# Supplementary Material for FEASIBILITY OF 4D GRAVITY MONITORING IN DEEP-WATER TURBIDITES RESERVOIRS

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# Introduction

In order to complement the information displayed in the article, we created this supplementary material with some computational tests.

The tests are focused on adding noise to the modeling results to show the robustness of the methodology. The additive pseudorandom noise has a Gaussian distribution with zero mean. We tested three values for the noise standard deviation: 0.5, 0.3, and 0.1 μGal.

The noise was added to the gravity anomaly generated by forward modeling in each year (2002, 2013, 2014, 2015, and 2018). Then, the 4D gravity anomaly was computed in the cases with and without subsidence (see Figures 10 and 16 in the article).

# Results – 4D Gravity Anomaly with Noise

## Scenario without subsidence:

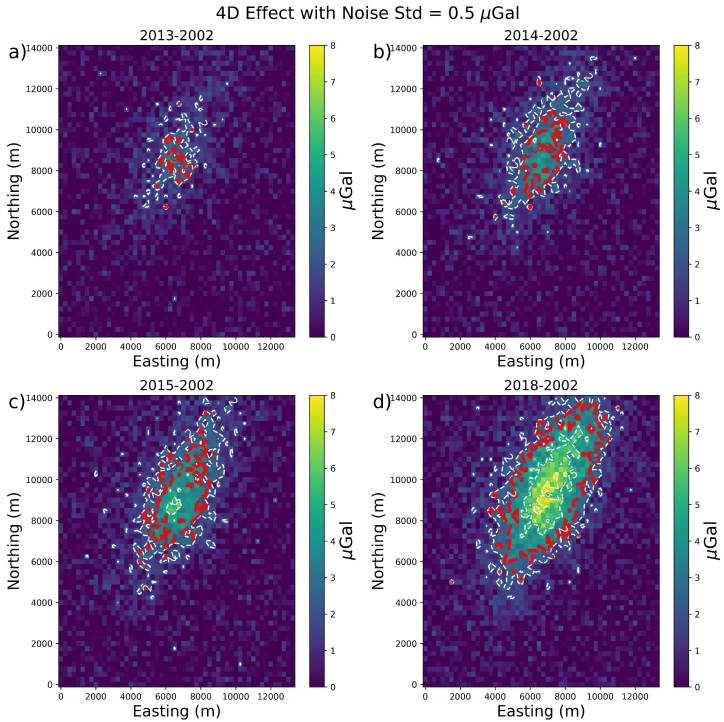


**Figure S1:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.5 μGal in the scenario without subsidence. Compare with Figure 10 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 μGal is represented by the red lines.

# Results – 4D Gravity Anomaly with Noise

## Scenario without subsidence:

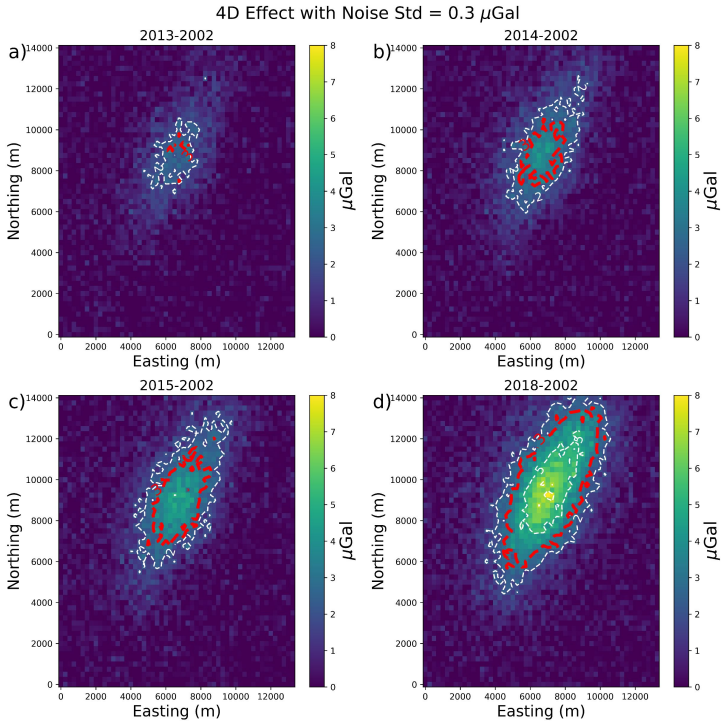


**Figure S2:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.3 µGal in the scenario without subsidence. Compare with Figure 10 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 µGal is represented by the red lines.

# Results – 4D Gravity Anomaly with Noise

## Scenario without subsidence:

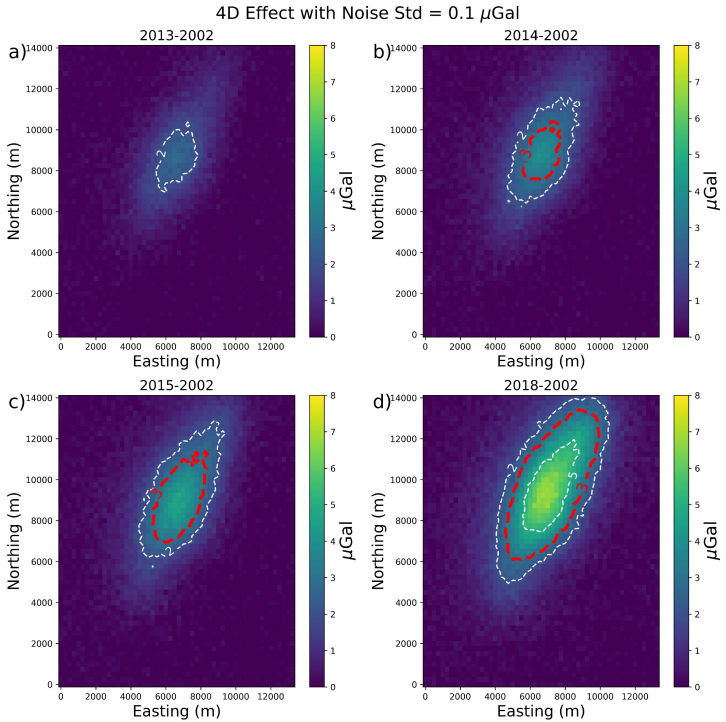


**Figure S3:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.1 μGal in the scenario without subsidence. Compare with Figure 10 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 μGal is represented by the red lines.

# Results – 4D Gravity Anomaly with Noise

## Scenario with subsidence:

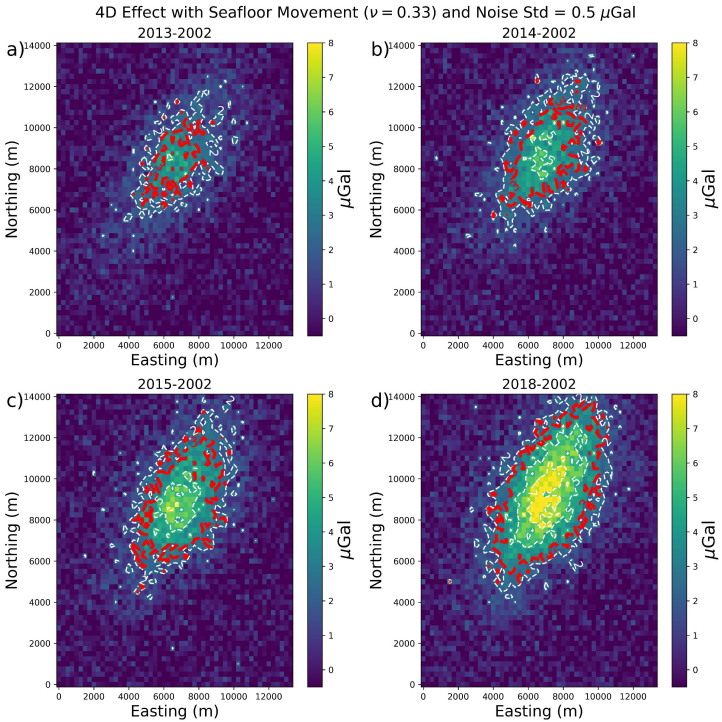


**Figure S4:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.5 µGal in the scenario with subsidence. Compare with Figure 16 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 µGal is represented by the red lines.

# Results – 4D Gravity Anomaly with Noise

## Scenario with subsidence:

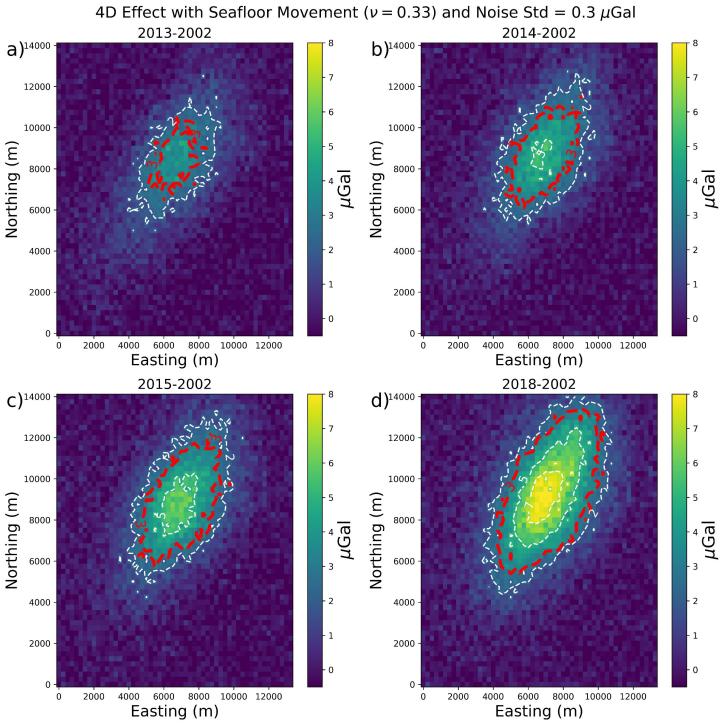


**Figure S5:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.3 µGal in the scenario with subsidence. Compare with Figure 16 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 µGal is represented by the red lines.

# Results – 4D Gravity Anomaly with Noise

## Scenario with subsidence:

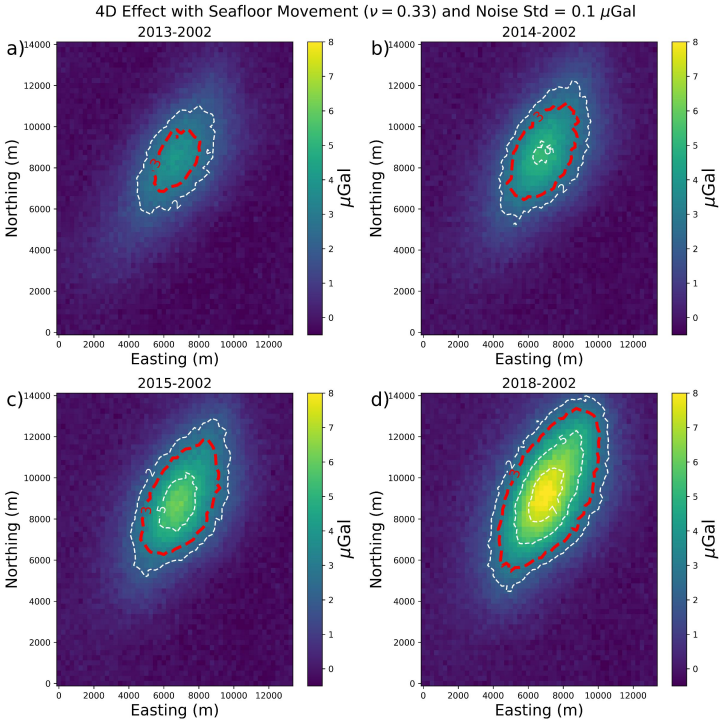


**Figure S6:** Noise-corrupted 4D gravity anomaly with zero mean and standard deviation of 0.1 µGal in the scenario with subsidence. Compare with Figure 16 in the article showing the noise-free 4D gravity anomaly. The feasible limit of 3 µGal is represented by the red lines.

# Discussion and Conclusion

We added normal distribution zero-mean noise with three standard deviations: 0.5, 0.3, and 0.1 μGal. The noise was added after calculating the gravity for each year (2002, 2013, 2014, and 2018). Then, we computed noisy 4D gravity anomaly.

We have shown, numerically, that by using noise-corrupted anomalies (Figures S1 - S6), we can identify anomalies higher than the feasible limit of 3 μGal and characterize them as we had done in the main article (see Figures 10 and 16). Even for the higher standard deviation of the noise distribution (in our tests, 0.5 μGal), it does not obliterate the 4D gravity anomaly, and we can identify the feasible limit of 3 μGal to detect them. However, in our numerical tests, standard deviations higher than 0.5 μGal can mask the 4D gravity anomaly.

These results illustrate the robustness of the methodology, showing that even in the presence of noise, our results indicate that the noisy gravity responses are higher than the feasible value of 3 μGal after 12 years from the base survey.