(b) **(b)**

Figure 2. (a): 3-D gravity map, (b): 3-D terrain map of the study area

Table 1. Valid navigation probability or convergence probability

Navigation method	convergence probability
Gravity aided navigation	%79
Terrain aided navigation	%75
Two maps aided navigation	%99.8

5. Conclusions

We presented a method for underwater vehicle navigation by measuring gravity and terrain of the water .the Kalman filter is used to combining information that comes from maps, sensors, and INS. The results show this method has high accuracy more than other methods and have high valid navigation probability. Two maps aided navigation method that presented in this paper does navigation based one filtering stage, unlike the other two maps aided method which uses one Kalman filter for every map and so the valid navigation probability can be decreased.

List of Symbols

K_k	Kalman gain
w_k	observation noise
H_k	observation matrix
v_x and v_y	velocity components of vehicle
v_k	process noise
g_k	measurement vector

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