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Looking for sedimentary basins using global gravity and crustal models

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Publically available and newly released global crustal model, CRUST 1.0 (Laske et al., 2013) in combination with satellite based global gravity models GOCO$_3$s (Mayer-Gürr T. et al., 2012) yield a possibility of combining global source models with global gravity models.

The depths to the top and to the base of the geological units obtained from the global crust model are used to fix the source geometry. This information is subsequently used to forward compute the global gravity signature of these units in different heights above the sources and for unit mass density. The average global mass density for the geological unit acts like a scaling factor and the relation to the gravity signal becomes linear. The computations are done both for Tz (gravity disturbances) and for some chosen gravity gradient components Tzz, Tzx and Tzy, where x,y and z refer to a local east-north-up Cartesian reference frame.

The above setup allows constructing a model of the regional (gravity) field both for Tz and for the above gradient components Tzz, Tzx and Tzy and to improve it on regional scale. In principle, the method allows to keep track of the relation between the regional (gravity) signal and the source model. Subsequently, a generalized Nettleton's method can be used to fine-tune density values for the sediments from any above type of gravity data and a combination of it.

Finally, for the well-surveyed areas, the results can be compared with the independent information about the basin geometry. This experience can be used for quantifying the information about the sedimentary basin in areas where the information is limited.