Thermopile Monument Overview

419 Beth Bartel March 26, 2010 Thermopile 2984

Thermopile Monument

Back to comparison table	Mount Commonly Used	Stability	Cost	Install Time	Labor	Substrate	
	 SCIGN mount	 med-high	 $6,700-16,000	 1-4 d	 1	U	

The geodetic thermopile monument allows installation of high-precision GPS/GNSS instruments for measuring tectonic signals in areas characterized by permafrost. The monument was designed for EarthScope's Plate Boundary Observatory (PBO) and has been installed at three sites in northern Alaska (AB18, AB45, and AB46). The monument consists of a single 4" (4.5" OD), 20'-long pillar containing pressurized, two-phase carbon dioxide to prevent thawing at the monument's base; this pile is set ~16' deep into the ground and coupled to the permafrost with a slurry of sand and water, which freezes in 1-10 days after installation. The portion of the monument in the active surface layer is wrapped in insulation to prevent deformation of the monument due to freeze-thaw activity; this portion of the hole is back-filled with soils saved from the drilling. Thermopile-monumented PBO sites AB45 and AB46 show reasonable multi-year stability.

Check out PBO Installs First of Four Permafrost GPS Stations in Alaska.

Site AB18 of EarthScope's Plate Boundary Observatory (PBO).

Pros

- can be installed in permafrost

Cons

- labor and tool intensive (requires a drilling rig and crew)
- expensive (can be $6,700 to $16,000, depending on drilling)
- can be time intensive (requires 1-4 days)
- may not be able to install in some remote locations... depends upon ease of site access

- large construction disturbance footprint

Design and Construction

A drilling contractor is required to install this monument.

Documents

Final thermopile design report from Duane Miller Associates LLC in .pdf format:

- Permafrost_Monument_Final_Report.pdf

Thermopile fabrication diagram from Arctic Foundations, Inc. in .pdf format:

- Proposal_Drawing_FabDwg.pdf

Installation Photos

An overstressed vehicle is drilled approximately 18 feet into the substrate.

The 20'-long pile is lowered into the hole.

The pile is set into the permafrost with potable water or a mix of water and sand.

Approximate Cost

$6,700-16,000 total, depending principally on drilling (distance and mode by which drill rig needs to travel to and from the site). Monument cost is $1700, drilling costs have ranged from $5,000 to $14,000 depending on whether there was a local drill rig available vs. needing to e.g. ship a drill rig to the site by cargo aircraft.

This cost is for the monumentation only; the antenna mount (e.g. SCIGN mount) is not included.

Materials

- thermopile
- 10-mil visqueen (polyethylene wrap) to wrap the top 4.0-5.0’ buried portion of thermopile
- water (provided by drillers
- threaded adapter (if using SCIGN mount)

Tools

- drill rig capable of drilling a 6.0"-diameter boring
- hoist or boom truck for lowering thermopile into boring
- shovels for backfill around thermopile
- level
- pipe wrench
- compass
- tape measure

Mount Commonly Used

The SCIGN mount is the antenna mount used to date with the thermopile monument, although it is only required when using the SCIGN radome.Â Otherwise, any other leveling mount, such as the SECO 2072-series antenna mount, is acceptable.

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