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SAR INTERFEROGRAM FILTERING METHOD BASED ON EMPIRICAL MODE DECOMPOSITION

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ABSTRACT:

Interferometric synthetic aperture radar (InSAR) has proven to be an effective technology for mapping surface topography and deformation. Because of its high spatial coverage and high accuracy, it has been widely used for measuring ground deformation associated with earthquakes, underground mining, glacier flow, volcanos, landslides, and other features. However, phase noise due to thermal, temporal, or geometrical decorrelation, inconsistency in Doppler centroids and other sources always exists. The presence of this unwanted noise signal can reduce the accuracy and reliability of topographic height and deformation information. So interferogram filtering is always an important step among all InSAR processing procedures. Over the last few decades, many filtering methods have been proposed to improve the quality of SAR interferograms. Empirical mode decomposition (EMD) is widely used in filtering SAR interferometric phase noise because of its superiority in analyzing nonlinear and nonstationary data. EMD was originally proposed by Huang et al. in 1998 and was first introduced to filter interferometric noise by Yue et al. in 2001. Based on partial reconstruction of relevant modes, EMD performs interferogram filtering procedure in an adaptive way. Recently some improvements have also been proposed to enhance the filtering performance of original EMD methods, such as local EMD method and bivariate EMD method. However, it still raises questions on how to select the decomposed modes in an efficient way. In this paper, a detailed research of the application of EMD method in SAR interferogram filtering field has been carried out. We compared the filtering results between the original EMD filtering method and its several enhanced versions. In order to reveal the advantages of EMD method, we also made further comparison between the results of EMD based filter and the mostly used Goldstein filter. We applied those filtering methods to InSAR pairs derived from different sensors and different surface features. L band PALSAR pair obtained from glaciers on the West Kunlun Mountains in China and X band COSMO-SkyMed pair obtained from Kilauea volcano in the Hawaiian Islands were used to make comparison among different filtering results.

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