A Minimal Demo of knitr with Beamer and Fragile Frames

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April 1, 2013

[1] I thank Richard E. Goldberg for providing this demo.

Background

- The **knitr** package allows you to embed R code and figures in LaTeX documents
  - It has functionality similar to Sweave but looks nicer and gives you more control
- If you already have Sweave working in LyX, getting **knitr** to work is trivial
  1. Install the **knitr** package in *R*
  2. Read `http://yihui.name/knitr/demo/lyx/`
- If you use Sweave or **knitr** with Beamer in LyX, you probably use the *Beamer Fragile* module[2] too. Let's see if **knitr** works with Beamer in this small demo.

[2] `http://www.lyx.org/trac/ticket/7273`

First Test

OK, let's get started with just some text:

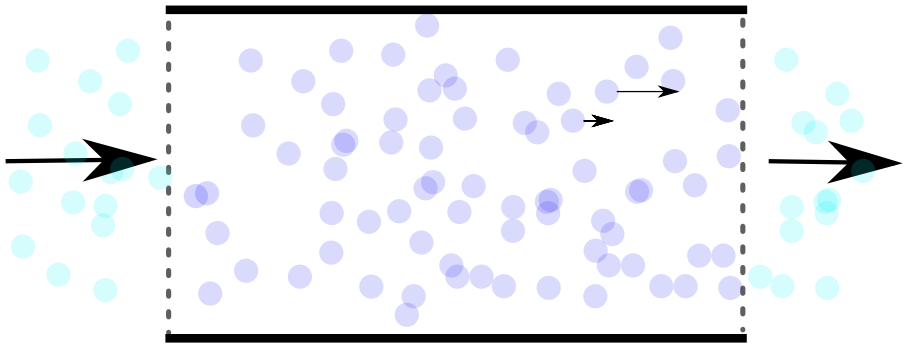
```
# create some random numbers
(x = rnorm(20))

##  [1]  0.14496  0.43832  0.15319  1.08494  1.99954 -0.81188
##  [7]  0.16027  0.58589  0.36009 -0.02531  0.15088  0.11008
## [13]  1.35968 -0.32699 -0.71638  1.80977  0.50840 -0.52746
## [19]  0.13272 -0.15594

mean(x)

## [1] 0.3217

var(x)

## [1] 0.5715
```

BTW, the first element of `x` is 0.145. (Did you notice the use of `\Sexpr{}`.)

The Big Question

Do the above chunks work? You should be able to compile the LyX document and get a nice-looking PDF slide presentation. If not, time to double-check everything...

The general concept of a reservoir



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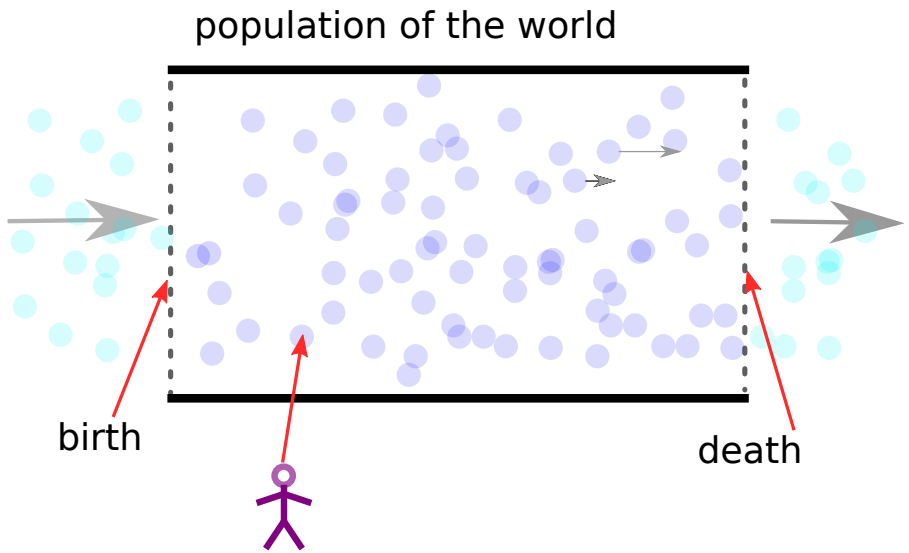
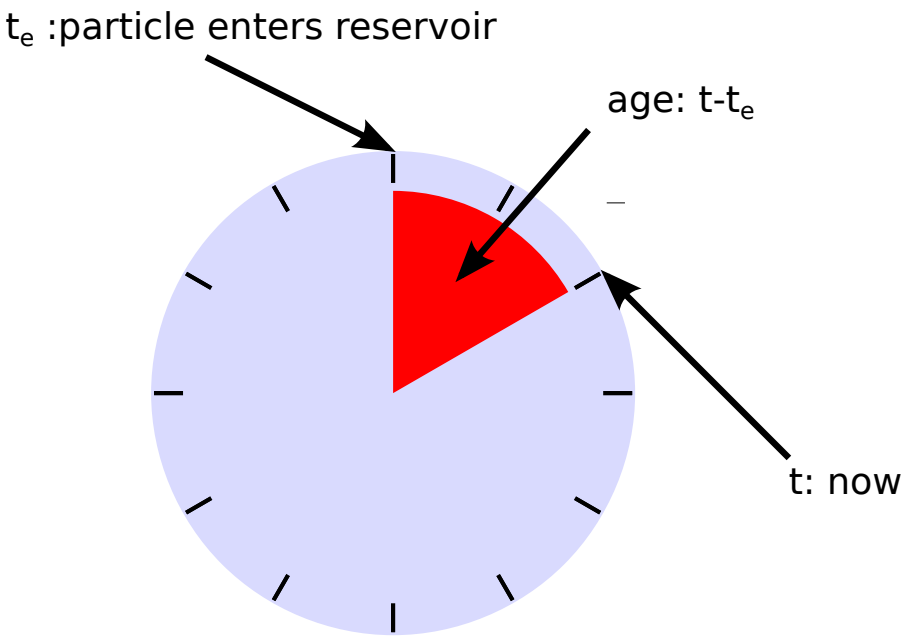
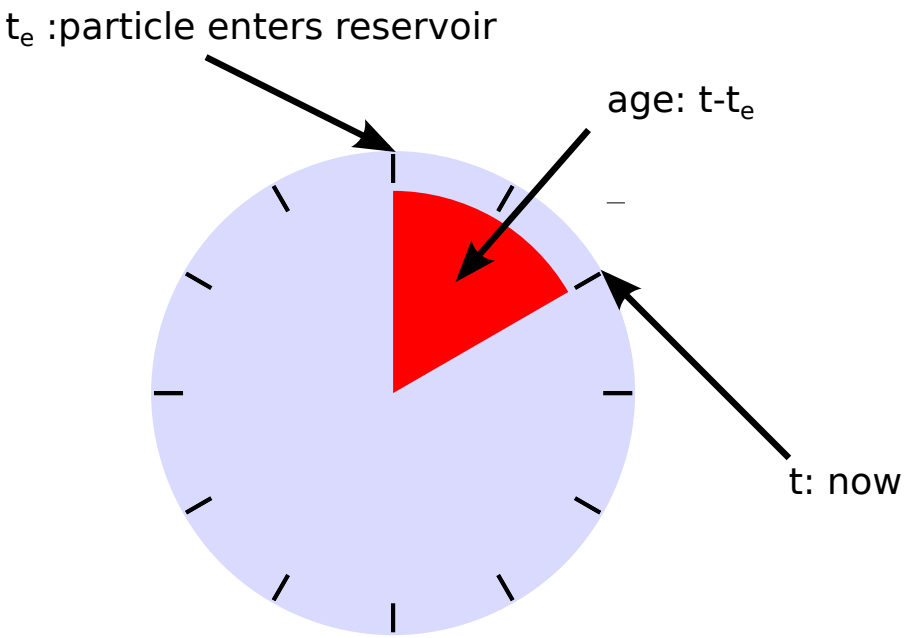


1. in and out "flows" do not necessarily involve "movement"
2. in and out flow "channels" do not always have to be defined physically or spatially

age of a particle



age of a particle

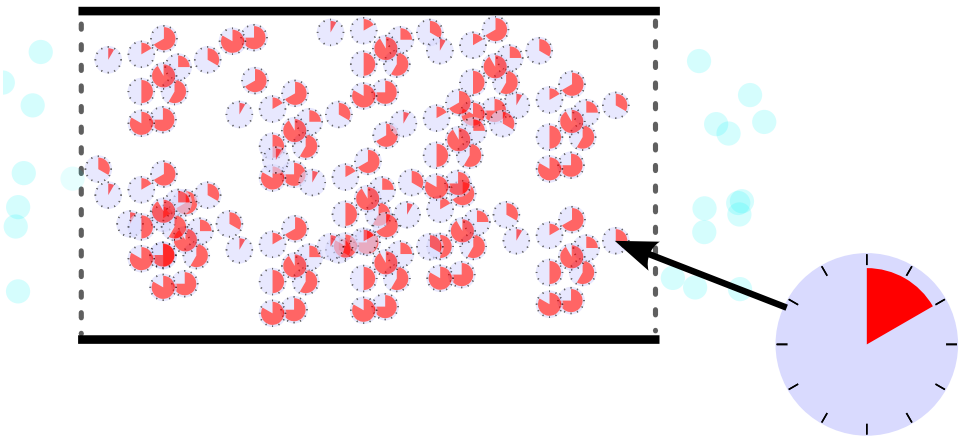


- The "age " is always defined in *context* of the reservoir

Mean age

- Usually time dependent
- Includes *all* particles that are in the reservoir at the given time.
- Usually depends on input rates as well as the dynamics of the system.

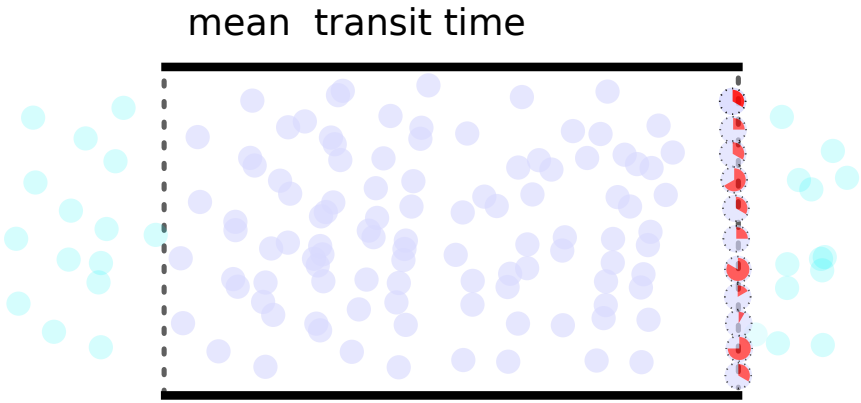
mean age



$$\bar{a}(t) = \frac{a_1 + a_2 + \cdots + a_N}{N}$$

With $N = N(t)$ the number of all particles in the reservoir at time t.

Mean transit time

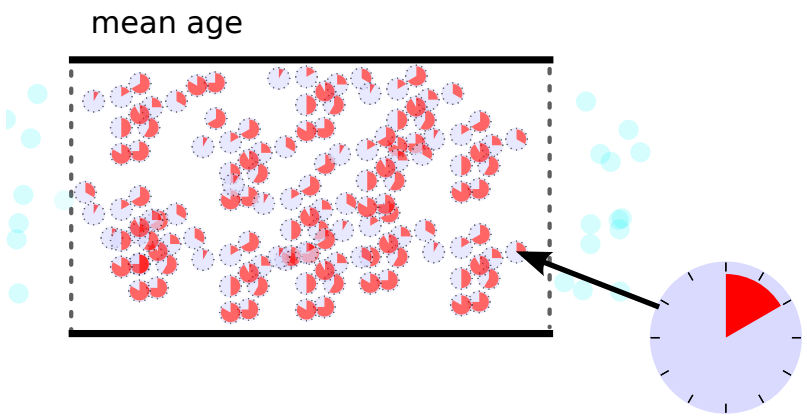


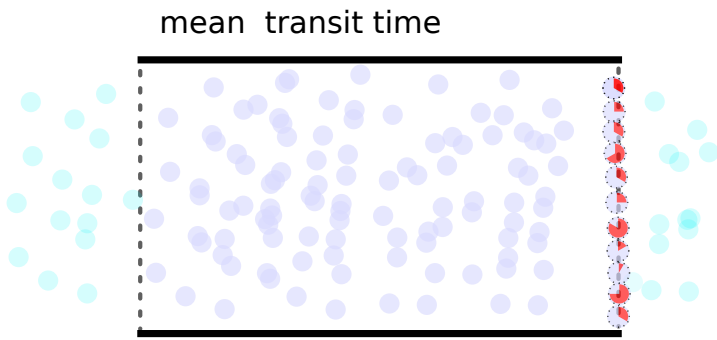
$$\bar{t}_r(t) = \frac{a_1 + a_2 + \cdots + a_{NO}}{NO}$$

With $NO = NO(t)$ the number of particles just leaving at time t

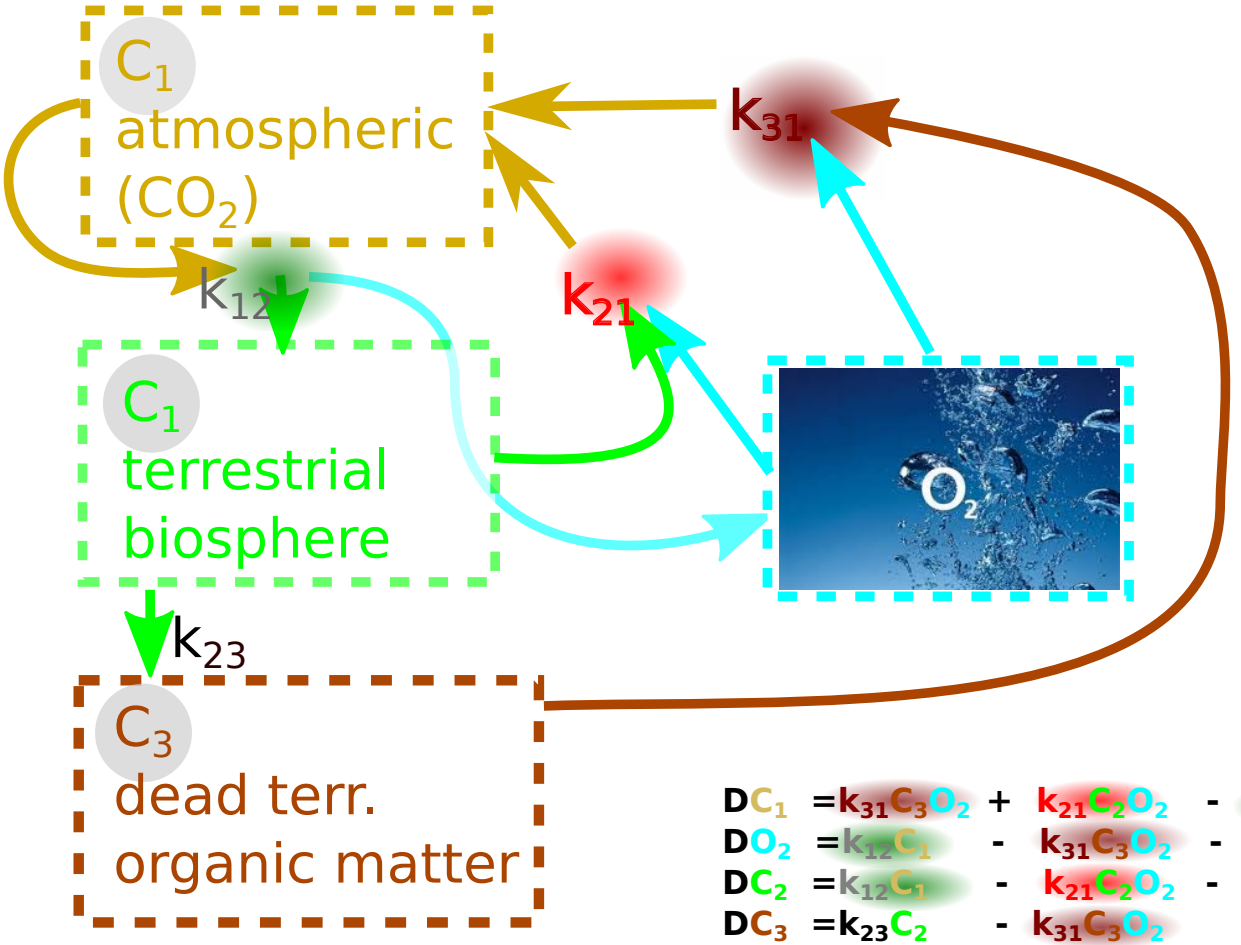
- Can be time dependent as well
- Includes only the subset of particles that are just leaving at the given time. (Can only be computed when there is an output stream)
- could be independent of input rates and only depend on the

Comparison





Example Model



$$
\begin{aligned}
DC_1 &= k_{31}C_3O_2 + k_{21}C_2O_2 - k_{12}C_1 \\
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DC_3 &= k_{23}C_2 - k_{31}C_3O_2
\end{aligned}
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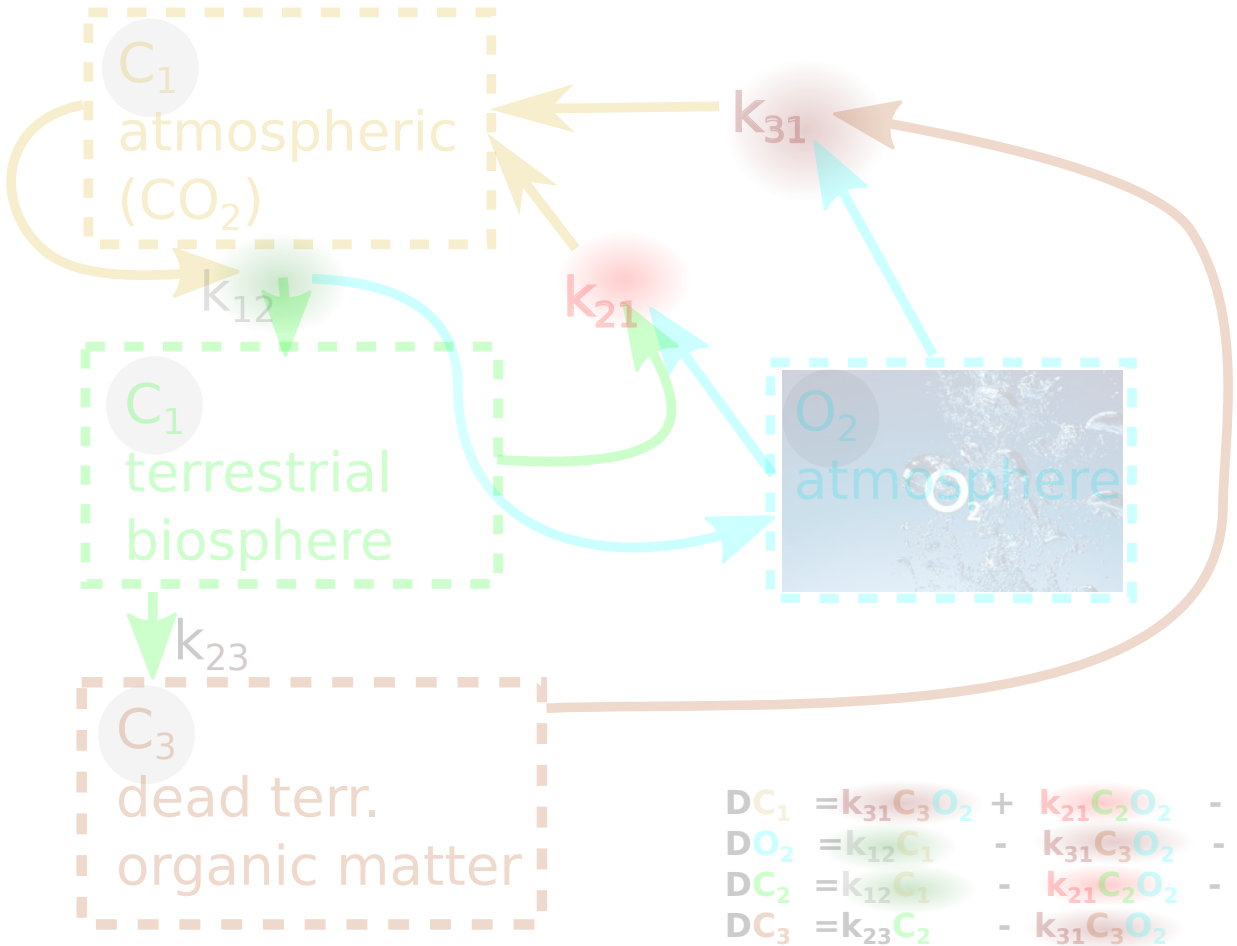
Didactical Considerations



- The system is a *cycle*.
  → Nothing leaves the system as a whole.
  → Transit times for the whole system do not make sense.
  → We will observe sub-reservoirs

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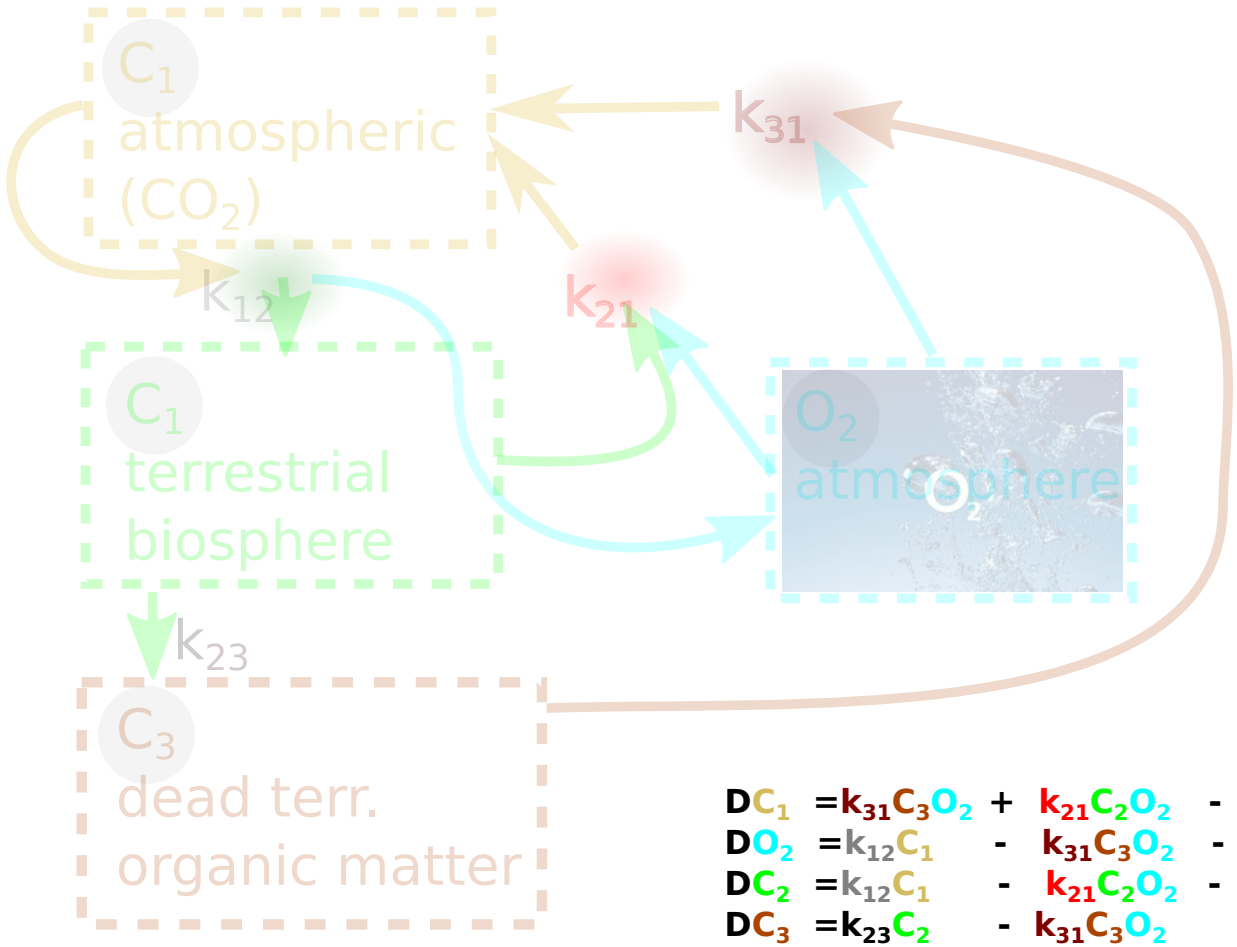

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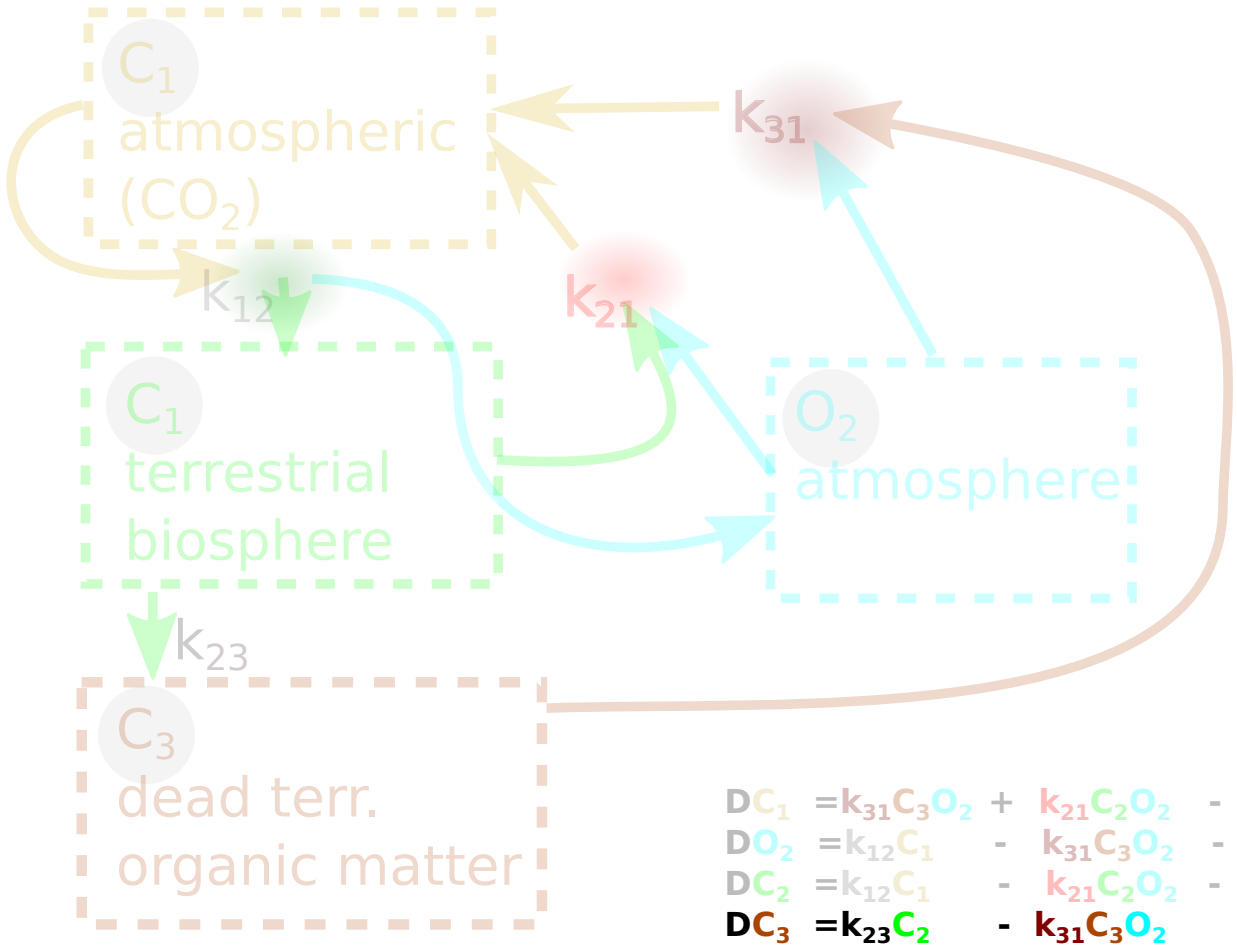

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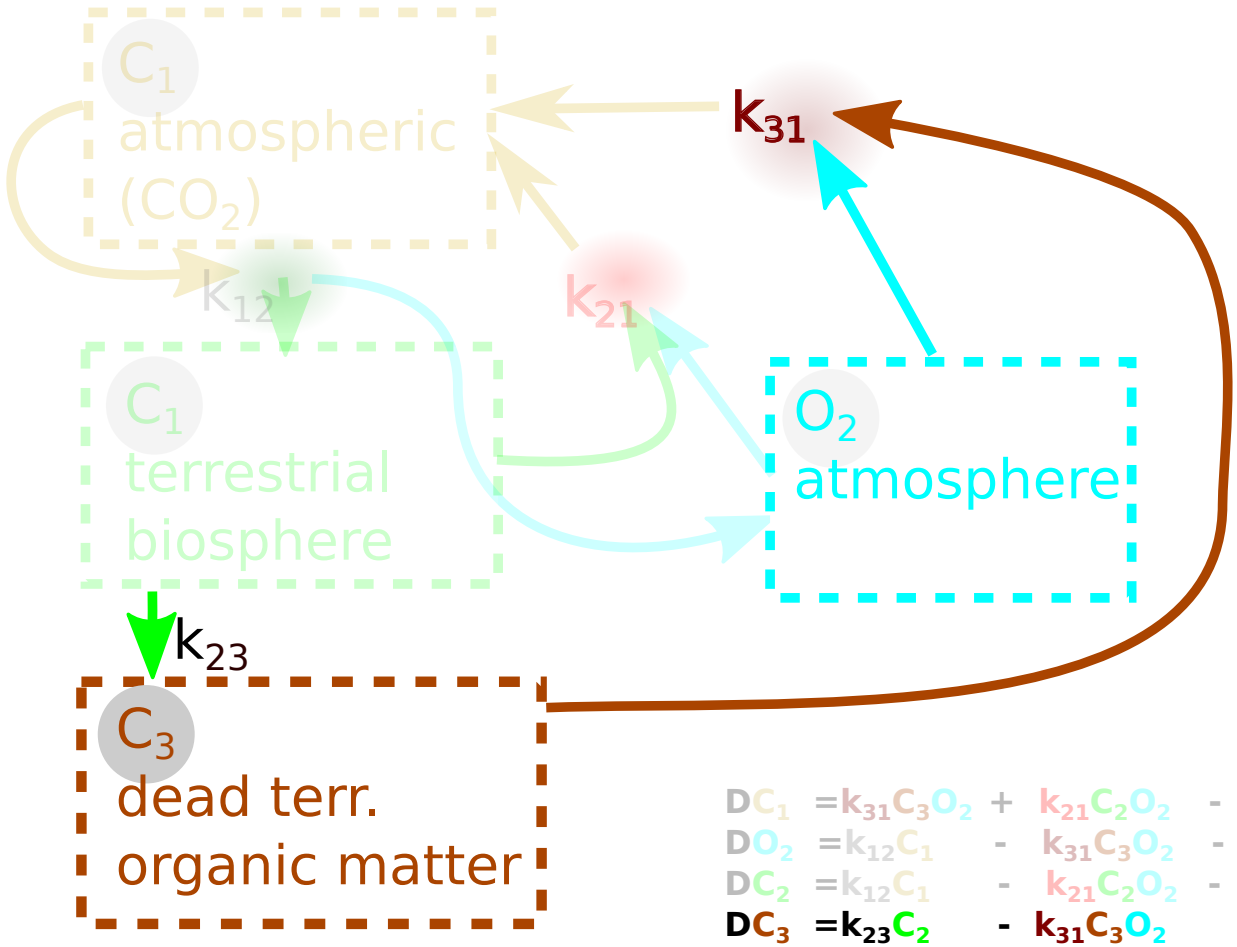

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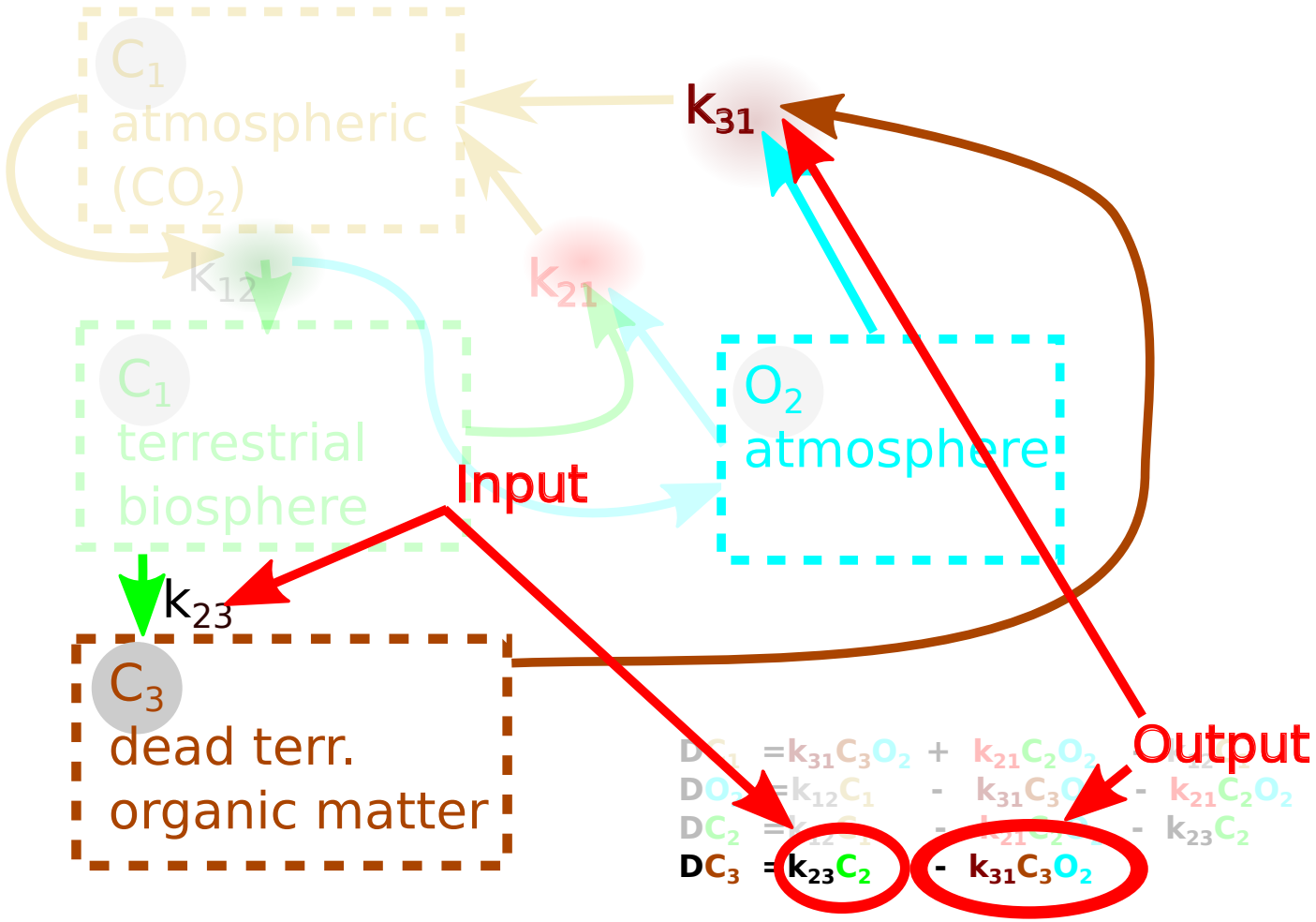

Mean transit time for the last pool

- remember:
  1. To compute the mean transit time we have to identify the particles just leaving.
  2. Ask every leaving particle when it entered and compute its age.
  3. Iterate over all particle and compute the average of their ages.

$$\bar{t}_r(t) = \frac{a_1 + a_2 + \cdots + a_{NO}}{NO}$$

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- Equivalent method: Iterate over all ages and ask how many particles are of that age. (histogram)
  1. as above
  2. as above + make a histogram of all ages
  3. iterate over all ages and compute their weighted average

$$\bar{t}_r(t) = \frac{a_1 n_{a_1} + a_2 n_{a_2} + \cdots + a_n n_{a_n}}{NO}$$

With $NO = NO(t) = n_{a_1} + n_{a_2} + \cdots + n_{a_n}$

Second Test

Text is nice but let's see what happens if we make a couple of plots in our chunk:

```
par(las = 1, mar = c(4, 4, 0.1, 0.1))  # tick labels direction
boxplot(x)
hist(x, main = "", col = "blue", probability = TRUE)
lines(density(x), col = "red")
```