Relationships between measured biochar incubation variables

# Notations & definitions

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| Notation | Unit | Definition |
|  |  | Total flux of carbon dioxide (expressed in C) mineralised between two measuring times, in absolute terms. |
|  |  | Share of biochar carbon in the mineralised flux of carbon, determined by isotopic technique |
|  |  | Share of soil organic carbon in the mineralised flux of carbon, determined by isotopic technique |
|  |  | Flux of biochar carbon (expressed in C) mineralised between two measuring times, in absolute terms. |
|  |  | Flux of biochar carbon (expressed in C) mineralised between two measuring times, in relative unit (divided by initial amount of biochar carbon). |
|  |  | Flux of soil organic carbon (expressed in C) mineralised between two measuring times, in absolute terms. |
|  |  | Flux of soil organic carbon (expressed in C) mineralised between two measuring times, in relative unit (divided by initial amount of soil organic carbon). |
|  |  | Flux of soil organic carbon (expressed in C) mineralised between two measuring times, in absolute terms, in the control experiment. |
|  |  | Flux of soil organic carbon (expressed in C) mineralised between two measuring times, in relative unit (divided by initial amount of soil organic carbon), in the control experiment |
|  |  | Decay rate of total soil carbon (biochar and soil), average between two measuring times, in absolute terms. |
|  |  | Decay rate of biochar carbon, average between two measuring times, in absolute terms. |
|  |  | Decay rate of soil organic carbon, average between two measuring times, in absolute terms. |
|  |  | Decay rate of biochar carbon, average between two measuring times, in relative terms (divided by initial amount of biochar carbon). |
|  |  | Decay rate of biochar carbon, average between two measuring times, in relative terms, dynamic (divided by biochar carbon remaining at the previous time step). |
|  |  | Cumulative biochar carbon loss since start of incubation, absolute |
|  |  | Cumulative biochar carbon loss since start of incubation, relative to initial amount of biochar carbon |
|  |  | Cumulative biochar carbon remaining since start of incubation, absolute |
|  |  | Cumulative biochar carbon remaining since start of incubation, relative to initial amount of biochar carbon |
|  |  | Cumulative total carbon loss since start of incubation, absolute |
|  |  | Cumulative total carbon loss since start of incubation, relative to initial amount of biochar and soil organic carbon |
|  |  | Priming flux of soil organic carbon, absolute (flux of SOC in biochar incubation minus flux of SOC in control incubation) |
|  |  | Priming flux of soil organic carbon, relative (flux of SOC in biochar incubation minus flux of SOC in control incubation, divided by initial amount of SOC) |

# Mathematical relationships

The variables listed on the previous page are interrelated. Usually, for biochar stability, only few values are reported. If priming effects are also studied, then many more variables are needed. The variables are also very much interrelated, meaning that most variables can be recalculated from a few available ones.

The ones highlighted in yellow have consistently been collected for all observations, and are the minimum required for running stability calculations.

Below, we summarise the main relationships, starting from the commonly available ones reported in biochar stability studies (where biochar C flux is known separately from any SOC).

## Fang 2014 – How were the data recalculated ?

Starting with available data: k\_bc\_abs expressed in mg of biochar carbon per day for 1 kg of soil, converted to g of biochar C per day for 1 kg of soil ( / 1000).

Then, I calculated in that order the absolute values:

* F\_bc\_abs as k\_bc\_abs x deltaTime
* C\_bc\_loss\_abs as 0 + F\_bc\_abs (cum sum)
* C\_bc\_rem\_abs as initial carbon in soil - C\_bc\_loss\_abs (without the cum sum, to get an easy formula); where initial carbon in soil was derived from the metadata table via a lookup e.g. VLOOKUP(B81;metadata!$B$11:$BN$300;29;FALSE)\*VLOOKUP(B81;metadata!$B$11:$BN$300;36;FALSE)\*1000

Then, calculating the relative values:

* F\_bc\_rel as F\_bc\_abs / (C\_bc\_loss\_abs + C\_bc\_rem\_abs) for having an easy formula to propagate along the Excel file
* C\_bc\_loss\_rel as C\_bc\_loss\_abs / (C\_bc\_loss\_abs + C\_bc\_rem\_abs)
* C\_bc\_rem\_rel as 100% - C\_bc\_loss\_rel
* k\_bc\_rel0 as k\_bc\_abs / (C\_bc\_loss\_abs + C\_bc\_rem\_abs)
* k\_bc\_reld as k\_bc\_abs / C\_bc\_rem\_abs (at previous time step, with condition statement)