

1] Izračunajte polje \vec{Q} -vektora za zadano polje geopotencijala:

$$\Phi = \Phi_0(\rho) + \kappa f_0 \left\{ -y \left[\cos\left(\pi \frac{\rho}{\rho_0}\right) + 1 \right] + \frac{1}{k} \sin k(x - \kappa t) \right\}, \text{ gdje}$$

κ, f_0, ρ_0 i k konstante.

Rij: $\vec{Q} = -f_0 \xi_g \frac{\partial \vec{V}_g}{\partial \rho}$ $\xi_g = \frac{1}{f_0} \nabla^2 \Phi$; $\vec{V}_g = \frac{1}{f_0} \vec{k} \times \nabla \Phi$

$$\xi_g = \frac{1}{f_0} \nabla^2 \Phi = \frac{1}{f_0} \left(\frac{\partial^2 \Phi}{\partial x^2} + \frac{\partial^2 \Phi}{\partial y^2} \right)$$

$$\vec{V}_g = \frac{1}{f_0} \vec{k} \times \nabla \Phi = \frac{1}{f_0} \vec{k} \times \left(\frac{\partial \Phi}{\partial x} \vec{i} + \frac{\partial \Phi}{\partial y} \vec{j} \right) = \frac{1}{f_0} \left(\frac{\partial \Phi}{\partial x} \vec{j} - \frac{\partial \Phi}{\partial y} \vec{i} \right)$$

$$\frac{\partial \Phi}{\partial x} = \kappa f_0 \cos k(x - \kappa t) \quad ; \quad \frac{\partial^2 \Phi}{\partial x^2} = -\kappa f_0 k \sin k(x - \kappa t)$$

$$\frac{\partial \Phi}{\partial y} = -\kappa f_0 \left[\cos\left(\pi \frac{\rho}{\rho_0}\right) + 1 \right] \quad ; \quad \frac{\partial^2 \Phi}{\partial y^2} = 0$$

$$\Rightarrow \xi_g = \frac{1}{f_0} \left[-\kappa f_0 k \sin k(x - \kappa t) + 0 \right] = -\kappa k \sin k(x - \kappa t)$$

$$\Rightarrow \vec{V}_g = \frac{1}{f_0} \left\{ \kappa f_0 \cos k(x - \kappa t) \vec{j} + \kappa f_0 \left[\cos\left(\pi \frac{\rho}{\rho_0}\right) + 1 \right] \vec{i} \right\} =$$

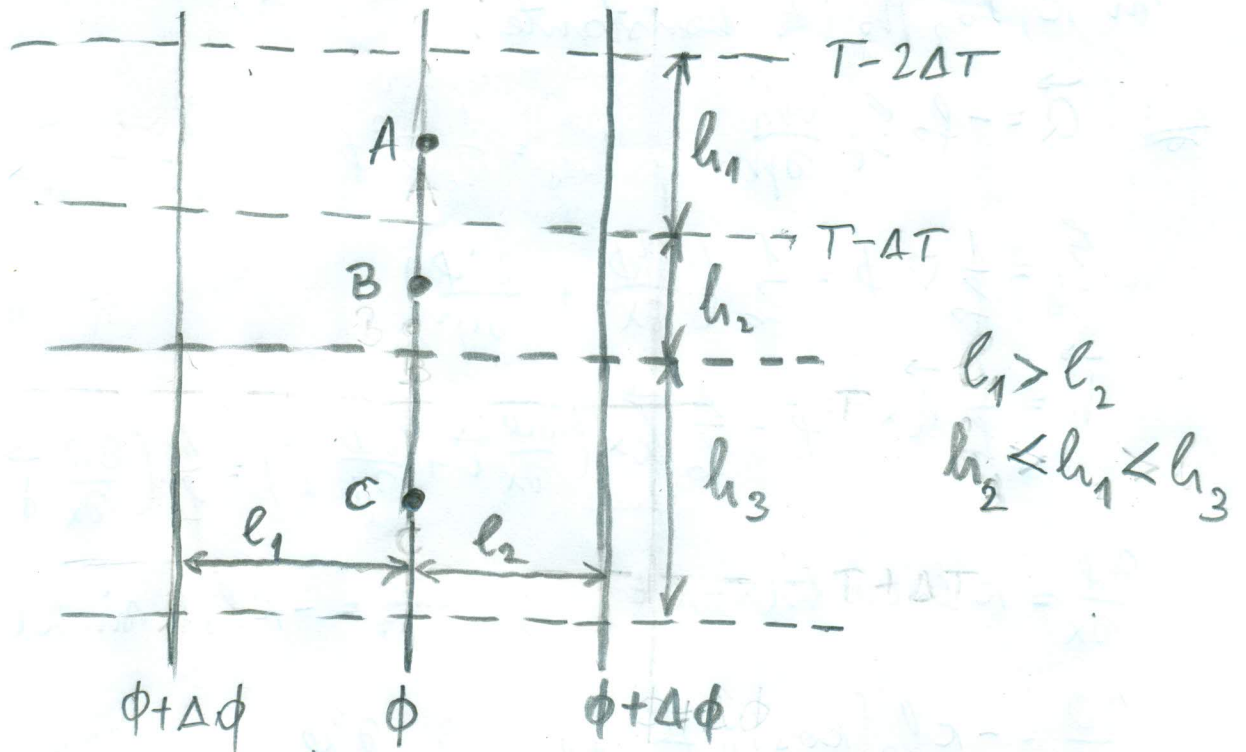
$$= \kappa \left\{ \cos k(x - \kappa t) \vec{j} + \left[\cos\left(\pi \frac{\rho}{\rho_0}\right) + 1 \right] \vec{i} \right\}$$

$$\Rightarrow \vec{Q} = -f_0 \left[-\kappa k \sin k(x - \kappa t) \right] \frac{\partial}{\partial \rho} \left\{ \kappa \left[\cos k(x - \kappa t) \vec{j} + \left[\cos\left(\pi \frac{\rho}{\rho_0}\right) + 1 \right] \vec{i} \right] \right\} =$$

$$= \kappa f_0 k \sin k(x - \kappa t) \left(-\kappa \frac{\pi}{\rho_0} \right) \sin\left(\pi \frac{\rho}{\rho_0}\right) \vec{i}$$

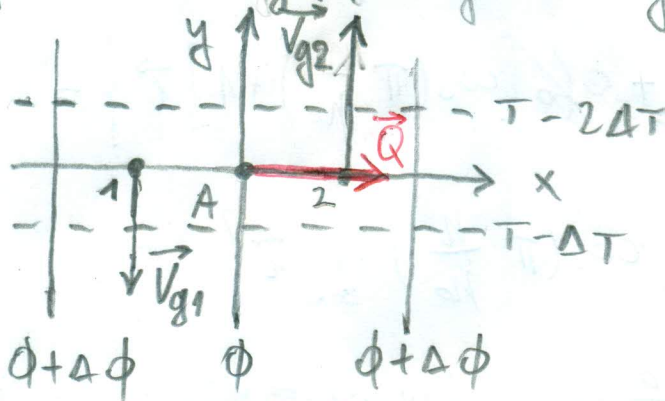
$$\Rightarrow \vec{Q} = -\frac{\kappa^2 f_0 k \pi}{\rho_0} \sin k(x - \kappa t) \sin\left(\pi \frac{\rho}{\rho_0}\right) \vec{i}$$

3. Kvalitativno procijenite polje \vec{Q} -vektora u zadanim točkama A, B i C na slici ispod:



Pj. za točku A (Dz ostale točke i vrtoti \vec{Q} -ove na gornju slicu)

1. u točku A postavimo približno paralelne osi koord. nastav sa y-osi u smjeru negativnog gradijenta temperature



2. uzmemo na x-osi točke lijevo i desno od točke A i vrtimo vektore geostrofičkog vjetrova u njima

3. formula glasi: $\vec{Q} = \frac{R}{p} \left| \frac{\partial T}{\partial y} \right| (-\vec{k}) \times \frac{\partial \vec{V}_g}{\partial x} \Rightarrow$ član $\frac{\partial \vec{V}_g}{\partial x}$ procijenjujemo na način da se pitamo koji vektor moramo dodati vektoru \vec{V}_{g1} da bismo došli do vektora \vec{V}_{g2} ?

