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Changes monitoring of the Drygalski Ice Tongue front during 1973 to 2012

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Drygalski Ice Tongue is the largest outlet glacier in the Victoria Land part of the East Antarctic ice sheet with an area of 224,000 km2, and it is the seaward extension of David Glacier, located on the Scott Coast, in the northern part of McMurdo Sound of Antarctica's Ross Dependency. The supply of the David Glacier-Drygalski Ice Tongue comes from two main flows, a northern one from the Talos Dome and a southern one from Dome C. The importance of this glacier is due to the fact that it is the most massive drainage glacier in the Victoria Land part of East Antarctica sector. In addition, the ice tongue forms the southern coastline of Terra Nova Bay and the maximum eastward extent of the Terra Nova Bay polynya is limited by the length of the ice tongue. In this study, we extracted the boundaries of the Drygalski Ice Tongue front from 1973-2012 using a time series of ENVISAT ASAR and Landsat TM/ETM+ data. To quantify the ice tongue front changes, we measured the length of the ice tongue along two ice flowlines in the southern and northern side from the latest grounding line data. In January 2005, the Drygalski Ice Tongue was about 147 km and 114 km long in the southern and northern side. In March 2005, the giant 120 km long iceberg known as B15A collided with the end of the ice tongue breaking off two large pieces (the western one is 70.38 km2 and the eastern one is 91.76 km2). A year later in March 2006 another giant iceberg known as C16 broke another piece off of $\sim$105.3 km2 in size. Since then the ice tongue started another steady propagation and amounted to be around 134 km and 111 km along the southern and northern flow. By calculating the distance of coastlines in different years, we found that the average propagation rate of the ice tongue front along the south flowline is 600 m a-1, while that along the north flowline is 596 m a-1. It indicates that the velocity of the southern flow is almost same as that of the northern one, which is different from the velocity near the grounding line where the southern velocity (580 $\pm$ 30 m a-1) is larger than the northern one (259 $\pm$ 30 m a-1). Besides, the results suggest that velocities of both the southern and northern flow in the front remained relatively constant from about 1973 to 2012, and show a similar change trend. The average velocity of the ice front between 1960 and 1993 was approximately 800 m a-1, faster than 600 m a-1 during 1973 to 2012, which also proved that the propagation rate of the ice tongue was slowing down.