(1) EmpBVOC - Empirical model of BVOC emissions for some typical ecosystems in China

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(3) Available modes for the model runs: Research and operational

(4) Components & processes: Atmosphere, Biosphere & Physical, Chemical, Biological

(5) Brief model description

Empirical BVOC emission model is a model to estimate BVOC emissions on a canopy level. Based on PAR energy balance, an empirical BVOC emission model was developed that includes the processes of BVOC emissions and PAR transfer above the canopy level, including PAR absorption and consumption, and scattering by gases, liquids, and particles (**GLPs**). The input parameters are solar radiation (PAR, S, Q) and water vapor pressure. Simulated BVOC emissions (including isoprene and monoterpenes) were in agreement with observations. A brief introduction about the empirical emission model is as follows (*Bai et al., 2016*). Three important processes are considered when dealing with PAR transfer and consumption:

1. BVOC emissions and their interactions with PAR. Isoprene and dominant monoterpenes (e.g., α pinene, β pinene) are not PAR absorbers, but they do attenuate PAR. Their attenuations are expressed as $e^{-k_1 Itm}$, $e^{-k_2 Mtm}$, respectively, where k_1 and k_2 are the absorption coefficients of isoprene and monoterpenes (presumed to be unity), I and M are isoprene and monoterpene emission fluxes (mg m^{-2} h^{-1}), I = 0.5×**EFI**×0.1, M = 0.5×**EFM**, **EFI** and **EFM** are emission fluxes of isoprene and monoterpenes, 0.1 is a normalizing coefficient for isoprene, t is the sampling period (0.5 hour), and m is the optical air mass in the middle of the sampling period (dimensionless quantity).

2. PAR energy absorption and consumption by GLPs, **with emphasis on BVOCs through OH radicals.** The PAR energy absorption and utilization by GLPs is expressed by e^{-kWm} (a photochemical term) is given by 1 - $\triangle S/I_o$, where $\triangle S = 0.172\ (mW)^{0.303}$ is the absorption by water vapor of solar shortwave radiation (0.70-2.845 μm), W=0.021E$\times 30$, E is the average of water vapor pressure (hPa) at the ground during the sampling period, solar constant I_o = 1.94 cal $min^{-1}cm^{-2}$ (=1367 W m^{-2}), and k is the averaged absorption coefficient of water vapor in the wavelength range of 0.70-2.845 μm. The actual value of the photochemical term is determined observationally.

3. The scattering/attenuating roles of GLPs. The scattering term is $e^{-S/Q}$. S and Q are solar scattered and global radiation. S/Q (the scattering factor) is an indicator of the attenuation effect by GLPs (Bai, 2012, 2013).

Then, $e^{-k_1 Itm}$, $e^{-k_2 Mtm}$ and e^{-kWm} are multiplied by cos(Z) for getting their amounts at horizontal plane. Here, cos(Z) = 1/m, where Z is the solar zenith angle. The PAR balance at a horizontal plane for BVOCs are as follows (take isoprene as an example):

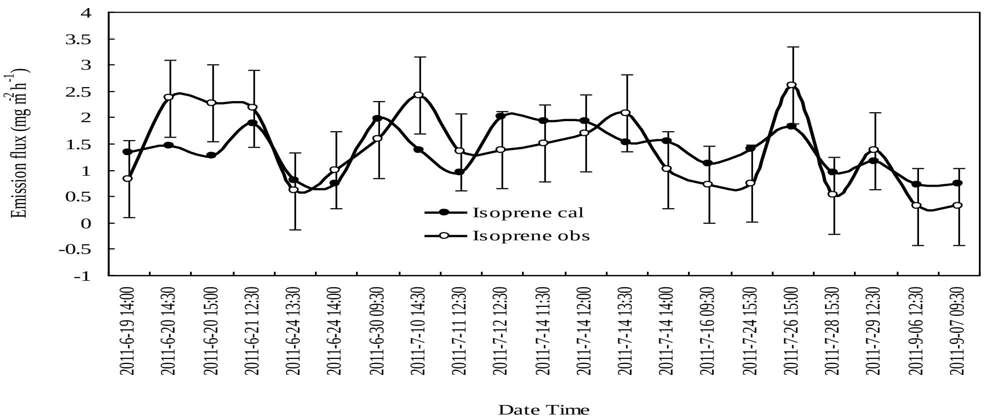
$$PAR = A_1' e^{-k_1 Itm} \times \cos(Z) + A_2' e^{-kWm} \times \cos(Z) + A_3' e^{-S/Q} + A_0'$$

The empirical emission models of isoprene was:

$$e^{-k_1 Itm} \times \cos(Z) = A_1\, PAR + A_2 e^{-kWm} \times \cos(Z) + A_3 e^{-S/Q} + A_0$$

Finally, on the analysis of observational data, an empirical BVOC emission model was developed (Bai et al., 2016).

Figure 1*: The observed and calculated isoprene emission fluxes (Isoprene cal and Isoprene obs, respectively) in the 2011 growing season, the observed fluxes show error bars as one standard deviation.*



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