

THE PROBLEM OF FORECASTING THE PRESSURE FIELD FROM

A FULL SYSTEM OF HYDROMECHANICS EQUATIONS

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Certain generalizations are made of the solution of the problem of a short-range forecast made previously [1].

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CALCULATION OF THE HORIZONTAL AND VERTICAL COMPONENTS OF THE CORIOLIS FORCE

The system of hydromechanics equations in a rectangular right system of coordinates is written as follows:

$$\begin{aligned} \frac{du}{dt} + 2\omega_y w - 2\omega_z v + \frac{1}{\rho} \frac{\partial p}{\partial x} + \frac{\partial \Phi}{\partial x} &= 0, \\ \frac{dv}{dt} + 2\omega_z u - 2\omega_x w + \frac{1}{\rho} \frac{\partial p}{\partial y} + \frac{\partial \Phi}{\partial y} &= 0, \end{aligned} \quad (1)$$

$$\begin{aligned} \frac{dw}{dt} + 2\omega_x v - 2\omega_y u + \frac{1}{\rho} \frac{\partial p}{\partial z} + \frac{\partial \Phi}{\partial z} &= 0, \\ \frac{d \ln \rho}{dt} + \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} &= 0, \end{aligned} \quad (2)$$

$$\frac{d \ln T}{dt} - \frac{AR}{c_p} \frac{d \ln p}{dt} = 0, \quad (3)$$

$$p = \rho RT, \quad (4)$$

where Φ is the potential of Newtonian attraction, and the other symbols are as usual.

Let us select as the basic coordinate system that in which the x-axis is directed toward the east, the y-axis toward the north, and the z-axis vertically upward. Then,

$$\omega_x = 0, \quad \omega_y = 2\omega \cos \varphi, \quad \omega_z = 2\omega \sin \varphi,$$

whereupon

$$\begin{aligned} \frac{du}{dt} + 2\omega \cos \varphi w - 2\omega \sin \varphi v + \frac{1}{\rho} \frac{\partial p}{\partial x} + \frac{\partial \Phi}{\partial x} &= 0; \\ \frac{dv}{dt} + 2\omega \sin \varphi u + \frac{1}{\rho} \frac{\partial p}{\partial y} + \frac{\partial \Phi}{\partial y} &= 0, \\ \frac{dw}{dt} - 2\omega \cos \varphi u + \frac{1}{\rho} \frac{\partial p}{\partial z} + \frac{\partial \Phi}{\partial z} &= 0. \end{aligned} \quad (1a)$$

This system will also be the initial system of equations.. Further, let us turn the x-axis such that it becomes parallel with the earth's axis. Here the old and new coordinates are connected by the formulas

$$\begin{aligned} x &= x'; \quad y = y' \sin \varphi + z' \cos \varphi; \quad z = -y' \cos \varphi + z' \sin \varphi, \\ x' &= x; \quad y' = y \sin \varphi - z \cos \varphi; \quad z' = x \cos \varphi + z \sin \varphi. \end{aligned} \quad (5)$$

From this,