

Satellites Keep Watch Over Arctic Ice

In 1978 Japanese adventurer Naomi Uemura successfully completed a solo voyage to the North Pole by dog sled. Supporting him on this incredible feat was a wireless data collection platform, or DCP, developed by NASA. A DCP carried by Uemura used radio frequency to transmit information on his position, air temperature, wind speed, and weather to the Nimbus 6 weather satellite orbiting Earth. That information was sent to a NASA facility in Washington, D.C., then a day later, the information was sent back to Uemura to let him know where he was. There are no signs marking the location of the North Pole, so without his DCP, Uemura would have had no way of proving he'd ever reached it. The Nimbus satellite program eventually led the way to the development of the current Global Positioning System, which is more commonly known as simply GPS. Satellites like Nimbus 6 are mounted*1 with sensors used to observe the Earth using various kinds of electromagnetic waves including ultraviolet*2, infrared*3, microwave. The technology to observe the earth from sensors on-board satellites and/or airplanes is called remote sensing.

Japan's geostationary weather satellite Himawari is used for weather forecasting not only in Japan but also in many Asian countries. Images taken with Himawari's thermal infrared sensor show low-temperature clouds in white, and high temperature ocean in black. People in Japan will be used to seeing such Himawari images in weather forecast programs on TV. In 2015, JAXA launched the earth observation satellite called GCOM-W1, which is mounted with one of the most advanced microwave radiometers in the world, called AMSR2. Basically, the data acquired by the satellites operated by the space agencies such as NASA and JAXA are open to public.

The Tokai University Research & Information Center (TRIC) was established in 1974, and the researchers of TRIC has been conducting various research works on remote sensing. TRIC is operating several antenna systems to receive data from various remote sensing satellites in space. TRIC collaborates with numerous institutions, not only JAXA, but also Geological Survey Institute, Japan Coast Guard, and overseas entities such as NASA and the European Space Agency (ESA). Professor Kohei Cho is Director of TRIC, and he has spent many years researching remote sensing technologies. Recently, he is concentrating in sea ice monitoring, where the effects of global warming are particularly noticeable.

The two images on the right show the extent of Arctic sea ice coverage in summer as observed by satellites in 1982 and 2012. The difference in the coverage is shown in red in the image on the right, and we see a clear reduction in Arctic sea ice between 1982 and 2012. It is thought that global warming is causing Arctic sea ice to melt. White sea ice reflects the solar radiation, so it actually helps reduce the effects of global warming. However, when ice melts due to global warming, the sunlight is absorbed by the ocean and makes our planet even warmer. If the Arctic sea ice were to melt completely, it would have an enormous effect on the global climate. Remote sensing technologies are extremely important as they provide us with the data we need when thinking about global problems like this.



Provided by NASA/TRIC

Provided by JAXA/TRIC

Extent of Arctic ice in 1982 (left) and 2012 (right).

*1 Mounted means to be attached to something.

*2 Ultraviolet (or UV) is the electromagnetic radiation which has wavelength shorter than visible light.

*3 Infrared (or IR) has wavelength longer than visible light.



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