Supplementary Materials

Improved Modeling of Gross Primary Productivity of Alpine Grasslands on the Tibetan Plateau Using the Biome-BGC Model

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- **Morris Method**

The Morris method is often used as the first step in global sensitivity analysis to screen out those parameters that have negligible effects on the output variables. Given that $X = (x_1, \ldots, x_n)$ represents the n-dimensional parameter vector and $f(X)$ represents the model output, the elementary effect of the ith input parameter on the output variable can be defined as

$$d_i = \frac{f(x_1, \ldots, x_{i-1}, x_i + \Delta, x_{i+1}, \ldots, x_n) - f(X)}{\Delta} \tag{1}$$

where d_i is the elementary effect of the ith input parameter, Δ is a predetermined multiple of $1/(p-1)$, and p is the number of levels corresponding to quantiles of the parameter distribution. After repeating this procedure r times, the sensitivity measures of the Morris method can be obtained, which are defined as
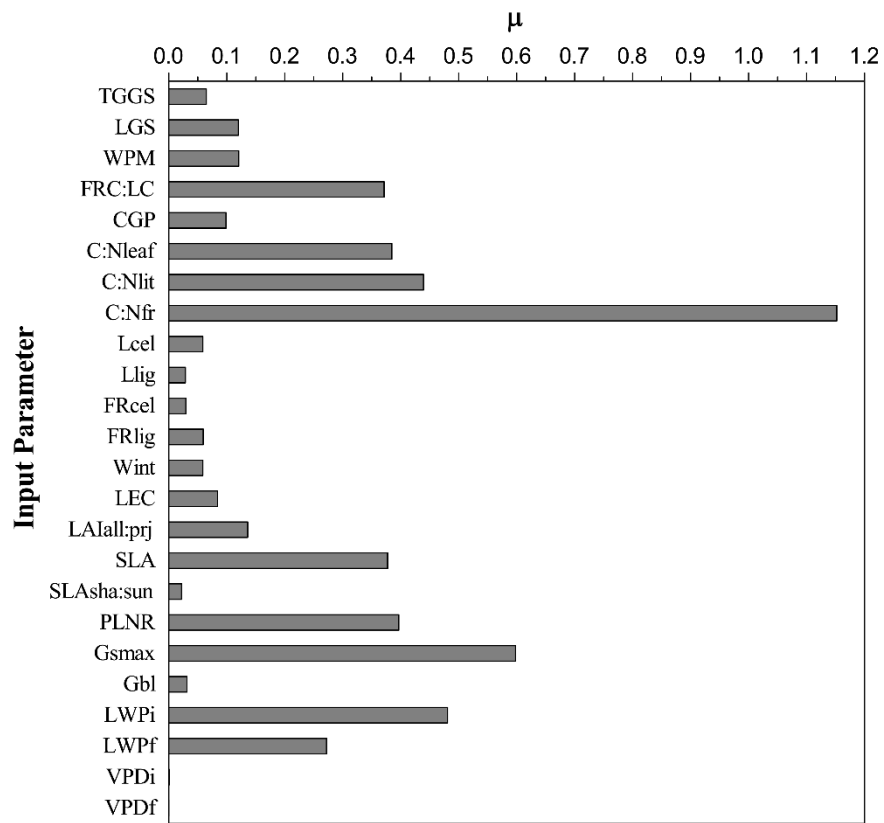
$$\mu_i = \sum_{j=1}^{r} d_i(j)/r \tag{2}$$

and

$$\sigma_i = \sqrt{\sum_{j=1}^{r} (d_i(j) - \mu_i)^2 / r} \tag{3}$$

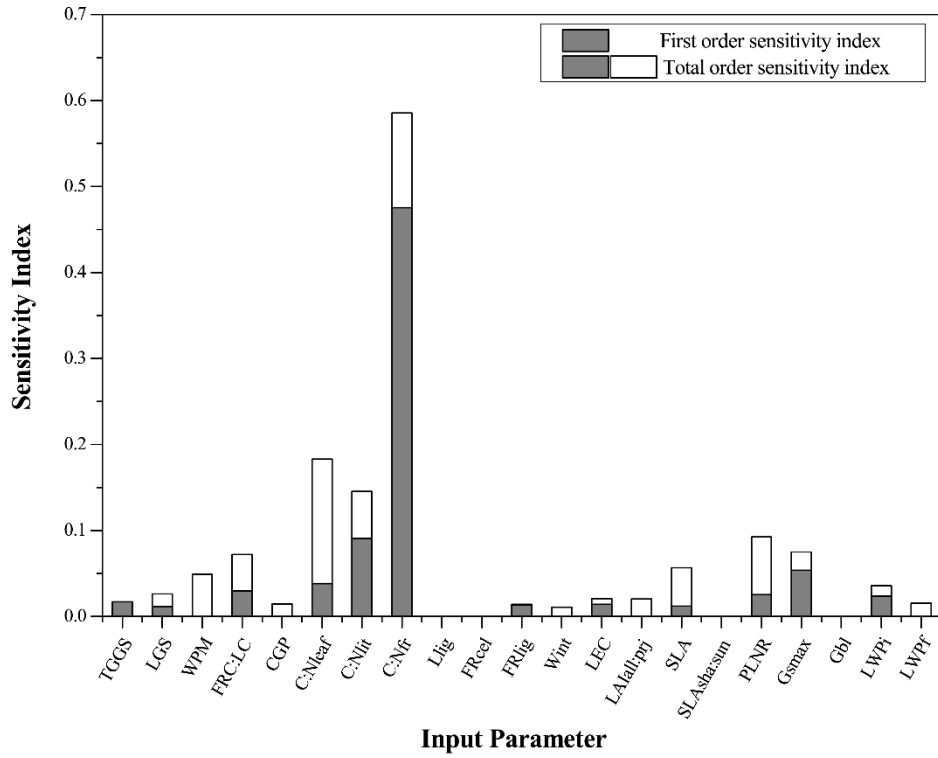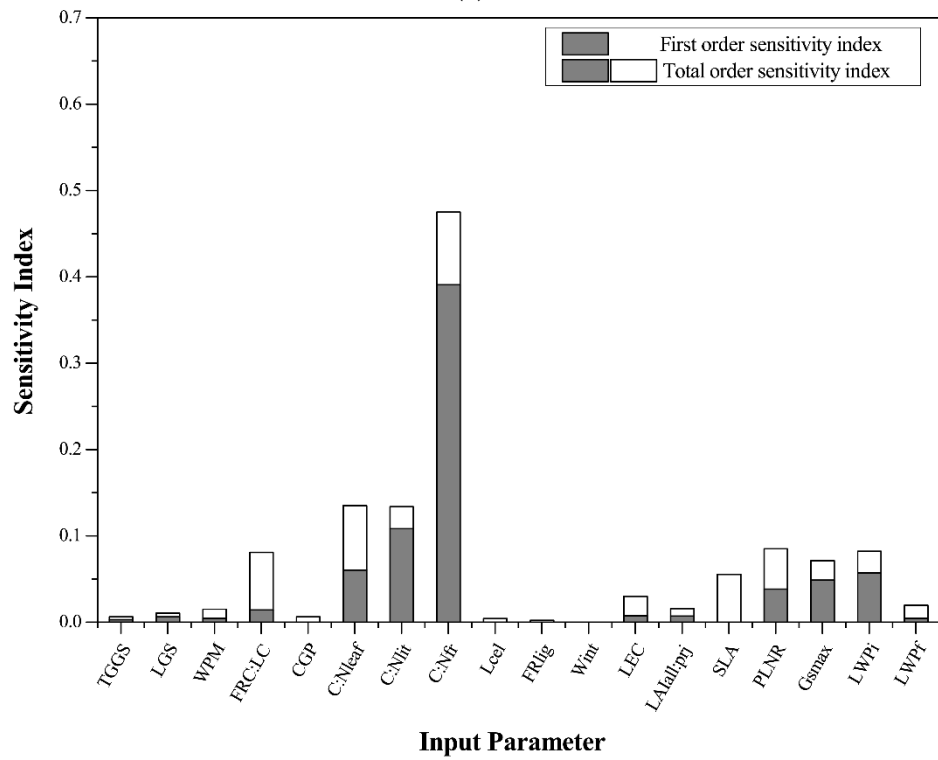where μ_i and σ_i are the mean and standard deviation of d_i, respectively.
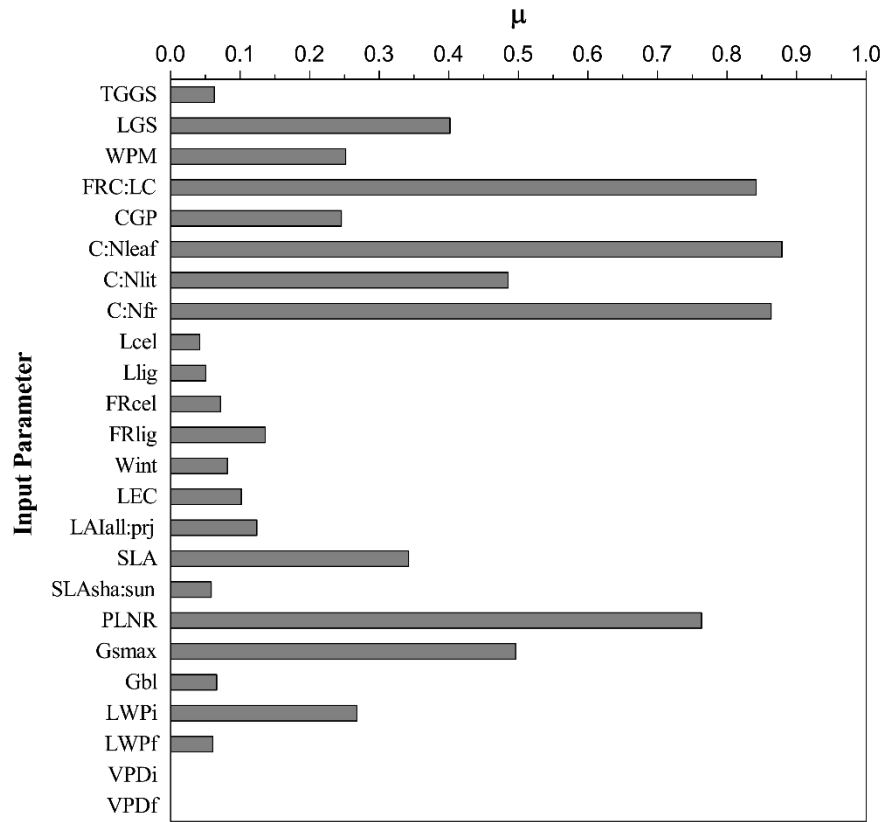
Figure 1. Morris sensitivity indices of mean annual GPP to the input ecophysiological parameters. (**a**) Haibei Station (alpine meadow); (**b**) Damxung Station (alpine steppe).

Figure 2. Sobol' sensitivity indices of mean annual GPP to the input ecophysiological parameters screened by the Morris method. (**a**) Haibei Station (alpine meadow); (**b**) Damxung Station (alpine steppe).
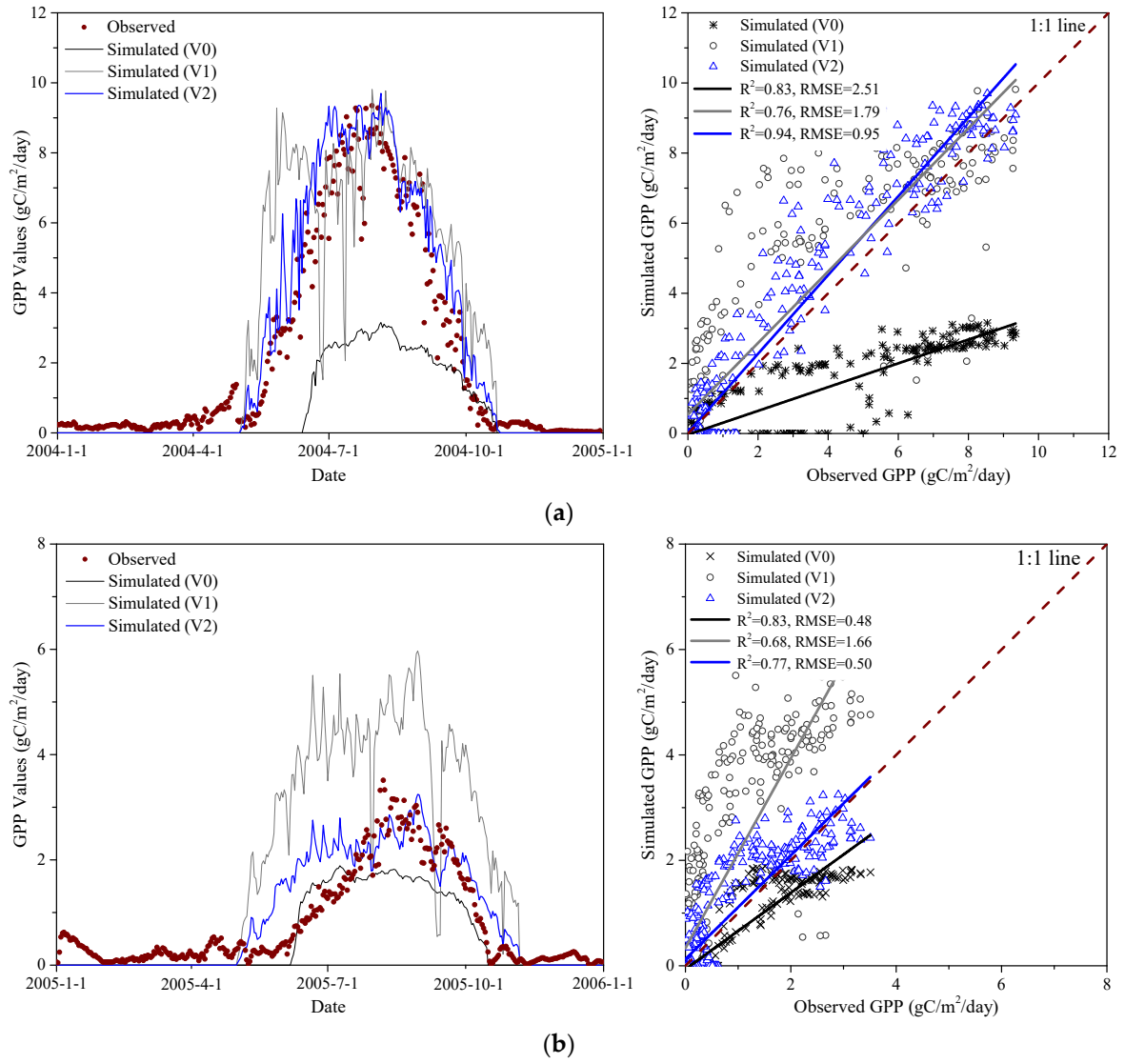
Figure 3. Comparisons between GPP derived from EC measurements and GPP simulated by the version of V0, V1, and V2 for the validation year. (**a**) Haibei Station (alpine meadow); (**b**) Damxung Station (alpine steppe).
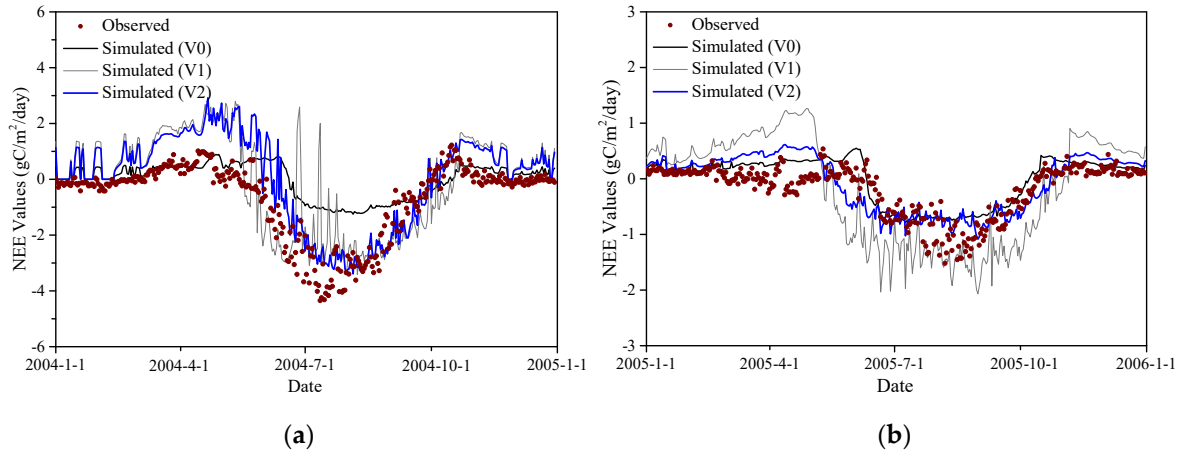
Figure 4. Comparisons between NEE measured by EC technique and NEE simulated by the version of V0, V1, and V2 for the validation year. (**a**) Haibei Station (alpine meadow); (**b**) Damxung Station (alpine steppe).
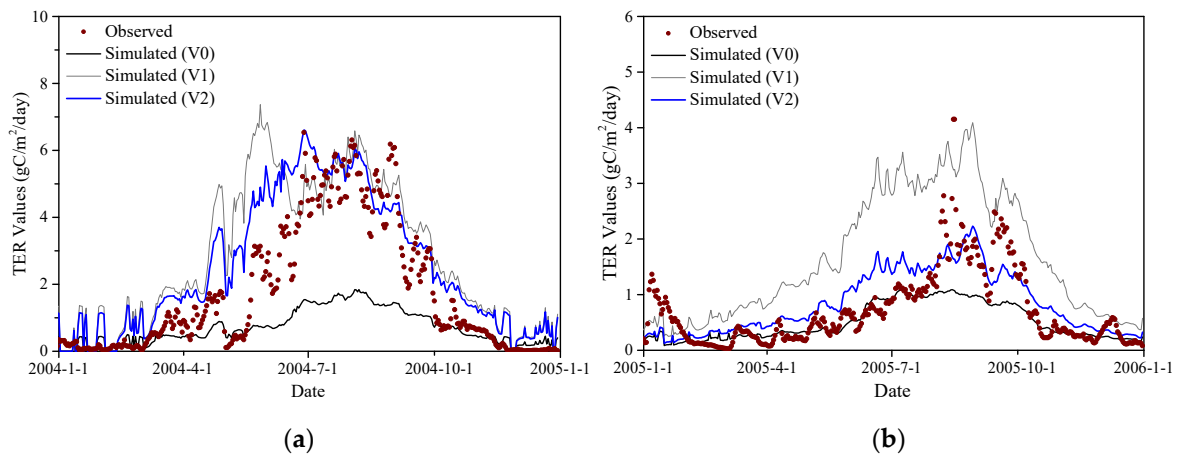

Figure 5. Comparisons between TER derived from EC measurements and TER simulated by the version of V0, V1, and V2 for the validation year. (**a**) Haibei Station (alpine meadow); (**b**) Damxung Station (alpine steppe).