Conference Volume	6th Symposium for Research in Protected Areas 2 to 3 November 2017, Salzburg	pages 753 - 756

Speleology in the Berchtesgaden National Park Eiskapelle: 26 years of surveying

[1]Andreas Wolf & [2]Bärbel Vogel

[1]German Speleological Federation VdHK, Institut for Karst and Cave Science Germany IKH
[2] German Speleological Federation VdHK, Institut for Karst and Cave Science Germany IKH,
IUCN / WCPA Caves and Karst Specialist Group

Abstract

The Eiskapelle, one of the lowest-lying permanent snowfields in the Alps, is fed by mighty avalanches that slide down from the east face of the Watzmann and accumulate in the angle of the rock face. The thickness and expansion of the ice is related to the quantity of snowfall and the temperature during the year. Every year since 1989, speleologists have surveyed the ice cave under the snowfield. In cooperation with the Technical University of Munich and Munich University of Applied Science the surface has also been monitored. From 1970 to 2014, a loss of more than 1,000,000 m³ of ice has been determined.

Keywords

firn, ice, cave, snowfield, climate change

Introduction

The scientific study of caves and other karst features, their composition, structure, physical properties, history, life forms, and the processes by which they form and change over time started in the Berchtesgaden National Park in the early 1970s. Speleology is an interdisciplinary field that combines the knowledge of geology, biology, climatology, paleontology, archaeology, meteorology and cartography to develop portraits of caves as complex, evolving systems. The area around Berchtesgaden is famous in Germany for its numerous deep and large cave systems. Six of the twenty-five longest caves and twenty-four of the twenty-five deepest caves are located inside or near the national park. Caving clubs from all over Germany have been working together to explore these difficult systems. In 1984 the Speleo Club of Munich VHM started to survey the Eiskapelle ice cave, a small snowfield at the bottom of the eastern face of the Watzmann. The Eiskapelle is the most low-lying perennial accumulation of firn and ice in the German Alps.

Figure 1: Eiskapelle in 1994, photo: Werner Vogel

Eiskapelle

The Eiskapelle's surface and its cave system are subject to great annual fluctuations. The firn and ice fields are fed by avalanche snow from the slopes of the Watzmann. The cave is consequently filled with masses of snow through the gap at the rock face and entrance areas. During the winter, the snow is deposited on the surface of the ice. In the early summer, the rock wall heats up in the contact zone, melting the ice and feeding countless streams. These are reinforced by productive springs located at the foot of the wall. The ice cave is characterised by a main corridor which undercuts the glacier from west to east. Up to two side corridors have been documented on the northern side and one on the southern side. These are not visible or accessible every year. The middle section of the main corridor is characterised by scallops formed by water and wind. Iit can reach a width of 30 metres. The corridor floors are created by moraine scree which also serves as the bed for the cave stream. Although the body of ice appears to be solid, the cave does experience spalling, especially in the summer. Ice flows regularly fall into the entrance area, which is why the survey activities are conducted during the cooler weather in autumn.

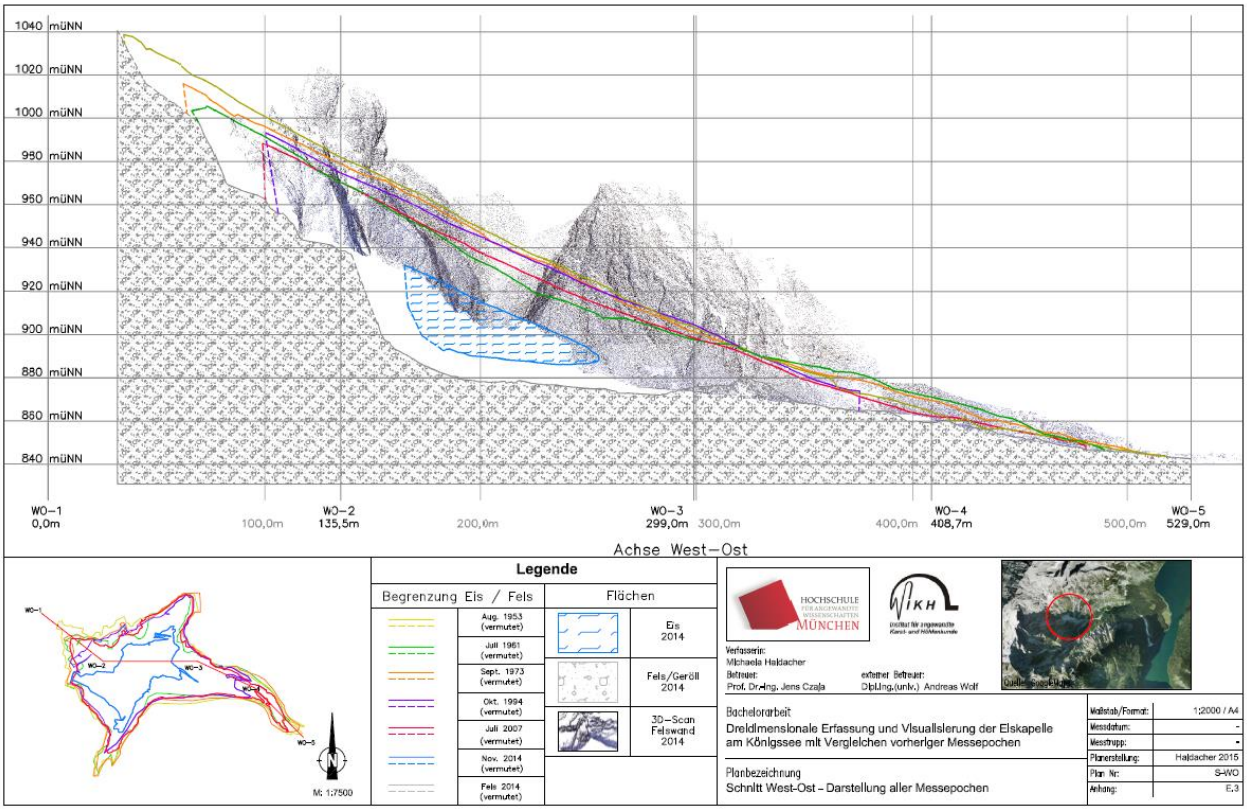

Table 1: Eiskapelle cross section, loss of ice between 1953 and 2014

Survey of the Eiskapelle

The speleological surveys and documentation underground in the ice and firn field have been conducted by members of Southern Bavaria's organised speleology.

Since 1953, the surface of the Eiskapelle has been surveyed at irregular time intervals through geodetical measurement campaigns by the following institutions:

- 1953 Technical University of Munich photogrammetric evaluation of aerial photographs
- 1961 Technical University of Munich: photogrammetric evaluation of aerial photographs
- 1973 Technical University of Munich: photogrammetric evaluation of aerial photographs
- 1994 Technical University of Munich: terrestrial field survey
- 1997 Technical University of Munich: photogrammetric evaluation of aerial photographs
- 2007 Technical University of Munich: terrestrial laser scan
- 2014 Munich University of Applied Science in cooperation with the German Institute for Karst and Cave Science: terrestrial laser scan
- 2017 Munich University of Applied Science in cooperation with the German Institute for Karst and Cave Science: terrestrial laser scan

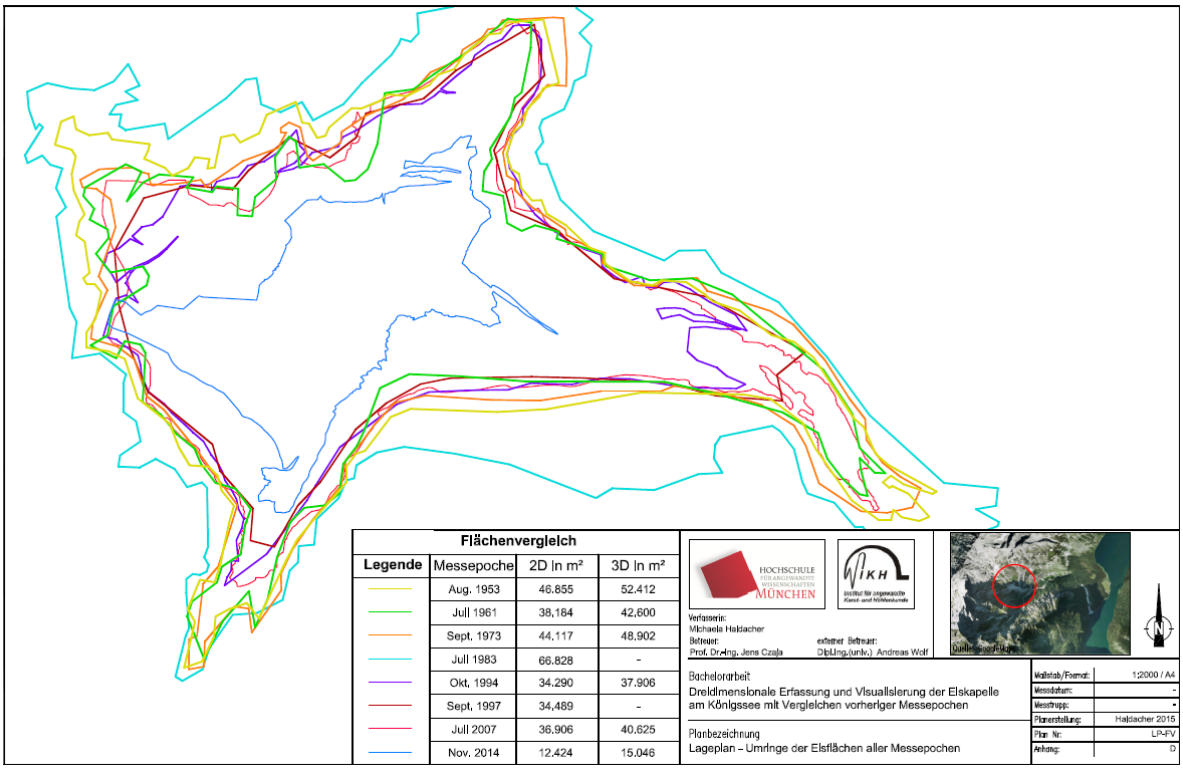

Table 2: Eiskapelle ground plan: loss of surface between 1953 and 2014

Results

Based on the long-term speleological monitoring together with the research conducted by the Technical University of Munich und Munich University of Applied Science, the following results can be presented:

- The cave system, with passages of up to 650 m in length is subject to dramatic changes.
- The surface has been reduced from 46,855 m² in 1953 to 12,424 m² in 2014.
- In the period from 1973 to 2014, a loss of up to 1,000,000 m³ of the ice mass has been observed.

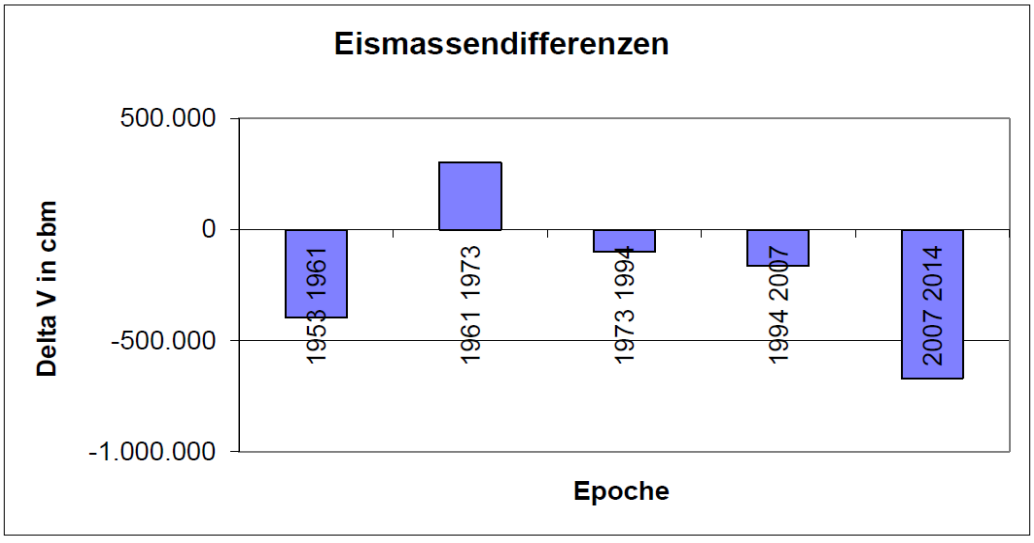

Table 3: loss of ice mass in m³

Conclusion

Despite climate change, the Eiskapelle will continue to exist due to its prominent position at the foot of the eastern wall of the Watzmann, although it will do so in reduced form. Research above and below ground will be continued.

Acknowledgements

Verband der deutschen Höhlen und Karstforscher e.V. (VdHK)
Institut für angewandte Karst- und Höhlenkunde (IKH)
Verein für Höhlenkunde München e.V. (VHM)
Höhlenfroschung Südbayern e.V. (HFS)
Nationalpark Berchtesgaden
Bergwacht Bayern
Technische Universität München (TUM)
Hochschule für angewandte Wissenschaften München (HM)

References

WOLF, A. 2007 Die Eiskapelle am Königssee – ein schmelzendes Naturwunder? In VdHK Alpine Underground Proceedings. 86-88. München

WOLF, A. 2005 Die Eiskapelle am Königssee. In: VdHK Karst und Höhle 2004/2005 Berchtesgadener Alpen: 183-191. München.

WOLF, A. 2004 Die Eiskapelle am Königssee. In: VHM Münchener Höhlengeschichte: 1334-1335. München.

WOLF, A. 1998: Die Eiskapelle beim Königssee, Watzmann (Berchtesgadener Alpen). In: Salzburger Geographische Materialien, Band 27: 111-121. Salzburg.

Further links

www.vdhk.de
www.karstinstitut.org
www.hoehlentier.de

Contact

Andreas Wolf
wolf.andreas.1@gmx.de
Elisenstr. 24
82152 Krailling
Germany
Phone: +49 89 8596747