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Humic substances may control dissolved iron distributions in the global ocean: Implications from numerical simulations

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This study used an ocean general circulation model to simulate the marine iron cycle in an investigation of how simulated distributions of weak iron-binding ligands would be expected to control dissolved iron concentrations in the ocean, with a particular focus on deep ocean waters. The distribution of apparent oxygen utilization was used as a proxy for humic substances that have recently been hypothesized to account for the bulk of weak iron-binding ligands in seawater. Compared to simulations using a conventional approach with homogeneous ligand distributions, the simulations that incorporated spatially variable ligand concentrations exhibited substantial improvement in the simulation of global dissolved iron distributions as revealed by comparisons with available field data. The improved skill of the simulations resulted largely because the spatially variable ligand distributions led to a more reasonable basin-scale variation of the residence time of iron when present at high concentrations. The model results, in conjunction with evidence from recent field studies, suggest that humic substances play an important role in the iron cycle in the ocean.