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**Discrete-analytical approximations in data
assimilation problem for convection diffusion model
of heat conduction in the atmosphere**

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Introduction

An algorithm for reconstructing the vertical temperature distribution in the atmospheric boundary layer is presented. Applying the data assimilation system based on numerical model of convection - turbulent diffusion processes ensures reconstruction of the state function of the model with specified spatio-temporal resolution.

Statement of the problem

The system of equations of convective-diffusive transport of heat conduction is considered

$$\frac{\partial \varphi}{\partial t} + L\varphi = f + r, \quad L\varphi = u \frac{\partial \varphi}{\partial x} + v \frac{\partial \varphi}{\partial y} - \frac{\partial}{\partial x} \nu \frac{\partial \varphi}{\partial x} - \frac{\partial}{\partial y} \nu \frac{\partial \varphi}{\partial y},$$

u, v - horizontal velocity component of air masses,

ν - coefficient of turbulence,

$f(x, y, t)$ - the source function,

$\varphi(x, y, t)$ - the desired state function (temperature),

$r(x, y, t)$ - uncertainty of the model.

Functions of uncertainty in model and initial data

Fig. 1

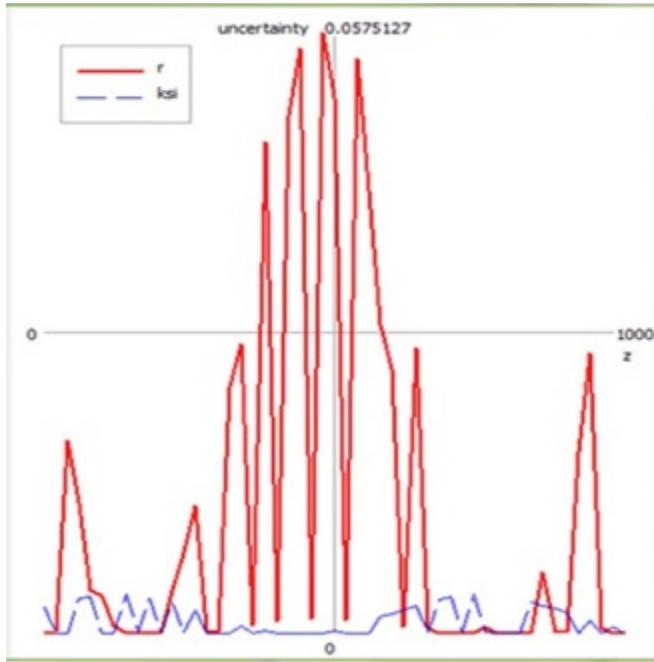
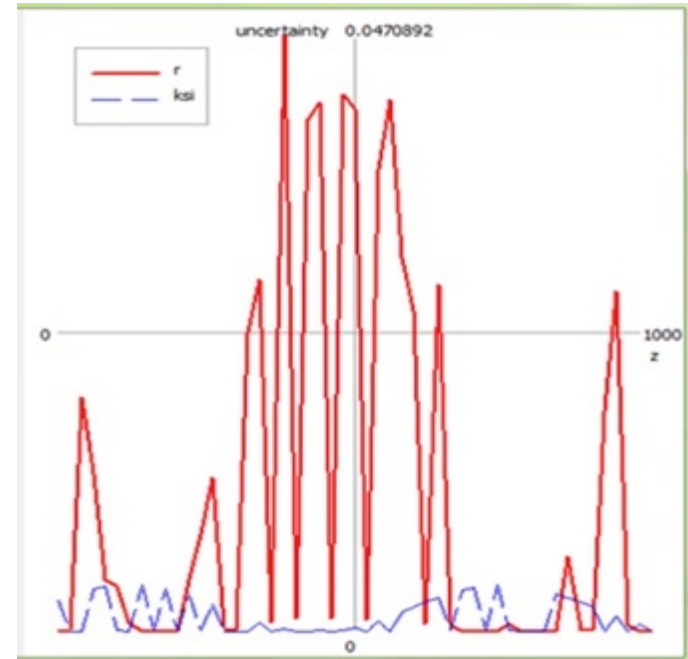


Fig. 2



$\xi(x, y)$ - uncertainty of the data (blue),
 $r(x, y, t)$ - uncertainty of the model (red).

Reducing the values of model uncertainty by adding additional data, "observations" in the 10% of the points where it reaches its maximum value at $t=T$.

Conclusion

The algorithm allows one to predict the state function behavior and to adjust forecast to data obtained from contact temperature measurements.

Comparative analysis of efficiency of applying the discrete-analytical [2] and finite-difference numerical schemes in the implemented algorithm of variational sequential data assimilation is conducted. Due to analytical solutions of local-adjoint problems used the discrete-analytical approach provides the opportunity to construct accurate numerical schemes in space and to decrease uncertainties of the numerical algorithm caused by approximation errors.

list of references:

- 1 V. V. Penenko , 2009. Variational methods of data assimilation and inverse problems for studying the atmosphere, ocean, and environment // Numerical Analysis and Applications, 2009 V 2 No 4, 341-351.
2. V. Penenko, E. Tsvetova. Discrete-analytical methods for the implementation of variational principles in environmental applications// Journal of Computational and Applied Mathematics 226 (2009) 319-330.

Thank you
for your attention!