

On Thinner Ice

Few people connect the study of melting ice with surveying or surveying equipment. But a group of South Pole scientists rely on surveying principles and sophisticated surveying equipment daily.

In the harsh and unforgiving minus 20-degree Celsius Antarctic environment, researchers with the Korea Polar Research Institute (KOPRI) regularly depend on rugged surveying equipment as they study the environmental warming conditions of the region. KOPRI, a leading research organization for paleoclimatic studies in the Antarctic, has been studying and surveying in the area for more than two decades. In accordance with its mission to

Korean researchers use SOKKIA GSR2700 ISX receivers to track environmental warming conditions in Antarctica.



A Sokkia GSR2700 ISX GNSS receiver collects data despite the frosty Antarctic climate.

“survey and [conduct] long-term observations addressing key issues of global or fundamental importance,” in November 1986, Korea became the 33rd signatory of the Antarctic Treaty, the international agreement signed by 46 countries that names the continent a scientific preserve. Korea also joined the Scientific Committee on Antarctic Research (SCAR) in July 1990 and participates as a regular member.

“We were the third Asian country to sign the Antarctic Treaty,” says Dr. Young Keun Jin, a principal research scientist for KOPRI. “Since signing the treaty in 1986, Korea has continued to play an active role with SCAR and in preserving the responsibilities of scientific research in Antarctica.”

Home Bitter Home

In the past 50 years, the Antarctic region has experienced an increase in annual mean temperature. Although this warming trend has been linked to significant environmental changes in the region, including a decrease in the mass and extent of ice shelves and a decline of annual sea-ice coverage, no quantitative data currently exists. Scientists are presently in the early stages of data collection and intend to perform a yearly survey to track the affects and effects of warming, which will be analyzed and used in collaboration with scientists and researchers around the world.

KOPRI's base camp for major expeditions that carry out year-round research is King Sejong Station situated on King George Island on the western edge of the Antarctic's Barton Peninsula—the site of one of the most extreme cases of environmental warming anywhere on Earth. King George Island provides a strategic point for studying the patterns of the changing Antarctic ice shelves. With the assistance of neighboring Chinese and Chilean bases, researchers at King Sejong Station combine their efforts with similar projects performed by scientists worldwide.

A key element to this work is advanced surveying technology and instrumentation. With GNSS receivers and real-time kinematic (RTK) surveying instruments, researchers monitor the rate of melting glaciers and sea ice to gain a better glimpse into the fragile nature of Antarctica.

Safe, Secure and Timesaving

Researchers at the King Sejong Station originally surveyed and studied the region using only a level and tape. Performed in rocky terrain and high winds, surveys using this primitive technique required a three-person crew minimum and an enormous amount of time and energy only to produce potentially tainted and inaccurate data.

“In the early stages, we were compromised by our survey equipment, the land and the climate. Wind speeds often reach up to 120 kilometers per hour rendering the tape virtually useless,” said professor Shon, a joint researcher on the project and a member of the Department of Civil, Environment and Railroad Engineering at PaiChai University in Korea.

KOPRI researchers soon turned to SOKKIA Series 30RK total stations to



acquire accurate and timely positioning data in the harsh conditions. The total stations replaced the awkward level and tape and provided surveyors with the ability to research efficiently and with few complications.

As projects expanded and additional research projects emerged, the need for more surveying equipment became apparent. When studying retreating sea ice, a researcher could not depend on the ice to hold his or her body weight. Therefore, the use of a total station to take such measurements was no longer an option. Other projects required a different surveying method altogether.

To address these issues, the KOPRI team turned to GPS equipment, namely Sokkia GSR2700 ISX receivers, which enabled them to collect high-accuracy spatial data on the changing ice shelf and sea ice without having to exit their boats. Like the SOKKIA total stations they were already using, the rugged GSR2700 ISX receivers handled the Antarctic conditions well.

“Our job is to perform surveys in conditions that are less than favorable,” Jin says, “and our equipment must provide consistent, accurate results.”

Able to use U.S. GPS and Russian Glonass signals in its RTK algorithm, the GSR2700 ISX and its AdVance RTK engine provides accurate and reliable extended baseline positioning, even in polar regions where satellite availability is sparse.

“The first time we used the GSR2700 ISX in the field, we were instantly impressed with the ease of use and the quality of results,” Shon says. “This receiver was not only rugged, but it also provided a great level of efficiency and accuracy.” He then adds, “On a good day, the GSR2700 ISX tracks

more than eight satellites. Even in poor conditions we can still track satellites.”

The GSR2700 ISX receivers require fewer and quicker setups, which allows for maximized productivity and minimal expense and energy. It not only lessens the time KOPRI researchers need to be exposed to the Antarctic elements, the equipment has proven to withstand the bitter Antarctic environment.

“SOKKIA products continually provide accurate results regardless of the



On the grounds of King Sejong Station, a GSR2700 ISX stands beside traditional Korean totem poles that include geographical signs and serve to secure the return of researchers.

conditions,” Jin says. “Even in minus 20-degree Celsius weather with 120 kilometer-per-hour wind, we know that we can trust our SOKKIA products.”

Researchers also use GSR2700 ISX receivers to measure and calculate the delay of GPS signals in order to study and analyze the changing conditions of the uppermost level of the atmosphere, the ionosphere. Antarctica is unique in that the ionosphere is readily and easily accessed to study solar radiation levels. But to accurately survey in the region, an operational control reference point and leveling bench mark for identifying elevations is needed to assist scientists. These reference points are identified using

Mr. Pyo Ki Won and his crew maneuver around icebergs to gather accurate data to track floating sea ice.

GSR2700 ISX receivers and SOKKIA’s post-processing software, Spectrum Survey, which allows researchers to perform a static survey. Once created, this control point and leveling bench mark will be the first fully operational control point in Antarctica.

And because surveyors use both SOKKIA GNSS receivers and total stations, the SDR+ data collector was chosen as the solution to easily toggle between the devices. With the SDR+, data from both devices can be stored in the same job. And in the normally choppy waters around King George Island, the SDR+ “Read Delay” feature provides researchers with time to steady the pole before storing a reading, thereby maximizing the accuracy of each GPS measurement.

Many additional SDR+ features guarantee that researchers use their time in the field wisely. With its live database platform, data can be edited in the SDR+ on-the-fly. Advanced real-time blunder detection ensures that each survey meets accuracy specifications before the survey crew journeys back to King Sejong Station. For researchers who travel for hours to perform a survey, these features eliminate costly return trips.

“Each trip to a survey site can cost as much as 100 million won (\$100,000 U.S.),” Shon says. “Repeating surveys takes away valuable time we could be spending analyzing data or surveying a different, equally important site.”

Tough and Targeted

As studies continue, KOPRI researchers continue to rely on sophisticated and rugged surveying equipment. Proven to be as tough as these scientists and the environment in which they work, the instruments will create the first Antarctic control point and provide accurate, reliable data needed to evaluate the environmental changes of the Antarctic region for years to come. 🌐

MANUFACTURER INFORMATION:

Sokkia, www.sokkia.com.

FOR MORE INFORMATION:

For more information on KOPRI, visit www.polar.re.kr.