INFLUENCE OF DEBRIS FLOWS AND CHANNEL ENGINEERING ON SEDIMENT CONNECTIVITY AND CHANNEL MORPHOLOGY IN HIGH MOUNTAIN AREAS (VENOSTA VALLEY, ITALIAN ALPS)

Report from the ES1306 STSM stay

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Note: Due to recent rock glacier movements, rapid glacier retreat and recent debris flow events in the Italian Alps and their potential implications for sediment connectivity in high-alpine environments the focus and title of this STSM have changed (see below).

NEW TITLE:
INFLUENCE OF ROCK GLACIER MOVEMENT, GLACIER RETREAT AND DEBRIS FLOW EVENTS ON SEDIMENT CONNECTIVITY IN THE ITALIAN ALPS

1. INTRODUCTION

Active rock glaciers are periglacial depositional landforms resulting from creeping permafrost-rich debris in high, typically dry, mountain environments (Barsch, 1996; Haeberli et al., 2006; Berthling, 2011). The temporal change of a rock glacier's surface flow velocity is primarily related to climate (Kääb et al., 2007; Delaloyle et al., 2008; Kellerer-Pirklbauer and Kaufmann, 2012). Global warming therefore potentially increases the velocity of rock glacier movement which may further cause blockage of Alpine valley floors. Global warming also causes glacier retreat and sediment release from the glacial system as well as brings along increased frequencies of high-magnitude rainfall events which together influence frequency and magnitude of debris flow events in high mountain environments (e.g. Chiarle et al., 2007) such as the European Alps. However, knowledge about the influence of rock glacier movement, glacier retreat and debris flow events on sediment connectivity in high mountain areas is scarce and depicts a significant research gap. Therefore the main focus of this STSM was to investigate the influence of rock glacier movement, glacier retreat and debris flow events on sediment connectivity in high mountain environments using geomorphological mapping.

2. STUDY AREAS

The study areas of this STSM are spread over the Alpine areas of the Italian regions Trentino-South Tyrol and Lombardy (see Fig. 1).

Fig. 1 Regions of Italy (STSM study regions are located within the red circle); source: https://en.wikipedia.org/wiki/Regions_of_Italy

In Figure 2 and Table 1 five locations within the study region (see also Figure 1) at which geomorphological mapping was applied are designated.

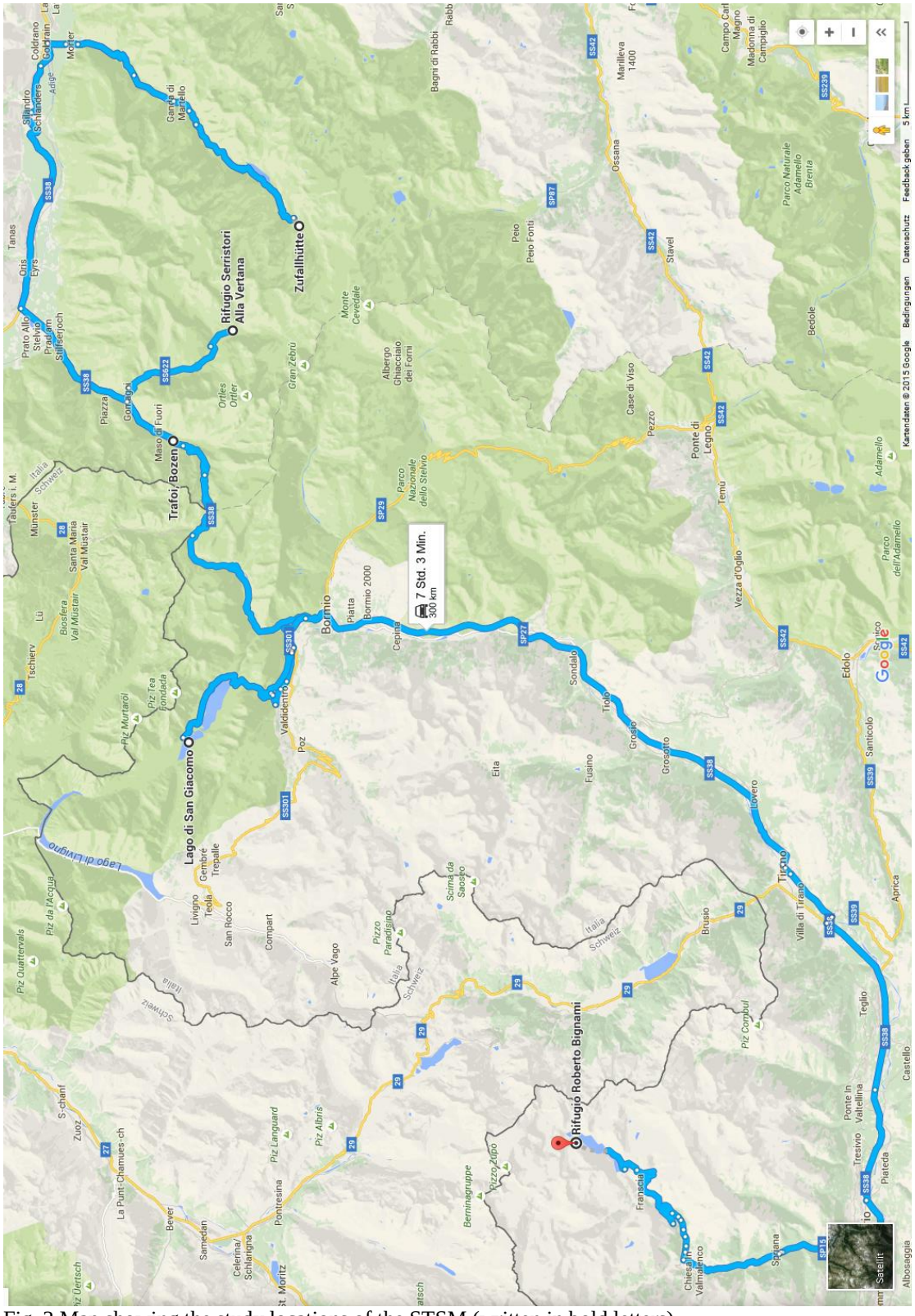

Fig. 2 Map showing the study locations of the STSM (written in bold letters)

Table 1 Study locations of the STSM: name, date and region

Number	Name	Date	Region
1	Rifugio Serristori Alla Vertana	July 27, 2015	Sulden Valley, Trentino-South Tyrol
2	Trafoi	July 28, 2015	Sulden Valley, Trentino-South Tyrol
3	Zufallhütte	July 29, 2015	Martello Valley, Trentino-South Tyrol
4	Lago di San Giacomo	July 30, 2015	Cancano Lake area, Lombardy
5	Rifugio Roberto Bignami	July 31, 2015	Lanterna Valley, Lombardy

3. FIRST RESULTS

Phenomena related to the STSM focus which were observed and photographed in the course of the geomorphological mapping are presented in the following sections according to the numbering as presented in Table 1.

3.1 Rifugio Serristori Alla Vertana

Deglaciated area with an enormous amount of stored sediments: glacial sediments superimposed by rockfall debris. However, downvalley sediment connectivity is low due to a low longitudinal valley gradient (glacial cirque).
Photograph: Ronald Pöppl, 2015

3.2 Trafoi

Morainic (unconsildated) material in a valley affected by glacier retreat. Sediment connectivity is high due to a high longitudinal valley gradient.
Photograph: Ronald Pöppl, 2015

3.3 Zufallhütte

	High lateral sediment connectivity due to fast moving rock glaciers entering and blocking a valley thereby decreasing longitudinal sediment connectivity. Photograph: Ronald Pöppl, 2015

3.4 Lago di San Giacomo

	Highly frequent debris flow events (high lateral sediment connectivity) entering and filling the Lago di San Giacomo with sediments. Photograph: Ronald Pöppl, 2015
	River entering and filling the Lago di San Giacomo with sediments. Note that the installation of the dam reduced the channel gradient significantly which further caused a change in the river style (from straight-braiding to meandering-braiding). Photograph: Ronald Pöppl, 2015

3.5 Rifugio Roberto Bignami

	Deglaciated area showing a significant amount of unconsolidated morainic sediments (left). However, downvalley sediment connectivity is low due to a low longitudinal valley gradient (glacial cirque). Photograph: Ronald Pöppl, 2015

4. OUTLOOK

The following investigations will be performed in cooperation with the host institute:

a) quantifying sediment transport and storage in the main valley/channel (field measurements, GIS-based analyses)
b) modelling geomorphic processes and sediment delivery (CAESAR-Lisflood landscape evolution model)
c) developing a conceptual model on sediment connectivity in high mountainous areas

Furthermore, the suitability of thermal imagery technology to detect rock glacier temperatures in order to derive the presence of ice and with this rock glacier status and mobility (see example in Fig. 3).

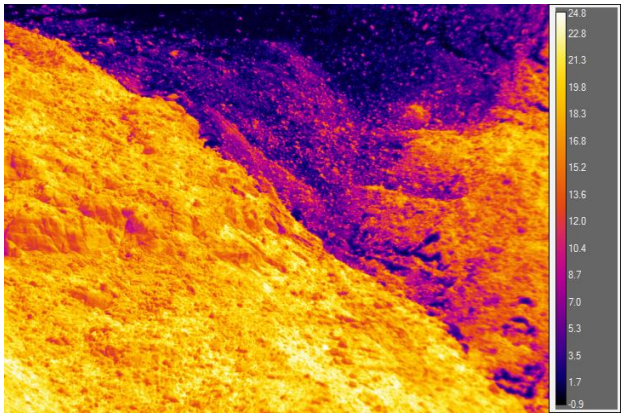

Fig. 3 Thermal image showing an active rock glacier (dark areas) and adjacent ice-free areas (light areas)

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October 20, 2015, Vienna (Austria) Ronald Pöppl