The paper presents an interesting ecosystem modelling study dealing with multiple elements and competition. This issue is timely and interesting to a broad community.

The manuscript has improved in this revision. Especially the provided appendices and the Figures of the calibration help with understanding the paper. It represents a needed effort in understanding and modelling nutrient cycling at ecosystem and larger scales. I recommend publishing the paper despite still large problems. The problems, however, should be clearly stated. Then the community can improve on this.

Modelling the multiple nutrients is an ambitious task. We cannot expect a model to work well and fit the data. But the problems must be clear and conclusions must take caution.

# General comments

## Sensitivity analysis conclusion

From the sensitivity analysis (Fig. 3), I infer that consistently across all temperature/moisture scenarios, the predictions are sensitive to the same parameters. How can the conclusion be drawn from this, that uptake is more regulated by internal kinetics  instead of temperature or moisture? To my understanding, one cannot draw this conclusion.

## Calibration did not converge to limiting distribution

Contrary to the statements in the paper (L. 351), Fig. A1 clearly shows that the chains starting from different position did not converge to the (same) limiting distribution. They seem to sample different (local?) minima (e.g. plot of Km^plant_NO3).  Hence all conclusions on the sampled parameters are all very vague.

Moreover, in Fig. 4, the posterior sample is at the edge of the prior distribution. This indicates an inconsistency between the model- data- and prior. E.g. the model and data suggest a much higher plant uptake rate of P (k^plant_P) than previous knowledge. This means, either the previous knowledge or the model cannot be reconciled with the data.

Contrary to the text (L.  438), Fig. A1 suggest that also plant uptake of NO3 (K^plant_NO3) seems important, as the data significantly changes the prior.

## Stoichiometry of SOM Pools

The calculation of gross nutrient mineralization and immobilization fluxes based on current stoichiometry of soil organic matter (SOM) pools becomes clearer in the revised version. Potential fluxes are calculated so that current C/N/P ratio is not changing. However, the adjustments due to competition with multiple consumers alter those potential fluxes and the stoichiometry over time. The rational and consequences of these choices need to be elaborated.

## Description of multiple data stream inversion

The paper now includes some information on the cost-function used in the calibration. However, the handling of different data streams is not sufficiently described by the word “including time series” L.343. I guess the different time series were just concatenated to one big series and enter the cost function without weights. To evaluate the results it is important is to state the number of records per data stream in Table 4 and the average variance of an observation (here corresponding to the magnitude of the observations). From Fig. 4 I get that there are more observations in the gas-data ($CO_2$ and $N_2O$) streams. Hence I expect the calibration to choose parameters so that these streams are better matched than the streams with sparse observations.

### Interpretation of uncertainty reduction

Eq. (30) compares a parameter of log-normal distribution in the prior, i.e. the standard deviation of a log-transformed value, to a parameter of the normal distribution in the posterior. I cannot interpret this. Fig. 2 is more helpful. For a similar quantitative uncertainty reduction measure, I suggest to base it on inter-quantile ranges, e.g. the 10-90% range instead of sigma. For the prior it can be calculated from the distribution, for the posterior estimated from the sample. This is simpler, straightforward and easier to interpret.

## Specific comments

L421: “prognostic prediction could be uncertain”: Better do it instead of guessing. I.e sampling from the parameter space and generate several predictions. Then plot the uncertainty of the model predictions.

L439: The new paragraph seems quite unmotivated. What are “those fractions”

L450: To me the analogue of root spatial occupation is not intuitive. If diffusivity limits a process a high concentration of Enzymes at one site e.g. hotspots like rhizosphere or litter layer will not increase uptake when the substrate access is limited by diffusion.

L461 Thanks for now acknowledging soil heterogeneity. I still would expect some discussion on the consequences of ignoring this heterogeneity in the model. The ratios of enzymes between competing groups will be very different in different in rhizosphere and bulk soil. Will this lead to an underestimation of overall plant competitiveness in the model? What other predictions will be strongly affected?

L493: The statement of more data leading to better constrained posteriors need to be backed up. I still think it will not have a big effect (by looking at Fig4, where the model error is larger than the observation error). By generating more artificial observations (but as far away from the model results as in Fig 4) and repeating the model calibration, one could check if posterior is narrower.

L496ff: Thanks for the additional discussion. This demonstrates how we can gain insight from the modelling exercise.

L516: More frequent measurement of the already richer streams will probably be of little help (See my comment on more data (L493) and on multiple data streams. I suggest additional measurements of the sparse streams.

Fig. 2: Thanks for the figure. This greatly helps to understand the calibration.

Fig. 5: Uncertainty of model prediction is missing. See comment L421.

Fig A2. Are multimodal distributions close to Gaussian?

Appendix B2: Missing description of VMAX. I Suppose it is k + [E_tot]
typo: simplify after B1

Several of my previous comments were ignored in this revision, e.g.

- When stating the objectives p4063, (2) seem to be a means of achieving (1), rather than an objective.
- P4066L18, the “respectively” is ambiguous.