

Supplementary Materials

Vegetation Production Model

Based on the concept that leaves and canopy can be divided into chlorophyll and non-photosynthetic vegetation, the vegetation production model (VPM) divides the proportion of photosynthetic effective radiation absorbed by vegetation canopy into the chlorophyll absorption part ($FPAR_{chl}$) and non-photosynthetic vegetation absorption part, and only the former is used for photosynthesis [1,2]. Therefore, the VPM can be expressed by the actual efficiency of utilization of light multiplied by the photosynthetic effective radiation absorbed by chlorophyll:

$$GPP = \varepsilon \times PAR \times FPAR_{chl}$$

where ε is the actual efficiency of utilization of light; PAR is photosynthetic active radiation and $FPAR_{chl}$ is the effective proportion of photosynthetic radiation absorbed by chlorophyll.

$$FPAR_{chl} = (EVI - 0.1) \times 1.25$$

where EVI is an enhanced vegetation index.

$$\varepsilon = \varepsilon_{max} \times T_{scalar} \times W_{scalar} \times P_{scalar}$$

where ε_{max} is the maximum efficiency of utilization of light, the ε_{max} of the GE is $0.42 \text{ g CM} \cdot \text{J}^{-1}$; T_{scalar} is a temperature stress factor; W_{scalar} is a water stress factor and P_{scalar} is the coefficient of regulation of leaf phenophase on maximum efficiency of utilization of light.

$$T_{scalar} = \frac{(T - T_{min})(T - T_{max})}{(T - T_{min})(T - T_{max}) - (T - T_{opt})^2}$$

where T is the temperature, and T_{min} , T_{max} and T_{opt} are the lowest temperature, highest temperature and best temperature, respectively. The lowest, highest and best temperatures of the GE are 0, 48 and 27°C , respectively [3].

W_{scalar} indicates the effect of water on photosynthesis. In the VPM, the water-sensitive land surface water index ($LSWI$) is used for calculation. The formula for calculating the W_{scalar} is:

$$W_{scalar} = \frac{1 + LSWI}{1 + LSWI_{max}}$$

where $LSWI_{max}$ is the maximum surface water content index.

P_{scalar} indicates the effect of leaf age on photosynthesis at the canopy scale. In this study, the GE continues to have vegetation with new leaves throughout the growing season, so P_{scalar} was set to 1.0 [4].

References

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