

On calibration

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Types of parameters

The parameters we present are all characterized by a high degree of uncertainty. The derivation of certain parameters from different model structures, the use values from other sites or other groups of species, or even different types of particles, are all pragmatic solutions but require a special attention on the calibration and sensitivity of the model to uncertainty.

In this context, there are several types of parameters:

- calibrated parameters that are then fixed in the model: phenology-based parameters (guesstimated), interaction parameters (use of direct values, and +/- 10% around this value). These values will be called fixed parameters hereafter as they won't be changed in the model.
- so-called free parameters for which we select a specific parameter set among the different proposed values (see sets of values in the Table: chosen values will most certainly be the middle one) and see changes in the final abundances and amplitudes of the total population. These parameters can be related to different biological phenomena. These parameters are the sinking rate s , cyst mortality m and burial ζ , germination and resuspension γ .
- parameters used in the scenarii: the exchange rate e and the presence of the seed bank (varied with the cyst mortality m , this time set to 0 to make the seed bank virtually disappear).

The effect of change in parameters is assessed with several diagnostics.

Diagnostics

We only want phytoplankton-like dynamics corresponding to different morphotypes. Even though these groups may be linked with groups of species in the studied dataset, we do not aim to model them separately and with a good precision. In addition to the persistence of all 11 species, the diagnostics we use are therefore the following:

- average abundance: $f_1 = \sum_i^S |\bar{N}_{i,obs} - \bar{N}_{i,sim}|$
- amplitude of the cycles: $f_2 = \sum_i^S |[\max(N_{i,obs}) - \min(N_{i,obs})] - [\max(N_{i,sim}) - \min(N_{i,sim})]|$
- beginning of the bloom: we divide the year into three periods. The two periods during which blooms are possible are spring+autumn, gathered (for cold-specialists which bloom either once or twice in the year during these seasons) and summer. In winter, species are not supposed to bloom. We give a score of 0 point if the species fall into the right period, 1 point if it falls in the other probable period, 2 points if the species bloom in winter.

Scaling and weights can be attributed to each diagnostics and summarized into a single objective function.

Interaction calibration - fixed parameters

There are 49 parameters to calibrate in the interaction matrix. We will test variations of more or less 10% around the calculated values of these parameters, one at a time. This means a total of $49 \times 48 \times 3 = 7056$ simulations that will be evaluated with the above function.

Free parameters - test for biological hypotheses

The values of certain parameters are highly uncertain and the effect of such uncertainty should at least be assessed.

As a reminder, those are:

- sinking rate $\{0.1; 0.3; 0.5\} \beta(0.55, 1.25)$
- cyst mortality and burial $\approx 10^{-4}/10^{-5} + 0.01; 0.1; 0.3$
- germination/resuspension $0.1; 0.01; 0.001 * 10^{-5}, 0.1$

Even though these are not the focus of the paper, variations in these values could at least be discussed at the end of the paper to improve our hindsight on the results.