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A more accurate estimate of biological activity in models and observations from oxygen utilization : the EOU concept

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Apparent Oxygen Utilization (AOU) is a classical measure of the amount of oxygen consumed by biological processes in the ocean interior. We show that the AOU systematically overestimates the True Oxygen Utilization (TOU) in 6 coupled circulation - biogeochemical ocean models, due to atmosphere-ocean oxygen disequilibrium in the subduction regions. We develop a new approach, that we call the Evaluated Oxygen Utilization (EOU), which approximates the TOU at least twice better than does the AOU in all of the 6 models. Applying the EOU concept to a global observational dataset leads to a an estimated biological oxygen consumption lower by 25 percent when compared to AOU based estimates. As a consequence, the relative strength of the biological pump, defined as the ratio of regenerated over total nutrients, is equal to 0.3, which is significantly lower than the results found in previous studies. We recommend to use the EOU concept rather than the classical AOU to evaluate the biological activity in ocean models or observations.