

# ADEOS-II



**"Diagnose our Planet Earth from Space"**

**A**DEOS-II is state-of-the-art Earth observing platform that contributes to the understanding of global environment changes through its precise measurement of diverse geophysical phenomena particularly related to the global energy-water and carbon cycle. In addition to the NASA's mission instruments, AMSR and GLI, ADEOS-II has advanced observing instruments on board such as SeaWinds (NASA/JPL), POLDER (CNES), ACS (CNES), and ILAS-II (MOE). By using these special eyes in wide range of wavelength, we can diagnose our planet from various perspectives.

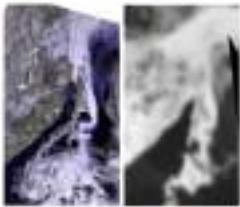
**D**ata from ADEOS-II are expected to be utilized by various international research programs such as the Global Energy and Water Cycle Experiment (GEWEX), the Climate Variability and Predictability (CLIVAR), and the International Geosphere-Biosphere Research Program (IGBP). ADEOS-II data will also be utilized in practical purpose such as weather forecasting and fishery. ADEOS-II satellite will be launched by Japanese H-IIA launch vehicle in 2002.

## 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 (H<sub>2</sub>O), can be estimated from AMSR.



### Earth View at Microwave Frequencies



Since the microwave imaging techniques do not require solar light, microwave techniques can observe day and night. In addition, microwave radiometers are capable of observing through clouds. The figure on the left contains an Special Sensor Microwave Imager (SSM/I) 22 GHz microwave, a fine-resolution Radiometer (SEVIRI) that can see distributions in the Sea of Okhotsk in winter time. It can be seen that the SEVIRI measures the fine structure of the sea ice distribution and that the SSM/I image is not affected by clouds.

That Radiometer  
H2O (22 GHz)  
Clouds (22 GHz)  
Microwave (22 GHz)

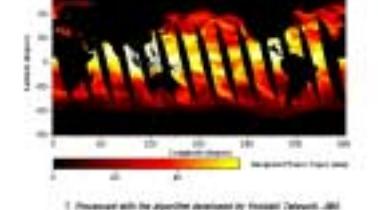
As the microwave sensor, the AMSR sensor can measure various types of microwave frequencies. The following table shows the frequency bands of the AMSR sensor.

| Frequency (GHz)  | 18.7 | 36.5 | 85.6 | 147  | 223  | 367  | 565  | 855   | 1185  |
|------------------|------|------|------|------|------|------|------|-------|-------|
| Cloud Radiometer | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| SSM/I            | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| SeaWinds         | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| ILAS-II          | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| POLDER           | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| ACS              | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |
| GLI              | 2.2  | 1.4  | 0.85 | 0.55 | 0.35 | 0.22 | 0.14 | 0.085 | 0.055 |

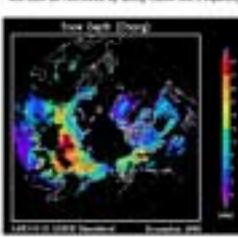
### Atmosphere

Global water vapor distribution derived from simulated AMSR data (left, ascending pass). AMSR measurements observes water vapor, one of the most effective green house gases, which is important for understanding climate change. AMSR also observes various trace gases such as the carbon dioxide, methane, and ozone.

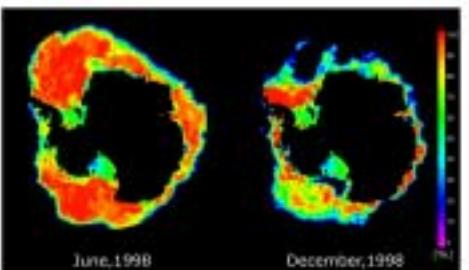
### Land and Cryosphere



Distribution of snow depth in the Northern Hemisphere derived from AMSR simulated data using 18 and 22 GHz. The snow depth over land is easier to predict and measure in spring when snow disappears. The figure on the right shows the AMSR may measure the snow depth information for heavy snow domain regions. Various operational parameters, including soil moisture, will also be retrieved by using these low frequency channels.



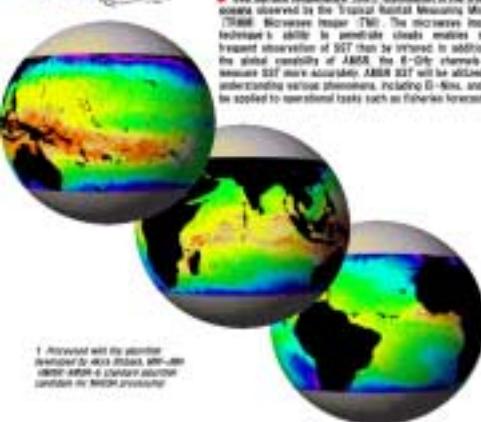
1. Processed with the geoprobe algorithm by JPL (JPL-AMSR-1) against algorithms on AMSR processing.



2. Distribution of sea ice concentration derived from AMSR simulated data. The effects of global warming should appear in terms of reduction in sea ice cover in the polar regions. Since the microwave imaging techniques do not depend on sunlight, they are capable of observing the polar regions, including the Arctic and Antarctic, and heavy cloud cover. In limited areas such as the Arctic Ocean and the Sea of Okhotsk, a potential data application is to find unique atmospheric routes for predicting the ice condition. Higher spatial resolution of AMSR would be very useful for this kind of application.

1. Retrieved with the geoprobe algorithm by JPL (JPL-AMSR-1) against algorithms on AMSR processing.

### 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 is able to penetrate clouds enables more frequent observation of SST than infrared. In addition to the global coverage of AMSR, the 8.6-GHz channels will measure SST more accurately. AMSR SST will be utilized for monitoring various parameters, including El-Nino, and will be applied to operational tasks such as fisheries forecasting.

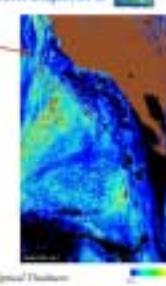
1. Retrieved with the geoprobe algorithm by JPL (JPL-AMSR-1) against algorithms on AMSR processing.



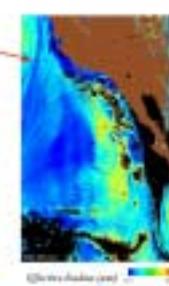
## Global Imager

NASA has been developing this since 1993 as a general purpose medium spatial resolution visible-infrared imager to cover atmosphere and land observation as well as ocean color observations.

### Atmosphere



Showing the interaction between clouds and aerosols. These figure show optical thickness (left) and aerosol radiance (right) of the marine stratospheric clouds observed in a north-northwest area off the coast of California. An image of input MODIS-like images of small cloud particles was used. They are bright areas with edges of visual absorption, by means of shape averaging over the same vertical and horizontal window-sizes. The figure on the left shows the optical thickness of the clouds, which gives a big influence to climate change. Cloud and aerosol observations with GLI are made use of assessment of climate change impact and climate forecast in the future. (MODIS data acquired on June 18, 2003 were analyzed by GLI Level 2 algorithm).



### Land and Cryosphere

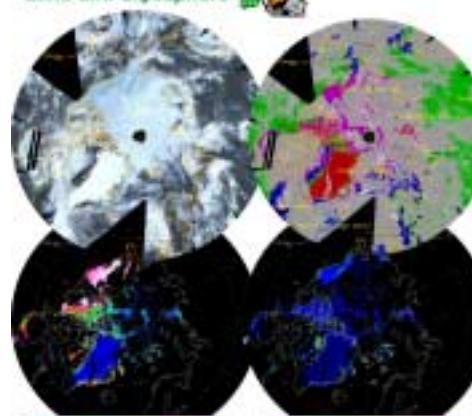


Figure 4.8 panel: GLI announces image around the northern polar region composed from about 30 MODIS Level 2A data on June 16, 2000 (MODIS at 1 km resolution) on 8.5, 10.7, and 12.3 μm wavelengths assigned to Red, Green and Blue channels respectively. (Top right panel) color-coded image of the cloud and aerosol distribution. (Bottom panel) color-coded image of the snow and ice distribution. (Left panel) color-coded image of the land and mountain distribution.

Image credit: The snow and ice images come from the University associated to this panel. Clouds off the east-shore of North America is a common phenomenon over this area.

Lower panel: color-coded image of the day-night distribution of (Upper left) and (lower left) in 17.5 μm. (Upper right) color-coded image of the day-night distribution of (Upper right) and (lower right) in 17.5 μm.

These panels are from MODIS (1 km resolution) over the Greenland ice sheet where altitude is very high and the temperature is kept just above zero, on the contrary the snow ground over the same area is very cold and the temperature is below zero. And because the temperature is very low, the snow ground reflects the spatial distribution of measured solar radiation and air temperature. As for snow properties these values are large for the snow over sea area near the continental shelf, which can be due to the dry deposition of chloride ions that originates several pathways from the continents.

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