Comments PCL, October 22, 2015:

1. Change: [4]OFM Research, Redmond, Washington, United States

   to

   [4]OFM Research—Southwest, Santa Fe, New Mexico, United States

2. L25: Caution needs to be taken for the scaling method ⇒ Caution needs to be taken in choosing the appropriate scale factor as a small value ...

3. L28: ... for addressing nonnegativity issue ... ⇒ for addressing nonnegativity issues ...

4. L29: ... and facilitates mechanistic biogeochemistry representation in earth system models to reduce climate prediction uncertainty.

   ⇒

   ... and facilitates the representation of a mechanistic biogeochemical description in earth system models to reduce climate prediction uncertainty.

5. L78: As LSMs need to run under varies conditions ... ⇒ As LSMs need to run under various conditions ...

6. L84: reaction network using PFLOTRAN, coupled that model to CLM ... ⇒ reaction network using PFLOTRAN (Lichtner et al., 2015), couple that model to CLM ...

   Note: coupled ⇒ couple

7. L109: PFLOTRAN solves the ordinary differential equations for the kinetic reactions, the mass action equations for the equilibrium reactions, and provides the final concentrations back to CLM.

   ⇒

   PFLOTRAN solves ordinary differential equations for kinetic reactions, mass action equations for equilibrium reactions, and provides final concentrations back to CLM.

8. Rewrite L117-124.

9. L129: with flexible number of reactions, species, rate terms ... ⇒ with a flexible number of reactions, species, rate terms ...

10. L133: this new approach ⇒ the more general approach used by PFLOTRAN ... (not really new!)

11. L139: A residual concentration is often added to represent ... ⇒ A residual concentration $[CN_u]_r$ is often added to represent ...

12. L143: and moisture response function. ⇒ and moisture response functions, respectively.

13. L154: the rate is decreased by about half. ⇒ the rate is reduced by a factor of one half.

    This sentence is actually unclear: decreased by half from what?

14. L155: The derivative of the Monod term, $k_N([N] + k)^{-2}$ ⇒ What is $k_N = k_m$?

15. L159: we need to distribute ⇒ it is necessary to distribute

16. L165: Where Rp, Ra, and Rn are ... ⇒ In this equation Rp, Ra, and Rn are ...

17. L168: ... plant nitrate uptake rate remained low until ammonium concentrations dropped below a threshold ... ⇒ plant nitrate uptake rate remains low until ammonium concentrations drop below a threshold ...

18. L169: However, the preference differs ... ⇒ However, the form of the rate expression will differ ... which will require different representations ...

19. L176: need to define "downregulation."

20. L182: In contrast, use of Monod function ⇒ In contrast, use of the Monod function

21. L192: in eq. 6 α is not defined.

22. L212: carbon in organic layer); ⇒ carbon in an organic layer);

23. L217: We examine remedies in the simple test problems, and test them in the coupled simulations. For convenience of presentation in this paper, we examine the reaction network and illustrate the numerical issues and remedies using simple test problems, and then test them in the coupled simulations.

    ⇒ these two sentences essentially say the same thing.

24. L221: ... to examine numerical solution for Monod ... ⇒ ... to examine the numerical solution for Monod ...

25. L255: what is the purpose of $= -R_{at}$ in eq 10?

26. L261: We use spreadsheet ... $\Rightarrow$ We use a spreadsheet ...

27. L265: (sheet case4, case8, case9). $\Rightarrow$ (spreadsheet case4, case8, case9).
    Also below: sheet $\Rightarrow$ spreadsheet

28. L311: Should eq 11 read 12?

29. L322: "PlantA or nitrate" is mentioned 3 times in one sentence.

30. L395: ... nitrate will not be taken. $\Rightarrow$ not clear what is meant here

31. L540: We illustrate that with implicit time stepping and Newton- Raphson method, which are typically used in reactive transport codes $\Rightarrow$ implicit time stepping is not typical at all—only Steefel's Crunch, FLOTRAN, MULTIFLO and PFLOTRAN use it. Other codes generally use operator splitting.

32. L858: Define iteration counter p. It would not be that difficult to include the flux F to make the discussion more general and applicable to the situation at hand. Seems too simplistic to include it as is.

33. L865: eq B6 is not correct: should read $c^{k+1,p+1} = c^{k+1,p} + \delta c^{k+1,p+1}$ etc. Also the use of p doesn't appear to be consistent with the previous equations: maybe should be p and $p-1$.