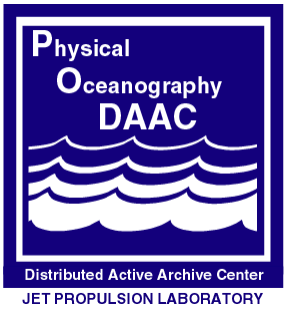
Physical Oceanography DAAC

SeaWinds on ADEOS-II Level 3 Daily, Gridded Ocean Wind Vectors

(JPL SeaWinds Project)

Guide Document



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Jet Propulsion Laboratory
California Institute of Technology

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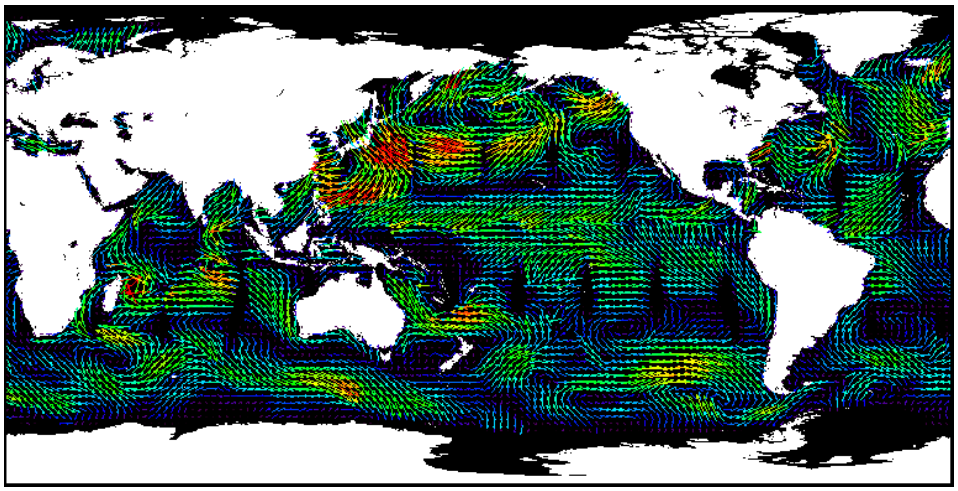

Summary:

The SeaWinds on ADEOS-II Level 3 data set consists of gridded values of scalar wind speed, meridional and zonal components of wind velocity, time given in fraction of a day. Rain probability determined using the Multidimensional Histogram (MUDH) Rain Flagging technique is also included as an indicator of wind values that may have degraded accuracy due to the presence of rain. Data are currently available in Hierarchical Data Format (HDF) and exist from April 10, 2003 to present.

The Level 3 data were obtained from the Direction Interval Retrieval with Threshold Nudging (DIRTH) wind vector solutions contained in the ADEOS-II Level 2B data and are provided on an approximately 0.25° x 0.25° global grid. Separate maps are provided for both the ascending pass (10:30PM LST equator crossing) and descending pass (10:30AM LST equator crossing). By maintaining the data at nearly the original Level 2B sampling resolution and separating the ascending and descending passes, very little overlap occurs in one day. However, when overlap between subsequent swaths does occur, the values are over-written, not averaged. Therefore, a SeaWinds on ADEOS-II Level 3 file contains only the latest measurement for each day.

This product is also referred to as JPL PO.DAAC product 142.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

SeaWinds on ADEOS-II Level 3 Daily, Gridded Ocean Wind Vectors
JPL PO.DAAC Product 142

Data Set Introduction:

The NSCAT experience showed that there is no single, sophisticated gridding algorithm that satisfies every science user's need. As a result, this SeaWinds Level 3 product was intended to be a very generic, gridded product which can easily be manipulated to fit the exact requirements necessary for multiple science topics.

For example, this product separates ascending and descending pass data in order to facilitate the use of this product in studies affected by diurnal trends. However, the ascending and descending maps may also be easily combined to obtain daily wind maps.

In addition, the Level 3 data are given on a global grid of 1440 pixels in longitude by 720 pixels in latitude (0.25° grid). This is nearly the same sampling resolution as the Level 2B. Therefore, users wishing to use their own interpolation schema to fill data gaps can do so easily. Users requiring lower resolution data (0.5° or 1° grids) can also easily average the scientific data sets contained in this product to their exact specifications.

A list of alternate SeaWinds Level 3 products created by members of the ADEOS-II Science Working Team will be available on the PO.DAAC SeaWinds Links Page (http://podaac.jpl.nasa.gov/seawinds/sws_links) for those users who require lower resolution or gap-filled SeaWinds data but do not wish to perform their own averaging or interpolation.

Objective/Purpose:

This data set was created in order to provide a simple, global, gridded map of the scatterometer wind vector data for use in research topics such as global climatic change and air-sea interaction.

The high-spatial resolution (1440 pixels longitude by 720 pixels latitude) of the Level 2B product was maintained in order to allow researchers to easily re-bin or average the data to lower resolutions as required by their individual research. The ascending and descending passes were kept separate in order to preserve the integrity of diurnal trends.

The high resolution and separation of passes generates little overlap of data within a day. As a result, this data set is also useful as a quick, browse reference for the SeaWinds Level 2B data set.

Summary of Parameters:

The following parameters are available for both the ascending and descending passes:

- Wind Speed
- Wind Velocity (U and V components)
- Null Data Indicator
- Time in fraction of a day
- Rain Probability
- Rain Flag

Discussion:

The Level 3 gridded wind vector processing bins the Direction Interval Retrieval with Threshold Nudging (DIRTH) wind vector solutions contained in the Level 2B data from the swath-based wind vector cell (WVC) grid to a 0.25° rectangular global map grid over a nominal UTC data day (i.e. between 00:00:00.000Z and 23:59:59.999Z). Separate maps are created for both the ascending and descending passes. The ADEOS-II orbit is such that the ascending and descending equator crossings are at local (mean sun) times of 10:30 PM and 10:30 AM, respectively. **Data which overlap on subsequent passes are overwritten, not averaged.** Therefore, a Level 3 file contains only the latest measurement for each day.

For simplicity, the time of each wind measurement is written as an HDF Scientific Data Set (SDS) in the Level 3 product instead of using a Vdata object as was done in the Level 2B data. To convert the Level 2B Vdata timetag to the Level 3 SDS representing time in fraction of a day, the following equation was used:

time_fraction=(HH*3600 + MM*60 + SS.SSS)/86400

where: HH = hour of day out of 24 hours from the Level 2B measurement

3600 = seconds per hour

MM = minute from the Level 2B measurement

60 = seconds per minute

SS.SSS = second from the Level 2B measurement

86400 = seconds per day

Before writing a DIRTH wind value to the Level 3 daily grid, it was necessary to differentiate between NULL values and wind measurements which were actually 0 m/s. Two tests were performed in order to distinguish NULLs from zero wind speed. First, at least one

ambiguity had to be present in the L2B wind vector cell (WVC). If the number of ambiguities in a Level 2B WVC was zero, then winds were not retrieved in that WVC. This was accomplished by checking the Level 2B num_ambigs SDS. Second, each Level 2B WVC wind retrieval flag (bit 9 of the wvc_quality_flag SDS) needed to be set to 0, indicating wind retrieval was, in fact, performed for the WVC. If a WVC measurement passed both criteria, the DIRTH wind value was written to the corresponding Level 3 wind grid cell, and the null data indicator was set to 0. If one or both criteria were not met, no wind values were written to the Level 3 product, and the null data indicator in the Level 3 product was set to 1.

Similar to the Level 2B product, NULL values of wind speed must be differentiated from 0 m/s values of wind speed. However, as mentioned above, this can be done simply by looking at the null data indicator value corresponding to each measurement. If the null data indicator is 1, a zero wind measurement indicates a NULL value. If the null data indicator is 0, a zero indicates a measurement with a value of 0.

The Level 3 product also contains four Scientific Data Sets to address possible rain contamination of the wind data. The Level 3 rep_rain_probability SDS contains the corresponding values of the Level 2B mp_rain_probability SDS provided bit 12 of wvc_quality_flag was set to 0 (indicating the rain flag for the Level 2B wind vector cell was usable). More information pertaining to the use of mp_rain_probability in rain flagging can be obtained from Huddleston and Stiles [2000].

Rain flags for ascending and descending nodes are also available in the Level 3 product in order to indicate whether or not rain is detected by a rain flag algorithm. These flags are set to 0 if the Rain Flag Usable (bit 3) and the Rain Flag (bit 4) are set to 0 in grid_cell_quality_flag. These flags are set to 1 otherwise.

Related Data Sets:

The following related data sets are available at the JPL PO.DAAC:

- SeaWinds on ADEOS-II Level 2B Ocean Wind Vectors in 25 Km Swath Grid (JPL SeaWinds Project)
  JPL PO.DAAC Product 141

- SeaWinds on QuikSCAT Level 2B Ocean Wind Vectors in 25 Km Swath Grid (JPL SeaWinds Project)
  JPL PO.DAAC Product 108

- SeaWinds on QuikSCAT Level 3 Daily, Gridded Ocean Wind Vectors (JPL SeaWinds Project)
  JPL PO.DAAC Product 109

- NSCAT Scatterometer Ocean Wind Products CD-ROM (JPL)
  JPL PO.DAAC Product 085

- NSCAT scatterometer global 25km Sigma-0 and Ocean Winds (Dunbar)
  JPL PO.DAAC Product 084

- NSCAT Scatterometer Science Product, Levels 1.7, 2, 3 (JPL)
  JPL PO.DAAC Product 066

In addition to the products mentioned above, several additional Level 3 products have been produced by members of the SeaWinds on ADEOS-II Science Working Team. Many of these products provide the SeaWinds data on coarser grids (0.5° or 1°) or at smaller time intervals (6 or 12 hour maps). Advanced interpolation techniques may also be used to fill gaps in the wind fields. A list of the publicly available SeaWinds Level 3 products produced by SeaWinds on ADEOS-II Science Working Team members can be found on the PO.DAAC SeaWinds on ADEOS-II Web Site Links Page, (http://podaac.jpl.nasa.gov/seawinds/sws_links.html).

2. Investigator(s):

NOTE: Please refer all questions concerning the SeaWinds on ADEOS-II Level 3 product to the PO.DAAC SeaWinds Data Team, sws@podaac.jpl.nasa.gov, or the PO.DAAC User Services Office, podaac@podaac.jpl.nasa.gov.

The SeaWinds on ADEOS-II Project is a mission of the NASA Jet Propulsion Laboratory (JPL). Further information on the SeaWinds Project is available on-line at http://winds.jpl.nasa.gov.

SeaWinds on ADEOS-II Level 3 Product Author:

Dr. R. Scott Dunbar
Jet Propulsion Laboratory

SeaWinds on ADEOS-II Science Team Lead:

Dr. Michael Freilich
Oregon State University

SeaWinds on ADEOS-II JPL Project Scientist

Dr. W. Timothy Liu
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3. Theory of Measurements:

"Spaceborne scatterometers transmit microwave pulses to the ocean surface and measure the backscattered power received at the instrument. Since the atmospheric motions themselves do not substantially affect the radiation emitted and received by the radar, scatterometers use an indirect technique to measure wind velocity over the ocean. Wind stress over the ocean generates ripples and small waves, which roughen the sea surface. These waves modify the radar cross-section (sigma-0) of the ocean surface and hence the magnitude of backscattered power. In order to extract wind velocity from these measurements, one must understand the relationship between sigma-0 and near-surface winds. This relationship is known as the geophysical model function." [*Dunbar et al*, 2001]

The SWS-1 model function was used to obtain the SeaWinds on ADEOS-II ocean wind data.

4. Equipment:

NOTE: This section was obtained entirely from the **SeaWinds Science Data Product User's Manual** [*Dunbar et al*, 2000]. Please refer to the User's Manual for more information.

Sensor/Instrument Description:

Collection Environment:

The SeaWinds instrument is a specialized microwave radar onboard the ADEOS-II satellite.

Source/Platform:

The ADEOS-II satellite was launched into a sun-synchronous, 803-kilometer, circular orbit on 14 December 2002. The local equator crossing time at the ascending node is 10:30 P.M. ± 30 minutes.

The nominal orbit for ADEOS-II is defined by the following parameters:

Nominal Orbital Parameters	
Recurrent Period	4 days (57 orbits)
Orbital Period	101 minutes (14.25 orbits/day)
Local Sun Time at Ascending Node	10:30 P.M. ± 30 minutes
Altitude above Equator	803 km
Inclination	98.616°

Source/Platform Mission Objectives:

The Satellite Surface Stress Working Group mission requirements are as follows:

Quantity	Requirement	Applicable Range
Wind Speed	2 m/s (rms)	3-20 m/s
	10%	20-30 m/s
Wind Direction	20° (rms) selected ambiguity	3-30 m/s
Spatial Resolution	25 km	sigma-0 cells
	25 km	Wind Vector Cells
Location Accuracy	25 km (rms)	Absolute
	10 km	Relative
Coverage	90% of ice-free ocean every day	
Mission Duration	36 months	

Key Variables:

The SeaWinds instrument on ADEOS-II is an active microwave radar designed to measure electromagnetic backscatter from wind roughened ocean surface.

Principles of Operation:

Spaceborne scatterometers transmit microwave pulses to the ocean surface and measure the backscattered power received at the instrument. Since the atmospheric motions themselves do not substantially affect the radiation emitted and received by the radar, scatterometers use an indirect technique to measure wind velocity over the ocean. Wind stress over the ocean generates ripples and small waves, which roughen the sea surface. These waves modify the radar cross section (sigma-0) of the ocean surface and hence the magnitude of backscattered power. In order to extract wind velocity from these measurements, one must understand the relationship between sigma-0 and near-surface winds. This relationship is known as the geophysical model function.

The QuikSCAT-1 model function was used to obtain the SeaWinds on ADEOS-II ocean wind data.

Sensor/Instrument Measurement Geometry:

The SeaWinds instrument uses a rotating dish antenna with two spot beams that sweep in a circular pattern. The antenna radiates microwave pulses at a frequency of 13.4 GHz across broad regions on Earth's surface. The instrument collects data over ocean, land, and ice in a continuous, 1,800-kilometer-wide band centered on the spacecraft's nadir subtrack, making approximately 1.1 million ocean surface wind measurements and covering 90% of Earth's surface each day.

Unlike the fan-beam scatterometers flown on previous missions (Seasat SASS and NSCAT), the SeaWinds instrument on ADEOS-II is a conically scanning pencil-beam scatterometer. SeaWinds employs a single 1-meter parabolic antenna dish with twin offset feeds for vertical and horizontal polarization. The antenna spins at a rate of 18 rpm, scanning two pencil-beam footprint paths at incidence angles of 46° (H-pol) and 54° (V-pol). The transmitted radar pulse is modulated, or "chirped", and the received pulse (after Doppler compensation) is passed through an FFT stage to provide sub-footprint range resolution. The range resolution is commandable between 2 km and 10 km, with the nominal value set at about 6 km. The nominal pulse repetition frequency is 187.5 Hz (also commandable). Each telemetry frame contains data for 100 pulses. Signal and noise measurements are returned in the telemetry for each of the 12 sub-footprint "slices." Ground processing locates the pulse "egg" and "slice" centroids on the Earth's surface. The sigma-0 value is then computed for both the "egg" and the best 8 of the 12 "slices" (based on location within the antenna gain pattern).

Manufacturer of Sensor/Instrument:

Jet Propulsion Laboratory

Calibration:

Specifications:

The system must measure winds between 3 and 30 m/s with an accuracy better than (the greater of) 2 m/s or 10% in speed and 20° in direction with a spatial resolution of 50 km.

Frequency of Calibration:

SeaWinds generates an internal calibration pulse and associated load pulse every half-scan of the antenna. In ground processing, the load pulses are averaged over a 20-minute window, and the cal pulses over a 10-pulse (approximately 18-second) window, to provide current instrument gain calibration needed to convert telemetry data numbers into power measurements for the sigma-0 calculation.

SeaWinds "programmability" includes commanding of major mode selection and range resolution, antenna spin rate and PRF, and the ability to uplink new Doppler compensation and range tracking tables as changes in the orbit occur, or to conduct special engineering tests. Mode changes will be made periodically to obtain additional calibration data.

Other Calibration Information:

Operating Modes

- Mode 0: Wind Observation Mode

  Wind observation mode is the primary science mode for SeaWinds, and will be in effect more than 95% of the time.

- Mode 1: Receive-Only Mode

  In Receive-only mode, the transmitter is turned off while the receiver collects data at the antenna ports. This mode was used during Cal/Val to assess radio frequency interference and internal receiver biases. No science data is returned in this mode.

- Mode 2: Continuous Calibration Mode

In Continuous Calibration mode, SeaWinds performs only calibration/load cycles in place of normal pulse transmission cycles. This mode provides the most accurate receiver calibration data, and will be used periodically throughout the mission. No science data is returned in this mode.

5. Data Acquisition Methods:

NOTE: This section was obtained entirely from the **SeaWinds Science Data Product User's Manual**. Please refer to the User's Manual for more information.

This section describes the overall design and functionality of the ground processing system for data from ADEOS-II. The parts most relevant for SeaWinds data:

NASDA/EOC

- receives raw data from the ground stations
- sends AMSR Level 1A data to PO.DAAC
- sends raw SeaWinds data to SeaPAC

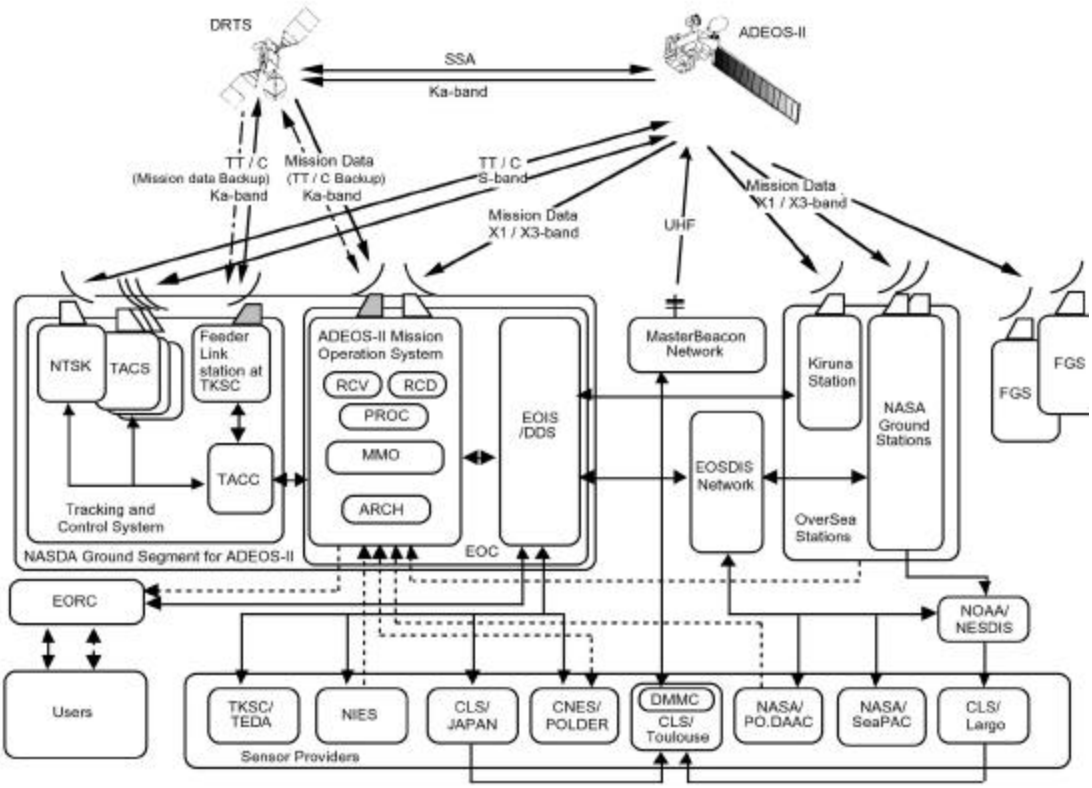
JPL/SeaPAC

- receives data from PO.DAAC and EOC
- processes data into higher level SeaWinds products
- sends SeaWinds products to PO.DAAC

JPL/PO.DAAC

- receives AMSR L1A data from EOC, sends them to SeaPAC, and stores them for a limited time
- receives SeaWinds data from SeaPAC, archives them (except for near-real-time data), and distributes data products

The ADEOS-II Mission Operations Interface Specification (MOIS Common Part version 1.1, February 2002, AD2-EOC-96-054) more thoroughly describes the overall ground processing system. Each major component, as identified in the data flow diagram Figure 5.1, is described in a subsection below.



EOC	: Earth Observation Center
EOIS	: Earth Observation and Information System
DDS	: Data Distribution Subsystem
RCV	: Receiving Subsystem
RCD	: Recording Subsystem
PROC	: Processing Subsystem
MMO	: Mission operation Management Organization
ARCH	: Archiving Subsystem
TACC	: Tracking And Control Center
TACS	: Tracking And Control Station
NTSK	: NASDA Transportable Station-Kiruna
EORC	: Earth Observation Research Center
EOSDIS	: Earth Observation System Data and Information System
TKSC	: Tsukuba Space Center
NIES	: National Institute for Environmental Studies
CNES	: Center National des Etude Spatiales
CLS	: Collecte Localisation par Satellite
DMMC	: Downlink Messages Management Center
PO.DAAC	: Physical Oceanography Distributed Active Archive Center
SeaPAC	: SeaWinds Processing and Analysis Center
NESDIS	: National Environmental Satellite Data and Information Service
FGS	: Foreign Ground Station

Ground Station — Feeder Link Station

On-Line — Off-Line

Figure 5-1: ADEOS-II Data Flow

5.1 NASDA Ground Segment for ADEOS-II

5.1.1 ADEOS-II Mission Operation System

ADEOS-II Mission Operation System, located at the Earth Observation Center (EOC) in Hatoyama, is the main planning organization for ADEOS-II mission operations. The ADEOS-II Mission Operation System makes the operation plan of ADEOS-II onboard instruments based on the operation requests from sensor providers such as the SeaWinds project and NASDA PIs. The ADEOS-II Mission Operation System also schedules data downlinks and plans mission data recorder operations (tape management). This system also has some link responsibilities for the spacecraft and archive and processing responsibilities for the NASDA instruments on board ADEOS-II.

5.1.2 Earth Observation Information System/Data distribution and Management Subsystem (EOIS/DDMS)

NASDA's EOIS/DDMS at the EOC provides network services for ADEOS-II operations, distributes standard product data sets and catalog information to users, and provides catalog system interoperability with EOSDIS. Additionally, the Data Distribution Subsystem, part of DDMS, is the primary interface for ADEOS-II mission operations information and data flows between EOC and related agencies using network.

5.1.3 Tracking and Control System

The Tracking and Control System verifies the EOC mission operations plan against satellite constraints, generates the satellite commands, and transmits them. It also acquires the satellite engineering telemetry and ranging data for orbit determination, monitors the safety of the instruments, and activates emergency procedures if necessary, and processes Doppler tracking data to provide predict and definitive satellite ephemeris.

5.2 Earth Observation Research Center (EORC)

EORC develops the higher level processing software for AMSR and other Japanese instruments.

5.3 Overseas Stations

5.3.1 NASA/NOAA Ground Network

The NASA/NOAA Ground Network (NGN) is a NASA management activity for the coordination of data acquisition from passes not available to EOC at Hatoyama, Japan or Kiruna, Sweden. The NGN Data Acquisition Stations (NASA Ground Stations) consist of Alaska SAR Facility located at Fairbanks, Alaska and Wallops Flight Facility at Wallops Island, Virginia.

5.3.2 Kiruna Station

Kiruna Station serves as a Direct Downlink Station of NASDA.

5.4 Sensor Providers

These receive minimally processed data from NASDA/EOC, the NASA/NOAA Ground Network, and Kiruna via network.

5.4.1 SeaWinds Processing and Analysis Center (SeaPAC)

The SeaWinds Processing and Analysis Center (SeaPAC) at JPL is responsible for the reception of telemetry data, production and analysis of the science data products, and for delivery of the science products to the PO.DAAC for distribution. The SeaPAC consists of six principal subsystems, described in the following sections.

5.4.1.1 File Transfer Subsystem (FX)

The FX subsystem is responsible for all external data transfers into the SeaPAC. These include the reception of the science telemetry data from EOC, collection of ice edge data from the National Ice Center, and collection of NWP wind field data from NCEP. While the FX software can be run manually, most of its functions are completely automated.

5.4.1.2 Process Management Subsystem (PM)

The PM subsystem performs the database and automatic job scheduling functions for the SeaPAC, as well as providing a user interface for the SeaPAC operator. Using a rule-based algorithm PM is able to determine when all of the necessary input data for a particular job have

become available, and can start that job automatically or inform the operator that the job is ready to be run manually.

5.4.1.3 Preprocessor Subsystem (PP)

The PP subsystem takes care of the initial processing of the Level 0 science telemetry, creating the basic input products for initiating the main science data processing. PP creates time correlation, ephemeris, and attitude files, creates the SeaWinds Level 0 files that are the input to the Level 1A processor, and also extracts and converts NWP data to the format needed by the Level 2B processor.

5.4.1.4 Level Processor Subsystem (LP)

The LP subsystem is the heart of the science processing, implementing the conversions from Level 0 telemetry up through the Level 3 wind vector products. LP consists of five main programs, one each to produce L1A, L1B, L2A, L2B and L3 data in sequence. LP software incorporates and implements all of the science algorithms, and creates the HDF data products delivered to PO.DAAC and to the science community.

5.4.1.5 Engineering Analysis Subsystem (EA)

The EA subsystem has the primary responsibility to monitor the instrument health and safety. EA focuses mainly on the Level 1A data to perform trend analyses on key instrument and spacecraft temperatures, voltages, and other engineering parameters.

5.4.1.6 Science Analysis Subsystem (SA)

The SA subsystem performs the primary QA and data analysis functions for the SeaPAC. SA is concerned with assuring that the science algorithms as implemented in the LP are performing correctly, and making algorithm corrections and refinements as needed. SA monitors the science data quality throughout the mission. QA reports are provided with all data products.

5.4.2 Physical Oceanography Distributed Active Archive Center (PO.DAAC)

PO.DAAC's main function is to receive science data from SeaPAC, archives the data, and distributes Level 1B, Level 2A, Level 2B and Level 3 to the SeaWinds science community. PO.DAAC also archives all telemetry, Level 0, Level 1A and ancillary files collected during the SeaWinds mission.

PO.DAAC also acts as a sensor provider by receiving AMSR L1A data from EOC, which PO.DAAC then forwards to SeaPAC and stores for a limited time.

5.5 Centre National d'Etudes Spatialies (CNES)

CNES manages two instruments on ADEOS-II:

- POLDER observes intensity and polarization of solar radiation reflected by the atmosphere under different viewing angles
- ARGOS DCS is a location and data collection system for studying and protecting the environment

5.6 National Institute for Environmental Studies (NIES)

Japan's NIES and Ministry of the Environment manage the Improved Limb Atmospheric Spectrometer-II, which monitors the high-latitude stratospheric ozone.

5.7 Tsukuba Space Center (TKSC)

TKSC supplies TEDA, the Technical Data Acquisition Equipment, which monitors the space environment and acquires engineering data.

5.8 National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite, Data, and Information Service (NESDIS)

NOAA/NESDIS utilizes SeaWinds and other data in near real-time for weather analysis and forecasting.

6. Observations:

Data Notes:

No additional notes.

Field Notes:

No additional notes.

7. Data Description:

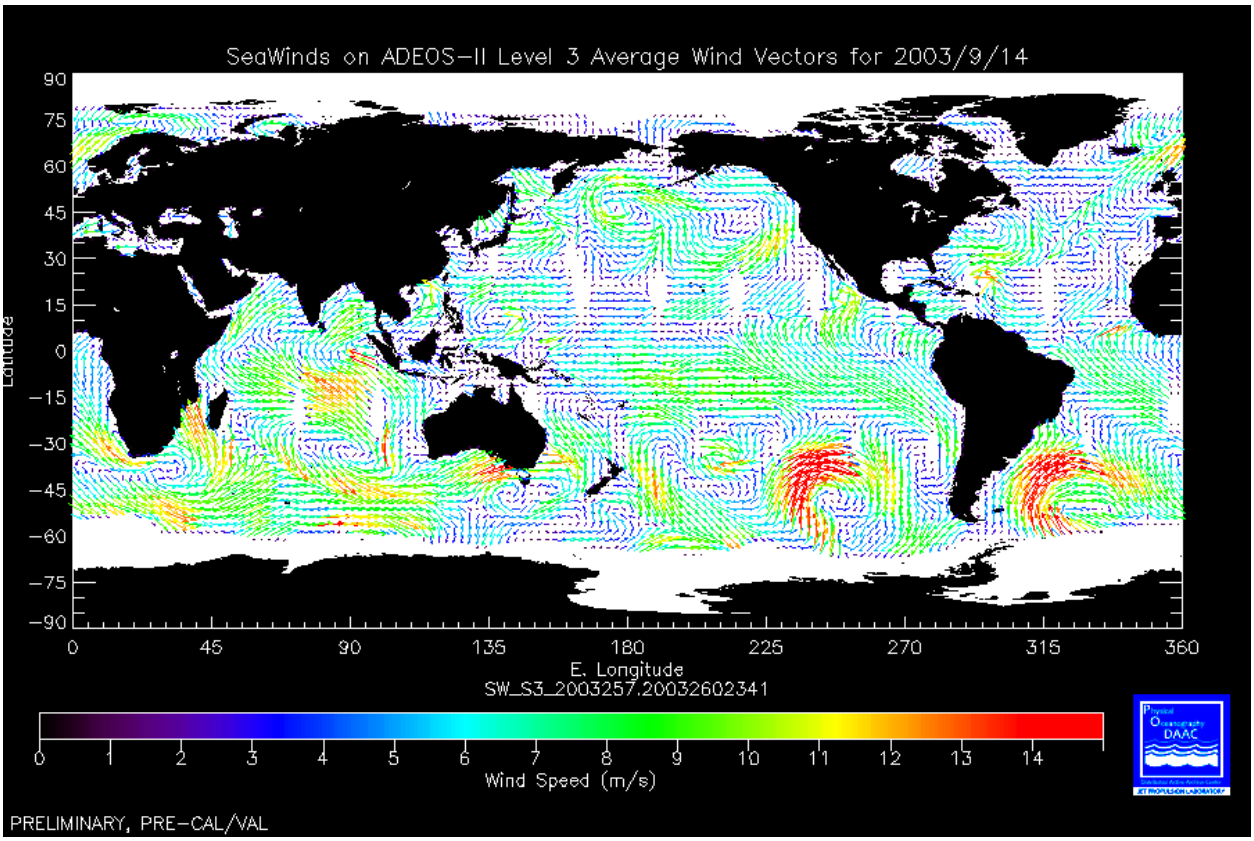
Spatial Characteristics:

Spatial Coverage:

Global Oceans
Approximately 90% of the ice-free ocean every day.

Spatial Coverage Map:

The following image shows a typical coverage for one day of SeaWinds on ADEOS-II Level 3 data. (Note: Image is the SeaWinds average of the descending and ascending passes for September 14, 2003.)



Spatial Resolution:

The SeaWinds Level 3 data are provided on a global grid of 1440 pixels longitude by 720 pixels latitude or 0.25° by 0.25°.

Projection:

Global data are on a simple, 0.25° rectangular grid. Each grid contains 1440 pixels from east to west and 720 pixels from south to north.

Grid Description:

The SeaWinds Level 3 data set is on a simple, rectangular grid of 1440 columns by 720 rows. Therefore, a grid element spans 0.25 degrees in longitude (360/1440) and latitude (180/720). Latitude and longitude coordinates are assigned to each grid element based on its center. To calculate the longitude and latitude of a grid point, the following equations can be used:

lon[i] = (360./XGRID) * (i+0.5) for i=0...XGRID-1

lat[j] = (180./YGRID) * (j+0.5) - 90. for j=0...YGRID-1

where:

XGRID = grid elements in the x-direction (1440)

YGRID = grid elements in the y-direction (720)

As shown by the above formulas, the latitude and longitude of the center of the first grid cell of each SeaWinds Level 3 scientific data is -89.875° North (89.875° South) and 0.125° East. The latitude and longitude of the final grid cell of each data set is centered at 89.875° North and 359.875° East (0.125° West).

Temporal Characteristics:

Temporal Coverage:

Daily data exist from January 2003 to approximately present. More recent data will be added to this data set as it becomes available.

Temporal Coverage Map:

Not available.

Temporal Resolution:

Each file contains data for a given day, and each grid point within this file

contains the latest measurement at that location. Ascending and descending measurements are contained in separate data fields within a file.

Data Characteristics:

There are 11 Scientific Data Sets within each SeaWinds Level 3 HDF data file.

1. **rep_wind_speed:** The wind speed for a Level 3 grid cell location.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.01	0.00	0.00	50.00	m/s	16-bit unsigned integer

2. **rep_wind_velocity_u:** The U component of the wind velocity vector for a Level 3 grid cell location. This value is positive for winds blowing from the West to the East, and represents zonal winds.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.01	0.00	0.0	50.00	m/s	16-bit signed integer

3. **rep_wind_velocity_v:** The V component of the wind velocity vector for a Level 3 grid cell location. This value is positive for winds blowing from the South to the North, and represents meridional winds.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.01	0.00	-50.00	50.00	m/s	16-bit signed integer

4. **null_data_indicator:** A flag that indicates whether data at a Level 3 grid cell location is null. This flag is set to 0 if the Data Exists Flag (bit 0) is set to 0 in grid_cell_quality_flag. This flag is set to 1 otherwise. A value of 0 indicates that the data is usable. A value of 1 indicates that the data is null and should not be used.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	1.00	0.00	0.00	1.00	count	8-bit unsigned integer

5. **rep_time_of_day:** The time of day that data was acquired for a Level 3 grid cell location. The time is represented as a fraction of the day. A value of 0.0000 corresponds to 00:00:00.000 UTC. A value of 0.9999 corresponds to 23:59:59.999 UTC.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.00002	0.00	0.00	1.00	fraction of day	16-bit unsigned integer

6. **rep_rain_prob:** The rain probability for a Level 3 grid cell location. This value indicates the probability of a columnar rain rate that is greater than 2 km*mm/hr.

   This variable is similar to the mp_rain_probability SDS in the Level 2B product. Please refer to "Multidimensional Histogram (MUDH) Rain Flag" [Huddleston and Stiles, 2000] for more information.

   Please note that all values of mp_rain_probability which were less than 0 were set to 0. In particular, a -3.0 value of mp_rain_probability in the Level 2B product indicated an inability to calculate a probability value. This value is 0.0 in the Level 3 product.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.001	0.00	0.00	1.00	n/a	16-bit unsigned integer

7. **rain_flag:** A flag that indicates whether rain was detected at a Level 3 grid cell location. This flag is set to 0 if the Rain Flag Usable (bit 3) and the Rain Flag (bit 4) are set to 0 in grid_cell_quality_flag. This flag is set to 1 otherwise

   .

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	1.00	0.00	0.00	1.000	n/a	8-bit unsigned integer

8. **grid_cell_quality_flag:** Bit flags that indicate the quality of a Level 3 grid cell location.

The significance of each of the bit flags is as follows:

Bit	Definition
0	Data Exists Flag
	0 - Data was located for this L3 grid cell.
	1 - Data was not located for this L3 grid cell.
1	Multiple WVC Flag
	0 - Only one data set was located within this L3 grid cell.
	1 - More than one data set was located within this L3 grid cell.
2	Data Overwritten Flag
	0 - Data in this L3 grid cell was not overwritten.
	1 - Data in this L3 grid cell was overwritten.
3	Rain Flag Usable
	0 - The rain flag is usable.
	1 - The rain flag is not usable.
4	Rain Flag
	0 - Rain was not detected.
	1 - Rain was detected.
5	Available Data Flag
	0- Inner beam data with SeaWinds view forward and aft and outer beam data with SeaWinds view forward and aft are available.
	1- Data from at least one of the four possible beam and view combinations are not available.
6	Attenuation Correction Flag

0- Attenuation corrections were applied to sigma0s used to retrieve winds.

1- Attenuation corrections were not applied to sigma0s used to retrieve winds.

7-8 Attenuation Source Flag

0- AMSR brightness temperatures were used to correct sigma0s for atmospheric attenuation.

1- The climatological attenuation map was used to correct sigma0s for atmospheric attenuation.

2- The apparent brightness temperatures based on scatterometer measurements were used to correct sigma0s for atmospheric attenuation.

3-N/A

9 Coastal Flag

0- No land mass was detected within this L3 grid cell.

1- Some portion of this L3 grid cell is over land.

10 Ice Edge Flag

0- No ice was detected within this L3 grid cell.

1- Some portion of this L3 grid cell is over ice.

11 AMSR Rain Indicator Flag

0 - The reported AMSR rain indicator value is usable.

1 - The reported AMSR rain indicator value is not usable.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	1.00	0.00	0.00	4095.00	n/a	16-bit unsigned integer

9. **rep_amsr_rain_indicator:** The representative AMSR rain indicator for a Level 3 grid cell location. rep_amsr_rain_indicator is a non-dimensional

parameter that reflects the ambient atmospheric conditions. The table below lists three ranges of rain indicator values, specifies the atmospheric conditions that are typical for those numerical ranges, and describes the relative effect of those conditions upon the backscatter signal detected by the SeaWinds instrument:

Rain Indicator Range	Atmospheric Condition and the Effect on the Scatterometer Echo Signal
Less than 0.5	Clear sky or cloudy conditions. Atmosphere attenuates the backscatter signal
Between 0.5 and 4.0	Light to moderate rain conditions. Atmospheric phenomena attenuate the backscatter signal. Most of the attenuation is due to precipitating hydrometeors.
Greater than 4.0	Heavy rain conditions. Backscatter generated by hydrometeors in the atmosphere dominates the surface echo signal. Phenomena that attenuate the backscatter signal are less important by comparison.

The value is retrieved using observations of the Advanced Microwave Scanning Radiometer (AMSR).

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.01	0.00	-20	100.00	n/a	16-bit unsigned integer

10. **rep_atten_cor:** The representative atmospheric nadir attenuation for the Level 3 grid cell location.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.001	0.00	0.0	32.767	db	16-bit signed integer

11. **rep_srad_rain_rate:** The representative rain rate for a Level 3 grid cell location. These rain rates are based on 13.402 GHz brightness temperatures that were generated using the noise energy level in the echo channel of the

SeaWinds instrument.

Dimensions	Scale	Offset	Minimum	Maximum	Units	Storage Type
[1440,720,2]	0.01	0.00	0.0	50.0	mm/hr	16-bit signed integer

Sample Data Record:

The following sample output was obtained using program read_sws3.f. Data between latitudes 9 South and 10 South and longitudes between 209 East and 210 East were read from input file SW_S3_2001211.20021570025. Please note that all calibrations and offsets have been applied.

ASCENDING PASS (DAYTIME)

LAT	LON	SPD	U	V	TIME	RAIN PROB
-9.875	209.125	8.41	-4.57	-7.06	0.667	0.005
-9.625	209.125	8.90	-4.98	-7.38	0.667	0.002
-9.375	209.125	8.36	-5.02	-6.68	0.667	0.000
-9.125	209.125	7.84	-5.06	-5.99	0.667	0.002
-8.875	209.125	7.58	-5.21	-5.50	0.667	0.037
-9.875	209.375	8.01	-4.13	-6.87	0.667	0.004
-9.625	209.375	8.10	-4.62	-6.65	0.667	0.002
-9.375	209.375	8.27	-4.94	-6.63	0.667	0.003
-9.125	209.375	7.26	-4.74	-5.50	0.667	0.007
-8.875	209.375	7.27	-4.78	-5.48	0.667	0.003
-9.625	209.625	7.71	-3.97	-6.61	0.667	0.000
-9.375	209.625	7.50	-4.08	-6.29	0.667	0.003
-9.125	209.625	7.23	-4.63	-5.55	0.667	0.002
-8.875	209.625	7.34	-5.00	-5.38	0.667	0.001
-9.625	209.875	7.46	-4.40	-6.02	0.667	0.006
-9.375	209.875	7.57	-4.77	-5.88	0.667	0.003
-9.125	209.875	7.57	-4.76	-5.88	0.667	0.007
-8.875	209.875	7.44	-5.17	-5.35	0.667	0.003
-9.625	210.125	9.04	-6.61	-6.17	0.667	0.016
-9.375	210.125	7.92	-4.88	-6.24	0.667	0.001
-9.125	210.125	8.41	-5.70	-6.19	0.667	0.006
-8.875	210.125	7.94	-5.55	-5.68	0.667	0.020

DESCENDING PASS (NIGHTTIME)

LAT	LON	SPD	U	V	TIME	RAIN PROB
-9.875	209.125	7.41	-5.51	-4.95	0.145	0.003
-9.625	209.125	7.84	-6.09	-4.94	0.145	0.003
-9.375	209.125	8.15	-6.47	-4.96	0.145	0.002
-9.125	209.125	8.52	-6.88	-5.02	0.145	0.003
-8.875	209.125	8.53	-6.94	-4.95	0.145	0.003
-9.875	209.375	7.53	-5.55	-5.08	0.145	0.001
-9.625	209.375	8.20	-6.46	-5.05	0.145	0.003
-9.375	209.375	8.48	-6.82	-5.04	0.145	0.001
-9.125	209.375	8.85	-7.20	-5.15	0.145	0.001
-8.875	209.375	8.56	-6.99	-4.94	0.145	0.000
-9.375	209.625	9.10	-7.39	-5.31	0.145	0.000
-9.125	209.625	8.59	-7.01	-4.96	0.145	0.011
-8.875	209.625	8.65	-7.10	-4.94	0.145	0.001
-9.375	209.875	8.94	-7.27	-5.20	0.145	0.004
-9.125	209.875	9.02	-7.41	-5.15	0.145	0.000
-8.875	209.875	9.05	-7.58	-4.95	0.144	0.120
-9.875	210.125	9.10	-7.13	-5.66	0.145	0.001
-9.625	210.125	9.64	-7.81	-5.66	0.145	0.003
-9.375	210.125	9.16	-7.54	-5.20	0.145	0.000
-9.125	210.125	9.18	-7.58	-5.18	0.145	0.001
-8.875	210.125	8.82	-7.43	-4.75	0.144	0.014

Sample Header/Attribute Information:

The following sample header was obtained using program read_sws_info.f and SeaWinds L3 file SW_S3_2001211.20021570025.

```
HDF info for file: SW_S3_2001211.20021570025
Number of Datasets=  11
Number of Global Attributes=  42

 Dataset/Name          Rank   Dimensions      Scale        Offset     Data Type
 ---------------------------------------------------------------------------
 0  rep_wind_speed       3      2  1440   720   0.010000000  0.000000000  uint16
 1  rep_wind_velocity_u  3      2  1440   720   0.010000000  0.000000000  int16
 2  rep_wind_velocity_v  3      2  1440   720   0.010000000  0.000000000  int16
 3  rep_atten_corr       3      2  1440   720   0.001000000  0.000000000  int16
 4  rep_time_of_day      3      2  1440   720   0.000100000  0.000000000  uint16
 5  rep_rain_probabilit  3      2  1440   720   0.001000000  0.000000000  uint16
 6  rep_srad_rain_rate   3      2  1440   720   0.010000000  0.000000000  int16
 7  rep_amsr_rain_indic  3      2  1440   720   0.010000000  0.000000000  int16
 8  rain_flag            3      2  1440   720   1.000000000  0.000000000  uint8
 9  null_data_indicator  3      2  1440   720   1.000000000  0.000000000  uint8
10  grid_cell_quality_f  3      2  1440   720   1.000000000  0.000000000  uint16

 Index/Attribute Name                   Values
 ---------------------------------------------------------------------------
   0  LongName                          SeaWinds Level 3 Ocean Wind Vectors in a 0.25 Degree Global
   1  ShortName                         SWSL3
   2  producer_agency                   NASA
   3  producer_institution              JPL
   4  PlatformType                      spacecraft
   5  InstrumentShortName               SeaWinds
   6  PlatformLongName                  Advanced Earth Observing Satellite II
   7  PlatformShortName                 ADEOS-II
   8  project_id                        SeaWinds
   9  data_format_type                  NCSA HDF
  10  QAPercentOutOfBoundsData          0
  11  QAPercentMissingData              0
  12  build_id                          3.2.1/2002-05-30
  13  HDF_version_id                    4.1r5
  14  ProductionDateTime                2002-157T00:25:29.000
  15  sis_id                            686-644-23/2000-09-05
  16  EquatorCrossingLongitude          74.92895
                                        49.67197
                                        24.41319
                                        359.1595
                                        333.9005
                                        308.6405
                                        283.3817
                                        258.1308
                                        232.8696
                                        207.6077
  17  EquatorCrossingDate               2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
                                        2001-211
  18  EquatorCrossingTime               00:53:47.479
                                        02:34:49.103
                                        04:15:50.667
                                        05:56:52.153
                                        07:37:53.634
                                        09:18:55.119
                                        10:59:56.641
                                        12:40:58.266
                                        14:21:59.883
                                        16:03:01.438
  19  OrbitParametersPointer            SW_SEPHG20012102304.20021542036
                                        SW_SEPHG20012110050.20021542157
                                        SW_SEPHG20012110237.20021542157
                                        SW_SEPHG20012110356.20021542158
                                        SW_SEPHG20012110543.20021542158
                                        SW_SEPHG20012110729.20021542158
```

```
                                    SW_SEPHG20012110915.20021542158
                                    SW_SEPHG20012111035.20021542216
                                    SW_SEPHG20012111221.20021542217
                                    SW_SEPHG20012111407.20021542217
                                    SW_SEPHG20012111553.20021542217
 20  StartOrbitNumber               10993
 21  StopOrbitNumber                11003
 22  l3_actual_grid_cells           401971
 23  l3_actual_grid_cells_asc       253491
 24  l3_actual_grid_cells_dsc       247783
 25  num_l3_rows                    720
 26  num_l3_columns                 1440
 27  RangeBeginningDate             2001-211
 28  RangeBeginningTime             00:28:29.848
 29  RangeEndingDate                2001-211
 30  RangeEndingTime                17:18:45.352
 31  OperationMode                  Wind Observation
 32  wind_vector_source             Direction Interval Retrieval
 33  wind_vector_cell_resolution    25.0km
 34  observation_date               2001-211
 35  ParameterName                  rep_wind_speed
 36  percent_rev_data_usage         9.961219
                                    10.52359
                                     9.50558
                                    12.05828
                                    12.14027
                                    8.773246
                                    6.946899
                                    9.374314
                                    9.901771
                                    10.81484
 37  l3_algorithm_descriptor        Uses wind vector cell nearest to center of grid cell.  No av
                                    is performed.  Later revs overwrite previous revs.
 38  InputPointer                   SW_S2B10994.20021562238
                                    SW_S2B10995.20021552243
                                    SW_S2B10996.20021550418
                                    SW_S2B10997.20021550430
                                    SW_S2B10998.20021550430
                                    SW_S2B10999.20021550430
                                    SW_S2B11000.20021550430
                                    SW_S2B11001.20021552303
                                    SW_S2B11002.20021552258
                                    SW_S2B11003.20021562259
 39  ancillary_data_descriptors     SW_PC3_0001
                                    SW_MC3_0001
                                    GLOB0003
                                    SW_CN3_0001
                                    LEAP0001
 40  QAGranulePointer               None
 41  GranulePointer                 SW_S3_2001211.20021570025
```

File Naming Convention:

SW_XWGRD3_yyyyddd.YYYYDDDHHMM

where:	SW	=	SeaWinds
	XWGRD3	=	Level 3 Gridded Product
	yyyy	=	Calendar Year Covered by Data in File
	ddd	=	Day of Year Covered by Data in File
	YYYY	=	Calendar Year Data were Produced

DDD	=	Calendar Day Data were Produced
HH	=	Hour in Twenty-Four Hour Time when Data were Produced
MM	=	Minute Data were Produced

8. Data Organization:

Data Granularity:

The basic granule is one data file. Each data file contains the data for one day.

A general description of data granularity as it applies to the Earth Observing System Data Gateway (EDG) appears in the EOSDIS Glossary.

Data Format:

The SeaWinds on ADEOS-II Level 3 data are provided in Hierarchical Data Format (HDF) version 4.1r3. The HDF library and further information about HDF may be obtained from the NCSA HDF web site at http://hdf.ncsa.uiuc.edu.

There are 11 scientific data sets and 42 global attributes in each SeaWinds on ADEOS-II Level 3 file. For a description of each scientific data set and global attribute, please refer to the Data Description portion (Section 7) of this document.

9. Data Manipulations:

Formulae:

Derivation Techniques and Algorithms:

NOTE: This section is summarized from Section 5.3 of the **SeaWinds Science Data Product User's Manual**. Please refer to the User's Manual for more information.

Sigma-0 Grouping

The sigma-0 grouping algorithm prepares the SeaWinds sigma-0 data for wind retrieval processing. The data contained in the Level 1B product are grouped by geographic location into wind vector cells (WVC). The grouped sigma-0 data are saved in WVC rows in the L2A product.

Surface Flags

After the sigma-0 data have been assigned to a WVC, each cell is checked for land and sea ice. The land map used is the same CIA land-sea map used for NSCAT. The sea ice mask is generated from weekly National Ice Center ice edge data. Both the land and ice flagging algorithms check the center of the sigma-0 cell against the land-sea map and the ice mask.

SeaWinds on ADEOS-II Level 2B Processing

The Wind Vector Cell Preparation algorithm operates on a row of WVC values, passed from the Grouping algorithm, one WVC at a time. It then must determine if there is sufficient data of sufficient quality to perform wind retrieval. This algorithm checks each WVC to determine the data counts (total and by beam), quality flags, and surface flags. It then computes the centroid of the sigma-0 locations to give a WVC location (latitude/ longitude; the binning grid is essentially "thrown away" at this point), and passes the "good" data to the Wind Retrieval algorithm. Upon return from wind retrieval, the ambiguous wind vector data are placed in the Level 2B output buffer.

Wind Retrieval

An accurate model function is essential to deriving ocean wind vectors from scatterometer measurements. Varieties of Ku-band models exist, some of which are derived from scattering theory, and some which are empirically derived. The tabular form of the model function, using a table of real-space (non-dB) sigma-0 values, is used for SeaWinds, with modifications for the incidence angle range and the resolution of the table in azimuth and incidence angle. The model function used for SeaWinds is the QuikSCAT-1 model.

Ambiguity Removal

The SeaWinds ambiguity removal algorithm uses a modified median filter technique to select a unique wind vector out of a set of ambiguous wind vectors at each wind vector cell. The algorithm is a direct adaptation of the ambiguity removal algorithm used for NSCAT.

NWP Initialization of Ambiguity Removal

The baseline ambiguity removal algorithm for SeaWinds incorporates the Numerical Weather Product (NWP) initialization technique used for NSCAT-1 and NSCAT-2 processing. In this "nudging" technique, the median filter algorithm is initialized with either the first or the second ranked wind vector solution, whichever is closer to the direction of the NWP analysis field. The median filter algorithm then proceeds as described above to generate the final wind vector selections.

DIRTH Algorithms

At far swath, ambiguity removal skill is degraded due to the absence of inner beam measurements, limited azimuth diversity, and boundary effects. Near nadir, due to nonoptimal measurement geometry (fore and aft looking measurement azimuths approximately 180° apart), there is a marked decrease in directional accuracy even when ambiguity removal works correctly. Two algorithms were developed, direction interval retrieval (DIR) to address the nadir performance issue, and threshold nudging (TN) to improve ambiguity removal at far swath. The two algorithms work independently and need not be used together. However, both were used to obtain the DIRTH solutions, wind_speed_selection and wind_dir_selection, in the Level 2B product.

Please refer to Stiles [1999] for more information on the DIRTH algorithms.

Level 3

The Level 3 data were obtained from the Direction Interval Retrieval with Threshold Nudging (DIRTH) wind vector solutions contained in the SeaWinds Level 2B product. Please refer to the Data Description portion of this document for more details pertaining to deriving the SeaWinds Level 3 data product from the Level 2B.

Data Processing Sequence:

Processing Steps:

SeaWinds on ADEOS-II science processing proceeds through a well-defined series of level conversion stages, producing more refined products at each stage. The products are created in the following order:

- **Level 0**: Science Telemetry Processing
- **Level 1A**: Engineering Unit Converted Telemetry
- **Level 1B**: Time-Ordered Earth-Located Sigma-0's
- **Level 2A**: Surface Flagged Sigma-0's and Attenuations
- **Level 2B**: Ocean Wind Vectors in a 25km Swath Grid
- **Level 3**: Daily, Gridded Ocean Wind Vectors

Processing Changes:

None at this time.

Calculations:

Special Corrections/Adjustments:

Each SeaWinds Level 3 parameter is stored as an integer. To convert to a real value, multiply the parameter by the scaling factor and add the offset. The scaling factor and offset for each parameter is given in the Data Characteristics section of this document and in the attributes of each Level 3 HDF file.

Calculated Variables:

The SeaWinds Level 3 Product contains the following calculated variables:

- wind speed
- u and v components of wind velocity
- null data indicator
- time in fraction of a day
- rain probability
- rain flag
- grid cell quality flag
- AMSR rain indicator
- atmospheric nadir attenuation
- rain rate

Graphs and Plots:

No additional information.

10. Errors:

Sources of Error:

"When rain is present, measurements of the ocean surface sigma-0 [from which wind speed is derived] become contaminated for several reasons. Some of the transmitted energy is scattered back towards the scatterometer by the rain and never reaches the ocean surface. Energy backscattered from rain can constitute a significant but unknown portion of the measured echo energy. Some of the transmitted energy is

scattered and/or absorbed by the rain and is never measured by the scatterometer. This has the effect of attenuating the echo energy from the ocean. Additionally, the rain roughens the ocean surface and changes its radar cross section." [Huddleston and Stiles, 2000]

The normalized standard deviation of sigma-0, known as Kp, is computed to give an estimate of the measurement uncertainty of the backscatter. There are three major sources of Kp in the scatterometer system:

- the uncertainty in the receiver noise, known as communication Kp or Kpc
- the uncertainties in the geometric and gain parameters, known as retrieval Kp or Kpr
- the uncertainty associated with the geophysical model function

Other sources of error include attitude pointing uncertainty, instrument processing, and various bias errors.

Quality Assessment:

Data Validation by Source:

"The SA subsystem performs the primary QA and data analysis functions for the SeaPAC. SA is concerned with assuring that the science algorithms as implemented in the LP are performing correctly, and making algorithm corrections and refinements as needed. SA monitors the science data quality throughout the mission. QA reports are provided with all data products." [Dunbar et al, 2000]

The QA reports are available on the PO.DAAC FTP site, podaac.jpl.nasa.gov, in the pub/ocean_wind/seawinds/mission_status_report directory.

Confidence Level/Accuracy Judgment:

Tests of the SeaWinds ambiguity algorithm with simulated wind data show that the vectors closest to the true winds are selected 96% of the time, on average.

Measurement Error for Parameters:

Information not currently available.

Additional Quality Assessments:

No additional notes.

Data Verification by Data Center:

None.

11. Notes:

Limitations of the Data:

Wind measurements may be contaminated when rain is present. The rep_rain_probability, rep_rain_flag, rep_srad_rain_rate and rep_amsr_rain_indicator Scientific Data Sets are included in this product to account for possible contamination.

Radar returns from land and ice correspond to different scattering processes than those over open ocean, and can contaminate wind vector estimates. A land mask has been applied to the SeaWinds data in order to negate most contamination due to land and ice.

Known Problems with the Data:

The QuikSCAT-1 model function has a tendency to underestimate high winds. There is also insufficient information in its behavior in calm situations.

Usage Guidance:

Wind direction convention

The oceanographic, or flow vector, convention for wind direction is adopted for SeaWinds on ADEOS-II. Under this convention, a wind direction of 0° implies a flow *toward* the north.

Reference Height for Surface Winds

The adopted reference height for all wind vectors is 10 meters.

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

- global and regional climate studies
- atmospheric forcing, ocean response and air-sea interaction mechanism research
- input to numerical weather- and wave-prediction models

13. Future Modifications and Plans:

For the most current information concerning the SeaWinds on ADEOS-II mission, please refer to the JPL SeaWinds on ADEOS-II web site, (http://winds.jpl.nasa.gov/missions/seawinds/seaindex.html).

14. Software:

Software Description:

Sample read and display software for the SeaWinds on ADEOS-II Level 3 data are available in C, FORTRAN-77 and Interactive Data Language (IDL). These programs can be easily modified to meet the requirements of individual users.

The latest versions of the sample read and display software can be obtained via anonymous FTP to the PO.DAAC FTP site, podaac.jpl.nasa.gov, in the pub/ocean_wind/seawinds/L3/sw/ directory. These sample programs are also accessible through the PO.DAAC SeaWinds Web Site, http://podaac.jpl.nasa.gov/seawinds/sws_sw.html.

Program Name	Description	Notes
read_sws3ez.c	Simple C program to read the Level 3 data	1
read_sws3.c	More standard C program to read the Level 3 data	1
read_sws3.f	FORTRAN-77 program to read the SeaWinds Level 3 data	1
read_sws_info.f	FORTRAN-77 program to read the attributes in SeaWinds Levels 1B, 2A, 2B and 3 data	1
ave_vecmap.pro	IDL program to display a map of wind vectors from a SeaWinds Level 3 file	2
read_sws3.pro	IDL program to read the SeaWinds Level 3 data	2
read_sws_info.pro	IDL program to read the attributes in SeaWinds Levels 1B, 2A, 2B and 3 data	2

Notes:

1. The HDF library (version 4 ONLY) must be installed locally before the read software in C or FORTRAN will work properly. The HDF library and further information

about HDF may be obtained from the NCSA HDF web site at http://hdf.ncsa.uiuc.edu.

.

2. IDL is a software tool used for the analysis and display of scientific data. It is a registered trademark of Research Systems, Inc. The installation of the HDF library is not necessary in order to use the IDL read software, because IDL already contains the HDF library.

3. Caution should be used when interpreting the results produced by the IDL program ave_vecmap.pro; some artifacts may affect the map. Artifacts may be due to the following causes:

    - the binning algorithm leaves some isolated cells empty, because grid size and data spacing are almost, but not exactly, identical. Variables affected are **rep_wind_velocity_u** and **rep_wind_velocity_v.**

    - when the ascending and descending grids are averaged, a later empty cell in a later neighborhood acquires the wind vector of the earlier cell, about 1/2 day earlier. This happens because Level 3 files contain only the latest measurement for each day. Since ADEOS-II orbit is sun-synchronous, the local time of the samples is about the same every revisit.

    Easy 'solutions' to the problem would be to 'fill' the isolated empty cells with some average of their neighbors, or to discard cells for which either ascending or descending values are missing

Software Access:

The latest versions of the sample read and display software can be obtained via anonymous FTP to the PO.DAAC FTP site, podaac.jpl.nasa.gov, in the pub/ocean_wind/seawinds/L3/sw/ directory. These sample programs are also accessible through the PO.DAAC SeaWinds Web Site, http://podaac.jpl.nasa.gov/seawinds/sws_sw.html.

Please note that the global SeaWinds on ADEOS-II Level 3 data product is currently only available in Hierarchical Data Format (HDF). The HDF library (version 4 ONLY) must be installed before the C or FORTRAN read software will work properly. The HDF library and further information about HDF may be obtained from the National Center for Supercomputing Applications (NCSA) at http://hdf.ncsa.uiuc.edu.

15. Data Access

Contact Information:

Questions and comments concerning the SeaWinds Science Data Products should be directed to the Physical Oceanography Distributed Active Archive Center (PO.DAAC) at the NASA Jet Propulsion Laboratory (JPL). Please note that e-mail is always the preferred method of communication.

E-Mail: podaac@podaac.jpl.nasa.gov

WWW: http://podaac.jpl.nasa.gov/seawinds/

Phone: 626-744-5508

Fax: 626-744-5506

Mail:
JPL PO.DAAC User Services Office
Jet Propulsion Laboratory
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4800 Oak Grove Drive
Pasadena, CA 91109 U.S.A.

Data Center Identification:

Jet Propulsion Laboratory (JPL)
Physical Oceanography Archive Center (PO.DAAC)

Procedures for Obtaining Data:

The SeaWinds on ADEOS-II Level 3 Daily, Gridded Ocean Wind Vectors data set is available via anonymous FTP to podaac.jpl.nasa.gov in the pub/ocean_wind/seawinds/L3 directory.

This product is also available on CD-ROM. Orders may be placed using the PO.DAAC on-line order form, http://podaac.jpl.nasa.gov/order, or the Earth Observing System (EOS) Data Gateway, http://poseidon.jpl.nasa.gov/~imswww/pub/imswelcome/.

Further information about SeaWinds on ADEOS-II data is also available at the PO.DAAC SeaWinds web site, http://podaac.jpl.nasa.gov/seawinds/.

Data Center Status/Plans:

Plans to provide the SeaWinds on ADEOS-II data on DVD are currently under consideration.

16. References:

Dunbar, R. S., S. V. Hsiao, and B. H. Lambrigtsen, "Science Algorithm Specifications for the NASA Scatterometer Project," JPL D-5610 (597-521), Vol. 1 (Sensor Algorithms) and Vol. 2 (Geophysical Algorithms). October 2001.

Freilich, M. H., SeaWinds ALGORITHM THEORETICAL BASIS DOCUMENT, NASA ATBD-SWS-01

Freilich, M. H., and R. S. Dunbar, "A Preliminary C-Band Scatterometer Model Function for the ERS-1 AMI Instrument," *Proceedings of the First ERS-1 Symposium: Space at the Service of our Environment*, Cannes, 4-6 November 1992, ESA SP-359, European Space Agency, Paris.

Huddleston, J.N. and B.W. Stiles, "Multidimensional Histogram (MUDH) Rain Flag Product Description, Version 2.1," Jet Propulsion Laboratory, Pasadena, CA, 2000.

LaPointe, J, Level 3 Data Software Interface Specification (SIS), SeaWinds/ADEOS-II era, October 2003

Naderi, F. M., M. H. Freilich, and D. G. Long, "Spaceborne Radar Measurement of Wind Velocity Over the Ocean—An Overview of the NSCAT Scatterometer System," *Proc. IEEE, 79*, 6, June 1991.

Shaffer, S., R. S. Dunbar, S. V. Hsiao, and D. G. Long, "A Median-Filter-Based Ambiguity Removal Algorithm for NSCAT," *IEEE Trans. Geosci. Remote Sens., 29*, 1991.

Stiles, B.W., "Special Wind Vector Data Product: Direction Interval Retrieval with Threshold Nudging (DIRTH) Product Description, Version 1.1," Jet Propulsion Laboratory, Pasadena, CA, 1999.

Tsai, W., J. E. Graf, C. Winn, J. N. Huddleston, R. S. Dunbar, M. H. Freilich, F. J. Wentz, D. G. Long, and W. L. Jones, "Postlaunch Sensor Verification and Calibration of the NASA Scatteromoter," *IEEE Trans. Geosci. Remote Sens.*, vol. 37, pp. 1517-1542, May 1999.

Wentz, F. J., "Climatology of 14 GHz Atmospheric Attenuation," Remote Sensing Systems Tech. Memo 052096, May 1996.

Zhang, A, R. S. Dunbar, S. V. Hsiao, K. Pak, Y. Kim, "Science Algorithm Specifications for SeaWinds," Internal JPL SeaWinds project document, 1996, 1999.

*** SeaWinds Science Data Product Users Manual, Overview & Geophysical Data Product, Editor: Lungu, T., JPL D-21551 Jet Propulsion Laboratory, Pasadena, CA, October 2003.

Collections:

"NSCAT: Scientific Applications," American Geophysical Union collection of NSCAT papers reprinted from *J. Geophys. Res, Geophys. Res Letters, Eos, Transactions*, AGU, 1999.

17. Glossary of Terms:

Please refer to the EOSDIS Glossary for a more general listing of terms related to the Earth Observing System project.

18. List of Acronyms:

ADEOS: Advanced Earth Observing Satellite

EA: SeaPAC Engineering Analysis program set

EDG: Earth Observing System Data Gateway

EOS: Earth Observing System

EOSDIS: Earth Observing System Data and Information System

FTP: File Transfer Protocol

FX: SeaPAC File Transfer program set

GSFC: Goddard Space Flight Center

HDF: Hierarchical Data Format

IDL: Interactive Data Language

JPL: Jet Propulsion Laboratory

L1B: SeaWinds Level 1B Product

L2A: SeaWinds Level 2A Product

L2B: SeaWinds Level 2B Product

L3: SeaWinds Level 3 Product

LASP: Laboratory for Atmospheric and Space Physics at the University of Colorado

LP: SeaPAC Level Processor program set

MOC: Mission Operations Center

NASA: National Aeronautics and Space Administration

NCEP: National Center for Environmental Prediction

NCSA: National Center for Supercomputing Applications

NSCAT: NASA Scatterometer

NWP: Numerical Weather Prediction

PM: SeaPAC Process Management program set

PP: SeaPAC Preprocessor program set

PO.DAAC: Physical Oceanography Distributed Active Archive Center

QA: Quality Assurance

QuikSCAT: NASA Quick Scatterometer

SA: SeaPAC Science Analysis program set

SAFS: Standard Autonomous File Server

SDS: Scientific Data Set

SEAPAC: SeaWinds Processing and Analysis Center

SWT: Science Working Team

URL: Uniform Resource Locator

UTC: Universal Time Coordinated

WVC: Wind Vector Cell

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