2.3. Surface Meteorological Observation

(1) Personnel

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(2) Objectives

Surface meteorological parameters are observed as a basic dataset of the meteorology. These parameters bring us the information about the temporal variation of the meteorological condition surrounding the ship.

(3) Methods

Surface meteorological parameters were observed throughout the MR10-05 cruise. During this cruise, we used three systems for the observation.

i) MIRAI Surface Meteorological observation (SMet) system
ii) Shipboard Oceanographic and Atmospheric Radiation (SOAR) system

i) MIRAI Surface Meteorological observation (SMet) system

Instruments of SMet system are listed in Table.2.3-1 and measured parameters are listed in Table.2.3-2. Data were collected and processed by KOAC-7800 weather data processor made by Koshin-Denki, Japan. The data set consists of 6-second averaged data.

ii) Shipboard Oceanographic and Atmospheric Radiation (SOAR) measurement system

SOAR system designed by BNL (Brookhaven National Laboratory, USA) consists of major three parts.

a) Portable Radiation Package (PRP) designed by BNL - short and long wave downward radiation.
b) Zeno Meteorological (Zeno/Met) system designed by BNL - wind, air temperature, relative humidity, pressure, and rainfall measurement.
c) Scientific Computer System (SCS) developed by NOAA (National Oceanic and Atmospheric Administration, USA) - centralized data acquisition and logging of all data sets.

SCS recorded PRP data every 6 seconds, while Zeno/Met data every 10 seconds. Instruments and their locations are listed in Table.2.3-3 and measured parameters are listed in Table.2.3-4.

For the quality control as post processing, we checked the following sensors, before and after the cruise.

i) Young Rain gauge (SMet and SOAR)

Inspect of the linearity of output value from the rain gauge sensor to change Input value by adding fixed quantity of test water.

ii) Barometer (SMet and SOAR)
Comparison with the portable barometer value, PTB220CASE, VAISALA.

iii) Thermometer (air temperature and relative humidity) (SMet and SOAR)
Comparison with the portable thermometer value, HMP41/45, VAISALA.

(4) Preliminary results

Figure 2.3-1 shows the time series of the following parameters;
Wind (SMet)
Air temperature (SMet)
Sea surface temperature (SMet)
Relative humidity (SMet)
Precipitation (SOAR, Optical rain gauge)
Short/long wave radiation (SOAR)
Pressure (SMet)
Significant wave height (SMet)

(5) Data archives

These meteorological data will be submitted to the Data Integration and Analysis Group (DIAG) of JAMSTEC just after the cruise.

(6) Remarks

i) SST (Sea Surface Temperature) data was available in the following periods.
07:36UTC 25 Aug. 2010 - 16:27UTC 01 Sep. 2010
18:43UTC 02 Sep. 2010 - 23:30UTC 15 Oct. 2010

ii) In the following period, SOAR true wind speed, true wind direction, gyro and LOG were invalid because they were not updated due to the network server trouble.
21:36UTC 30 Aug. 2010 - 22:14UTC 30 Aug. 2010

iii) In the following period, FRSR data acquisition was suspended to prevent damage to the shadow-band from freezing.
05:53UTC 16 Sep. 2010 - 01:22UTC 13 Oct 2010

iv) In the following period, SMet and SOAR anemometer were frozen. Wind speed and direction not available.
15 Sep. 2010 - 17 Sep 2010

v) In the following time, SMet rain gauge amount values were increased because of test transmitting for MF/HF radio.
10:24, 10:29, 23:12UTC 28 Aug. 2010
03:36, 03:39UTC 05 Sep. 2010
14:50UTC 13 Sep. 2010
15:05UTC 21 Sep. 2010

vi) During the cruise, T/RH sensor was not in good condition. We replaced the T/RH sensor at 19:03UTC 10 Sep., due to the sensor trouble. Before changing the sensor, temperature was about -3 degrees lower than one of SMet, relative humidity was almost same as one of SMet. After changing the sensor, temperature had been about -0.3 degrees lower than one of SMet, relative humidity had been about -6% lower than one of SMet.

vii) During the cruise, anemometer was not in good condition. Relative wind direction was about +7 degrees larger than one of SMet.

viii) The following period, data was not available.
06:54UTC - 07:14UTC 12 Oct. 2010

Table.2.3-1
Instruments and installations of MIRAI Surface Meteorological observation system

Sensors	Type	Manufacturer	Location (altitude from surface)
Anemometer	KE-500	Koshin Denki, Japan	foremast (24 m)
Tair/RH	HMP45A	Vaisala, Finland	
with 43408 Gill aspirated radiation shield		R.M. Young, USA	compass deck (21 m)
			starboard side and port side
Thermometer: SST	RFN1-0	Koshin Denki, Japan	4th deck (-1m, inlet -5m)
Barometer	Model-370	Setra System, USA	captain deck (13 m)
			weather observation room
Rain gauge	50202	R. M. Young, USA	compass deck (19 m)
Optical rain gauge	ORG-815DR	Osi, USA	compass deck (19 m)
Radiometer (short wave)	MS-801	Eiko Seiki, Japan	radar mast (28 m)
Radiometer (long wave)	MS-200	Eiko Seiki, Japan	radar mast (28 m)
Wave height meter	MW-2	Tsurumi-seiki, Japan	bow (10 m)

Table.2.3-2
Parameters of MIRAI Surface Meteorological observation system

Parameter	Units	Remarks
1 Latitude	degree	
2 Longitude	degree	
3 Ship's speed	knot	Ship log, DS-30 Furuno
4 Ship's heading	degree	Ship gyro, TG-6000, Tokimec
5 Relative wind speed	m/s	6sec./10min. averaged
6 Relative wind direction	degree	6sec./10min. averaged
7 True wind speed	m/s	6sec./10min. averaged
8 True wind direction	degree	6sec./10min. averaged
9 Barometric pressure	hPa	adjusted to sea surface level
		6sec. averaged
10 Air temperature (starboard side)	degC	6sec. averaged
11 Air temperature (port side)	degC	6sec. averaged
12 Dewpoint temperature (starboard side)	degC	6sec. averaged
13 Dewpoint temperature (port side)	degC	6sec. averaged
14 Relative humidity (starboard side)	%	6sec. averaged
15 Relative humidity (port side)	%	6sec. averaged
16 Sea surface temperature	degC	6sec. averaged
17 Rain rate (optical rain gauge)	mm/hr	hourly accumulation
18 Rain rate (capacitive rain gauge)	mm/hr	hourly accumulation
19 Down welling shortwave radiation	W/m^2	6sec. averaged
20 Down welling infra-red radiation	W/m^2	6sec. averaged
21 Significant wave height (bow)	m	hourly
22 Significant wave height (aft)	m	hourly
23 Significant wave period (bow)	second	hourly
24 Significant wave period (aft)	second	hourly

Table.2.3-3
Instruments and installation locations of SOAR system

Sensors (Zeno/Met)	Type	Manufacturer	Location (altitude from surface)
Anemometer	05106	R.M. Young, USA	foremast (26 m)
Tair/RH	HMP45A	Vaisala, Finland	
with 43408 Gill aspirated radiation shield		R.M. Young, USA	foremast (23 m)
Barometer	61202V	R.M. Young, USA	
with 61002 Gill pressure port		R.M. Young, USA	foremast (23 m)
Rain gauge	50202	R.M. Young, USA	foremast (25 m)
Optical rain gauge	ORG-815DA	Osi, USA	foremast (25 m)

Sensors (PRP)	Type	Manufacturer	Location (altitude from surface)
Radiometer (short wave)	PSP	Epply Labs, USA	foremast (25 m)
Radiometer (long wave)	PIR	Epply Labs, USA	foremast (25 m)
Fast rotating shadowband radiometer		Yankee, USA	foremast (25 m)

Table.2.3-4 Parameters of SOAR system

Parameter	Units	Remarks
1 Latitude	degree	
2 Longitude	degree	
3 SOG	knot	
4 COG	degree	
5 Relative wind speed	m/s	
6 Relative wind direction	degree	
7 Barometric pressure	hPa	
8 Air temperature	degC	
9 Relative humidity	%	
10 Rain rate (optical rain gauge)	mm/hr	
11 Precipitation (capacitive rain gauge)	mm	reset at 50 mm
12 Down welling shortwave radiation	W/m^2	
13 Down welling infra-red radiation	W/m^2	
14 Defuse irradiance	W/m^2	