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Mapping glacier ice thickness in Patagonia

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The two Patagonian icefields cover an area of 17194km2 and they have been estimated to accommodate an ice volume of 5561km3. They are therefore the largest connected ice entities in the southern hemisphere, apart from the Antarctic ice sheet. The last distributed estimate of glacier ice thickness was solely informed by glacier geometry (Carrivick et al., 2016). Moreover, the inferred thickness fields were only loosely compared to few available measurements. The approach deliberately ignored the fast glacier flow characteristic for these icefields as well as the singular climatic setting. The Andes constitute a formidable obstacle for the tropospheric flow, which results in the formation of one of the most extreme climatic divides in the world with super humid conditions in the west and dry conditions in the east. I expect that these unique climatic and ice-dynamic conditions are imprinted in the basal topography but it remains unclear to what extent the total ice volume estimate is affected. I therefore applied a mass-conserving approach for mapping glacier ice thickness that accounts for the ice-dynamic and climatic state as well as recent changes in the glacier geometries. Moreover, the approach can readily assimilate available thickness measurements.

In a first attempt to map the thickness distribution of the Northern Patagonian Icefield, the approach could be constrained by more than 160’000 individual thickness measurements. These results confirm the previous geometry-based volume estimate. Yet the spatial thickness distribution differs substantially. Differences are observed both in areas with and without observational constraints and they have severe implications for estimating the ice discharge through the many marine- and lake-terminating outlet glaciers in this area.