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Three-dimensional surface velocities of Argentiere and Mer de Glace glaciers, France, derived from radar interferometry : Analysis and comparison with in-situ measurements.

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Abstract : Four descending ERS1-2 tandem mode synthetic aperture radar (SAR) interferometric (InSAR) data pairs are used to measure the surface flow field of two alpine glaciers in the French Alps mountains. The topographic component of the interferometric phase is removed by using a digital elevation model (DEM) of the terrain and precise orbit data to reconstruct the ERS InSAR imaging geometry. As one line of sight (LOS) measurement is not sufficient to derive the three dimensional (3D) surface flow field, several different assumptions are considered to determine the missing variables, and to calculate the 3-D surface flow fields. An expert knowledge and the analysis of ten years measurements of the glacier flow allow the detection of areas when the velocity is stationary during the different seasons. Annual in-situ measurements at the date of the SAR acquisition are taken into account to fix the unknown LOS displacement offset. Finally, a discussion of the four velocity fields observed over different glaciers is proposed and a good agreement with differential GPS measurements is shown.