



## **The first year of borehole measurements in the rock permafrost at Aiguille du Midi (3842 m a.s.l., Mont Blanc massif)**

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Three 11 m deep boreholes have been drilled in September 2009 into the central pillar of the Aiguille du Midi (AdM, 3842 m a.s.l.) by a team of researchers and alpine guides, as part of the EU co-funded project PermaNET project (Permafrost long-term monitoring network: [www.permanet-alpinespace.eu](http://www.permanet-alpinespace.eu)) in order to complete ongoing research and monitoring activities at this site. Today, these boreholes are the highest permafrost boreholes in the European Alps and complement the measurement activities at the AdM site, which have been initiated five years ago with the observation of near-surface temperature loggers (down to 55 cm), meteo parameters by a weather station, repeated ERT and laser scanning. The borehole data will be highly valuable for (1) the study of the thermal regime at the AdM as well as in high Alpine rock face in general including effects of the steep 3D geometry, (2) long-term monitoring of rock temperatures and their relation to the evolution of climatic conditions, and (3) validation of models to simulate the thermal conditions at and below the surface in steep rock. The summit of the AdM is accessible from Chamonix, France, by cable car. Besides its easy accessibility, the site was chosen for its elevation, geometry, and year-round accessibility to rock slopes of diverse aspects and galleries inside the rock pillar.

The boreholes are located on steep rock characterized by differing aspect, slope angle and rock fracturation:

- the north-west face (borehole at 3738 m a.s.l.) is a vertical rock wall in a very massive granite; snow can only accumulate on a small 2-m-wide terrace;
- the south-east face (borehole at 3745 m a.s.l.) has a 55° slope angle in a highly fractured area; it is covered by snow during a part of the year;
- the north-east face (borehole at 3753 m a.s.l.) has a 65° slope angle; drilling of the borehole was carried out in a very fractured couloir, where snow accumulation is facilitated during a large part of the year by the concave topography.

The boreholes are drilled normal to the surface and located well below the infrastructures for the cable car and the visitors in order to minimize their influence on the measured temperatures. They have been equipped with a 10-m-long, 15-nodes thermistor chain in December 2009 at the NW and SE faces, and in April 2010 at the NE face.

This presentation describes the setting and instrumentation of the boreholes and focuses on the results of the first year of measurement. In particular, the state and evolution of permafrost during the first one-year period are described, together with the characteristics and development of the active layer. The borehole data will further be compared to meteo data as well as the various data gained from other measurement activities. In the future, the data will also be used both as input and validation data for modelling studies of current and future 3D thermal fields of the AdM.

(This is a contribution from the AdM Team)