Geophysical Research Abstracts
Vol. 13, EGU2011-276, 2011
EGU General Assembly 2011

Inverse and "velocity image" assimilation problems for a model of magnetic hydrodynamics

Anna Semenenko (1), Valery Agoshkov (2), and Sergey Kostrikin (3)

(1) Moscow Institute of Physics and Technology, Moscow, Russian Federation (stormerr@gmail.com), (2) Institute of numerical mathematics RAS, Moscow, Russian Federation (agoshkov@inm.ras.ru), (3) Institute of numerical mathematics RAS, Moscow, Russian Federation (kostr@inm.ras.ru)

This work is devoted to formulation of mathematical model of physical processes in the experiment, performed in the Institute of Physics of atmosphere (IFA RAN) for investigation of vortical flow, that is created in magnetic hydrodynamical way in a thin layer of rotating liquid.

The experimental system is a rectangular cavity with conductive liquid. The height of the liquid layer is 0.75 cm. The cavity is placed on the rotating platform with adjustable angular velocity. The electrodes are situated on the opposite sides of the cavity. The electrical current passes through the liquid. The vortical flow in the cavity is generated by the system of permanent magnets with chess change of polarity. The vertical component of magnetic field is 3200 gauss and slightly changes with altitude.

The flow is observed in the state of rest and when the cavity is rotating. To measure the velocity of the flow, the displacements of the particles of the floating dash were made with the camera. Then the obtained shots were processed. The fields of velocities for different currents were obtained as the result.

In this work besides stating the mathematical model for verification of physical process's model performance in the experiment, an inverse problem on restoring of electrical field vector is formulated. The algorithm for solving the inverse problem will be generated with variational assimilation of the "image of velocity observed fields". The verification of the model performance will be made by numerical solution of the inverse problem and the analysis of the results will be carried out.

The work was supported by the Russian Foundation of Basic Research (10-01-000806 project) and by the Russian Federal target Program "Research and educational human resources for innovative Russia"(project nos. NK-408P-42, NK-421P-67).

1. Agoshkov V.I. The methods of optimal control and adjoint equations in the problems of mathematical physics.//INM RAS, Moscow, 2003. - 256 p.

2. Doronin Y.P. Ocean dynamics // Leninngrad Gidrometeoizdat, 1980. - 304 p.

3. Ponomariov V.M., Hapaev A.A., Yakushin I.G. Nonlinear Ekman's friction and asymmetry of cyclonic and anticyclonic coherent structures in geophysical flows //RAS, 2009, volume 425, No.6, p. 821-826.