Impact of the Recent Warming Trend in the Southern Indian Ocean on Antarctic Ice Shelves

남인도양의 최근 온난화 경향이 남극 빙붕에 미치는 영향

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Recently, the West Antarctic ice shelf has rapidly melted due to global warming. The melting of the ice shelf induces ice loss from the Antarctic ice sheet and consequently leads to global sea level rise. The decrease of the ice shelf height has been attributed to the basal melting by the warm Circumpolar Deep Water (CDW) import into cavities beneath ice shelves, the suppressed mass accumulation by reducing snowfall, and the increased ice discharge by ice dynamics. In particular, the basal melting has been known to be related to the recently accelerated ice mass loss in the Amundsen Sea embayment (ASE). The atmospheric westerly wind anomaly near the shelf break is responsible to the import of the CDW. Some researcher have revealed that the wind anomaly is induced by the equatorial Pacific variabilities such as the El Nino-Southern Oscillation (ENSO) and the Interdecadal Pacific Oscillation (IPO) (i.e., Paolo et al. 2018; Holland et al. 2019). They have found that the equatorial internal climate variability could be a factor that accounts for changes in Antarctic ice shelf on interannual to decadal time scales. However, since the 1990s, the rapid sea surface temperature (SST) warming trend has been observed in the Indian Ocean, especially in the southern Indian Ocean (SIO), where the highest warming of ~0.02 degC/year appears. On the other hand, the Pacific shows the weak cooling trend of ~ -0.008 degC/year. From a trend perspective, it indicates that in recent decades the warming in the SIO may have has a greater impact on climate change in the Antarctic than the Pacific one. This study analyzes the correlation between SST variation in the SIO and the ASE ice shelf variation on interannual time scale because of a limitation of a short observation period of ice shelf data. The result represents

that diabatic forcing in the SIO, located to an entrance of the subtropical jet, generates a teleconnection toward the Southern Hemisphere high latitudes, then modifies the Amundsen Sea Low, which causes the westerly wind anomaly. Based on the same mechanism, it can be inferred that the warming in the SIO is closely related to the rapid ice loss in the ASE in recent decades.

Key words: CDW, Ice Loss of the Amundsen Sea Embayment, Southern Indian Ocean warming, Teleconnection