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VIEWS AND NEWS

International viewpoint and news

Global interagency IPY polar snapshot year: an update

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Dramatic changes in Earth's ice covered regions are sparking new and vigorous scientific interest in these remote parts of the world. Observations of record reductions in Arctic summer sea ice extent, the loss of Antarctic Peninsula ice shelves and rapid thinning of glaciers and ice caps around the world raise concern about changing climate and the attendant societal impacts including global sea level rise. Partly in response to these observations and partly as a continuation of the heritage of polar scientific observations, the International Council for Scientific Unions established an International Polar Year (IPY) 2007–2008. The IPY comes at the 50th anniversary of the International Geophysical Year (IGY) that in many respects ushered in the modern era of high latitude scientific research. A primary objective of the IPY is to compile legacy data sets that will provide new information about polar processes and establish benchmarks against which future changes in Earth's cryosphere can be assessed.

Spaceborne data collection systems have been a primary source of information about recent changes in the polar regions. Spaceborne technology also represents one of the most significant technical advances since the IGY. To realize the benefit of the growing constellation of international satellites to the IPY, the Global Interagency IPY Polar Snapshot Year (GIIPSY) proposal was selected as an IPY flagship project. The goal of GIIPSY is to develop consensus polar science requirements and objectives that can best and perhaps only be met using the international constellation of earth observing satellites. Requirements focus on all aspects of the cryosphere and range from sea ice to permafrost to glaciers and ice sheets. Individual topics include development of high resolution digital elevation models of outlet glaciers using stereo optical systems, measurements of ice surface velocity using interferometric synthetic aperture radar (SAR/InSAR), and frequently repeated measurements of sea ice motion using medium resolution optical and microwave imaging instruments.

The link between the GIIPSY science community and the space agencies operating earth observing satellites is through the Space Task Group (STG) that is convened by the World Meteorological Organization (WMO). STG membership presently includes representatives from the national space agencies of Italy, Germany, France, UK, US, Canada, Russia, China, Japan, and the European Space Agency (ESA), which in itself represents 17 nations. Members of GIIPSY, the WMO, and representatives of IPY data management programs also attend STG meetings. The primary objective of the STG is to determine how best to satisfy GIIPSY science requirements in a fashion that distributes the acquisition burden across the space agencies and recognizes the operational mandates that guide the activities of each agency.

The STG has met in full session three times. The first meeting was held in January 2007 at the WMO headquarters in Geneva. Since then, the STG has met at

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EUMETSAT in Darmstadt, Germany in November, 2007 and at ESA ESRIN located in Frascati, Italy in May 2008. The STG also convened a SAR workshop in March 2008 at the Canadian Space Agency in Montreal, Canada. The primary objectives of the STG meetings are to review requirements, to provide agency reports on progress in support of IPY, and to identify and solicit new members. GIIPSY science requirements were presented at the first STG meeting (a full description of the details can be found on the GIIPSY web page: http://bprc.osu.edu/rsl/GIIPSY). These requirements highlight a set of *first time observational achievements* that include:

- Pole to coast multi-frequency InSAR measurements of ice-sheet surface velocity.
- Repeat fine-resolution SAR mapping of the entire Southern Ocean sea ice cover for sea ice motion.
- One complete high resolution visible and thermal IR (Vis/IR) snapshot of circumpolar permafrost.
- Pan-Arctic high and moderate resolution Vis/IR snapshots of freshwater (lake and river) freeze-up and break-up.

Subsequent STG meetings and workshops have focused on the development of data acquisition strategies. To that end, GIIPSY and the STG have made significant progress towards achieving the first two goals. The ESA Envisat SAR has been used to obtain extensive coverage of Arctic and Antarctic sea ice. The Japanese ALOS SAR and optical systems have acquired data over much of Antarctica as well as northern permafrost terrain. The Canadian Radarsat satellites are imaging portions of Antarctica and together with the German TerraSAR-X system are in the planning to be used to collect data over the usually unobserved portion of Antarctica south of about −80° latitude, Fig. 1. In the near future, the STG plans to investigate how best to coordinate plans for high resolution optical systems. There is also an intention to broaden and strengthen the science objectives to include polar atmospheric dynamics and chemistry.

The confluence of scientific urgency about the polar regions and the technical capabilities offered by the space faring countries and by the IPY present a once-in-a-lifetime opportunity for gathering data essential for understanding the changing polar climate and its global impact. In the spirit of IGY, the intention is to openly provide these data sets for use by today's scientists and to secure them as an important legacy to future generations of polar scientists. Looking beyond IPY, the establishment of technical and programmatic infrastructure in support of GIIPSY can be viewed as a prototype for developments necessary to support and sustain grander concepts including the Global Earth Observing System of Systems.

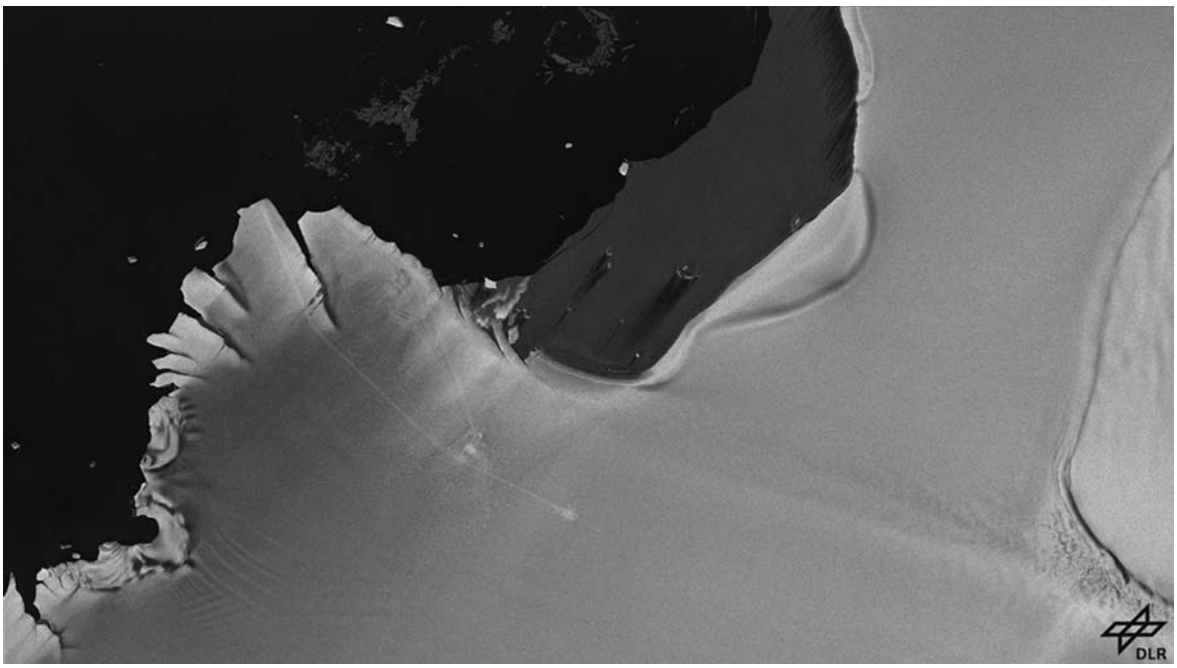

Fig. 1 This image was acquired by TerraSAR-X on 10 February 2008 in strip map mode with a mean incidence angle of 43°, HH polarization and covers an area of about 30 × 50 km^2. The slant range and azimuth resolutions of the single look complex product are 1.75 and 3.3 m, respectively. In the center the Antarctic station Neumayer II (70°39′S, 8°15′W) located on the Ekström ice shelf and the Atka iceport can be observed. Due to the high spatial resolution of TerraSAR-X products and the sensitivity of X-band (9.5 GHz) to features on snow and ice, these data show the great potential of this sensor to obtain detailed information on the ice shelf and sea ice structure. As such, TerraSAR-X is considered as a primary instrument for obtaining data about the polar ice sheet and sea ice during the IPY. Image provided by D. Floricioiu, German Aerospace Center