An equipotential line is:

A A line where the gravitational force is constant ✗

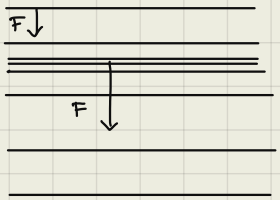
Zurücksetzen

B A line that approximates sea level ✓

Senden

C A line where the gravitational potential is constant ✓

Zurücksetzen



Q5 Gravity Method

The gravitational force at the Earth's surface

A is larger at the equator than at the poles

Senden

B is smaller at the equator than at the poles

Zurücksetzen

C is constant at the Earth's Surface

Senden

Zentripetalkraft wirkt entgegen

Gravitationskraft 0 im Erdmittelpunkt

Gradient der des Drucks ist Kraft

Quizz

Results from DIY free-fall gravimeter

Principle: $x = \frac{GM}{2R_E} t^2 \quad \Leftrightarrow M = \frac{2R_E^2 x}{Gt}$

technical key: acustic trig per Phyphox

$M_1 = 4,8 \cdot 10^{24}$ kg

$M_2 = 5,5 \cdot 10^{24}$ kg

$\rho = \frac{M}{V} = \frac{M}{\frac{4}{3}\pi R_E^3} = \frac{5,5 \cdot 10^{24}}{\frac{4}{3}\pi \, 6370 \cdot 10^3 m} = 5080 \frac{kg}{m^3}$

$= 5,08 \frac{g}{cm^3}$

Basalt / Granites: 2-3 $\frac{g}{cm}$

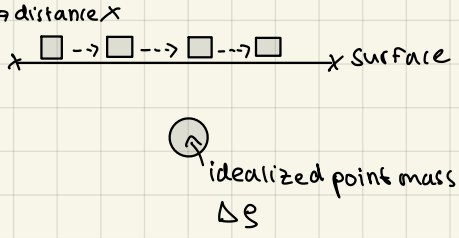
First order finding: Density increases with depth

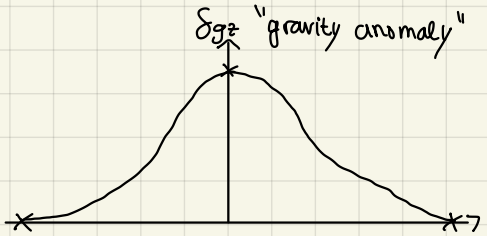
⇒ Evidence for higher density material (Fe, Ni, ...)

⇒ First finding of a gravity measurement

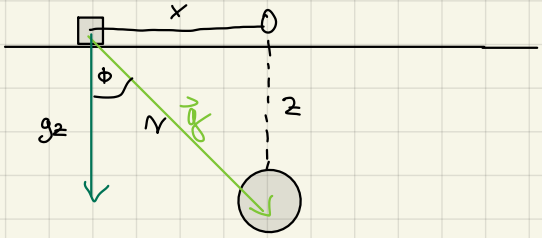
⇒ Free-fall gravimeter is one operational principle for absolute gravimeters.

⇒ How good does the instrument need to be to detect smaller-scale features (e.g. caves)





Required is quantification of the anomaly as a function of distance x and depth z and density contrast $\Delta\rho$



z.B. Kearsley

$\vec{g} = -G \frac{M}{r^2} \hat{r}$

$\cos(\Phi) = \frac{gz}{r}$

$gz = r \cdot \cos\Phi = -G \frac{M}{r^2} \cos(\Phi)$

$g_z = -G \frac{M}{r^2} \cos(\Phi)$

$= -G \frac{4}{3} \rho\pi \cos(\Phi) \frac{R_E^3}{r^2}$

$\rho = \frac{M}{V} \quad M = \rho \cdot V = \frac{4}{3}\pi R_E^3 \cdot \rho$

$$g_z = -6\tfrac{4}{3}\rho\pi \frac{R_E^3}{x^2+z^2}\cos(\phi)$$

$$= -6\tfrac{4}{3}(\rho_E + \Delta\rho)\cdot\pi \frac{R_E^3}{x^2+z^2}\cos(\phi)$$