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Glacier meltwater drainage patterns, discharge and sediment load at the debris covered Suldenferner, Ortler massif, Italy.

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The westernmost part of Suldenferner (46°29’46"N/10°34’03"E) descends from Ortler (3905m) towards the South East and is largely debris-covered below 2900 m. Meltwater is discharged in two main outflows: Outflow A discharges relatively clear waters along the northern glacier margin and Outflow B discharges more turbid water towards the south of the glacier front. While terrestrial photographs show that Outflow A has remained unchanged since summer 2015, Outflow B has undergone substantial reorganisation due to melting of the surrounding ice. In summer 2017 and 2018 a series of dye tracing studies was undertaken to identify the drainage pathways across the glacier and quasi-concurrently monitor the discharge and suspended sediment content (SSC) in these outflows.

The drainage pathways were found to be well separated around a medial moraine structure in both summers, with waters from the main glacier exiting in Outflow A and waters from a subsidiary part of the glacier exiting Outflow B. A transient surface lake fed solely by waters from the southern side of the glacier formed in 2017 but not in 2018.

The northernmost lateral outflow is fed by the larger part of the glacier surface and discharges the bulk of the glacier meltwater. Both outflows show a strong diurnal cycle in discharge as expected, and suspended sediment loads were typically higher during the day. A seep of relatively clean water (SSC 2-38 mg/L) flowing into Outflow A was observed to maintain its discharge levels into the evening. Outflow A had mean SSC of 72 mg/L, while Outflow B contained an order of magnitude higher sediment load with mean SSC of 33g/L. Dye tracing studies revealed the source of the high sediment load in Outflow B to be ice rich basal ice and moraine close to the glacier margin rather than distally sourced basal glacier sediments.
These findings indicate that the higher sediment load from the debris covered glacier compared to neighbouring clean ice glaciers is related to the fluvial erosion of the substantial sediment retained within the debris covered glacier body. The SSC in the glacial waters from the debris covered Suldenferner can be expected to change substantially with ongoing changes in channel geometry at the glacier margin.