Radar technologies against Natural disaster and Man-made hazards

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Japan and Sri Lanka have some commonfeatures regarding natural disasters. For example, in mountainous areas due to much rainfall, landslides occurfrequently.Coastal areas can suffer from Tsunami.In order to solve thesesocial problems using science and technology, we are investigating radartechnologies to be used for the mitigation of natural disasters. They can also be used for humanitarian demining.

GB-SAR (Ground Based Synthetic Aperture Radar) is one kind of Synthetic Aperture Radar (SAR), whose platform is fixed on the ground surface. GB-SAR is useful for monitoring slow varying phenomena such as ground deformation due to landslides and volcanic activities. One GB-SAR system can monitor a wide area with high resolution making unnecessary the selection ofdiscrete positions for measurementcommon for conventional methods such as GPS and strain meter. GB-SAR technology has been developed since 1980s, where most systems employed a vectornetwork analyzer (VNA) as a transmitter and a receiver. Then in 1990, commercialsystemswhich could acquire much faster than VNAswere developed. These GB-SAR systems used a liner rail to move a radar unit with a pair of transmitting and receiving antennas.

Compared to space borne SAR systems, GB-SAR normally images near range targets. Therefore, SAR processing algorithm used in space borne SAR systems cannot be used, and generally the SARprocessing of GB-SAR data required relatively larger computation for the size of the data sets. In order process the data faster, we are proposing a method using fractional Fourier transformation. In order to obtain higher resolution, we have also used CS (Compressive Sensing) approaches.

Tohoku University is operating 3 sets of GB-SAR systems using 17GHz. One of thesystems is fixed at Arato-zawa landslide site located in Miyagi prefecture since November 2011. Interferometric SAR images are obtained in real time and transferred to the university through internet. This is a social demonstration of real time warning system, which is a collaboration of Tohoku University and Kurihara city. This type of observation is strongly required in Japan. We are now planning to use it for observation of volcanic activities.

We have developed a dual sensor "ALIS", which combines a metal detector with Ground Penetrating Radar (GPR) for humanitarian demining. Since 2009, we have deployed ALIS systems in real mine fields in Cambodia together with the Cambodian Mine Action Center(CMAG). The test has been quite successful, and we have detected more than 80 land mines. We have found that operation of ALIS by Cambodian operators (deminers) is a good example of the introduction of new technology for humanitarian demining to local people.