

Variability of Kerguelen-Davis Oscillation Index (KDOI) influencing environmental ecosystem in the Prydz Bay region, east Antarctica

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Large change of the environment (climate-ocean) and the ecosystem in the Antarctic Ocean happens frequently in recent decades (as general reviews, IPCC, 2001, 2007; Turner et al., 2009; Rintoul et al., 2012). The key factor that brings the change of the environmental ecosystem in the Antarctic Ocean seems to be a large change of the circum-westerlies around the Antarctica analyzing Southern Annular Mode (SAM), alias Antarctic Oscillation Index (AOI).

We are interested in researching about relationships between environment (climate-ocean), Antarctic krill ecosystem which is a keystone species of the Antarctic ecosystem, and whale ecosystem which is one of main predators in the Antarctic. A fundamental issue is how to take approaches for the understanding of relationships between climate-ocean-ecosystem in various specific phenomena to such the Antarctic Ocean. This issue may be originally complex. The attempt of various approaches exists. In the beginning, we tried to investigate, arrange and analyze relevant data to climate variability in the complex relation systems of climate-ocean-ecosystem.

We have assessed a climate environmental index determined from sea level pressure differences between Kerguelen Islands (Port-aux-français; 49-21S, 70-15E) and Davis Station (68-34S, 77-58E), the east Antarctica, from 2006 to 2013 (Kerguelen-Davis Oscillation Index; KDOI) (Fig. 1), designed by an aspect of hypothesis applying the results and consideration with the Drake Passage Oscillation Index (DPOI) in the west Antarctic Ocean (Naganobu et al., 1999). In addition, we have assessed the extent of sea ice (data by AMSR-E, JAXA) enclosed with 60S south and 70-90E, from 1979 to 2011.

The time-series of KDOI indicated as follows. (1) The effective dataset of Kerguelen had the limited years since 2006 while the Davis's data had 56 years since 1957. Therefore, an analytical period of KDOI was limited in seven and half years at this stage. (2) KDOI during 2006 and 2013 showed the variability of upward trend with 4-year periodicity (Fig. 2). In addition, the time-series of sea ice extent in austral summer from 1979 to 2011 showed the upward trend taking yearly variability (Fig. 3) suggesting some relationship with KDOI.

KDOI newly identified indicates the characteristic variability and suggests the relationships to the regional environmental ecosystems such as sea ice, ocean and biological ecosystem including krill and whale as the axis of coordinate climate index.

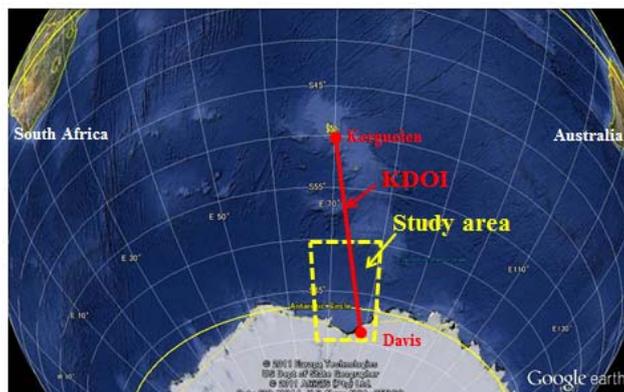


Fig. 1: KDOI (between Kerguelen Islands and Davis Station, Antarctica) and the study area including SIBEX, JARPA and others around Prydz Bay, west Antarctica.

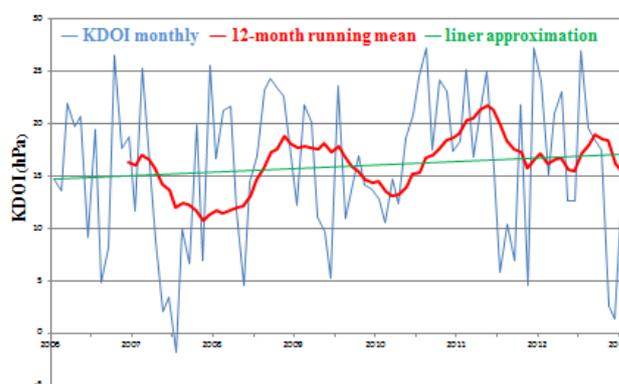


Fig. 2: Time-series of KDOI from 2006 to 2013. The trend of 12-month running mean shows approximately 4-year periodicity and being elevated overall.

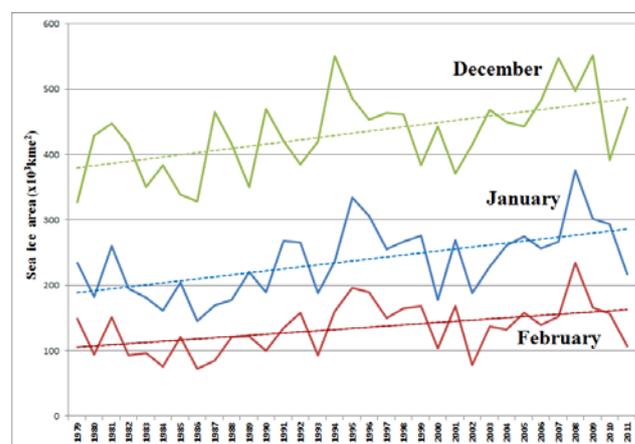


Fig. 3: Time-series of sea ice extent in austral summer (December, January and February), south 60S between 70-90E from 1979 to 2011. The trends show upward tendencies.