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Along-track InSAR for observation of crustal deformation

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Interferometric Synthetic Aperture Radar (InSAR) has been successfully applied to mapping crustal deformation associated with earthquakes and volcanic activity and so on. However, there is a flaw that the InSAR technique can only measure 1-D displacement along the antenna's line-of-sight direction. The along-track displacement cannot be detected in principle. SAR satellites travel a nearly north-south direction, thus the InSAR measurement is insensitive to displacement in the north-south direction. A pixel offset method has been often employed to measure the along-track displacement, but the measurement accuracy is low (several tens of centimeters) and the spatial resolution is low (several hundreds of meters to ˜ one kilometer). This is why practical applications to crustal deformation observations are limited. A significant improvement in measuring the along-track deformation has been proposed: multiple-aperture SAR interferometry (MAI) (Bechor and Zebker, 2006). This method utilizes split-beam InSAR processing which creates one forward- and one backward-looking interferogram, and then constructs a multiple aperture interferogram from the two different-looking interferograms. It is reported the achieved measurement accuracy is higher than that by pixel offset method. In this study, we apply the MAI method to ALOS/PALSAR data and we discuss the measurement accuracy for consideration of the range of applications to crustal deformation observations. Preliminary results of MAI show that the achieved accuracy is 5-10 cm (1 standard deviation) with a coherence more than 0.5 with 20-40 multi-looking in azimuth. On the other hand, the measurement accuracy of pixel offset analysis is approximately 20 cm (1 standard deviation) with 128 x 256 pixels of a cross correlation window, suggesting that a MAI method is achieved higher accuracy with higher spatial resolution than a pixel offset method.

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