

# **COADS Bridge Data Quality Control Report**

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### *Introduction:*

The data referenced in this report are bridge observations obtained from the Comprehensive Ocean Atmosphere Data Set (COADS) (Slutz et. al.). The data originated on research vessels Takuyo (identifier: 7JWN), Hudson (identifier: CGDG), Sonne (identifier: DFCG), Le Noroit (identifier: FITA), Charles Darwin (identifier: GDLS), Chofu Maru (identifier: JCCX), Shumpu Maru (identifier: JFDG), Kaiyo (identifier: JRPG), T. Washington (identifier: KGWU), Tyro (identifier: PIBQ), Akademik A. Nesmeyanov (identifier: UBYK), Akademik Lavrentyev (identifier: UJFY), Franklin (identifier: VJFF), New Horizon (identifier: WKWB), Discoverer (identifier: WTEA), Vickers (identifier: WTEC), Malcom Baldrige (identifier: WTER), Oceanus (identifier: WXAQ), James Clarke Ross (identifier: ZDLP), and Agulhas (identifier: ZSAF). The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by and were converted to standard DAC netCDF format. The data were then processed using an automated screening program, which adds quality control flags to the data, highlighting potential problems. Finally, the Data Quality Evaluator (DQE) reviewed the data and current flags, whereby flags were added, removed, or modified according to the judgement of the DQE and other DAC personnel. Details of the WOCE quality control procedures can be found in Smith et al. (1996). The data quality control report summarizes the flags for the Comprehensive Ocean Atmospheric Data Set, including those added by both the preprocessor and the DQE.

### *Statistical Information:*

The Comprehensive Ocean Atmospheric Data Set is expected to include observations taken at irregular time intervals on all 71 WOCE cruises. Values for the following variables were collected, although some variables were not measured on different research vessels and cruises:

|                               |      |
|-------------------------------|------|
| Time                          | TIME |
| Latitude                      | LAT  |
| Longitude                     | LON  |
| Earth Relative Wind Direction | DIR  |
| Earth Relative Wind Speed     | SPD  |
| Atmospheric Pressure          | P    |
| Air Temperature               | T    |
| Sea Temperature               | TS   |
| Dewpoint Temperature          | TD   |
| Wet Bulb Temperature          | TW   |
| Present Weather               | WX   |
| Total Cloud Amount            | TCA  |
| Low/Middle Cloud Amount       | LMCA |
| Cloud Base Height             | ZCL  |
| Low Cloud Type                | LCT  |
| Middle Cloud Type             | MCT  |
| High Cloud Type               | HCT  |

Sixteen of the 71 WOCE cruises were missing one or more of the variables listed above. These missing variables are listed by ship and cruise in Table 1.

**Table 1: Missing Variables**

| <b>RV/CTC</b>                              | <b>TD</b> | <b>TW</b> | <b>WX</b> | <b>LMCA</b> | <b>ZCL</b> | <b>LCT</b> | <b>MCT</b> | <b>HCT</b> |
|--|-----------|-----------|-----------|-------------|------------|------------|------------|------------|
| <b>CGDG</b>                                |           |           |           |             |            |            |            |            |
| AR_05_/01;A_04_/01;<br>AR_20C/01;AR_22_/01 |           | <b>X</b>  |           |             |            |            |            |            |
| AR_07W/02                                  |           | <b>X</b>  |           |             |            |            |            |            |
| AR_07W/03                                  |           | <b>X</b>  |           |             |            |            |            |            |
| AR_13_/05                                  |           |           |           |             | <b>X</b>   |            |            |            |
| <b>FITA</b>                                |           |           |           |             |            |            |            |            |
| PR_15_/18                                  |           | <b>X</b>  |           |             |            |            |            |            |
| PR_15_/19                                  |           | <b>X</b>  |           |             |            |            |            |            |
| <b>JCCX</b>                                |           |           |           |             |            |            |            |            |
| PR_19_/01                                  |           |           | <b>X</b>  |             |            |            |            |            |
| PR_19_/03                                  |           | <b>X</b>  | <b>X</b>  |             |            |            |            |            |
| <b>JFDG</b>                                |           |           |           |             |            |            |            |            |
| PR_17_/04                                  |           | <b>X</b>  |           |             |            |            |            |            |
| PR_17_/19                                  |           |           |           |             | <b>X</b>   |            |            |            |
| <b>PIBQ</b>                                |           |           |           |             |            |            |            |            |
| AR_07E/01                                  |           | <b>X</b>  |           |             |            |            |            |            |
| AR_07E/02                                  |           | <b>X</b>  |           |             |            |            |            |            |
| <b>UBYK</b>                                |           |           |           |             |            |            |            |            |
| P__01W/00                                  | <b>X</b>  | <b>X</b>  |           |             |            |            |            |            |
| <b>UJFY</b>                                |           |           |           |             |            |            |            |            |
| PR_13N/03                                  | <b>X</b>  | <b>X</b>  |           |             |            |            |            |            |
| <b>WXAQ</b>                                |           |           |           |             |            |            |            |            |
| AR_11_/02                                  |           | <b>X</b>  |           | <b>X</b>    |            | <b>X</b>   | <b>X</b>   | <b>X</b>   |
| <b>ZSAF</b>                                |           |           |           |             |            |            |            |            |
| ISS01_/01                                  |           | <b>X</b>  |           |             |            |            |            |            |

Details of the cruises are listed in Table 2 and include cruise dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 70,354 values were evaluated with 1,132 flags added by the preprocessor and the DQE for a total of 1.61% of the values being flagged. The coded data (WX, TCA, LMCA, ZCL, LCT, MCT, HCT) were not included in these statistics.

**Table 2: Statistical Cruise Information**

| <b>RV/CTC</b>                              | <b>Dates</b>        | <b>Number of Records</b> | <b>Number of Values</b> | <b>Number of Flags</b> | <b>Percentage Flagged</b> |
|--|---------------------|--------------------------|-------------------------|------------------------|---------------------------|
| <b>CGDG</b>                                |                     |                          |                         |                        |                           |
| AR_05_/01;A_04_/01;<br>AR_20C/01;AR_22_/01 | 04/25/91 - 05/23/91 | 88                       | 792                     | 12                     | 1.52                      |
| AR_07W/02                                  | 05/27/91 - 06/04/91 | 20                       | 180                     | 0                      | 0.00                      |
| AR_07W/03                                  | 05/28/92 - 06/13/92 | 40                       | 360                     | 0                      | 0.00                      |
| AR_10_/07                                  | 04/07/93 - 05/12/93 | 72                       | 720                     | 6                      | 0.83                      |
| AR_07W/04                                  | 06/19/93 - 06/28/93 | 32                       | 320                     | 8                      | 2.50                      |
| AR_13_/02;AR_19_/02;<br>AR_22_/02          | 11/05/93 - 12/16/93 | 79                       | 790                     | 0                      | 0.00                      |
| AR_07W/05;AR_13_/03                        | 05/25/94 -06/12/94  | 45                       | 450                     | 1                      | 0.22                      |
| AR_13_/04                                  | 10/13/94 - 11/09/94 | 91                       | 910                     | 4                      | 0.44                      |
| AR_13_/05                                  | 04/20/95 - 05/16/95 | 60                       | 600                     | 2                      | 0.33                      |
| A_01W/00                                   | 06/09/95 - 07/04/95 | 63                       | 630                     | 1                      | 0.16                      |
| <b>DFCG</b>                                |                     |                          |                         |                        |                           |
| IR_04_/01                                  | 12/23/90 - 01/19/91 | 95                       | 950                     | 17                     | 1.79                      |
| <b>FITA</b>                                |                     |                          |                         |                        |                           |
| PR_15_/17                                  | 02/01/91 - 03/03/91 | 139                      | 1,390                   | 10                     | 0.72                      |
| PR_15_/18                                  | 03/11/91 - 04/06/91 | 83                       | 747                     | 6                      | 0.80                      |
| PR_15_/19                                  | 07/18/91 - 08/13/91 | 70                       | 630                     | 7                      | 1.11                      |
| PR_15_/20                                  | 01/02/92 - 02/16/92 | 224                      | 2,240                   | 7                      | 0.31                      |
| PR_15_/21                                  | 02/21/92 - 03/17/92 | 185                      | 1,850                   | 7                      | 0.38                      |
| PR_15_/22                                  | 08/06/92 - 08/31/92 | 177                      | 1,770                   | 10                     | 0.56                      |
| PR_15_/23                                  | 09/05/92 - 10/02/92 | 173                      | 1,730                   | 13                     | 0.75                      |
| AR_04_/05;AR_15_/16                        | 09/09/95 - 10/11/95 | 239                      | 2,390                   | 21                     | 1.51                      |
| <b>GDLS</b>                                |                     |                          |                         |                        |                           |
| AR_10_/03                                  | 05/09/92 - 06/07/92 | 113                      | 1,130                   | 9                      | 0.80                      |
| AR_11_/08                                  | 10/01/92 - 10/20/92 | 59                       | 590                     | 3                      | 0.51                      |
| AR_10_/08                                  | 04/23/93 - 05/24/93 | 125                      | 1,250                   | 24                     | 1.92                      |
| <b>JCCX</b>                                |                     |                          |                         |                        |                           |
| PR_19_/01                                  | 11/13/90 - 11/16/90 | 25                       | 250                     | 3                      | 1.20                      |
| PR_19_/02                                  | 11/18/90 - 11/21/90 | 29                       | 290                     | 0                      | 0.00                      |
| PR_19_/03                                  | 11/07/91 - 11/08/91 | 12                       | 108                     | 0                      | 0.00                      |
| PR_19_/05                                  | 11/08/92 - 11/18/92 | 75                       | 750                     | 14                     | 1.87                      |
| <b>JFDG</b>                                |                     |                          |                         |                        |                           |
| PR_17_/04                                  | 10/14/91 - 10/16/91 | 22                       | 198                     | 0                      | 0.00                      |
| PR_17_/17                                  | 10/01/94 - 10/05/94 | 37                       | 370                     | 0                      | 0.00                      |
| PR_17_/19                                  | 07/01/95 - 07/05/95 | 34                       | 340                     | 0                      | 0.00                      |
| <b>JRPG</b>                                |                     |                          |                         |                        |                           |
| PR_24_/02                                  | 10/06/92 - 10/19/92 | 15                       | 150                     | 0                      | 0.00                      |
| PR_23_/03                                  | 12/13/92 - 12/23/92 | 56                       | 560                     | 9                      | 1.61                      |

|             |           |                     |     |       |     |      |
|-------------|-----------|---------------------|-----|-------|-----|------|
| <b>KGWU</b> |           |                     |     |       |     |      |
|             | P__17C/00 | 06/03/91 - 07/11/91 | 132 | 1,320 | 1   | 0.08 |
|             | P__17S/00 | 07/17/91 - 08/25/91 | 120 | 1,200 | 10  | 0.83 |
|             | P__16C/00 | 09/01/91 - 10/01/91 | 85  | 850   | 10  | 1.18 |
| <b>PIBQ</b> |           |                     |     |       |     |      |
|             | AR_07E/01 | 07/03/90 - 08/02/90 | 64  | 576   | 5   | 0.87 |
|             | AR_07E/02 | 04/13/91 - 04/30/91 | 31  | 279   | 3   | 1.08 |
| <b>UBYK</b> |           |                     |     |       |     |      |
|             | P__01W/00 | 08/31/93 - 09/03/93 | 11  | 88    | 3   | 3.41 |
| <b>UJFY</b> |           |                     |     |       |     |      |
|             | PR_13N/03 | 05/13/93 - 06/08/93 | 75  | 600   | 0   | 0.00 |
| <b>VJFF</b> |           |                     |     |       |     |      |
|             | IR_04_/03 | 08/28/94 - 09/03/94 | 23  | 230   | 0   | 0.00 |
|             | IR_02_/01 | 11/20/94 - 12/01/94 | 22  | 220   | 7   | 3.18 |
|             | ISSO3_/01 | 04/01/95 - 04/22/95 | 66  | 660   | 3   | 0.45 |
|             | IR_06_/04 | 09/20/95 - 10/09/95 | 66  | 660   | 2   | 0.30 |
| <b>WKWB</b> |           |                     |     |       |     |      |
|             | PRS03_/04 | 11/17/94 - 12/04/94 | 29  | 290   | 1   | 0.34 |
| <b>WTEA</b> |           |                     |     |       |     |      |
|             | PR_16_/01 | 11/28/90 - 12/06/90 | 74  | 740   | 19  | 2.57 |
|             | P__16N/01 | 02/28/91 - 02/28/91 | 8   | 80    | 0   | 0.00 |
|             | P__16N/02 | 03/07/91 - 04/06/91 | 241 | 2,410 | 28  | 1.16 |
|             | PR_16_/03 | 11/01/91 - 11/13/91 | 231 | 2,310 | 36  | 1.56 |
|             | PR_16_/05 | 10/14/92 - 11/18/92 | 209 | 2,090 | 43  | 2.06 |
|             | PR_16_/09 | 09/18/93 - 10/15/93 | 168 | 1,680 | 40  | 2.38 |
|             | PR_16_/10 | 01/27/94 - 01/29/94 | 19  | 190   | 0   | 0.00 |
|             | PR_16_/14 | 02/06/95 - 05/02/95 | 189 | 1,890 | 15  | 0.79 |
|             | PR_16_/16 | 08/05/95 - 08/26/95 | 156 | 1,560 | 6   | 0.38 |
| <b>WTER</b> |           |                     |     |       |     |      |
|             | PR_16_/02 | 03/23/91 - 04/19/91 | 205 | 2,050 | 13  | 0.63 |
|             | PR_16_/04 | 02/23/92 - 03/26/92 | 255 | 2,550 | 34  | 1.33 |
|             | PR_16_/06 | 02/21/93 - 03/18/93 | 208 | 2,080 | 74  | 3.56 |
|             | PR_16_/07 | 04/18/93 - 05/14/93 | 221 | 2,210 | 66  | 2.99 |
|             | AR_21_/02 | 08/22/93 - 10/03/93 | 259 | 2,590 | 14  | 0.54 |
|             | PR_16_/11 | 04/16/94 - 05/09/94 | 229 | 2,290 | 75  | 3.28 |
|             | PR_16_/15 | 05/17/94 - 06/17/94 | 284 | 2,840 | 106 | 3.73 |
|             | PR_16_/12 | 08/04/94 - 08/25/94 | 215 | 2,150 | 138 | 6.42 |
|             | PR_16_/13 | 08/30/94 - 09/25/94 | 247 | 2,470 | 91  | 3.68 |
|             | IR_04_/05 | 08/24/95 - 09/25/95 | 238 | 1,380 | 0   | 0.00 |
| <b>WXAQ</b> |           |                     |     |       |     |      |
|             | AR_11_/02 | 06/19/91 - 07/04/91 | 8   | 72    | 0   | 0.00 |
| <b>ZDLP</b> |           |                     |     |       |     |      |
|             | SR_01_/04 | 11/20/93 - 12/18/93 | 64  | 640   | 14  | 2.19 |
| <b>ZSAF</b> |           |                     |     |       |     |      |
|             | ISS01_/01 | 04/05/91 - 05/07/91 | 186 | 1,674 | 81  | 4.84 |

*Summary:*

The overall quality of the bridge data for the COADS proves to be excellent, though the quality varies by ship and by cruise. The distribution of flags for each variable is detailed in Table 3.

**Table 3:** Number of Flags and Percentage Flagged for Each Variable

| Variable                                | B    | D    | F    | G    | L     | S    | T    | Total Number of Flags | Percentage of Variable Flagged |
|---|------|------|------|------|-------|------|------|-----------------------|--------------------------------|
| TIME                                    |      |      |      |      |       |      | 497  | 497                   | 6.99                           |
| LAT                                     |      |      | 57   |      | 1     | 166  |      | 225                   | 3.16                           |
| LON                                     |      |      | 57   |      | 1     | 145  |      | 202                   | 2.84                           |
| DIR                                     | 55   |      |      |      |       | 5    |      | 60                    | 0.84                           |
| SPD                                     |      |      |      | 20   |       | 13   |      | 33                    | 0.46                           |
| P                                       |      |      |      | 4    |       | 10   |      | 14                    | 0.20                           |
| T                                       |      | 7    |      | 17   |       | 8    |      | 32                    | 0.45                           |
| TS                                      | 6    |      |      | 16   |       | 16   |      | 38                    | 0.53                           |
| TD                                      |      | 6    |      |      |       | 7    |      | 13                    | 0.18                           |
| TW                                      |      | 13   |      |      |       | 5    |      | 18                    | 0.25                           |
| WX                                      |      |      |      |      |       |      |      | 0                     | 0.00                           |
| TCA                                     |      |      |      |      |       |      |      | 0                     | 0.00                           |
| LMCA                                    |      |      |      |      |       |      |      | 0                     | 0.00                           |
| ZCL                                     |      |      |      |      |       |      |      | 0                     | 0.00                           |
| LCT                                     |      |      |      |      |       |      |      | 0                     | 0.00                           |
| MCT                                     |      |      |      |      |       |      |      | 0                     | 0.00                           |
| HCT                                     |      |      |      |      |       |      |      | 0                     | 0.00                           |
| <b>Total Number of Flags</b>            | 61   | 26   | 114  | 57   | 2     | 375  | 497  | 1,132                 |                                |
| <b>Percentage of All Values Flagged</b> | 0.09 | 0.04 | 0.16 | 0.08 | 0.00* | 0.53 | 0.70 | 1.61                  |                                |

\*Percentage < 0.01

*Time Duplicate Problem:*

Almost seven percent of the time stamps were flagged with the T flag by the preprocessor, indicating time duplication. If there are two values for any given variables that share the same time stamp they will both be displayed at that time by the visual data assessment tool. In many cases, this problem caused spikes in the data. Often times if a spike occurred the DQE determined which value was real and flagged the other value as a spike (S). Though the time duplicate spike occurred throughout the data, it was most

common in the position data. The user may wish to avoid using meteorological data at times flagged as duplicates.

*Other Problems:*

Latitude and Longitude received F flags indicating unrealistic platform velocity as determined by the position data. Both variables also received an L flag, denoting a position over land. Erroneous position reports are not uncommon to bridge data.

A total of 26 D flags were assigned by the preprocessor to T, TW, and TD for failing the  $T \geq TW \geq TD$  test. In the free atmosphere, the value of the temperature is always greater than or equal to the wet-bulb temperature, which in turn is always greater than or equal to the dewpoint temperature (Smith et al. 1996).

The G flag designates data that are four standard deviations from the COADS climatological means (da Silva et al. 1994).

The B flag assigned by the preprocessor designates a wind direction outside the 0 to 360 degree bounds. A value of 362 degrees refers to variable wind and a value of 361 degrees refers to calm wind in COADS data. All of these values were flagged with the B flag by the preprocessor, but can be considered as reliable data values.

*References:*

- Smith, S.R., C. Harvey, and D.M. Legler, 1996: *Handbook of Quality Control Procedures and Methods for Surface Meteorology Data*. WOCE Report No. 141/96, Report WOCEMET 96-1, Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee FL 32306-2840
- da Silva, A.M., C.C. Young and S. Levitus, 1994: *Atlas of Surface Marine Data 1994, Volume 1: Algorithms and Procedures*. NOAA Atlas Series.
- Slutz, R.J., S.J. Lubker, J.D. Hiscox, S.D. Woodruff, R.L. Jenne, D.H. Joseph, P.M. Seurer and J.D. Elms, 1985: COADS - Comprehensive Ocean Atmosphere Data Set, CIRES/ERL/NCAR/NCDC, Boulder, Colorado.