GS543 Tutorial -2

A two-layered model response (for DC resistivity method) in isotropic media can be calculated using the following formula (TELFORD et al., 1990):

$$\rho_{a_i} = \rho_1 \left[1 + 2p \sum_{m=1}^{\infty} k^m \left(\frac{1}{\left(r_1^2 + 4m^2 z^2\right)^{\frac{1}{2}}} - \frac{1}{\left(r_2^2 + 4m^2 z^2\right)^{\frac{1}{2}}} - \frac{1}{\left(r_3^2 + 4m^2 z^2\right)^{\frac{1}{2}}} + \frac{1}{\left(r_4^2 + 4m^2 z^2\right)^{\frac{1}{2}}} \right) \right],$$

where ρ_1 the resistivity of the first layer, z denotes the thickness of the first layer, r_1 is the distance between C_1 and P_1 electrodes and it can be written as $r_1 = |C_1 P_1|$. Similarly, the rest of the distances between the current and potential electrodes are $r_2 = |P_1 C_2|$, $r_3 = |C_1 P_2|$, and $r_4 = |P_2 C_2|$, respectively (Fig. 1). Quantity k can be calculated with $k = \frac{(\rho_2 - \rho_1)}{(\rho_2 + \rho_1)}$ and p is given

$$p = \left\{ \left[\frac{1}{r_1} - \frac{1}{r_2} \right] - \left[\frac{1}{r_3} - \frac{1}{r_4} \right] \right\}^{-1}. \tag{4}$$

m is a constant for summing variables which was chosen as 45 for this study. Thus, one can calculate a two-layered earth model response analytically using Eq. (3). Figure 1 shows a sketch of current and potential electrode configurations on the surface and a simple two-layered earth.

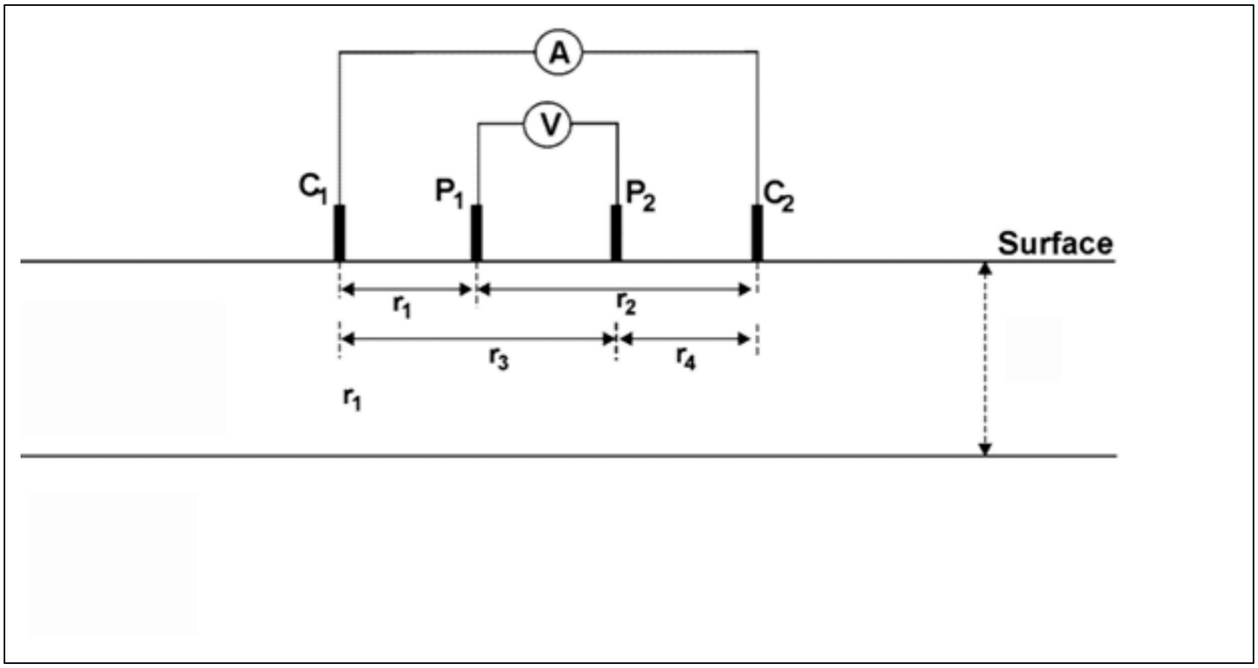

Figure 1: A sketch of current and potential electrode configuration and spacing on the earth surface

2)Write a program to compute the two-layer model response and complete the table accordingly.

1) **Take rho1=10, rho2=100 z=5m**
2) **C1C2by2=logspace(0,2,50) and P1P2=2m**