Exercise 4

Name, First Name	
Matriculation number	
k-value	

Date of issue: 11.12.2018 Deadline: 25.12.2018

Sedimentary rock as a disturbing mass

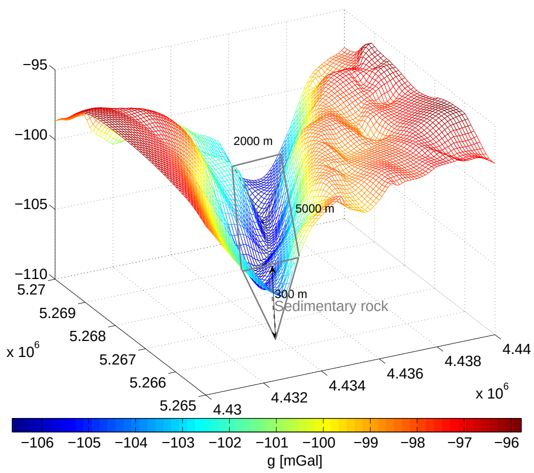
With the Gauss's divergence theorem

$$\iiint_V \text{div } \mathbf{a} \, dV = \iint_S \mathbf{a} \cdot d\mathbf{S} \tag{1}$$

one can determine underground disturbing masses using gravity measurements collected at the surface.

Task 1: Using the above equation and inserting $\mathbf{a} = \nabla U = \delta \mathbf{g}$, derive the equation to quantify the disturbing mass from gravity measurements at the surface.

The Loisachtal in the Bavarian Alps is filled with sedimentary rocks. The sediment body represents a disturbing mass in comparison to the surrounding mountains. This can be clearly seen at the measurements of the gravity (see figure), which has a background gravity of -98 mGal.



Task 2: Compute the disturbing mass of the sedimentary rock using the Gauss's divergence theorem. Note that the gravity data are stored in *loisach.mat*, which can be downloaded from ILIAS.

From geometrical point of view, the valley has a V-shaped profile with the depth of at most 300 m and its surface has a shape of a parallelogram (see figure). The density difference between the sedimentary rock and rock is $\delta\rho = -700\,\mathrm{kgm^{-3}}$

Task 3: Determine the disturbing mass of the sedimentary rock using the shape of the valley and the density difference and compare it with the outcome of Task 2.

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