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Hypoxia off the Oregon Coast results in the accumulation of Fe(II) in shelf and slope bottom waters

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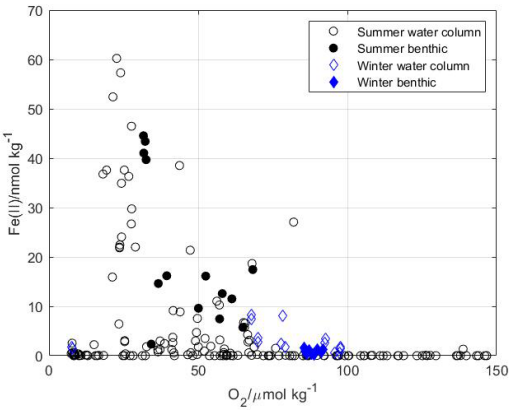

Widespread hypoxia occurs seasonally across the Oregon continental shelf, and the duration, intensity, and frequency of hypoxic events have increased in recent years. In hypoxic regions, iron reduction can liberate dissolved Fe(II) from continental shelf sediments. Fe(II) was measured across the continental shelf and slope in the Oregon coast during summer and winter 2022 using both a trace metal clean rosette and high resolution benthic gradient sampler. In the summer, Fe(II) concentrations were exceptionally high (40-60 nM) within bottom waters and ubiquitous across the Oregon shelf, reflecting the low oxygen condition (40-70 μM) of the shelf. In the winter, similar sites had far lower Fe(II) concentrations (<10 nM), likely due to the higher oxygen concentrations (70-90 μM). The inverse correlation between Fe(II) and bottom water oxygen concentrations matches previous estimates found in Severmann et al. (2010). At depths near the continental shelf, Fe(II) dominates the speciation of the dissolved Fe pool, highlighting the importance of reducing conditions, rather than Fe(III) particle resuspension, for Fe fluxes in hypoxic coastal systems.

Permanently Oxygen Deficient Zones contain characteristic Fe(II) and I^- plumes around the 26.3 kg m^{-3} potential density surface due to shelf enrichment of the 13CW water mass and its subsequent transport offshelf. On the seasonally hypoxic Oregon continental margin, we observe extremely high benthic fluxes of Fe(II) into shelf waters in the 26.5–26.6 kg m^{-3} potential density range. Unlike ODZs, however, direct transport of this Fe(II) off the shelf does not occur. Water column profiles on the continental slope reveal two Fe(II) features at 26.8 kg m^{-3} and 27.2 kg m^{-3} potential density surfaces, potentially from benthic boundary layer exchange between the continental shelf and slope and/or continental slope Fe(II) sources. In addition, we observe minimal I^- accumulation, unlike in ODZs. We attempt to deconvolute the processes supplying Fe to the North Pacific, with a focus on Fe(II) to anticipate how increased hypoxia on the Oregon continental margin will impact this Fe source.