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Overcoming spatial scales in geothermal modelling

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Understanding heat transport in the subsurface requires assessing the impact of different flow and heat transport processes. Of these, conductive heat transport may be influenced by advective and convective transients in the upper few km of the crust. A major problem in quantifying this influence using geothermal modelling is the lack of knowledge on the thermal and hydraulic conditions at the model boundaries. In addition the different transport mechanisms may affect the system to different degrees. Conductive heat transport is mainly controlled by the distribution of thermal properties (e.g. thermal conductivity, radiogenic heat production) and by variations of heat input from the crust and the mantle. In response to these variations, large temperature differences may be present at a certain constant depth level. Advective heat transport, is related to regional flow pattern in the porous geological units of the subsurface, the dynamics of which are controlled by the regional structural and hydrogeological setting. To assess the local dynamics of a geothermal reservoir it is therefore necessary to consider the different influencing factors accordingly in order to make predictions on reservoir performance in case of its utilization. We present a workflow to overcome this scale problem for 3D geothermal modelling and we illustrate how such a workflow can be successful by its application to a system of an intracontinental basin going from the lithosphere-scale to the scale of a geological reservoir.