

GLOBAL SURFACE ARCHIVES

Documentation

1 July 2013



Global Surface Archives is a dataset containing hourly and special observations from official observation sites which were transmitted over longline circuits. These observations started anywhere from 1930 to the 1950s for most stations, and continue forward through the current date to provide a continuously updated source of historical hourly and special observations. This is an outgrowth of the Total Archives product, originally developed in 1997 which focused on a small subset of North America. The source of Global Surface Archives data is observations transmitted via Global Telecommunications System and aviation networks, along with historical data from federal agencies which stored the information as packed archives on 9-track and LTO tapes.

The primary intent of this dataset is to preserve original information from each observation, so derived fields and climatological variables are not provided in this dataset unless explicitly provided in the observation.

CAUTION

Due to the vast size of this project and the fact that it has just recently been developed, Global Surface Archives has not been thoroughly quality-controlled. Errors and improper expressions or coding forms may exist. Please contact us if you notice issues, as we are continuously improving this product and may be able to correct important issues in scheduled updates.

NOTICE

As there is no source of raw longline observations prior to the 1990s due to the expense of storing data in the early computer age, all agencies decoded longline data in real-time and stored the elements as packed records to save space. This dataset emulates all METAR and SAO/Airways reports, regardless of year, in the "New METAR" code form (the specification that was implemented starting in 1996 worldwide).

1. Volume 1: By Date-Time

* File naming convention: *yyyymmddhh_metar.txt* or *yyyymmddhh_synop.txt*

* Archive naming convention: *yyyy-mm_obs.zip*

Volume 1 contains collectives of METAR and SYNOP observations for a given hour (date and time). These can be imported directly into off-the-shelf viewing software such as Digital Atmosphere and GEMPAK. The data is in standard METAR and SYNOP format, which is defined in WMO Pub. 306 Section FM 15 and FM 12, respectively. All SYNOP reports preserve the AAXX or BBXX header and the YGGi_w group followed by a linefeed. They are not in any particular order. All METAR reports are contained on a single line, with a linefeed and then the next observation, without any particular order.

2. Volume 2: By Station

* File naming convention: *iiii-yyyy.txt*, where *iiii* is the ICAO or WMO identifier

* Archive naming convention: *stn-bb.zip*, where *bb* is the first 2 of the ICAO or WMO

Volume 2 contains collectives of METAR and SYNOP observations for a given station on a given year. These cannot normally be imported directly into viewing software, but they can be loaded into text editors and viewed to manually find trends in weather conditions at a given place and date. The data is in standard METAR and SYNOP format, which is defined in WMO Pub. 306 Section FM 15 and FM 12, respectively. Data is ordered chronologically. Each row is prefixed with a date-time group and a vertical bar (|), as the reports themselves do not fully convey this information.

3. Volume 3: Tabular

* File naming convention: *iiii-yyyy.txt*, where *iiii* is the ICAO or WMO identifier

* Archive naming convention: *tbl-bb.zip*, where *bb* is the first 2 of the ICAO or WMO

Volume 3 is a tabular, decoded representation of both the METAR and SYNOP observations for a given station. Data is ordered chronologically. The format is comma-separated values (CSV), which can be imported into most spreadsheets and potentially by customized database front ends. CSV was chosen due to its small size and flexibility. Alternate formats like JSON and XML would create prohibitively large versions of this dataset due to the considerable markup.

Note that double rows may exist if the station has re-transmitted the observation. We are currently working to eliminate these from the data holdings. Any scripts or code that you write should ignore double entries.

Except for station identifier data and date/time values, all numerical fields are real numbers unless otherwise indicated as an integer.

Here is the metadata for Volume 3 as of July 2013. This is subject to change.

3.1. **Row 1: Year.** The year of the observation, rounded to the nearest minute.

3.2. **Row 2: Month.** The month of the observation, rounded to the nearest minute.

3.3. **Row 3: Day.** The day of the observation, rounded to the nearest minute.

3.4. **Row 4: Hour.** The hour of the observation, rounded to the nearest minute.

3.5. **Row 5: Minute.** The minute of the observation.

3.6. **Row 6: Latitude.** Latitude of the observation point, decimal degrees.

3.7. **Row 7: Longitude.** Longitude of the observation point, decimal degrees.

3.8. **Row 8: Elevation.** Elevation of the barometer, meters.

3.9. **Row 9: ICAO.** The ICAO identifier for the observation, if one exists. This is normally a 4-letter identifier, but numerical digits may occur in position 3 and 4. Assignments are determined by International Civil Aviation Organization members and published quarterly in Doc. 7910. Identifiers are expressed in the Epoch 2010 system, where the correct identifier for that location in the year 2010 is used, and shields the user from having to research old ICAO assignment documentation.

3.10. **Row 10: FAA.** The FAA identifier for the observation, if one exists. This is a 3-letter alphanumeric code. Assignments are determined by the U.S. Federal Aviation Administration and are published in FAA Publication FAAO 7350.

3.11. **Row 11: WMO.** The WMO identifier for the observation, if one exists. This is a 5-digit numerical code. Assignments are determined by World Meteorological Organization members and are published in WMO Pub 9A.

3.12. **Row 12: WBAN.** The WBAN number for the observation, if one exists. This is a 5-digit numerical code. Assignments are determined by the National Climatic Data Center (National Oceanic and Atmospheric Administration) and published in their STN-HIST catalog.

3.13. **Row 13: Country.** The country of the observation site, expressed as a 3-letter code. This is the standard "country code" and is defined in ISO 3166-1 alpha-3.

3.14. **Row 14: Region.** The region for the observation site, normally expressed as 2-letter code. This is defined in ISO 3166-2.

3.15. **Row 15: Total cloud cover,** in oktas (eighths). The number 0 will indicate clear and 9 will indicate obscured. [Integer]

3.16. **Row 16: Ceiling,** in hundreds of feet. This is the lowest height where a cloud and all lower layers are covering more than half of the sky. A value of 888 or 9999 indicates the station reports no ceiling, and 999 or 9900 indicates unknown ceiling. [Integer]

3.17. **Row 17: Prevailing visibility,** in whole meters. [Integer]

3.18. **Row 18: Present weather,** expressed as a numerical *ww* code. The *ww* code is a widely used expression defined in WMO Pub. 306. In addition, a set of supplementary codes are used if the precipitation type cannot be decoded to an existing *ww* code. See Table 1 and 2 for a quick reference. [Integer]

3.19. **Row 19: Past weather, type 1.** This is code W_1 from WMO Pub. 306, indicating other past weather types since the last observation. Refer to Appendix 3 for a quick reference.

[Integer]

3.20. **Row 20: Past weather, type 2.** This is code W_2 from WMO Pub. 306, indicating other past weather types since the last observation. Refer to Appendix 3 for a quick reference. The definitions of W_2 are the same as for W_1 . [Integer]

3.21. **Row 21: Temperature,** in degrees Celsius. Values may be whole or in tenths.

3.22. **Row 22: Dewpoint temperature,** in degrees Celsius. Values may be whole or in tenths.

3.23. **Row 23: Relative humidity,** in percent. [Integer]

3.24. **Row 24: Wind direction,** in degrees relative to true north. [Integer]

3.25. **Row 25: Wind speed,** in knots (nautical miles per hour). [Integer]

3.26. **Row 26: Wind gust,** in knots (nautical miles per hour), if a gust is occurring. The exact definition of a gust may vary from nation to nation; see WMO Pub. 306 for full information. [Integer]

3.27. **Row 27: Altimeter setting,** in decimal inches of mercury to the nearest hundredth.

3.28. **Row 28: Sea-level pressure,** in decimal millibars to the nearest tenth, if reported or available.

3.29. **Row 29: Snow depth,** in millimeters. *

3.30. **Row 30: Maximum 24-hour temperature,** in Celsius degrees. *

3.31. **Row 31: Minimum 24-hour temperature,** in Celsius degrees. *

3.32. **Row 32: Maximum 12-hour temperature,** in Celsius degrees. *

3.33. **Row 33: Minimum 12-hour temperature ,** in Celsius degrees. *

3.34. **Row 34: Maximum 6-hour temperature ,** in Celsius degrees. *

3.35. **Row 35: Minimum 6-hour temperature,** in Celsius degrees. *

3.36. **Row 36: Precipitation in past 24 hours,** in tens of millimeters. *

3.37. **Row 37: Precipitation in past 12 hours,** in tens of millimeters. *

3.38. **Row 38: Precipitation in past 6 hours,** in tens of millimeters. *

3.39. **Row 39: Precipitation in past hour,** in tens of millimeters. *

3.40. **Row 40: Source of data**, coded value. A value of 1-8 or 10-14 indicates decoded data by federal agencies and reduced to a packed interim form, a value of 15-17 indicates data keyed manually by NCDC into a packed interim form, a value of 18-23 indicates other sources and keyed into a packed interim form, 100 indicates the source is live data decoded by Weather Graphics from GTS or other circuits; and 9 or 255 indicates from a federal source but is unknown.

3.41. **Row 41: Data type**, coded value. A data type of 10-11 is SAO (airways), 12-13 is METAR, 14-15 is automated, 20 is SYNOP data; 21 is ship SYNOP, 100-154 is merged data from a federal source, and 255 indicates data from a federal source but of unknown origin.

3.42. **Row 42: Year of observation**, rounded to nearest hour.

3.43. **Row 43: Month of observation**, rounded to nearest hour.

3.44. **Row 44: Day of observation**, rounded to nearest hour.

3.45. **Row 45: Hour of observation**, rounded to nearest hour.

* = indicates that this field will only contain data if the station is mandated to report the data, it has reported a value, and it has been successfully decoded. Weather Graphics does not postprocess climatological statistics, so values are displayed only if they are expressly reported. If no data is available, this value will be blank. If the station reports the precipitation is unknown, the value will be -1.

MISSING DATA: If data is missing or blank, normally the field will be blank, but other codes such as -9999 may exist.

Table 1. WMO Weather Codes. This is prescribed by World Meteorological Organization Publication 306, Table 4677, ww, Present Weather.

00 Cloud development not observed or observable	34 Severe duststorm or sandstorm - no appreciable change during the preceding hour	71 Continuous fall of snow flakes slight at time of observation
01 Clouds dissolving or becoming less developed	35 Severe duststorm or sandstorm - has begun or has increased during the preceding hour	72 Intermittent fall of snow flakes moderate at time of observation
02 State of sky on the whole unchanged during the past hour	36 Slight or moderate blowing snow generally low (below eye level)	73 Continuous fall of snow flakes moderate at time of observation
03 Clouds generally forming or developing during the past hour	37 Heavy drifting snow generally low (below eye level)	74 Intermittent fall of snow flakes heavy at time of observation
04 Visibility reduced by smoke haze	38 Slight or moderate blowing snow generally high (above eye level)	75 Continuous fall of snow flakes heavy at time of observation
05 Haze	39 Heavy drifting snow generally high (above eye level)	76 Ice prisms (with or without fog)
06 Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation.	40 Fog or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer	77 Snow grains (with or without fog)
07 Dust or sand raised by the wind at or near the station at the time of the observation, but no well-developed dust whirl(s), and no sandstorm seen	41 Fog or ice fog in patches	78 Isolated starlike snow crystals (with or without fog)
08 Well developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm	42 Fog or ice fog, sky visible has become thinner during the preceding hour	79 Ice pellets, type (a)
09 Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour	43 Fog or ice fog, sky invisible has become thinner during the preceding hour	80 Rain shower(s), slight
10 Mist	44 Fog or ice fog, sky visible no appreciable change during the preceding hour	81 Rain shower(s), moderate or heavy
11 Patches of shallow fog or ice fog, less than 2 m deep	45 Fog or ice fog, sky invisible no appreciable change during the preceding hour	82 Rain shower(s), violent
12 More or less continuous shallow fog or ice fog, less than 2 m deep	46 Fog or ice fog, sky visible has begun or has become thicker during the preceding hour	83 Shower(s) of rain and snow mixed, slight
13 Lightning visible, no thunder heard	47 Fog or ice fog, sky invisible has begun or has become thicker during the preceding hour	84 Shower(s) of rain and snow mixed, moderate or heavy
14 Precipitation within sight, not reaching the ground or surface of sea	48 Fog, depositing rime, sky visible	85 Snow shower(s), slight
15 Precipitation within sight, reaching ground or the surface of the sea, but distant, i.e. estimated to be more than 5 km from the station	49 Fog, depositing rime, sky invisible	86 Snow shower(s), moderate or heavy
16 Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station	50 Drizzle, not freezing, intermittent slight at time of observation	87 Shower(s) of snow pellets or ice pellets, type (b), with or without rain or rain and snow mixed - slight
17 Thunderstorm, but no precipitation at the time of observation	51 Drizzle, not freezing, continuous slight at time of observation	88 Shower(s) of snow pellets or ice pellets, type (b), with or without rain or rain and snow mixed - moderate or heavy
18 Wind squalls, at or near the station during the preceding hour or at time of observation	52 Drizzle, not freezing, intermittent moderate at time of observation	89 Shower(s) of hail*, with or without rain or rain and snow mixed, not associated with thunder - slight
19 Funnel cloud, tornado, or waterspout, at or near the station during the preceding hour or at time of observation	53 Drizzle, not freezing, continuous moderate at time of observation	90 Shower(s) of hail*, with or without rain or rain and snow mixed, not associated with thunder - moderate or heavy
20 Recent drizzle (not freezing) or snow grains	54 Drizzle, not freezing, intermittent heavy (dence) at time of observation	91 Slight rain at time of observation - thunderstorm during the preceding hour but not at time of observation
21 Recent rain (not freezing)	55 Drizzle, not freezing, continuous heavy (dence) at time of observation	92 Moderate or heavy rain at time of observation - thunderstorm during the preceding hour but not at time of observation
22 Recent snow	56 Drizzle, freezing, slight	93 Slight snow, or rain and snow mixed or hail** at time of observation - thunderstorm during the preceding hour but not at time of observation
23 Recent rain and snow or ice pellets	57 Drizzle, freezing, moderate or heavy (dence)	94 Moderate or heavy snow, or rain and snow mixed or hail** at time of observation - thunderstorm during the preceding hour but not at time of observation
24 Recent freezing drizzle or freezing rain	58 Drizzle and rain, slight	95 Thunderstorm, slight or moderate, without hail**, but with rain and/or snow at time of observation - thunderstorm at time of observation
25 Recent shower(s) of rain	59 Drizzle and rain, moderate or heavy	96 Thunderstorm, slight or moderate, with hail** at time of observation - thunderstorm at time of observation
26 Recent shower(s) of snow, or of rain and snow	60 Rain, not freezing, intermittent slight at time of observation	97 Thunderstorm, heavy, without hail**, but with rain and/or snow at time of observation - thunderstorm at time of observation
27 Recent shower(s) of hail, or of rain and hail	61 Rain, not freezing, continuous slight at time of observation	98 Thunderstorm combined with duststorm or sandstorm at time of observation - thunderstorm at time of observation
28 Recent fog or ice fog	62 Rain, not freezing, intermittent moderate at time of observation	99 Thunderstorm, heavy, with hail** at time of observation - thunderstorm current or recent thunderstorm
29 Recent thunderstorm (with or without precipitation)	63 Rain, not freezing, continuous moderate at time of observation	
30 Slight or moderate duststorm or sandstorm - has decreased during the preceding hour	64 Rain, not freezing, intermittent heavy at time of observation	
31 Slight or moderate duststorm or sandstorm - no appreciable change during the preceding hour	65 Rain, not freezing, continuous heavy at time of observation	
32 Slight or moderate duststorm or sandstorm - has begun or has increased during the preceding hour	66 Rain, freezing, slight	
33 Severe duststorm or sandstorm - has decreased during the preceding hour	67 Rain, freezing, moderate or heavy	
	68 Rain, or drizzle and snow, slight	
	69 Rain, or drizzle and snow, moderate or heavy	
	70 Intermittent fall of snow flakes slight at time of observation	

Table 2. Supplementary Codes used to clarify weather types. These additional codes are needed because of differences in original reporting definitions that cannot be accurately mapped to a ww code.

100	unknown precipitation (UP)
101	volcanic ash (VA)
102	blowing spray (BLPY)
103	drifting dust (DRDU)
104	ice fog
107	rain/drizzle and snow, light
108	rain/drizzle and snow, moderate
109	rain/drizzle and snow, heavy
110	ice pellets, light (IP-)
111	ice pellets, moderate (IP)
112	ice pellets, heavy (IP+)
113	rain shower, light (RW-)
114	rain shower, moderate (RW)
115	rain shower, heavy (RW+)
116	rain-snow shower, light
117	rain-snow shower, moderate
118	rain-snow shower, heavy
119	snow shower, light (SW-)
120	snow shower, moderate (SW)
121	snow shower, heavy (SW+)
122	freezing drizzle, light (ZL-)
123	freezing drizzle, moderate (ZL)
124	freezing drizzle, heavy (ZL+)
125	freezing rain, light (ZR-)
126	freezing rain, moderate (ZR)
127	freezing rain, heavy (ZR+)
128	freezing and frozen precipitation, any combination
129	rain/drizzle and ice pellets (all intensities)
130	rain/drizzle and snow (all intensities)
131	snow or snow pellets or snow grains, light
132	snow or snow pellets or snow grains, moderate
133	snow or snow pellets or snow grains, heavy
134	snow pellets, light (SP-)
135	snow pellets, moderate (SP)
136	snow pellets, heavy (SP+)
137	snow grains, light (SG-)
138	snow grains, moderate (SG)
139	snow grains, heavy (SG+)
140	blowing dust (BD)
141	blowing sand (BS)

Table 3. W_1 and W_2 codes. This is prescribed by World Meteorological Organization Publication 306, Table 4561, W_1 and W_2 , Past weather.

0	Cloud covering 1/2 or less of the sky throughout the appropriate period
1	Cloud covering more than 1/2 of the sky during part of the appropriate period and covering 1/2 or less during part of the period
2	Cloud covering more than 1/2 of the sky throughout the appropriate period
3	Sandstorm, duststorm or blowing snow
4	Fog or ice fog or thick haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed
8	Shower(s)
9	Thunderstorm(s) with or without precipitation