

For Using Data

Data Policy	JAMSTEC
Principal Investigator	Data Management Office
Use Constraints	See Terms and Conditions about constrain of use.
Data Citation	See Terms and Conditions about data citation.

Quality

DMO-Processed

Instrument

General maritime meteorological observation system



SOAR (Shipboard Oceanographic and Atmospheric Radiation : MR20-03 -)



Overview

"MIRAI meteorological integrated dataset" is a set of "suitably composed data" which consists of 10-minute-average corrected Atmospheric Pressure, Air Temperature, Relative Humidity, Wind Direction and Speed, Precipitation, Radiation, Sea Surface Temperature, and Wave Height observed by R/V MIRAI.

The correction and processing method was produced by Dr. K. Yoneyama (RIGC/JAMSTEC) in cooperation with DMO. The actual data processing was conducted by DMO. See "Flow of Meteorological Data Processing" for detailed correction and processing method.

Measurement System

Sensors	Manufacturer	Type	Location (from sea surface)
Anemometer	R.M. Young, USA	05106	Foremast (25m)
Tair/RH	Vaisala, Finland R.M. Young, USA	HMP155 with 43408 Gill aspired radiation shield	Starboard and port side at compass deck (21m)
Thermometer (SST)	Sea-Bird Electronics, USA	SBE-38	Bow thruster room (-4.5m)
Barometer	Setra System, USA	Model-370	Weather observation room at captain deck (13m)
Rain gauge	R.M. Young, USA	50202	Foremast (24m)
Radiometer (shortwave)	Hukseflux, The Netherlands	SR20 with VU01 ventilation unit*	Foremast (25m)
Radiometer (long-wave)	Hukseflux, The Netherlands	IR20 with VU01 ventilation unit*	Foremast (25m)
Wave height meter	Tsurumi-Seiki, Japan	WM-2	Bow (10m)

* used only in cold regions to prevent dew and frost formation on the radiometer sensors.

Calibration Information

- 1) Tair/RH sensor calibration date
 - Starboard side : 2023/1/11
 - Port side : 2023/1/11
- 2) Rain gauge calibration (Using the revision of rain data)
 - Minimum value (0.0 cc) : 0.60 mm
 - Maximum value (504.0 cc) : 50.34 mm
 - Date: 2023/8/17

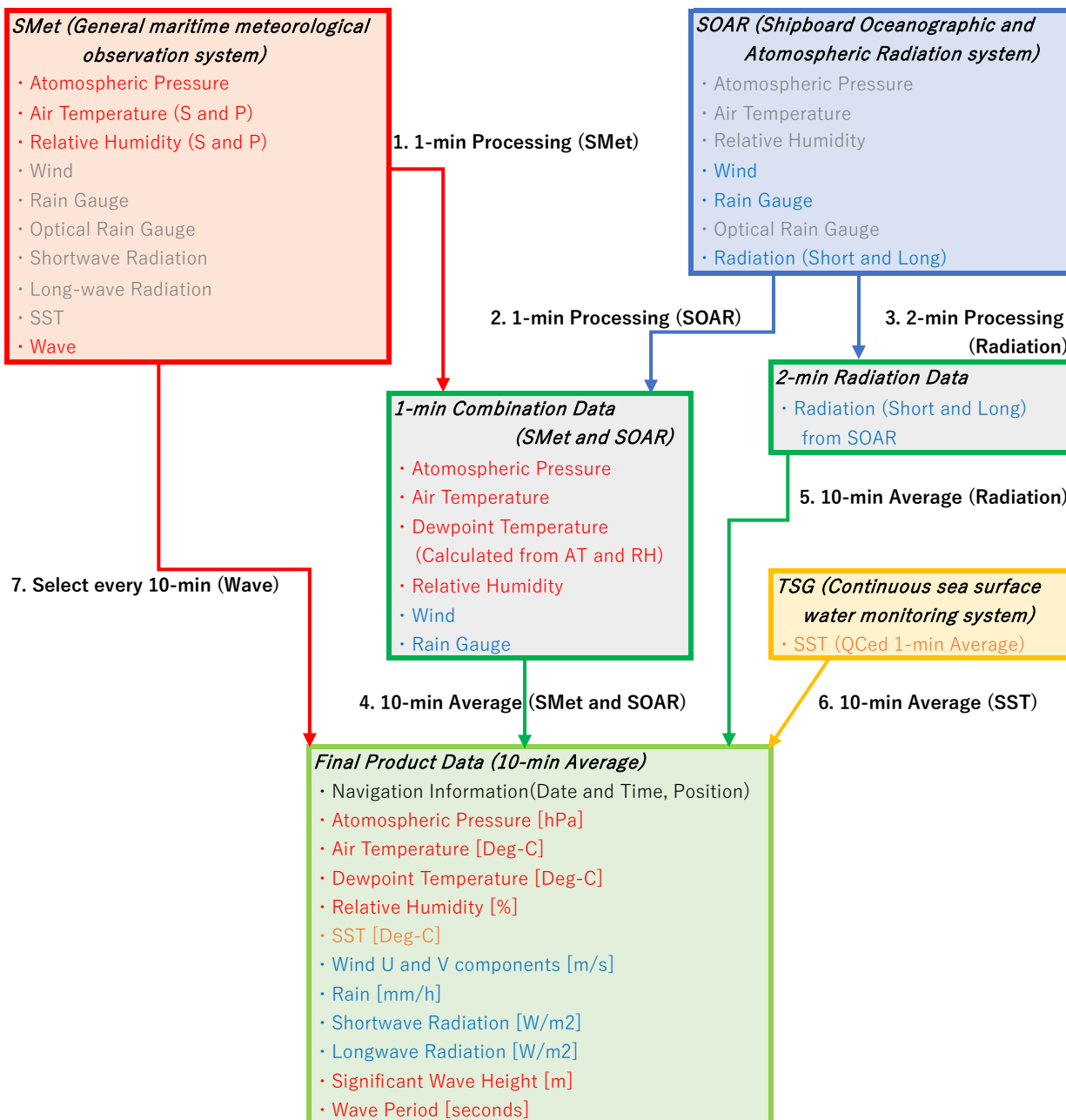
Note

- 1) During the cruise, precipitation value is using optical rain gauge data for snow.
- 2) Ventilation units (VU01) of short and long-wave radiometer are used in this cruise.
- 3) If you would like the raw data set, please contact DMO at "dmo@jamstec.go.jp".

Flow of Meteorological Data Processing

Mean durations are different in each parameters in primary processing. This is to give the most suitable processing for each physical quantity. Furthermore, 10-min averaged processing for time scale adjusting in each parameters and noises removing.

* Wind, rain, and radiation data from the SMet system are used before MR00-K06 cruise because the SOAR meteorological data are not collected.



1. 1-min Processing (SMet)

A) Data contained after processing

Date&Time (UTC), Julianday, Longitude (degE; 0 to 360), Latitude (degN; -90 to +90), Atmospheric pressure (hPa), Air temperature (deg-C), Dew-point temperature (deg-C), Relative Humidity(%), Sea surface temperature (deg-C), Wind velocity components U & V (m/s), An hour amount of Optical Rain Gauge (mm), Rainfall of Capacitance Rain Gauge (mm), Down welling Short wave radiation (W/m2), Down welling Long wave radiation (W/m2)

B) Averaging algorithm

One-minute mean data are produced from raw 6-second data. After maximum and minimum values are removed from each 1-minute data sets to remove noise data, 1-minute mean value is calculated as a simple average of the rest of data (usually 8 samples). Note that if the number of good data is less than 5, we considered them as missing value.

C) Definition of 1-minute mean value

One-minute mean value is defined as a average of past 1 minute from the time (i.e., time stamp at end of average).

D) Air temperature and Relative Humidity calculation

Air temperature and relative humidity sensors are equipped at both port/starboard sides on-board the R/V Mirai, and we adopt windward sensor data. To obtain consistent data sets for sensors of both sides, we compared data from both sides assuming that they agree well each other when the wind came from the bow side (within 15 degrees) and wind speed is faster than 2 m/sec. We set starboard side data as a reference and correct port side data using a linear regression method. This calculation requires data number with over half day or 20% of total data sets. We then evaluate their variance. Once we obtain 1-minute mean data for temperature and relative humidity, we calculated dew point temperature using them from a formula described in the Guide of WMO (WMO, 1996; Guide to meteorological instruments and methods of observations. WMO-No.8, 6th Edition.)

*1 The calculation mentioned above is applied to data after May 2003. For data before April 2003, relative humidity data is calculated from air temperature and dew point data using a formula of WMO-No.8, since air temperature and dew point sensors were equipped on the R/V Mirai before April 2003.

*2 When RH data shows the value in the range of 100-104%, we assume them as result of supersaturation and set them as 100%. As for data over 104%, we set as a missing value.

E) Rainfall data calculation

The Capacitance Rain Gauge (CRG) data were corrected using a result of manual calibration conducted before each cruise. In addition, when only CRG data shows a value (i.e., when Optical Rain Gauge does not detect rainfall), it is regarded as an error. All suspicious data are manually checked using other field records such as log book, ceilometer data, and so on.

F) Position data

Since the missing data for position are originally recorded as (0, 0), it causes an error of position when averaging. Those values are detected by checking the ship's speed limit, and then expressed as "9999".

2. 1-min Processing (SOAR)

A) Data contained after processing

Date&Time (UTC), Julianday, Longitude (degE; 0 to 360), Latitude (degN; -90 to +90), Atmospheric pressure (hPa), Air temperature (deg-C), Dew-point temperature (deg-C), Relative Humidity (%), Sea surface skin temperature (deg-C), Wind velocity components U & V (m/s), An hour amount of Optical Rain Gauge (mm), Rainfall of Capacitance Rain Gauge (mm), Down welling Short wave radiation (W/m²), Down welling Long wave radiation (W/m²)

* Sea surface skin temperature is effective for during "SeaSnake" observation.

B) Averaging algorithm

One-minute mean data are produced from raw 6 second data. After maximum and minimum values are removed from each 1-minute data sets to remove noise data, 1-minute mean value is calculated as a simple average of the rest of data (usually 8 samples). Note that if the number of good data is less than 5, we considered them as missing value.

C) Definition of 1-minute mean value

One-minute mean value is defined as a average of past 1 minute from the time (i.e., time stamp at end of average).

D) Air temperature and Relative Humidity calculation

An air temperature and a relative humidity sensor were installed at a fore mast on R/V MIRAI, and it is calculated based on average handling of B).

Once we obtain 1-minute mean data for temperature and relative humidity, we calculated dew point temperature using them from a formula described in the Guide of WMO (WMO, 1996; Guide to meteorological instruments and methods of observations. WMO-No.8, 6th Edition.)

When RH data shows the value in the range of 100-104%, we assume them as result of supersaturation and set them as 100%. As for data over 104%, we set as a missing value.

E) Rainfall data calculation

The Capacitance Rain Gauge (CRG) data were corrected using a result of manual calibration conducted before each cruise. In addition, when only CRG data shows a value (i.e., when Optical Rain Gauge does not detect rainfall), it is regarded as an error. All suspicious data are manually checked using other field records such as log book, ceilometer data, and so on.

F) Position data

Since the missing data for position are originally recorded as (0, 0), it causes an error of position when averaging. Those values are detected by checking the ship's speed limit, and then expressed as "9999".

3. 2-min Processing (Radiation)

A) Data contained after processing

Date&Time (UTC), Down welling Short wave radiation (W/m^2), Down welling Long wave radiation (W/m^2)

B) Definition of 2-minute mean

Time stamp of 2-minute mean value is defined as a average of past 2 minutes from the time. For example, data of 19:20 is the average between 19:18 - 19:20.

C) Remarks

Data logger (CR-1000) converts each voltage reading into radiation amount using calibration coefficients. All sensors are calibrated by manufacturer (Hukseflux, The Netherlands) or authorized distributor every year.

4. 10-min Average (SMet and SOAR)

A) Data contained after processing (10-minutes mean value produced from 1-minute mean data)

Date&Time (UTC), Julian day, Longitude (degE; 0 to 360), Latitude (degN; -90 to +90), Atmospheric pressure (hPa), Air temperature (deg-C), Dew-point temperature (deg-C), Relative Humidity (%), Sea surface temperature (deg-C), Wind velocity components U & V (m/s), An hour amount of Optical Rain Gauge (mm), Rainfall of Capacitance Rain Gauge (mm), Down welling Short wave radiation (W/m^2), Down welling Long wave radiation (W/m^2)

B) Averaging algorithm

Ten-minutes mean value is produced from 1-minute mean data as a simple average of 10 data, requiring minimum 5 samples. Since the procedure of creating 1-min (or 2-min) data sets for surface meteorological data, radiation, sea surface temperature, and wave height data, these data are finally combined after each 10-minutes data sets are produced.

C) Definition of 10-minutes mean value

Ten-minutes mean value is defined as a average of past 10 minutes from the time (i.e., time stamp at end of average).

D) Use sensors

Atmospheric pressure - Adopted SMet sensor which is relatively free from the influence of wind pressure.

Air temperature/Relative humidity - Adopted SMet sensors, since windward data is available.

Anemometer - Adopted SOAR sensor which has better minimum detectable wind speed.

Rain gauge - Adopted SOAR sensor which is free from the influence of obstacle (ex. mast).

Radiation - Adopted SOAR sensor whose accuracy is much better than that of SMet radiation sensor.

E) Remarks

It is subject to change the combination of used sensors due to mechanical troubles. It is highly recommended to read "Note" fine for each cruise.

5. 10-min Average (Radiation)

A) Data contained after processing (Averaging for 10-minutes data set from 2-minutes average data)
Date&Time (UTC), Down welling Short wave radiation (W/m^2), Down welling Long wave radiation (W/m^2)

B) Averaging algorithm

For the unusual value removal, it makes 10-minutes average data from 2-minutes average data. Data Processing are different for each data (Meteorological, Radiation, SST, Wave) which be combined finally. Therefore it makes 10-minutes average data and each data were combine at the time, after the processing by suitable time (1 minute or 2 minutes) for each data.

C) Define as 10 minutes averaging

example, a data of 19:20 shows the average from 19:10 to 19:20.

6. 10-min Average (SST)

A) Data contained after processing (Averaging for 10-minutes data set from every 1-minute data that quality checked)
Date&Time (UTC), Sea surface temperature (deg-C)

B) Averaging algorithm

It makes 10-minutes average data from every 1-minute data. Every 1-minute data that quality checked was used. You can obtain every 1-minute data from "TSG".

C) Define as 10-minutes averaging

example, a data of 19:20 shows the average of 10 samples (usually) 19:11:00, 19:12:00, , 19:20:00. Note that if the number of good data is less than 5, we considered them as missing value.

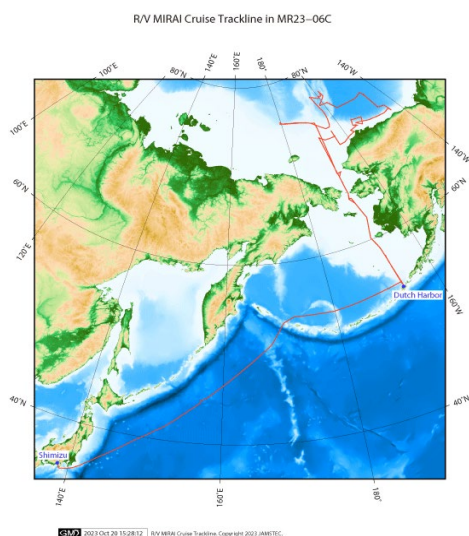
7. Select every 10-min (Wave)

A) Information of Data (Processing of every 10-minutes wave data from every 6 seconds original raw data)
Date&Time (UTC), Wave Height (m), Wave period (sec.)

B) Algorithm

Wave height is significant wave height was measured by the every one hour. The significant wave height is calculated by the wave was measured for during 20 minutes from every 35 minutes to 55 minutes per hour. The significant wave height was picked up from original Smet data and example, a data of 19:10, 19:20, 19:30, 19:40, 19:50, and 20:00 shows the significant wave height measured from 19:35 to 19:55.

Related Information



MR23-06C

Ship Name: MIRAI
Period: 2023/08/25 - 2023/10/04
Chief Scientist: Amane Fujiwara (JAMSTEC)
Proposal: Arctic Expedition for Environmental Studies

Observational study of the Arctic environmental changes: Pacific-Arctic interaction, biogeochemical transport, mixing and marine ecosystem

Quantification of the microplastic inventory in the waters of the western Arctic Ocean and microplastic influx from the Pacific Ocean

Changes in clouds and aerosols over the ice-free Arctic Ocean

Possibility of the expanding distribution in plankton and fishes associated with sea ice reduction in the Pacific sector of the Arctic Ocean

Observation of air-sea-wave-ice interaction over the Pacific Arctic region

Investigating the physical and ecophysiological basis of fall phytoplankton blooms in the Chukchi and Beaufort seas

Nitrogen Fixation in a Changing Arctic Ocean An Overlooked Source of Nitrogen

Exploring microplankton interactions and their functional roles in a changing Arctic

Determining the contribution of siphonophores to mesopelagic backscatter in the Arctic

Better understanding of climate-driven changes of biogeochemical dynamics in the western Arctic Ocean via R/V Mirai 2023 Cruise A perspective of stable carbon isotope

Temporal variations of the carbonate chemical components the Arctic Ocean within summertime

Observation of water vapor isotopic ratios

Observation of atmospheric greenhouse gases and related species in the North Pacific region

Format Description for Meteorology Corrected

Single space separated.

No.	Column	Content	Format (nodata or baddata)	Unit	Remarks
1	1-12	Date and time [YYYYMMDDhhmm]	i4,i2,i2,i2		Every 10 minutes*
2	14-21	Julian day [DDD.DDDD]	f8.4		Every 10 minutes*
3	23-29	Longitude [0 to 360]	f7.3 (999.999)	degree	Location at time stamp East longitude
4	31-37	Latitude [-90 to 90]	f7.3 (999.999)	degree	Location at time stamp +: North latitude -: South latitude
5	39-44	Atmospheric pressure	f6.1 (9999.9)	hPa	10-minute mean*
6	46-50	Air temperature	f5.1 (999.9)	deg-C	10-minute mean* Data is selected on the windward side
7	52-56	Dewpoint temperature	f5.1 (999.9)	deg-C	10-minute mean* Calculated from 'Air temperature' and 'Relative humidity' using WMO's Formula** for liquid water
8	58-62	Relative humidity	f5.1 (999.9)	%	10-minute mean* Data is selected on the windward side
9	64-70	Sea surface temperature (SST)	f7.4 (99.9999)	deg-C	10-minute mean* From TSG
10	72-76	Wind speed (zonal)	f5.1 (999.9)	m/sec	10-minute mean* No anemometer height adjustment
11	78-82	Wind speed (meridional)	f5.1 (999.9)	m/sec	10-minute mean* No anemometer height adjustment
12	84-89	Rainfall intensity	f6.2 (999.99)	mm/hr	10-minute mean*
13	91-96	Short wave radiation	f6.1 (9999.9)	W/m2	10-minute mean*
14	98-102	Long wave radiation	f5.1 (999.9)	W/m2	10-minute mean*
15	104-108	Significant wave height	f5.2 (99.99)	m	Calculated every an hour Calculated every 3 hours, before March 2003
16	110-114	Wave period	f5.2 (99.99)	second	Calculated every an hour Calculated every 3 hours, before March 2003

* Time stamp is set at the end of average

** WMO-No.8 (Guide to Meteorological Instruments and Methods of Observation)