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Synchronous Early Holocene glacier behavior in the European Alps – Evidences from a new cosmogenic 10Be chronology of Argentière glacier (Mont-Blanc massif, French Alps)

Marie Protin (1), Irene Schimmelpfennig (1), Jean-Louis Mugnier (2), Ludovic Ravanel (3), Philip Deline (3), Melaine Le Roy (3), Jean-François Buoncristiani (4), Aster Team (1,5)

(1) Aix-Marseille Université, CNRS, IRD, Coll France, CEREGE, Aix en Provence, France (protin@cerege.fr), (2) Université Savoie Mont Blanc, CNRS, ISTerre, F-73376 Le Bourget du Lac, France, (3) Université Savoie Mont Blanc, CNRS, EDYTEM, F-73376 Le Bourget du Lac, France, (4) Université de Bourgogne, CNRS, Biogéosciences, F-21000 Dijon, France, (5) ASTER Team: Georges Aumaître, Didier Bourlès, Karim Keddadouche

Reconstruction of past glacier fluctuations is an important step towards the comprehension of glacier response to past and future climate changes. Moraine deposits and roches moutonnées represent univocal geomorphic markers of advanced glacier extensions, and their dating using in situ-produced cosmogenic nuclides is a valuable approach for better constraining past glacier behavior.
To better understand the past glacier fluctuations in the European Alps, this study focuses on the Argentière glacier, located on the north-western flank of the Mont-Blanc massif (MBM) in the Western Alps, and hosting some of the largest European glaciers. Here, gemorphological analysis and new 10Be exposure ages obtained from moraine boulders and roches moutonnées surfaces on the left-lateral side of the Argentière glacier are presented. The exposure ages of the investigated roches moutonnées suggest that the Early Holocene deglaciation in the studied area started around 11 ka ago. The adjacent lateral moraines indicate that the glacier oscillated at least three times during the subsequent millennium. Afterwards, around 10 ka ago, it retreated within the Little Ice Age (LIA) limits represented by the largest moraine. The geometry and proximity of these Early Holocene and LIA moraines suggest that the glacier had nearly the same thickness at roughly 2200 m a.s.l. during those two periods. The obtained chronology is in agreement with several other studies in the western and central parts of the Alps, implying that throughout the Alps, glacier behavior was synchronous at the beginning of the Holocene. Based on these data and additional 10Be exposure ages obtained from Argentière glacier frontal moraines located almost 2.5 km outboard of the LIA terminus, we will present potential climate scenarios for the studied periods in comparison with the LIA and the present. Furthermore, the influence of local factors versus regional and hemispheric climate drivers responsible for the observed glacier fluctuations will be discussed.