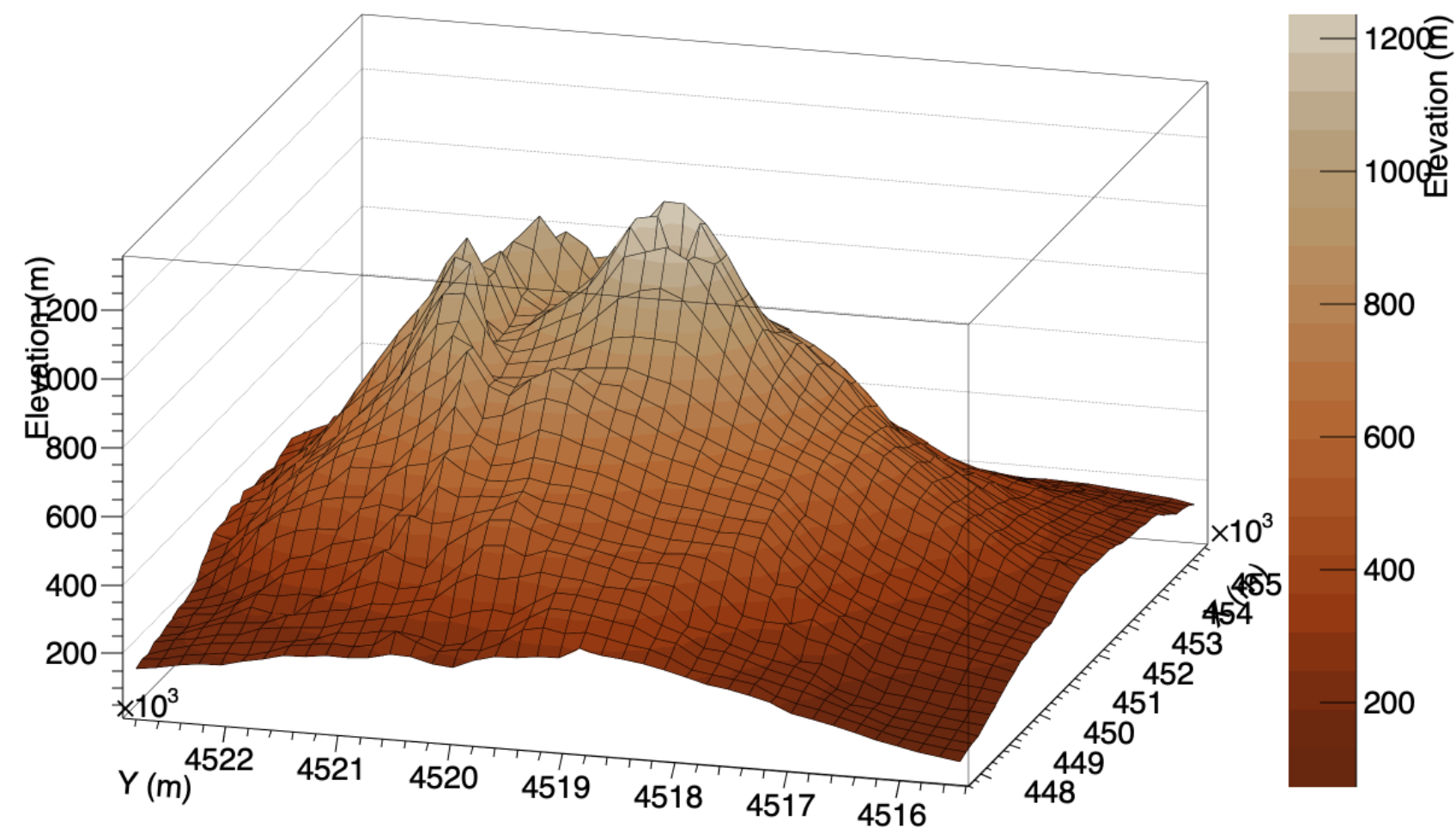


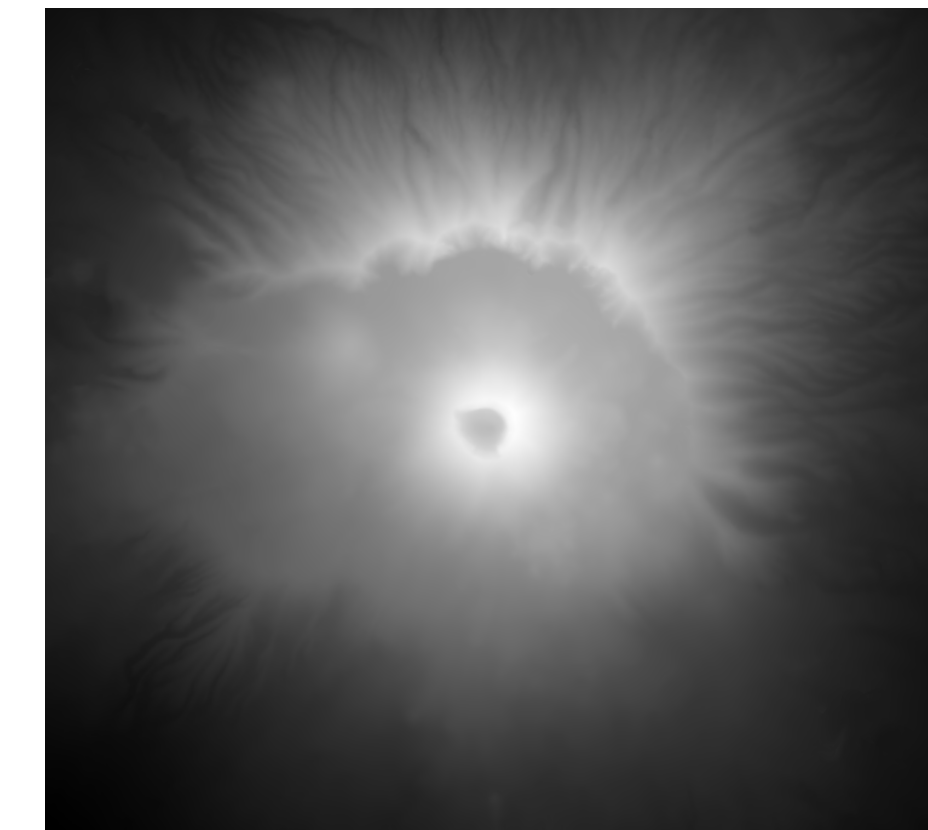
1. used example-projection.c

starting from DEM file from INGV, create projected map,
and get the geodetic coordinate of the experiment location.



visualisation of of the surrounding area of the
Mt. Vesuvius, based on a 5m precision **DEM**
file from INGV.

National Institute of Geophysics and Volcanology - Vesuvius Observatory.



projected map

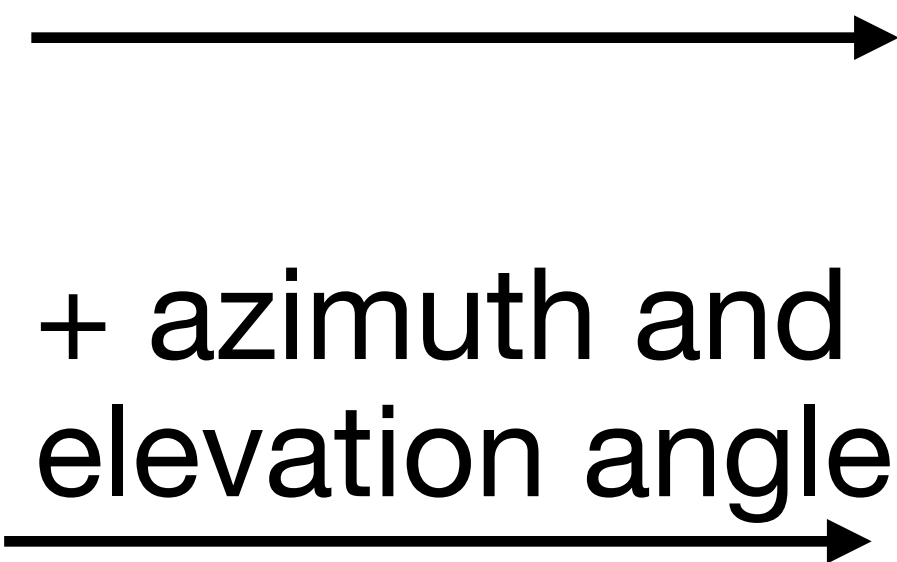
MURAVES location in DEM

MURAVES experiment **Geodetic Coordinate.**
latitude = 40.810251, longitude = 14.411708

checked with Google Earth

2. used example-stepper.c

MURAVES'
Geodetic Coordinate



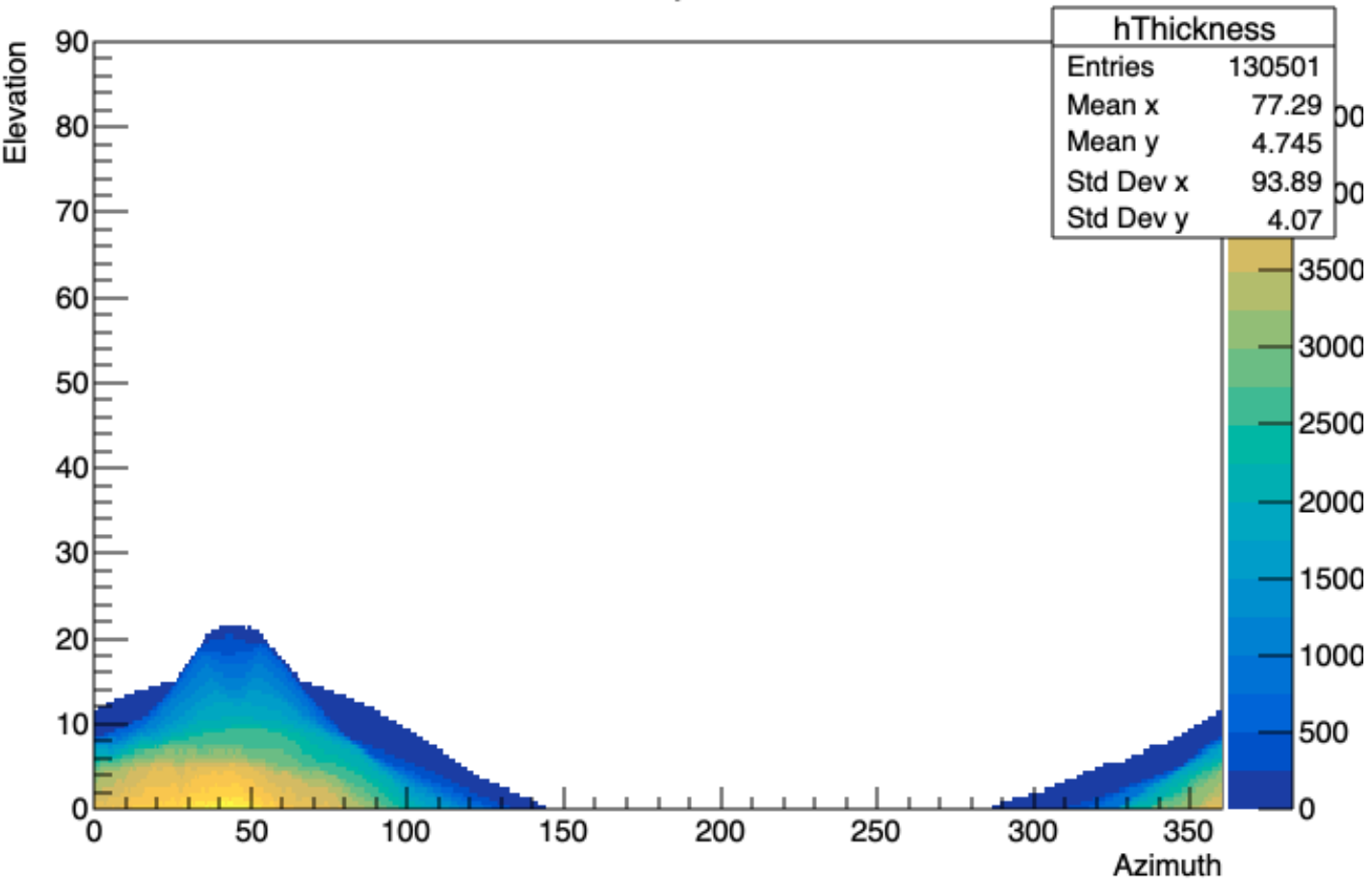
ECEF Coordinate Position

Cartesian Direction in ECEF

Loaded the projected map,
used turtle_stepper_step



Rockthickness map of the Mt. Vesuvius
at the observation point MURAVES



3. using geometry.c



- only take 2 arguments: Azimuth (ψ) and Elevation (α) angels.
 - > direction = $(-\sin\theta, 0, -\cos\theta)$, $\theta = 90 - \alpha$
- load RockThickness evaluated with Turtle.
- one medium so far: local_rock

```
state.position = { x, y, z }  
state.direction = { ux, uy, uz }
```

$$r = \sqrt{x^2 + y^2 + z^2} \qquad ur = \sqrt{ux^2 + uy^2 + uz^2}$$

- ? 1. $z < 0$, Muon outside the simulation area;
step = -1
2. $r < \text{rock thickness } t$,
1) $uz > 0$, backwards upgoing:

$$\text{step} = \frac{t - r}{ur}$$

- 2) $uz < 0$, backwards downgoing:

$$\text{step} = -\frac{r}{ur}$$

