CO-050

ACCURACY ASSESSMENT OF ASTER GDEM IN NORTH SHAANXI OF CHINA

YANG X., ZHANG W., ZHU S.
Nanjing Normal University, NANJING, CHINA

For the preferred time-present, high accuracy and easy availability, ASTER GDEM becomes one of the most important global topographic data. Studies on the accuracy assessment of ASTER GDEM are of great significance to the application. The elevation accuracy of Aster GDEM is 20 meters with respect to a global scale. However, the accuracy in specific area, like North Shaanxi province which is the main part of Loess Plateau of China, is not very clear.

In this paper, 46 areas with different land forms, each with a area of 100Km^2, in North Shaanxi province of China were selected as test areas. Two main methods, namely root mean square error (RMSE) and contour matching difference (CMD), are used in accuracy assessment of ASTER GDEM.

1. RMSE of ASTER GDEM elevation

The national DEMs with 5 meters resolution which generated from 1:10000 scale of relief map is assumed as relatively true value. We calculated RMSE of elevation in all test areas, and interpolated the RMSE map in the North Shaanxi province (Figure 1).

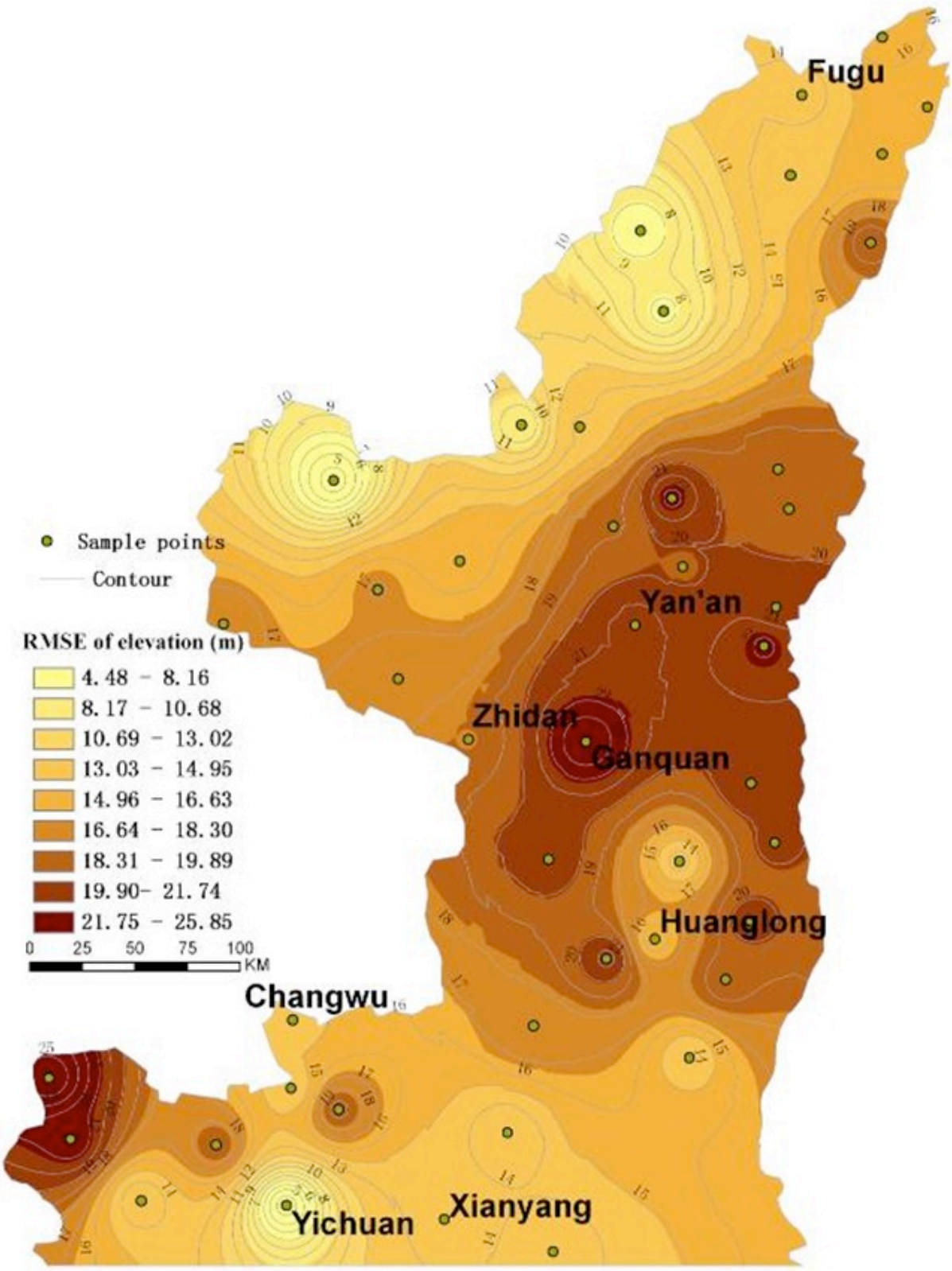

Figure 1. RMSE of Aster GDEM elevation in North Shaanxi province

Figure1 shows the RMSE has a trend of increase-decrease from north to south. In north part of sand valley area, the average RMSE is 11.9m. While in the middle part of loess gully-hill area, the average RMSE is 18.9m, and 24m for maximum value. Weihe river terraces and loess Yuan lies in the south part get the average of RMSE of 14.2m.

2. Contour matching difference of Aster GDEM

Contour matching difference (CMD) is a quantities indicator describing the difference between original contour and regenerated contour. Through the overlap between original contour and regenerated contour, some fine polygons along the original contour occur. The ratio of the total area with these fine polygons and the enveloping area of neighbouring two half-interval contours is named as accumulative contour matching difference (ACMD). Figure 2 shows the definition of ACMD.

For a single contour, ACMD can express as:

$$ACMD = \frac{\sum S_i}{M} \quad (1)$$

where S_i is total area of fine polygons through overlap between original contour and regenerated contour. M denotes area closed by neighbouring two half-interval contours.

For total test area, the calculation of $ACMD_t$ can give as:

$$ACMD_t = \sqrt{\frac{1}{m}\sum ACMD^2} \quad (2)$$

where m is the number of contours.

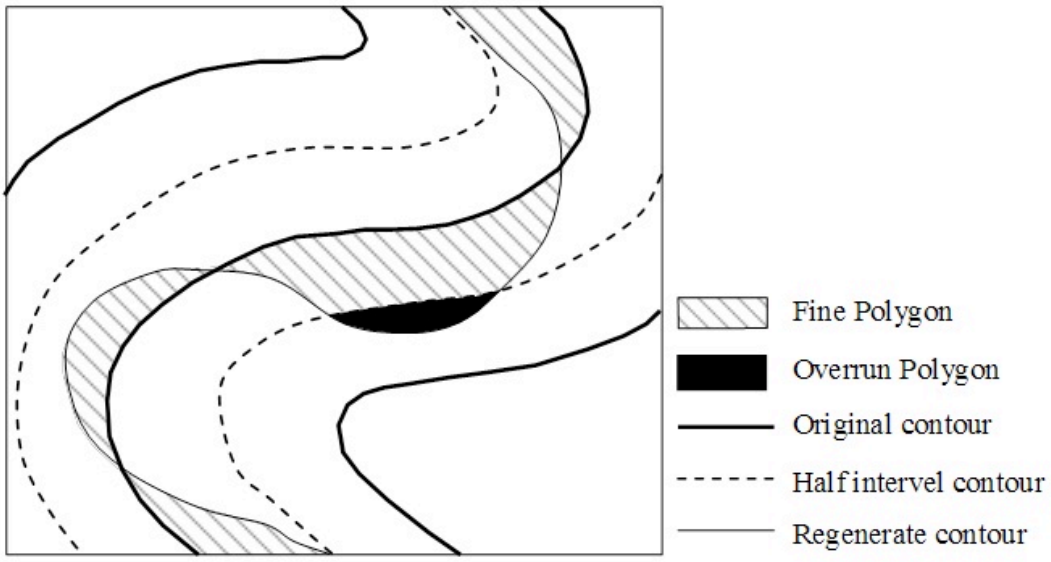

Figure 2. Conception of contour matching difference

Through comparing with DEMs from 1:10 000 scale of relief map, ACMD were calculated with the data of Aster GDEM and national DEMs from 1:50 000 scale of relief map. A smaller ACMD value indicates a better matching of two contours.

Table 1 shows that ACMD values of four test areas, namely Yan'an, Zhidan, Ganquan and Huanglong, are smaller than 0.1, showing a well matching with the contour of 1:10 000, which means a high representation of Aster DEM to real terrain in these areas. While in the gentle relief area, like Fugu, Yichuan and Chang Wu area, ACMD of Aster GDEM is larger than 0.1, meaning a relative bad contour matching result. In general contour matching is better in rugged area than that in gentile relief area which presents an inverse trend from RMSE of height error.

Table 1. ACMD of ASTER GDEM and 1:50 000 scale of DEM in typical landform areas

ACMD	Fugu	Yan'an	Zhidan	Ganquan	Huanglong	Changwu	Yichuan	Xianyang
ASTER GDEM	0.108	0.077	0.070	0.094	0.078	0.155	0.104	-
1:50 000 DEM	0.058	0.072	0.049	0.104	0.041	0.139	0.087	-

3 Conclusion and discussion

Accuracy of ASTER GDEM is spatially different across the North Shaanxi area. From north to south the RMSE had a general trend of low-high-low corresponding to slightly undulating-rugged-flat relief. Contour matching difference shows Aster GDEM have higher reliability in description of terrain structure. Although Aster GDEM has a larger height error of single point in loess gully-hill area, it can describe the relief characters effectively. Contrarily, in gentle relief area in spite of higher accuracy of single point, the

ability for expressing the terrain structure of Aster GDEM is inferior, owing to more noise of Aster GDEM there. Therefore we should take both elevation accuracy and description ability of terrain structure into consideration when using it to analysis. In general, the comparison indicates that the accuracy of Aster GDEM is similar to the national DEM of 1:50000 scale, but is greater than it in topographic details.