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Migrations of the Antarctic Polar Front in the Indian sector of the Southern Ocean since the last interglacial

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Southern Ocean holds key to variations in atmospheric CO_2 as its sea surface temperature (SST) is strongly coupled to CO_2 over the past 720 kyr (Uemura et al., 2018). SST changes likely accompany migrations of the Antarctic Polar Front (PF) which is defined by the southern bound of strong SST gradient (>1.5° over 100 km) (Dong et al., 2006; Freeman et al., 2016). Because the circumpolar path of the PF closely matches the boundary between carbonate and siliceous sediments (Dutkiewicz et al., 2015), the PF position can be estimated from the plankton assemblages of deep-sea sediments. In this study, we conducted planktic foraminifera census counts to reconstruct SST and the PF position since the last interglacial (last 150 kyrs). Sediment samples were collected from the DCR-1PC (46°S, 44°E, 2632 m water depth) recovered on the Del Can˜o Rise in the Indian sector of the Southern Ocean. Reconstructed SST based on transfer functions ranged from 13.4˚C $\sim$ 1.9˚C and 4 $\sim$ 6˚C anomalies were observed at the last two deglaciations (positive) and Marine Isotope Stage (MIS) 5d/5e transition (negative). We compared our SST changes with the stacked SST record (Uemura et al., 2018) to determine whether SST changes occurred over broad regions (i.e. Indian sector) or only at studied site. The SST anomalies at the last two deglaciations are comparable with the stacked record, whereas that at MIS 5d/5e transition is only found in our SST record. To constrain the past PF position, we developed Southern Ocean Foraminifera Assemblage (SOFA) ratio based on the relative abundance of specific foraminifera species. The application of SOFA into foraminifera database in surface sediments (Siccha and Kucera, 2017) revealed distinct ratio between the north and south of the PF, allowing us to estimate the PF position relative to studied sites. The SOFA ratio at the DCR-1PC indicated southward migrations of the PF at the last two deglaciations and northward migration at MIS 5d/5e. We considered that SST changes at the last two deglaciations largely reflect Indian sector-wide PF migrations, whereas that at MIS 5d/5e explain site-specific PF migration.