Errors of initial data are mainly baseline vector, initial slant range and interferometric phase offset. As can be seen from table 2, for initial data, it exist obvious height errors, which are caused by the deviation of baseline, interferometric phase and the initial range. We can also see that MLHE and proposed method have similar errors in the G15, G16 and G17, the main reason is that the two methods adopt the rigorous geometric model, and the most errors come from system parameters. While in the G11 and G13, MLHE method has obvious errors, moreover, about 2300 columns height values in the near-range side of height map (a) is relatively low, and G11 and G13 happen to locate in this region. It illustrates that systematic errors cause the maximum value of probability density function to shift from one maxima to another one, which leads to the abrupt changes of height in the near-range area. For calibrated data, the height accuracy of two methods is similar, and height maps (b) and (d) also show the same trend.

Significantly, in Fig. 3 (a) and (b), the height maps inversed by MLHE method, there are abundant abnormal values, MB-3DRe method effectively solves the problem as shown in (c) and (d). From view of execution efficiency, MB-3DRe method is 6~7 times the MLHE as shown in table 2.

In short, MB-3DRe method has higher precision and is more efficient than MLHE.

3.2 Analysis

The most significant difference between MB-3DRe method and other multi-baseline elevation inversion method beside MLHE is that MB-3DRe method use three-dimensional coordinates of targets to connect different interferograms however other methods only using elevation information. Therefor MB-3DRe method has two more restrictions than others. When system parameters error or phase noise only occurs in one dimension, for instance, phase noise has great influence on elevation dimension and has little effect on planar (i.e., two dimensions of X and Y constituting a planar), MB-3DRe method reduce the influence of errors on cycle number solution via decomposing in three orthogonal directions. Not only MLHE method but also other methods, except [9], use only elevation value connecting different interferograms. Although MB-3DRe method is only compared with MLHE method, still can represent most of the other methods. Therefore, MB-3DRe method is robust and has good accuracy.

When interference fringe is too dense, MLHE method usually does not work as it remains the wrapped phase value leading to the removal of flat earth effect failure. MB-3DRe method can reduce the fringe density by flat earth phase removal, so as to reduce the difficulty of solving cycle number. Therefore, in dense fringe region, MB-3DRe method does work well.

As for the implantation efficiency, in the case of GCPs, MB-3DRe method can converge in a short time. In the case of no GCPs, MB-3DRe method can run fast as well when a low precision DEM data is introduced.

4. CONCLUSION

The multi-baseline InSAR technique is vast importance to complex area mapping. This paper studies a multi-baseline elevation inversion method based on three-dimensional reconstruction model, which placed the cycle number as unknown parameter in equation set to be solved. Comparing with other methods, MB-3DRe method has better robustness, applicability, higher precision and speed. Because error sources under multi-baseline InSAR condition are in many aspects, the results of this paper have a small amount abnormal value. The next step will introduce the advantages of noise suppression to further improve the performance of MB-3DRe method.

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