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Inferring lateral density variations in Great Geneva Basin, western Switzerland from wells and gravity data.

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In the framework of sustainable energy development Switzerland supports the growth of renewable energies. SIG (Services Industriels de Genève) and the Canton of Geneva intend to develop the use of hydrothermal energy in western Switzerland. As a Mesozoïc-formed sedimentary basin, the Great Geneva Basin (GGB) shares geological and petrophysical similarities with the Munich area (Baviera, Germany) and Paris Basin (France). The latter already provide significant amounts of geothermal energy for district heating. The prospection phase has been launched in 2014 by SIG and aims at identifying relevant geological units and defining their geometries.

Lower Cretaceous and Tertiary geological units have first been targeted as potential layers. At the depth we find these units (and according to the normal geothermal gradient), low enthalpy geothermal resources are rather expected.
In this framework, our study aims at constraining and refining lateral and vertical heterogeneities of Quaternary to Cretaceous sedimentary layers in GGB. Linear velocity law is inverted at wells and then interpolated to the whole basin for each geological layer. Using time pickings from available data and Quaternary information from previous studies time to depth conversion is performed. Thickness map of every geological unit is then produced. Tertiary thickness ranges from 0 m at the NW border of the GGB at the foothill of the Jura Mountains to 3000 m in the SE of the GGB at the border with the French Alps. These observations are consistent with field and well observations.

The produced thickness map will be used as a geometry support for gravity data inversion and then density lateral variations estimation. Unconstrained, and a priori constrained inversion has been performed in GGB using Gauss-Newton algorithms. Velocity versus density relationships will then enable to refine velocity law interpolation.

Our procedure allowed us to reduce the uncertainty of key target formation and represents an important step towards the development of geothermal energy in the Great Geneva Basin.