Data Collection

CHAPTER 5

DATA COLLECTION

Meteorological parameters affecting the crop evapotranspiration, their necessity, availability of data in Gujarat and brief introduction of the selected agrometeorological stations are covered in this chapter.

5.1 SELECTION OF PARAMETERS

Number of empirical relations are available for finding evapotranspiration of crops which are in use in different countries. The principal factor that influence the amount of irrigation water required by plants i.e. evapotranspiration rate depends upon several climatic parameters viz.temperature humidity, evaporation, sunshine hours (radiation), wind speed and rainfall. The food and Agricultural Organisation (FAO) has dealt with this aspects in its publication no 24 entitled "crop water requirements" published in 1977. In this publication four different methods viz.(1) Blaney criddle method (2) Radiation method (3) Penman method and (4)Pan evaporation

method are discussed. After this other research workers also developed some empirical formulae for crop water requirements. Different formulae are based on different data.Table 5.1 shows the required data to fit in the various formulae.

Table 5.1

Data Requirement for Various Estimation Methods

Name of Pridiction Method	Data used				
	Temper-ature	Sunshine hours	Relative Humidity	Evaporation	Wind Velocity
Blaney Criddle	*	*	*	--	*
Radiation	*	*	*	--	*
Penman	*	*	*	--	*
Pan evapora-tion	--	--	--	*	--
Hargreaves	*	*	--	--	--
Jensen Haise	*	--	--	--	--
Thornthwaite	*	--	--	--	--

From table 5.1, it can be seen that generally following data is used in the internationally well known formulae.

(1) Temperature

(2) Sunshine hours

(3) Relative humidity

(4) Wind velocity

(5) Pan evaporation

Therefore it was decided to collect all above data from meteorological observatories. The basic data available

from the observatories and the data required to fit in the above mentioned methods is listed out in Table 5.2. Required data is derived from the available collected data.

Table 5.2

Data Used for Various Estimation Methods

Sr. No.	Data available from observatories	Data used in different methods
1	Maximum Temperature & Minimum Temperature	Maximum, Minimum & Mean Temperature
2	Dry Bulb & Wet Bulb Temperature	Relative Humidity (Maximum, Minimum)
3	Observed Sunshine hours	Radiation
4	Evaporation	Evaporation
5	Wind velocity at different height	Wind velocity at 2 m height

5.2 DIRECT VALUE OF EVAPOTRANSPIRATION

Directly observed ET values may be ascertained using following methods

(A) Water balance methods

(i) Hydrologic method

(ii) Method of vegetation pots

(iii) Lysimetric method

(B) Microclimatic methods

(i) Aerodynamic method

(ii) Method of energy balance

Hydrologic method is a direct application of balance

equation to the irrigated area and requires various observations, assumptions and calculations. In view of complexity of the microclimatic methods, lysimetric method is usually adopted in practice. Lysimetric method allows the ascertainment of all parameters of the balance equation. Based on simplicity and accuracy of this method, it was decided to collect lysimetric data for the direct value of ET.

5.3 SELECTION OF AGROMETEOROLOGICAL STATIONS

About 475 agrometeorological stations are established in Gujarat at dam sites and in their command area by irrigation department of Gujarat (GOG). Such stations are also established by Gujarat Agricultural University at various locations at Agricultural College Campus (ACC). Meteorological department of Agricultural College Anand has established meteorological station which collects various data as shown in Table 5.3. Out of all above mentioned stations five stations having data for longer period which are selected for the study. Other stations are established in recent years having data of 2 to 5 years only. Thus five stations were selected for collection of agrometeorological data. The stations were selected on following ground.

(i) Selected station should provide more than 12 years data for all parameters shown in Table 5.1 and 5.2.

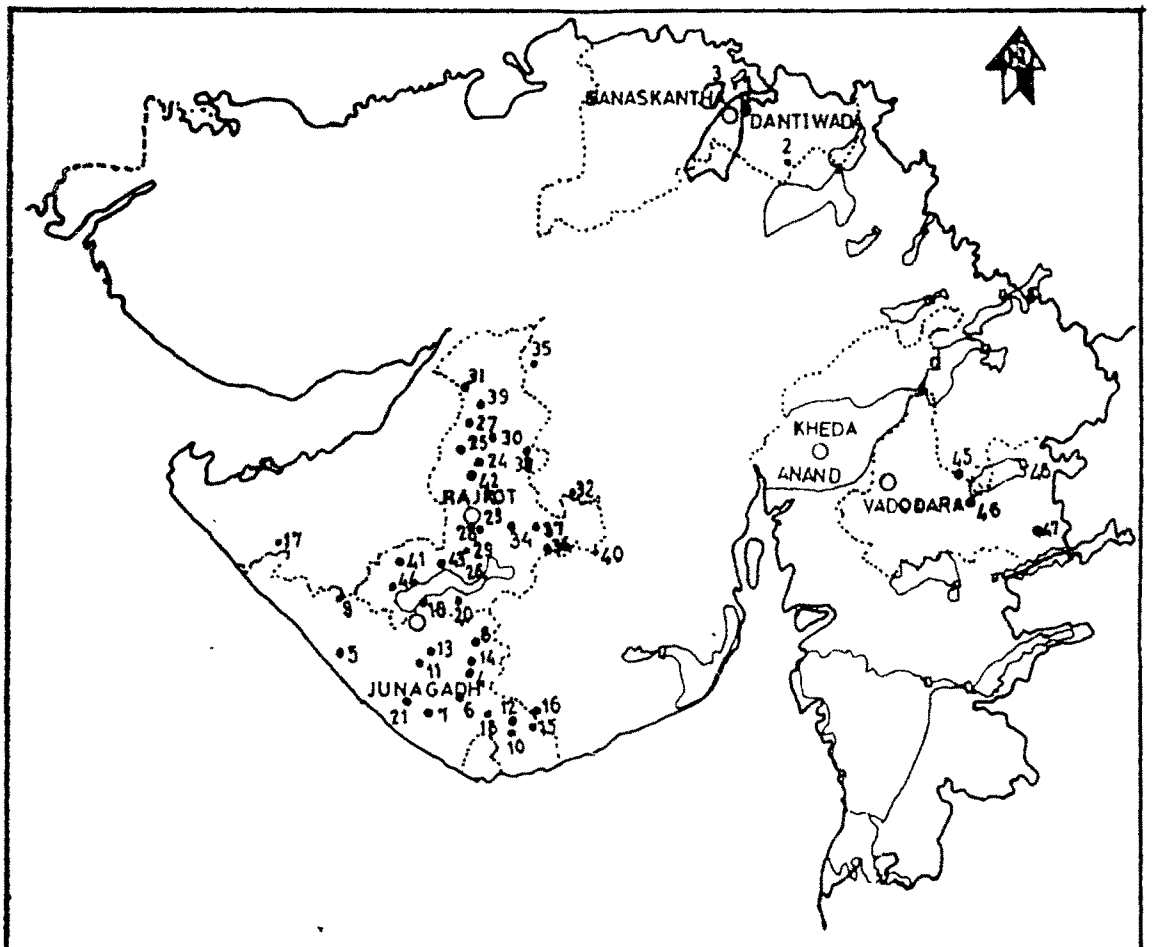
(ii) The station is well maintained, and method of observation is authentic.

(iii) A pair of lysimeter is also established at the station and must be functioning well.

In Gujarat, lysimeters are installed at three places (i) Agricultural University Campus, Dantiwada,(ii) Targadia farm near Rajkot, and (iii) Agricultural College Campus,. Anand. Looking to the availability of lysimeter data for various crops for 2 to 3 years and other data for 12 to 30 years, above three stations were selected. Meteorological data is collected for last 20 years at GERI campus near village Gotri on outskirt of Vadodara city. As Vadodara is nearer to Anand it is also included under study. As Rajkot is the only station having lysimeter in Saurashtra, Junagadh Station is also selected for supporting the Saurashtra region data. Five stations selected under study are such that they represent the cross sections of the regions under study as shown in fig 2.3. The irrigation projects and command areas nearby the selected sites are shown in figure 5.1.

5.4 INTRODUCTION OF SELECTED SITES.

5.4.1 Dantiwada Agrometeorological station lies in North Gujarat in Banaskantha district. The latitude, Longitude and Altitude of the station are N 24.32°, E 72.32° and 154.52 m respectively. The station is maintained by Gujarat Agricultural University. Dantiwada is the headquarters of this University. Figure 5.1 shows that the station is located near Dantiwada dam site on river Banas. Irrigation command area of Dantiwada project is 59895 ha and the reservoir is spreaded in 4050 ha area. Average rainfall of the area is 500-600 mm and maximum and minimum temperatures are about 41° and 10° celsius. Beyond Dantiwada the area of semi desert and desert starts, known as little rann of Kachchha and Rann of Kachchha.



BANASKANTHA

1 DANTIWADA
2 MUKTESHWAR
3 BIPU

JUNAGADH

4 AMBAJAL
5 AMIPUR
6 HIRAN_I
7 HIRAN_II
8 JHANJESHRI
9 KALINDRI
10 MACHHUNDRI (P. W.)
11 MADHUVANTI
12 MACHHUNDRI_II
13 OZAT
14 OZAT (DHARFAD)
15 RAVAL (P.W.)
16 RAVAL- II
17 SORTHI
18 SHINGHODA
19 UBEN (P W)
20 UBEN
21 VRAJMI

KHEDA

22 MAHI STAGE I

RAJKOT

23 AJI-I
24 AJI II
25 AJI III
26 BHADAR
27 BANGAWADI
28 CHHAPARWADI
29 CHHAPARWADI
30 DEMI I
31 DEMI II
32 DHARI
33 GHELO (SOMNATH)
34 GONDLI
35 GHODADHAROI
36 ISWARIA
37 KARMAL
38 MACHHU I
39 MACHHU II
40 MALGADH
41 MOJ
42 NYARI
43 PHOPHAL
44 VENU

VADODARA

45 DEO
46 JOJWA-WADHWANA
47 RAMI
48 SUKHI

O SELECTED STATION

FIG: 5.1- IRRIGATION PROJECTS NEAR BY SELECTED SITES

5.4.2 Anand Agrometeorological station lies in Central Gujarat in Kheda district. The latitude, longitude and Altitude of the station are N 22.58°, E 72.97° and 45.10 m respectively.

The station is maintained by Gujarat Agricultural University in their college campus at Anand nearby WALMI. WALMI is a state Government institute for the research and management in irrigation and agriculture. An automatic weather station is established since 1981. Pair of lysimeter has been installed since 1979. Photo 5.1 and 5.2 shows the automatic weather station and a pair of lysimeter. The region is well cultured and prosperous due to well established perennial canal Irrigation system of Kadana and Wanakbori projects on river Mahi. Kharif, Rabi and Summer Crops are cultivated due to plenty of water available from rainfall and existing canal irrigation system. The average rainfall of the area is 950 mm and maximum and minimum temperatures of the area are about 40 and 10 degree celsius respectively. Cash crops like tobacco and cotton are the major crops of the region while the other crops like wheat, groundnut, maize are also cultivated in the area.

5.4.3 Vadodara Station is established in GERI Campus at Gotri since 1971. The latitude, longitude and altitude of the station are N 22.05°, E 73.37° and 30 m respectively. This area is covered under the command area of Sardar Sarovar Project. Nearby this station is Padra taluka growing vegetables and crops in plenty. Average annual rainfall, average maximum and minimum temperatures are 1050 mm, 40° and 12° celsius. This station is near the WREMI, the prime institute of M.S.University for water management studies located at Samiala.

5.1 Automatic Weather Station At Anand

5.2 Weather Station At GERI, Vadodara

5.4.4 Rajkot Agrometeorological Station lies in Central Saurashtra. The latitude, longitude and altitude of the station are N 22.28° ,E 70.80° and 137.70 m respectively. This station is located at Targadia farm near village Targadia about 12 Km from Rajkot. Rajkot is located centrally in Saurashtra region having Aji, Nyari and Bhadar projects nearby. Average annual rainfall, average maximum and minimum temperatures are 600 mm, 41° and 10° celsius.

5.4.5 Junagadh agrometeorological observatory is located on the outskirt of Junagadh city having values of latitude, longitude and altitude N 21.50°, E 70.50°, and RL 82.52 m respectively. Observatory is established since 1965. Junagadh district is located in southren Saurashtra. Compared to central and Northern Saurashtra, this area is nearby the well-known forest 'Sasan Gir ' and on the foothill of Girnar hill. Average annual rainfall, average maximum and minimum temperatures are 600 mm, 40° and 10° celsius.

5.5 COLLECTION OF DATA

5.5.1 Meteorological parameters which basically affect the crops ET are already listed in para 5.1. Daily observed data (twice a day) is available at the selected stations. The quantum of available data at above stations is as shown in Table 5.3. The data observed daily twice a day, in the morning and afternoon, were collected from all five stations for the period shown in Table 5.3.

Table 5.3

Data Available at Various Stations

Meteorological Parameters	Daily Observed data				
	Dantiwada	Anand	Vadodara	Rajkot	Junagadh
Temperature (Max.)	1961-1989	1958-89	1971-1980 1982-1992	1977-1990	1965-90 Ex.75,83
Temperature (Min.)	1961-1989	1958-89	1971-1980 1982-1992	1977-1990	1972-90 Ex.83,84
Wet Bulb Temp.	1961-1989	1980-89	1971-1980 1982-1992.	1977-1990	1965-80
Dry Bulb Temp.	1961-1989	1980-89	1971-1980 1982-1992	1977-90	1965-80
Sun Shine hours.	1981-1989	1958-89	1976-1980 1982-1992	1982-90	1976-80
Evaporation	1980-1989	1980-89	1976-1980 1982-1992	1977-90	1965-90 Ex.67,72,73
Wind velocity	1982-1989	1958-89	1976-1980 1982-1992	1977-90	1965-90 Ex.85,86,72,73
Rain fall	1978-1989	1958-89	1976-1980 1982-1992	1977-90	-

5.5.2 Lysimeter data were collected from Dantiwada, Anand and Rajkot station. Daily observed data, mean of observations of a pair of lysimeter are shown in Table 5.4. Daily observed data from three stations were collected for the crops and period mentioned in Table 5.4.

Table 5.4
Lysimetric value of ET

(1) Dantiwada station

Sr.No.	Type of crop	Date of Sowing	Date of Harvesting
1	Mug	13-07-90	21-09-90
2	Mug	28-10-90	8-03-91

(2) Anand station

Sr.No.	Type of crop	Date of Sowing	Date of Harvesting
1	Tobacco	7-09-79	18-02-80
2	Tobacco	21-02-80	27-01-81
3	Tobacco	18-08-81	23-01-82
4	Cotton H-6	27-07-82	26-02-83
5	Cotton H-6	27-06-83	14-02-84
6	Groung Nut Kharif	20-06-86	18-10-86
7	Ground Nut Kharif	07-07-88	19-11-88
8	Maize	11-07-89	11-10-89

(3) Rajkot station

Sr.No.	Type of crop	Date of Sowing	Date of Harvesting
1	Bajara, BJ 104	25-06-80	28-09-80
2	Ground Nut GAUG 1	30-06-81	18-10-81
3	Bajara BJ 104	06-07-82	22-09-82
4	Ground Nut JL 24	25-06-83	01-10-83
5	Bajara GHB 27	06-07-84	28-09-84
6	Bajara GHB 27	07-07-88	25-09-88
7	Ground Nut JL 24	25-06-89	16-10-89
8	Bajara GHB 32	07-07 90	02-10-90