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# Heat transfer in the upper crust - paleoclimate and fluid flow near the Kola super-deep borehole, Russia

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We present a coupled heat and fluid flow 3D model of the upper crust in the region of the Kola super-deep borehole, studying the effects of advection, structure and paleoclimate. The model is calibrated by new heat flow and petrophysical data obtained from shallow boreholes in the immediate vicinity of the super-deep borehole, as well as data from the deep borehole itself.

Steady-state simulations yield a quantification of structural and advective processes. For sensitivity studies the most important model parameters (thermal conductivity, heat production, permeability) are varied within their standard deviations. Our calculations show that the significant increase in heat flow measured in the upper 4-5 km in the super-deep borehole and some surrounding shallow boreholes is a combined effect of groundwater flow and paleoclimatic temperature changes. The latter are studied by transient simulations, whereby several simplified models for the ground surface temperature history were applied. The results of these forward calculations are compared with single and multiple inversions of temperature logs including the Kola super-deep borehole, presented in an accompanying paper (Rath and Mottaghy, this meeting).