

2007 SMILE Winter Activity  
Buoy Data

## Buoy Data Information

### Measurement Descriptions and Units

Note: Station pages display the current hour's measurements in English units by default, but can be changed by the viewer to metric units. When accessing Real Time and Historical data files, the measurements are generally in metric units, as described below, and cannot be changed.

STATION ID	Five-digit WMO Station Identifier used since 1976. ID's can be reassigned to future deployments within the same 1 degree square.
DATE	In UTC (formerly called Greenwich Mean Time - GMT)
TIME	In UTC for data files/display. Station pages show current observations in station local time by default, but can be changed by the viewer to UTC. See the Acquisition Time help topic for a more detailed description of observation times.

Data are classified according to the following groups. Any data field that contains "9 filled" represents missing data for that observation hour. (Example: 999.0 99.0)

### Standard Meteorological Data

ATMP	Air temperature (Celsius). For sensor heights on buoys, see Hull Descriptions. For sensor heights at C-MAN stations, see C-MAN Sensor Locations
WTMP	Sea surface temperature (Celsius). For sensor depth, see Hull Description.
DEWP	Dewpoint temperature taken at the same height as the air temperature measurement.
PRES	Sea level pressure (hPa). For C-MAN sites and Great Lakes buoys, the recorded pressure is reduced to sea level using the method described in NWS Technical Procedures Bulletin 291 (11/14/80).
WSPD	Wind speed (m/s) averaged over an eight-minute period for buoys and a two-minute period for land stations. Reported Hourly. See Wind Averaging Methods.
WDIR	Wind direction (the direction the wind is coming from in degrees clockwise from true N) during the same period used for WSPD. See Wind Averaging Methods
GST	Peak 5 or 8 second gust speed (m/s) measured during the eight-minute or two-minute period. The 5 or 8 second period can be determined by payload, See the Sensor Reporting, Sampling, and Accuracy section.
WVHT	Significant wave height (meters) is calculated as the average of the highest one-third of all of the wave heights during the 20-minute sampling period. See the Wave Measurements section.
APD	Average wave period (seconds) of all waves during the 20-minute period. See the Wave Measurements section.
DPD	Dominant wave period (seconds) is the period with the maximum wave energy. See the Wave Measurements section.
MWD	Mean wave direction corresponding to energy of the dominant period (DOMPD). The units are degrees from true North just like wind direction. See the Wave Measurements section.
VIS	Station visibility (statute miles). Note that buoy stations are limited to reports from 0 to 1.9 miles.
PTDY	Pressure Tendency is the direction (plus or minus) and the amount of pressure change (hPa) for a three hour period ending at the time of observation.
TIDE	The water level in feet above or below Mean Lower Low Water (MLLW).

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**Derived Met Values**

- HEAT For more information on heat index, please see the NWS Heat Wave page.
- CHILL Please note that NDBC uses unadjusted winds to calculate wind chill. The winds are calculated at anemometer height. For more information on wind chill, please see the NWS Wind Chill Temperature Index.
- ICE Estimated ice accretion in inches per hour based on an algorithm developed by Overland and Pease at the Pacific Marine Environmental Laboratory in the mid-1980s. The algorithm relates icing to the presently observed wind speed, air temperature, and sea surface temperature. The method is designed for trawlers in the 20 to 75 meter length range, underway at normal speeds in open seas and not heading downwind. In general, NWS forecasters translate ice accretion rates to the following categories:  
light: 0.0 to 0.24 inches of ice accretion/hour;  
moderate: 0.25 to 0.8 inches/hour; and  
heavy: greater than 0.8 inches/hour.

**Detailed Wave Summary**

- H0 Significant Wave Height is the average height (meters) of the highest one-third of the waves during a 20 minute sampling period.
- SWH Swell height is the vertical distance (meters) between any swell crest and the succeeding swell wave trough.
- SWP Swell Period is the time (usually measured in seconds) that it takes successive swell wave crests or troughs pass a fixed point.
- SWD Swell Direction is the compass direction from which the swell wave are coming from.
- WWH Wind Wave Height is the vertical distance (meters) between any wind wave crest and the succeeding wind wave trough (independent of swell waves).
- WWP Wind Wave Period is the time (in seconds) that it takes successive wind wave crests or troughs to pass a fixed point.
- WWD Wind Wave Direction is the compass direction (degrees) from which the wind waves are coming.
- Steepness Wave steepness is the ratio of wave height to wave length and is an indicator of wave stability. When wave steepness exceeds a 1/7 ratio; the wave becomes unstable and begins to break.
- AVP Average Wave Period is the average period (seconds) of the highest one-third of the wave observed during a 20 minute sampling period.
- MWD Mean wave direction corresponding to energy of the dominant period (DOMPD). The units are degrees from true North just like wind direction. See the Wave Measurements section.

**Ocean Current Data**

- DEP01,DEP02,... The distance from the sea surface to the middle of the depth cells, or bins, measured in meters.
- DIR01,DIR02,... The direction the ocean current is flowing toward. 0-360 degrees, 360 is due north, 0 means no measurable current.
- SPD01,SPD02,... The speed of the ocean current measured in cm/s.

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**Ocean Current Data (Expanded ADCP format)**

Instrument Number	Stations may have more than one ADCP instrument. This field distinguishes these instruments by number. Valid values are 0-9, with 0 being reserved for surface measurements.
Bin	The bin number, ranging from 0 to 128, where 0 is the bin closest to the transducer head.
Depth	The distance from the sea surface to the middle of the depth cells, or bins, measured in meters.
Dir	The direction the ocean current is flowing toward. 0-360 degrees, 360 is due north, 0 means no measurable current.
Speed	The speed of the ocean current measured in cm/s.
ErrVl	The error velocity measured in cm/s.
VerVl	The vertical velocity of the ocean current measured in cm/s.
%Good3	The percentage of three-beam solutions that are good.
%Good4	The percentage of four-beam solutions that are good.
%GoodE	The percentage of transformations rejected.
EI1,EI2,EI3,EI4	The echo intensity values for the four beams. Valid values are 0 to 255. EI1 = Echo Intensity for beam #1; EI2 = Echo Intensity for beam #1; EI3 = Echo Intensity for beam #3; and EI4 = Echo Intensity for beam #4.
CM1,CM2,CM3,CM4	The correlation magnitude values for the four beams. Valid values are 0 to 255. CM1 = Correlation Magnitude for beam #1; CM2 = Correlation Magnitude for beam #1; CM3 = Correlation Magnitude for beam #3; and CM4 = Correlation Magnitude for beam #4.
Flags	The nine quality flags represent the results of the following quality tests based on their position in the flags field. Flag 1 represents the overall bin status. Flag 2 represents the ADCP Built-In Test (BIT) status. Flag 3 represents the Error Velocity test status. Flag 4 represents the Percent Good test status. Flag 5 represents the Correlation Magnitude test status. Flag 6 represents the Vertical Velocity test status. Flag 7 represents the North Horizontal Velocity test status. Flag 8 represents the East Horizontal Velocity test status. Flag 9 represents the Echo Intensity test status. Valid values are: 0 = quality not evaluated; 1 = failed quality test; 2 = questionable or suspect data; 3 = good data/passed quality test; and 9 = missing data.

**Continuous Winds**

DIR	Ten-minute average wind direction measurements in degrees clockwise from true North.
SPD	Ten-minute average wind speed values in m/s.
GDR	Direction, in degrees clockwise from true North, of the GSP, reported at the last hourly 10-minute segment.
GSP	Maximum 5-second peak gust during the measurement hour, reported at the last hourly 10-minute

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segment.

GMN The minute of the hour that the GSP occurred, reported at the last hourly 10-minute segment. For more information on continuous winds and the timing of these measurements, see the continuous winds help section.

**Spectral Wave Data**

Spectral wave density Energy in (meter\*meter)/Hz, for each frequency bin (typically from 0.03 Hz to 0.40 Hz).

Spectral wave direction Mean wave direction, in degrees from true North, for each frequency bin. A list of directional stations is available.

Directional Wave Spectrum =  $C11(f) * D(f,A)$ ,  $f$ =frequency (Hz),  $A$ =Azimuth angle measured clockwise from true North to the direction wave is from.  
 $D(f,A) = (1/PI)*(0.5+R1*COS(A-ALPHA1)+R2*COS(2*(A-ALPHA2)))$ .  $R1$  and  $R2$  are the first and second normalized polar coordinates of the Fourier coefficients and are nondimensional.  $ALPHA1$  and  $ALPHA2$  are respectively mean and principal wave directions.

In terms of Longuet-Higgins Fourier Coefficients  
 $R1 = (SQRT(a1*a1+b1*b1))/a0$   
 $R2 = (SQRT(a2*a2+b2*b2))/a0$   
 $ALPHA1 = 270.0-ARCTAN(b1,a1)$   
 $ALPHA2 = 270.0-(0.5*ARCTAN(b2,a2)+\{0. \text{ or } 180.\})$

Note! The  $R1$  and  $R2$  values in the monthly and yearly historical data files are scaled by 100, a carryover from how the data are transported to the archive centers. The units are hundredths, so the  $R1$  and  $R2$  values in those files should be multiplied by 0.01.

For more information on the mathematics behind the measuring of surface water waves, see the waves help section.

**Water Level**

TG01, TG02,...,TG10 Six-minute water levels representing the height, in feet, of the water above or below Mean Lower Low Water (MLLW), offset by 10 ft. to prevent negative values. Please subtract 10 ft. from every value to obtain the true water level value, in reference to MLLW.

**Marsh-McBirney Current Measurements**

DIR Direction the current is flowing TOWARDS, measured in degrees clockwise from North.  
SPD Current speed in cm/s.

**Oceanographic Data**

Depth (DEPTH) Depth (meters) at which measurements are taken.  
Ocean Temperature (OTMP) The direct measurement (Celsius) of the Ocean Temperature (as opposed to the indirect measurement (see WTMP above)).  
Conductivity (COND) Conductivity is a measure of the electrical conductivity properties of seawater in milliSiemens per centimeter.

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Salinity (SAL)	Salinity is computed by a known functional relationship between the measured electrical conductivity of seawater (CON), temperature (OTMP) and pressure. Salinity is computed using the Practical Salinity Scale of 1978 (PSS78) and reported in Practical Salinity Units.
Oxygen Concentration (O2%)	Dissolved oxygen as a percentage.
Oxygen Concentration (O2PPM)	Dissolved oxygen in parts per million.
Chlorophyll Concentration (CLCON)	Chlorophyll concentration in micrograms per liter (ug/l).
Turbidity (TURB)	Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample (APHA 1980). Units are Formazine Turbidity Units (FTU).
pH (PH)	A measure of the acidity or alkalinity of the seawater.
Eh (EH)	Redox (oxidation and reduction) potential of seawater in millivolts.

**Solar Radiation Data**

Shortwave Radiation (SRAD)	Average shortwave radiation in watts per square meter for the preceding hour. Sample frequency is 2 times per second (2 Hz). If present, SRAD1 is from a LI-COR LI-200 pyranometer sensor, and SRAD2 is from an Eppley PSP Precision Spectral Pyranometer.
Longwave Radiation (LRAD)	Average downwelling longwave radiation in watts per square meter for the preceding hour. Sample frequency is 2 times per second (2 Hz). If present, LRAD1 is from an Eppley PIR Precision Infrared Radiometer.

**Supplemental Measurements Data**

Lowest 1 minute pressure	Lowest recorded atmospheric pressure for the hour to the nearest 0.1 hPa and the time at which it occurred (hour and minute).
Highest 1 minute wind speed	Highest recorded wind speed for the hour to the nearest 0.1 m/s, its corresponding direction to the nearest degree, and the time at which it occurred (hour and minute).

**DART Measurements**

T (TYPE)	Measurement Type: 1 = 15 minute measurement; 2 = 1 minute measurement; and 3 = 15 second measurement.
HEIGHT	Height of water column in meters.

**24-Hour Rain Measurements**

24-Hour Rain Rate	Average precipitation rate in units of millimeters per hour over 24-hour period from 00:00 to 23:59.99 GMT.
24-Hour Rain Accumulation	Total accumulation of precipitation in units of millimeters on station over 24-period from 00:00 to

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23:59.99 GMT.

Percent Time Raining in 24-Hour Period	Percentage of 144 ten-minute periods within a 24 hour period with a measurable accumulation of precipitation.
Flag	In the case of 24-hour rainfall measurements, a flag is assigned when over half of the 10-minute measurements from which it is derived are flagged.

**Hourly Rain Measurements**

Hourly Rain Accumulation	Total accumulation of precipitation in units of millimeters on station during the 60-minute period from minute 0 to minute 59:59.99 of the hour.
Flag	In the case of one-hour accumulation, a flag is assigned when over half of the 10-minute measurements from which it is derived have been flagged.

**10-Minute Rain Measurements**

10-Minute Rain Rate	Rain rate in units of millimeters per hour on station over the 10-minute period from 5 minutes before to 4 minutes 59.99 seconds after the time with which it is associated.
Flag	In the case of 10-minute rainfall measurements, a flag is assigned to any measurement when either the -5 or +5 minute rain measurement from which it is derived is missing or obviously an error.