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# Short-term to interannual time-series variations in the vertical distribution of iron in the eastern and western subarctic Pacific

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Trace metals in the ocean play critical roles as micro-nutrients supporting marine primary productivity and as chemical tracers of water mass processes. The GEOTRACES program has substantially advanced our understanding of their basin-scale distributions and controlling mechanisms; however, knowledge of their temporal variability remains limited. Here, we investigate short-term to interannual variations in the vertical distributions of iron in the subarctic North Pacific, based on repeated time-series observations in both the western and eastern regions. In the western subarctic North Pacific, full-depth observations were conducted 11 times between 2008 and 2023 at time-series station K2 (47°N, 160°E). In addition, meridional vertical sections of dissolved iron along 155°E, spanning subarctic to subtropical waters, were obtained in 2008 and 2022 to assess basin-scale variability. In the eastern subarctic North Pacific, five vertical profile observations were conducted between 1997 and 2025 at Station Papa (50°N, 145°W). All samples were collected using trace-metal clean techniques, basically following GEOTRACES protocols. Vertical profiles of dissolved and labile particulate iron were obtained from the repeated sampling. Marked regional contrasts were observed in iron distributions. The western subarctic exhibited elevated dissolved iron concentrations in the intermediate layer and pronounced temporal variability on the order of 1–2 nM over the observation period. In contrast, dissolved iron concentrations at the eastern station remained relatively stable throughout the water column over time. Labile particulate iron concentrations were also substantially higher in the western region than in the east. Comparisons of the vertical iron sections between 2008 and 2022 suggest that the temporal changes in the western subarctic are driven by variability in iron loading within source regions and subsequent long-distance transport by water masses.