

Glacier field Monitoring: Sulzbachkees, Salzburg, Austria

Since 2001 the glacier-field “Sulzbachkees” was scanned several times to calculate the height- and length- decrease, which is supposed to be initialized by the global climate warming. The field work was done during the summer-month of 2001, 2003 and 2006, when reaching the glacier-field by hiking is possible. The paper describes the workflow and is visualizing the mass-balance of the glacier-field.

Project Key-Facts:

RIEGL instrument	LMS Z-210ii
Object of interest	Sulzbachkees, a glacier field in the “Hohe Tauern” (Austria)
Client’s order	high resolution full 3d digital terrain models of different years, as base-data to verify climate change in the alps
Project management	EGEO and Riegl LMS in coordination with university of Salzburg (Institut of Geography) and local government of Salzburg

Process Key-Facts:

Number of field surveys	3 (2001, 2003, 2006)
Time needed for each campaign	5 hours measuring time, 3 hours hiking to reach the glacier-field
Time needed for post processing	1 day
Acquisition workflow	panorama scan (VxH 80°x360°), registration of scan-data was realized by GPS-data and RiSCANPRO “Multi Station Adjustment”-plugin
Acquisition platform	standard surveying tripod

Scanner at work:



At the Obersulzbachkees (OSK) in Summer 2006 the third laser scan survey campaign of the tongue area and the recently formed front end of the glacier (proglacial lake) took place after 2001 and 2003. Again a terrestrial laser scan system from RIEGL Lasersystems, Austria was in use.

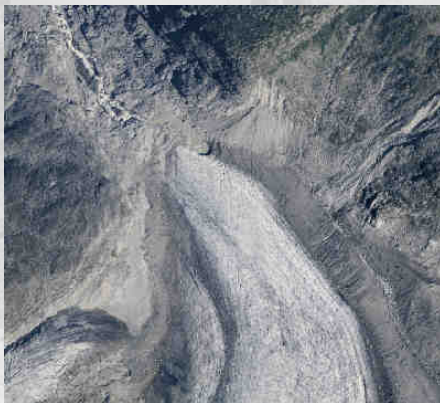
In 2001 a very unfortunate event was the reason for the detailed survey of the glacier tongue and the gravel slope on the east-side of the tongue. On August 3rd, 2001 a group of ten german tourist hiking towards the Kürsingerhütte intended to use the old trail which was already closed in 1999. In that moment, some big blocks in the slope began to move and buried four of the alpinists. Three of them died, the last one just got little injuries.

To make a detailed declaration for the cause of the accident, the area was surveyed for the first time on August 14th 2001 with a RIEGL laser scanner. From the resulting data a detailed terrain model of the area was derived. The results helped to support Prof. Dr. Slupetzky (University of Salzburg) in his expert activity.

In the year 2003 the first survey of comparison took place. The results were depressing. The worst fears about the collapse of the OSK came true. Additionally to a number of years that really hurted the glaciers, 2003 with an extreme summer finally was a catastrophic year.

In summer 2006 the tongue area was surveyed for a third time. Now there exists some time series which optimally documents the permanent recession of the glacier in recent years.

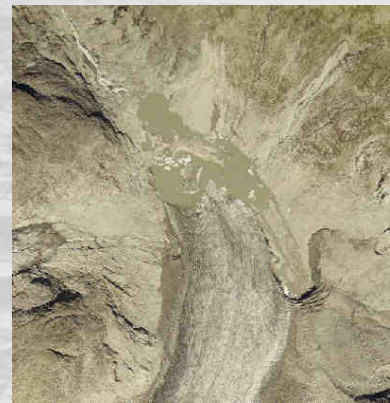
Orthophotos of 2001/2003/2006 showing the recession of the glacier from a bird's view



2001

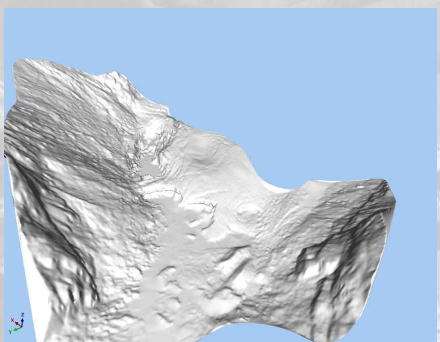


2003

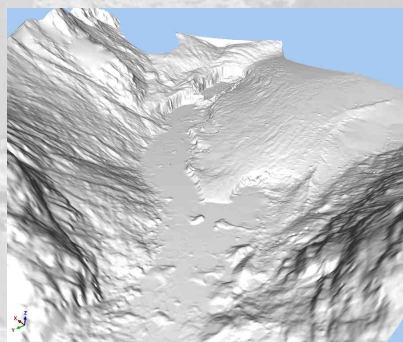


2006

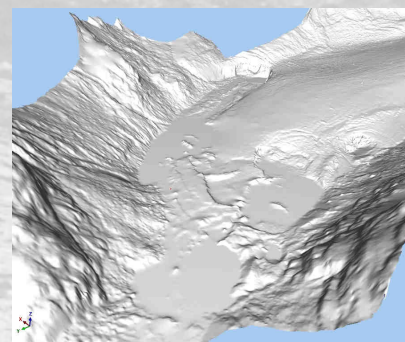
3D model (view-direction from north) showing recession of the glacier



2001

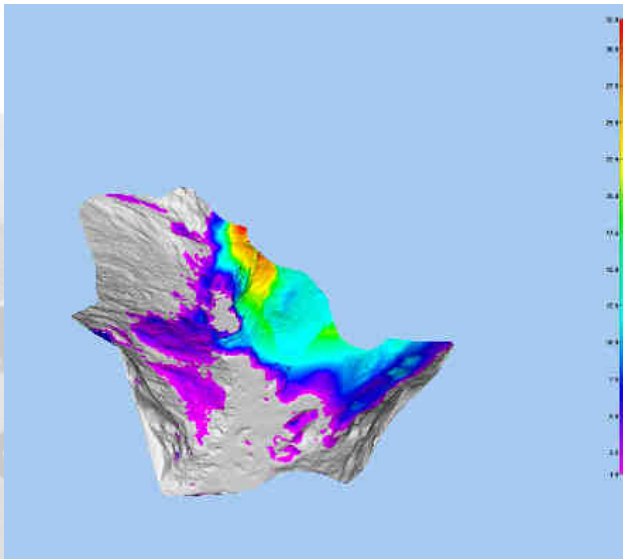


2003

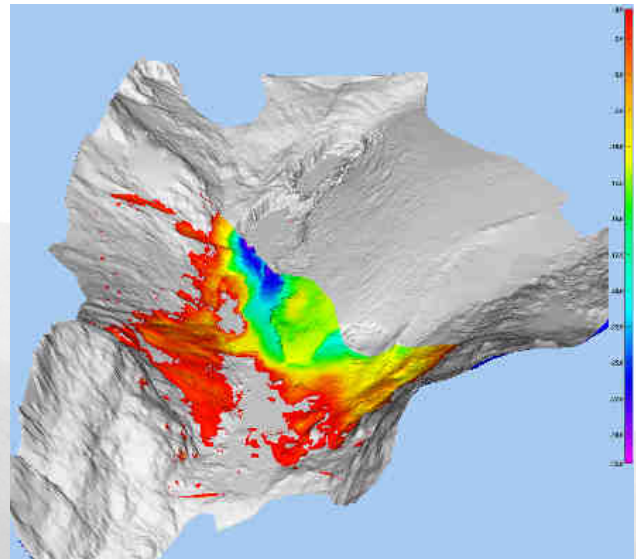


2006

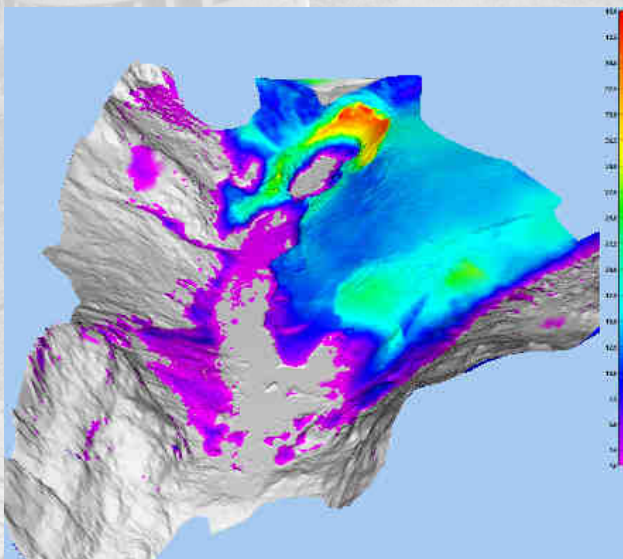
The following comparison maps are showing the dramatic volume-reduction of the glacier field during the last 5 years.



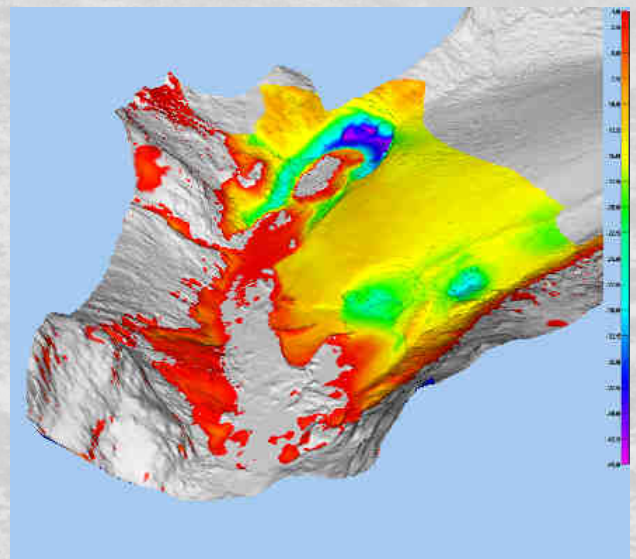
model 2001 compared to 2003



model 2003 compared to 2001



model 2003 compared to 2006



model 2006 compared to 2003

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