

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET: 3853 (DSI-3853)

Surface Airways Observations (CDMP)

March 9, 2006

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1. **Abstract:** The dataset DSI-3853 consists primarily of U.S. surface airways observations (SAO) data beginning in 1965 and extending through 1981. Due to budgetary constraints the 1965-1981 SAOs were originally digitized in three-hourly intervals, even though they were available hourly in manuscript form. This presented problems for users who were conducting research using the pre-65 and post-81 hourly data in conjunction with the 65-81 data. In order to create a more homogenous dataset, the National Climatic Data Center (NCDC) has re-digitized the 65-81 in an hourly fashion.

Note that a few stations have already had certain years within this 1965-81 period re-keyed as hourly. For these stations, only a subset of the period was keyed. In addition, other stations did not have data keyed at all during this period, or during the periods immediately before or after the 1965-81 range. These stations data have been keyed to as thoroughly as possible complete their entire period of record back to July, 1948 (see documentation for dataset DSI-3851 for pre-1948 data sets).

The major data variables are as follows: WBAN Identification Station Number, observational type, ceiling and cloud, visibility, present weather, temperature, relative humidity, wind, pressure and precipitation. The observations are generally recorded for the 24 hour period midnight to midnight.

The keying format was designed to reflect the data as entered on the page to make keying easier for the key entry personnel, who were not trained meteorological technicians. The "raw" observations which comprise the DSI-XXXX dataset will be quality checked to include data adjustments and converted to NCDC's Integrated Surface Hourly (ISH) format.

Official surface weather observation standards can be found in the Federal Meteorological Handbooks. The images are available on a web based system, Web Search Store Retrieve Display (WSSRD), and will eventually be accessible through NCDC's On-Line store.

2. **Keying Format Names and Definitions:**

The following is the format keyed from the Surface Airways Observations.

**SAO 1965-1981 OUTPUT KEYING FORMAT
(Revised Nov 1, 2005)**

Data Records	Contents	Instructions
1-5	WBAN Number	Auto filled from NCDC WBAN list
6	,	Comma delimited
7-10	Year	e.g. 1965
11	,	Comma delimited
12-13	Month	e.g. 01 = January e.g. 02 = February

		<p>.</p> <p>.</p> <p>12 = December</p>
14	,	Comma delimited
15-16	Day	Right justify, zero fill e.g. 01,02, ...31
17	,	Comma delimited
18-19	Observational type	<p>Key only the hourly observations, these generally occur near the hour. Key only those records that contain a "R", "RS", or "SA" as part of the designator on the WBAN 10, WBAN 10-A, MF1-10A and MF1-10C forms. On the "B" part of the forms (WBAN 10-B or MF1-10B) each observation corresponds to the hourly (e.g. 0352) on the A form and will be keyed as part of the corresponding observation (00-23 hourly observations). IE may actually key the A and B separately, but bring them back together for the output. Some WBAN Form 10As do not have a designator (e.g. "R", "RS" etc...) listed. When no designator is listed fill in the form type column with the designator "RA" (Record Automated).</p> <p>Left justify, blank fill e.g. if = R, then Position 18 =R Position 19 = Blank If entry is RS, then Position 18 = R Position 19 = S If entry = SA, then Positions 18-19 = SA If no entry, then Positions 18-19 = RA If entry is S, L, or SP on the A part of the form do not key the record. On the B forms there are no designators but</p>

Ⓢ each record entry is keyed as they correspond to the hourly observations on the A form. If any question regarding which type are hourly observations contact NCDC for clarification. The C form is a combination of the A and B form and carries the same designators as the A form. Stations reporting on the C Ⓢ forms often only work limited hours (partial days).

20	,	Comma delimited
21	Time indicator	1 = Local Standard Time 2 = Greenwich Mean Time
22	,	Comma delimited
23-26	Time	Insure the proper time indicator is set in position 21 according to the time entries on the form (Local Standard Time or Greenwich Mean Time). Time entries are based on a 24 hour clock. Entries range from 0000-2400. e.g. if entry = 0957, Positions 23-26 = 0957. The entry time for the hourly observations should be the same on both the A and B forms.
27	,	Comma delimited
28-59	Sky and Ceiling Ceiling defined (designator)	A ceiling is defined by inserting a letter in front of the Cloud group (see following list). A backslash (/) indicates that the height of high clouds (cirriform) is unknown and that they do not constitute a ceiling e.g. /- U = Ceiling due to cirriform clouds of

unknown height
 E = Estimated height (ceiling)
 M = Measured height (ceiling)
 B = Balloon Ascent
 R = Radar
 V = Variable ceiling
 W = Indefinite ceiling
 A = Aircraft Report
 P = Precipitation ceiling
 D =   Persistent

cirriform ceiling

Cloud amount

Numerical codes representing the cloud amounts per layer:
 0 = clear or less than .1 coverage
 1 = thin scattered
 2 = scattered
 3 = dark scattered
 4 = thin broken
 5 = broken
 6 = dark broken
 7 = thin overcast
 8 = overcast
 9 = dark overcast
 x = obscuration 10/10ths obscuration
 * = partial obscuration (-X)

28- 35

First cloud layer

28

Ceiling letter designator

Only one of the cloud layers will be designated as the ceiling (the height ascribed to the lowest layer of clouds or obscuring phenomena when it is reported as broken, overcast, or obscuration (at least half the sky covered) and not classified “thin” or “partial”).

e.g. M21

32

		Position 28 = M
		If the first layer did not constitute a layer then position 28 = blank
29	,	Comma delimited
30- 32	height (first cloud layer)	In example above the height is 2100 feet, therefore: Position 30 = blank Position 31 = 2 Position 32 = 1
33	,	Comma delimited
34	Cloud amount	In example above = (Broken) Position 34 = 5 (see list above)
35	,	Comma delimited
36-43	Second cloud layer	
36	Ceiling letter designator	in example above e.g. M21 32 The second layer  does not constitute a ceiling as the first layer designated the ceiling layer, therefore: Position 36 = blank
37	,	Comma delimited
38-40	height (second layer)	In example above it is 3200 feet, thus Position 38 = blank Position  39  = 3 Position 40 = 2
41	,	Comma delimited
42	Cloud amount	In example above =

	(second layer) (Overcast) Position 42 = 8	
43	,	Comma delimited
44-51	Third cloud layer	
44	Ceiling letter designator	Same rules as above, leave blank if not designated as a ceiling.
45	,	⊕mma delimited
46-48	height (third layer)	Same rules as above. If no third layer blank fill
49	,	Comma delimited
50	Cloud amount (third layer)	same rules as above. If no third layer blank fill. e.g. if entry was 18 M34 / Position 44 = blank (ceiling at 3400 ft) Position 46 = blank Position 47 = blank Position 48 = / (backslash; unknown height) Position 50 = 5 (broken)
51	,	Comma delimited ⊖ ⊕ ⊕
52-59	Fourth Cloud Layer	
52	Ceiling letter designator	Same rules as above, leave blank if not designated as a ceiling. It would be rare to have a ceiling at the fourth cloud layer.
53	,	Comma delimited
54-56	height (fourth layer)	Same rules as above. If no fourth layer blank fill
57	,	Comma delimited

58 Cloud amount (fourth layer) Same rules as above. If no fourth layer blank fill.

59 , Comma delimited

If sky entry = W0X or W5X, then
Position 28 = W
Position 30 = blank
Position 31 = blank
Position 32 = 0(1st example) or
5 (2nd example)
Position 34 = x (obscuration)

60-64 Visibility Key surface visibility unless not available then key tower visibility

Positions 60-62 = whole miles
Positions 63-64 = fractions of miles
e.g. if entry = 1 3/4 miles, then
Position 60 = blank
Position 61 = blank
Position 62 = 1
Position 63 = 3
Position 64 = 4

Coding instructions for fractions of a mile:

Entry	Key
1/16	16
1/8	18
1/4	14
5/16	56
3/8	38
1/2	12
5/8	58
3/4	34
7/8	78

65 , Comma delimited

66-77 Weather and Obstructions
Position 66 = Rain/Rain Showers
Position 67 = Thunderstorms/Dust/

To Vision

Hail

- Position 68 = Freezing Rain/Ice Pellets/ Ice Crystals
- Position 69 = Snow/Snow Showers
- Position 70 = Blowing Snow/Blowing Dust
- Position 71 = Blowing Sand/Smoke
- Position 72 = Drizzle/Freezing Drizzle
- Position 73 = Sleet/Sleet Showers
- Position 74 = Snow Pellets/Snow Grains
- Position 75 = Fog/Ground Fog
- Position 76 = Ice fog/Haze
- Position 77 = Tornado/Waterspout/Funnel Cloud

Intensity symbols (+, -, --) are not attached to the following elements hail (A), small hail (AP) and ice crystals (IC)

66

Rain/Rain Showers

- 0 = Heavy Rain (R+)
- 1 = Moderate Rain (R)
- 2 = Light Rain (R-)
- 3 = Very Light Rain (R--)
- 4 = Heavy Rain Showers (RW+)
- 5 = Moderate Rain Showers (RW)
- 6 = Light Rain Showers (RW-)
- 7 = Very Light Rain Showers (RW--)

67

Thunderstorms/Dust/Hail

- 0 = Heavy Thunderstorm (T+)
- 1 = Moderate Thunderstorm (T)
- 2 = Light Thunderstorm (T-)
- 3 = Very Light Thunderstorm (T--)
- 4 = Heavy Dust (D+)
- 5 = Moderate Dust (D)
- 6 = Light Dust (D-)
- 7 = Very Light Dust (D--)
- 8 = Moderate Hail (A)
- 9 = Small Hail (AP)

68

Freezing Rain/ Ice Pellets/Ice Crystals

- 0 = Heavy Freezing Rain (ZR+)
- 1 = Moderate Freezing Rain (ZR)
- 2 = Light Freezing Rain (ZR-)
- 3 = Very Light Freezing Rain (ZR- -)
- 4 = Heavy Ice Pellets (IP+)
- 5 = Moderate Ice Pellets (IP)

		6 = Light Ice Pellets (IP-)
		7 = Very Light Ice Pellets (IP- -)
		8 = Ice Crystals (IC)
69	Snow/Snow Showers/ Drifting Snow	0 = Heavy Snow (S+) 1 = Moderate Snow (S) 2 = Light Snow (S-) 3 = Very Light Snow (S- -) 4 = Heavy Snow Showers (SW+) 5 = Moderate Snow Showers (SW) 6 = Light Snow Showers (SW-) 7 = Very Light Snow Showers (SW- -) 8 = Heavy Drifting Snow (DS+) 9 = Moderate Drifting Snow (DS) A = Light Drifting Snow (DS-)
70	Blowing Snow/ Blowing Dust	0 = Heavy Blowing Snow (BS+) 1 = Moderate Blowing Snow (BS) 2 = Light Blowing Snow (BS-) 3 = Very Light Blowing Snow (BS- -) 4 = Heavy Blowing Dust (BD+) 5 = Moderate Blowing Dust (BD) 6 = Light Blowing Dust (BD-) 7 = Very Light Blowing Dust (BD- -)
71	Blowing Sand/Smoke	0 = Heavy Blowing Sand (BN+) 1 = Moderate Blowing Sand (BN) 2 = Light Blowing Sand (BN-) 3 = Very Light Blowing Sand (BN- -) 4 = Heavy Smoke (K+) 5 = Moderate Smoke (K) 6 = Light Smoke (K-) 7 = Very Light Smoke (K - -)
72	Drizzle/Freezing Drizzle	0 = Heavy Drizzle (L+) 1 = Moderate Drizzle (L) 2 = Light Drizzle (L-) 3 = Very Light Drizzle (L- -) 4 = Heavy Freezing Drizzle (ZL+) 5 = Moderate Freezing Drizzle (ZL) 6 = Light Freezing Drizzle (ZL-) 7 = Very Light Freezing Drizzle (ZL- -) 8 = Heavy Freezing Drizzle Showers (ZLW+) 9 = Moderate Freezing Drizzle Showers

		(ZLW) A = Light Freezing Drizzle Showers (ZLW-) B = Very Light Freezing Drizzle Showers (ZLW--)
73	Sleet/Sleet Showers	0 = Heavy Sleet (E+) 1 = Moderate Sleet (E) 2 = Light Sleet (E-) 3 = Very Light Sleet (E- -) 4 = Heavy Sleet Showers (EW+) 5 = Moderate Sleet Showers (EW) 6 = Light Sleet Showers (EW-) 7 = Very Light Sleet Showers (EW- -)
74	Snow Pellets/Snow Grains	0 = Heavy Snow Pellets (SP+) 1 = Moderate Snow Pellets (SP) 2 = Light Snow Pellets (SP-) 3 = Very Light Snow Pellets (SP- -) 4 = Heavy Snow Grains (SG+) 5 = Moderate Snow Grains (SG) 6 = Light Snow Grains (SG-) 7 = Very Light Snow Grains (SG- -) 8 = Heavy Snow Pellet Showers (SPW+) 9 = Moderate Snow Pellet Showers (SPW) A = Light Snow Pellet Showers (SPW-) B = Very Light Snow Pellet Showers (SPW--)
75	Fog/Ground Fog	0 = Thick (Dense) Fog (F+) 1 = Moderate Fog (F) 2 = Light Fog (F-) 3 = Very Light Fog (F- -) 4 = Thick (Dense) Ground Fog (GF+) 5 = Moderate Ground Fog (GF) 6 = Light Ground Fog (GF-) 7 = Very Light Ground Fog (GF- -)
76	Ice Fog/Haze	0 = Thick (Dense) Ice Fog (IF+) 1 = Moderate Ice Fog (IF) 2 = Light Ice Fog (IF-) 3 = Very Light Ice Fog (IF- -) 4 = Thick (Dense) Haze (H+)

5 = Moderate Haze = (H)
6 = Light Haze = (H-)
7 = Very Light Haze (H- -)

77	Tornado/Waterspout/ Funnel Cloud	0 = TORNADO 1 = WATERSPOUT 2 = FUNNEL CLOUD (Always spelled out in Capital Letters and written out in full)
78	,	Comma delimited
79-81	Sea Level Pressure (Millibars)	Sea Level Pressure entries include only the last three values of the pressure reading leaving the first two positions implied, e.g. if the observed value was 1014.4 millibars only the 144 would be entered on the form by the observer. If e.g. the observed value was 981.7 millibars only 817 would be entered on the form. e.g if entry is 989, then Position 79 = 9 Position 80 = 8 Position 81 = 9
82	,	Comma delimited
83-86	Dry Bulb Air Temperature in whole degrees Fahrenheit	Dry Bulb Air Temperature Position 83 represents the sign field. If positive blank fill, if negative enter a dash (-). Positions 84-86 whole degrees. Blank fill. e.g. if entry is 103 Position 83 = blank Position 84 = 1 Position 85 = 0 Position 86 = 3 e.g. if entry is -16 Position 83 = - Position 84 = blank Position 85 = 1 Position 86 = 6
87	,	Comma delimited

88-90	Dew Point Temperature	Dew Point Temperature in whole degrees Fahrenheit. Position 88 represents the sign field. If positive blank fill, if negative enter a dash (-). Positions 89-90 whole degrees. Blank fill. e.g. if entry is -9 Position 88 = - Position 89 = blank Position 90 = 9 e.g. if entry is 79 Position 88 = blank Position 89 = 7 Position 90 = 9
91	,	Comma delimited
92	Estimated Wind Direction	key as entered, e.g. E = estimated direction
93-94	Wind Direction (Tens of Degrees)	36 point scale from 00-36, 00 represents calm. e.g. if entry is 30 Position 93 = 3 Position 94 = 0
95	,	Comma delimited
96-98	Wind Speed	right justify, blank fill. Speeds measured in knots. e.g. if entry is 8 Positions 96-97 = blank Position 98 = 8 e.g. if entry is 35 Position 96 = blank Position 97 = 3 Position 98 = 5 e.g. if entry is 103 Position 96 = 1 Position 97 = 0 Position 98 = 3
99	,	Comma delimited
100-103	Wind Character	

100	Character	key as entered, e.g. G or + = gusts Q = squalls
101-103	Value	e.g. entry = G36 or +36 Position 100 = G Position 101 = blank Position 102 = 3 Position 103 = 6 Note: a gust must be greater than the wind speed.
104	,	Comma delimited
105-107	Altimeter	key as entered e.g. entry = 005 positions 105-107 = 005 if entry = 995, then positions 105-107 = 995
108	,	Comma delimited
Additional information located on the 10C or 10B forms		
109-113	Barometer Station Pressure (Inches)	Station Pressure is recorded to a thousandth of an inch. If available key to inches and thousandths, decimal implied. e.g. if entry is 28.165 Positions 109-113 = 28165 Note: station pressure available on the 10, 10C, and 10B forms
114	,	Comma delimited
115-119	Dry Bulb Temperature	Dry bulb not a required entry, when available key, decimal implied Position 115 = sign field, positive = blank, negative = - positions 116-118 = whole degrees position 119 = tenths of degree e.g. entry = 69.3 position 115 = blank

position 116 = blank
positions 117-119 = 693

120

,

Comma delimited

121-124

Wet Bulb Temperature

The Wet Bulb Temperature is not a required entry but when available is measured to tenths of a degree. The Wet Bulb Temperature value always lies between the air (Dry Bulb) and Dew Point Temperature. Follow the same rules as for the air temperature entry above except that a wet bulb temperature of 100 F is unrealistic and therefore one less position is provided. Right justify and blank fill, decimal implied. Position 121 represents the sign field. If positive blank fill, if negative enter a dash (-).

e.g. if entry is 46.1

Position 121 = blank

Position 122-124 = 461

125

,

Comma delimited

126-128

Relative Humidity

The Relative Humidity is not a required entry but when available is measured to the nearest percent. Right justify, blank fill.

e.g. if entry is 79

Position 126 = blank

Position 127-128 = 79

129

,

Comma delimited

130-131

Total Sky Cover

Right justify, blank fill.

0 = Clear or less than .1 coverage

1 = Scattered clouds .1 coverage

2 = Scattered clouds .2 coverage

3 = Scattered clouds .3 coverage

4 = Scattered clouds .4 coverage

5 = Scattered clouds .5 coverage

6 = Broken clouds .6 coverage

7 = Broken clouds .7 coverage

8 = Broken clouds .8 coverage
 9 = Broken clouds .9 coverage
 10 = Overcast 1.0 coverage
 99 = Unknown
 Blank fill if blank
 e.g. if entry is 3
 Position 130 = blank
 Position 131 = 3

132	,	Comma delimited
133-134	Cloud amount (Lowest layer)	Same rules as for total sky cover (positions 130-131)
135	,	Comma delimited
136-140	Cloud types (Lowest layer)	Key as entered, right justify blank fill See list of possible cloud types below

Possible cloud type entries
 CU
 TCU
 TC
 STFRA
 SCSL
 SC
 ST
 CUFRA
 CB
 CBMAM
 AS
 NS
 AC
 ACSL
 ACCAS
 ACMAM
 CI
 CCSL
 CS
 CC

141	,	Comma delimited
142-145	Cloud height (Lowest layer)	position 142 = ceiling designator same rules as position 28

positions 143-145 = height in hundreds of feet

e.g. entry = M32

position 142 = M

position 143 = blank

position 144 = 3

position 145 = 2

if entry = E250, then

position 142 = E

position 143 = 2

position 144 = 5

position 145 = 0

146	,	Comma delimited
147-148	Cloud amount (Second layer)	Same rules as for total sky cover (positions 130-131)
149	,	Comma delimited
150-154	Cloud types (Second layer)	Key as entered, right justify blank fill See list of possible cloud types above positions 136-140.
155	,	Comma delimited
156-159	Cloud height (Second layer)	Same rules as position 142-145
160	,	Comma delimited
161-162	Summation totals (following second layer)	Same rules as for total sky cover (positions 130-131)
163	,	Comma delimited
164-165	Cloud amount (Third layer)	Same rules as for total sky cover (positions 130-131)
166	,	Comma delimited
167-171	Cloud types (third layer)	Key as entered, right justify blank fill See list of possible cloud types above positions 136-140.
172	,	Comma delimited

173-176	Cloud height (Third layer)	Same rules as position 142-145
177	,	Comma delimited
178-179	Summation totals (following second layer)	Same rules as for total sky cover (positions 130-131)
180	,	Comma delimited
181-182	Cloud amount (Fourth layer)	Same rules as for total sky cover (positions 130-131)
183	,	Comma delimited
184-188	Cloud types (Fourth layer)	Key as entered, right justify blank fill See list of possible cloud types above positions 136-140.
189	,	Comma delimited
190-193	Cloud height (Fourth layer)	Same rules as position 142-145
194	,	Comma delimited
195-196	Total Opaque Sky Cover	See Total Sky Cover Positions 130- 131 Above e.g. if entry is 10 Position 195 = 1 Position 196 = 0
197	,	Comma delimited
198	Pressure tendency	values = 0-9
199	,	Comma delimited
200-202	Net 3 hour change	leading decimal implied, right justify, zero fill. Values may range from 000 to 999 e.g. entry is .065, then

		position 200 = 0 position 201 = 6 position 202 = 5
203	,	Comma delimited
204	Estimated Precipitation	key as entered, e.g. E = estimated precipitation
205-207	Precipitation	position 205 = whole inches positions 206-207 = hundredths of an inch decimal implied, right justify, blank fill If Trace (T) key T in position 207 and blank fill. If no precipitation reported (A blank entry) then blank fill. If greater than 9.99 then key 9++ (positions 205-207) e.g. entry = .35, then position 205 = blank position 206 = 3 position 207 = 5

Note: Any values that are not readable then fill with a tilde (~).

3. **Start Date:** 1965 (except as noted above).
4. **Stop Date:** 1981 (except as noted above).
5. **Coverage:** U.S. Weather Bureau/National Weather Service and Federal Aviation Administration-manned stations in the contiguous 50 States.
6. **How to Order Data:**

 Ask NCDC's Climate Service about costs to obtain this dataset.
 Phone: 828-271-4800
 FAX: 828-271-4876
 E-mail: NCDC.Orders@noaa.gov
7. **Archiving Data Center:**

 National Climatic Data Center,
 Federal Building
 151 Patton Avenue
 Asheville, NC 28801-5001

8. Technical Contact:

Name: Mark Seiderman
Address: National Climatic Data Center
NOAA/NESDIS
Veach-Baley Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Voice Telephone: 828-271-4798
Fax: 828-271-4126
E-mail: Mark.Seiderman@noaa.gov

9. Known Uncorrected Problems: During the keying process if a value was entered on the form, but the keyer could not read the handwriting, a tilde (~) was placed in the element field. Where possible these entries should be corrected. Similar problems of incorrect observer entries as in the DSI 3851 may exist in the 1965-1981 re-keyed data, but not to the same extent as operational guidance, training and quality assurance were better established after World War II.

10. Quality Statement: These are "raw" keyed data, and have undergone limited quality control or quality assurance checks. A pre-keying check of the original data forms was performed to correct obvious errors, and some internal bounds checking was performed on the data at keying. The data will undergo extensive automated quality control using limits, internal and temporal consistency checks provided by the Northeast Regional Climate Center (NRCC), and additional manual quality control at NCDC, before conversion to the ISH format (see references).

11. Essential Companion Datasets: The NCDC in-house station history files (DSI-9767) would be essential in correcting location (WBAN Number) errors. The existing ISH (3505) three-hourly data may be used to correct any known biases in the data, and to compare to this data set, as may other datasets which cover this set's period of record.

12. References:

The following references describe many of the data problems and how they were corrected at the Northeast Regional Climate Center in their efforts to quality control and convert the data to the ISH format.

"CDMP-SAO_QA_NRCC": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2003: Quality assurance procedures for historical hourly surface airways data. Unpubl. Tech. Rep., 1 Apr. 2003, 56 pp.

"Graybeal-etal_2002": Graybeal, D. Y., K. L. Eggleston, and A. T. DeGaetano, 2002: A climatology of extreme hourly temperature variability across the United States: Application to quality control. Preprints, 13th Conf. Appl. Climatol., Amer. Meteor. Soc., Portland, OR, paper 2.11, 4 pp.

"Graybeal-etal_2004a": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: New techniques in quality assurance of hourly meteorological: Resolving multiple flags through a decision tree. Preprints, 14th Conf. Appl. Climatol., Amer. Meteor. Soc., Seattle, WA, paper 7.2, 4 pp.

"Graybeal-etal_2004b": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Complex quality assurance of historical hourly surface airways meteorological data. J. Atmos. Oceanic Technol., 21, 1156-1169.

"Graybeal-etal_2004c": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Improved quality assurance for historical hourly temperature and humidity: Development and application to environmental analysis. J. Appl. Meteor., 43, 1722-1735.

"Graybeal_2004": Graybeal, D. Y., 2004: Relationships among daily mean and peak gust wind speeds: Reanalysis for application to data quality assurance. Submitted to Int. J. Climatol., conditionally accepted.