

IMPACT OF AQUIFER VARIATION ON ABSOLUTE GRAVIMETRY

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Absolute gravimetry value is needed in gravimetric, geodesic or geoids studies i.e.. Gravimetry measurements are extremely precise, of $10E-9$ USI order with absolute gravimeter like FG5 ballistic gravimeter. With this precision of value some fluctuations in data are not understood. A possible cause of this variation is due to the change in the free surface water level of an aquifer, close to the gravimeter, which change the attractive masse under the gravimeter. Theoretical gravity variation range due to an aquifer level variations can be explored by simulating the gravity variation with a simple model where a cylinder represents the aquifer water change. With the use of this model we show that the change of 1 meter water level changes with an aquifer porosity of 10%, which is currents values for aquifers variations, generates $4 \times 10E-8$ USI of gravity variation. This is the same order that precision of absolute gravimeter measures. From a point over an aquifer, gravity value due to this aquifer decreases laterally around this point. This influence cannot be negligible, i.e. in a radius of 1000 m around this point for a water level change of 1 meter with aquifer porosity of 10% and a water level 200 meters down the gravimeter. Gravity variation map, due to an aquifer level change with a homogeneous porosity can be computed with a basic model using decomposition in small parallelogram of uniform density. With this model, we can simulate the gravity variation, due to the variation of aquifer near Strasbourg FG5 gravimeter, where we observe over a month (7-1999 to 8-1999) that the gravity value can change of $4 \times 10E-8$ USI at Strasbourg FG5 measurements spot due to some change in the aquifer (precisely due to a well for Strasbourg built-up area). With observing only the influence of the aquifer level variation under the Strasbourg FG5 gravimeter, no correlation between variation of gravity acceleration are directly linked with the water level change of 0.15m, this for two different periods of a week around. At the

opposite, over 17 months studies, with a water table change near 0.9 meter during this period, a correlation can be observed between absolute value of gravity change and water level variation, correlation link to the porosity of aquifer under FG5 gravimeter.