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Widespread decadal-scale decrease of glacier speed revealed using repeat optical satellite images

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Matching of repeat optical satellite images to derive glacier velocities is an approach that is much used within glaciology. Lately, focus has been put into developing, improving, automating and comparing different image matching methods. This makes it now possible to investigate glacier dynamics within large regions of the world and also between regions to improve knowledge about glacier dynamics in space and time. In this study we investigate whether the negative glacier mass balance seen over large parts of the world has caused the glaciers to change their speeds. The studied regions are Pamir, Caucasus, Penny Ice Cap, Alaska Range and Patagonia. In addition we derive speed changes for Karakoram, a region assumed to have positive mass balance and that contains many surge-type glaciers. We find that the mapped glaciers in the five regions with negative mass balance have decreased their speeds over the last decades, Pamir by 43\,\% in average per decade, Caucasus by 8\,\% in average per decade, Penny Ice Cap by 25\,\% in average per decade, Alaska Range by 11\,\% in average per decade and Patagonia by 20\,\% in average per decade. Glaciers in Karakoram have generally increased their speeds, but surging glaciers and glaciers with flow instabilities are most prominent in this area.