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A new GNSS multi-constellation procedure based on the variometric approach applied to aerogravimetry

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The regional gravity field modeling is nowadays widely used in different contexts: from geodetic applications for the regional gravimetric geoid determination to geophysics applications for exploration purposes. However, the accuracies and resolutions required usually do not consent the exploitation of satellite only gravity data but need the integration with observations acquired at lower altitude.
Thanks to the development, in the late eighties, of Global Navigation Satellite Systems (GNSS) and the consequent availability of accurate navigational data, techniques such as airborne gravimetry, that can provide this complementary information, started to spread worldwide. This technique is nowadays one of the most efficient techniques ideal to collect gravity observations close to the Earth's surface (also in challenging environments), in a fast and cost-effective way.
In principle, to measure gravity with this technique, two principal components are required: an accelerometer for measuring the specific force (gravimeter) and a system that measures the inertial acceleration of the aircraft. This latter acceleration is nowadays derived from GNSS observations. By combining the acceleration from the two systems, gravimeter and GNSS, gravity observations can be obtained.
In this work a new methodology to process airborne gravity measurements is presented.
The proposed procedure allows to pre-process the raw observations coming from both the GNSS receiver and the gravimeter, with the aim to optimally combine the derived accelerations to compute gravity disturbances together with their predicted accuracy.
The algorithms developed to pre-process raw GNSS acquired data are obtained from the manipulation of the classical GNSS observation equation in such a way to derive a new expression sensitive to the receiver acceleration but almost insensitive to its actual position. Moreover, the GNSS accelerations are derived by exploiting the so called multi constellation approach.
In order to evaluate the performances of the whole methodology in terms of accuracy and computational times various numerical tests, on a real aerogravimetric survey, are presented.