Heat flow refraction on subsurface contrast structures - the influence both on measurements and on interpretation approaches

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A b s t r a c t: The contribution deals with some problems of the heat flow refractions on the subsurface structures with the contrasting thermal conductivity values. The qualitative and quantitative analysis of these effects was made on the selected structure configurations. Analysed structures are important for study of temperature as well as heat flow density distributions influencing the Earth's heat flow measurements, the construction of terrestrial heat flow distributions maps and also the interpretation of the heat flow density data.

The related 2D and 3D mathematical problems were solved mainly by the means of the finite difference methods, boundary integral technique or by various exact approaches.

Presented results have a great importance both for solution of problems of the applied geothermics (e.g. determination of the heat flow density values from measured data, their accuracy, eventual data corrections and relation of measured data to the surface heat flow density distributions, geothermal maps construction) and also for the modelling of the thermal state of the lithosphere (e.g. determination of the boundary conditions and of the model check parameters, robustness of the modelling approaches,…).

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Key words: geothermal models, refraction, interpretation, heat flow density, map, finite difference method

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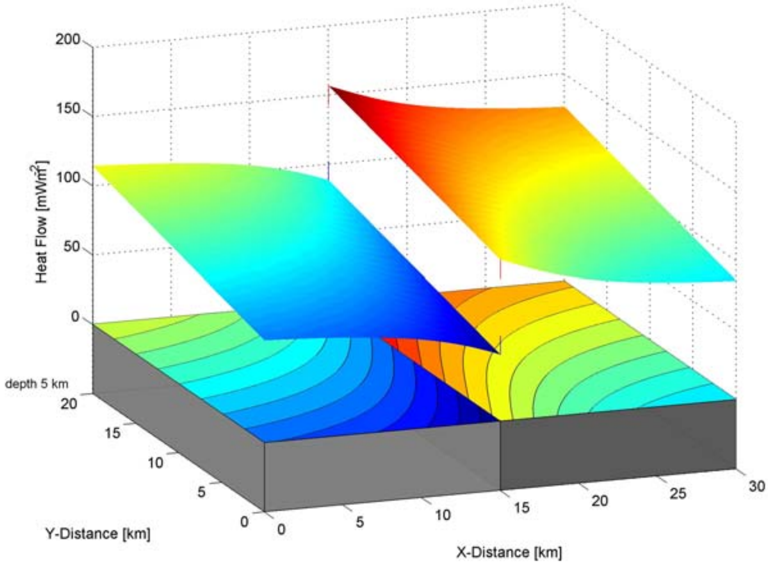

Fig. 1. The distribution of the surface heat flow density over the vertical contact zone with thermal conductivity contrast and with additional heat flow density gradient along the surface boundary of rock blocks. The figure demonstrates the step change in terrestrial heat flow density distribution typical for such contact zones (and in slightly changed forms also for various model configurations with aslant contacts of blocks).

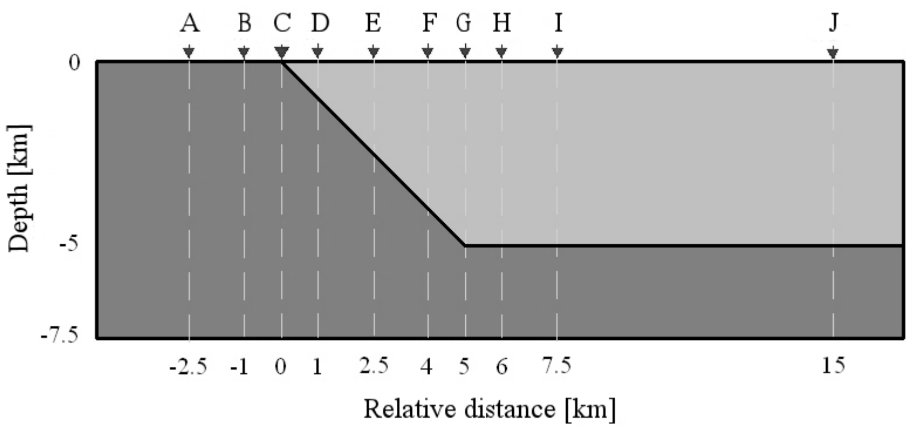

Fig. 2a. Border of the sedimentary basin. Relative positions for determination of the heat flow density vertical distribution.

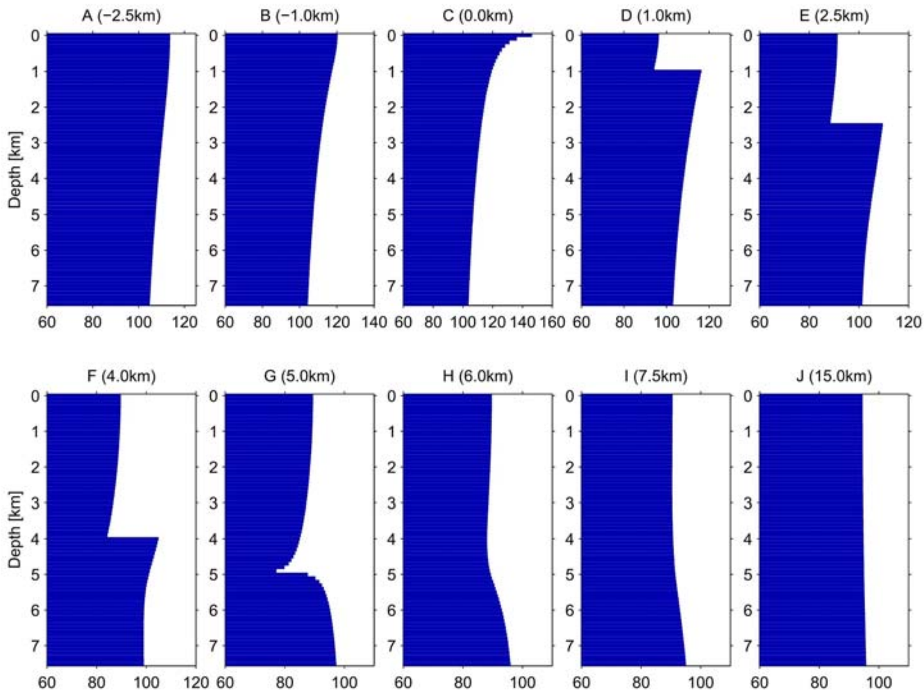

Fig. 2b. The vertical distributions of the heat flow density vertical component determined for various selected positions over the sedimentary basin structure. We used very common thermal conductivity contrast 2.0/3.0 W/m K. The distributions D,E,F show that the step change exists also on aslant lateral boundary between filling of sedimentary basin and basement materials. The variability of the vertical component of heat flow density within separate model blocks reaches up to 20 percent of mean value. The extreme variability occurs nearby the surface contact of blocks (upper part of distribution in position C).