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Multi-year observations of calving and front characteristics of two marine terminating outlet glaciers

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We observed two outlet glaciers in West- and Nordwest-Greenland with a terrestrial radar interferometer (TRI), pressure sensors and time-lapse cameras over six and two years, respectively. The resulting detailed dataset provides us with insights on the calving process and the changes in front geometry over the last years. Since the two glaciers are characterised by different geometries and velocity fields, the influence of those parameters on the calving process can be investigated. The combination of the three different observation methods enable us to overcome their individual disadvantages. With the time-lapse camera taking pictures of the glacier front every 10 seconds, we detect all calving events of different sizes and styles but cannot quantify the volume. We used the TRI to quantify the volumes of aerial calving events by DEM differentiation. Further, calving waves measured with pressure sensors are used to distinguish between different calving types. We develop a relationship between calving volumes and wave heights and use this as an additional indirect method to estimate calving volumes. We find that the calving style and size as well as the front geometry is mainly controlled by the bed topography and the presence of a subglacial discharge plume. The location of the plume is observed to migrate from year to year, which leads also to changes in the calving pattern. Calving style and pattern as well as glacier velocity fields and geometry changes are additionally compared with environmental conditions such as the air temperature and the presence of ice-mélange in the proglacial fjord. In years with an early spring we find different front characteristics and calving patterns than for years with colder conditions.