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The influence of plant water stress on vegetation–atmosphere exchanges: implications for ozone modelling

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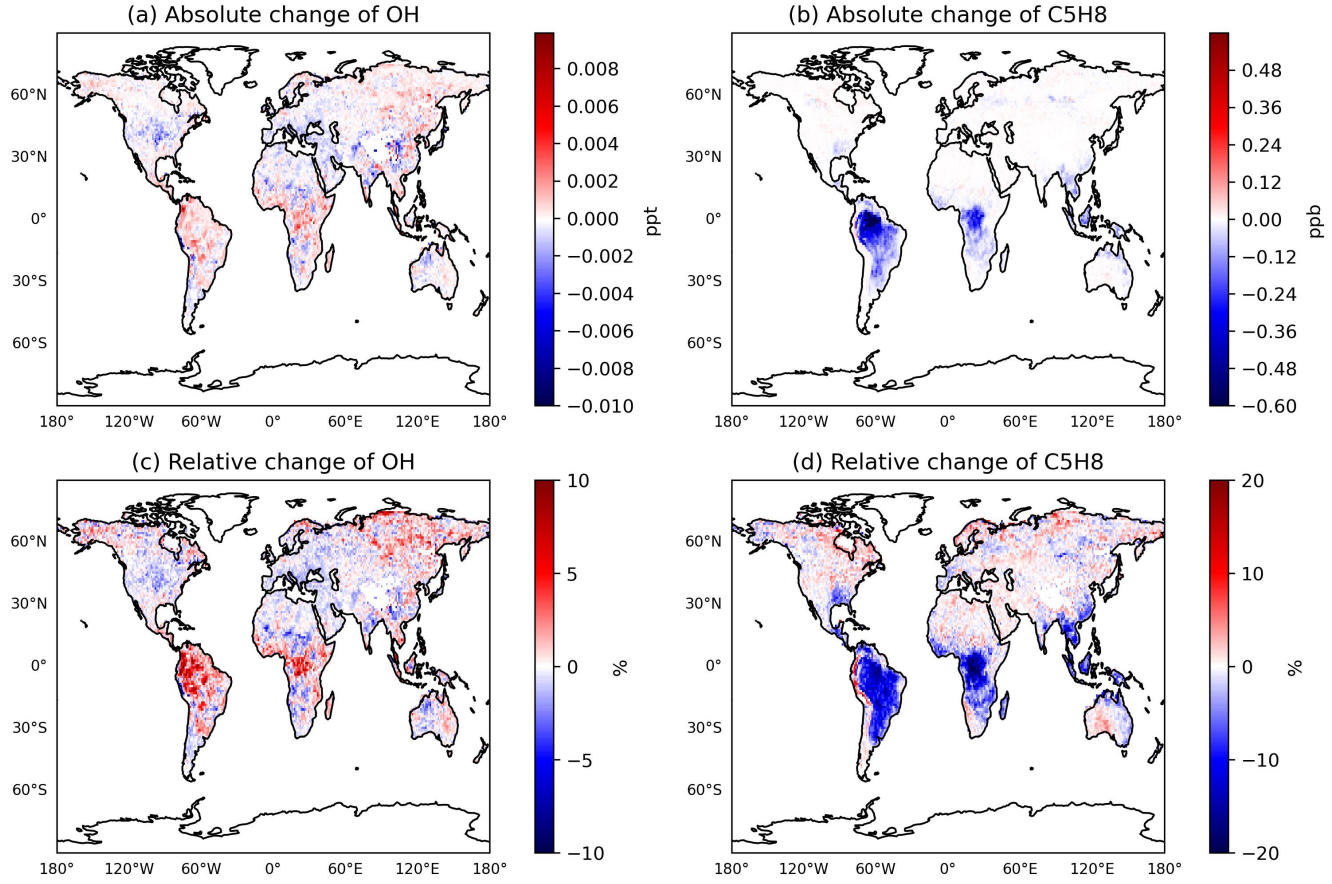

Figure S1. Annual mean relative change of OH (a) and isoprene (b) mixing ratio at the surface (for regions with isoprene>50 ppt) (*LWPfrac-REF*).

S1 Description of the photosynthesis model

According to the established IFS model, A_n is derived from the saturation level A_m (among others) and is used for the calculation of g_s afterwards. The calculation of the net assimilation rate (A_n) distinguishes for a CO_2 limiting and the radiation limiting regime which changes at level A_m (from radiation to CO_2 limiting regime):

$$A_m = A_{m,max}\,[1 - \exp(-g_m(C_i - \Gamma)/A_{m,max})] \tag{S1}$$

The maximum photosynthetic capacity $A_{m,max}$ is calculated as follows:

$$A_{m,max}(T_s) = \frac{A_{m,max}(25)Q_{10Am,max}^{(T_s-25)/10}}{(1+e^{0.3(T_{1am,max}-T_s)})(1+e^{0.3(T_{2am,max}-T_s)})} \tag{S2}$$

with $T_{1am,max} = 8°\mathrm{C}$, $T_{2am,max} = 38°\mathrm{C}$ and $A_{m,max} = 2.2mg(CO_2)m^{-2}s^{-1}$. The mesophyll conductance g_m is calculated:

$$g_m(T_s) = \frac{g_m(25°C)Q_{10gm}^{(T_s-25)/10}}{(1+e^{0.3(T_{1gm}-T_s)})(1+e^{0.3(T_{2gm}-T_s)})} \tag{S3}$$

with $T_{1gm} = 5°\text{C}$ and $T_{2gm} = 36°\text{C}$. T_s is the leaf surface temperature (here 2m temperature) and the Q_{10} constant is 2. $g_m(25°C)$ depends on soil moisture and is further described in ECMWF (2021). An exponential transition function represents A_n in dependence on radiation and A_m. According to Calvet et al. (1998, 2004), plants respond in the a complex way through the mesophyll conductance (g_m) to soil moisture stress:

$$g_m(25°C) = g_m^N \frac{f(W_s)}{W_{crit}} \tag{S4}$$

$$g_m(25°C) = g_m^N + g_m^0(25°C) \frac{f(W_s) - W_{crit}}{1 - W_{crit}} \tag{S5}$$

where $g_m^0(25°C)$ is a species-dependent parameter (here: 25 $mm\ s^{-1}$). g_m^N is the stressed value of g_m and described in ECMWF (2021).