Using Remote Sensing for Dynamic Monitoring of Quake-ravaged Wenchuan: Five Years On

Soon after a magnitude 8.0 earthquake struck Wenchuan, in south China's Sichuan Province, on May 12, 2008, RADI conducted monitoring and assessment of the damage with remote sensing technologies, providing important support to decision-making on emergency relief and reconstruction. From 2008 to 2011, RADI carried out flight experiments in continuous and dynamic aerial monitoring with remote sensing to comprehensively understand its aftermath, changes and reconstruction and provide scientific evidence for post-quake development. In April 2013, on the eve of the fifth anniversary of the deadly catastrophe, RADI carried out its fifth flight experiment.

Covering major quake-affected areas, including Wenchuan, Beichuan, Anxian, Shifang, Dujiangyan, Wolong and the Minjiang River Basin, this experiment could supply basic data for research and policymaking concerning the assessment of post-quake changes and construction. Aboard a B-4101, a Citation remote sensing aircraft of the CAS Center for Airborne Remote Sensing, was an ADS80, a push-broom digital camera that can capture higher than a 0.4 m resolution image data, and an ALS70 airborne laser radar.

To ensure the efficient performance of the test, headquarters were set up at RADI, with Director-General GUO Huadong as its leader, to coordinate data acquisition, processing, and liaison tasks. Under the head office were eight task forces to carry out remote sensing experiments on subjects including geological hazards, housing and urbanization development, road building, rivers and barrier lakes, agriculture and forest recovery, the eco-environment (including giant panda sanctuaries), major engineering projects, and digital Beichuan.

Based on ample data and findings from the five experiments, RADI researchers produced 20 comprehensive evaluation reports on topics ranging from major landslides, debris flows, engineering operations to defuse barrier lake dangers, to farmland and ecological recovery, and urban reconstruction, providing direct scientific evidence to show the progress of post-quake rebuilding.

Major Landslide and Debris Flow Hazards

Using aerial images taken from 2008 to 2013, dynamic monitoring and assessments were conducted on the evolution of major landslide bodies and debris flows, and ecological recovery in the quake-hit region.

(1) Intensive landslides have occurred frequently over the past five years. New debris flows covering an area of 418.66 hectares have been discovered near 13 large landslide clusters, accounting for 8.8% of the total. However, the activity of debris flows tends to be decreasing year by year.

RADI Researchers discuss plans for data processing.

(2) There has been a gradual vegetation recovery on the sliding bodies of landslide clusters caused by the earthquake. The recovery rate registered 9.01% for the first year after the disaster and 6.54% on average over the past five years.

(3) Nine places with risks of secondary geological hazards posing a threat to buildings have been found in Wenchuan.

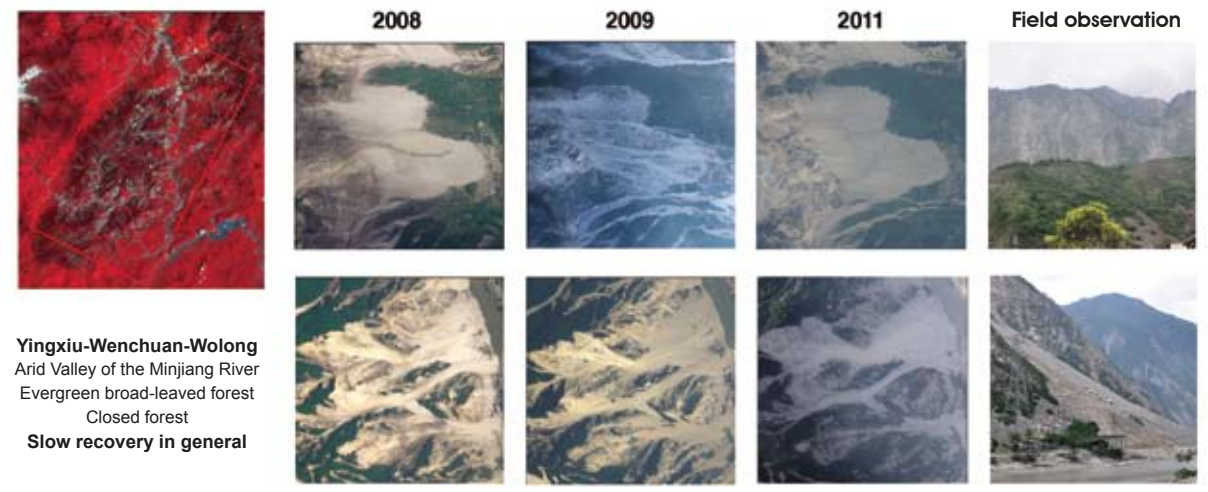
(4) The vegetation recovery process was very slow on the two largest landslide bodies in Anxian County and Mianzhu City over the five years with recovery rates of 2.3% and 8.9%, respectively. Potential risks of secondary hazards in the areas are high.

Engineering Projects to Eliminate Risks of Barrier Lakes

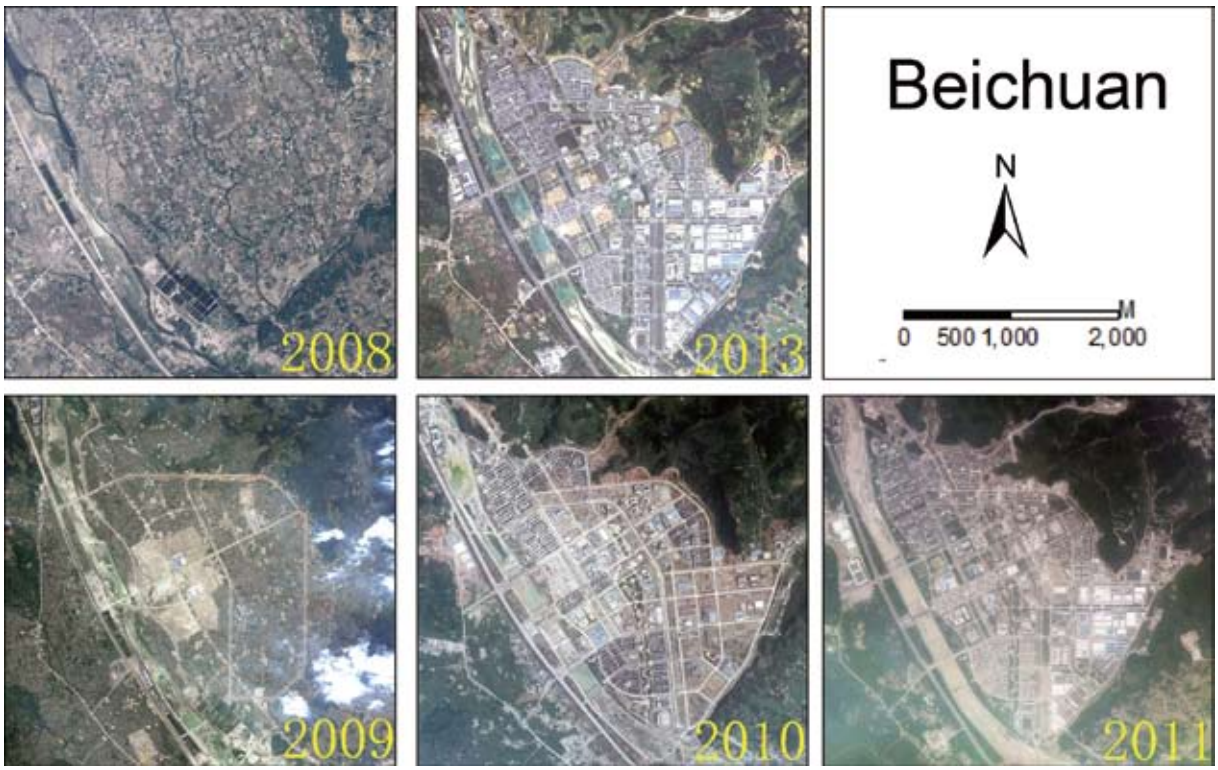
Dynamic monitoring of 36 barrier lakes in 70% of the quake-ravaged region traces tremendous achievements in this regard over the past five years, defusing almost all risks in the barrier lakes. No newly created barrier lakes have been found. The volume of the lakes that have not been completely dredged has effectively reduced and their dam bodies have been strengthened as a result of artificial reinforcement, dredging or natural scouring. They have become an important natural legacy and scenic sites, such as the huge Tangjiashan earthquake lake.

Farmland recovery

An analysis of land damage and recovery was made on the basis of dynamic monitoring of the 12 worst-hit counties and cities. Only 20% of the farmland ruined by landslides or debris flows had been recovered and used for planting. Because of the high utilization rate of arable land and enthusiasm of the farmers, there is almost no fallow or waste land except ruined land. There have been no big changes to local planting structures, patterns and habits. The planting area of cash crops has increased slightly at the cost of that of food crops



Yingxiu-Wenchuan-Wolong
Arid Valley of the Minjiang River
Evergreen broad-leaved forest
Closed forest
Slow recovery in general



Changes to the earth surface in the county seat of Beichuan over the past five years.

Vegetation Recovery

The earthquake and secondary disasters extensively damaged the local vegetation. Dynamic monitoring from 2007 to 2011 shows:

(1) Vegetation coverage was reduced by 6.5%. However, by 2011, 4.4% had been recovered, accounting for 68% of the total lost. The situations were better in eastern and northern areas.

(2) Forest resources in the arid valley of the Minjiang River and Penzhoushan region were the worst damaged by the quake. Five years later, shrubs and broad-leaf tree seedlings are growing there. Through setting apart hills for tree growing and forest plantation, vegetation recovery is faster in Penzhoushan than that of the arid valley.

(3) The earthquake has caused ecological degradation and scenery fragmentation in the Wolong National Nature Reserve. Analysis of multi-source images shows that, thanks to natural recovery and the program for ecological reconstruction, vegetation in the giant panda habitat has returned to pre-quake levels in terms of area and canopy coverage. The quality of its ecological system has improved, and the habitat corridors for giant panda movements have been restored.

Post-quake Urban Reconstruction

Huge progress has been made in terms of urban rebuilding in 12 townships in Beichuan over the past five years. Temporary emergency shelters have been dismantled. The urban rebuilding program of 2011 has been completed with improved infrastructure, such as schools and roads, with more rational layout. The overall ecological conditions have been greatly upgraded and transport on roads and rivers has returned to normal. (Adopted from a report of the 2nd Issue of RADI Newsletter)