

Interactive comment on “Evaluation of the capacities of a field absolute quantum gravimeter (AQGB01)” by Anne-Karin Cooke et al.

Anonymous Referee #1

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This study reports on first performance tests of a new generation of absolute quantum gravimeters that have explicitly been designed for mobile operation in field measurement campaigns. The study is of value in reporting for the first time on the measurement performance of one instrument of this type of the Muquans AQQ B series, and on the possible impacts of changing operation parameters such as ambient temperature, tilt or orientation of the instrument on the observed gravity values. To this end, several sensitivity tests have been performed with the instrument in an attempt to mimic to some extent changing conditions that one might be confronted with during field campaigns. Nevertheless, the value and impact of this paper could be enhanced if the study actually included real field tests to assess the capacities of a field instrument, as the title implies. Beyond the tests reported here under observatory or lab conditions,

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several aspects that might be at least similarly relevant for field operation and impact the accuracy, precision and repeatability are missed, such as the impact of wind, humidity, of varying ambient temperatures and insolation along (laser) cables, vibrations and tilting of the laser unit itself, instabilities of power supply, frequent system mounting and un-mounting cycles, instruments displacements under warm conditions (without a full restart of the system at the new location), for instance.

Detailed comments:

Line 4-6: "... and hydrological mass changes". Syntax of sentence unclear, as it starts with "... instrument's performance in terms of ...".

Page 6, line 13: "... 1.2m height difference." Height difference relative to which reference?

Page 6, line 14: "In the Larzac observatory, estimated vertical gravity gradients on pillar 1 (FG5) and 2 (AQG) ...". On page 4, however it was mentioned that at Larzac the FG5 and the AQG were operated on the same pillar?

Page 7, line 18: "Small-scale repeatability was assessed using repeated gravity measurements on the same position in the gravity lab ...". Has this been carried out without moving and/or unmounting the instrument in between the measurements?

Page 8, line 5: "...horizontal atomic velocities are reduced and the AQG#B01 should not be sensitive to the Coriolis effect." But if there are remaining horizontal components (they are 'reduced' only) an impact of the Coriolis effect cannot be excluded.

Page 8, line 17: "... the iGrav#002 shows a higher sensitivity at short time scale, but an increase at long time due to environmental noise and tides residuals." The statement is not fully clear as these noise and tide effects can be expected to impact the iGrav and the AQG in a similar way? Furthermore, to which extent are the results presented in Figure 2 impacted by internal filtering of the iGrav data and thus not directly comparable to the AQG results?

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Page 13, line 1: “Absolute comparison between both instruments [AQG and FG5] was not directly possible due to the set-up on different pillars and is impacted by the uncertainty related to the vertical gravity gradient (VGG) correction.” But the others give an assessment of this VGG uncertainty so that in view of this uncertainty the absolute values of both instruments could in fact be shown and compared.

Page 13, line 7: “based on” instead of “based”.

Page 13, line 10: What exactly has been done with the instrument in between measurements on the same location? This might be relevant information for setting the reported repeatability in a context, also with respect to displacements during future field campaigns.

Page 13, line 16: “The measurement on point 2 was carried out using rubber pads under the tripod which added a height of 1.2 cm.”. Why hasn’t the same setup been used to assure full compatibility of the two measurements?”

Page 13, line 19: “To summarise, these first results show a repeatability better than 50 nm.s⁻² . . .” Not clear where this value of 50 comes from given the results presented before.

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