HYDROLOGY PROJECT

World Bank & Government of The Netherlands funded

Training module # SWDP - 15

How to make data entry for climatic data

New Delhi, November 1999

CSMRS Building, 4th Floor, Olof Palme Marg, Hauz Khas,
New Delhi – 11 00 16 India
Tel: 68 61 681 / 84 Fax: (+ 91 11) 68 61 685
E-Mail: dhvdelft@del2.vsnl.net.in

DHV Consultants BV & DELFT HYDRAULICS

with
HALCROW, TAHAL, CES, ORG & JPS

Table of contents

		Page
1.	**Module context**	**2**
2.	**Module profile**	**3**
3.	**Session plan**	**4**
4.	**Overhead/flipchart master**	**5**
5.	**Handout**	**6**
6.	**Additional handout**	**8**
7.	**Main text**	**10**

1. Module context

While designing a training course, the relationship between this module and the others, would be maintained by keeping them close together in the syllabus and place them in a logical sequence. The actual selection of the topics and the depth of training would, of course, depend on the training needs of the participants, i.e. their knowledge level and skills performance upon the start of the course.

2. Module profile

Title	:	How to make data entry for climatic data
Target group	:	Data Processing Centre Assistants, Assistant Hydrologists, Hydrologists, Data Processing Centre Managers
Duration	:	One session of 30 min
Objectives	:	After the training the participants will be able to*:* • make entries for climatic data • make prescribed data entry checks
Key concepts	:	• climatic data (dry, wet, min. & max. temp, pressure, humidity, wind direction, run & velocity, sunshine duration) • manual, autographic and digitally observed climatic data • entry of daily climatic data • entry of climatic data at synoptic hours • entry of hourly data tabulated from autographic records • digital data from data loggers
Training methods	:	Lecture, exercises
Training tools required	:	Board, flipchart
Handouts	:	As provided in this module
Further reading and references	:	

3. Session plan

No	Activities	Time	Tools
1	***General principles*** • Main points	2 mi	 OHS 1
2	***SWDES and climatic data entry*** • SWDES & climatic data entry • List of variables	2 min	 OHS 2 OHS 3
3	***Manual inspection of field records*** • Inspection of field records	2 min	 OHS 4
4	***Entry of daily climatic data*** • Data entry screen- daily • Data entry checks • Plot of relative humidity with difference of dry & wet bulb temp. • Plot of wind rose diagram for wind direction and/or SWDES	12 min	 OHS 5 OHS 6 0HS 7 OHS 8
5	***Entry of twice daily climatic data*** • Data entry screen - twice daily and/or SWDES	2 min	 OHS 9
6	***Entry of hourly climatic data*** • Data entry screen – hourly temperature • Plot of hourly temperature in a day • Plot of hourly temperature in a month and/or SWDES	4 min	 OHS 10 OHS 11 OHS 12
7	***Entry of sunshine duration data*** • Data entry screen - hourly sunshine • Plot of sunshine duration in a month and/or SWDES	6 min	 OHS 13 OHS 14
8	***Exercises*** • Explore features of daily and hourly climatic data forms and enter one month daily min. & max. temperature data and perform appropriate data entry checks • Explore features of sunshine duration data form	 20 min 10 min	

4. Overhead/flipchart master

5. Handout

Add copy of Main text in chapter 8, for all participants.

6. Additional handout

These handouts are distributed during delivery and contain test questions, answers to questions, special worksheets, optional information, and other matters you would not like to be seen in the regular handouts.

It is a good practice to pre-punch these additional handouts, so the participants can easily insert them in the main handout folder.

7. Main text

Contents

1.	General principles	1
2.	SWDES and climatic data entry	1
3.	Manual inspection of field records	2
4.	Entry of daily climatic data	2
5.	Entry of twice daily climatic data	5
6.	Entry of hourly climatic data	6
7.	Entry of hourly sunshine duration data	9
8.	Entry of special variables	10

How to make data entry for climatic data

1. General principles

- **Climatological data are required in hydrology only for the computation of evapotranspiration by theoretical and empirical methods. Climatological data for the purpose of this module include the direct measurement of pan evaporation. Rainfall measurement is treated separately**

- **There is a requirement to make all climatic data available on computer for validation processing and reporting - the first step is therefore data entry.**

- **Data entry will be carried out at Sub-divisional offices as near as possible to the observation station to ensure interaction between data processing and observation personnel.**

- **All data entry of climatic data will be done through the primary module of dedicated hydrological data processing software (SWDES) which is specifically tailored for the purpose. Digital data from a limited number of Automatic Weather Stations (AWS) may be available.**

- **Initial emphasis will be on the entry of current climatic data, but SWDES also provides a suitable means of entering historical data, from original data sheets where available and otherwise from published tabulations.**

- **Prior to entry to computer two manual activities are essential:**

  - Registration of receipt - on the day of receipt (See Module 5)
  - Manual inspection of climatic data sheets and charts

- **On completion of data entry and primary validation in the primary module, data will be exported (transferred) to the secondary module for further validation and processing at the Divisional office.**

2. SWDES and climatic data entry

SWDES is primarily designed for the entry of time series data but it also incorporates space-oriented data sufficient to locate and catalogue the stations under the control of a particular state or agency. Stations, and series can then be accessed from typical Windows Menus and Toolbars by clicking on appropriate buttons. This feature, of course common to all variables.

For all time series data, SWDES provides entry screens automatically with date and time labels against which the variable values are entered. This simplifies data entry and avoids the potential errors of date/time entry.

SWDES provides data entry checking capability, rejecting clearly spurious values and flagging suspect ones for inspection. For example, it will reject entry of an alpha character in a numeric field or duplicate decimal point and will highlight for inspection values above a pre-set limit. In addition options for plotting time series graphs, at time of entry are available in most cases.

SWDES provides a suitable format for entry of data for all standard instruments installed at the Full Climate Stations (FCS) set up under Hydrology Project and their frequencies of operation:

- Dry bulb temperature - read daily or twice daily
- Wet bulb temperature - read daily or twice daily
- Maximum thermometer - read daily or twice daily
- Minimum thermometer - read daily or twice daily
- Relative humidity - historical data previously computed
- Instantaneous wind speed - read daily or twice daily
- Daily wind run - read daily
- Wind direction - read daily or twice daily
- Pan evaporation - read daily or twice daily
- Pan water temperature - read daily or twice daily
- Atmospheric pressure - read daily or twice daily
- Autographic recording of relative humidity - tabulated values on chart
- Autographic recording of temperature - tabulated values on chart
- Autographic recording of atmospheric pressure - tabulated values on chart
- Sunshine hours - from Campbell stokes sunshine recorder card.

3. Manual inspection of field records

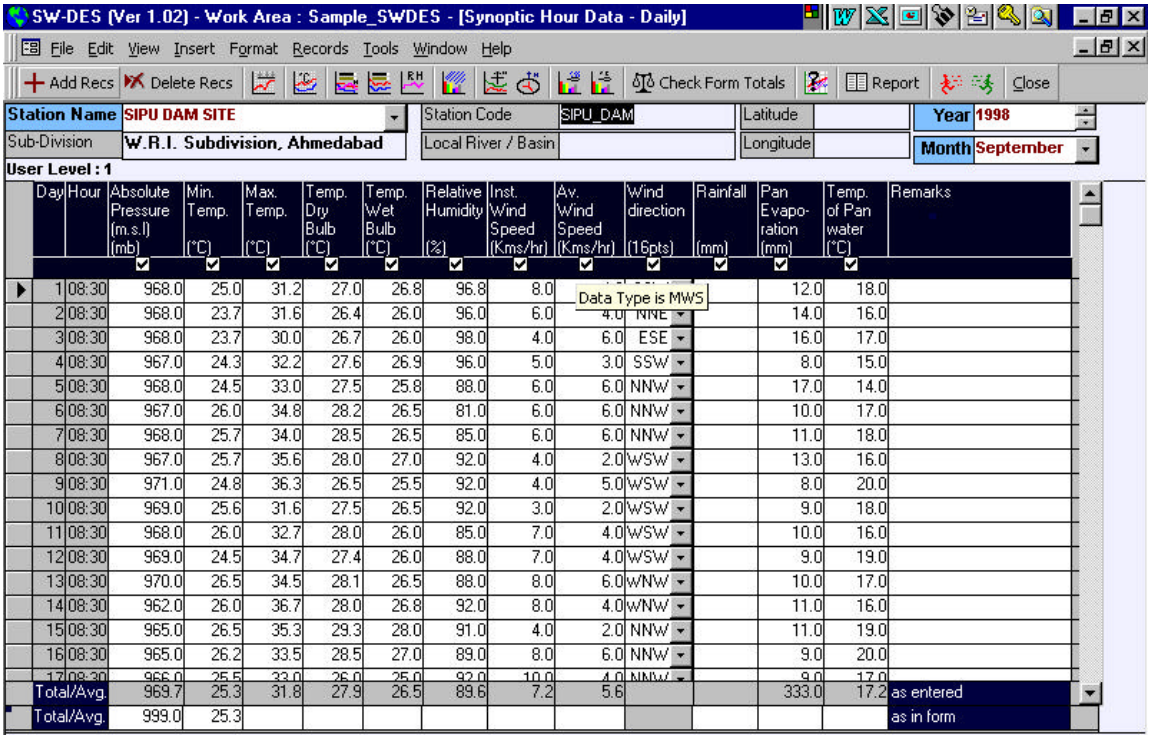
Prior to data entry to computer an initial inspection of field records is required. This is done in conjunction with notes received from the observation station on equipment problems and faults, missing records or exceptional rainfall. **Climate sheets and charts will be inspected for the following:**

- Is the station name and code and month and year recorded?
- Do the number of record days correspond with the number of days in the month?
- Are there missing values or periods for which values of a variable have been accumulated during absence of the observer?
- Have monthly totals or averages of variables been entered?
- Have the autographic records been extracted correctly? Do the check manual readings at the beginning and end agree with the chart values, and if not has a correction been applied?
- Are the records written clearly and with no ambiguity in figures or decimal points?

Any queries arising from such inspection will be communicated to the observer to confirm ambiguous data before data entry. Any unresolved problems will be noted and the information sent forward with the digital data to Divisional office to assist in secondary validation. Any equipment failure or observer problem will be communicated to the supervising field officer for rectification.

4. Entry of daily climatic data

Using SWDES the station and daily series is selected and the screen for entry (or editing) of daily rainfall is displayed as shown in Fig. 4.1. Simultaneously displayed are the station and series codes and corresponding Sub-division and local river/basin are also displayed. A window showing year and month, from which the month of entry may be selected. Upper and lower warning and maximum and minimum limits can also be specified for each variable. As there may be insufficient space available on the data entry screen, this must be specified on a separate screen on which the data series is defined.



Day	Hour	Absolute Pressure (m.s.l) (mb)	Min. Temp. (°C)	Max. Temp. (°C)	Temp. Dry Bulb (°C)	Temp. Wet Bulb (°C)	Relative Humidity (%)	Inst. Wind Speed (Kms/hr)	Av. Wind Speed (Kms/hr)	Wind direction (16pts)	Rainfall (mm)	Pan Evapo-ration (mm)	Temp. of Pan water (°C)	Remarks
1	08:30	968.0	25.0	31.2	27.0	26.8	96.8	8.0				12.0	18.0	
2	08:30	968.0	23.7	31.6	26.4	26.0	96.0	6.0	4.0	NNE		14.0	16.0	
3	08:30	968.0	23.7	30.0	26.7	26.0	98.0	4.0	6.0	ESE		16.0	17.0	
4	08:30	967.0	24.3	32.2	27.6	26.9	96.0	5.0	3.0	SSW		8.0	15.0	
5	08:30	968.0	24.5	33.0	27.5	25.8	88.0	6.0	6.0	NNW		17.0	14.0	
6	08:30	967.0	26.0	34.8	28.2	26.5	81.0	6.0	6.0	NNW		10.0	17.0	
7	08:30	968.0	25.7	34.0	28.5	26.5	85.0	6.0	6.0	NNW		11.0	18.0	
8	08:30	967.0	25.7	35.6	28.0	27.0	92.0	4.0	2.0	WSW		13.0	16.0	
9	08:30	971.0	24.8	36.3	26.5	25.5	92.0	4.0	5.0	WSW		8.0	20.0	
10	08:30	969.0	25.6	31.6	27.5	26.5	92.0	3.0	2.0	WSW		9.0	18.0	
11	08:30	968.0	26.0	32.7	28.0	26.0	85.0	7.0	4.0	WSW		10.0	16.0	
12	08:30	969.0	24.5	34.7	27.4	26.0	88.0	7.0	4.0	WSW		9.0	19.0	
13	08:30	970.0	26.5	34.5	28.1	26.5	88.0	8.0	6.0	WNW		10.0	17.0	
14	08:30	962.0	26.0	36.7	28.0	26.8	92.0	8.0	4.0	WNW		11.0	16.0	
15	08:30	965.0	26.5	35.3	29.3	28.0	91.0	4.0	2.0	NNW		11.0	19.0	
16	08:30	965.0	26.2	33.5	28.5	27.0	89.0	8.0	6.0	NNW		9.0	20.0	
17	08:30	966.0	25.5	33.0	26.0	25.0	92.0	10.0	4.0	NNW		9.0	17.0	
Total/Avg.		969.7	25.3	31.8	27.9	26.5	89.6	7.2	5.6			333.0	17.2	as entered
Total/Avg.		999.0	25.3											as in form

Fig. 4.1: Entry screen format for entering daily climate data

A single computer form in SWDES is used to enter all the variables for a month corresponding with the common field sheet for all observed variables. The first two columns are for the date and time, and then there are as many columns as there are parameters. The name and units of all the variables are given on the top of each column. There is facility available for switching off any column if that type of data is not available at certain station. In such cases the cursor will jump over this inactive column to go directly to the next active column. The data corresponding to each day is to be entered by the user. The cursor first goes horizontally to each column and then goes to the next day. Remarks may be entered against any specific date by using the mouse/tab/cursor.

When data are missing, the corresponding cell is left blank (not zero) and a remark entered against that day. Where the observer has missed readings over a period of days and an accumulated total is subsequently measured (e.g. pan evaporation) the cells corresponding to the missed days will be left blank (not zero) and a remark will be inserted against the date of the accumulation to specify the period over which the accumulation has occurred (e.g. Acc. 23 to 27 Sept).

Note: There are occasions when the climate observer is legitimately absent from his station, for example on account of sickness. The observer must be encouraged to leave such spaces “Missing” or “Accumulated” rather than guess the missing values. The computer validation procedures are better able to estimate the missing values.

At the bottom of the form, the monthly total or average (excepting wind direction), as appropriate is entered from the manuscript. The computed values of these quantities are also calculated from the entered quantities.

During the process of making entries the user can draw the graph for the data being entered. Various individual variables and combinations of variables are pre-set for plotting the monthly data as: (a) pressure, (b) min. and max. temperatures, (c) humidity and difference of dry and wet bulb temperatures (see Fig. 4.2) , (d) dry and wet bulb, (e) relative humidity, (f) rainfall, (g) average and instantaneous wind speed, (h) wind direction (see Fig. 4.3), (i) pan evaporation and (j) pan temperature. Any individual variable can also be plotted if required using a separate option. Data for instantaneous variables (e.g. dry bulb temperature are plotted as line graphs; data for cumulative variables (e.g. pan evaporation) are plotted as bars. The graph of the wind direction will be in the form of a rose diagram.

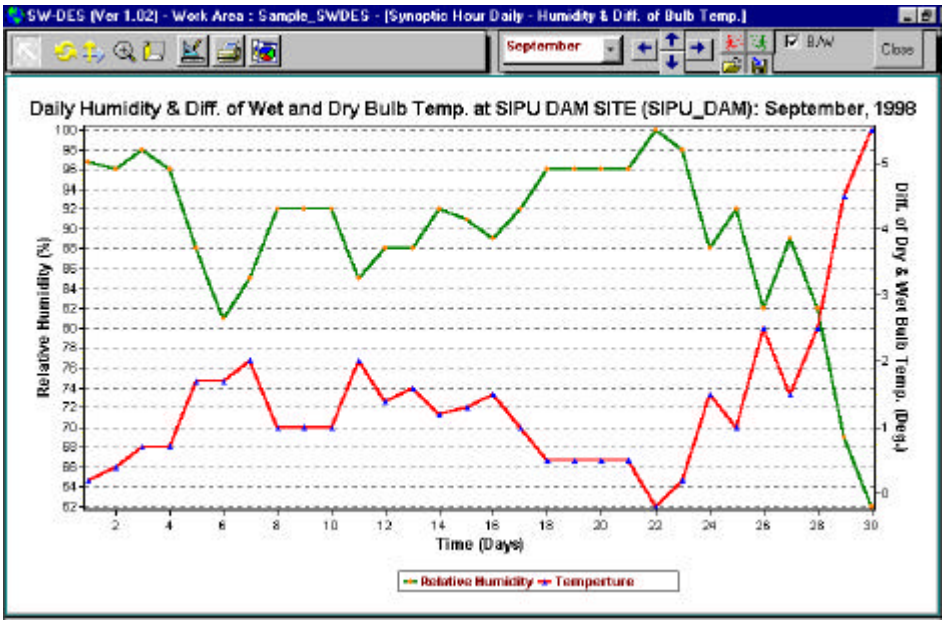


Fig. 4.2: Plot of relative humidity and difference of dry and wet bulb temperatures

Two types of data entry checks are performed for daily climate data.

(a) **The entered daily data can be compared against upper warning level and maximum value**. This allows the user to quickly know which data value has violated the prescribed limits. Upon such prompting the user can once again refer back to the manuscript to see if there was some mistake in entering the data. If such values which violated the maximum data limits are found to be actually reported in the manuscript then the user can put suitable remarks to indicate so.

(b) **Checks are carried out to see if there is a proper match between the entered and computed values of averages or totals of variables in the month**. In case of any mismatch the user is prompted by colour highlighting of the mismatch, so that he can check back the entries.

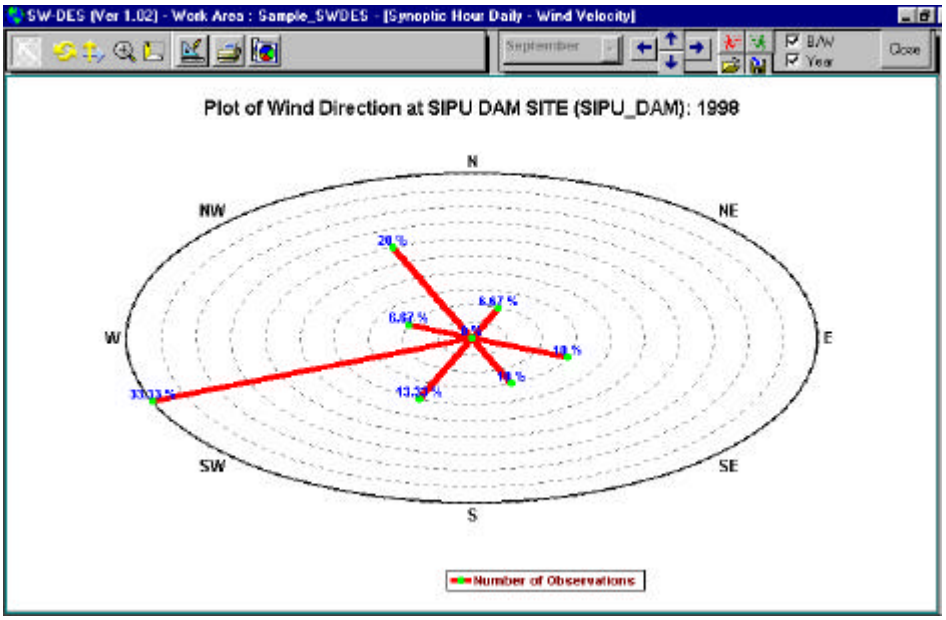


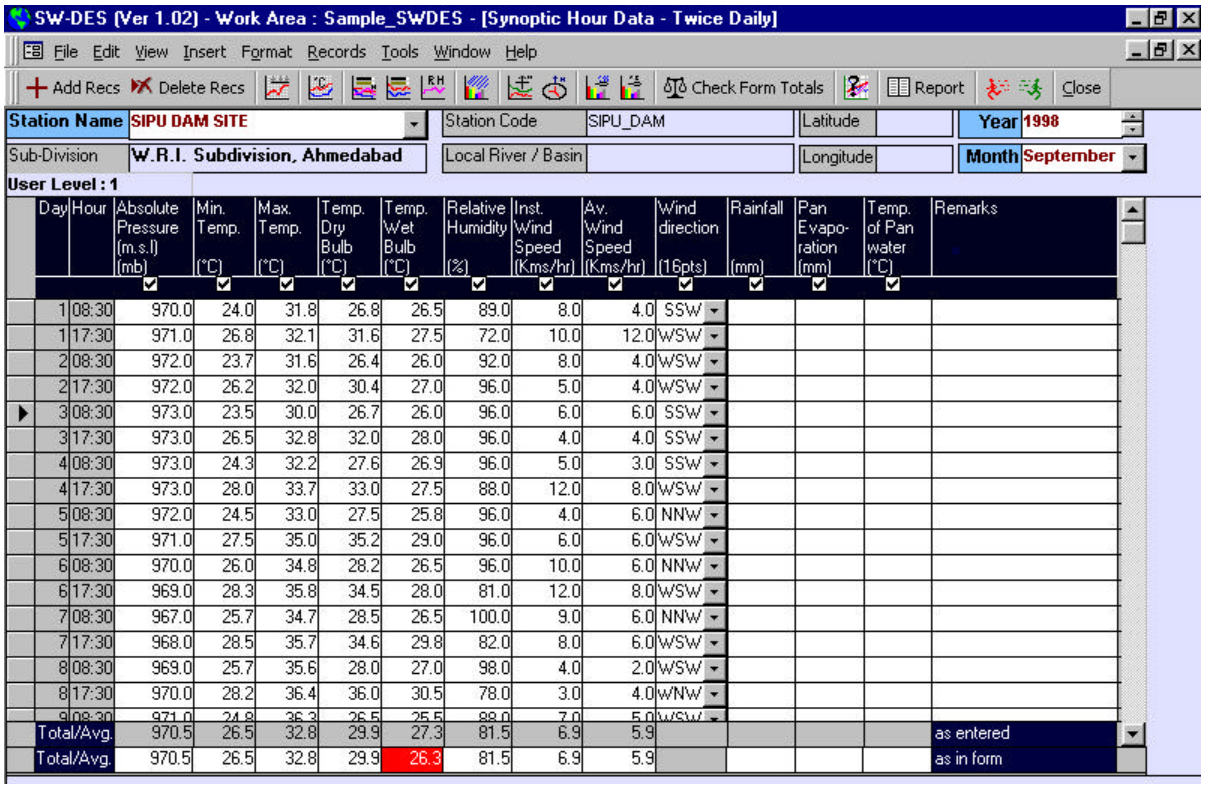
Fig. 4.2: Plot of relative humidity and difference of dry and wet bulb temperatures

5. Entry of twice daily climatic data

The layout of the form for entry of climatic data two times a day is similar to that for daily data as described above and is shown below. The only difference is that for every date there are two rows, one for each of the two observations in the day. The variables available are the same as for daily data. These data are entered for both the observations made at the standard times of observation i.e., 0830 and 1730.

All the data entry operations and facilities are the same as in the case of daily climatic data and similar graphical facilities for display are available. Checks are performed in the same way with respect to comparison of values with warning limits and comparison of manually-calculated totals with computed totals.

It is recommended that the twice daily form should **not** be used for the entry of daily data.



Day	Hour	Absolute Pressure (m.s.l) (mb)	Min. Temp. (°C)	Max. Temp. (°C)	Temp. Dry Bulb (°C)	Temp. Wet Bulb (°C)	Relative Humidity (%)	Inst. Wind Speed (Kms/hr)	Av. Wind Speed (Kms/hr)	Wind direction (16pts)	Rainfall (mm)	Pan Evapo-ration (mm)	Temp. of Pan water (°C)	Remarks
1	08:30	970.0	24.0	31.8	26.8	26.5	89.0	8.0	4.0	SSW				
1	17:30	971.0	26.8	32.1	31.6	27.5	72.0	10.0	12.0	WSW				
2	08:30	972.0	23.7	31.6	26.4	26.0	92.0	8.0	4.0	WSW				
2	17:30	972.0	26.2	32.0	30.4	27.0	96.0	5.0	4.0	WSW				
3	08:30	973.0	23.5	30.0	26.7	26.0	96.0	6.0	6.0	SSW				
3	17:30	973.0	26.5	32.8	32.0	28.0	96.0	4.0	4.0	SSW				
4	08:30	973.0	24.3	32.2	27.6	26.9	96.0	5.0	3.0	SSW				
4	17:30	973.0	28.0	33.7	33.0	27.5	88.0	12.0	8.0	WSW				
5	08:30	972.0	24.5	33.0	27.5	25.8	96.0	4.0	6.0	NNW				
5	17:30	971.0	27.5	35.0	35.2	29.0	96.0	6.0	6.0	WSW				
6	08:30	970.0	26.0	34.8	28.2	26.5	96.0	10.0	6.0	NNW				
6	17:30	969.0	28.3	35.8	34.5	28.0	81.0	12.0	8.0	WSW				
7	08:30	967.0	25.7	34.7	28.5	26.5	100.0	9.0	6.0	NNW				
7	17:30	968.0	28.5	35.7	34.6	29.8	82.0	8.0	6.0	WSW				
8	08:30	969.0	25.7	35.6	28.0	27.0	98.0	4.0	2.0	WSW				
8	17:30	970.0	28.2	36.4	36.0	30.5	78.0	3.0	4.0	WNW				
9	08:30	971.0	24.8	36.3	26.5	25.5	88.0	7.0	5.0	WSW				
Total/Avg.		970.5	26.5	32.8	29.9	27.3	81.5	6.9	5.9					as entered
Total/Avg.		970.5	26.5	32.8	29.9	26.3	81.5	6.9	5.9					as in form

Fig. 5.1: Entry screen format for the entry of twice daily climatic data

6. Entry of hourly climatic data

Hourly climatic data such as temperature, atmospheric pressure and relative humidity are obtained from autographic chart recorders, from which the hourly (or other interval values) are tabulated by the field observer.. Hourly data are entered separately for each variable.

Hourly climate data are entered in the form of a matrix in which the columns are the hourly variable values for a day and the rows represents different days of the month. Time-label entries for the dates and hours are filled automatically. Rows commence either at 0100 and end 2400 hrs or, start from 0830 and end at 0730. The value entered represents the instantaneous value of the variable at that hour. All the hourly values are entered by the user by navigating horizontally across the days. At the end of each day's entry the cursor moves to the column for entering the daily minimum, maximum and average as available in the manuscript. Finally, the monthly minimum, maximum and average as available in the manuscript have to be entered. The computed minimum, maximum and average for each day and for the month is filled automatically in the respective cells. Remarks, if available in the manuscript, can be entered on a daily basis.

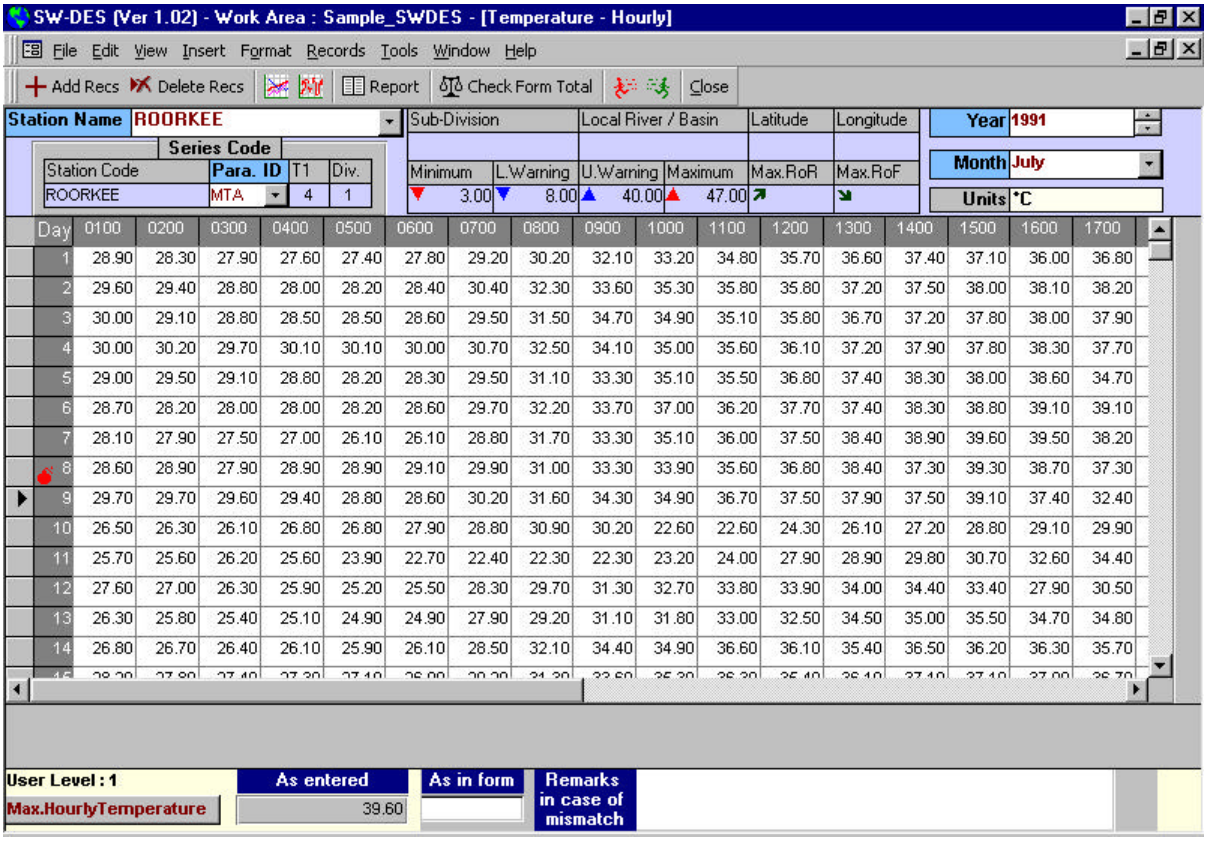


Fig. 6.1: Entry screen format for the entry of hourly climatic data.

For the graphical display of data there are two options:

(a) to plot the data of any day (see Fig. 6.2)
(b) to plot the data for the whole month (see Fig. 6.3)

Three types of data entry checks are performed for hourly climate data.

(a) The entered hourly data can be compared against upper minimum, lower warning level, upper warning level and maximum value.

(b) A check is carried out to see if there is a proper match between the manuscript and computed values for minimum, maximum and the average for each day.

(c) The monthly minimum, maximum and average are checked. In case of any mismatch the user is prompted to check back with the manuscript entries.

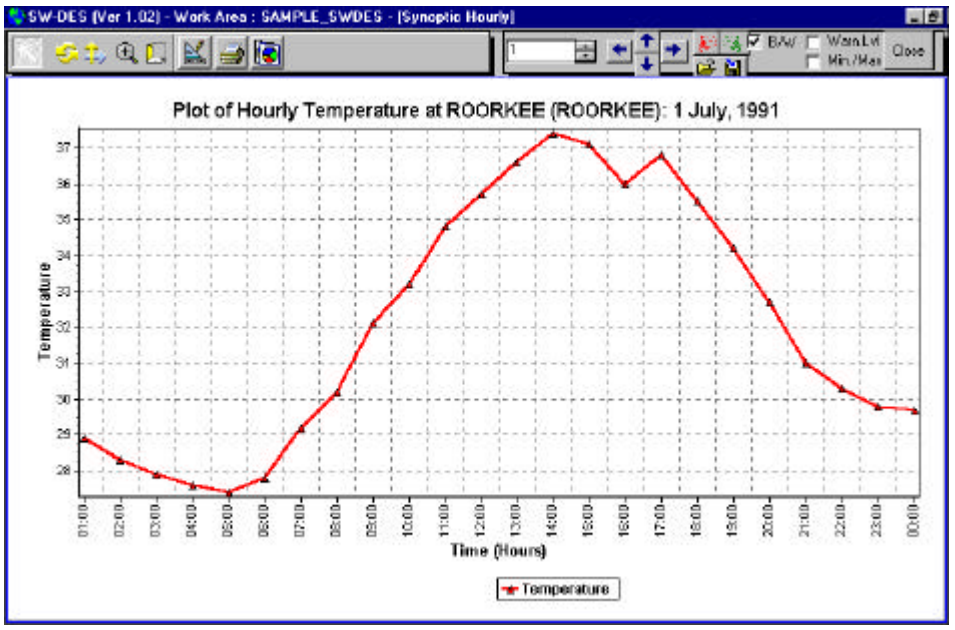


Fig. 6.2: Plot of hourly temperature data for a day

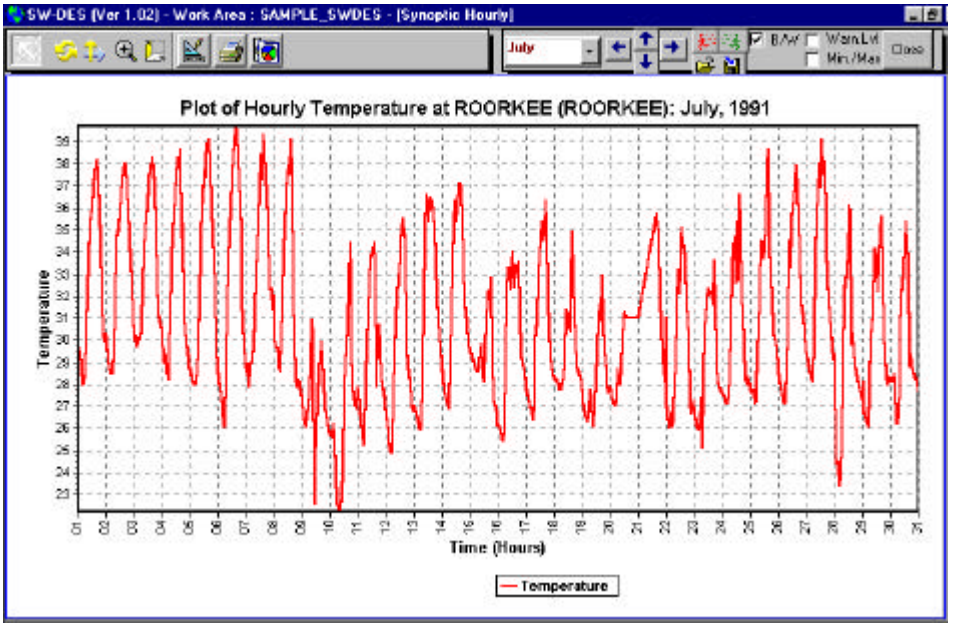


Fig. 6.3: Plot of hourly temperature data for a month

7. Entry of hourly sunshine duration data

A special form is provided for the entry of sunshine duration data derived from the analogue strip chart produced by Campbell Stokes sunshine recorders. Sunshine duration is reported for each clock hour starting from 0600 hrs and ending at 1900 hrs. Beyond these hours there is no possibility of having any sunshine at any place within the country. Each hourly value represents the duration of sunshine during the hourly intervals ending at each of these clock hours.

The layout of the hourly sunshine duration form is as shown below:

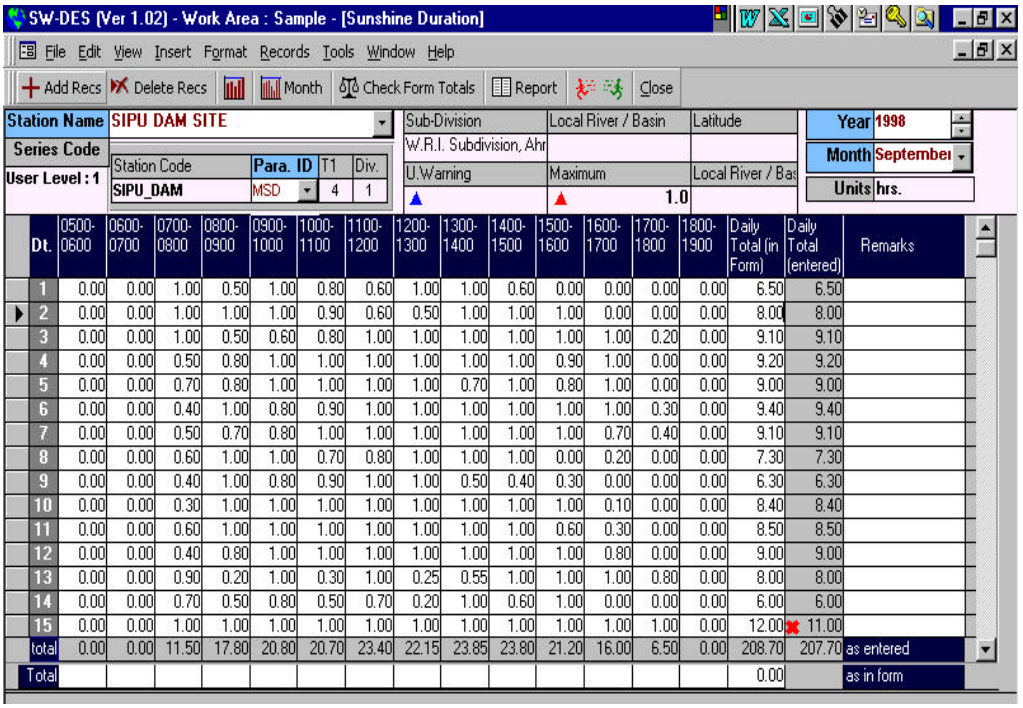


Fig. 7.1: Data entry screen for the entry of hourly sunshine duration records

In common with other data entry screens information on station code, station name sub-division and local river/basin is displayed In this case minimum and maximum limits of 0 and 1 respectively are automatically selected and displayed for reference.

The data entry screen outline is as for other hourly data except that there are 14 columns rather than 24 for entering sunshine duration from 0600 to 1900 hrs. Data entry and checking are otherwise similar to other options. There are two option for making graphs: (a) hourly variation of sunshine during a day and (b) daily variation of sunshine during the month and condensed hourly variation within each day (see Fig. 7.2).

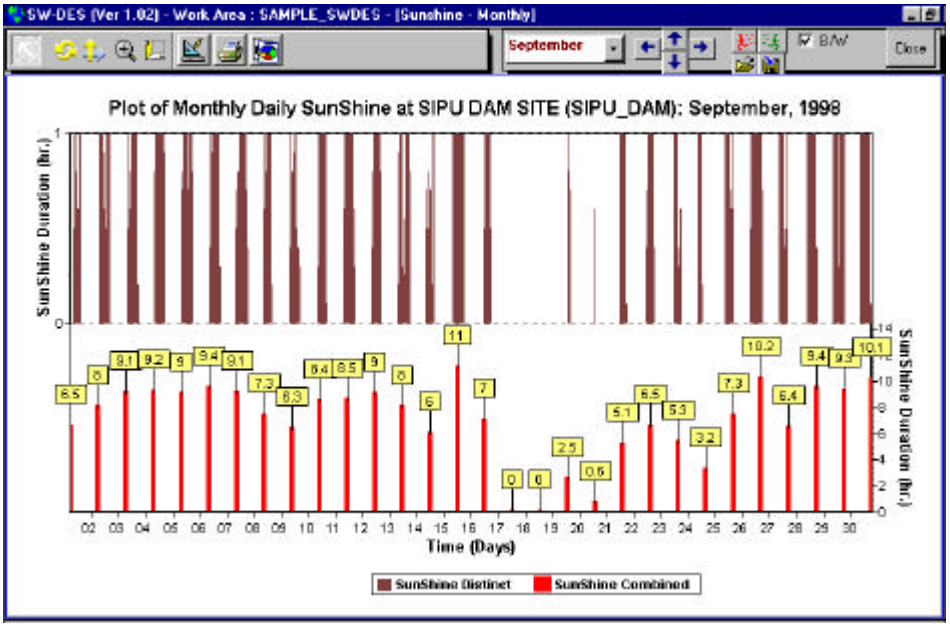


Fig. 7.2: Plot of daily variation of sunshine during a month and condensed hourly variation within each day of the month

8. Entry of special variables

Where additional variables are measured at certain principal stations, facility for entry of data is through general entry screens for equidistant or non-equidistant data. Such entiries might include:

- soil or earth temperatures at different depths
- net radiation, shortwave radiation or extra terrestrial radiation

Screen can be set up for selected stations for selected measurement intervals and all the checks available for specially designed screens will be available.