

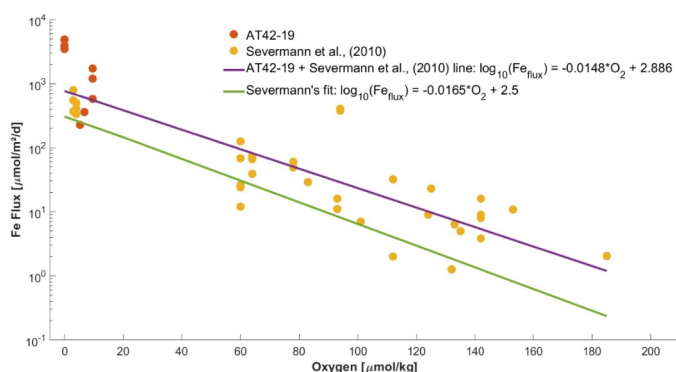
The manuscript by Robinson et al., firstly documented an enhanced beneath iron flux observed during their field campaign in the Santa Barbara Basin. To further evaluate the impact of such beneath iron flux in the regional biogeochemical cycles, the authors leveraged regional biogeochemical model by adjusting the strength of beneath iron flux. By comparing the model simulations under the different conditions (control vs high flux), the authors found that the beneath iron flux can exert a significant impact in the upper iron concentration and primary productivity. However, in the offshore region, the impact of beneath iron flux on the primary production may be partially counterbalanced by the simultaneously elevated NO<sub>3</sub> limitation.

Overall, this manuscript is well written and logically organized, with figures and tables presented in an effective manner. This study provides evaluable insight into how the beneath flux modulates the regional biogeochemistry.

However, I find a severe concern regarding the confidence in the parameterization equation used in the model to simulate high beneath iron flux, which may affect the central results and conclusion in the manuscript. Therefore, I am interested in seeing how authors response before making further recommendation.

### Major Concern:

The key parameterization assimilated in the biogeochemical model to simulate the high flux scenario relies on the new relationship between the oxygen and beneath iron, which is derived from the synthesis of the new data measured by the authors and historical dataset (Fig. 3 in the main text):



As shown, the newly added data (AT42-19) is quite skewed on the left-hand side, and visually, it gave me a hard time in believing that the inclusion of this new data can cause such a huge difference in the regression equation as presented in present figure, given its limited number of data points and distribution. Are slope and intercept of new equation statistically different with the existing one (i.e. passing one-way ANOVA test)? Or did authors use the different function to fit the data point? As I mentioned earlier, this new equation is very critical contributing to the key conclusion of your work.

### Other comments:

Line 89: will the seasonal evolution of oxygen in the beneath be affected by the temporal strength of upper organic carbon export as well?

Figure 1: Did you calibrate the oxygen sensor? If so, how did you calibrate it? Since the oxygen concentration is quite low on the bottom, the accuracy of sensor is important.

Line 235: it might be helpful to include a map denoting the entire dataset used for fitting the new equation.

Fig. 5: Should use the unit of  $d^{-1}$  for NPP to maintain the consistency with beneath iron flux. Maybe consider including another figure in SI to show the relative percentage change in iron and NPP.

Line 344: The symbol "°" should be included for longitude and latitude numbers.