Supplementary Material for

Characterisation of NO production and consumption: New insights by an improved laboratory dynamic chamber technique

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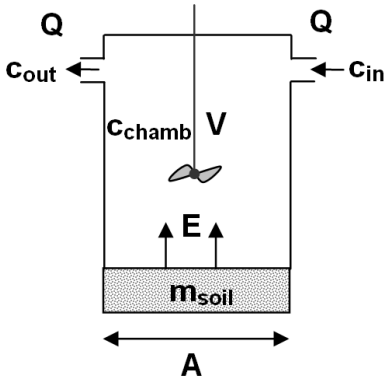
S1. Determination of soil sample's moisture from measurements of water vapour in the headspace of the laboratory dynamic chamber - a mass balance approach

Considering the H_2O vapour mass flux, i.e. the derivative of M_{H2O} with respect to time ($\partial M_{H2O}/\partial t = \Phi_{H2O}$ in kg s^{-1}), the individual flux components of the laboratory dynamic chamber system are defined as

Φ_{in} = mass flux of H_2O into chamber: $Q \cdot c_{H2O,in}$

Φ_{out} = mass flux of H_2O out of chamber: $Q \cdot c_{H2O,out}$

Φ_{soil} = mass flux of H_2O due to evaporation E from soil: $A \cdot E$



where $c_{H2O,in}$, $c_{H2O,out}$, and $c_{H2O,cham}$ are H_2O vapor concentrations (in kg m^{-3}, i.e. absolute humidity) at the inlet, the outlet and within the dynamic chamber; Q is the purging rate (m^3 s^{-1}), A is the cross section (m^2), and V is the volume (m^3) of the dynamic chamber. E is the flux density of H_2O vapour due to evaporation from the soil sample (kg m^{-2} s^{-1}), and m_{soil} is the (total) mass of the soil sample in kg ($m_{soil} = m_{soil,dry} + m_{soil,water}$). Furthermore, there are two well accepted prerequisites (c.f., Pape et al., 2009): (a) $c_{H2O,cham} = c_{H2O,out}$ (due to the effective mixing of the headspace's air by the fan and the high purging rate Q (i.e., short exchange time τ of the chamber's headspace volume), and (b) the H_2O vapour mass flux from the soil sample ($A \cdot E$) is equal to the temporal change of the total soil mass ($d\,m_{soil}(t)/d\,t$).

The dynamic chamber's mass balance of the H_2O vapour mass flux is then given by:

$$V \frac{d\,c_{H2O,cham}(t)}{d\,t} = Q\,c_{H2O,in}(t) - Q\,c_{H2O,cham}(t) + \frac{d\,m_{soil}(t)}{d\,t} \qquad \text{(S1)}$$

For the sake of convenience, data of H_2O vapor are considered only in terms of the measured signal s (in arbitrary units), where the relation between s and the H_2O vapour concentration is given by $c(t) = g \cdot s(t)$. Then, Eq. (S1) reads as follows:

$$V\,g\,\frac{d\,s_{H2O,cham}(t)}{d\,t} = g\,Q\,s_{H2O,in}(t) - g\,Q\,s_{H2O,cham}(t) + \frac{d\,m_{soil}(t)}{d\,t} \qquad \text{(S1.1)}$$

For each experiment, the total soil mass is determined (weighing) at the begin ($t = t_0$) and the end ($t = t_S$), as well as $s_{H2O,in}(t_0)$, $s_{H2O,in}(t_S)$, $s_{H2O,cham}(t_0)$, and $s_{H2O,cham}(t_S)$. Furthermore, we assume, that within a sufficiently short time interval, namely between t_i and t_{i-1}, the temporal change of $s_{H2O,cham}(t)$ and $s_{H2O,in}(t)$ is linear, i.e.,

$$s_{H2O,in}\left(\frac{t_{i-1}+t_i}{2}\right) = \frac{s_{H2O,in}(t_{i-1}) + s_{H2O,in}(t_i)}{2} \tag{S2.1}$$

$$s_{H2O,cham}\left(\frac{t_{i-1}+t_i}{2}\right) = \frac{s_{H2O,cham}(t_{i-1}) + s_{H2O,cham}(t_i)}{2} \tag{S2.2}$$

Re-arranging of Eq. (S1) gives :

$$\frac{d\,m_{soil}(t)}{d\,t} = g\,Q\,s_{H2O,cham}(t) - g\,Q\,s_{H2O,in}(t) + V\,g\,\frac{d\,s_{H2O,cham}(t)}{d\,t} \tag{S1.2}$$

Integration of both sides of Eq.(S1.2) with respect to t_0 and t_s:

$$\int_{t_0}^{t_S}\frac{d\,m_{soil}(t)}{dt}\,dt = g\,Q\int_{t_0}^{t_S}s_{H2O,cham}(t)\,dt - g\,Q\int_{t_0}^{t_S}s_{H2O,in}(t)\,dt + V\,g\,Q\int_{t_0}^{t_S}\frac{d\,s_{H2O,cham}(t)}{dt}\,dt \tag{S3}$$

This is equivalent to:

$$m_{soil}(t_s) - m_{soil}(t_0) = V\,g\left[s_{H2O,cham}(t_s) - s_{H2O,cham}(t_0)\right] + g\,Q\int_{t_0}^{t_S}s_{H2O,cham}(t)dt - g\,Q\int_{t_0}^{t_S}s_{H2O,in}(t)dt \tag{S3.1}$$

Considering individual time sub-intervals (t_i ; t_{i-1}), then both integrals of Eq. (S3.1) can be written as:

$$\int_{t_0}^{t_S}s_{H2O,cham}(t)\,dt = \sum_{i=1}^{i=S}\int_{t_{i-1}}^{t_i}s_{H2O,cham}(t)\,dt \tag{S4.1}$$

$$\int_{t_0}^{t_S}s_{H2O,in}(t)\,dt = \sum_{i=1}^{i=S}\int_{t_{i-1}}^{t_i}s_{H2O,in}(t)\,dt \tag{S4.2}$$

Making use of the “mean value theorem of integral calculus”, and assuming that (a) $s_{H2O,cham}(t)$ and $s_{H2O,in}(t)$ are between t_i and t_{i-1} sufficiently well approximated by linear representation, (b) $t_i - t_{i-1}$ is sufficiently small, then:

$$\int_{t_{i-1}}^{t_i} s_{H2O,cham}(t)\,dt \;=\; (t_i - t_{i-1})\;\frac{s_{H2O,cham}(t_i)+s_{H2O,cham}(t_{i-1})}{2} \tag{S5.1}$$

$$\int_{t_{i-1}}^{t_i} s_{H2O,in}(t)\,dt \;=\; (t_i - t_{i-1})\;\frac{s_{H2O,in}(t_i)+s_{H2O,in}(t_{i-1})}{2} \tag{S5.2}$$

Combining Eqs. (S4.1), (S4.2), (S5.1), (S5.2) with Eq. (S3.1) leads to:

$$m_{soil}(t_S) - m_{soil}(t_0) = g\left(V\left[s_{H2O,cham}(t_S) - s_{H2O,in}(t_0)\right] + S_0\right) \tag{S3.2}$$

where

$$S_0 = Q\left(\sum_{i=1}^{i=S}(t_i - t_{i-1})\frac{s_{H2O,cham}(t_i)+s_{H2O,cham}(t_{i-1})}{2} - \sum_{i=1}^{i=S}(t_i - t_{i-1})\frac{s_{H2O,in}(t_i)+s_{H2O,in}(t_{i-1})}{2}\right) \tag{S3.3}$$

which is equivalent to

$$S_0 = Q\left(\sum_{i=1}^{i=S+1}(T_i + T_{i-1})\left[s_{H2O,cham}(t_{i-1}) - s_{H2O,in}(t_{i-1})\right]\right);\quad T_i = \frac{t_i - t_{i-1}}{2};\; T_0 = T_{S+1} = 0 \tag{S3.4}$$

Re-arranging Eq. (S3.2) provides the formula to determine the proportionality factor *g* of *c(t)* and *s(t)*:

$$g \;=\; \frac{m_{soil}(t_S) - m_{soil}(t_0)}{V\left[s_{H2O,cham}(t_S) - s_{H2O,cham}(t_0)\right] + S_0} \tag{S6}$$

which includes the "calibration" of the integrated, arbitrary H_2O vapour signal by the amount of evaporated soil water which has been simply determined by weighing the soil sample before and after the experiment.

With the knowledge of *g*, a recursion formula for the calculation of the actual soil mass (and hence the actual soil moisture) is developed from Eq. (S3.2). Considering individual time sub-intervals (t_i ; t_{i-1}) instead of (t_0 ; t_S), Eq. (S3.1) can be formulated as:

$$\begin{aligned} m_{soil}(t_i) - m_{soil}(t_{i-1}) = {} & V g\left[s_{H2O,cham}(t_i) - s_{H2O,cham}(t_{i-1})\right] + \\ & + g Q \int_{t_{i-1}}^{t_i} s_{H2O,cham}(t)\,dt \;- g Q \int_{t_{i-1}}^{t_i} s_{H2O,in}(t)\,dt \end{aligned} \tag{S7}$$

Considering Eqs. (S5.1) and (S5.2), and resolving Eq. (S7) for $m_{soil}(t_i)$ provides the desired recursion formula for calculation of $m_{soil}(t_i)$:

$$m_{soil}(t_i) = m_{soil}(t_{i-1}) + V\,g\left[s_{H2O,cham}(t_i) - s_{H2O,cham}(t_{i-1})\right] + S_i \quad \text{(S7.2)}$$

where

$$S_i = \left(T_i + T_{i-1}\right)\left[s_{H2O,cham}(t_{i-1}) - s_{H2O,in}(t_{i-1})\right]; \quad T_i = \frac{t_i - t_{i-1}}{2};\ T_0 = T_{S+1} = 0 \quad \text{(S7.3)}$$

S2. Standard deviation of the proportionality factor *g*, actual total soil mass $m_{soil}(t_i)$, and actual gravimetric soil moisture $\theta_g(t_i)$

To calculate σ_g, Eq. (S6) and Eq. (S3.4) are recalled:

$$g = \frac{m_{soil}(t_S) - m_{soil}(t_0)}{V\left[s_{H2O,cham}(t_S) - s_{H2O,cham}(t_0)\right] + S_0} \quad \text{(S6)}$$

$$S_0 = Q\left(\sum_{i=1}^{i=S+1}\left(T_i + T_{i-1}\right)\left[s_{H2O,cham}(t_{i-1}) - s_{H2O,in}(t_{i-1})\right]\right); \quad T_i = \frac{t_i - t_{i-1}}{2};\ T_0 = T_{S+1} = 0 \quad \text{(S3.4)}$$

Consequently, the derivatives of g with respect to $m_{soil}(t_0)$, $m_{soil}(t_S)$, V, $s_{H2O,cham}(t_0)$, $s_{H2O,cham}(t_S)$, Q, and S_0, as well as their standard deviations ($\sigma_{msoil(t0)}$, $\sigma_{msoil(tS)}$, σ_V, $\sigma_{scham(t0)}$, $\sigma_{scham(tS)}$, σ_Q, and σ_{S0}) have to be considered. Application of general Gaussian error propagation leads to:

$$\sigma_g = \pm\left(\frac{\Delta m}{D^2}\right)\left[\left(\frac{D}{\Delta m}\right)^2\left(\sigma^2_{m\,soil\,(tS)} + \sigma^2_{m\,soil\,(t0)}\right) + \left(-\Delta s\,\sigma_V\right)^2 + V^2\left(\sigma^2_{scham\,(tS)} + \sigma^2_{scham\,(t0)}\right) + \sigma^2_{S0}\right]^{\frac{1}{2}} \quad \text{(S8)}$$

where

$$D = V\,\Delta s + S_0 \quad \text{(S8.1)}$$

$$\Delta m = m_{soil}(t_S) - m_{soil}(t_0) \quad \text{(S8.2)}$$

$$\Delta s = s_{H2O,cham}(t_S) - s_{H2O,cham}(t_0) \quad \text{(S8.3)}$$

$$\sigma^2_{S0} = \left(\sigma_Q\,\frac{S_0}{Q}\right)^2 + Q^2\sum_{i=1}^{i=S+1}\left(T_i + T_{i-1}\right)^2\left[\sigma^2_{scham(ti-1)} + \sigma^2_{sin(ti-1)}\right]; \quad T_i = \frac{t_i - t_{i-1}}{2};\ T_0 = T_{S+1} = 0 \quad \text{(S8.4)}$$

Here – for the sake of simplicity – the most simple formulation of Eq. (S8.4) is given, which is only valid for $\sigma_{s\,cham\,(ti)} = \sigma_{s\,cham\,(ti-1)} = \sigma_{s\,in\,(ti)} = \sigma_{s\,in\,(ti-1)} = \sigma_s$ = const. (as shown by experi-

mental evidence). If $\sigma_{s\,cham\,(ti)} \neq \sigma_{s\,cham\,(ti-1)} \neq \sigma_{s\,in\,(ti)} = \sigma_{s\,in\,(ti-1)} \neq \sigma_s \neq$ const., σ_{S0} can still be formulated in full, but becomes more complex. Since σ_V and σ_Q are usually negligible (1% of V and Q, respectively), $\sigma_{msoil(t0)}$, $\sigma_{msoil(tS)}$, $\sigma_{scham(t0)}$, and $\sigma_{scham(tS)}$ are known from corresponding measurements, Eqs. (S8) and (S8.4) read as follows:

$$\sigma_g = \pm\left(\frac{\Delta m}{D^2}\right)\left[\left(\frac{D}{\Delta m}\right)^2\left(\sigma^2_{m\,soil\,(tS)} + \sigma^2_{m\,soil\,(t0)}\right) + V^2\left(\sigma^2_{s\,cham\,(tS)} + \sigma^2_{s\,cham\,(t0)}\right) + \sigma^2_{S0}\right]^{\frac{1}{2}} \tag{S9}$$

$$\sigma^2_{S0} = 2\,\sigma^2_S\,Q^2\sum_{i=1}^{i=S+1}\left(T_i + T_{i-1}\right)^2; \qquad T_i = \frac{t_i - t_{i-1}}{2};\; T_0 = T_{S+1} = 0 \tag{S9.1}$$

To calculate the standard deviation $\sigma_{m\,soil\,(ti)}$ of the actual total soil mass $m_{soil}(t_i)$, Eqs. (S7.2) and (S7.3) are recalled:

$$m_{soil}(t_i) = m_{soil}(t_{i-1}) + V\,g\left[s_{H2O,cham}(t_i) - s_{H2O,cham}(t_{i-1})\right] + S_i \tag{S7.2}$$

$$S_i = \left(T_i + T_{i-1}\right)\left[s_{H2O,cham}(t_{i-1}) - s_{H2O,in}(t_{i-1})\right]; \quad T_i = \frac{t_i - t_{i-1}}{2};\; T_0 = T_{S+1} = 0 \tag{S7.3}$$

The most simple formulation for $\sigma_{m\,soil\,(ti)}$ is derived for negligible σ_V and σ_Q and for $\sigma_{s\,cham\,(ti)}$ = $\sigma_{s\,cham\,(ti-1)}$ = $\sigma_{s\,in\,(ti)}$ = $\sigma_{s\,in\,(ti-1)}$ = σ_s = const. (see above), namely

$$\sigma_{m\,soil\,(ti)} = \pm\left[\sigma^2_{m\,soil\,(ti-1)} + \left[\sigma_g\,V\left(s_{cham}(t_i)\left(1 + QT_i\right) - s_{cham}(t_{i-1})\left(1 - QT_i\right) - \right.\right.\right.$$

$$\left.\left.\left. - QT_i\left(s_{in}(t_i) + s_{in}(t_{i-1})\right)\right)\right]^2 + 2\sigma^2_S\,g^2\left(\left(V + QT_i\right)^2 + Q^2T_i^2\right)\right]^{\frac{1}{2}} \tag{10}$$

As already mentioned above for σ_{S0}, if $\sigma_V \neq 0$, $\sigma_Q \neq 0$ and $\sigma_S \neq$ const., the formulation for $\sigma_{m\,soil\,(ti)}$ can still be written in full, but becomes more complex.

The dimensionless gravimetric soil moisture is defined by $\theta_g = (m_{soil,wet} - m_{soil,dry})/m_{soil,dry}$. During the entire period of drying-out a soil sample in the laboratory dynamic chamber, the actual gravimetric soil moisture $\theta_g(t_i)$ is then given by

$$\theta_g(t_i) = \frac{m_{soil}(t_i) - m_{soil}(t_S)}{m_{soil}(t_S)} \tag{S11}$$

where $m_{soil}(t_S)$ is the mass of the soil sample at the end ($t = t_S$) of each laboratory drying-out experiment (determined by weighing). Application of Gaussian error propagation calculus to Eq. (11) delivers for $\sigma_{\theta g(ti)}$,

$$\sigma_{\theta g(ti)} = \pm\left[\left(\frac{\sigma_{m\,soil\,(ti)}}{m_{soil}(t_S)}\right)^2 + \left(-\frac{m_{soil}(t_i)}{m_{soil}^2(t_S)}\sigma_{m\,soil\,(tS)}\right)^2\right]^{\frac{1}{2}} \quad \text{(S12)}$$

S3. Control and automatic adjustment of incubation conditions

S3.1 Control of incubation conditions

A scheme of the control of the improved laboratory dynamic chamber system is shown Figure S1. The control routine starts at the lower of the selected soil temperatures; then humidification and the lower of the selected NO mixing ratios of the flushing air stream are adjusted for the "Meas low" and the "Flush flow" (Fig. S2). Next, the control scheme checks whether the system's temperature, the relative humidity, and the NO mixing ratio of the flushing air stream fulfil pre-scribed stability criteria, namely ±0.2 K, ±3 %, and <1 ppb (low NO mixing ratio; < 2 % in case of higher NO mixing ratio), respectively. Then the gas stream is sequentially cycled through all chambers, where the cycle serving box0 to box6 is called the "box cycle", and the cycle, which switches between low and high NO mixing ratio, is called the "NO cycle". Having completed a "box cycle" at low NO mixing ratio, the control scheme adjusts for the higher NO mixing ratio (usually 133 ppb). During the adjustment period, two gas streams are simultaneously probed. That gas stream, where NO mixing ratio is actually increasing is directed through the reference chamber (so-called "incoming air") and be measured by the NO-analyzer after the stability criterion (± 2% of prescribed mixing ratio) is reached. During this stabilization period, soil chambers are switched into the static mode to enable determination of the net CO_2 release through the measurement of the temporal increase of the CO_2 mixing ratio (see Fig. S3). It has to be noted that the CO_2 measurement starts after NO mixing ratio is already constant (t_{63} is 3 minutes for equilibration chambers' headspace NO mixing ratio within < ± 1 ppb). Control of the adjustment of NO mixing ratio and feedback observation of the stability criterion leads to that level of NO mixing ratio's temporal stability which is essential for the high precision NO measurements requested in this study. This is particularly important for the switch back to the lower of the two selected NO mixing ratios (usually "zero"-air). For practical reasons (temporal constraint for the entire drying-out experiment), it was decided to probe only three soil chambers in the static mode (4 minutes each) during one individual period of NO mixing ratio adjustment. The remainder of six soil

chambers is immediately probed after the “box cycle” is completed, and the next NO mixing ratio will be adjusted as part of the “NO cycle”. Now the system’s temperature is switched to the next higher/lower level accompanied by corresponding adjustment of the relative humidity of the flushing air stream. It needs 28 minutes (t_{63}) to adjust the system’s temperature (hence, soil temperature) and 2 minutes (t_{63}) for relative humidity. Another 10-15 minutes are allowed for satisfying corresponding stability criteria (i.e., ±0.2 K and ±3 %, respectively). Now, the “box cycle” at the lower NO mixing ratio level starts: three soil chambers (in static mode) are probed for CO_2 mixing ratio during the adjustment period of “incoming air” NO mixing ratio, and after its stabilization all six chambers (switched back to dynamic mode) are sequentially probed for each chamber’s headspace NO mixing ratio. Then, as part of the “NO cycle”, the control scheme switches to higher NO mixing ratio, chambers are switched to the static mode, the remainder of 6 chambers are probed for CO_2 mixing ratio during the adjustment period of the higher “incoming air” NO mixing ratio, chambers are switched to the dynamic mode, another “box cycle” will be completed before the control scheme switches the system’s temperature to the next lower/higher level. Finally, switching and cycling procedures are repeated until the soil is completely dried out.

For the sake of completeness, it should be noted that (i) the total time for drying-out can be extended by humidifying the air of the “Meas flow” as well as the “Flush flow”, (ii) response time (t_{63}) of the CO_2/H_2O-analyzer is < 10 s, and (iii) t_{63} of the NO-analyzer is 90 s. These response times are very small compared to those time periods which are necessary to switch and stabilize the incibation condition of the improved laboratory dynamic chamber system (s. above). Nevertheless, to eliminate any potential memory effects, which might be due the sequential switching from one chamber to another, only the last 90 s of data from the entire probing period (240 s) of each chamber are kept for further evaluation.

S3.2 Details of system’s temperature (soil temperature) control

The soil sample enclosed in the soil chamber can be characterized as a system of considerable thermal inertia, i.e., fast changes of system’s temperature (which is the air temperature inside the thermostat cabinet) will hardly impact the temperature of the soil sample. This is very fortunate for the investigation release rates at constant temperature, but once the soil temperature should be changed to another (pre-scribed) level, it will take a large amount of (heating/cool-

ing) energy and a long time until the system will be stable again. Therefore, a time discrete PI controller with an update rate of 5Hz was used to regulate the soil temperature in the improved laboratory dynamic chamber system. In general, a PI controller is comparing the difference of a constant set value and a changing input. In the incubation system the PI controller is a software based calculation of that difference which is divided into a proportional and integral part. The higher the proportional part, the faster reacts the controller but the higher the chance to result oscillations. Therefore, the integral part is used to compensate for oscillations by small changes in the output. In a first test experiment the air temperature of the thermostat cabinet was used as input temperature for the PI controller. This result a delay of the system of approximately 20 hours until the soil temperature was in equilibrium with the 10 K increased air temperature. The soil temperature itself could not be used as input temperature since the inertia of the system leads to even longer time constants. To accelerate fast temperature switching, the discrete set value of the PI controller was replaced by continuously changing soil temperature as

$$SetValue_{PI,T} = (R_T \cdot (Set_{Tsoil} - T_{soil})) + Set_{Tsoil} \quad \text{(S13)}$$

where Set_{Tsoil} is the set soil temperature (in °C; usually either 20°C or 30°C), T_{soil} the actual soil temperature (in °C), and R_{T} a system dependent, dimensionless factor to raise the set point (usually between 2 and 3). The adjustment of the soil temperature for an increase from 20 to 30°C is shown in Figure S4 to demonstrate the use R_{T} to raise the set point. When the routine is started, the lower soil temperature, the humidification and the “incoming air” NO mixing ratio are adjusted. The soil temperature is an average of the two chambers in the centre of the thermostat cabinet. Similar to Gödde and Conrad (1999) different temperature switches of 5 and 10°C were tested. The present version of the improved laboratory dynamic chamber system needs approx. 40–50 minutes to adjust soil temperatures for an increase or decrease of 10 K.

Since there were no significant differences between 5 K and 10 K switches, the 10 K switch has been chosen (from 20°C to 30°C). Since the total time of drying-out is limited, it is not recommended to switch more than two different NO mixing ratios and soil temperatures within one drying-out experiment.

S3.3 Details of relative humidity control of the flushing air stream

As for soil temperature, the relative humidity of the “Meas flow” and “Flush flow” is controlled by a PI-controller as well. However, it has to be noted, that through humidification of these air flows, drying-out of soil samples could not be completely stopped, but slowed down considerably. Since each soil of the enclosed sample is characterized by different field capacity and drying-out behaviour over time, several tests resulted in a time dependent look-up function for the control of humidification. This function could be used for all kinds of soils. Basically, for the total time of a drying-out experiment, a table consisting of 20 time increments is programmed, where for the first 14 increments the humidification is constant at 95% relative humidity and the last 6 increments the humidification is linearly decreasing to 0%. Once, the time for drying-out of a soil sample is known (usually about 1 day for desert soil and up to 5 days for organic rich soils), the set value for the humidification is the result of the interpolation of the relative humidity between the time increments which depend on the time of measurement and that for the total drying-out experiment. Input data for control of the relative humidity are measured data obtained by a digital humidity probe HTM B71 (HY-LINE SENSOR-TEC, Germany) mounted in the headspace of the reference (empty) soil chamber. The relative humidity of the “Meas flow” and “Flush flow” is then controlled by mixing dry and wet air flows together (s. Figs. S1–S3). The control scheme of the improved laboratory dynamic chamber system is programmed such, that flexible experimental performance is possible (considering other incubation conditions then chosen here): before starting the control scheme, incubation conditions (“incoming air” NO mixing ratio switch, static mode switch, soil temperature switch, humidification switch) may be (independently from each other) pre-scribed interactively.

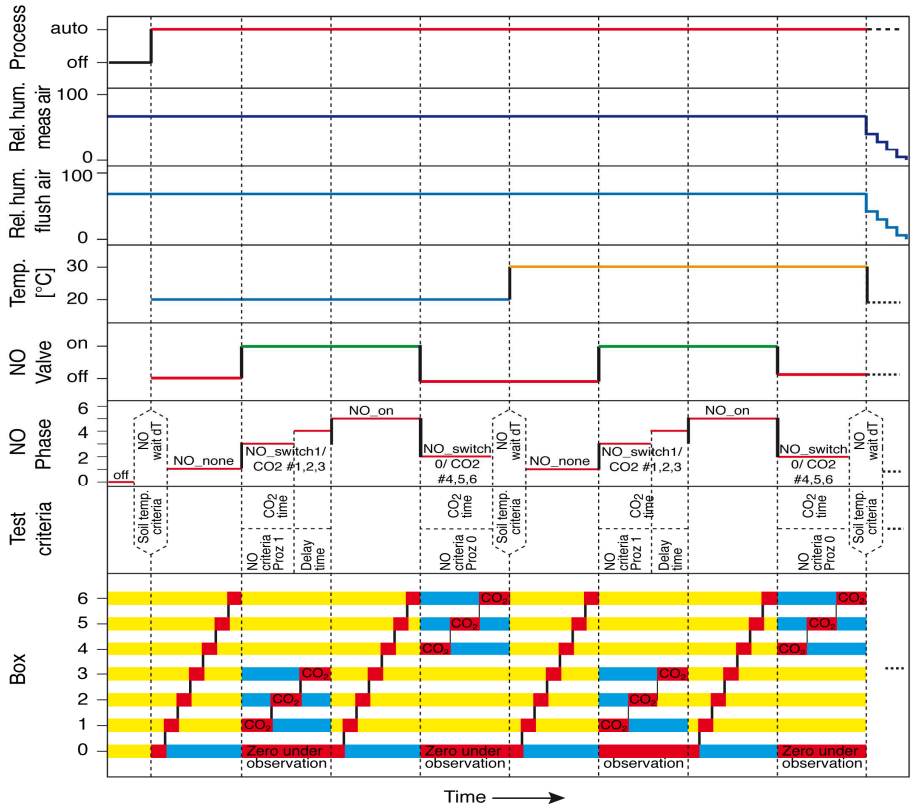


Fig. S1: Scheme for automatic control of the improved laboratory dynamic soil chamber system, NO headspace concentration, CO_2 mode, soil temperature and humidification

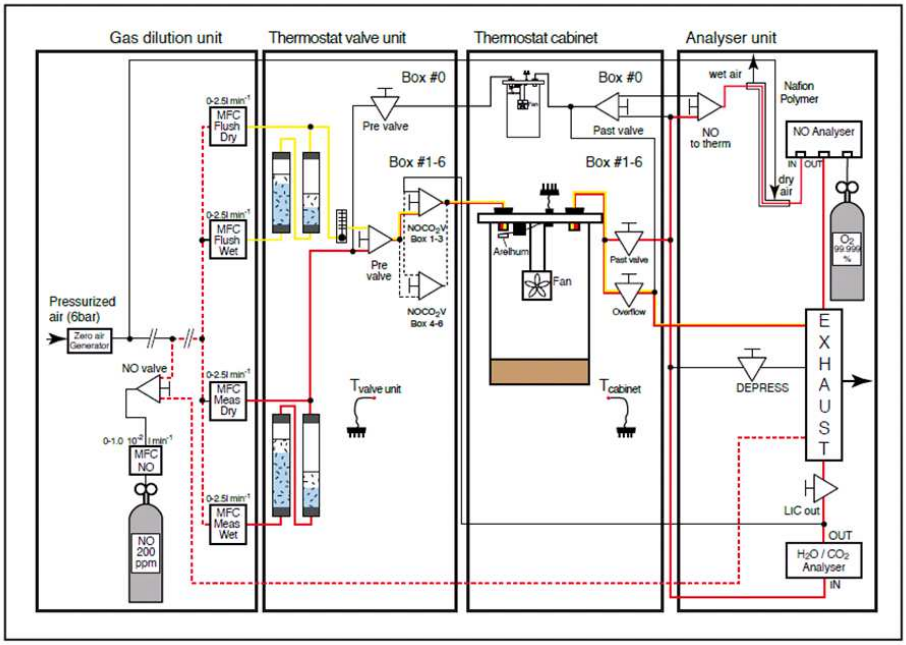


Fig. S2: Gas flow for the valve switch for the NO headspace concentration (red dots), the separate humidified Meas flow (red) and humidified Flush flow (yellow) for the not measured chambers in dynamic chamber mode to analyse NO

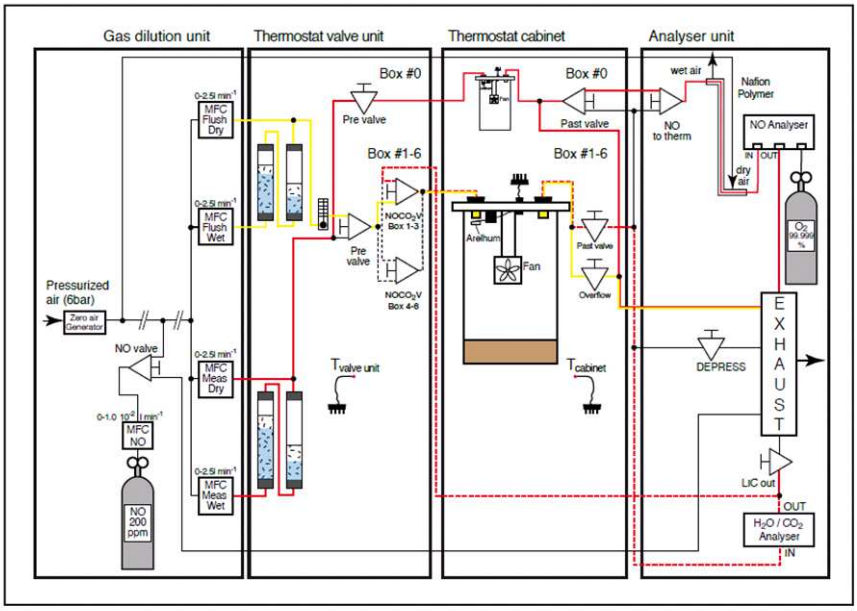


Fig. S3: Gas flow for the valve switch for CO2 measurement (red dots), the switch of the bypass mode for observation of NO (red) and humidified Flush flow (yellow) for the not measured chambers in the static chamber mode to analyse CO2

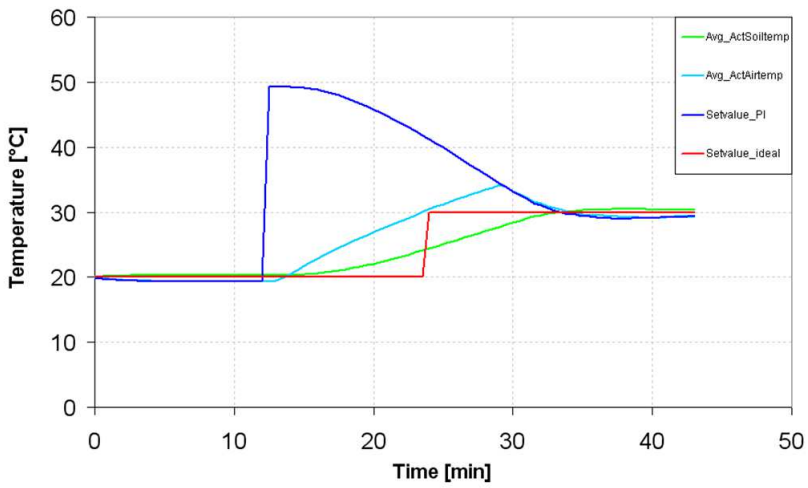


Fig. S-4: Example of the transient response of the soil temperature during a 10 K temperature change (from T_{soil}= 20°C to T_{soil}=30°C).