



Lead Author e-mail: michal.cieply@interia.pl

Title: *Studies on calving mechanism of Spitsbergen tidewater glaciers with special reference to Hansbreen*

Michał Cieply¹, Jacek A. Jania¹, Dariusz Ignatiuk¹, Michał Pęćlicki², Ethan Welty³

¹*Faculty of Earth Sciences, University of Silesia, Sosnowiec, Poland*

²*CEAZA, La Serena, Chile*

³*INSTAAR, University of Colorado, Boulder, USA*

Dynamic response of Arctic glaciers to climate warming accelerates production of icebergs and in turn influences global sea level rise. A general calving law applicable to all types of tidewater glaciers is still not formulated properly. We present results of studies on processes leading to better understanding of calving mechanism. They are concentrated on the terminal part of Hansbreen a medium size (56 km²) polythermal glacier emptying into the Hornsund Fiord in Southern Spitsbergen. Detailed observations of behavior of its ice cliff and the lower reach of the glacier have been done during two consecutive summer seasons 2011 and 2012 by couple of instruments. Monitoring system consists by time laps cameras, laser ranger for measurements of ice cliff position and sea pressure gauge station. In 2012, terrestrial laser scanner was used for repeated survey of ice cliff.

Results suggest that melting of subsea part of the ice cliff triggers calving. Maximum depth of the niche at the sea level is reaching 1.2-1.4 m and then breaking off starts above the undercut first. Collapse of the upper part of ice wall was observed subsequently. Sea water temperature and wave action play important role for development of this undercut along the ice cliff. Presence of sea ice floes in the fiord in July 2011 lowered sea water temperature and attenuates wave action. Therefore, calving of Hansbreen was significantly less frequent in this season. Intensity of calving was significantly higher in summer 2012. Calving intensity in the ice cliff segments where outflows of subglacial river appear is higher than in other terminus area. Photogrammetric examination of time lapse photos of the terminal part of the glacier documented that calving starts in the second half of June when sea water temperature is reaching positive values and ends in late November or in December. Calving events during winter are very rare.

Results from Hansbreen suggest calving mechanism of grounded polythermal glaciers in Svalbard. Ice flow plays an important role for preparation of the glacier terminus for detachment of icebergs due to weakening of its structure (propagation and widening of crevasses) and seaward processes are triggering calving.