Supplement of

Improved isoprene emission estimates over the Finnish boreal forest using the MEGANv3.2 model

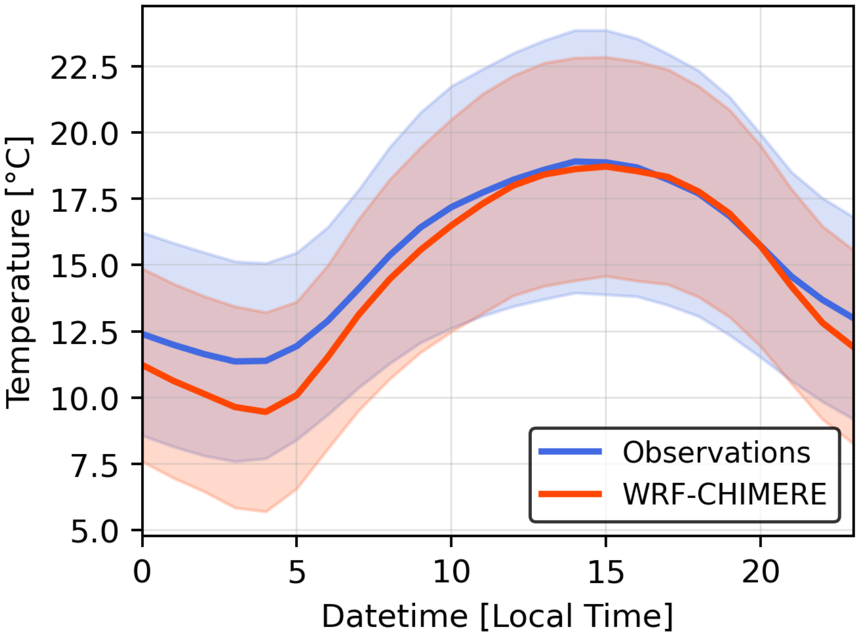

Figure S1. Diurnal variation of observed and WRF-CHIMERE modeled temperatures at SMEAR-II, showing the mean (solid lines) and the standard deviation (shaded areas) for both datasets.

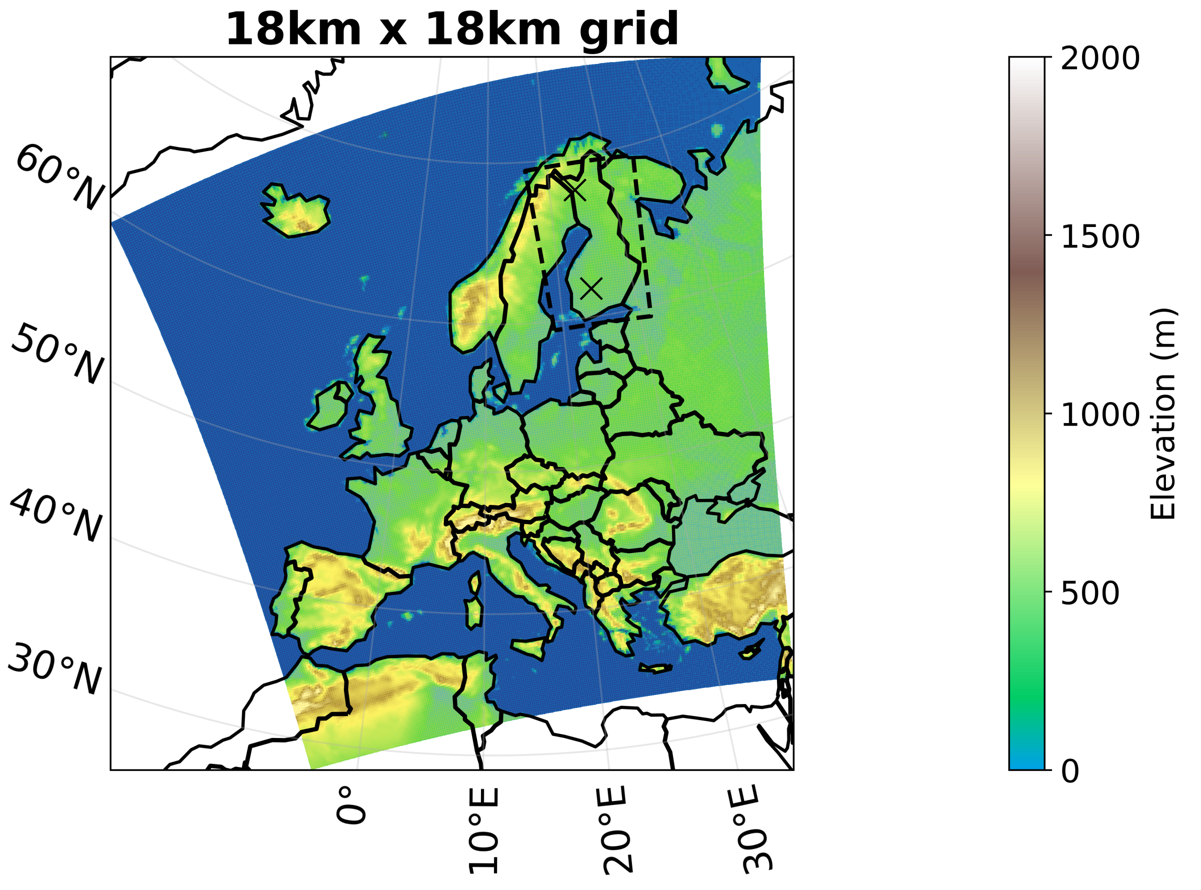

Figure S2. Domain configuration for the sensitivity simulation MEG3-UPD-CC-newD01. The nested domain is not modified.

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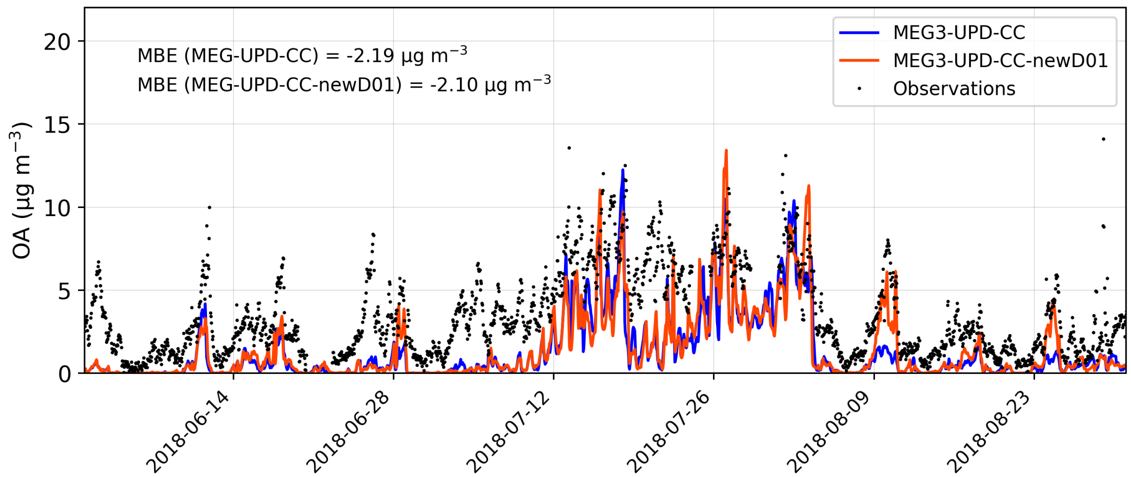

Figure S3. Evaluation of the organic aerosol concentration in Hyytiälä. The observations (black dots) are compared to the MEG3-UPD-CC simulation and the MEG3-UPD-CC-newD01 simulation which include a larger first domain covering the whole Europe.

S1 Canopy correction

As described in Cholakian et al. (2022), in the standard version of WRF-CHIMERE, vertical diffusion (K_z) is calculated using the parametrization (Eq. 1) from Troen and Mahrt (1986).

$$K_z = kw_s \frac{z}{h}(1-\frac{z}{h})^2 \quad \text{(S1)}$$

where k is the von Kármán constant and the vertical velocity scale w_s is calculated depending on the atmospheric stability, for stable condition:

$$w_s = \frac{u_*}{1+4.7\frac{z}{L}} \quad \text{(S2)}$$

while for unstable conditions:

$$w_s = (u_*^3 + 2.8ew_*^3)^{1/3} \quad \text{(S3)}$$

where z is the altitude of the layer, h is the boundary layer height, u_* is the friction velocity, and L is the Monin-Obukhov length, and $e = min(0.1, z/h)$.

In this paper we used a diffusivity and horizontal wind correction factors ($\phi_w(\xi)$ and $\phi_h(\xi)$, respectively) as described in Cholakian et al. (2022):

$$\phi_w(\xi) = \begin{cases} 1.25\,(1+3|\xi|)^{-1/3}, & -2 \le \xi < 0, \\ 1.25\,(1+0.2\xi), & 0 \le \xi < 1, \end{cases} \quad \text{(S4)}$$

$$\phi_h(\xi) = \begin{cases} (1+16|\xi|)^{-1/2}, & -2 \le \xi < 0, \\ (1+5\xi), & 0 \le \xi < 1, \end{cases} \quad \text{(S5)}$$

where the stability factor ξ is calculated according to:

$$\xi = \begin{cases} \dfrac{h_c}{L}, & z < z_{\mathrm{ruf}}, \\ \dfrac{z-d}{L}, & z \geq z_{\mathrm{ruf}}, \end{cases} \tag{S6}$$

where h_c is the canopy height, z in the altitude, d is the zero-plane displacement for momentum, and $z_{ruf} \simeq 2.3h_c$. In the end, K_z and the horizontal wind speed components in the first layer of the model are multiplied by $\phi_w(\xi)$ and $\phi_h(\xi)$ respectively.

References

Cholakian, A., Beekmann, M., Siour, G., Coll, I., Cirtog, M., Ormeño, E., Flaud, P.-M., Perraudin, E., and Villenave, E.: Simulation of organic aerosol, its precursors and related oxidants in the Landes pine forest in south-western France: Need to account for domain specific land-use and physical conditions, Atmospheric Chemistry and Physics Discussions, 2022, 1–41, https://doi.org/10.5194/acp-23-3679-2023, 2022.

Troen, I. and Mahrt, L.: A simple model of the atmospheric boundary layer; sensitivity to surface evaporation, Boundary-Layer Meteorology, 37, 129–148, https://doi.org/10.1007/BF00122760, 1986.