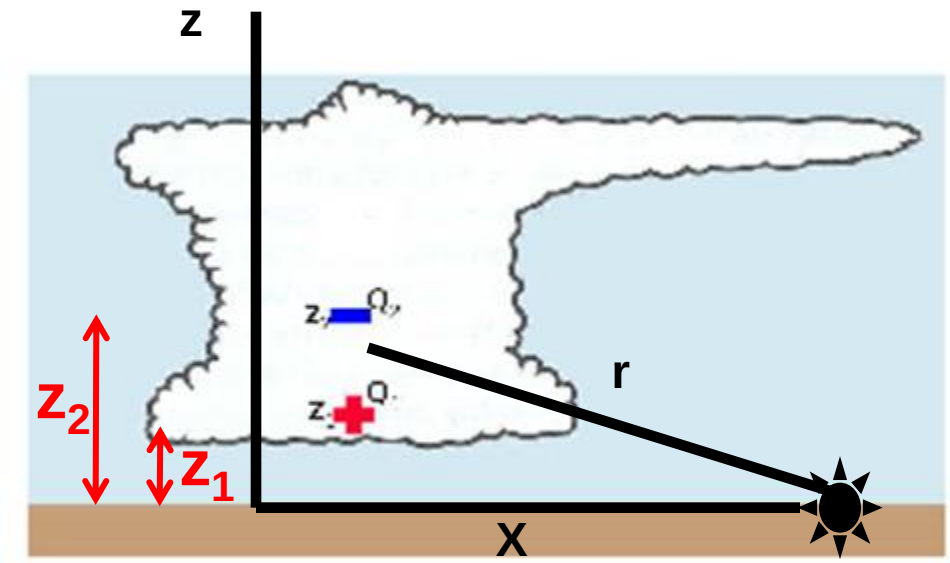
Exercício em Aula: Dipolo sob um condutor

Calcule o campo elétrico de uma nuvem em função da distância r sobre a superfície da Terra, assumindo a seguinte configuração:



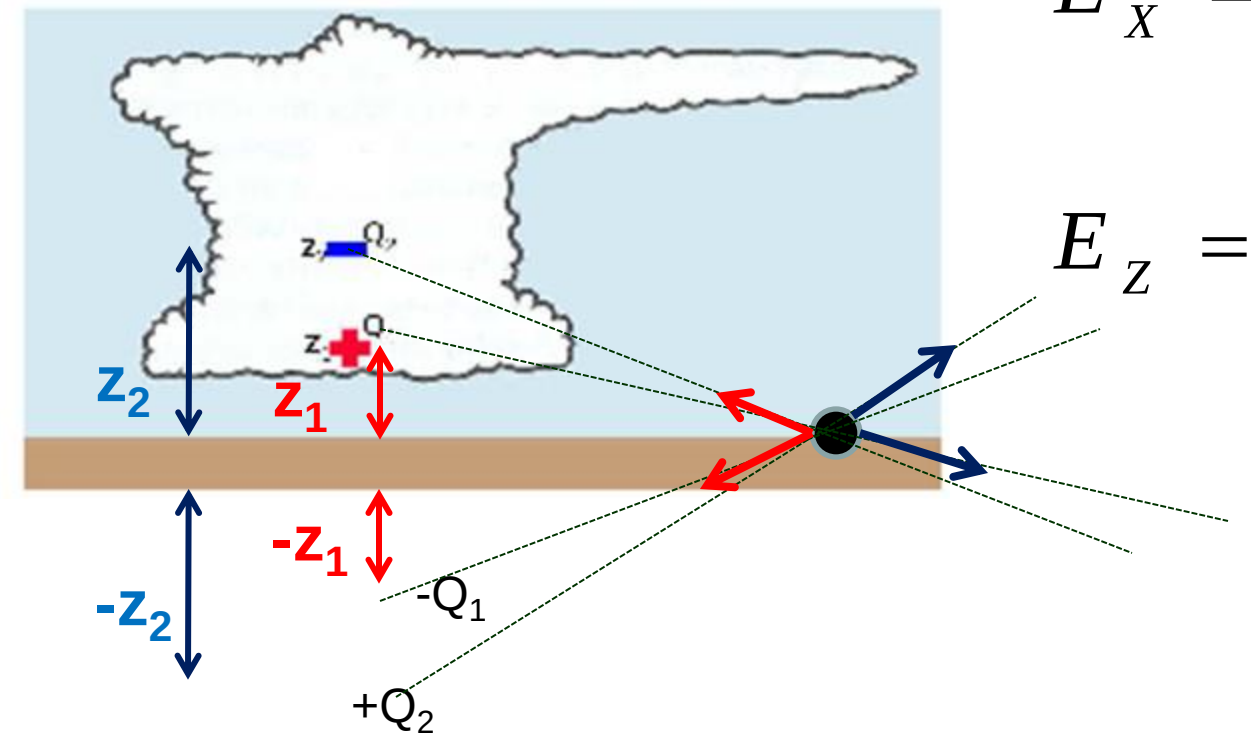
Onde $z_1 = z$ e $z_2 = 2z$

e

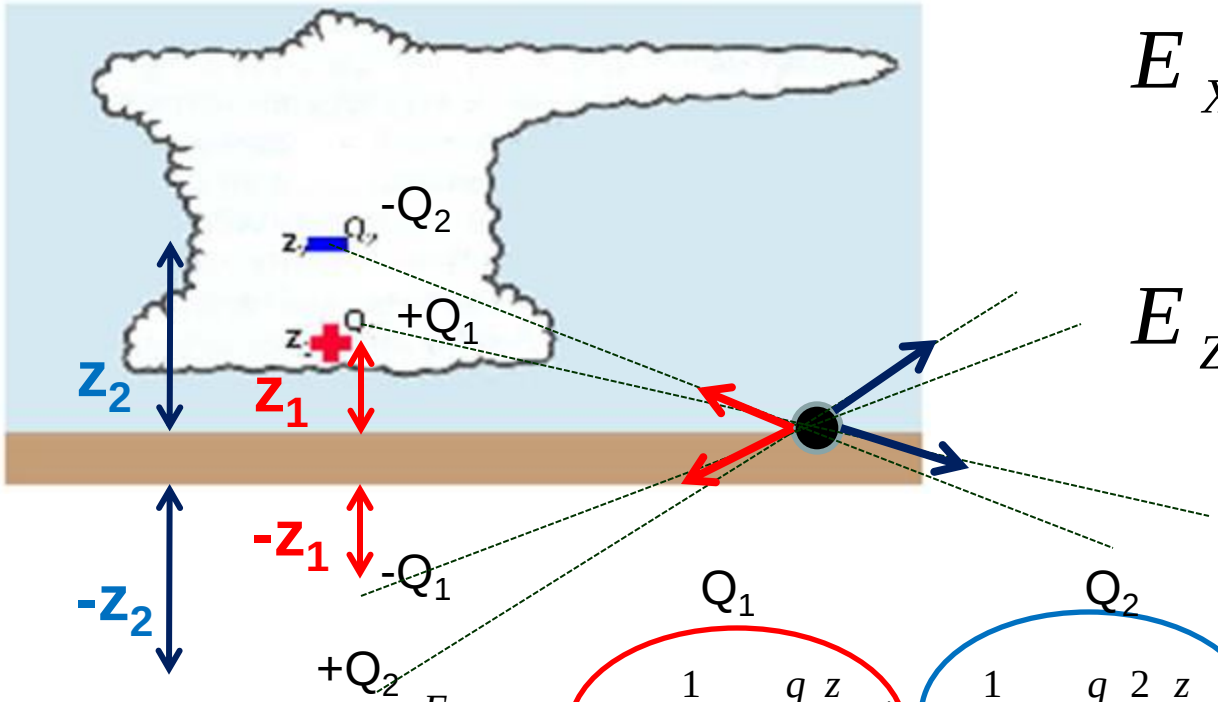
$|Q_1| = |Q_2| = |Q|$

$$E_X = E \sin \theta$$

$$E_Z = E \cos \theta$$



$$E_z = \frac{1}{4\pi\varepsilon}\frac{q_1 \cos\theta_1}{r_1^2} + \frac{1}{4\pi\varepsilon}\frac{q_2 \cos\theta_2}{r_2^2} + \frac{1}{4\pi\varepsilon}\frac{q_3 \cos\theta_3}{r_3^2} + \frac{1}{4\pi\varepsilon}\frac{q_4 \cos\theta_4}{r_4^2}$$



$$E_X = E \sin \theta$$

$$E_Z = E \cos \theta$$

Q_1 $\qquad$ Q_2

$$E_z = -\frac{1}{2\pi\varepsilon}\frac{q\,z}{r_1^3} + \frac{1}{2\pi\varepsilon}\frac{q\,2\,z}{r_2^3}$$

mas

$$r_1 = \sqrt{x^2 + z^2}$$

$$r_2 = \sqrt{x^2 + 4z^2}$$

então

$$E_z = -\frac{1}{2\pi\varepsilon}\frac{q\,z}{\sqrt{\left(x^2 + z^2\right)^3}} + \frac{1}{2\pi\varepsilon}\frac{2\,q\,z}{\sqrt{\left(x^2 + 4z^2\right)^3}}$$

$$E_z = \frac{q\,z}{2\pi\varepsilon}\left[\frac{-1}{\sqrt{\left(x^2 + z^2\right)^3}} + \frac{2}{\sqrt{\left(x^2 + 4z^2\right)^3}}\right]$$