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Analysis of thermal induced flows in laboratory by geoelectrical 3-D tomography

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In the Earth's mantle as well as in glass melting furnaces convection results from differences in temperature, density and concentration. Knowledge of these processes can be improved by numerical modelling, however, the obtained results have to be verified by experiments in laboratory.

Therefore dissolved polymer polyethylene glycol is heated in a tank to generate convection. But the localization of convection cells is quite difficult, because it is impossible to record temperatures inside the tank without an influence on the flow.

For this reason the temperature inside the viscous material is measured indirectly by DC-geoelectrical 3-D tomography based on the fact that a rise in temperature causes an increase in specific electrical conductivity. In this way the three-dimensional temperature distribution is calculated from the distribution of specific electrical conductivity according to the formula of Vogel (1), Fulcher (2) and Tammann (3).

In order to check the validity of the method the calculated temperatures are compared with the temperatures recorded by the 29 thermometers on the border of the tank. The obtained minor deviations demonstrate the suitability of this method.

References:

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