# Alpine Permafrost Index Map (APIM): Legend, Interpretation Key and Auxiliary Information

## Map Legend

This map shows a qualitative index describing how likely permafrost exists. It is consistent for the entire Alps and intended for practical use for infrastructure planning and maintenance.

**Blue:** Permafrost in nearly all conditions

**Purple:** Permafrost mostly in cold conditions

**Yellow:** Permafrost only in very favorable conditions

**Glacier**

Some important local factors such as sub-surface material or snow conditions are not or only approximatively accounted for in the map. However, they can cause strong differences in ground temperature in otherwise equal topograhic situations. For this reason, the map legend is accompanied by the interpretation key, shown on the right, that can be used to locally further refine the estimate shown on the map. As an example, one would not expect permafrost in fine material (B) or in homogeneous rock (H) where a yellow signature is shown on the map. In special circumstances, permafrost can exist outside the area of the color signature shown. The map shows estimated conditions; more certainty can locally be achieved by e.g., geophysics or boreholes.

## Auxiliary Information

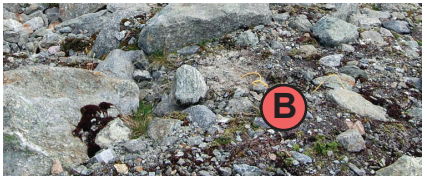
An additional map shows the surface types that were used. This allows comprehending the applied models (debris and rock model) and offset terms. To grid cells with a slope angle ≤ 35° only the debris model is applied, for slope angles ≥ 55° the rock model is used. In between, a fuzzy membership function is calculated.

1: Steep Bedrock (slope angle ≥ 55°)

0: Debris Cover (slope angle ≤ 35°)

2: Vegetation

## Interpretation Key

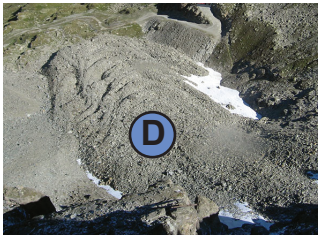



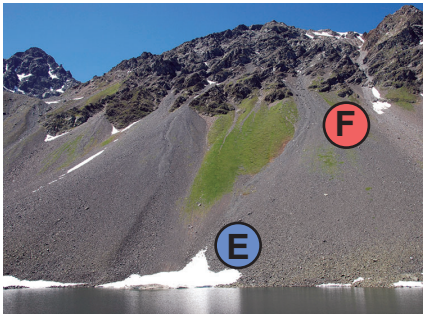

### Clast size, soil properties and vegetation

A cover of coarse blocks with open voids and no infill of fine material (A) indicates cold conditions. Bedrock, fine-grained soil or soil with coarse blocks but an infill of fines (B) indicate warm conditions. A dense vegetation cover (C) usually indicates the absence of permafrost.

### Rock glaciers

Active (intact) rock glaciers (D) are identified by signs of movement such as steep fronts. They are reliable visual indicators of permafrost within their creeping mass of debris but do not allow easy conclusions on adjacent areas.




### Slope position and long-lasting snow-patches

The position along a slope can affect ground temperatures through the sorting of clasts, air circulation within the slope, and snow re-distribution. Often, the foot of slope (E) has colder ground temperatures. It contains more coarse material and is affected by long-lasting avalanche snow. Similarly, other late-lying snow patches indicate locally cold conditions. The top of slope (F) often has locally rather warm conditions. Frequently, it contains smaller clasts as well as an infill of fine material.

### Steep rock slopes

Steep rock slopes have differing degrees of heterogeneity caused by micro-topography and fracturing. Higher heterogeneity (G) often enables a thin snow cover as well as ventilation and deposition of snow in large fractures, indicating locally cold conditions. Steep, smooth and largely unfractured rock (H) is indicative of warmer conditions. This effect is more pronounced in sun-exposed than in shaded locations.