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Dynamic changes in Dalk Glacier in East Antarctica derived from multisource satellite observations

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Monitoring variability in outlet glaciers can improve understanding of feedbacks associated with glacier calving, ocean thermal and climate changes. In this study, a comprehensive overview of dynamic changes in Dalk Glacier since 2004 was performed using multisource satellite data. Detailed measurements of the glacier extent, velocity and elevation were conducted. During 2004-2017, periodic advances and retreats of calving margins, anomalous interannual accelerations and seasonal fluctuations in surface velocity were monitored. For the front region, there were significant velocity increases (25-30 m/a) in 2007, 2012 and 2017, and velocities in the austral winter of 2016 were $\sim$ 30 m/a lower than the velocities during the austral summer in 2017. Our study indicates that there is a significant link between disintegrations and interannual speed variations. Different levels of disintegration and margin retreat contributed to different degrees of loss in ice-shelf buttressing and caused corresponding increases in the velocities of different regions. Simultaneous speedup of the Dalk Glacier front driven by large calving events was detected in 2007. However, the time of upstream ice flow acceleration was two years later (2009). For sporadic disintegrations between 2010 and 2012, surface velocities in all regions increased correspondingly in 2012. Although the surface elevation of the ice shelf was in a relatively stable condition from 2004 to 2016, the front ice rumple of Dalk Glacier provides significant constraining effects for upstream regions and greatly destabilizes the ice tongue. We found that disintegrations occurred when the glacier front crossed the whole ice rumple (2006 and 2016) or when the atmosphere and ocean temperatures changed significantly (2009 and 2010), triggered by ocean warming and current erosion.