THE PROBLEM OF FORECASTING THE PRESSURE FIELD FROM A FULL SYSTEM OF HYDROMECHANICS EQUATIONS by A. F. Diubiuk

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:

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

$$\frac{d \ln \rho}{dt} + \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0, \qquad (2)$$

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

$$p = \rho R T, \qquad (4)$$

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

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

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

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

From this,