INTERFEROMETRIC SAR PROCESSING AS A SUBJECT FOR TECHNOLOGY EDUCATION

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ABSTRACT:

Differential interferometric synthetic aperture radar (InSAR) technology can accurately measure ground deformations in a wide area. Advanced technical knowledge and special analytic devices are usually needed to process InSAR information. In recent years, the processing capabilities of information systems used in Japanese schools have been significantly enhanced, and it is possible to perform InSAR processing by using these systems. This study aims to develop interferometric SAR processing as a subject for technology education for enlightening usefulness of information technology and a method for measuring wide ground deformations.

So far a teaching guidance plan has been proposed and Doris has been chosen as a main teaching material. Doris is an open source and free InSAR processing software provided by the Delft University of Technology in the Netherlands. The teaching guidance plan includes learning contents in “Technology of Information Processing” under the “Technology” subject stipulated by the Ministry of Education, Culture, Sports, Science and Technology in Japan. This paper particularly presents the teaching materials using actual events based on educational considerations. SAR images and interferograms are produced by Doris and EduSAR which is an educational SAR processor developed by the Naruto University of Education in Japan. Doris requires phase preserved SLC (Single Look Complex) data with the zero-Doppler geometry only.

For this reason, EduSAR has been improved as follows: (1) Converting from “parameter” and “SLC data” files in the EduSAR format to “result” and “SLC data” files in the Doris format. (2) Applying a precise Doppler centroid frequency estimation method and compensating locations and phases so as to produce the SLC data on the zero-Doppler geometry. (3) Implementing the Hermite interpolation method in a procedure converting from the CEOS format to the EduSAR format because of reducing interpolation errors for state vectors.

Actual steps generating the teaching materials are described. At first, a teacher researches observation data on large earthquakes, volcano activities and other events. Next, the teacher obtains the SAR data corresponding the selected events and generates pairs of the SLC data using EduSAR. Learners carry out the InSAR processing using the prepared SLC data by Doris and other helper software. As examples of the teaching materials, ground deformation images of 2011 earthquake off the Pacific coast (Mw 9.0) and 2008 Sichuan earthquake (Mw 7.9) are presented by processing ALOS PALSAR data. The precise deformation fringes in those InSAR images are clearly appeared by using the improved EduSAR and Doris. The ground deformation images of the Sichuan earthquake are also shown by applying the ALOS PALSAR data observing from both strip and scan modes.

Keywords: Interferometric SAR, Technology education, Teaching materials, Ground deformation

Remarks:

We would like to request “Poster presentaion” to explain our study more effectively.