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## ***Interactive comment on “Belowground in situ redox dynamics and methanogenesis recovery in a degraded fen during dry-wet cycles and flooding” by C. Estop-Aragonés et al.***

**Anonymous Referee #3**

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The authors investigated changes in a variety of solutes and dissolved soil gases in response to water table manipulation in an intermediate fen ecosystem over two years. The authors elegantly demonstrate how O<sub>2</sub> penetration can occur during periods of drought, how peat bulk density attenuates O<sub>2</sub> diffusivity, and how this in turn builds a battery of TEAPs, which slowly disappear upon subsequent inundation. The authors also show evidence for thermodynamic inhibition mechanisms, where CH<sub>4</sub> production was favoured when water tables were high. The authors estimated e- acceptor turnover rates in relation to DIC production. While the authors cede that much of the cumulative pool of DIC produced during flooding cannot necessarily be explained, they propose several areas for future research that should prove helpful in increasing our under-

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Interactive Discussion

Discussion Paper



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Comment

standing. Specifically, the authors suggest that a significant store of solid phase (ferric) iron, upon reduction, could be contributing to the unknown quantities of DIC produced. The authors also suggest that humic substances could be acting as important sources of terminal electron accepting capacity. Altogether, the findings are presented clearly, and the discussion that follows is logical and informative for setting a compass heading for future research. The results presented and discussed are interesting, timely, thoroughly researched, and well presented. In fact, it was a pleasure to review such a polished manuscript – which seem to be rare in the peer-review process. I have little to offer in the way of substantive comments that build on comments already offered, and feel that this manuscript is very nearly ready for publication in its current form. Specific comments: P 11660, Line 7 Change “this dynamics” to “these dynamics” P 11664, first paragraph In the first read-through, I had wanted to see some details describing the sampling interval here, but I later noticed that this is depicted in the figures with the vertical arrows at the top. P 11680, line 9 I appreciated this discussion. Figures. There are a lot of figures. They are clear and captivating, but if space is an issue some of the figures presented in the earlier manuscript (JGR-B) might be removed.

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