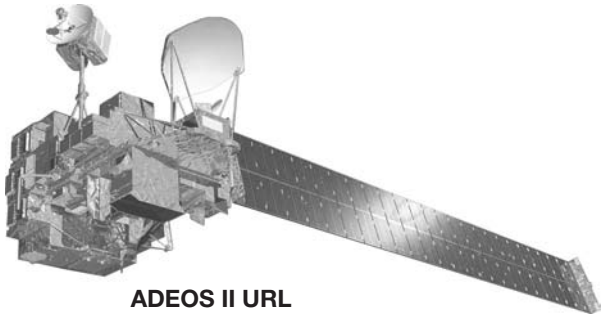
ADEOS II

Advanced Earth Observing Satellite II



ADEOS II URL
sharaku.eorc.jaxa.go.jp/ADEOS2

Summary

The ADEOS II mission was an international satellite mission led by the Japan Aerospace Exploration Agency (JAXA)—formerly the National Space Development Agency (NASDA) of Japan—with U.S. (NASA) and French Centre Nationale d'Etudes Spatiales (CNES) participation. Midori-II is the Japanese name for the mission.

The ADEOS II mission ended prematurely ten months after launch, owing to a failure of the solar panel on October 24, 2003.

Instruments

- Advanced Microwave Scanning Radiometer (AMSR)
- Global Imager (GLI)
- Improved Limb Atmospheric Spectrometer-II (ILAS-II)
- Polarization and Directionality of the Earth's Reflectances (POLDER)
- SeaWinds

Points of Contact

- *ADEOS II Program Scientist:* Akimasa Sumi, University of Tokyo
- *SeaWinds Project Scientist:* Timothy Liu, NASA Jet Propulsion Laboratory/California Institute of Technology

Mission Type

Earth Observing System (EOS) Systematic Measurements

Key ADEOS II Facts

Joint with Japan and France

Orbit:
Type: Near polar, sun-synchronous
Equatorial Crossing: 10:15 a.m.
Altitude: 803 km
Inclination: 98.6°
Period: 101 minutes
Repeat Cycle: 57 orbits (~4 days)

Dimensions: 4 m × 4 m × 6 m (spacecraft), 3 m × 24 m solar panel, with panel deployed, 7 m in-flight direction, 29 m perpendicular

Mass: 3680 kg at launch

Power: 5000 W

Downlink: 468.875 MHz at 4 Mbps. Cross-link to Data Relay Test Satellite (DRTS) at Ka-band, 120 Mbps

Design Life: Designed for 3-year mission, failed after 10 months

Contributor: JAXA built and operated ADEOS II

Launch and Location

Date and Location: December 14, 2002, from Tanegashima Space Center, Japan

Vehicle: H-IIA launch vehicle No. 4

Relevant Science Focus Areas

(see NASA's Earth Science Program section)

- Climate Variability and Change
- Weather

Related Applications

(see Applied Sciences Program section)

- Air Quality
- Coastal Management
- Disaster Management

ADEOS II Science Goals

- Monitoring the water and energy cycle as a part of the global climate system.
- Quantitatively estimate the biomass and fundamental productivity as a part of the carbon cycle, which plays an important role in global warming.

- Detect trends in long-term climate change as a result of continuing the observations started by ADEOS-I.

ADEOS II Mission Background

ADEOS II was the successor to ADEOS [Midori], designed to advance Earth-observation technologies. The mission was launched on December 14, 2002. Regrettably, the spacecraft's solar panel failed on October 24, 2003. Although the mission was short-lived, the data collected will help researchers better understand global environmental changes such as global warming. ADEOS II has provided data that helps us better understand the circulation of water, energy, and carbon in order to contribute to studies on global environmental changes.

ADEOS II was equipped with two JAXA sensors: the Advanced Microwave Scanning Radiometer (AMSR) for quantitatively observing various geophysical data concerning the water cycle, and the Global Imager (GLI) for observing oceans, land, and the atmosphere with high accuracy. It also carried three sensors provided by international and domestic partners.

Instrument Descriptions

Despite the spacecraft failure, brief descriptions are included for each instrument on ADEOS II. SeaWinds was the only NASA Earth Observing System (EOS) instrument, and hence Key Facts and Data Products boxes are provided only for SeaWinds.

AMSR

Advanced Microwave Scanning Radiometer

AMSR detects microwave emissions from Earth's surface and atmosphere. Various geophysical parameters, particularly those related to atmospheric water (H_2O), sea surface wind speed and temperature, and sea ice type and extent can be estimated from AMSR data. In addition to the proven parameters, such as integrated atmospheric water vapor and liquid water, precipitation rate, sea surface wind speed, and all-weather sea surface temperature (SST), novel geophysical parameters, including soil moisture, could be retrieved by using AMSR's low-frequency channels.

AMSR is an eight-frequency, total-power microwave radiometer with dual polarization (except two vertical channels in the 50 GHz band). Conical scanning is employed to observe Earth's surface with a constant incidence angle. Calibration counts are obtained every scan by using the hot-load target (around 300 K) and the cold-sky mirror to introduce the temperature of deep space (around 3 K). The offset-parabolic antenna with a diameter of 2 m is the largest spaceborne microwave radiometer antenna of its kind. A superior spatial resolution 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.

More details on AMSR can be found under the Aqua Mission description. Aqua carries a similar instrument called AMSR-E.

AMSR URL

sharaku.eorc.jaxa.jp/AMSR/index_e.htm

AMSR Science Team Leader

Akira Shibata, Earth Observation Research Center, JAXA

GLI

Global Imager

GLI is an optical sensor that observes the reflected solar radiation from Earth's surface, including land, oceans, and atmosphere and/or infrared radiation with a multi-channel system for measuring the biological content, such as chlorophyll, organic substance, and vegetation index as well as temperature, snow and ice, and cloud and aerosol distribution. These data will be used for understanding the global circulation of carbon and climate changes.

GLI URL

sharaku.eorc.jaxa.jp/ADEOS2

GLI Science Team Leader

Teruyuki Nakajima, University of Tokyo

ILAS

Improved Limb Atmospheric Spectrometer-II

ILAS-II was developed by the Ministry of the Environment to monitor high-latitude stratospheric ozone. The objectives of ILAS-II are to monitor and study changes in the stratosphere triggered by emissions of chlorofluorocarbons (CFCs) and to evaluate the effectiveness of worldwide emission controls of CFCs. ILAS-II is a spectrometer that observes the atmospheric limb absorption spectrum from the upper troposphere to the stratosphere, using sunlight as a light source (solar-occultation technique). The spectrometer covers the infrared region (3–13 μm) and the

near-visible region (753–784 nm). ILAS-II was designed to improve observation accuracy and cover wider spectral ranges than ILAS, which was based on the Limb Atmospheric Spectrometer (LAS) aboard EXOS-C (Ohzora, ISAS, 1984). ILAS-II observations are focused on the high latitudes (56–70°N, 63–88°S) because of the geometrical relation of the solar-occultation events with the sun-synchronous orbit. From these spectral observations, ILAS-II can measure the vertical profiles of species related to ozone depletion, including ozone (O_3), nitrogen dioxide (NO_2), nitric acid (HNO_3), aerosols, water vapor (H_2O), CFC-11, CFC-12, methane (CH_4), nitrous oxide (N_2O), chlorine nitrate ($ClONO_2$), and temperature and pressure.

ILAS-II URL

www-ilas2.nies.go.jp/en

ILAS-II Principal Investigator

Yasuhiro Sasano, National Institute for Environmental Studies

POLDER

Polarization and Directionality of the Earth's Reflectances

POLDER observes the polarization, directional, and spectral characteristics of the solar light reflected by aerosols, clouds, oceans, and land surfaces.

POLDER is a 2-dimensional charge-coupled device (CCD) array, with a wide field of view, multi-band imaging radiometer and polarimeter developed by CNES. Multi-angle viewing is achieved by the along-track migration, at the spacecraft velocity, of a quasi-square footprint intercepted by the total instantaneous ±43° × ±51° wide field of view. This footprint is partitioned into 242 × 274 elements of quasi-constant 7-km × 6-km resolution, imaged by a CCD matrix in the focal plane. Simultaneously, a filter and polarizer wheel rotate and scan eight narrow spectral bands in the visible and near infrared (443, 490, 564, 670, 763, 765, 865, and 910 nm).

POLDER URL

smsc.cnes.fr/POLDER

SeaWinds

NASA's SeaWinds Scatterometer provided high-accuracy, near-all-weather surface wind speed and direction measurements over at least 90% of the ice-free global oceans every two days. SeaWinds on ADEOS II contributed to the long-term wind data set for studies of ocean circulation, climate, air-sea interaction, and weather

Key SeaWinds Facts

Heritage: SeaSat, NSCAT

Dimensions:
- CDS: 32 cm × 46 cm × 34 cm
- SES: 81 cm × 91 cm × 43 cm
- SAS: ~150 cm; 100-cm diameter antenna dish on 60-cm diameter × 60-cm pedestal

Mass: 220 kg

Power: 220 W

Duty Cycle: 100%

Data Rate: 40 kbps

Thermal Control: Radiators

Thermal Operating Range: 5–40° C

Field of View (FOV): Rotating (at 18 rpm) pencil-beam antenna with dual feeds pointing 40° and 46° from nadir

IFOV: ± 51° from nadir

Swath: 1800 km (± 51° look angles) from 803-km altitude

Pointing Requirements (3σ):
- Control: <0.3° (~1000 arcsec)
- Knowledge: <0.05° (~167 arcsec)
- Stability: <0.008°/s (30 arcsec/s)

Contributor: NASA JPL designed

forecasting. SeaWinds was a follow-on to the NASA Scatterometer (NSCAT) on ADEOS; the SeaWinds instrument on ADEOS II complemented an identical instrument on the QuikSCAT spacecraft.

The SeaWinds scatterometer used a 1-m-diameter dish antenna with two beams, which rotated about the satellite nadir axis at 18 rpm. SeaWinds radiated and received microwave pulses at a frequency of 13.4 GHz across an 1800-km-wide swath.

Scatterometers use a highly indirect technique to measure wind velocity over the ocean. Changes in the wind velocity cause changes in ocean surface roughness, modifying the radar cross section of the ocean and the magnitude of the backscattered power. Multiple collocated measurements acquired from several viewing geometries (incidence angles, polarizations, and directions) are used to determine wind speed and direction simultaneously. The directly measured backscatter cross-sections over land and ice-covered regions yield information on vegetation type and ice type and extent.

A full write-up on the SeaWinds instruments is found under the entry for QuikSCAT, which carries a SeaWinds instrument identical to the one that was on ADEOS II.

SeaWinds URL

winds.jpl.nasa.gov/

SeaWinds Principal Investigator

Michael Freilich, Oregon State University

ADEOS II References

Freilich, M. H., and R. S. Dunbar, 1999: The accuracy of the NSCAT 1 vector winds: comparisons with National Data Buoy Center buoys. *J. Geophys. Res.*, **104**, 11,231–11,246.

Liu, W. T., ed., 2003: Scientific Opportunities Provided by SeaWinds in Tandem. JPL Publication 03-12, Jet Propulsion Laboratory, Pasadena, 39 pp.

Liu, W. T., 2002: Progress in scatterometer application. *J. Oceanogr.*, **58**, 121–136.

Note: Additional SeaWinds references are provided in the QuikSCAT section.

ADEOS II Data Products

Product Name or Grouping	Processing Level	Coverage	Spatial/Temporal Characteristics
SeaWinds *Data Set Start Date: April 10, 2003; Data Set End Date: October 24, 2003*			
Normalized Radar Cross Section and Ancillary Data	1B	Global	6 × 25-km horizontal resolution, 70% daily and 90% every 2 days
Grouped and Surface-Flagged Backscatter and Attenuations	2A	Global	25 × 25-km horizontal resolution, 70% daily and 90% every 2 days
Ocean Wind Vectors in 25-km Grid	2B	Oceans	25-km horizontal resolution, 90% every 2 days
Ocean Wind Vectors on regular lat-lon grid	3	Oceans	25-km horizontal resolution, 90% every 2 days
Note: Since SeaWinds is the only EOS instrument that flew on ADEOS II, only its data-product information is included here.			

ADEOS II Data Products