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Earth and environmental remote sensing community in South Korea: A review

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ABSTRACT

This paper is a review of the satellite remote sensing community in South Korea, in the field of Earth and environmental sciences. The community has been invigorated by the Communication, Ocean, and Meteorological Satellite (COMS), the first Korean geostationary satellite project. Since its successful launch on July 26, 2010, about 300 organizations have officially received remotely sensed COMS data. This paper describes how satellite remote sensing has been used for decision-making in Korea, and the evolution of the associated education system. Despite the rapid development of remote sensing, Korea is facing shortcomings in the applicability of remote sensing to industry and society. The two future geostationary satellites planned by the Korean Government, GK (Geo-KOMPSAT)-2A and GK-2B, for monitoring climate and the environment in East Asia from 2018/2019 will alleviate these shortcomings.

Contents

1. Background to Korean satellite remote sensing community

Satellite remote sensing in Korea began in the early 1990s, and thus has a short history compared to other developed countries. The beginning of space technology development was marked by the first Korean satellite

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KITSAT-1 (Korean Institute of Technology Satellite-1; also known as Uribyul-1), which was launched into low Earth orbit (LEO) on August 11, 1992, making South Korea the 22nd country to operate a satellite. KITSAT-1 was developed through a university collaboration program between the Satellite Technology Research Center (SATREC) of the Korea Advanced Institute of Science and Technology (KAIST), and the University of Surrey in the UK. KTSAT-1 carried a communication antenna for an amateur radio service. Many members received training in satellite engineering through the program. This KITSAT program continued until KITSAT-3 was launched in 1999. SATREC then launched another LEO satellite series, called the Science and Technology Satellite (STSAT) that carried different types of sensors, such as an ultraviolet telescope on STSAT-1 (2003) and an infrared imaging system on STSAT-3 (2013).

The Korean Government also established a national institute, the Korea Aerospace Research Institute (KARI), in 1989 to develop satellite launch and sensor manufacturing capability. Several years after its establishment, on December 21, 1999, KARI launched another LEO satellite, the Korea Multi-Purpose Satellite-1 (KOMPSAT-1, also referred to as Arirang-1), carrying an electro-optical camera. This was succeeded by a number of KOMPSAT series, with the most recent, KOMSAT-3A, launched in 2014. Presently, KARI operated the ground station with governmental support from the Ministry of Science, ICT, and Future Planning (MSIP).

The capacity accumulated in these LEO payload activities has led to a new geostationary Earth orbit (GEO) satellite program (Table 1). The GEO satellite is located at an altitude of 36,000 km, and can observe an area in the fixed sky with the same angular velocity as the Earth's rotation. Thus, it can take images at very frequent intervals for particular events of interest. Due to this observation capability, GEO satellites have been widely used to support the national weather service. Japan has operated a GEO satellite series called Himawari (GMS and MTSAT series) since 1977. Prior to the launch of the Korean GEO satellite, the Korean Government received GEO satellite images from Japan for a weather forecasting service. In the meantime, individual research activities were carried out by the Korea Meteorological Administration (KMA) and Korean universities, using the overseas satellite data to monitor severe weather events. This use of overseas data is suggested as inhibiting the independent progress of advanced domestic services and research in Korea. Thus, the demand has arisen for launching the GEO satellite in Korea. Korea's own GEO satellite was expected to provide considerable benefits. Above all, cooperative works beyond individual research activities can be invigorated. Additionally, independent operation of the GEO satellite would permit focal measurement every few minutes for targeted events; severe weather events could then be better predicted. The prediction information can be used for official disaster management activities, and reduce great economic losses from natural disasters. As all of these benefits appear to be fairly promising, it was not difficult to reach a consensus on launching the GEO satellite.

The most serious challenge for such a project was a lack of domestic experience. Thus, in-depth discussions and research on the project have begun. These activities constitute the beginning of the Earth and environmental satellite remote sensing community in Korea. Since the development of the GEO satellite project in the early 2000s until its launch on July 26, 2010, few experts in the field and related jobs existed in Korea. Due to an uncertain future, many scientists and graduate students that had participated in this satellite project left the field or went to work overseas. However, many researchers involved with the project were trained and educated with the expectation that the GEO satellite could be applied in many fields in the future.

The Communication, Ocean, and Meteorological Satellite (COMS), the first Korean GEO satellite, (positioned at longitude 128.2°E), is now capturing Earth images. A number of new jobs were created to support the mission, especially at national institutes such as KARI, KMA, and the Korea Institute of Ocean Science and Technology (KIOST).

Table 1
Korean Satellites.Source: http://satrec.kaist.ac.kr/.

Satellites	Launched Date	Orbit	Missions
KITSAT-1	1992.8.11	LEO	To test and demonstrate the new satellite bus and payloads
KITSAT-2	1993.9.26		
KITSAT-3	1999.5.26		
KOREASAT-1	1995.8.5	LEO	Communication and broadcast satellite focus on Korea Peninsula, from KOREASAT-5 service area extended to East Asia
KOREASAT-2	1996.1.14		
KOREASAT-3	1999.9.5		
KOREASAT-5	2006.8.22		
KOREASAT-6	2010.12.30		
KOMPSAT-1	1999.12.21	LEO	Earth observation satellite system (1) to provide imagery for geographic information applications and (2) to monitor environmental disasters
KOMPSAT-2	2006.7.28		
KOMPSAT-3	2012.5.18		
KOMPSAT-5	2013.8.22		
KOMPSAT-3A	2015.3.26		
STSAT-1	2003.9.27	LEO	Science satellite system (1) to test and demonstrate new technology (2) to provide astronomical infrared imagery of the galaxy and of the cosmic background and (3) infrared and hyperspectral imagery for Earth observation.
STSAT-2C	2013.1.30		
STSAT-3	2013.11.21		
COMS	2010.6.27	GEO	Multifunctional application in the fields (1) experimental communications, (2) ocean color monitoring, and (3) meteorological observations