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Persistent scatterer SAR interferometry using multi-polarimetric SAR interferograms

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Persistent scatterer SAR interferometry (PS-InSAR) is a method to estimate surface deformation using a number of SAR interferograms, and has been applied to aseismic fault slip, volcano and land subsidence as a practical monitoring tool. In recent years, more and more satellites that are equipped with SAR, which can acquire multi-polarimetric data has been operated. In this study, we propose a method to processing PS-InSAR analysis using multi-polarimetric SAR interferograms, and show that the estimation accuracy of surface deformation increases.

In this study, we increase estimation accuracy by processing multi-polarimetric SAR interferograms simultaneously. Since, the amount of noise ratio would differ in different multi-polarimetric SAR interferograms depending on the geometry or electromagnetic characteristics of targets, we determine the weighting coefficient between polarimetric SAR interferograms from observed phase based on maximum likelihood method.

We applied the method to ALOS/PALSAR data acquired in multi-polarimetric mode. First, we processed HH-HH and VV-VV interferograms simultaneously. As a result, weighting of HH-HH and VV-VV interferogram was almost identical, suggesting that decorrelation-induced noise in HH-HH and VV-VV interferograms was almost same. In this case, the accuracy of estimated deformation rate would increase twice. On the other hand, when we processed HH-HH and HV-HV interferograms simultaneously, the weighting of HH-HH interferograms are larger than that of HV-HV interferograms, suggesting that HH-HH interferograms has less amount of noise compared with HV-HV interferograms. Nevertheless, we found that the estimation accuracy increases by using both HH-HH and HV-HV interferograms compared with the standard analysis using HH-HH interferograms.

Keywords: persistent scatterer SAR interferometry, surface deformation, polarimetry