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GPS and TerraSAR-X time series measure temperate glacier flow in the Mont Blanc massif (France): the Argentière glacier test site.

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We present measurements of the surface velocity of the Argentière glacier in the Mont Blanc massif, France, obtained by SAR and GPS observations. We produce surface velocity fields from several couples of descending and ascending TerraSAR-X acquisitions repeated at 11 days intervals in spring 2009, using the offset power tracking technique. Moreover, we dispose of four years of GPS data acquired continuously on the Argentière glacier. Our local permanent GPS network is composed of two stations on the glacier at altitudes of 2441 m and 2770 m, and two stations in static places, one in the valley of Chamonix at an altitude of 1121 m and the other on a rock outcrop near the glacier at the altitude of 2835 m. The measurements yield average displacement rates of about 13 cm/day for the upper glacier station (2770 m) and 17 cm/day for the lower site (2441 m). These in situ GPS results have been used already to validate the displacement rates of a corner reflector on the glacier measured by SAR interferometry. Here, we will use the GPS observations to validate longitudinal profiles of the surface velocity field obtained by offset power tracking. The combination of continuous GPS time series and successive TerraSAR-X images yield new information on temperate glacier dynamics, constraining an annual variability of the displacement rates of up to 28 %, with fastest flow in late summer, and a spatial variability of the displacement rates of up to 50%, with fastest flow at the bottom of the glacier. The continuous monitoring (in space and time) of the Argentière glacier flow over several annual cycles can be used to examine the correlation with climatological parameters such as temperature and cumulated precipitations and provides an exceptional data set for improving models of temperate glacier flow mechanisms.