Modelling growth of *Pinus taeda* and *Eucalyptus grandis* as a function of light sums modified by air temperature, vapour pressure deficit, and water balance

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Additional File 1

Calculation of radiation

Radiation measurements were not available for the study sites, so the Angstrom equation was used to calculate global horizontal radiation (MJ/m^2/day):

$$H_s = (a + b\frac{n}{N_o})H_o \quad \text{(S1)}$$

where n and N_o are actual and maximum sunshine duration respectively (hours), H_o extraterrestrial radiation (MJ/m^2/day), a and b are parameters. This equation was adjusted for 17 meteorological stations in Uruguay by Abal et al. (2010) for developing solar maps, hence, the parameters' values were interpolated to 500 m x 500 m cells using thin plates splines in order to have values for each plot location.
H_o was calculated for each day of the year as described by Landsberg and Sands (2011):

$$H_o = \frac{0.0864}{\pi} d_r \left[\frac{\pi}{24} h_d \sin(\varphi)\sin(\delta) + \cos(\varphi)\cos(\delta)\sin\left(\frac{\pi}{24} h_d\right)\right] \quad \text{(S2)}$$

where d_r is inverse relative distance Earth-Sun, ω_s is sunrise hour angle (rad), φ is latitude (rad), δ is solar declination (rad). Those variables are calculated as follows:

$$d_r = G_{sc}\left[1 + 0.033cos\left(2\pi\frac{J}{365}\right)\right] \quad \text{(S3)}$$

$$\delta = 0.410152374219sin(0.017202418893n_{ve}) \quad \text{(S4)}$$

$$\omega_s = cos^{-1}\left(-tan(\varphi)tan(\delta)\right) \quad \text{(S5)}$$

$$N = \frac{24}{\pi}\omega_s \quad \text{(S6)}$$

Where G_{sc} the solar constant = 1367 Wm^{-2}; J the number of the day in the year between 1 and 365 or 366 (starting on January 1st); n_{ve} the number of days since vernal equinox; and h_d daylength.
In a second step, monthly average daily values of global horizontal radiation were adjusted to account for the slopes and aspects of each plot. For this purpose, the formulation proposed by (Tian et al. 2001), based on Revfeim (1978) was used:

$$H_s{}^* = H_s[R_d(1-K_r) + f_b K_r + 0.12(1-f_b)] \tag{S7}$$

Where $H_s{}^*$ is the global radiation received on a surface with an orientation α and a slope β,f_b is a "slope reduction factor" calculated as $1-\frac{\beta}{180}$. R_d is the direct radiation proportion of that on a flat surface given aspect and slope, which was calculated as proposed by (Revfeim 1978):

$$R_d = \left[\frac{sin(\varphi)}{sin(\varphi^*)}\right]\left[\frac{d_d - sin(d)cos(e_e)cos(g)}{cos(\omega_s{}^*)}\right]\left[\frac{1}{\omega_s - tan(\omega_s)}\right] \tag{S8}$$

Where:

$$d_d = \frac{(h_1 - h_0)}{2} \tag{S9}$$

$$e_e = \frac{(h_1 + h_0)}{2} \tag{S10}$$

$$g = sin^{-1}[sin(\beta)sin(\alpha)sec(\varphi^*)] \tag{S11}$$

$$\varphi^* = sin^{-1}[sin(\varphi)sin(\beta) - cos(\varphi)sin(\beta)cos(\alpha)] \tag{S12}$$

$$\omega_s{}^* = cos^{-1}[tan(\varphi^*)tan(\delta)] \tag{S13}$$

where h_1 and h_0 are sunrise and sunset hour angle on an arbitrary slope, respectively. The algorithm suggested by Erbs et al. (1982) was used for computing the proportion of diffuse radiation to the global horizontal radiation(K_r):
For $\omega_s \leq 1.4208$ and $0.3 \leq K_t \leq 0.8$

$$K_r = 1.391 - 3.560K_t + 4.189{K_t}^2 - 2.137{K_t}^3 \tag{S14}$$

For $\omega_s > 1.4208$ and $0.3 \leq K_t \leq 0.8$

$$K_r = 1.311 - 3.022K_t + 3.427{K_t}^2 - 1.821{K_t}^3 \tag{S15}$$

where K_t is the proportion of global horizontal radiation to extra-terrestrial radiation ($\frac{H_s}{H_o}$).