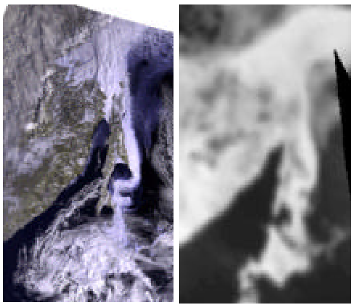
Advanced Microwave Scanning Radiometer

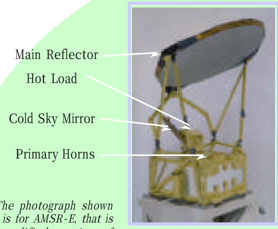
AMSR Advanced Microwave Scanning Radiometer

The AMSR is a multi-frequency, dual-polarized microwave radiometer that detects microwave emissions from the Earth's surface and atmosphere. Various geophysical parameters, particularly those related to water (H2O), can be estimated from AMSR.

Earth View at Microwave Frequencies



Since the microwave imaging techniques do not require solar light, microwave radiometers can observe day and night. In addition, microwave radiometers are capable of observing through clouds. The figures on the left compare an Special Sensor Microwave/Imager (SSM/I) 37GHz image and a two-band composite of the Advanced Very High Resolution Radiometer (AVHRR) for sea ice distributions in the Sea of Okhotsk in wintertime. It can be seen that the AVHRR resolves the fine structure of the sea ice distribution and that the SSM/I image is not affected by clouds.



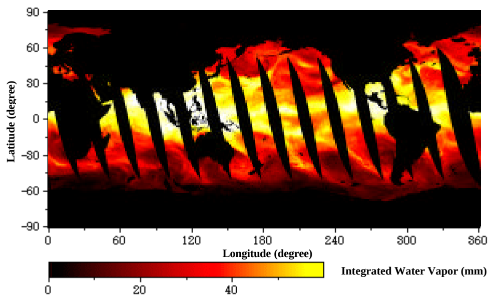
※ The photograph shown here is for AMSR-E, that is the modified version of AMSR for flight on EOS Aqua platform.

Conical scanning is employed to observe the Earth's surface with a constant incidence angle. Multifrequency measurement is realized by an array of primary horns. Calibration counts are obtained every scan by using the hot load target (around 300K) and the cold-sky mirror to introduce the temperature of deep space (around 3K). The offset-parabolic antenna is the largest space-borne microwave radiometer antenna of its kind. A spatial resolution better than before enables us not only to resolve small-scale features, including clouds, precipitation, sea ice, and land, but also to improve retrieval accuracy of geophysical parameters.

Center Frequency (GHz)	6.925	10.65	18.7	23.8	36.5	50.3	52.8	89.0 A	89.0 B
Band Width (MHz)	350	100	200	400	1000	200	400	300	
Polarization	Vertical and Horizontal					Vertical		Vertical and Horizontal	
3dB Beam Width (°)	1.8	1.2	0.65	0.75	0.35	0.25	0.25	0.15	0.15
IFOV (km)	40x70	27x46	14x25	17x29	8x14	6x10	6x10	3x6	
Sampling Interval (km)	10x10							5x5	
Temperature Sensitivity (K)	0.34	0.7	0.7	0.6	0.7	1.8	1.6	1.2	
Incidence Angle (°)	55.0								54.5
Dynamic Range (K)	2.7 - 340								
Swath Width (km)	Approximately 1600								
Integration Time (msec)	2.5							1.2	
Quantization (bit)	12	10							
Scan Cycle (sec)	1.5								

Atmosphere

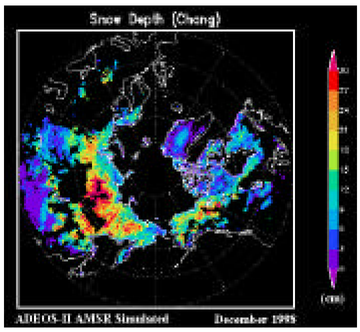
Global water vapor distribution derived from simulated AMSR data (1-day, ascending passes). AMSR quantitatively observes water vapor, one of the most effective green house gases. Near real-time products will be delivered to operational agencies such as the Japan Meteorological Agency. They will be used for assimilating satellite data into numerical weather prediction models and will contribute to improving forecast accuracy.



↑ Processed with the algorithm developed by Yoshiaki Takeuchi, JMA (AMSR/AMSR-E standard algorithm candidate for NASDA processing)

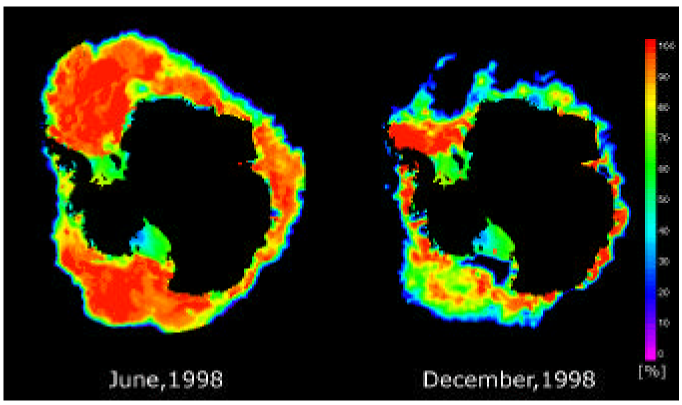
Land and Cryosphere

Distribution of snow depth in the Northern Hemisphere derived from AMSR simulated data using 19 and 37GHz. The snow storage over land in winter will provide soil moisture in spring when snow melts. Low frequency channels (6.9 and 10.7GHz) of the AMSR may improve the snow depth estimations for heavy snow storage regions. Novel geophysical parameters, including soil moisture, will also be retrieved by using these low frequency channels.



← Processed with the algorithm developed by Alfred T. C. Chang, NASA/GSFC (AMSR/AMSR-E standard algorithm candidate for NASDA processing)

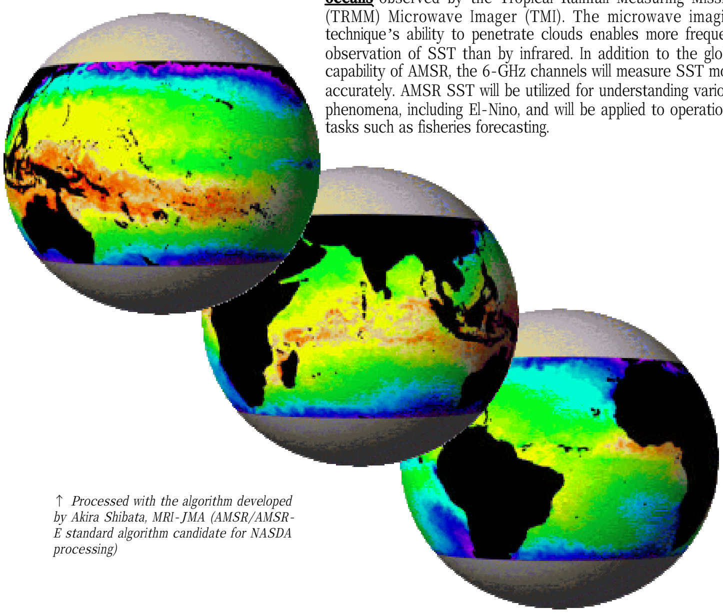
↓ Processed with the algorithm developed by Josefino Comiso, NASA/GSFC (AMSR/AMSR-E standard algorithm candidate for NASDA processing)



Distribution of sea ice concentration around the Antarctic Continent derived from AMSR simulated data. The effects of global warming should appear in terms of variations in sea ice cover in the polar regions. Since the microwave imaging techniques do not depend on sunlight, they have the advantage of being able to observe the polar regions through long polar nights and heavy cloud cover. In boreal seas such as the Arctic Ocean and the Sea of Okhotsk, a potential data application is to find proper shipping routes by predicting the ice condition. The higher spatial resolution of AMSR would be very useful for this kind of application.

Ocean

Sea surface temperature (SST) distribution in the tropical oceans observed by the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI). The microwave imaging technique's ability to penetrate clouds enables more frequent observation of SST than by infrared. In addition to the global capability of AMSR, the 6-GHz channels will measure SST more accurately. AMSR SST will be utilized for understanding various phenomena, including El-Nino, and will be applied to operational tasks such as fisheries forecasting.



↑ Processed with the algorithm developed by Akira Shibata, MRI-JMA (AMSR/AMSR-E standard algorithm candidate for NASDA processing)