Protocols for Compiling a Standard Monthly Climatological Return

These notes detail the standard recording times and intervals, along with the dates to be assigned to each reading, in order to produce a monthly climatological return in accordance with COL standards. These aim to approximate the UK Met Office standards as far as possible, bearing in mind the limitation that may apply to amateur observing networks (in particular the observing time). With the exception of Observation Time, they are dealt with in the order in which they appear on the COL monthly return form.

Whilst it is accepted that owing to individual circumstances strict adherence to these protocols, especially with regard to timing, is sometimes difficult to achieve they should be followed as closely as possible. It is particularly important to note any deviation from standard procedures in the station metadata notes, kept with the observational data. These deviations (especially terminal hours) can cause significant differences in monthly means and occasional differences in dates of occurrence when compared with a standard record.

Observation time (OT) - this should ideally be 09GMT or else as close as possible to 09GMT but within the period 06-09GMT if at all possible. However, it is recognised that a few sites an afternoon/evening observation time may be unavoidable. However, in some case the use of autographic instruments can enable the observer to generate observations as for an 09GMT observing hour.

Max and Min Temperatures (ºC) - the thermometers should be read and reset at the OT. When the OT lies in the range 06-09GMT the max temperature should be assigned to the date of the previous day or 'thrown back', the min temperature should be entered to the date of the current day.[1][2]

Mean Max and Min Temperatures (ºC) - these are the means of the daily max and min temperatures assigned to each date of the month, as above.

Mean Temperature (ºC) - this is the arithmetic mean of the monthly mean max and min temperatures. (The mean of an AWS which logs temperature at frequent intervals during the day may give a more accurate daily mean temperature, but this long-standing climatological convention is used for consistency between stations and with historical records.)

Grass Min Temperature (ºC) - the thermometer should be read at the OT and reset either at the OT or, preferably, at sunset. The grass min temperature should be assigned to the date

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[1] When the OT does not lie in the period 06-09GMT, and the OT lies after 14GMT, the max temperature is assigned to the current day. When the OT does not lie in the period 06-09GMT, and the OT lies before 14GMT, the max temperature is assigned to the previous day. This method is based on the fact that the average time of occurrence of the max temperature lies at about 14GMT.

[2] When the OT does not lie in the period 06-09GMT, and the OT lies after 06GMT, the min temperature is assigned to the current day. When the OT does not lie in the period 06-09GMT, and the OT lies before 06GMT, the min temperature is assigned to the previous day. This method is based on the fact that the average time of occurrence of the min temperature lies at about 06GMT.

of the morning reading.[3] However, if the OT is *before* 06GMT, then the thermometer should *only* be reset at the OT, otherwise the minimum temperature is likely to occur between tasking the reading and resetting the thermometer, and hence go unrecorded.

Precipitation (mm) - precipitation is measured at the OT. When the OT lies in the range 06-09GMT the total rain and melted solid precipitation received should be 'thrown back', i.e. assigned to the date of the previous day (solid precipitation remaining in the gauge at 09GMT should be melted before the measurement is made).[4]

Rain days - these are days on which 0.2 mm or more of precipitation are recorded, and will include those days counted as wet days.

Wet days - these are days on which 1.0 mm or more of precipitation are recorded.

Day with Air Frost - a day with a reading of the air min thermometer of -0.1°C or below when read at the OT.

Day with Ground Frost - a day with a reading of the grass min thermometer of -0.1°C or below when read at the OT.

Day with Sleet or Snow Falling - this is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT. If both sleet and snow falls separately during the same day, this counts as one day of sleet/snow.

Day with at Least 50% Snow Cover at Morning Observation Time - the date is assigned to the date of the observation. The reading is taken with reference to an open area, representative of the site – not simply a bare plot of soil.

Day with Thunder - this is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT.

Day with Hail - this is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT. One entry is made for hail each day, both small and large hail being reckoned as one entry. If both small and large hail fall on the same day this counts as a day with large hail. The monthly total of small and large hail together cannot exceed the number of hail days in the month.

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[3] **When the grass min thermometer is reset at the observation time:** When the OT does not lie in the period 06-09GMT, and the OT lies after 06GMT, the min temperature is assigned to the current day. When the OT does not lie in the period 06-09GMT, and the OT lies before 06GMT, the min temperature is assigned to the previous day. This method is based on the fact that the average time of occurrence of the min temperature lies at about 06GMT.
  When the grass min thermometer is reset at sunset: When the OT does not lie in the period 06-09GMT, and the OT lies after 06GMT, the min temperature is assigned to the current day.

[4] When the OT is not in the period 06-09GMT the observer needs to consider how much of the previous 24 hours during which the precipitation was collected occurred during the current and previous days. For observations made before 12GMT the majority of the previous 24 hours occurred during the previous calendar day, and the rainfall total should therefore be assigned to the previous calendar day. For observations made after 12GMT the majority of the previous 24 hours occurred during the current calendar day, and the rainfall total should therefore be assigned to the current day.

Sunshine (h) – The observer should keep a note of the daily sunshine totals from sunrise to sunset (or 00GMT to 00GMT) in order to provide the required sunshine information. Sunless days are those with exactly 0.0h of bright sunshine.

Mean Soil Temperatures at OT (°C) - the thermometers should be read at the OT daily and the temperature assigned to the date of reading. The mean temperature for the monthly return is the mean of these daily readings.

Day with Gale - a gale is a mean wind over a 10 minute interval of 34 knots (39 mph) or more, occurring at any time during the day. The date is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT.

Wind Direction at OT - this should be the point reading at the OT or, where wind direction is logged continuously, it may be the daily vector mean wind direction. Whichever system is used, this should be noted with the return.

Mean Wind Speed (mph) - there are two acceptable conventions for this variable: the mean at the OT or the mean over a 24-hour period ending either at midnight GMT or, at some stations, at the OT. If the mean is calculated over a 24-hour period ending at midnight GMT it should be assigned to the corresponding calendar day; if ended at the OT the date assigned should be "thrown back" as detailed for precipitation etc.. If the 'mean of the morning observation speeds' is to be used, then a 10-minute mean ending at the OT should be used to ensure the mean is representative of the wind prevailing at that time. Whichever system is used, this should be noted with the return.

Max Wind Gust (mph) - the max point wind speed reading reached. The date is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT.

Mean Cloud Cover at OT (%) - cloud cover should be estimated at the OT daily and the date assigned to the date on which the reading is taken. The mean cloud cover for the monthly return is the mean of these daily readings. Where cloud cover is noted in oktas the percentage cover is the mean cloud cover in oktas x 12.5%. Days where the sky is obscured (by fog, etc) should be counted as missing data and not used in computing the monthly average cover.

Mean Relative Humidity at OT (%) - relative humidity should be recorded at the OT daily and the date assigned to the date on which the reading is taken. The mean relative humidity for the monthly return is the mean of these daily readings.

Rainfall Duration (h) - this is reckoned from the OT on the 1st day of the month to the OT on the first day of the month following that for which the monthly return is being compiled. The number of hours during which the rainfall rate equalled or exceeded 0.1mm/hour is calculated. This statistic is most relevant as a monthly or annual value. So, although calculating this on a calendar month basis (i.e. from midnight to midnight) can theoretically throw up anomalies when compared with other rain returns it is acceptable to calculate it on this basis for reasons of ease.

Air Frost Duration (h) - this is reckoned from the OT on the last day of the month preceding that for which the monthly return is being compiled to OT on the last day of the month for which the monthly return is being compiled. The number of hours during which the air thermometer reads -0.1°C or below is calculated. This statistic is of only minor

climatological value and is most relevant as a monthly or annual value. So, although calculating this on a calendar month basis (i.e. from midnight to midnight) can theoretically throw up anomalies when compared with other temperature returns it is acceptable to calculate it on this basis for reasons of ease.

Evaporation (ml or mm) - this is read at the OT daily and the reading obtained assigned in an identical manner to that for of the precipitation/rainfall.

Sea surface temperature (ºC) – this should (ideally) be noted on a daily basis at the OT, and be assigned to the day of the observation. The average, max and min values for the month are then determined from the observations made during the month.

Mean MSL Pressure at 09GMT (mb) - this reading must only be taken at 09GMT. It is recorded at 09GMT daily and the date assigned to the date on which the reading is taken. The mean MSL pressure for the monthly return is the mean of these daily readings.

Highest and Lowest MSL Pressure (mb) - this is reckoned on a calendar day basis, i.e. midnight - midnight, and the date assigned to the date on which the event occurs. Remember during BST to assign the date according to GMT. A barograph (or equivalent instrument) is therefore needed to determine these quantities.

Black bulb temperatures (ºC) – these should be treated in the same way as the max and min air temperatures.

Solar radiation (MJ/m^2 or W/m^2) – Daily values of the global solar radiation should be determined and assigned to the 00-24GMT calendar days. The highest, lowest and average of these values can then be determined. The maximum global radiation received in one hour (beginning 'on the hour' for each day can also be noted, and the highest of these values then entered in the return.

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