Multi-temporal Satellite Imagery

Taiwan lies at the border of the Eurasian and Philippine Sea Plates and faces the Pacific Ocean. Earthquakes and typhoons are the two main threats, and can cause landslides, debris flow, flooding and other natural hazards. In 2005 the World Bank categorised Taiwan as the most vulnerable country in the world in terms of the percentage of exposed areas and multiplicity of disasters. Given these circumstances, planning for hazard mitigation is important, as is management for hazardous conditions. Also necessary are decision-support tools for understanding firstly where disaster is likely to occur, secondly, when, and thirdly what kinds of disasters need to be handled.

Typhoon and Earthquake

Of the many natural disasters that have occurred in Taiwan over past decades, two of the most serious were the Chi-Chi earthquake on 21st September 1999 and Typhoon Morakot. The Chi-Chi earthquake measured 7.3 in magnitude on the Richter scale and was severe enough to change the geographical orientation of the island's mountain areas. Typhoon Morakot, which swept over the Southern Taiwan area on 8th Augustus 2009, dumped over 2,700mm precipitation in 72 hours and caused a vast number of landslides and debris flows.

The whole of Shiao-Lin village was heavily damaged; 330 buildings were destroyed and 565 people killed. In the face of such dangers, satellite imagery has the capability to monitor landscape over a large coverage area, making it an excellent information source for disaster survey.

Monitoring Recovery

My employer, the Center for Space and Remote Sensing Research (CSRSR) of National Central University (NCU) monitors the area by detecting changes using archived multi-temporal Formosat-2 and SPOT satellite images. After orthorectification using digital elevation models (DEMs), the Normalized Difference Vegetation Index (NDVI) and slope criteria provide parameters on types and rates of change. For example, in the eleven years since the Chi-Chi earthquake, changes in the landscape of central Taiwan have been monitored to show a slow trend towards vegetation recovery in areas affected by landslide. For the virtual reconstruction of affected environments over different periods, integrating orthorectified satellite images, DEMs, aerial imagery and airborne Lidar data delivers useful information. The landscape of Shiao-Lin village has been analysed at several moments in three dimensions using building models and DEMs in an effort to help decision-makers understand gradual changes in the environment in an intuitive way. Our studies demonstrate that multi-temporal satellite images provide an opportunity to efficiently trace disaster locations and areas. The resulting information is beneficial, among other things, for government policy decision making.