The impact of Drake and Tasmanian Passages on Antarctic regions and deep ocean temperature

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Through the Cenozoic, the climate has long term cooling trend. At Eocene/Oligocene boundary, the opening of the Drake and Tasmanian Passages caused the development of Antarctic Circumpolar Current and led to the thermal isolation of Antarctica (Kennett, 1977), and previous modeling studies investigated the effect of the opening those passages (Sijp and England, 2004, 2011, Zhang et al., 2010). In addition to the passages, the effect of the land-sea configuration change was investigated (Sijp et al., 2014, Lunt et al., 2015). And CO2 is considered as the important forcing of the Cenozoic cooling (Hansen et al., 2013). In long-term climate change, the relative importance of various forcings wasn't understood well. It is suggested that the different conditions about land-sea configuration, CO2 concentration, and the existence of Antarctic ice sheet in these previous studies affect the amplitude of the Antarctic regions at the closing the passages.
Here we investigate the Antarctic regions and deep ocean temperature change between the opening and closing Drake and Tasmanian Passage under with Antarctic ice sheet and without that. Our result says that the closing passages cause the temperature increase at Antarctic regions through the strong deep water formation at Southern Ocean and strong southward heat transport. The deep ocean temperature is mainly affected by the absence of the Antarctic ice sheet. Our results suggest that the absence of Antarctic ice sheet largely affect the temperature change of the deep ocean and at the Antarctic regions by closing Drake and Tasmanian Passages.

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