

## **Ice cave research in the Ice Caves on Mauna Loa (HI)**

**Andreas Pflitsch, Norbert Schorghöfer, Steve Smith, David Holmgren**

### **Abstract**

The Mauna Loa shield volcano (19 °N 156 °W), one of two summits over 4000 m a.s.l. on the Island of Hawaii, has a high density of lava tubes. The Hawaiian chain, the most isolated islands on earth with the highest summits in the North Pacific, is located in the northern tropics, and air temperatures inside lava tubes near sea level are well above 20 °C. At high elevations, the climate is alpine in character and snowfall and freezing temperature are possible any time of the year. Heavy storms occasionally bring snow to the tallest summits of Hawaii, but at elevations below 3,350 m any snow vanishes quickly. Mean annual temperatures are well above freezing, even on the summit. Many of the high altitude lava tubes on Mauna Loa have icy floors during winter months or seasonal icicles, but perennial ice has rarely ever been reported in Hawaii. Patches of buried permafrost were once documented near the summit of the other tall volcano on the island, Mauna Kea.

We provide the first detailed documentation of a lava tube cave with permanent ice on the Hawaiian Islands. “Mauna Loa Icecave” had been surveyed in 1978; we periodically visited the cave and monitored temperature, humidity, and ice levels from 2011 to 2015. Perennial ice still blocks the lava tube at the terminal end, but a previously present large ice floor (estimated 260 m<sup>2</sup>) has disappeared. Airflow measurements, scallop patterns in the ice, strong temperature and humidity variations, and ice volume fluctuations indicate ventilation of the cave, which suggests that additional ice loss could occur rapidly. But the last year showed us some interesting changes.