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Interactive comment on “Modeling the impact of iron and phosphorus limitations on nitrogen fixation in the Atlantic Ocean” by V. J. Coles and R. R. Hood

V. J. Coles and R. R. Hood

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In our response to reviewer #2, we noted:

"1. The half saturation constant for dissolved inorganic nitrogen (DIN) uptake was indeed too high in this simulation. For the revised manuscript we reran the model with a much smaller value (changing it from 0.5 to 0.1 mmol m⁻³). This did not substantially change the nutrient limitation pattern. However, we did need to change the phytoplankton growth rate slightly to compensate. The differences between the new simulation with more realistic half saturation constants, and the old version can be seen in comparing the NSTAR figures in the manuscript with the previous version. The parameter values have been updated in Appendix B. DIN vertical sections were presented in our

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previous study, so we do not include them here. The addition of P and Fe limitations did not dramatically alter the DIN vertical distributions from our previous simulations. However, as expected, lowering the half saturation values for DIN uptake did lower the surface DIN concentrations. "

In further testing of this lower nitrogen half saturation coefficient simulation, we found that surface nitrate values became too low, and the subtropical gyre became too oligotrophic. Many changes to the phytoplankton and nitrogen fixing parameterizations were required to retune the model back to observations. In this model, with only a single phytoplankton compartment that must perform reasonably in equatorial and subtropical regions as well as the subtropics and tropics, the autotroph pool must represent a broad range of species with varying nitrate uptake kinetics. In this case a higher half saturation coefficient seems more appropriate.

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