



Thinning of the Mer de Glace (Alps) during the last 25 years: relative contribution of changes in surface ablation and glacier dynamics

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By using sequential digital elevation models (DEMs) derived mostly from satellite images, we have observed, in a previous study, thinning rates evolving from 1 +/- 0.4 m/a (years 1979-1994) to 4.1 +/- 1.7 m/a (2000-2003) on the tongue of the Mer de Glace (French Alps). Our goal here is to assess the relative contribution of both changes in surface ablation and changes in glacier dynamics to this recent evolution.

To estimate the direct impact of changes in atmospheric conditions, we use a positive degree day model. The enhanced surface ablation, due to rising temperatures, is responsible for about 45% of the increase in thinning rate. The contribution of changes in glacier dynamics is then estimated. The satellite-derived annual velocities for years 1993-94 and 2000-01 are 30 to 40% slower than field measurements performed between 1965 and 1980. These reduced ice fluxes from the upper to the lower part of the glacier are responsible for about 40% of the increased of the thinning of the glacier tongue.

Our study highlights the major role played by glacier dynamics in their response to climate change.

All SPOT images were acquired through the ISIS program at CNES.

Keywords: mountain glaciers, ice dynamics, mass balance, climate change, remote sensing