Improvement of spatial resolution of airborne gravimetry for wider applications

Jiro Segawa[1]; Yoshio Yoshio[2]; Minoru Sasaki[3]

[1] Tokyo Univ. Mar. Sci. Tech.; [2] JHA; [3] Buyodo Corporation

In this paper we discuss the improvement of airborne gravimetry and its applications.

The strong points of airborne gravity measurement are as follows:

1)Seamless and homogeneous gravity measurements are possible over all areas including land, sea and mountains.

2)Airborne measurements are ten to a hundred times as efficient as those on land or at sea.

3)By changing the flight altitude the vertical gradient of gravity dg/dz can directly be measured.

4)By comparing airborne gravity at height with land gravity on the mountains taking also the topography into account it is possible to evaluate the density of the rock composing the mountains so that spatial distribution of rock density can be mapped.

5)Draping measurement of gravity is possible by flying at low altitude while skimming the mountain. This may be useful to find detailed structures on the mountains. From the point of gravity measurement, however, gravity thus obtained may be contaminated by noises caused by complicated movement of the airplane.

The weak points are:

1)In the case of gravity measurement the noises caused by the airplane have to be filtered out. However, since the spectral distributions of true gravity signals and airplane noises are overlapped to some extent the signals of short wavelength

are likely to be dropped out together with noises. Such loss of signals causes difficulty in the study of detailed structural anomaly as the seismic faults.

2)GPS used for positioning causes sometimes a big problem. The DGPS loses function above the mountains higher than 1000m. In addition, when the satellite visibility is small the interferometric GPS positioning does not work either.

3)Gravity measurement is affected by the change of airplane speed. This is because the data processing inside the gravimeter is based on time, while the gravity anomaly changes with position. So, we have to devise a new algorithm which incorporates the effect of airplane speed.

4)In the case of airborne gravity measurement it is likely that we employ a too strong low-pass filter. This must be avoided.

The new steps therefore:

1)Employ the Kalman Filter.

2)Slow down the airplane speed as 90 knots down to 60 knots.

3)Newly map the Free-air reduction co-efficient.

4)Incorporate the airplane speed in the algorithm of gravity processing.