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Nitrogen-carbon connections in a deoxygenating ocean

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Anthropogenic warming is expected to drive oxygen (O_2) out of the ocean causing a massive perturbation of the nitrogen (N) cycle leading to increasing N removal and oceanic N_2O production via denitrification, which would trigger enhanced N_2 fixation. Our intermediate complexity Earth system model simulations reveal that N_2 fixation does not compensate the enhanced N loss due increased phosphorus (P) limitation. However, emerging feedbacks between the carbon (C) and N cycle can stabilize the N-inventory and N_2O emissions under global warming. The expansion of water column denitrification under ocean deoxygenation is offset by decreasing benthic denitrification brought about by a reduction in export production. This latter is related to ocean warming and yields a decline in oceanic N_2O production, which contributes to the reduction in oceanic N_2O emissions by 2100. Our model simulations support the existence of strong regulatory feedbacks among the O_2 -C-N and P-cycles that maintain N inventory homeostasis and contribute to stabilize climate against anthropogenic changes.

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