Interpolirovanie astronomo-geodetic anomalies of height

Ogorodova L.V.
Professor, Department of higher Geodesy,
Moscow state university of Geodesy and Cartography, Russia

Balbekov A.
Specialist

Uzefovich A.P.
Professor, Department of higher Geodesy,
Moscow state university of Geodesy and Cartography, Russia

Geodetic height H of item in a classical geodesy find as the sum of normal height H^{γ} of astronomo-geodetic anomaly $\sum^{az}$ of height on a physical surface of the Earth of (height kvazigeoida)

$$H = H^{\gamma} + \sum^{az} .$$

Anomaly of height transferred on numbers of a triangulation astronomical or astronono-gravimetricheskim levelling. Anomaly of height can be found under formula Stoksa numerical integration of anomalies of a gravity in some near area around of a computing point (radius of this area usually some tens or hundreds kilometers); anomalies of a gravity on all other surface of the Earth (thus represent distant area) as lines.

Having executed exact GPS measurements on item of geometrical levelling, it is possible to find geodetic height H with accuracy of 1,5-2 sm and size $\sum^{az}$.

Having received sizes $\sum^{az}$ for a rare network of items of levelling, it is possible prointerpolirovat them on other items GPS - measurements and on geodetic heights on these items to find normal heights without prolozhenija nivelirnogo a course:

$$H^{\gamma} = H - \sum^{az}_{изм} .$$

However linear interpolirovanie anomalies of height even on distance in some kilometers it can be accompanied by mistakes because of local neodnorodnostej fields of a gravity. Therefore indirect interpolation is preferable.

At indirect interpolation under formula Stoksa calculate local gravimetricheskie anomalies of height $\sum^{ep}$ for all basic and determined items of a high-altitude network, using gravimetricheskoj a card.

Integration under formula Stoksa carry out in circular area which radius should exceed the sizes of investigated territory. Local anomalies of height reflect local features of a field and consequently differences- $\sum^{az} - \sum^{ep}$, received for strong points, vary slowly and on a regular basis and they can be interpolated confidently linearly.

So, required normal height on are determined items it is possible to find from expression

$$H^{\gamma} = H - (\sum^{az} - \sum^{ep})_{инт} - \sum^{ep} .$$

Advantages of indirect interpolation have been investigated in a network from 17 items GPS - the measurements executed by experts MIIGAiK, on reference points of geometrical levelling: average distance between items 6,0 of km. Astronomo-geodetic anomalies of height between extreme items of this network of (36

km), located in flat area change on 1,0 m. Determined began to count 5 items of this network, and on the rests 12. (between them of 7-13 km) have executed linear interpolation of sizes $\sum^{ac}$. Then 9 items, and basic - 8 with distances between them of 15-20 km became determined. Average quadratic divergences with the measured values have made accordingly 33 and 40 mm.

For the same determined items, all over again five, and then nine, indirect interpolation has been executed. Local gravimetricheskie anomalies of height $\sum^{cp}$ calculated for all 17 items on detailed to a card of anomalies in free air section 5 mGal. Numerical integration of anomalies under formula Stoksa was carried out every time in circular area of radius of 40 km with the help paletki with the ring zones, the offered L.V.Ogorodovoj. The number of ring zones and their width have been designed proceeding from the set accuracy of calculation $\sum^{cp}$ in 5 mm under a condition of equality of influence of each zone. The received sizes $\sum^{cp}$ change from 0,21 up to 0,53, i.e. up to 15mm/km.

Comparison of results of indirect interpolation with the measured sizes $\sum^{ac}$ has made in both cases of only 9 mm. Apparently, indirect interpolation allows to calculate astronomo-geodetic anomalies of height with a mistake about 10 mm and to find on items GPS of measurements normal heights with the accuracy comprehensible to geometrical levelling.