

LIGHTNING INJURIES IN AN ICE CAVE IN THE AUSTRIAN MOUNTAINS

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Abstract

At least seven visitors of an ice cave in the Austrian mountains have been injured inside the cave by a lightning strike. The accident was associated with a local electrical discharge over a distance of about one meter from the cave surface to the left shoulder of one of the victims. The victims location was covered by 300 m to 400 m of rock up to the ground striking point at the top of the mountain.

Introduction

On September, 5th 1996 moderate thunderstorm activity was observed in an area south to the city of Salzburg as shown in Fig. 1.

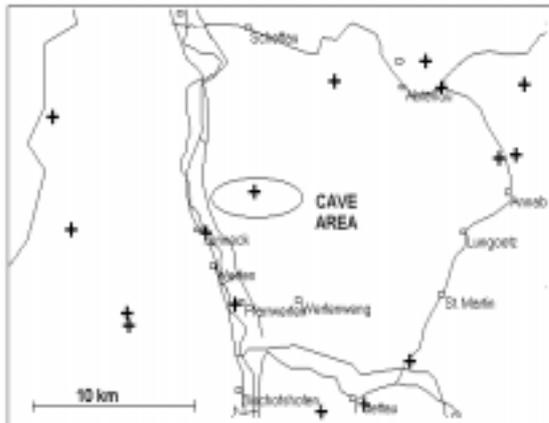


Fig. 1: Lightning activity in the region of the ice cave (+ are the flashes located by the Austrian Lightning Detection & Information System ALDIS)

In the region labeled "Cave area" there exists a large cave system partly open for public visitors and being a major tourist attraction in this region. Daily several hundreds of tourists are visiting this famous ice-cave. As reported by the guides and the victims at about 12:35 local time there was a big bang inside the cave and preceding the bang at several locations inside the cave visitors observed small blue flames. Associated with the bang several visitors noticed a more or less intense electrical shock. After a period of some minutes of confusion one of the guides went to the entrance of the cave and called the emergency number at 12:41 local time.

Seven visitors showed injuries or reported an electrical shock and some of them had to stay at the hospital for several days.

Abstract

Au moins 7 visiteurs d'une caverne de glace dans les montagnes autrichiennes ont été blessés dans la grotte par un coup de foudre. Au cours de l'accident une décharge électrique de plus d'un mètre s'est formé entre la surface de la grotte et l'épaule gauche de l'une des victimes. L'endroit où se trouvait les victimes était séparé du point de chute de la foudre par 300 à 400 m de rocher.

One victim showed on the skin of his left shoulder typical signs of electrical flash over. A small hole of the size of about 1 mm was visible on his jacket and shirt. While he was touching a metallic railing with his right hand, he had also injuries at the finger tips of his right hand due to current flow - but less severe than on the shoulder.

Based on the position of this particular victim in the cave, the minimum distance from the cave surface to his left shoulder is about one meter. At this location, cave visitors are walking on a wooden footbridge with a metallic railing. Partly this foot bridge is in direct contact with the soil or on ice.

First investigations right after the accident showed that there is no electrically conducting connection from outside the cave to the location where the visitors have been injured. Therefore a penetration of the lightning current into the cave by any kind of installation was not possible.

The lightning location system ALDIS reported a flash in the cave region at 12:30:26 local time with an amplitude of 9 kA. Because there is no exact time reference for the accident, it is unclear whether this "small" flash caused the injuries or the location system missed the actual flash responsible for the accident.

When lightning hits the top of the mountain, to penetrate into the cave the current has to pass about 300 to 400 m of rock.

The only explanation to imagine a potential difference inside the cave to cause flash over a distance of 1 m is some kind of very good conducting path from the mountain surface into the cave.

Measurements of local ground conductivity inside the cave are planned in late April 1997 when the cave is reopened after the winter break. Results of this measurements will be presented at the Lightning & Mountain Conference in June 1997.