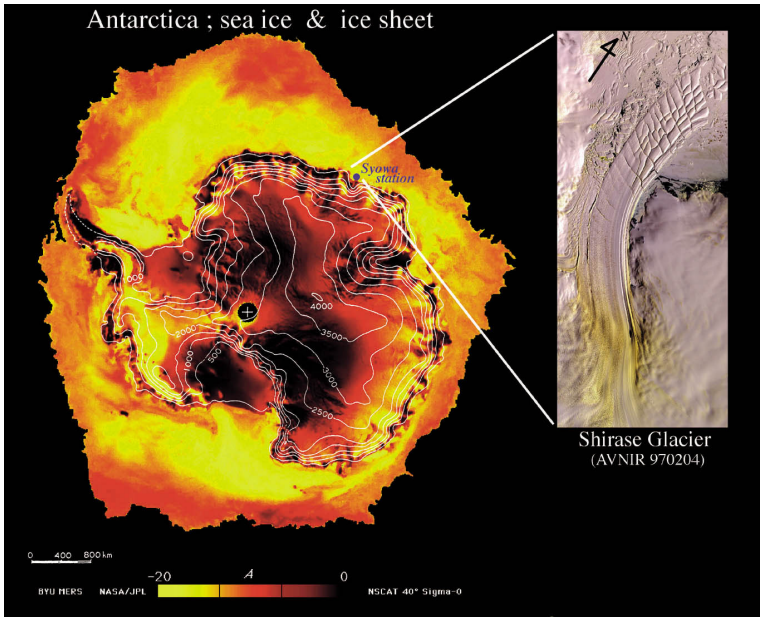

Fig.1

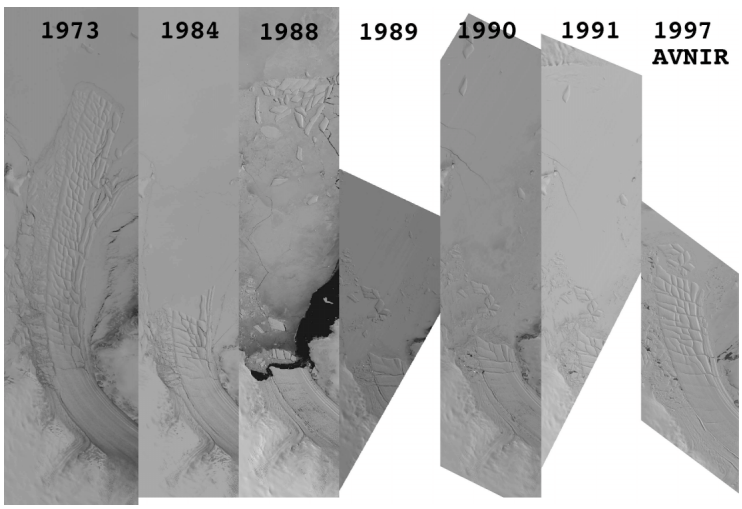

Fig.2

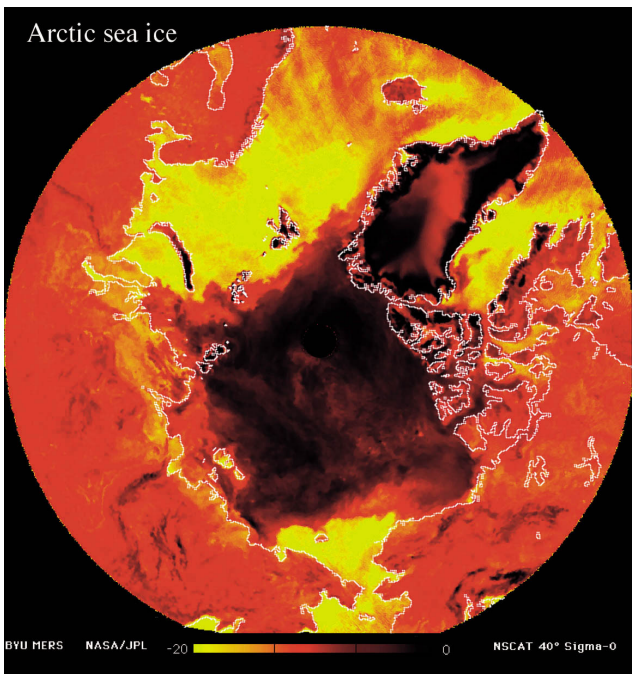

Fig.3

Provided by NASDA / NASA-JPL / HUE/NIPR

Global Change, Sea Ice, Glaciers and Ice Sheet

It is worried that global warming is occurring by the increase of greenhouse gases. It is estimated that the effect of global warming will appear most strongly on the cryosphere. Satellite observation is the most important tool to monitor the changes of cryosphere continuously. A lot of information of the cryosphere can be obtained by combining data from multiple sensors covering wide range of wavelength from visible to the microwave. In the ADEOS Program, cryosphere observations were mainly conducted by using AVNIR and NSCAT. It was planned to monitor the cryosphere changes, i.e. the sea ice distribution, mapping of glaciers and ice sheets, and changes of the ice sheet edges in the Arctic and the Antarctic by global warming using these sensors continuously. However, long term monitoring could not be done by the ADEOS accident.

Though it is generally known that glacier retreat on the Earth are caused by temperature increase since the little ice age (*1), the details of the speed and mechanism of the retreat aren't clarified yet.

Figure 1 is an image of Antarctica and the surrounding sea-ice cover generated from six days of data acquired by NASA Scatterometer (NSCAT) in September 1996. Antarctica is covered with a thick ice sheet that appears red in the image. It means that the coarse snow grains and refrozen ice strongly reflect the scatterometer's radar signal. The red and yellow band around the continent is evolving sea-ice cover. The red rectangular object in the sea-ice cover is a gigantic iceberg that was broken off the ice tongue and is now circulating in the sea-ice cover. The right image inside Fig.1 is a detailed image of the Shirase glacier acquired by AVNIR. Shirase glacier is the fastest-moving glacier (3 km per year) in the Antarctic.

Figure 2 shows images of Shirase glacier which have been acquired by many kind of visible and microwave sensors including Landsat MSS, TM, MOS1 MESSR, ERS SAR, and AVNIR during 1973-1997. From these images, it is apparent that end of Shirase glacier retreated and then advanced again. Shirase glacier is floating on the ocean, and a part of it discharges to the outer ocean as an iceberg when sea ice disappears. Glaciers and ice tongues are related to the distribution of sea ice, and it is important to understand the effects of interactions between sea-ice, ocean and the climate system.

Figure 3 shows NSCAT is uniquely suited for mapping the sea-ice cover in Arctic region. As compared with the past data (though they are not shown in this point), the sea ice distribution and thickness is decreasing. Further, researches of the interaction between sea ice, ocean, and biosphere is important to estimate the primary production (*2) of the sea. Monitoring of the distribution of open sea surface, thin and thick sea ice is important from this point of view.

*1 Little ice age: A cold period during 1550-1890.

*2 Primary production: Fixed carbon which was generated through photosynthesis. Vegetation plays a main role in land while phytoplankton plays a main role in the ocean.