Support Quake Rescue Operation with Remote Sensing Technology

A 7.0 magnitude earthquake hit Lushan County of Ya'an in south China's Sichuan Province at 08:02 Beijing Time on April 20, 2013. With a solid foundation of science and technology and a lofty sense of mission, the newly established CAS Institute of Remote Sensing and Digital Earth (RADI) rapidly started its emergency response system with remote sensing technology and built up a space-air-ground "sky-eye" system for the disaster monitoring. Its remote sensing airplane took off to conduct disaster monitoring tasks only 108 minutes after the earthquake. Nine hours after the disaster, key data was shared through the Internet, and an analysis report on the disaster was submitted to decision-makers within 24 hours. The institute provided urgently needed information for the earthquake relief.

Initiating Emergency Response 8 Minutes after the Quake

At 08:10 on April 20, only eight minutes after the earthquake, RADI staff conducting a "remote sensing flight experiment to mark the fifth anniversary of the Wenchuan Earthquake" in Sichuan submitted a preliminary report on the disaster. A leading group for quake monitoring and damage assessment with Prof. GUO Huadong as its leader was then formed immediately. Under its coordination, task forces were set up to handle such matters as satellite and aerial data acquisition and processing, damage analysis and assessment, image production and data sharing, information reporting and liaison, and logistics. At the same time, platforms for data exchange between different task forces and for remote sensing data sharing were established.

First Plane Took Off for Ya'an 108 Minutes after the Quake

When the earthquake took place, RADI remote sensing airplane B-4101 was carrying out a task in Mianyang, Sichuan

An aerial remote sensing image of Lushan County produced by RADI.

Province. On receiving instructions from the institute, the five researchers and crew members rapidly formulated an action plan to monitor the earthquake, including air route design, GPS base station erection and data downloading. At 09:50, 108 minutes after the earthquake, the plane took off for Ya'an from Mianyang Airport. It was the first remote sensing airplane to reach the quake-hit area.

The first sortie was completed at 13:40 after obtaining 256 GB of airborne remote sensing image data at 0.6 meter resolution. The next three sorties covered the whole quake-stricken area of 50,000 square kilometers and obtained a total of 503 GB of data. After receiving the first batch of data, the 7-member task force for data processing worked continuously for about 40 hours with their state-of-the art technology and transmitted the first "quick-look" data to the headquarters in Beijing at 16:00, providing important data support to the rescue operation.

Starting Distribution and Sharing of Data after 9 Hours

At 16:57 on April 20, by using the Internet, RADI shared its first batch of satellite data, including pre-quake data about Ya'an from such satellites as SPOT-5, LANDSAT-5 and SPOT-4. At 08:00 am on April 21, the institute posted its aerial and satellite data online. By 16:00 on April 27, there had been nearly 230,000 downloads totaling 613 GB of data. About 5,700 GB of such data were sent via different channels to 35 organizations in 14 government departments, including the State Office for Emergency Management, China Earthquake Administration, the Ministry of Civil Affairs, the Ministry of Transport, the Ministry of Land and Resources, the General Staff Department of the PLA, the Ministry of State Security, the National Administration of Surveying, Mapping and Geoinformation, China Meteorological Administration, Ministry of Water Resources, Ministry of Environmental Protection, the Ministry of Education and the Ministry of Culture. Thanks to the rapid distribution system for large amounts of remote sensing data specially launched for the disaster-hit areas, the data could be distributed to as many as 12 users concurrently, with an average distribution speed of 840bps and a highest speed of 4800Mbps. This was 14 times faster than the distribution of the Yushu Earthquake data three years previously.

In addition, at noon on April 22, five minutes after receiving the instruction to start a special line for e-government, many aerial remote sensing images were sent to the State Council Office for Emergency Management.

Submitting Analysis Report 24 Hours after the Quake

While RADI staff worked hard at the frontline to obtain and share remote sensing data, nearly 100 researchers worked all through the night in Beijing to interpret the data and sent the central department their preliminary report about the disaster conditions in such counties as Lushan, Baoxing and Qionglai.

From April 20 to 22, the task force on damage assessment produced a total of 23 reports on the basis of more than 40 analyses, concerning such aspects as earthquake intensity, population and region affected by the disaster, damage to buildings, road conditions and secondary disasters. In addition, two comprehensive reports were made for a comprehensive assessment of damage in the worst-hit counties.

By using the remote sensing and spatial information system, RADI quickly determined that the intensity at the epicenter of the quake reached 9 magnitude, while 15,720 square kilometers and 1.85 million people were hit by a quake of 6 magnitude or more.

On the basis of aerial remote sensing data on April 20, RADI researchers analyzed the road damage in Baoxing County and confirmed there were 14 ruined sections with a total length of 500 meters along the 7-km road from Daping to Shunjiang. This information was quickly sent to, and used by, decision-making departments.

Furthermore, researchers produced a 3D monitoring and assessment system for Lushan County by using the Digital Earth science platform and high-resolution aerial remote sensing images to show real scenes of the disaster-hit regions.

On April 24, invited by the Sichuan provincial government, RADI researchers went to the Emergency Management Headquarters of China Earthquake Administration in Ya'an to discuss the intensity of the quake and presented the headquarters with aerial remote sensing images at different scales.

Following the Wenchuan Earthquake in 2008 and Yushu Earthquake in 2010, the Lushan Earthquake was yet another remote sensing monitoring of major disasters task undertaken by RADI. By learning from past experience, RADI researchers responded even faster this time. Their timely data acquisition and sharing and comprehensive reports greatly improved the disaster rescue capacity, saved huge amounts of resources and rendered strong support to the operation. Their work was highly praised by the central authorities and the general public.

One example of their invaluable contributions is that Vice Premier LIU Yandong gave instructions based on the analysis of the road damage in Baoxing County. Moreover, CAS President BAI Chunli said that RADI made rapid efforts to collect and process data and send their analyses to the central government. This is a yet one more demonstration of how science and technology can help resolve major issues concerning people's livelihoods. (Adopted from a report of the 2nd Issue of RADI Newsletter)