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Key techniques of the high precision gravity field system

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Ground-based gravity time series provide a direct method to monitor all sources of mass changes from local to global scale. But the effectively infinite spatial sensitivity of gravity measurements make it difficult to isolate the signal of interest. The high precision gravity field system is an alternative approach of modeling mass changes under-ground. The field system, consists of absolute gravity, gravity and gravity gradient, GNSS, leveling and climate hydrology measurements, can improve the signal-to-noise ratio for many applications by removing contributions of unwanted signal from elevation changes, air pressure changes, local hydrology, and others. The networks of field system combination, such as field-profile in more than 100 kilometers, can be used in critical zone with high seismic risk for monitoring earth dynamics, volcanic and seismic phenomena.
The system is constituted by 9 typical observation stations in 3*3 array (or 4 in 2*2 array) in 60 square meters field, each station is designed for integrated measurements, including absolute gravity, gravity gradient, elevation changes, air pressure and hydrology. Time-lapse gravity changes resulting from absolute gravimeter (FG5 or A10) with standard deviation less than 2 μGal, without the contributions of Earth tides, loading and polar motion. Additional measurements such as air pressure change, local hydrology and soil moisture are indispensable. The elevation changes resulting from GNSS (on the base station) and leveling (between stations) with precision less than 10 mm. The gravity gradient is the significant measurement for delimiting the location of the related mass changes underground the station, which is measured by Scintrex CG-5 gravimeters in different height (80cm in the test field), with precision less than 10 E. It is necessary to improve the precision of gravity gradient measurements by certain method in field experiment for the high precision measurement system.

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