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Ground based radar measurements in a marine environment for glacier calving front studies.

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A ground-based radar has been used successfully for monitoring velocities and calving events at Kronebreen, Svalbard, for four test seasons in 2007,2008, 2009 and 2010. The radar is placed ∼4 km from the glacier front and it transmits the signal across Kongsfjorden. It transmits at 5.75 GHz and measures at high temporal rate (2 Hz). The antenna lobe covers a width of∼700m of the calving front, and a range of 300 m. The latter includes the calving front and 250m up-glacier. We find that the glacier surface provides natural permanent scatterers, so spatially continuous movements at the front and at locations further up-glacier can be tracked. High frequent noise is present in the velocity data. We used daily terrestrial optical photogrammetry and continuous visual observation to validate the identification of calving events in a 116 hour record of amplitude of return signal data measured from 26 to 30 August 2008. Calving events were detected applying an automated change-detection technique to the radar dataset. This technique allowed us to detect 92% of the events that were observed during the same time. We also observe that the marine environment affects the radar signal in several ways. Destructive interference due to multipath scattering covers an enlarged area in the amplitude data set due to the tidal cycles. The transmitted and received radar signal is disturbed due to variations in the refraction index over the fjord. High frequent noise as observed on the velocity measurements may be due to ocean water waves in the fjord. The observed noise may be affected by the choice of antenna polarization. Plans for an improved version of the radar system designed for calving front monitoring and 2D mapping of glacier velocities will also be presented.