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Basal friction evolution and crevasse distribution during the surge of Basin 3, Austfonna ice-cap – offline coupling between a continuum ice dynamic model and a discrete element model

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The outlet glacier at Basin 3, Austfonna ice-cap entered its active surge phase in autumn 2012. We assess the evolution of the basal friction during the surge through inverse modelling of basal friction coefficients using recent velocity observation from 2012 to 2014 in a continuum ice dynamic model Elmer/ice. The obtained basal friction coefficient distributions at different time instances are further used as a boundary condition in a discrete element model (HiDEM) that is capable of computing fracturing of ice.

The inverted basal friction coefficient evolution shows a gradual 'unplugging' of the stagnant frontal area and northwards and inland expansion of the fast flowing region in the southern basin. The validation between the modeled crevasses distribution and the satellite observation in August 2013 shows a good agreement in shear zones inland and at the frontal area. Crevasse distributions of the summer before and after the glacier reached its maximum velocity in January 2013 (August 2012 and August 2014, respectively) are also evaluated. Previous studies suggest the triggering and development of the surge are linked to surface melt water penetrating through ice to form an efficient basal hydrology system thereby triggering a hydro- thermodynamic feedback. This preliminary offline coupling between a continuum ice dynamic model and a discrete element model will give a hint on future model development of linking supra-glacial to sub-glacial hydrology system.