permanet

Permafrost long-term monitoring network

WP6 Permafrost and Natural Hazards
Action 6.1 – Method sheet

Topographical Survey (TS)

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General information	
Category	Geodetic surveying
Background	
Basic principles	
Technology	The precision topographical survey is based on a combination, on the same device (called *total station*), of an optical system (*theodolite*) composed of a telescope mounted on two axes that measures horizontal and vertical angles between the device, the point targeted and reference plans, and an electro-optical system (*tacheometer*) that measures the distance between the device and the point. The use of total station necessitates two operators, one handling the device itself and one displacing a wire mounted on a pole from point to point, with a direct visibility between both and a distance lower than 1000 m. Topographical survey generally allows a precision lower than a few centimetres, especially when angle reading is doubled for error reduction.
Data processing	With the measured vertical and horizontal angles and distance, one can project the point on a horizontal plan and derive coordinates in a defined projection system.
Possible applications	
Why?	Determination of surface displacements and elevation changes
What?	Glacier, rock glacier, mass movement
Where?	Bare rock, debris, grasslands (using benchmark). Not possible where no direct visibility between terrain and total station
Main results	
- Survey of small-size medium-resolution high-precision Digital Elevation Models - Determination of surface movements of mountain landforms - Long-term survey of permafrost creep	

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Main advantages

- High precision of the positioning
- Low cost
- Fast deployment

Main disadvantages/problems

- Necessary visibility between the station and the surveyed terrain
- Limited distance between station and target
- Weight and energetic autonomy of the equipment

References

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Kienast G., Kaufmann V., 2004. Geodetic measurements on glaciers and rock glaciers in the Hohe Tauern National Park (Austria). Proceedings of the 4th ICA Mountain Cartography Workshop, 30 September - 2 October 2004, Vall de Núria, *Monografies tècniques*, 8, Institut Cartogràfic de Catalunya, Barcelona: 101-108.

Total station positioned at a fixed survey point in front of the Laurichard rock glacier (Ecrins massif, France)