HAKUHO MARU **KH-20-J01** **Expendable Bathythermograph (XBT) Fall-rate bias corrected**

Last Modified: 2022/6/23

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 level Processed (DMO)-QCed

Instrument

Expendable bathythermograph (XBT)

Overview

Using XBT (eXpendable Bathy Thermograph) system, the vertical distribution of water temperature is observed during free fall of its probe part in the seawater.
On board, the analogue signal is converted to the temperature by data processor and the data is stored in PC.
Depth data is calculated from the elapsed time.

Correction method

Fall-rate bias corrected data using new coefficients of Kizu et al. (2005) for all TSK T-5 probes.

[Reference]
Kizu et al. (2005): A New Fall-Rate Equation for T-5 Expendable Bathythermograph (XBT) by TSK. Journal of Oceanography, Vol. 61, pp. 115 to 121

Measurement System

1) Launcher

Manufacturer : Tsurumi Seiki Co., LTD.
Type : Hand launcher
Operation area : Rear 2 Deck

2) Converter

Manufacturer : Tsurumi Seiki Co., LTD.
Type : See `Use probes'
Sampling rate : 50 msec
Location : No.3 Laboratory

3) XBT probe specifications

Probe Type	**TSK T-5**	**TSK T-6**	**TSK T-7**	**TSK T-10**
Range	-2 to 35 [deg-C]			
Accuracy	+/- 0.2 [deg-C]			
Resolution	0.01 [deg-C]			
Mesurement depth	1830 [m]	460 [m]	760 [m]	300 [m]
Depth accuracy	5 or +/- 2% of depth; whichever is larger [m]			
Maximum elapsed time	291 [sec]	73 [sec]	123 [sec]	48 [sec]
Rated ship speed	6 [knot]	15 [knot]	15 [knot]	10 [knot]

Since XBT carries no pressure sensor, we need to estimate depth from the elapsed time. The fall-rate equation is as follows.

$Z = at + 10E^{-3} * bt^2$

Where Z(m) is the depth and t(sec) is the elapsed time.
In addition, coefficients of the fall-rate equation are different by probe types.

The depth was recalculated using the new coefficients after converting the original depth determined by the manufacturer's coefficients to elapsed time.

Probe Type	**TSK T-5 (New Coefficients by Kizu et al.)**	**TSK T-5 (Manufacturer's Coefficients)**
Coefficient-a	6.54071	6.828

Coefficient-b	-1.8691	-1.82

Use probes

The list of a XBT type used in each cast is as follows.

Cast name	Probe Serial No.	Probe Type	Launcher	Converter
XB000_20200617p	-	T-5	Hand	MK-130
XB001_20200618p	-	T-5	Hand	MK-130
XB002_20200619p	-	T-5	Hand	MK-130

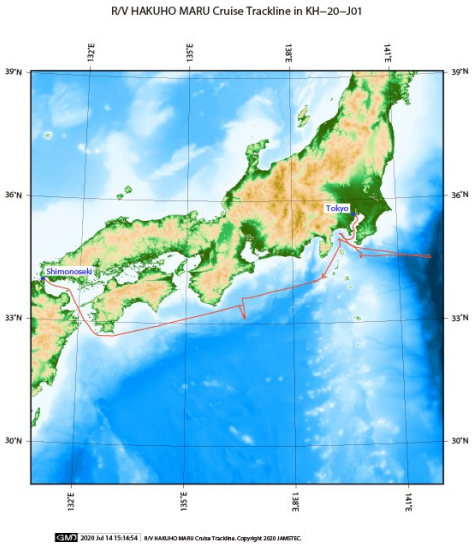
Data processing

1) For sensor's stability, values of less than 1 m for temperature are replaced by missing values, respectively, based on manufacturer's recommendation.
2) Quality control
   QCed data were added flag according to the NODC (National Oceanographic Data Center) quality control procedure.
   i. The gradient check of adjacent depth data
   ii. The broad range check set up at given ocean space and depth
   Please see the paper for quality control procedure in detail.
   Quality control and processing of historical oceanographic temperature, salinity, and oxygen data.
   P. Boyer and Levitus, 1994. NOAA technical report NESDIS ; 81
   * https://repository.library.noaa.gov/view/noaa/13443
   In addition, an abnormal value is identified by a visual check, and the data after visual QC is released.

Note

1) If you would like the raw data set, please contact DMO at "dmo@jamstec.go.jp".

Related Information



KH-20-J01

Ship Name:	HAKUHO MARU
Period:	2020/06/17 - 2020/06/22
Chief Scientist:	Takatoshi Yamamura (JAMSTEC)
Proposal:	R/V Hakuho-maru Engineering cruise

Format Description for XBT DMO

Each data file contains one line header (meta data) followed by data lines for each cast.
The number of data lines are recorded in the header.

Header part

No.	Column	Content	Format	Remarks
1	1	Header ID	a1	fixed as '#'
2	3 - 6	Data ID	a4	XBT
3	8 - 22	Cruise ID	a15	
4	33 - 40	Date	i8	YYYYMMDD (UTC)
5	42 - 45	Time	i4	hhmm (UTC)
6	47 - 55	Latitude	i2,a1,f5.2,a1	dd-mm.mmN(S)
7	57 - 66	Longitude	i3,a1,f5.2,a1	ddd-mm.mmE(W)
8	68 - 71	Number of data lines	i4	
9	72 - 73	Terminator	a2	[CR][LF]

Data part

No.	Column	Content	Format	Unit	Remarks
1	1 - 11	Depth	f11.1	m	
2	12 - 22	Temperature	f11.2	deg-C	ITS-90
3	45 - 55	Quality contral flag	i11		45 - 51 : space 52 : flag of depth 53 : flag of temperature 54 - 55 : space
4	56 - 57	Terminator	a2		[CR][LF]

Each contents of the data part is stored in 11 bytes.
Missing value is presented by '-5', and error value is presented by '-9'.

Definition of Quality Control Flags

1) Depth Flags
   - 0 - accepted value
   - 1 - error in recorded depth (same or less than previous depth)
   - 2 - density inversion

2) Observed Level Flags
   - N - missing value
   - 0 - accepted value
   - 1 - range outlier (outside of broad range check)
   - 2 - failed inversion check
   - 3 - failed gradient check
   - 4 - zero anomaly
   - 5 - failed combined gradient and inversion checks
   - 6 - failed range and inversion checks
   - 7 - failed range and gradient checks
   - 8 - failed range and zero anomaly checks
   - 9 - failed range and combined gradient and inversion checks
   - A - failed visual check

* Range and gradient check is performed to XBT data.