New Generation of Imaging Radars for Earth and Planetary Science Applications

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SAR (Synthetic Aperture Radar) is an imaging radar which can scan and image Earth System targets without solar illumination. Most Earth observation SAR systems operate in X-, C-, S-, L-, and P-band frequencies, where the shortest wavelength is approximately 1.5 cm. This means that most opaque objects in the SAR signal path become transparent and SAR systems can image the planetary surface targets without sunlight and through rain, snow and/or even volcanic ash clouds. Most conventional SAR systems in operation, including the Canada's RADARSAT-1, operate in one frequency and in one polarization. This has resulted in black and with images, with which we are familiar now. However, with the launching of ENVISAT on March 1 2002, the ASAR system onboard the ENVISAT can image Earth's surface targets with selected polarimetric signals, HH+VV, HH+VH, and VV+HV. In 2004, Canadian Space Agency will launch RADARSAT-II, which is C-band, fully polarimetric HH+VV+VH+HV. Almost same time, the NASDA of Japan will launch ALOS (Advanced land Observation Satellite) which will carry L-band PALSAR system, which is again fully polarimetric. This means that we will have at least three fully polarimetric space-borne SAR system for civilian operation in less than one year. Are we then ready for this new all weather Earth Observation technology? Actual imaging process of a fully polarimetric SAR system is not easy to explain. But, most Earth system scientists, including geologists,are familiar with polarization microscopes and other polarization effects in nature. The spatial resolution of the new generation of SAR systems have also been steadily increased, almost to the limit of highest optical resolution. In this talk some new applications how they are used for Earth system observation purpose.