Annex A: Reliability of relative gravity measurements error budget

As the relative gravity surveys performed in this study are targeting a small gravity signal, one needs to check that formal errors do not underestimate the gravity differences precision. For this purpose, some stations - referred to control stations - were measured twice within two different loops for each survey. Out of the 25 relative gravity surveys, a total of 72 control stations were repeated. The measurement error of control stations (assessed as the standard deviation of repeated measurements) ranges from 0 to 150 $nm.s^{-2}$, the median measurement error is 35 $nm.s^{-2}$. For the same stations, the formal error ranges from 0 to 110 $nm.s^{-2}$ (Fig. A (1)), the median formal error is 32 $nm.s^{-2}$. So formal errors obtained from loop least-square adjustment (median formal error of 32 $nm.s^{-2}$ for the control stations)re found to be representative of the precision of the measurement protocol we used (median measurement error of 35 $nm.s^{-2}$ for the control stations). As a result, formal errors are considered as a reliable estimate of gravity difference errors $\varepsilon(\Delta g_t^i)$ (Eq. 3).

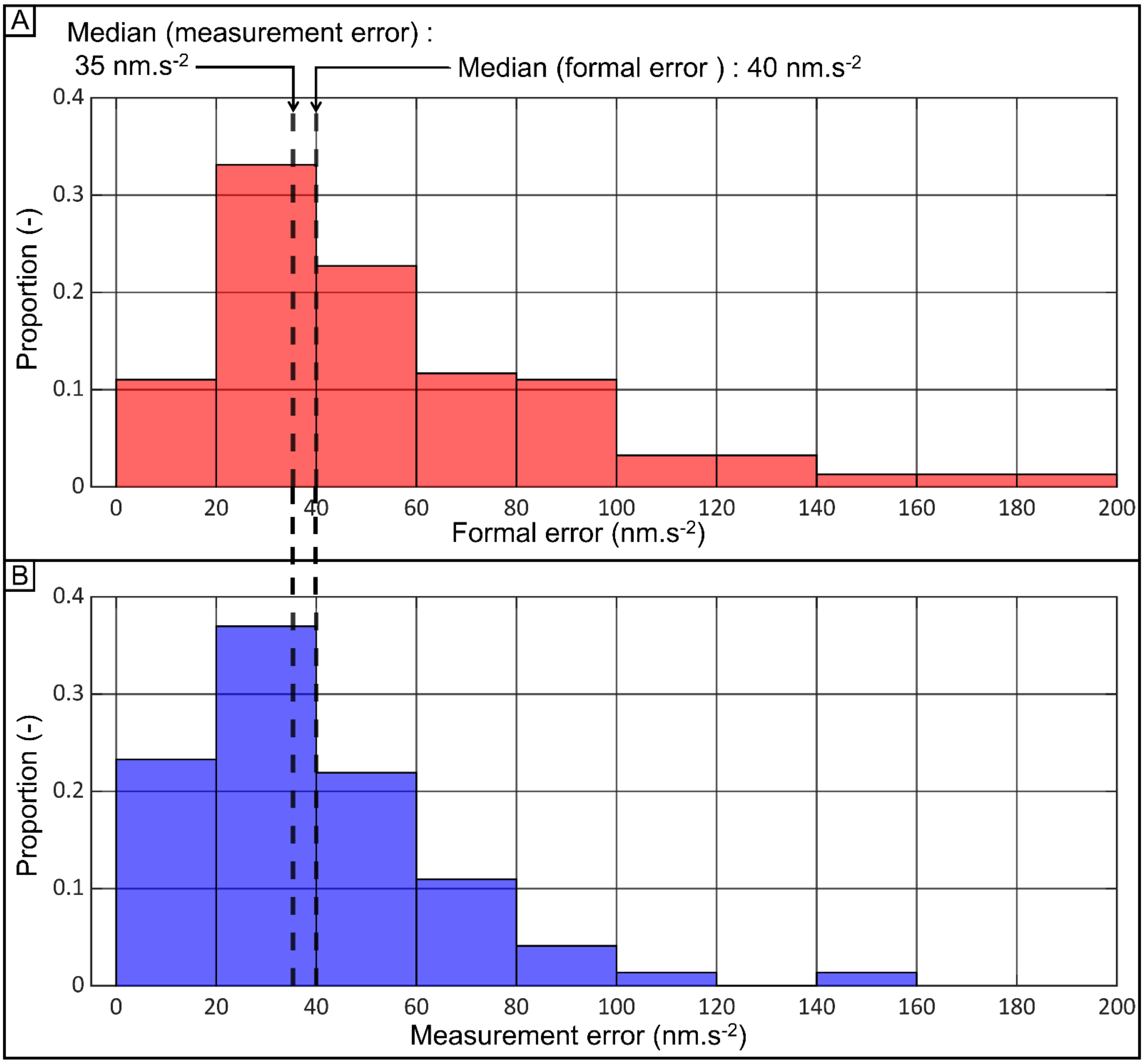

Figure A.1. **Comparison of the distribution of formal errors and measurement errors for control gravity measurements**. A) Distribution of formal errors. B) Distribution of measurement errors.

Annex B: Optimization of the mesh used for 3D forward gravity modeling

We tested different meshes in order to reach a good compromise in terms of accuracy of gravimetric calculation and speed of calculation. Figure B.1 shows the temporal variations of gravity calculated at a daily step from the NIHM model at STR F5 (Fig. B.1 (A)) and STR F8 (Fig. B.1 (B))for 3 different gravity meshes: (i) a fine mesh with a constant horizontal step of 1 m, (ii) a coarse mesh with a constant step of 10 m, or (iii) an horizontally variable mesh, with a step of 1 m in a 40 m square area centered on the gravity stations, and 10 m elsewhere. The vertical step of the mesh is 0.2 m for the

3 meshes tested. The duration of the hydro-gravimetric calculation depends on the number of mesh elements, it is thus maximum for mesh (i) (640 s per date), minimum for mesh (ii) (7 s per date), and intermediate for mesh (iii) (23 seconds per date). The gravity signal modeled using the variable mesh at stations STR F5 and STR F8 (dashed green lines Fig. B.1 (A) and (B)) differs very little from that computed with the fine mesh (doted red lines Fig. B.1 (A) and (B)). This variable mesh thus ensures an accurate calculation of gravity variations, while being particularly efficient in term of computation time compared to a fine mesh with constant step.

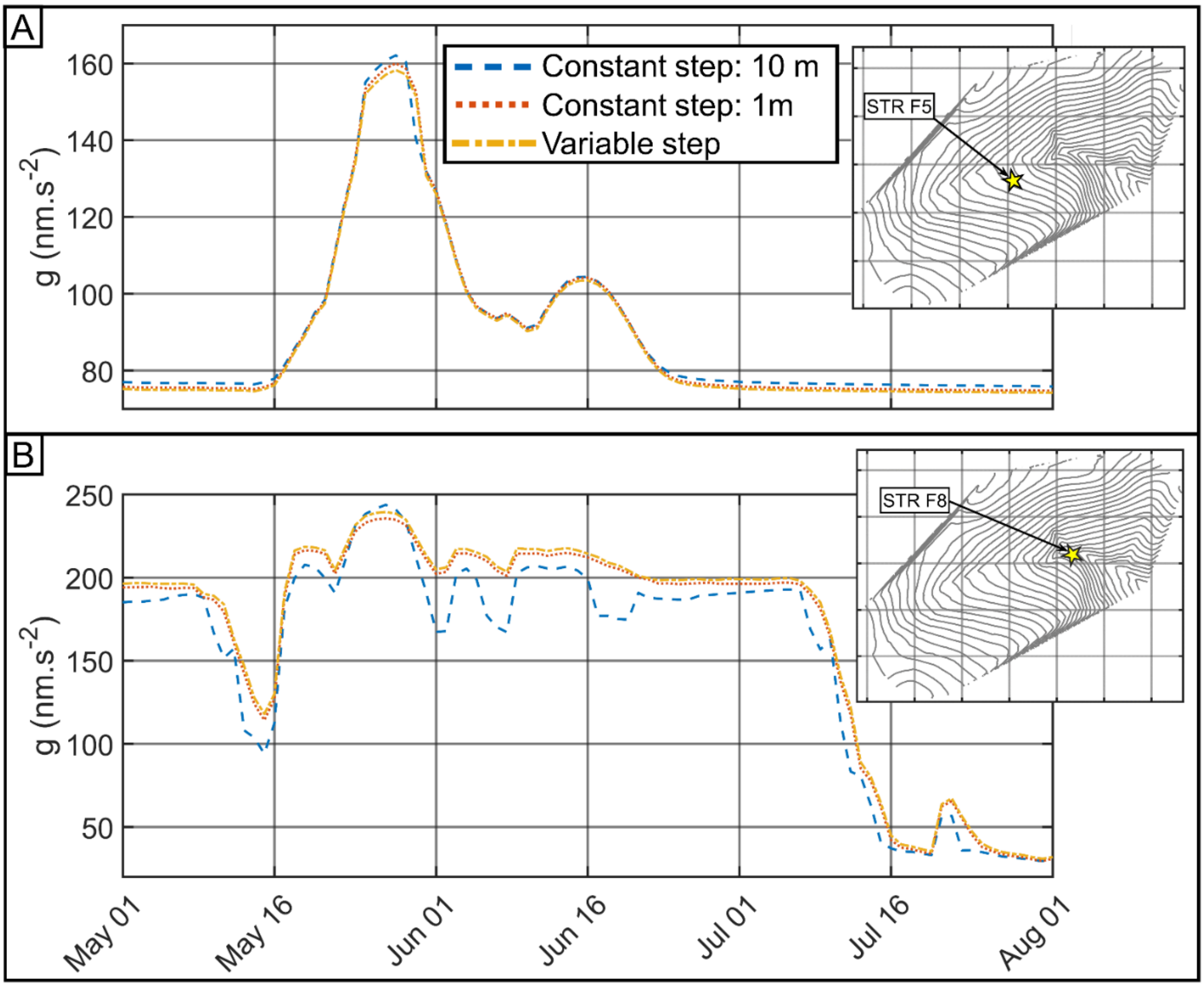

Figure B.1 **Search for the optimal mesh for gravity forward modeling**. A) Gravity modeled at station STR F5 from the NIHM model at a daily timestep, using: (i) a coarse mesh with a constant horizontal step of 10 m (dashed blue line), (ii) a fine mesh with a constant horizontal step of 1 m (red dotted line) or (iii) a mesh with variable horizontal step which is finer (1m) in 40 m wide squares centered on the gravity stations, and larger everywhere (10 m). B) same as A) but for station STR F8.