.2^{0.1(T_1-T_0)}\right)$$

$$K_c(T_1) = 30\left(2.1^{0.1(T_1-T_0)}\right)$$

$$\tau(T_1) = \frac{30000\left(1.2^{0.1(T_1-T_0)}\right)}{0.21*30\left(2.1^{0.1(T_1-T_0)}\right)}$$

The leaf temperature is $T_1(K)$ and the reference temperature, $T_0 = 298.15K$.

b) *Temperature response function two* (TRF2)

TRF2 is adapted from Leuning (2002), where the temperature dependence of the kinetic properties of Rubisco was based on Bernacchi et al. (2001).

*c) Temperature response function three (*TRF3*)*

TRF3 is a temperature response function based on Kattge & Knorr (2007)'s formulation of acclimation, where temperature optimum is a function of growth temperature. The temperature dependence of the kinetic properties of Rubisco in TRF4 was based on Bernacchi et al. (2001).

*d) Temperature response function one* (TRF4)

TRF4 is used by the community land model version 4.5 (CLM4.5) (Oleson et al. 2013), where the partial pressures of oxygen, *O* is considered as 20900Pa. The kinetic properties of Rubisco which depend on temperature are Rubisco specific factor, τ (Jordan and Ogren 1984), $K_c$ and $K_o$, which are the Michaelis-Menten constants for $CO_2$ and $O_2$, respectively. Their temperature functions are essentially based on Bernacchi et al. (2001), which are described below with the fixed coefficients of the equations being the kinetic properties of Rubisco at 25°C.

$$K_0(T_1) = 27840e^{[(36380/RT_0)(1-T_0/T_1)]}$$

$$K_c(T_1) = 40.49e^{[(79430/RT_0)(1-T_0/T_1)]}$$

$$\tau(T_1) = 2407.834e^{[(37830/RT_0)(1-T_0/T_1)]}$$

In the above equations, *R* is the universal gas constant (8.314 J $mol^{-1}$ $K^{-1}$), $T_1$ is the leaf temperature (*K*) and the reference temperature, $T_0 = 298.15K$.

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