SUPPORTING REPORT D
METEOROLOGY
AND HYDROLOGY

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SUPPORTING REPORT D METEOROLOGY AND HYDROLOGY

1. Introduction

This chapter presents details of meteo-hydrological condition of the Maritza river basin. A clear understanding of the meteo-hydrological condition is of utmost importance in basin management of the Maritza river. An extensive set of data on meteorology and hydrology have been collected and analyzed. This forms the basis for hydrodynamic model development which in turns plays a key role in development of water quality model for the Maritza river basin.

2. Observation Network on Meteorology

In the Maritza river basin, there are 97 meteorological (37 climatic and 60 precipitation) stations that are presently operating and are under the control of National Institute of Meteorology and Hydrology (NIMH) of Bulgarian Science Academy. Concerning the type of measurement of precipitation, 14 stations are of automatic (recording: float–limnigraph) type and the rest 83 stations are of manual (non-recording) type. There is no telemetric type precipitation gauging station in the Maritza river basin.

Observation items at the meteorological stations are listed in Table D.2.1.

Detailed listings of the meteorological stations are given in Table D.2.2. Locations of the meteorological stations are shown in Fig. D.2.1.

The meteorological stations are well distributed with an average area of about 220 km^2 for each station. The lowest and highest stations are located at Svilengrad (EL. 54 m) and Mussala Peak (EL. 2,952 m) respectively. There also exist 4 climatic stations at mountain peaks. The historical data at these stations are quite fragmentary. The stations are at:

- Mussala Peak (EL. 2,925 m) where the Maritza river spring lies;
- Botev Peak (EL. 2,396 m) where the Biala river spring lies;
- Snezhanka Peak (EL. 2,000 m) and
- Rozhen Peak.

3. Observation Network on Hydrology

In the Maritza river basin, there are 48 hydrometric stations (7 on Maritza mainstream and 41 on tributaries) that are presently operating and are under the control of NIMH. All the hydrometric stations are manual. Among them, 15stations (5 out of 7 on Maritza mainstream and 10 on tributaries) are of automatic (float-liminigraph) type and only one station (on Chepelarska at Bachkovo) is of telemetric type. The rest 32 stations (2 on Maritza mainstream and 30 on tributaries) are of manual (staff gage) type.

Observation items at the hydrometric stations are listed in Table D.2.1.

Detailed listings of the hydrometric stations are given in Table D.3.1. Locations of the hydrometric stations are shown in Fig. D.3.1.

The hydrometric stations are sparsely distributed along the Maritza mainstream. There exists only 7 hydrometric stations along the Maritza mainstream, i.e. 1 station for each 44 km. Hydrometric stations along the major tributaries are also very scarce.

4. Meteorological Characteristics

(1) General Meteorological Condition

Monthly average precipitation, temperature and relative humidity distributions at 7 climatic stations are shown in Fig. D.4.1. The 7 stations represent overall meteorological condition of the Maritza river basin taking into account different climatic zones except mountainous regions along basin boundary. The general meteorological conditions are summarized below:

- Annual average precipitation varies from 491 to 652 mm. Averages of monthly maximum (56 to 84 mm) and minimum (26 to 46 mm) precipitations occur in May and August respectively.
- Averages of monthly maximum and minimum temperatures vary from 19°C to 24°C (in July) and -2°C to 2°C (in January) respectively.
- Averages of monthly maximum and minimum relative humidities vary from 76% to 85% (in December) and 60% to 70% (in July) respectively.

(2) Precipitation

1) Selection of representative stations

All the meteorological stations lying within the Maritza river basin have been analyzed to evaluate the precipitation condition of the entire Maritza river basin. Among them, 22 representative stations have been selected for detailed analysis on precipitation. Basically, the following criteria have been used in the selection procedure:

- Annual average precipitations at all the meteorological stations have been analyzed (Fig. D.4.2). The selected 22 stations can well represent annual average precipitation for the Maritza mainstream / major tributary basins as well as the total Maritza river basin. Fig. D.4.2 also gives a detailed picture of spatial distribution of precipitation of the Maritza river basin.
- Correlation of annual precipitation between the selected and neighboring unselected stations has been investigated. Fig. D.4.3 shows that good correlation exists between the selected and neighboring unselected stations which implies that temporal distributions of precipitation within the selected and neighboring unselected stations are likely to be uniform. The correlation coefficients are mostly above 0.70 and can be as high as 0.92. Only in a few cases, the correlation coefficients are below 0.65. However, the correlation coefficients associated with Anton station are quite low. The eccentric behavior

of the Anton station can be explained by its location. The station is situated at a very high altitude of 1,700 m with a very low annual precipitation of about 600 mm.

- Continuity of historical data at each of the meteorological station has been checked. Stations with too many missing data have been rejected.

2) Correlation between representative stations

Correlation of annual precipitation between the representative stations have been investigated. Table D.4.1 presents the correlation matrix which provides an in-depth view of temporal distribution of precipitation of the Maritza river basin as a whole. Considering availability of data and practical importance for the present study, correlation matrix for individual sub-basin has not been prepared.

Fig. D.4.4 shows correlation between Svilengrad and other representative stations. As can be seen, the correlation coefficients are mostly above 0.65 except for stations in mountainous regions bordering the Maritza river basin. This implies that temporal distribution of precipitation in most part of the Maritza river basin is likely to be uniform with exceptions at following areas:

- The area near Manastir which is surrounded by the Prespa mountain to the south-east, Radyuva mountain to the west and Chernirid mountain to the north-east of Manastir;
- The area near Ihtiman which is blocked by the Chernirid mountain to the south-west and Vetren mountain to the north-east of Ihtiman;
- The narrow belt to the north-west of Svilengrad lying between the Sredna and Stara mountains and
- The area near Ivailo and Plovdiv.

3) Monthly and annual precipitations

Monthly precipitation distributions along with annual total precipitation at the representative stations are shown in Fig. D.4.5. It can be seen that variation in monthly precipitation is not well defined. In general, precipitation gradually increases from March-April, reaches the maximum in May-June and then decreases to the minimum in September-October. The monthly average precipitation can be as low as 26 mm (in August at Svilengrad) to as high as 125 mm (in May at Manastir).

High precipitations are observed along the mountainous regions bordering the Maritza river basin. Annual average precipitation at Manastir near Rozhen peak of the Rodopi Mountains is as high as 1,061 mm. Along the Maritza mainstream, annual precipitation is above 650 mm in the uppermost part, but suddenly drops to below 500 mm between Pazardjik and Plovdiv and then again rises above 550 mm after Plovdiv up to Svilengrad. In other parts of the Maritza river basin, annual precipitation lies between 600 mm to 725 mm with exception at Sadievo in the north-east part where annual precipitation is 503 mm.

4) Yearly variation of annual total precipitation

Fig. D.4.6 shows yearly variation of annual total precipitation at the representative stations. It can be seen that annual precipitation had started decreasing in the mid-1970s and had been continued to decrease until early-1990s. However, in recent years (since around 1993), annual total precipitation has an increasing tendency.

5) Basin mean precipitation

Thiessen Polygon method has been applied to calculate the basin mean precipitation. The Thiessen Polygons are shown in Fig. D.4.7. Monthly distribution of basin mean precipitation is shown in Fig. D.4.8. Annual total basin mean precipitation is calculated to be 597 mm with maximum and minimum monthly precipitations of 70 mm (in May) and 34 mm (in September) respectively.

Yearly variation in annual total basin mean precipitation (along with tables) is also shown in Fig. D.4.8. It can be seen that 1992 was the most severe drought year (in recent years) in terms of precipitation. The table of Fig. D.4.8 (the right bottom one) indicates that annual average basin mean precipitation for the period 1989-1995 is about 75% (479 mm) of that for the period 1963-1973 (641 mm).

6) Drought month(s) in terms of precipitation

Frequency histograms of drought month(s) for precipitation are presented in Fig. D.4.9. Combining the results of frequency histograms with monthly basin mean precipitation, the critical drought months and corresponding precipitations are summarized below:

Period	Critical Drought Month(s)	Basin Mean Precipitation (mm)
1-month	September	34
2-month	September-October	72
3-month	August-September-October	117

7) Probability analysis on minimum precipitation

Probability analysis on minimum precipitation has been carried out. Goodness of fits for the two widely used probability distributions - the Gumbel's and the Log-Normal distributions have been investigated. Thomas or Weibull's Plotting Position formula which is suitable for drought flow has been applied. It is found that for minimum 1-month precipitation, Gumbel's distribution gives the better result; whereas for minimum 3, 6, 9 and 12-month precipitations, Log-Normal distribution gives the better result. The results of probability analysis are shown in Fig. D.4.10 and Fig. D.4.11 and are summarized in Table D.4.2. Probable minimum 4 and 10-year annual basin mean precipitations are calculated to be 507 and 452 mm respectively.

8) Outer-basin precipitation

Precipitations at arbitrarily selected 12 nearby meteorological stations lying within other river basins bordering the Maritza river basin have been investigated. Locations of the outer-basin stations along with annual precipitations (averaged over recent years) is shown in Fig. D.4.12. Monthly distributions as well as yearly variation of annual total precipitation are shown in Fig. D.4.13 and Fig. D.4.14 respectively. Compared to annual precipitation in the Maritza river basin:

- low annual precipitation is observed at stations in the Tundza (Elhovo, Sliven and Kazanlak), Iskar (Murgash Peak, Central Meteorological Station at Sofia and Iskar Reservoir) and Struma (Blagoevgrad) river basins;
- moderate annual precipitation is observed at stations in the Mesta (Bansko and Dospat) and Arda (Raikovo and Kardjali) river basins.

As in the Maritza river basin, very low precipitation was observed in 1992 in the Tundza river basin whereas for other outer basins, very low precipitation was observed mainly in 1993.

(3) Estimation of Potential Evaporations

Monthly potential evaporations for the Maritza mainstream and major tributary basins have been estimated using modified Penman method specified by Food and Agricultural Organization of the United Nations (FAO, 1992). The results are shown in Fig. D.4.15. It can be seen that annual total potential evaporation varies from 883 mm (at Vacha river basin) to 1,072 mm (at Sazliyka river basin). Monthly maximum (in July) and minimum (in December) potential evaporations vary from 141 to 181 mm and 17 to 22 mm respectively.

In the estimation of potential evaporation, following data have been used:

- monthly average temperature (°C);
- monthly average relative humidity (%);

- monthly average maximum relative humidity (%);
- monthly average 24-hr wind speed (m/s) with correction for measurement height (NIMH measures wind speed at 10 m height whereas FAO specifies wind speed at 2 m height);
- day time wind speed (m/s) with adjustment factor for ratio of day to night time wind speed;
- cloudiness (tenths) and
- radiation (mm/day).

The two basic data: temperature and relative humidity are for period 1963-1995 whereas the other data are for time periods before 1981 (meteorological yearbook had been published until 1981). However, the estimated values can be considered to be average potential evaporation over the period 1963-1995.

(4) Relation between Elevation and Meteorological Parameters

There exists good correlation between elevation and meteorological parameters as can be seen from Fig. D.4.16 (where R stands for correlation coefficient). The equations are suitable for estimating meteorological parameters (annual as well as monthly basis) at any elevation from a known elevation (such as of a meteorological station). However, analysis based on simple linear relations between elevation and meteorological parameters indicates that with a rise in elevation of 100 m, there will be an increase in precipitation of about 21 mm, a drop in temperature of about 0.5°C and a decrease in potential evaporation of about 17 mm.

5. Hydrological Characteristics

(1) Monthly Average, Maximum and Minimum Discharges

Monthly average discharges along with averages of monthly maximum and minimum discharges at 6 hydrometric stations on Maritza mainstream and at 8 hydrometric stations

on major tributaries are shown in Fig. D.5.1. It can be seen that discharges are high during March to May and are low during July to September. Averages of monthly minimum, average and maximum discharges at Svilengrad station on Maritza mainstream in August (the lowest) are 22, 37 and 86 m^3/s respectively and in March (the highest) are 86, 151 and 367 m^3/s respectively.

(2) Monthly and Annual Runoffs

Monthly average runoff distributions along with annual total runoffs at 14 hydrometric stations are shown in Fig. D.5.2. The monthly minimum (in August) and maximum (in March) runoffs at Svilengrad station are observed to be 100 and 405 million m^3 respectively. Annual total runoff along Maritza mainstream varies from 239 to 3,130 million m^3.

(3) Yearly Variation of Annual Total Runoff

Yearly variation of annual total runoff at 14 hydrometric stations is shown in Fig. D.5.3. Mean monthly and annual total runoffs for different time periods are presented in Table D.5.1. It can be seen that runoff has considerably been decreased during the last two decades starting from mid-1970s with 1994 as the most critical recent year in terms of runoff. The decrease is significant not only along Maritza mainstream where runoff is highly disturbed by human activities but also along major tributaries some of which are still in natural condition.

Table D.5.1 indicates that annual average runoff for the period 1989-1995, compared to that for the period 1946-1973 is only about 53% at Svilengrad on Maritza mainstream, about 65% at Poibrene on Topolnitza river and about 66% at Bania on Stryama river. The reason for sharp decrease in runoff can partly be explained by decrease in precipitation during the last two decades, construction of storage facilities during the 1970s and high water uses for different purposes. The figures show no tendency in recovering the runoff.

(4) Monthly and Annual Specific Discharges under Disturbed Condition

Specific discharges for monthly and annual total flow through Maritza mainstream under disturbed condition for different time periods are presented in Table D.5.2. It can be seen that specific discharge at Pazardjik hydrometric station is the lowest, possibly due to diverted discharge through Channel Pashaark. For the period 1946-1995, monthly average specific discharge varies from 1.2 l/s.km^2 (in August at Pazardjik station) to 23.0 l/s.km^2 (in May at Belovo station). Annual specific discharge for the same period varies from 4.5 l/s.km^2 (at Pazardjik station) to 10.1 l/s.km^2 (at Belovo station). Annual specific discharge at Svilengrad station is calculated to be 4.66 l/s.km^2.

(5) Monthly and Annual Runoff Rates Under Disturbed Condition

Monthly and annual runoff rates averaged over the period 1963-1995 at stations on Maritza mainstream under disturbed condition are presented in Table D.5.3. Runoff rate is expressed as the ratio of observed mean runoff at a hydrometric station to computed mean runoff from the catchment of the station due to precipitation. It can be seen that runoff rate at Pazardjik hydrometric station is the lowest. Monthly average runoff rate varies from 0.07 (in July at Pazardjik station) to 0.66 (in May at Belovo station). Annual runoff rate varies from 0.20 (at Pazardjik station) to 0.45 (at Belovo station). Annual runoff rate at Svilengrad station is calculated to be 0.24.

Analysis on accumulated runoff rate (mass curve analysis) under disturbed condition along the Maritza mainstream has been carried out and the results are shown in Fig. D.5.4. It can be seen that monthly accumulated rates gradually increase during January to June after which they remain almost constant. As for annually normalized runoff rates, they remain almost constant to one from July to January whereas they are greater that one from January to June with maximum in March (except at Belovo) which can be attributed as due to effect of snow melting. Up to June, the annually normalized runoff rate curves from Pazardjik to Svilengrad can be represented by an average curve leaving Belovo as a separate one. From July, the annually normalize runoff rate for the entire Maritza basin can be represented by a single average curve.

(6) Evaluation of Natural and Disturbed Runoffs

A comparison has been made on annual total runoff of hydrometric stations that are assumed to be under natural condition with that of assumed to be under disturbed condition. Hydrometric stations which lie mainly on upstream of the river courses and are not (apparently) affected by human activities are assumed to be under natural condition. Fig. D.5.5 shows the best fit curves for natural and disturbed runoffs averaged over the period 1963-1995. The curves indicate that for a moderately sized catchment with an area of 3,000 km^2 (about the size of Sazliyka river basin), natural runoff is likely to be about 25% more than disturbed runoff. The curves for annual runoff under natural and disturbed conditions (Fig. D.5.5 - the bottom ones) can be combined with the curves for annual total runoff rate (Fig. D.5.5 - the top one) and annually normalized runoff rate (Fig. D.5.4 - the bottom ones) under disturbed condition to estimate monthly as well as annual natural runoff for catchments with different sizes.

(7) Base Flow Estimation

Natural and disturbed base flow (Fig. D.5.6) have been estimated using 1995 monthly minimum discharge data of hydrometric stations under (assumed) natural and disturbed conditions. 1995 represents average year in terms of precipitation for the period 1963-1995. It is found that natural base flow is likely to be about 15% more than disturbed base flow (for the year 1995) for the entire Maritza river basin.

(8) Relation between Disturbed Annual Runoff Rate and Landuse

Relation between annual total runoff rate along the Maritza mainstream under disturbed condition (Table D.5.3) and landuse for three major categories: forest, irrigated and non-irrigated areas are shown in Fig. D.5.7. It can be interpreted that with increase in forest area, annual runoff rate is likely to be increased. The curves indicate that annual runoff rate for a catchment with forest area of 30% can be as low as 0.23 whereas that for a 100% forest area can be as high as 0.6.

(9) Probability Analysis on Minimum Runoff

Probability analysis on minimum runoff at the hydrometric stations on Maritza mainstream has been carried out. Goodness of fits for the two widely used probability distributions - the Gumbel's and the Log-Normal distributions have been investigated. Thomas or Weibull's Plotting Position formula which is suitable for drought flow has been applied. It is found that Log-Normal distribution gives the better result. The results of probability analysis are shown in Fig. D.5.8 and are summarized in Table D.5.4.

(10) River Bed Morphology

A morphological study on river bed along Maritza mainstream and major tributaries has been carried out. Historical (1950s to 1990s) cross-sections at 12 hydrometric stations (6 along Maritza mainstream and 6 along major tributaries) along with stage-discharge relations (simplified and replotted) where degradation / aggradation have taken places (at 6 places : 2 along Maritza mainstream and 4 along major tributaries) are shown in Fig. D.5.9. The figures reveal that NIMH updates the rating curves with time. Since the degradation / aggradation process depends on structures (dams etc.) and intake facilities on the river course, a figure showing the locations of the 12 hydrometric stations along with the structures / intake facilities is presented in Fig. D.5.10.

In general, the degradation / aggradation process has been taken place during the two decades of 1970s to 1980s. It can be seen that the river bed profile along Maritza mainstream is likely to be stable only with degradation at the downstream part (about 2 m at Svilengrad) and aggradation at the upstream part (about 1.25 m at Belovo). Along major tributaries, river bed at Harmanli on Harmanliyska river had been degraded severely (about 4 m). There is a mild degradation at Marko Nikolovo on Chepinska river (about 0.5 m). River beds at Sbor on Luda Yana river and Bachkovo on Chepelarska river seems to be stable whereas river bed at Galabovo on Sazliyka river seems to be unstable (horizontal shifting) without showing any clear trend in degradation / aggradation. The river bed at Bania on Stryama river has aggraded by about 1.5 m.

TABLE D.2.1 OBSERVATION ITEMS AT METEO-HYDROLOGICAL STATIONS

(measured by NIMH)

Observation Item	Observation Parameter	Meteorological Station		Hydrometric Station
		Climatic	Precipitation	
Precipitation (mm)	Daily	✓	✓	
	Monthly total	✓	✓	
	Maximum 24-hr with date	✓	✓	
	No. of days according to type	✓	✓	
	No. of days according to amount	✓	✓	
Temperature of Air (°C)	Daily	✓	✓	
	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
	Monthly maximum with date	✓		
	Monthly minimum with date	✓		
	Maximum and minmum of daily average	✓		
	No. of days according to value	✓		
Relative Humidity (%)	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
Absolute Humidity (mb)	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
Humidity Deficiency (mb)	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
Wind Speed (m/s) (measured at 10 m)	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
	Monthly maximum	✓		
Wind Direction	Frequency of occurrence according to direction	✓		
Wind Intensity	Frequency of occurrence according to calmness	✓		
	No. of days with strong wind	✓		
Atmospheric Pressure (mb)	Monthly average	✓		
	Monthly maximum with date	✓		
	Monthly minimum with date	✓		
Cloudity (tenths)	Monthly average at 7, 14 and 24-hr	✓		
	Monthly average	✓		
Discharge (m3/s)	Daily average			✓
	Monthly average			✓
	Monthly maximum			✓
	Monthly minimum			✓
Water Stage (cm)	Daily average			✓
	Monthly average			✓
	Monthly maximum			✓
	Monthly minimum			✓

TABLE D.2.2 INVENTORY ON METEOROLOGICAL STATIONS OF NIMH (1/2)

CLIMATIC STATIONS

No.	Region	Code No.	Location	Date of Establishment	Elevation (EL. m)	Geographic Coordinates		Measurement Type
						Latitude	Longitude	
1	Sliven	41030	Sadievo	01-08-1957	136	26°05′	42°32′	M
2		41050	Lyubenova Mahala	24-07-1929	170	25°58′	42°21′	
3	Stara Zagora	42010	Stara Zagora	01-02-1893	200	25°42′	42°22′	
4		42020	Chirpan	01-04-1915	173	25°20′	42°12′	A
5	Haskovo	43010	Haskovo	01-07-1898	194	25°35′	41°57′	
6		43011	Dolno Botevo	15-03-1940	240	25°43′	41°45′	M
7		43020	Svilengrad	21-09-1929	54	26°12′	41°46′	A
8		43030	Harmanli	18-02-1930	78	25°53′	41°56′	
9	Smolyan	45010	Snezhanka Peak	01-03-1969	2,000	24°41′	41°40′	M
10		45030	Chepelare	01-07-1892	1,100	24°42′	41°44′	
11		45060	Hvoina	16-09-1929	707	24°42′	41°52′	
12		45090	Mihalkovo	10-03-1930	525	24°25′	41°50′	
13		45120	Rozhen Peak			24°44′	41°53′	
14		45130	Devin	15-12-1914	710	24°24′	41°45′	
15	Plovdiv	46010	Plovdiv	01-07-1891	160	24°45′	42°09′	A
16		46015	Brestnik	01-03-1958	197	24°44′	42°03′	M
17		46020	Sadovo	01-09-1891	153	24°57′	42°09′	A
18		46030	Assenovgrad	01-09-1934	230	24°52′	42°01′	M
19		46040	Boikovo	23-07-1937	1,108	24°37′	42°00′	
20		46060	Karlovo	01-01-1895	400	24°49′	42°39′	A
21		46070	Hissaria	01-06-1929	278	24°40′	42°30′	M
22		46090	Botev Peak	01-11-1949	2,396	24°50′	42°40′	
23	Pazardjik	47010	Ivailo (Pazardjik)	01-10-1947	214	24°20′	42°13′	A
24		47020	Vetren	01-07-1967	400	24°03′	42°17′	M
25		47030	Yundola	25-02-1929	1,380	23°52′	42°04′	
26		47040	Velingrad	12-05-1929	755	23°58′	42°02′	A
27		47050	Panagyurishte	01-07-1829	565	24°11′	42°30′	
28		47060	Kozarsko	10-05-1934	252	24°25′	42°03′	M
29		47070	Peshtera	01-01-1893	432	24°18′	42°02′	A
30		47081	V. Kolarov Reservoir	01-03-1949	1,535	24°08′	41°49′	
31	Sofia	64101	Ihtiman	04-07-1892	637	23°49′	42°26′	M
32		64115	Georgi Dimitrov / Kostenetz	01-10-1896	837	23°50′	42°15′	
33		64120	Koprivstitza	16-04-1901	945	24°21′	42°38′	
34		64132	Zlatitza	01-01-1943	685	24°09′	42°43′	
35		64215	Mussala Peak	01-12-1932	2,925	23°35′	42°11′	
36		64230	Sitniakovo	01-01-1906	1,741	23°37′	42°14′	
37		64330	Vakarel - Military Station	01-12-1939	851	23°43′	42°33′	

Measurement Type : M => Manual (Non-Recording)
A => Automatic (Recording : Float-Limnigraph)
T => Telemetric

Station Code Number : rrSnn rr => Region Number; S => Type of Station; nn => Order Number

rr = 29 : Yambol Region
rr = 41 : Sliven Region
rr = 42 : Stara Zagora Region
rr = 43 : Haskovo Region
rr = 45 : Smolyan Region
rr = 46 : Plovdiv Region
rr = 47 : Pazardjik Region
rr = 64 : Sofia Region

S = 0 - 3 : Climatic Station
S = 4 - 7 : Precipitation Station

TABLE D.2.2 INVENTORY ON METEOROLOGICAL STATIONS OF NIMH (2/2)

PRECIPITATION STATIONS

No.	Region	Code No.	Location	Date of Establishment	Elevation (EL. m)	Geographic Coordinates		Measurement Type
						Latitude	Longitude	
1	Yambol	29520	Skalitza / Kunevo	01-02-1941	160	26°14′	42°18′	
2	Sliven	41480	Polski Gradetz	01-02-1953	165	26°07′	42°11′	
3		41520	Elenovo	25-09-1953	220	26°09′	42°23′	
4	Stara Zagora	42401	Sarnevo	19-11-1953	128	25°51′	42°22′	
5		42420	Dalboki	01-11-1930	162	25°47′	42°29′	
6		42540	Bratia Daskalovi	01-04-1950	235	25°12′	42°20′	
7		42570	Badesthe	11-08-1929	200	25°41′	42°19′	
8		42620	Orizovo	01-01-1930	151	25°10′	42°12′	
9	Haskovo	43401	Merichleri	01-11-1949	150	25°30′	42°08′	
10		43402	Dimitrovgrad	01-09-1947	103	25°35′	42°05′	
11		43410	Mineralni Bani / Brestovo	01-01-1944	390	25°22′	41°56′	
12		43420	Simeonovgrad / Maritza	01-12-1896	108	25°50′	42°02′	
13		43430	Izvorovo	01-08-1929	350	26°09′	41°58′	
14		43460	Oreshetz	01-02-1930	276	25°55′	41°46′	
15		43470	Elena	01-12-1939	210	25°48′	41°50′	
16		43490	Konush	01-12-1941	200	25°31′	41°52′	
17		43520	Tzareva Poliana	18-08-1940	220	25°36′	41°47′	
18	Smolyan	45450	Mugla	01-01-1938	1,360	24°30′	41°33′	
19		45470	Borino	15-04-1954	1,150	24°19′	41°42′	
20		45500	Trigrad	17-01-1951	1,200	24°23′	41°37′	
21		45510	Shiroko Laka	15-05-1952	1,045	24°23′	41°37′	
22		45530	Manastir	01-06-1950	1,450	24°52′	41°43′	
23		45540	Zabardo	16-01-1952	1,140	24°35′	41°48′	
24		45550	Lakki	01-04-1947	1,000	24°51′	43°48′	M
25		45570	Narechenski Bani	23-03-1939	597	24°46′	41°54′	
26	Plovdiv	46410	Topolovo	01-01-1905	405	25°00′	41°54′	
27		46420	Briagovo	21-07-1930	235	25°11′	41°59′	
28		46430	Popovitza	01-01-1905	140	25°03′	42°09′	
29		46440	Parvomay	27-05-1929	132	25°14′	42°07′	
30		46460	Bachkovo	01-01-1941	406	24°52′	41°57′	
31		46500	Zdravetz Chalet	01-05-1952	1,165	24°45′	42°00′	
32		46510	Brestovitza	01-06-1960	207	24°36′	42°03′	
33		46540	Krichim	01-12-1938	185	24°28′	42°05′	
34		46550	Proslav	01-01-1948	165	24°41′	42°07′	
35		46560	Sekirovo	01-11-1940	170	24°56′	42°15′	
36		46580	Chernozem	01-12-1925	229	24°47′	42°24′	
37		46610	Belovitza	01-01-1951	295	24°32′	42°25′	
38			Belovo	01-08-1947	320	24°01′	42°13′	
39		46620	Saedinenie	16-06-1899	200	24°33′	42°16′	
40		46680	Svezhen	01-02-1949	774	25°02′	42°30′	
41		46690	Bania (Plovdivsko)	01-02-1949	295	24°50′	42°33′	
42		46700	Rozovetz	09-01-1915	430	25°07′	42°28′	
43		46750	Rozino	01-01-1905	535	24°33′	42°43′	
44		46760	Klissura	27-07-1928	711	24°27′	42°42′	
45	Pazardjik	47401	Pangyurski Koloni	10-08-1930	1,054	24°12′	42°35′	
46		47420	Strelcha	10-01-1905	480	24°19′	42°30′	
47		47440	Poibrene	10-11-1930	420	24°00′	42°30′	A
48		47460	Lessichevo	01-08-1906	228	24°07′	42°21′	
49		47520	Sestrimo	01-01-1941	550	23°55′	42°13′	M
50		47540	Patalenitza	01-08-1929	340	24°12′	42°07′	
51		47560	Ravnogor	01-07-1940	1,320	24°22′	41°57′	
52		47570	Batak Reservoir	01-07-1892	1,036	24°13′	41°55′	A
53		47660	Chehlovo	01-02-1935	1,450	24°00′	41°48′	
54		47670	Tzvetino	11-01-1952	1,000	23°49′	41°48′	
55		47680	Kurtovo	01-01-1952	1,750	23°48′	42°06′	
56	Sofia	64501	Topolnitza Reservoir	01-05-1961	420	24°02′	42°25′	M
57		64507	Dolna Bania	01-09-1851	637	23°45′	42°18′	
58		64525	Anton	01-07-1949	1,700	24°16′	42°44′	
59		64540	Mirkovo	01-01-1905	673	24°00′	42°42′	
60		64555	Smolsko	01-01-1952	635	23°57′	42°38′	

TABLE D.3.1 INVENTORY ON HYDROMETRIC STATIONS OF NIMH

No.	Station Code No. New	Station Code No. Old	River Name	Location of the Station	Date of Establishment	"0" Gauge Level (EL. m)	JICA Study Catchment Area of the Station (km2)	JICA Study Distance from the Mouth / Border (km)	NIMH Catchment Area of the Station (km2)	NIMH Distance from the Mouth / Border (km)	Measurement Type
1	73370	344a,b	Banska	t. Dimitrovgrad-Durkana	01-12-1953	97.62			326.00	2.45	
2	72270	327a,b	Biala Reka	vil. Kuntovo	11-05-1951	395.33			73.88	13.60	
3	71160	425	Bunovska	vil. Bunovo	17-06-1959	721.36			23.00	17.05	
4	72030	422	Chaindere	vil. Trigrad-Chaira	01-09-1970	1027.87			23.15	10.80	M
5	72040	436a,b	Chairdere	vil. Giovren	10-11-1966	889.87			115.70	2.00	
6	71801	2521.K	Channel Pashaark	t. Pazardjik	01-01-1937	201.73			-	-	
7	72450	323	Chepelarska	vil. Narechenski Bani	23-11-1946	607.08		44.50	392.60	49.40	
8	72460	324a,b,v	Chepelarska	vil. Dachkovo	01-08-1949	353.71	839.00	26.50	824.90	30.57	T
9	71390	256a,b,v	Chepinska	Chehlovo	21-05-1950	1456.85		62.00	23.40	70.11	M
10	71400	254	Chepinska	t. Velingrad	01-11-1947	781.11		42.50	431.10	51.00	A
11	71420	249	Chepinska	Marko Nikolovo	07-06-1951	370.53	892.00	14.00	881.00	14.95	
12	72150	266	Chermo Dere	Reservoir "V. Kolarov"	23-08-1949	1530.31			21.29	7.80	M
13	73030	345	Chinardere	vil. Dalbok Izvor	01-12-1953	200.46			48.30	1.20	
14	72170	277a,b,v	Devinska	t. Devin	08-09-1946	708.51			417.30	2.47	A
15	73550	308, 308A,B	Harmanliyska	t. Harmanli	12-05-1932	67.95	983.00	2.50	952.00	3.83	
16	71380	432, 432A	Iadenitza	vil. Goliamo Belovo	11-12-1962	372.05			128.90	2.90	M
17	72230	281a,b,v,g,d	Iugovska	vil. Lakki	08-10-1959	633.84			-	8.56	
18	71550	251a,b	Luda Yana	vil. Sbor	26-10-1941	277.59	593.00	26.20	569.80	25.65	
19	71650	231	Maritza	vil. Raduil	13-09-1946	828.81		286.50	96.68	291.90	A
20	71700	248a,b,v	Maritza	t. Belovo	20-08-1912	316.71	752.00	251.50	741.00	255.60	
21	71800	252	Maritza	t. Pazardjik	18-10-1911	199.58	4,027.00	219.50	4,126.00	222.20	M
22	72700	301a,b	Maritza	t. Plovdiv	01-03-1912	155.08	8,076.00	178.70	7,926.00	189.30	A
23	72850	304	Maritza	t. Parvomay	24-04-1912	116.98	12,918.00	131.50	12,728.00	138.00	M
24	73750	307	Maritza	t. Harmanli	23-07-1912	65.21	19,864.00	51.00	19,693.00	52.25	A
25	73850	309, 309A	Maritza	t. Svilengrad	18-09-1914	46.88	20,860.00	17.50	20,857.00	18.20	
26	71210	431	Mativir	vil. Mirovo	01-11-1962	614.03		16.70	248.50	16.20	M
27	71330	236a,b,v	Ochushnitza	vil. Ochusha	01-11-1950	586.2			57.75	14.60	
28	72420	303a,b,v	Parventiska	vil. Hrabrino	18-04-1951	287.78			179.10	12.18	A
29	73480	342	Sazliyka	t. Galabovo	27-07-1954	81.85		19.70	3,040.00	19.00	M
30	73400	305a,b	Sazliyka	vil. Rakilnitza	04-11-1925	205.26	353.00	83.50	346.00	108.20	A
31	72100	278a,b,v	Shirokolashka	vil. Shiroka Laka	19-07-1950	1045.76		15.20	63.80	16.92	
32	72120	477	Shirokolashka	t. Devin-Dobrostan	01-11-1974	735.07		1.00	218.00	1.30	M
33	71040	255a,b,A	Sofandere	Tzvetino	20-05-1950	1170.60			73.20	6.25	
34	71340	237	Stara	Georgi Dimitrov	01-11-1947	821.68			47.30	11.70	A
35	72260	337	Stara (Karlovsko)	Hyd. Center Karlovo	01-07-1952	480.14		12.50	51.00	10.60	M
36	71250	336a,b	Strelchanska Luda Yana	t. Strelcha	13-09-1954	481.87		14.50	95.10	17.35	A
37	72500	326a,b	Stryama	t. Klissura	07-07-1952	648.23		93.00	50.50	95.85	
38	72520	325, 325A	Stryama Left & Right	vil. Bania	10-08-1914	268.42	838.00	50.00	832.50	51.50	
39	72060	276a,b	Tenesdere	vil. Mugla	01-06-1950	1330.35			43.40	17.80	
40	72070	438	Tenesdere	vil. Giovren	10-11-1966	869.79			70.34	1.00	M
41	71450	422	Topolnitza	t. Koprivshtitza	19-06-1959	999.79		120.60	57.60	135.00	
42	71470	250a,b,v	Topolnitza	Medet	01-12-1962	577.79	339.00	91.10	339.20	100.60	
43	71480	240a,b,A	Topolnitza	vil. Poibrene	25-08-1912	403.83	918.00	58.60	910.80	67.52	A
44	72020	275a,b	Trigradska	vil. Trigrad	14-06-1950	1171.94			54.28	3.32	M
45	71140	424	Tsarkvishtenska	Zlatitza, sb.Tsarkvishte	16-06-1959	788.79			10.30	9.35	
46	72330	279a,b,v	Vacha	t. Devin-Nastan	07-09-1946	711.27		71.50	416.00	77.65	A
47	72340	421a,b, 422a	Vacha	t. Devin-Zabral	07-09-1946	684.95	668.00	69.00	637.40	74.50	
48	72320	471	Vacha (Buinovska)	Hyd. Center Teshel	01-01-1970	867.83		84.00	146.00	89.50	
I *	71410	257, 257A	Chepinska	vil. Draginovo	01-01-1953	717.64		34.00	756.70	37.35	M
II *	72140	264, 264A	Devinska (Beglishka)	Reservoir "Beglika"	01-12-1942	1494.42			86.60	39.20	
III *	72142	265	Devinska-Tunela	Reservoir "V. Kolarov"	02-02-1952	1525.38			59.05	-	
IV *	72240	343a,b	Iugovska	vil. Iugovo	07-08-1954	487.84			326.60	3.02	A
V *	71130	423a,b	Medetska	Medet	18-06-1959	605.01			31.00	0.66	
VI *	72310	434	Vacha (Buinovska)	Popina Laka	03-11-1966	1074.07		94.7	72.24	99.60	M
VII *	71280	271a,b	Zvezditza	Zvezditza	01-10-1941	1135.65			27.40	6.55	

Measurement Type : M => Manual (Non-Recording : Staff Gauge)
A => Automatic (Recording : Float-Limnigraph)
T => Telemetric

* *Not in operation. Closed in 1996*

Station at Chennel Pashaark (71801) is located on a diversion channel from the Maritza mainstream near Pazardjik.

Station at Bania (72520) gives combined discharge of two stations located on the left and right branches of Stryama river upstream of confluence with Biyala river.

JICA Study : remeasured by the JICA Study team by using topographic maps with scales of 1/100,000 and 1/200,000

NIMH : According to National Institute of Meteorology and Hydrology, Bulgarian Science Academy

250a,b,v stand for change in location of the station during different time period.

The last alphabet represent the latest location and the station parameters in NIMH columns are for the latest location

abbreviation : t. => town
vil. => village
sb. => suburb
Hyd. => Hydroelectric

TABLE D.4.1 CORRELATION MATRIX OF ANNUAL TOTAL PRECIPITATION

Representative Meteorological Station	Svilengrad	Polski Gradetz	Sadievo	Oreshetz	Harmanli	Stara Zagora	Haskovo	Parvomay	Rozovetz	Topolovo	Manastir	Bania	Plovdiv	Hvoina	Rozino	Devin	Ivailo	Anton	Panagyurishte	Velingrad	Sestrimo	Ihtiman
Svilengrad	1.00	0.81	0.76	0.75	0.83	0.68	0.82	0.72	0.59	0.75	0.55	0.63	0.56	0.67	0.49	0.65	0.62	0.16	0.72	0.67	0.76	0.47
Polski Gradetz	0.81	1.00	0.67	0.54	0.75	0.72	0.69	0.65	0.64	0.58	0.43	0.64	0.51	0.39	0.43	0.59	0.42	0.18	0.44	0.36	0.36	0.20
Sadievo	0.76	0.67	1.00	0.44	0.63	0.82	0.67	0.63	0.66	0.76	0.49	0.73	0.51	0.42	0.63	0.58	0.53	0.13	0.58	0.58	0.51	0.45
Oreshetz	0.75	0.54	0.44	1.00	0.73	0.60	0.75	0.76	0.48	0.75	0.68	0.51	0.62	0.61	0.34	0.62	0.78	0.26	0.43	0.58	0.67	0.47
Harmanli	0.83	0.75	0.63	0.73	1.00	0.67	0.81	0.72	0.51	0.68	0.47	0.51	0.63	0.53	0.29	0.53	0.63	0.13	0.39	0.43	0.47	0.20
Stara Zagora	0.68	0.72	0.82	0.60	0.67	1.00	0.72	0.70	0.83	0.71	0.59	0.87	0.62	0.49	0.73	0.63	0.66	0.11	0.68	0.60	0.62	0.52
Haskovo	0.82	0.69	0.67	0.75	0.81	0.72	1.00	0.80	0.60	0.65	0.50	0.62	0.57	0.52	0.44	0.54	0.63	0.18	0.41	0.45	0.40	0.33
Parvomay	0.72	0.65	0.63	0.76	0.72	0.70	0.80	1.00	0.65	0.81	0.72	0.70	0.76	0.64	0.52	0.68	0.76	0.10	0.50	0.63	0.59	0.37
Rozovetz	0.59	0.64	0.66	0.48	0.51	0.83	0.60	0.65	1.00	0.65	0.52	0.82	0.59	0.39	0.69	0.60	0.47	0.19	0.61	0.54	0.47	0.41
Topolovo	0.75	0.58	0.76	0.75	0.68	0.71	0.65	0.81	0.65	1.00	0.81	0.76	0.71	0.72	0.57	0.78	0.80	0.18	0.61	0.76	0.74	0.58
Manastir	0.55	0.43	0.49	0.68	0.47	0.59	0.50	0.72	0.52	0.81	1.00	0.69	0.66	0.73	0.54	0.76	0.72	0.34	0.58	0.73	0.70	0.49
Bania	0.63	0.64	0.73	0.51	0.51	0.87	0.62	0.70	0.82	0.76	0.69	1.00	0.67	0.53	0.77	0.73	0.66	0.13	0.67	0.64	0.58	0.52
Plovdiv	0.56	0.51	0.51	0.62	0.63	0.62	0.57	0.76	0.59	0.71	0.66	0.67	1.00	0.46	0.46	0.73	0.74	0.18	0.60	0.65	0.64	0.42
Hvoina	0.67	0.39	0.42	0.61	0.53	0.49	0.52	0.64	0.39	0.72	0.73	0.53	0.46	1.00	0.43	0.65	0.72	0.32	0.40	0.74	0.67	0.58
Rozino	0.49	0.43	0.63	0.34	0.29	0.73	0.44	0.52	0.69	0.57	0.54	0.77	0.46	0.43	1.00	0.65	0.53	0.38	0.75	0.55	0.54	0.55
Devin	0.65	0.59	0.58	0.62	0.53	0.63	0.54	0.68	0.60	0.78	0.76	0.73	0.73	0.65	0.65	1.00	0.70	0.31	0.57	0.70	0.62	0.58
Ivailo	0.62	0.42	0.53	0.78	0.63	0.66	0.63	0.76	0.47	0.80	0.72	0.66	0.74	0.72	0.53	0.70	1.00	0.22	0.62	0.80	0.86	0.71
Anton	0.16	0.18	0.13	0.26	0.13	0.11	0.18	0.10	0.19	0.18	0.34	0.13	0.18	0.32	0.38	0.31	0.22	1.00	0.27	0.27	0.38	0.44
Panagyurishte	0.72	0.44	0.58	0.43	0.39	0.68	0.41	0.50	0.61	0.61	0.58	0.67	0.60	0.40	0.75	0.57	0.62	0.27	1.00	0.63	0.71	0.65
Velingrad	0.67	0.36	0.58	0.58	0.43	0.60	0.45	0.63	0.54	0.76	0.73	0.64	0.65	0.74	0.55	0.70	0.80	0.27	0.63	1.00	0.83	0.70
Sestrimo	0.76	0.36	0.51	0.67	0.47	0.62	0.40	0.59	0.47	0.74	0.70	0.58	0.64	0.67	0.54	0.62	0.86	0.38	0.71	0.83	1.00	0.76
Ihtiman	0.47	0.20	0.45	0.47	0.20	0.52	0.33	0.37	0.41	0.58	0.49	0.52	0.42	0.58	0.55	0.58	0.71	0.44	0.65	0.70	0.76	1.00

TABLE D.4.2 PROBABLE MINIMUM PRECIPITATIONS (1963 - 1995) (1/3)

Station		Non-Exceedence	Return Period	Probable Minimum Precipitation (mm)				
Code No.	Location	Probability (%)	(Years)	1-Month	3-Month	6-Month	9-Month	12-Month
41030	Sadievo	50	2	6	47	165	287	494
		75	4	3	34	140	249	438
		80	5	2	30	132	237	421
		90	10	-	24	117	215	387
		95	20	-	20	107	198	361
		98	50	-	16	96	180	334
		99	100	-	14	89	169	317
42010	Stara Zagora	50	2	7	55	173	306	527
		75	4	4	43	145	259	452
		80	5	2	39	136	245	429
		90	10	-	32	120	219	386
		95	20	-	28	108	199	353
		98	50	-	23	96	178	319
		99	100	-	21	89	166	299
43010	Haskovo	50	2	9	67	210	376	641
		75	4	5	51	177	326	569
		80	5	3	46	167	310	547
		90	10	-	38	148	280	503
		95	20	-	32	135	257	470
		98	50	-	27	120	234	435
		99	100	-	24	112	220	413
43020	Svilengrad	50	2	7	49	171	311	551
		75	4	3	33	139	267	481
		80	5	2	28	129	253	459
		90	10	-	21	111	227	417
		95	20	-	17	99	207	385
		98	50	-	13	86	187	352
		99	100	-	11	79	175	332
43030	Harmanli	50	2	6	49	172	305	535
		75	4	3	35	145	266	470
		80	5	2	31	136	254	450
		90	10	-	24	120	230	411
		95	20	-	20	109	212	382
		98	50	-	16	97	194	351
		99	100	-	13	90	183	332
45060	Hvoina	50	2	9	68	213	371	635
		75	4	5	53	179	321	558
		80	5	3	49	169	306	534
		90	10	-	41	150	277	488
		95	20	-	35	136	255	453
		98	50	-	30	122	233	416
		99	100	-	27	113	219	393
45130	Devin	50	2	11	75	225	386	632
		75	4	6	58	195	342	566
		80	5	4	53	186	328	545
		90	10	-	45	168	302	504
		95	20	-	39	154	281	473
		98	50	-	33	140	260	440
		99	100	-	29	132	247	420
46010	Plovdiv	50	2	7	55	161	274	480
		75	4	4	43	137	233	417
		80	5	2	39	127	220	398
		90	10	-	33	112	197	361
		95	20	-	29	102	179	333
		98	50	-	24	91	161	304
		99	100	-	22	84	150	286

TABLE D.4.2 PROBABLE MINIMUM PRECIPITATIONS (1963 - 1995) (2/3)

Station		Non-Exceedence	Return Period	Probable Minimum Precipitation (mm)				
Code No.	Location	Probability (%)	(Years)	1-Month	3-Month	6-Month	9-Month	12-Month
47010	Ivailo (Pazardjik)	50	2	7	52	157	274	472
		75	4	4	39	134	237	419
		80	5	3	35	127	226	402
		90	10	-	29	114	205	369
		95	20	-	24	104	189	344
		98	50	-	20	94	172	318
		99	100	-	18	88	162	302
47040	Velingrad	50	2	10	71	210	359	593
		75	4	7	56	179	322	540
		80	5	5	51	170	310	523
		90	10	-	42	152	287	490
		95	20	-	37	139	270	464
		98	50	-	31	125	251	436
		99	100	-	28	117	239	419
47050	Pangyurishte	50	2	9	68	214	358	603
		75	4	5	54	180	301	519
		80	5	3	50	169	284	493
		90	10	-	42	150	252	443
		95	20	-	37	135	228	406
		98	50	-	32	121	204	368
		99	100	-	29	112	189	345
64101	Ihtiman	50	2	9	62	182	312	529
		75	4	6	51	158	278	478
		80	5	4	47	151	267	462
		90	10	-	41	137	246	430
		95	20	-	36	126	230	405
		98	50	-	32	116	213	379
		99	100	-	29	109	203	363
41480	Polski Gradetz	50	2	9	62	197	337	576
		75	4	5	42	164	286	491
		80	5	3	37	154	270	465
		90	10	-	28	135	240	416
		95	20	-	23	121	218	379
		98	50	-	18	107	196	341
		99	100	-	15	99	182	318
43460	Oreshetz	50	2	9	64	218	401	717
		75	4	5	45	180	345	643
		80	5	3	40	168	328	620
		90	10	-	31	146	295	574
		95	20	-	26	130	271	539
		98	50	-	20	115	246	502
		99	100	-	17	105	230	479
45530	Manastir	50	2	17	117	366	623	1,043
		75	4	9	91	298	539	928
		80	5	6	83	277	513	892
		90	10	-	69	240	463	822
		95	20	-	59	212	426	768
		98	50	-	50	185	388	712
		99	100	-	45	169	364	677

TABLE D.4.2 PROBABLE MINIMUM PRECIPITATIONS (1963 - 1995) (3/3)

Station		Non-Exceedence	Return Period	Probable Minimum Precipitation (mm)				
Code No.	Location	Probability (%)	(Years)	1-Month	3-Month	6-Month	9-Month	12-Month
46410	Topolovo	50	2	11	76	240	410	707
		75	4	6	57	195	346	612
		80	5	4	51	182	326	583
		90	10	-	42	157	289	526
		95	20	-	35	140	262	484
		98	50	-	29	122	235	441
		99	100	-	26	112	218	414
46440	Parvomay	50	2	7	57	189	318	561
		75	4	3	43	158	271	490
		80	5	2	39	148	256	468
		90	10	-	32	131	229	425
		95	20	-	27	118	209	393
		98	50	-	23	105	188	360
		99	100	-	20	97	176	340
46690	Bania (Plovdivsko)	50	2	7	56	170	301	535
		75	4	3	42	143	251	464
		80	5	1	38	135	236	442
		90	10	-	31	120	208	400
		95	20	-	26	109	187	368
		98	50	-	21	97	166	335
		99	100	-	19	90	154	315
46700	Rozovetz	50	2	9	66	206	357	614
		75	4	5	54	173	308	550
		80	5	3	51	163	293	530
		90	10	-	44	144	264	490
		95	20	-	40	131	242	460
		98	50	-	35	117	220	428
		99	100	-	32	108	206	408
46750	Rozino	50	2	10	71	213	378	646
		75	4	6	56	175	321	563
		80	5	4	52	164	304	538
		90	10	-	44	144	271	489
		95	20	-	38	129	246	452
		98	50	-	33	114	221	414
		99	100	-	29	104	206	390
47520	Sestrimo	50	2	11	77	227	393	669
		75	4	5	59	190	34	579
		80	5	3	54	178	316	551
		90	10	-	45	157	282	497
		95	20	-	39	141	256	457
		98	50	-	33	125	231	415
		99	100	-	29	116	215	390
64525	Anton	50	2	8	56	173	318	589
		75	4	5	41	143	275	521
		80	5	3	37	134	261	500
		90	10	-	29	117	235	458
		95	20	-	24	104	216	427
		98	50	-	20	92	196	394
		99	100	-	17	85	184	374

TABLE D.5.1 MEAN RUNOFF DURING DIFFERENT TIME PERIODS (1/2)

Station			Period	Mean Runoff (million m3)												Annual
Code No.	River Name	Location		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	(million m3)
71700	Maritza	Belovo	1946-1995	13.61	14.09	22.14	27.41	46.33	31.01	17.18	10.52	9.22	11.77	15.06	20.31	238.64
			1946-1973	13.98	15.74	28.14	36.38	62.20	41.96	17.62	7.25	8.91	11.14	13.87	23.04	280.22
			1973-1989	14.50	14.37	18.86	22.14	36.10	22.93	18.59	16.10	10.78	14.57	17.96	18.94	225.84
			1989-1995	7.16	5.68	5.92	9.87	12.50	8.22	10.11	6.97	5.62	6.21	10.08	9.95	98.30
71800		Pazardjik	1946-1995	48.41	56.29	85.19	82.06	79.82	51.59	21.84	13.12	18.40	26.89	37.90	48.37	569.88
			1946-1973	58.69	69.64	116.48	115.07	107.94	69.18	24.69	9.48	18.08	26.08	37.39	53.45	706.16
			1973-1989	39.99	48.40	61.98	67.10	62.17	38.08	20.70	20.89	22.88	33.34	42.22	46.54	504.29
			1989-1995	24.52	20.00	21.35	22.29	16.34	12.40	10.90	5.84	7.88	13.32	25.82	29.25	209.92
72700		Plovdiv	1946-1995	139.11	139.76	192.53	194.22	186.20	119.88	64.36	53.31	68.83	87.30	108.30	134.42	1488.21
			1946-1973	160.76	162.98	254.15	261.59	236.07	149.78	67.06	37.77	65.22	85.02	112.25	153.76	1746.42
			1973-1989	129.63	131.93	151.28	160.49	154.15	97.46	70.99	87.59	88.61	106.52	114.08	125.05	1417.79
			1989-1995	75.76	58.42	56.67	68.48	69.92	49.08	37.73	38.02	47.20	58.51	79.10	83.21	722.11
72850		Parvomay	1946-1995	234.92	250.06	323.12	328.04	310.20	207.66	110.53	82.47	117.83	145.01	177.19	231.65	2518.68
			1946-1973	286.07	304.63	418.01	425.25	385.16	251.56	120.46	59.30	111.54	147.25	190.17	268.23	2967.63
			1973-1989	202.52	226.32	272.53	298.41	275.93	181.77	115.45	133.48	152.33	167.78	184.44	214.15	2425.11
			1989-1995	114.80	94.73	113.80	135.85	129.40	94.51	61.30	45.62	66.79	87.77	107.33	127.98	1179.87
73750		Harmanli	1946-1995	311.18	353.46	392.31	384.63	372.97	257.37	137.52	107.26	142.09	181.53	209.25	280.18	3129.75
			1946-1973	388.48	448.54	501.94	499.89	475.19	324.14	158.07	79.76	134.74	197.46	223.13	328.46	3759.80
			1973-1989	264.98	320.98	372.93	364.06	332.55	222.25	142.01	164.45	182.13	196.82	217.28	256.19	3036.64
			1989-1995	167.81	127.04	148.99	188.86	176.46	124.89	77.29	57.22	76.94	109.35	145.71	181.23	1581.78
73850		Svilengrad	1946-1995	314.05	335.95	404.71	369.40	353.51	250.33	135.32	99.86	130.95	171.44	206.74	292.64	3064.89
			1946-1973	354.00	383.28	499.25	441.49	414.14	288.03	140.42	71.98	116.05	169.27	216.71	344.76	3439.40
			1973-1989	299.27	346.93	396.39	378.82	341.51	240.59	153.09	159.48	176.54	195.70	206.81	250.91	3146.04
			1989-1995	209.01	149.32	162.02	226.86	209.79	144.79	82.63	52.32	82.72	131.48	166.94	203.92	1821.80

TABLE D.5.1 MEAN RUNOFF DURING DIFFERENT TIME PERIODS (2/2)

Station			Period	Mean Runoff (million m3)												Annual
Code No.	River Name	Location		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	(million m3)
71420	Chepinska	Marko Nikolovo	1952-1995	10.72	12.86	20.75	20.13	18.80	12.86	9.42	8.32	5.92	6.24	7.06	9.81	142.90
			1952-1973	14.94	16.79	28.13	27.40	23.66	14.13	9.37	8.03	6.40	7.57	8.55	12.82	177.80
			1973-1989	7.15	10.76	16.64	16.82	16.02	13.04	10.17	9.38	6.16	5.47	6.01	7.59	125.19
			1989-1995	5.74	5.94	9.03	9.40	9.30	7.00	7.39	6.25	4.23	4.22	4.90	5.69	79.09
71480	Topolnitza	Poibrene	1946-1995	12.75	16.51	26.88	31.85	29.31	26.07	14.36	7.76	6.79	8.47	9.22	11.99	201.95
			1946-1973	15.76	19.90	32.83	35.31	29.49	27.55	12.63	6.55	7.18	10.11	10.09	13.23	220.63
			1973-1989	10.07	15.25	24.87	32.99	31.83	25.52	15.69	9.65	6.89	7.08	8.80	11.18	199.82
			1989-1995	7.51	6.94	10.76	23.22	23.02	22.73	16.35	6.82	5.20	5.93	6.77	9.09	144.35
71550	Luda Yana	Sbor	1947-1995	6.95	10.11	16.58	11.79	9.51	7.66	3.52	1.64	1.77	2.92	4.33	6.49	83.28
			1947-1973	10.36	14.23	25.22	16.42	11.82	10.91	4.67	1.55	2.47	4.05	4.95	9.04	115.67
			1973-1989	3.75	7.28	10.67	10.80	7.63	4.72	2.64	2.03	1.26	2.04	4.16	3.86	60.82
			1989-1995	3.71	3.95	4.75	6.49	6.30	4.51	1.89	0.83	0.83	1.37	2.41	4.18	41.21
72340	Vacha	Devin-Zabral	1961-1995	34.44	33.38	39.88	49.81	43.00	27.66	19.80	17.57	16.39	19.92	26.72	34.62	363.20
			1961-1973	37.34	35.51	47.11	58.09	52.41	31.65	23.77	17.62	14.92	17.72	25.91	29.30	391.36
			1973-1989	39.21	38.57	42.61	53.33	44.20	28.89	21.23	23.16	22.36	26.14	31.27	43.15	414.12
			1989-1995	17.89	15.29	19.23	26.99	24.95	17.81	13.06	10.60	9.87	14.34	18.89	24.34	213.27
72460	Chepelarska	Bachkovo	1950-1995	24.14	26.10	40.97	50.75	48.20	32.04	18.53	10.72	8.67	9.71	15.27	24.41	309.52
			1950-1973	33.38	31.46	48.29	57.86	54.02	36.67	20.87	9.97	10.07	12.04	19.14	30.24	364.00
			1973-1989	15.66	23.70	38.14	50.95	46.70	29.42	17.55	13.12	8.21	7.83	12.59	19.04	282.90
			1989-1995	10.15	12.35	24.78	30.33	29.51	19.00	13.94	6.93	4.55	5.85	7.24	13.76	178.38
72520	Stryama	Bania	1946-1995	14.14	15.06	22.29	28.28	26.36	21.34	11.37	7.31	7.26	10.92	12.83	16.24	193.41
			1946-1973	17.09	16.75	25.54	30.51	27.61	24.25	12.26	6.42	8.40	13.29	14.89	18.43	215.45
			1973-1989	11.32	15.63	22.33	29.60	26.32	16.63	10.26	9.85	7.00	9.22	12.01	13.73	183.88
			1989-1995	9.07	7.84	12.11	23.75	21.73	21.60	11.47	4.87	4.14	6.11	6.70	12.26	141.65
73480	Sazliyka	Galabovo	1955-1995	46.90	53.43	55.99	44.80	42.51	35.64	28.44	26.28	24.74	26.13	26.60	36.85	448.30
			1955-1973	61.07	74.04	76.56	59.47	52.89	42.34	29.25	23.22	24.72	30.56	31.07	47.23	552.41
			1973-1989	39.88	45.04	53.46	44.83	42.34	34.65	32.93	34.49	29.60	26.26	25.91	31.26	440.64
			1989-1995	21.47	15.75	16.78	19.77	19.90	18.55	16.76	14.34	13.92	13.87	14.79	18.81	204.71
73550	Harmanliyska	Harmanli	1947-1995	15.71	24.24	24.67	12.32	10.44	6.64	4.93	4.40	3.77	5.42	6.38	13.47	132.38
			1947-1973	11.54	21.16	22.08	13.00	7.91	7.43	5.93	5.93	4.17	4.54	6.46	9.65	119.80
			1973-1989	12.02	9.87	11.19	9.30	7.42	4.99	4.02	3.16	3.46	4.60	5.13	7.68	82.83
			1989-1995	15.04	23.80	22.80	12.06	9.91	6.81	5.52	5.11	4.74	6.46	6.04	12.00	130.30

TABLE D.5.2 SPECIFIC DISCHARGES ALONG MARITZA MAINSTREAM DURING DIFFERENT TIME PERIODS

Station		Catchment Area	Period	Specific Discharge (l/s.km2)												Annual Avg.
Code No.	Name	(km2)		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	(l/s.km2)
71700	Belovo	752	1946-1995	6.76	7.75	10.99	14.06	23.00	15.91	8.53	5.22	4.73	5.84	7.73	10.08	10.06
			1946-1973	6.94	8.65	13.97	18.67	30.88	21.53	8.75	3.60	4.57	5.53	7.12	11.44	11.82
			1973-1989	7.20	7.90	9.36	11.36	17.92	11.76	9.23	8.00	5.53	7.23	9.21	9.41	9.52
			1989-1995	3.55	3.12	2.94	5.06	6.20	4.22	5.02	3.46	2.89	3.08	5.17	4.94	4.14
71800	Pazardjik	4,027	1946-1995	4.49	5.78	7.90	7.86	7.40	4.94	2.03	1.22	1.76	2.49	3.63	4.48	4.49
			1946-1973	5.44	7.15	10.80	11.02	10.01	6.63	2.29	0.88	1.73	2.42	3.58	4.96	5.56
			1973-1989	3.71	4.97	5.75	6.43	5.76	3.65	1.92	1.94	2.19	3.09	4.04	4.31	3.97
			1989-1995	2.27	2.05	1.98	2.14	1.51	1.19	1.01	0.54	0.76	1.24	2.47	2.71	1.65
72700	Plovdiv	8,076	1946-1995	6.43	7.15	8.90	9.28	8.61	5.73	2.98	2.46	3.29	4.04	5.17	6.21	5.84
			1946-1973	7.43	8.34	11.75	12.50	10.91	7.16	3.10	1.75	3.12	3.93	5.36	7.11	6.86
			1973-1989	5.99	6.75	6.99	7.67	7.13	4.66	3.28	4.05	4.23	4.92	5.45	5.78	5.57
			1989-1995	3.50	2.99	2.62	3.27	3.23	2.34	1.74	1.76	2.25	2.71	3.78	3.85	2.84
72850	Parvomay	12,918	1946-1995	6.79	8.00	9.34	9.80	8.97	6.20	3.19	2.38	3.52	4.19	5.29	6.70	6.18
			1946-1973	8.27	9.75	12.08	12.70	11.13	7.51	3.48	1.71	3.33	4.26	5.68	7.75	7.28
			1973-1989	5.85	7.24	7.88	8.91	7.97	5.43	3.34	3.86	4.55	4.85	5.51	6.19	5.95
			1989-1995	3.32	3.03	3.29	4.06	3.74	2.82	1.77	1.32	1.99	2.54	3.21	3.70	2.90
73750	Harmanli	19,864	1946-1995	5.85	7.36	7.37	7.47	7.01	5.00	2.58	2.02	2.76	3.41	4.06	5.27	5.00
			1946-1973	7.30	9.33	9.43	9.71	8.93	6.30	2.97	1.50	2.62	3.71	4.33	6.17	6.00
			1973-1989	4.98	6.68	7.01	7.07	6.25	4.32	2.67	3.09	3.54	3.70	4.22	4.82	4.85
			1989-1995	3.15	2.64	2.80	3.67	3.32	2.43	1.45	1.08	1.49	2.06	2.83	3.41	2.53
73850	Svilengrad	20,860	1946-1995	5.62	6.66	7.24	6.83	6.33	4.63	2.42	1.79	2.42	3.07	3.82	5.24	4.66
			1946-1973	6.34	7.60	8.94	8.17	7.41	5.33	2.51	1.29	2.15	3.03	4.01	6.17	5.23
			1973-1989	5.36	6.87	7.09	7.01	6.11	4.45	2.74	2.85	3.27	3.50	3.82	4.49	4.78
			1989-1995	3.74	2.96	2.90	4.20	3.75	2.68	1.48	0.94	1.53	2.35	3.09	3.65	2.77

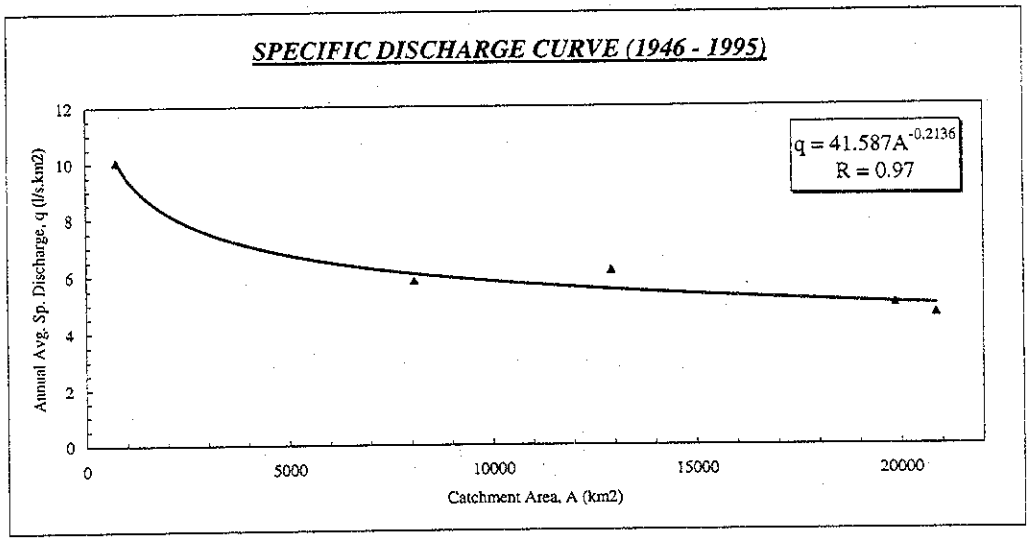


TABLE D.5.3 DISTURBED RUNOFF RATES ALONG MARITZA MAINSTREAM (1963 - 1995)

MEASURED MEAN RUNOFF (1963-1995)

Station		Catchment Area	Runoff, Vmeas (million m3)												Annual
Code No.	Name	(km2)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	(million m3)
71700	Belovo	752	13	13	18	24	41	26	16	12	9	12	14	21	219
71800	Pazardjik	4,027	40	52	65	65	66	38	17	15	19	29	36	43	484
72700	Plovdiv	8,076	127	134	152	163	162	97	59	62	74	96	105	122	1,353
72850	Parvomay	12,918	214	241	281	305	289	180	99	95	131	160	176	214	2,384
73750	Harmanli	19,864	289	353	382	367	346	224	124	120	155	194	210	274	3,038
73850	Svilengrad	20,860	312	353	395	365	341	228	128	114	146	191	205	276	3,054

MEAN RUNOFF AS COMPUTED FROM PRECIPITATION (1963-1995)

Station		Catchment Area	Runoff, Vcomp (million m3)												Annual
Code No.	Name	(km2)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	(million m3)
71700	Belovo	752	32	33	37	41	62	53	44	41	27	31	42	40	483
71800	Pazardjik	4,027	165	154	171	203	319	282	232	199	138	146	201	199	2,408
72700	Plovdiv	8,076	339	310	347	400	613	538	465	378	280	286	400	415	4,770
72850	Parvomay	12,918	544	505	560	651	977	877	766	633	453	468	652	681	7,767
73750	Harmanli	19,864	881	806	886	1,014	1,406	1,292	1,093	928	681	745	1,034	1,084	11,850
73850	Svilengrad	20,860	943	858	944	1,070	1,464	1,346	1,127	957	714	795	1,099	1,159	12,476

DISTURBED RUNOFF RATE (1963-1995)

Station		Catchment Area	Runoff Rate, Cd = Vmeas / Vcomp												Annual
Code No.	Name	(km2)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average
71700	Belovo	752	0.41	0.41	0.49	0.57	0.66	0.48	0.36	0.28	0.32	0.39	0.35	0.53	0.45
71800	Pazardjik	4,027	0.25	0.33	0.38	0.32	0.21	0.13	0.07	0.07	0.14	0.20	0.18	0.21	0.20
72700	Plovdiv	8,076	0.38	0.43	0.44	0.41	0.26	0.18	0.13	0.16	0.26	0.34	0.26	0.29	0.28
72850	Parvomay	12,918	0.39	0.48	0.50	0.47	0.30	0.21	0.13	0.15	0.29	0.34	0.27	0.31	0.31
73750	Harmanli	19,864	0.33	0.44	0.43	0.36	0.25	0.17	0.11	0.13	0.23	0.26	0.20	0.25	0.26
73850	Svilengrad	20,860	0.33	0.41	0.42	0.34	0.23	0.17	0.11	0.12	0.21	0.24	0.19	0.24	0.24

TABLE D.5.4 PROBABLE MINIMUM RUNOFFS ALONG MARITZA MAINSTREAM

Station		Non-Exceedence	Return Period	Probable Minimum Runoff (million m3)				
Code No.	Location	Probability (%)	(Years)	1-Month	3-Month	6-Month	9-Month	12-Month
71700	Belovo	50	2	4.01	17.85	55.62	105.63	210.64
		75	4	2.61	12.27	38.87	76.04	149.88
		80	5	2.24	10.76	34.30	67.85	133.16
		90	10	1.65	8.26	26.64	53.82	104.75
		95	20	1.29	6.64	21.62	44.45	85.92
		98	50	0.97	5.19	17.09	35.85	68.75
		99	100	0.80	4.41	14.61	31.06	59.26
71800	Pazardjik	50	2	4.74	26.58	103.38	239.49	481.53
		75	4	2.26	13.39	64.75	165.02	326.68
		80	5	1.70	10.36	54.78	144.85	285.06
		90	10	1.00	6.32	39.29	111.34	216.67
		95	20	0.64	4.21	29.86	89.60	172.76
		98	50	0.39	2.66	21.93	70.18	133.90
		99	100	0.28	1.96	17.85	59.63	112.98
72700	Plovdiv	50	2	33.83	137.10	392.51	766.33	1,355.06
		75	4	21.81	91.16	285.42	581.71	1,016.00
		80	5	18.66	78.94	255.62	529.24	920.22
		90	10	13.67	59.14	204.25	436.05	751.55
		95	20	10.57	46.59	169.71	371.62	635.86
		98	50	7.92	35.62	137.78	310.43	526.84
		99	100	6.53	29.79	119.90	275.35	464.76
72850	Parvomay	50	2	49.26	226.46	660.70	1,313.57	2,307.74
		75	4	28.73	150.80	473.99	998.11	1,743.63
		80	5	23.62	130.66	422.39	908.42	1,583.68
		90	10	16.08	97.99	334.24	749.00	1,300.51
		95	20	11.70	77.27	275.51	638.70	1,105.29
		98	50	8.19	59.14	221.67	533.89	920.46
		99	100	6.45	49.49	191.76	473.77	814.76
73750	Harmanli	50	2	60.09	277.28	807.96	1,611.76	2,847.63
		75	4	31.22	175.15	582.90	1,224.10	2,133.53
		80	5	24.47	148.68	520.52	1,113.90	1,931.89
		90	10	15.30	107.31	413.54	918.11	1,576.95
		95	20	10.38	81.98	342.00	782.68	1,333.62
		98	50	6.71	60.56	276.20	654.03	1,104.42
		99	100	5.01	49.49	239.53	580.25	973.98
73850	Svilengrad	50	2	57.54	263.22	794.00	1,589.61	2,847.23
		75	4	31.23	167.67	579.14	1,235.95	2,211.27
		80	5	24.94	142.80	519.27	1,134.26	2,028.52
		90	10	16.11	103.70	415.81	950.64	1,698.79
		95	20	11.22	79.63	346.12	821.67	1,467.36
		98	50	7.48	59.15	281.57	697.36	1,244.43
		99	100	5.70	48.52	245.38	625.13	1,114.99

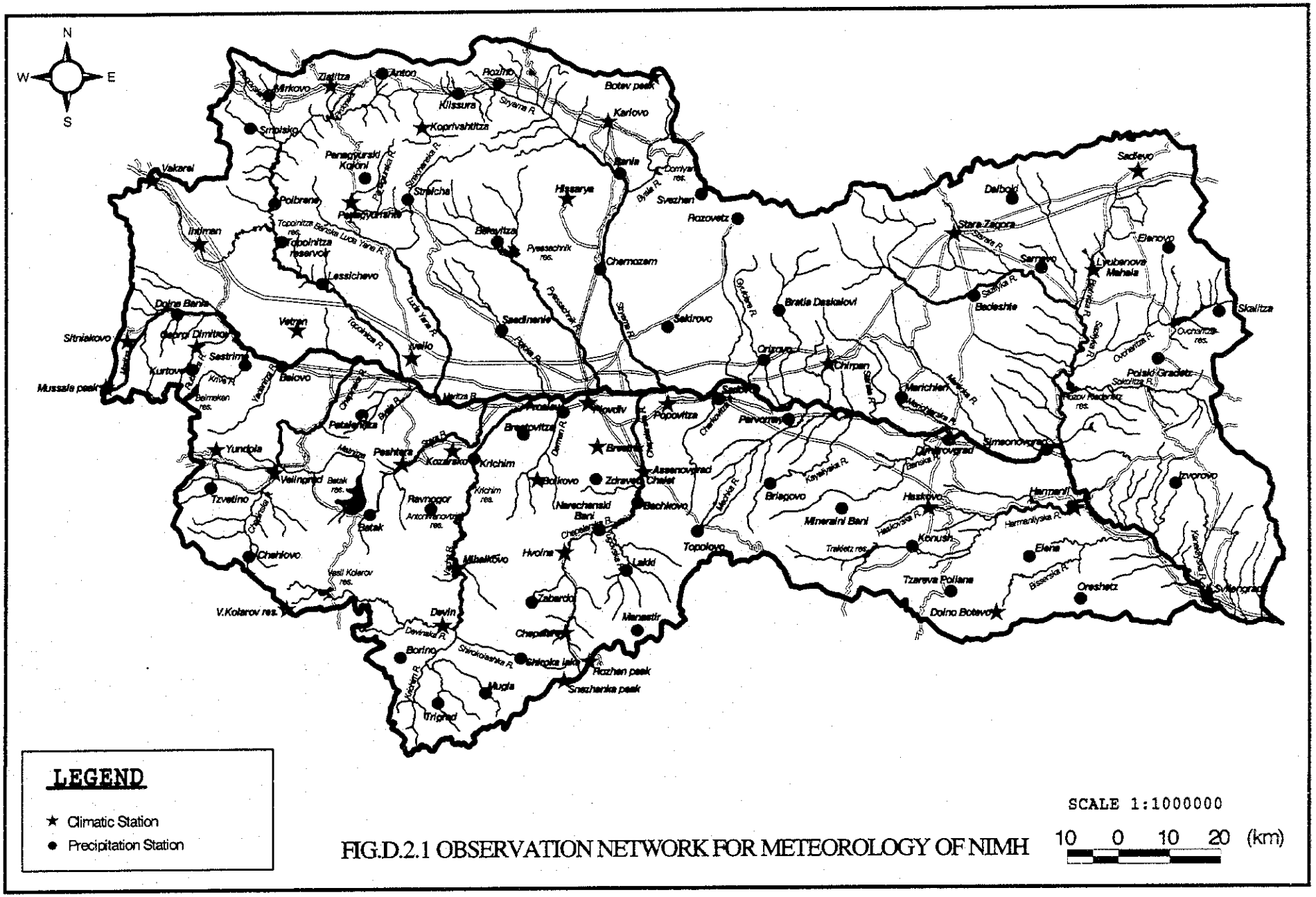


FIG.D.2.1 OBSERVATION NETWORK FOR METEOROLOGY OF NIMH

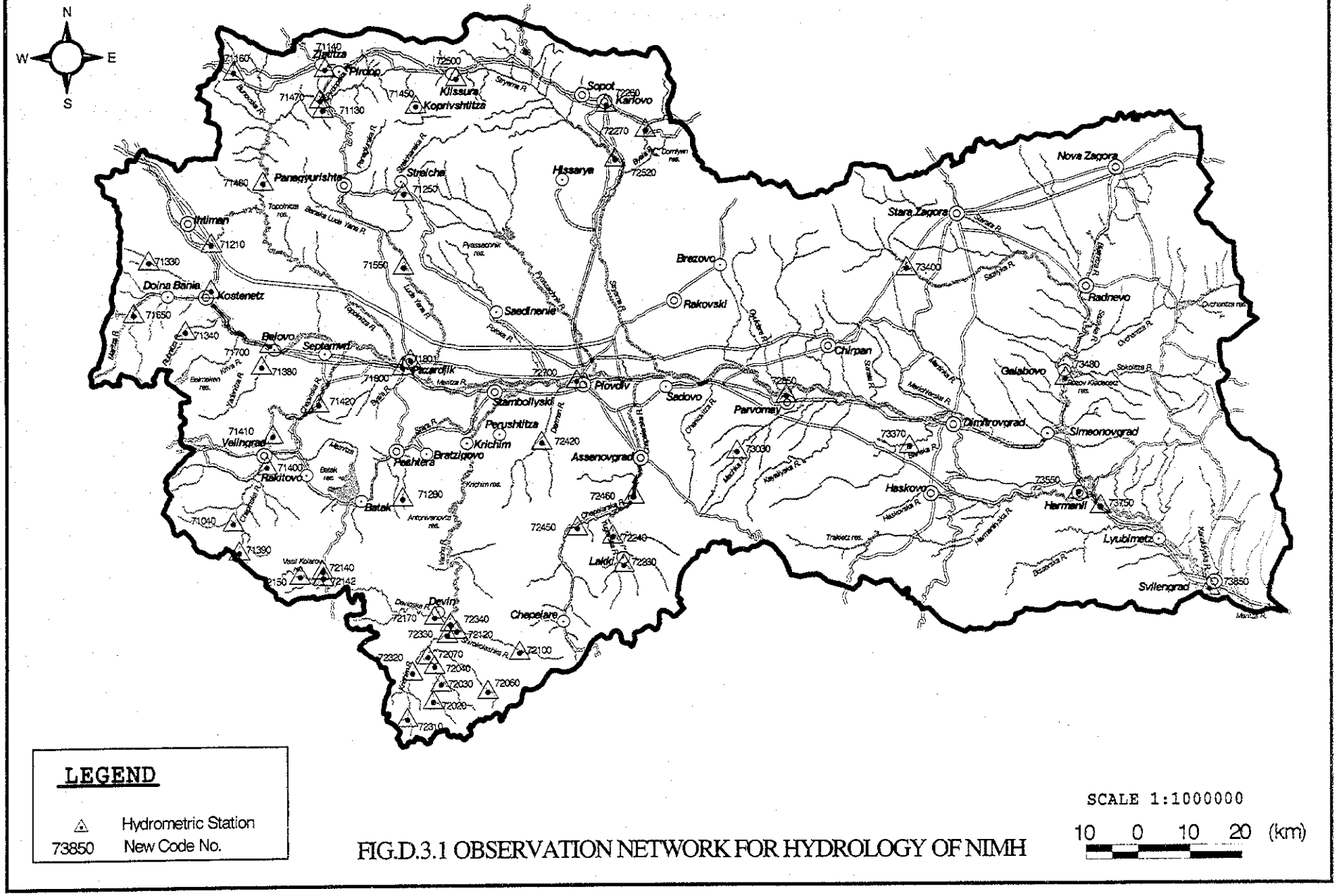


FIG.D.3.1 OBSERVATION NETWORK FOR HYDROLOGY OF NIMH

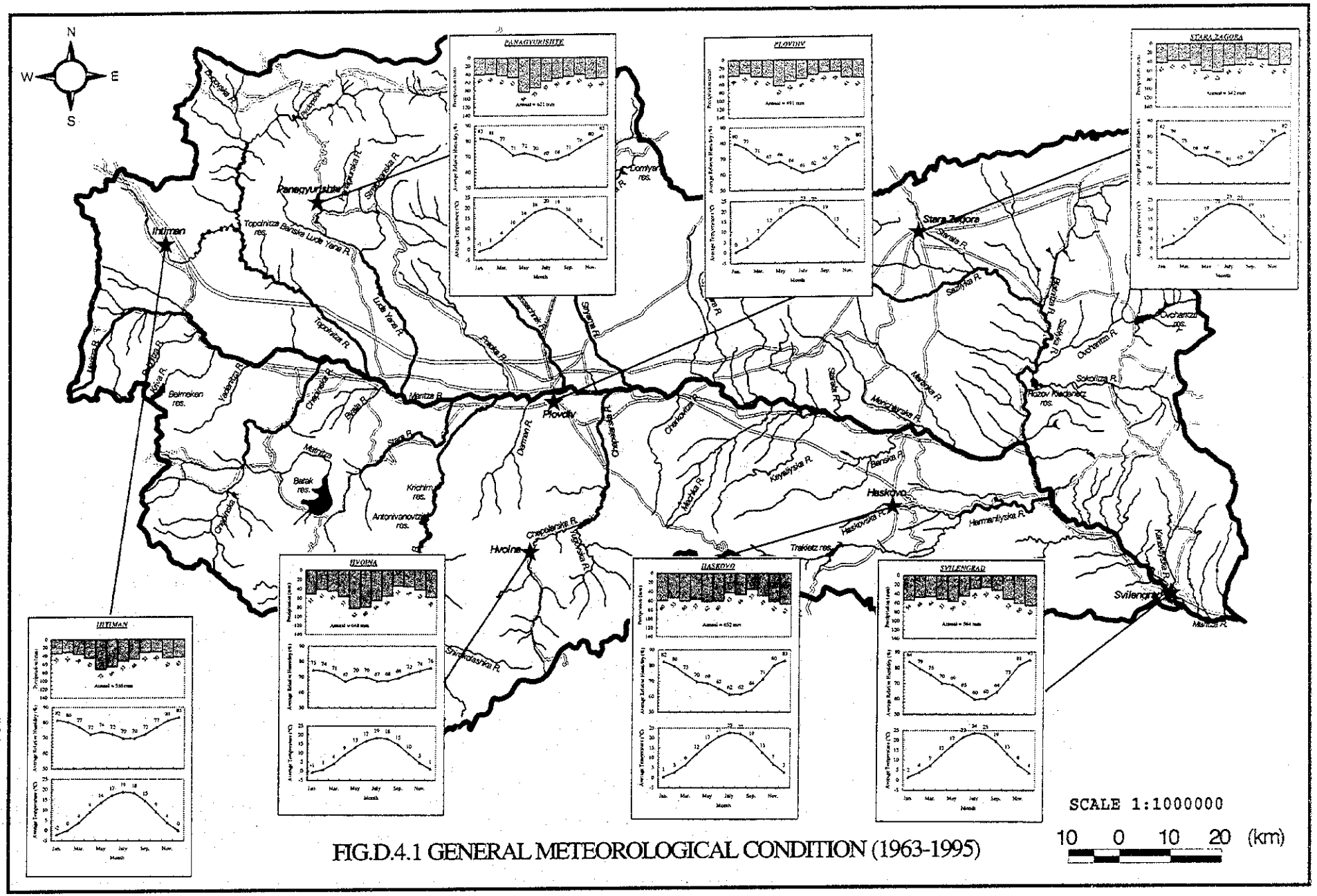


FIG.D.4.1 GENERAL METEOROLOGICAL CONDITION (1963-1995)

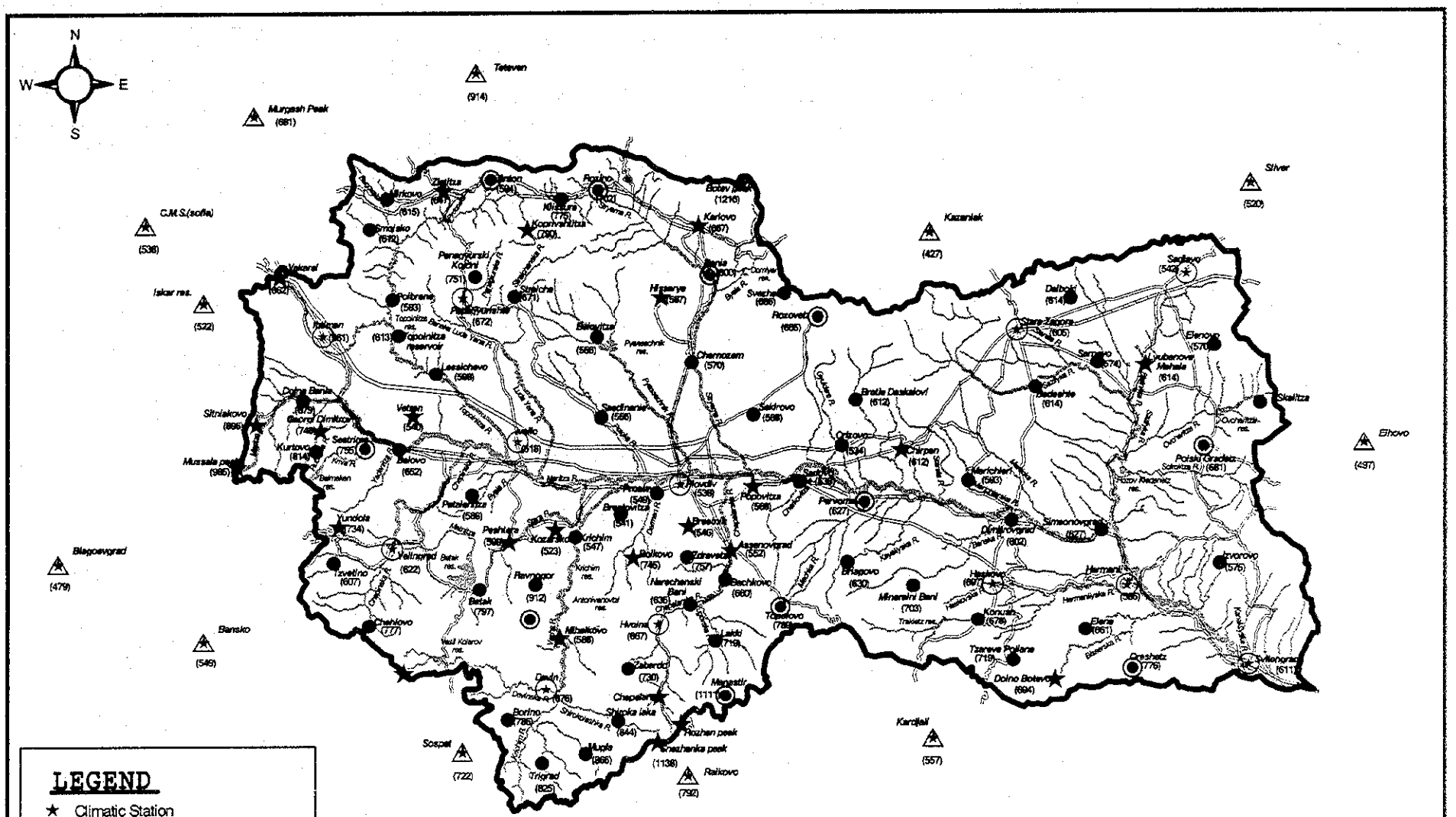


FIG.D.4.2 ANNUAL AVERAGE PRECIPITATIONS AT THE METEOROLOGICAL STATION
(For inner-basin stations,data ranges from 1963-1981,
where 1981 is the year up to when NIMH published data is the meteorogical year book
For outer-basin stations,data ranges from 1984-1996,
the data has been newly collected from NIHM)

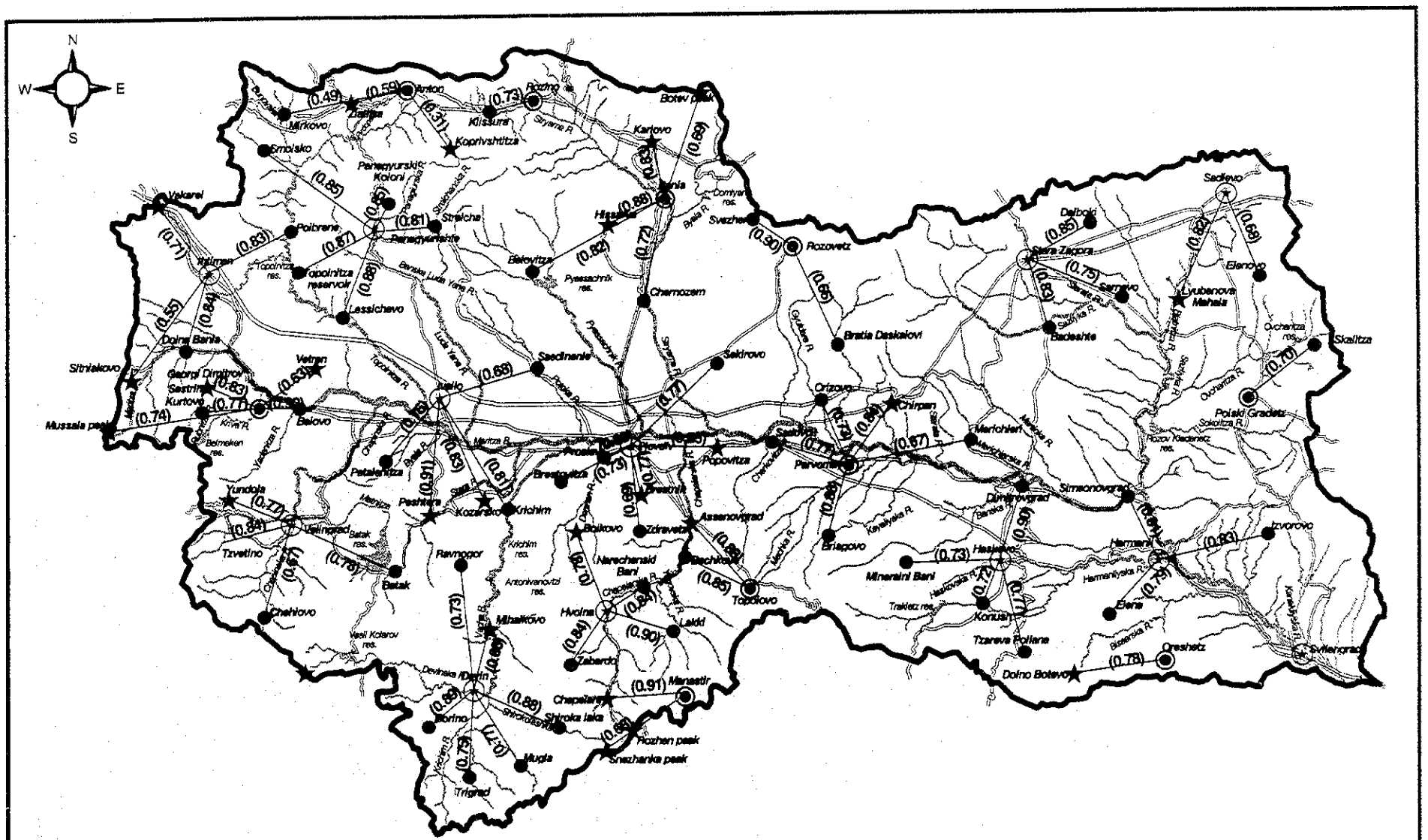


FIG.D.4.3 CORRELATIONS OF ANNUAL PRECIPITATIONS AMONG REPRESENTATIVE AND NEIGHBORING STATIONS (1963-1981)
(data had been published by NIMH in the meteorological year book up to 1981)

SCALE 1:1000000

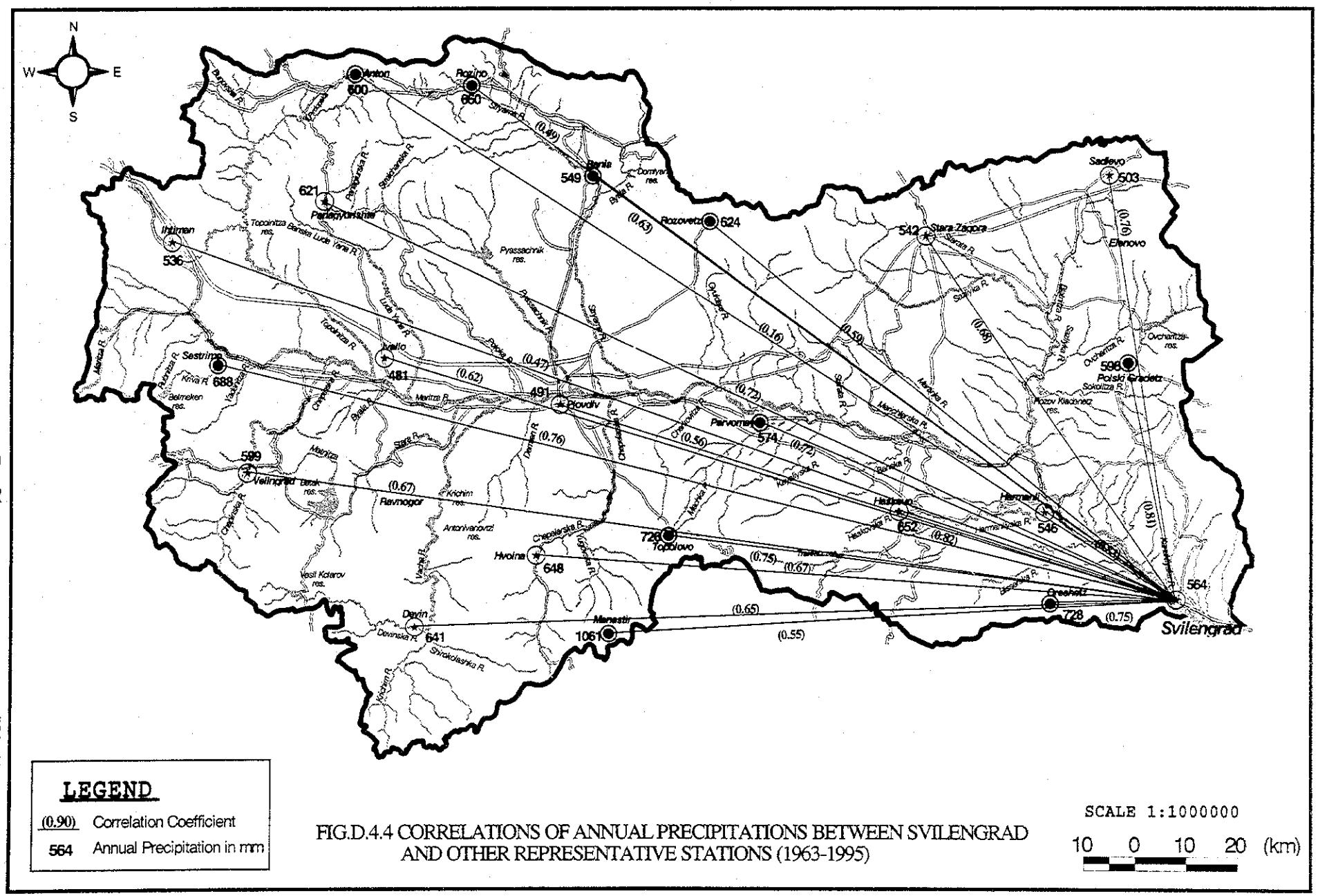
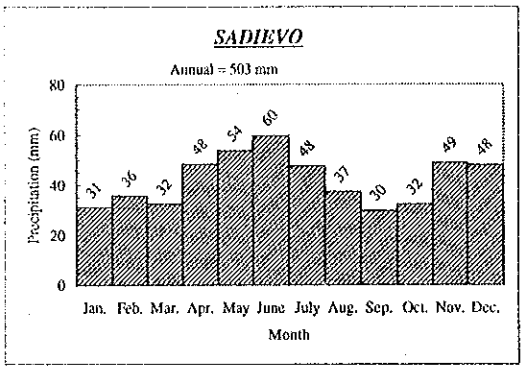
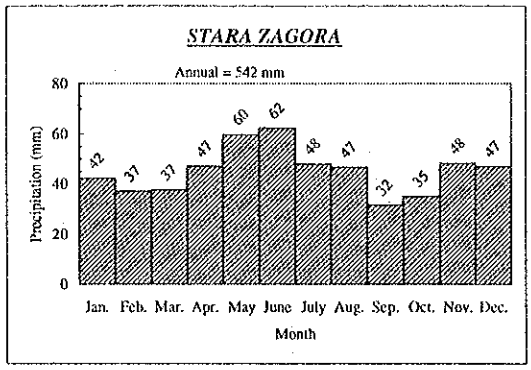
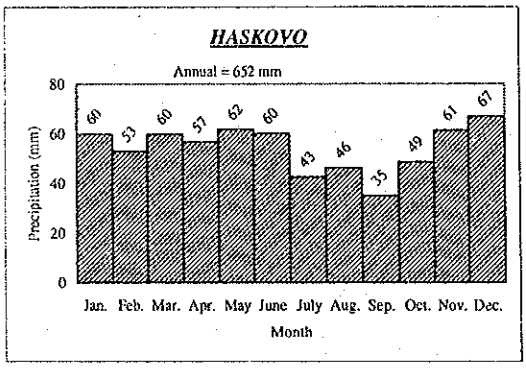
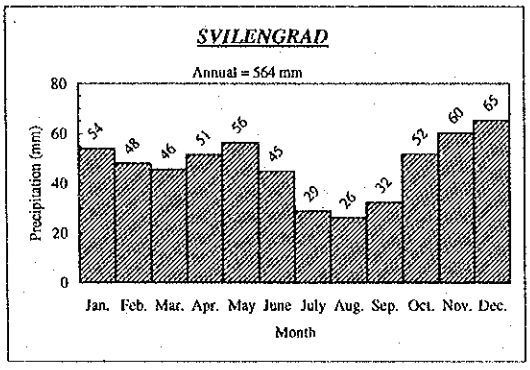


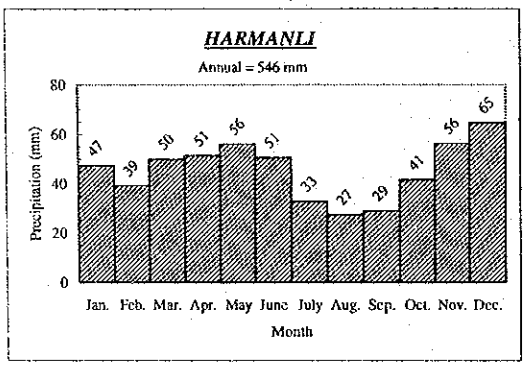
FIG.D.4.4 CORRELATIONS OF ANNUAL PRECIPITATIONS BETWEEN SVILENGRAD AND OTHER REPRESENTATIVE STATIONS (1963-1995)

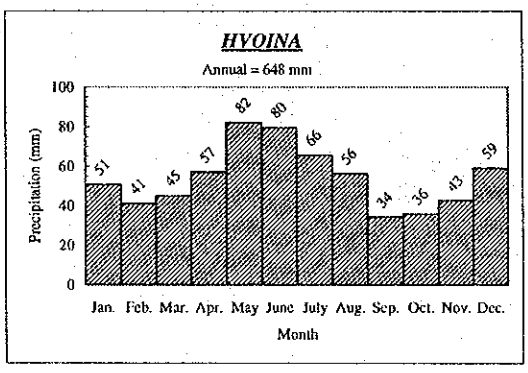


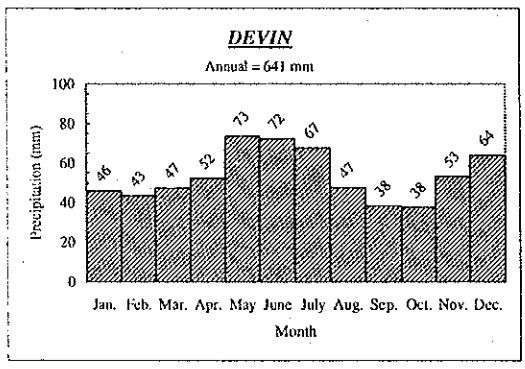












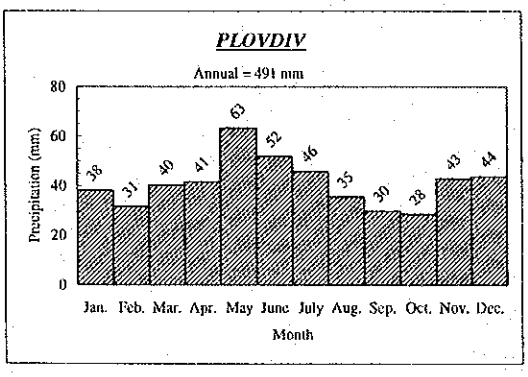
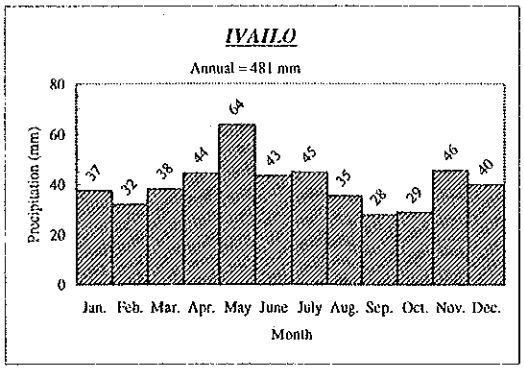
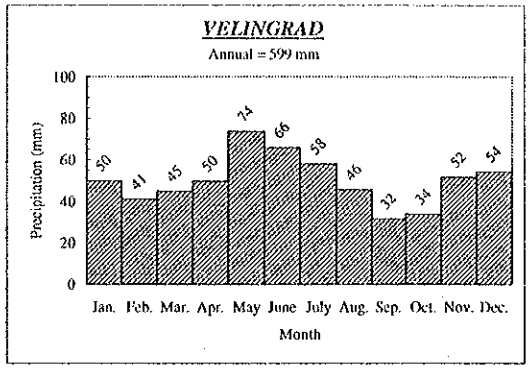
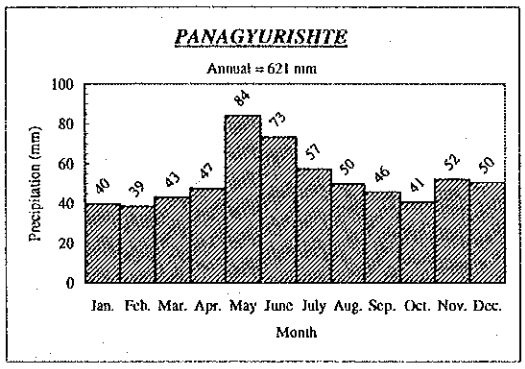
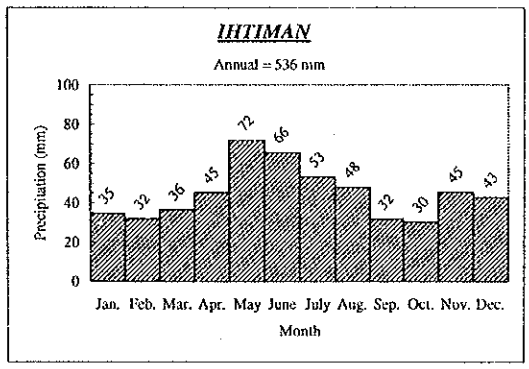


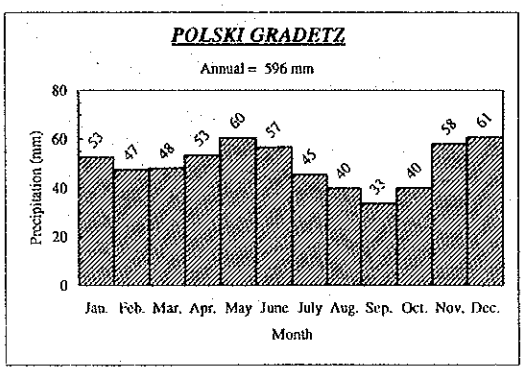
FIG. D.4.5 MONTHLY AVERAGE PRECIPITATIONS (1963 - 1995) (1/3)

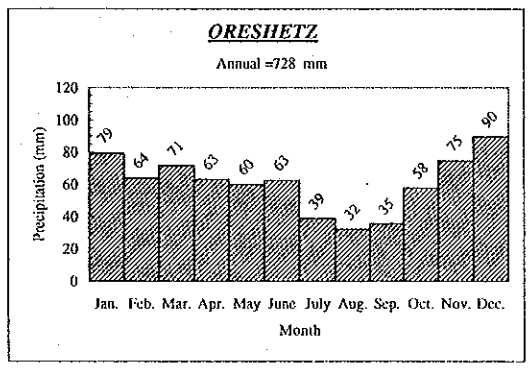


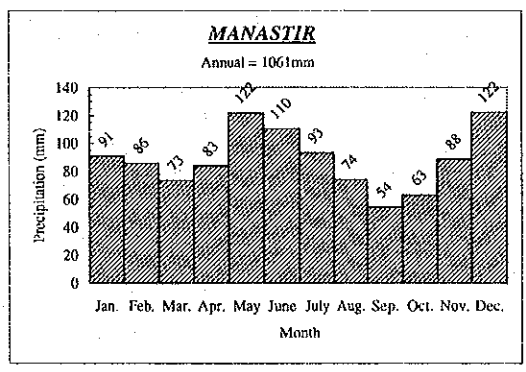












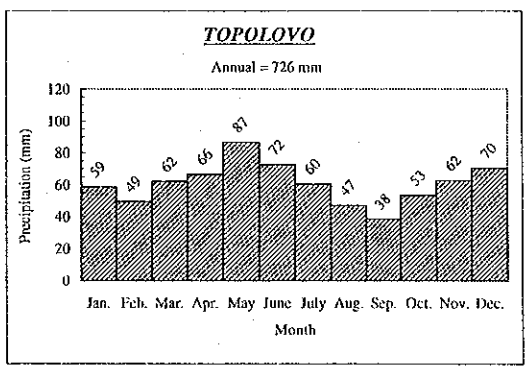
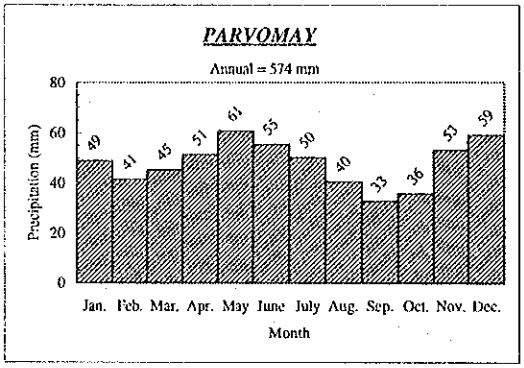
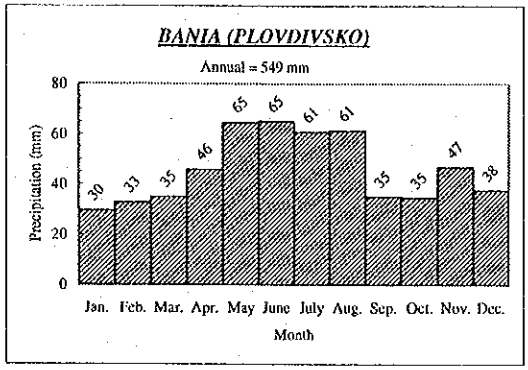
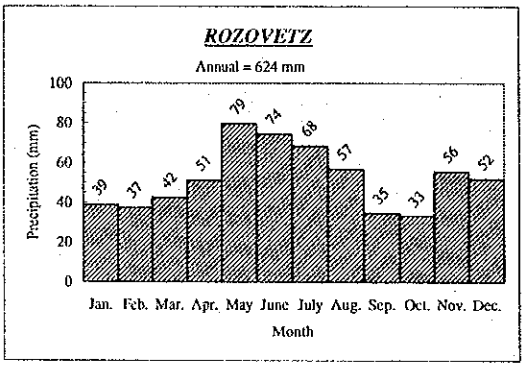
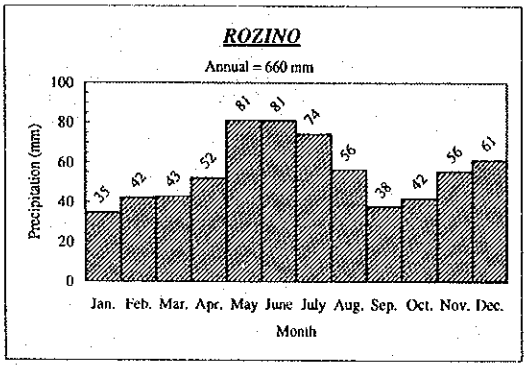


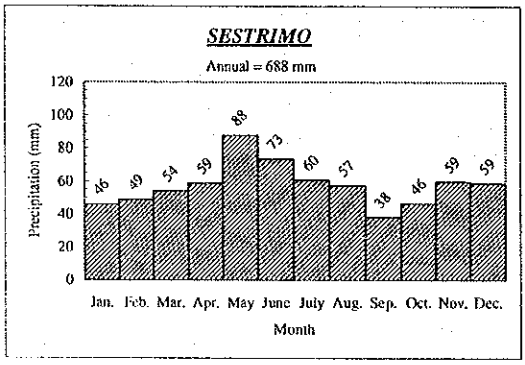
FIG. D.4.5 MONTHLY AVERAGE PRECIPITATIONS (1963 - 1995) (2/3)











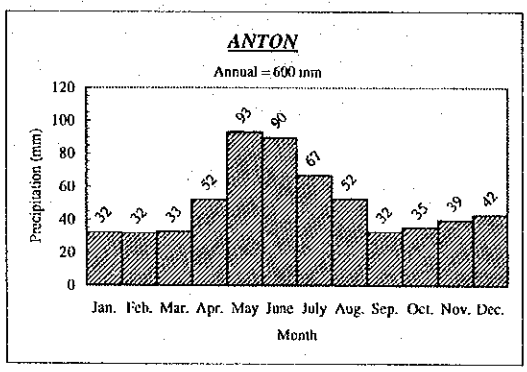


FIG. D.4.5 MONTHLY AVERAGE PRECIPITATIONS (1963 - 1995) (3/3)

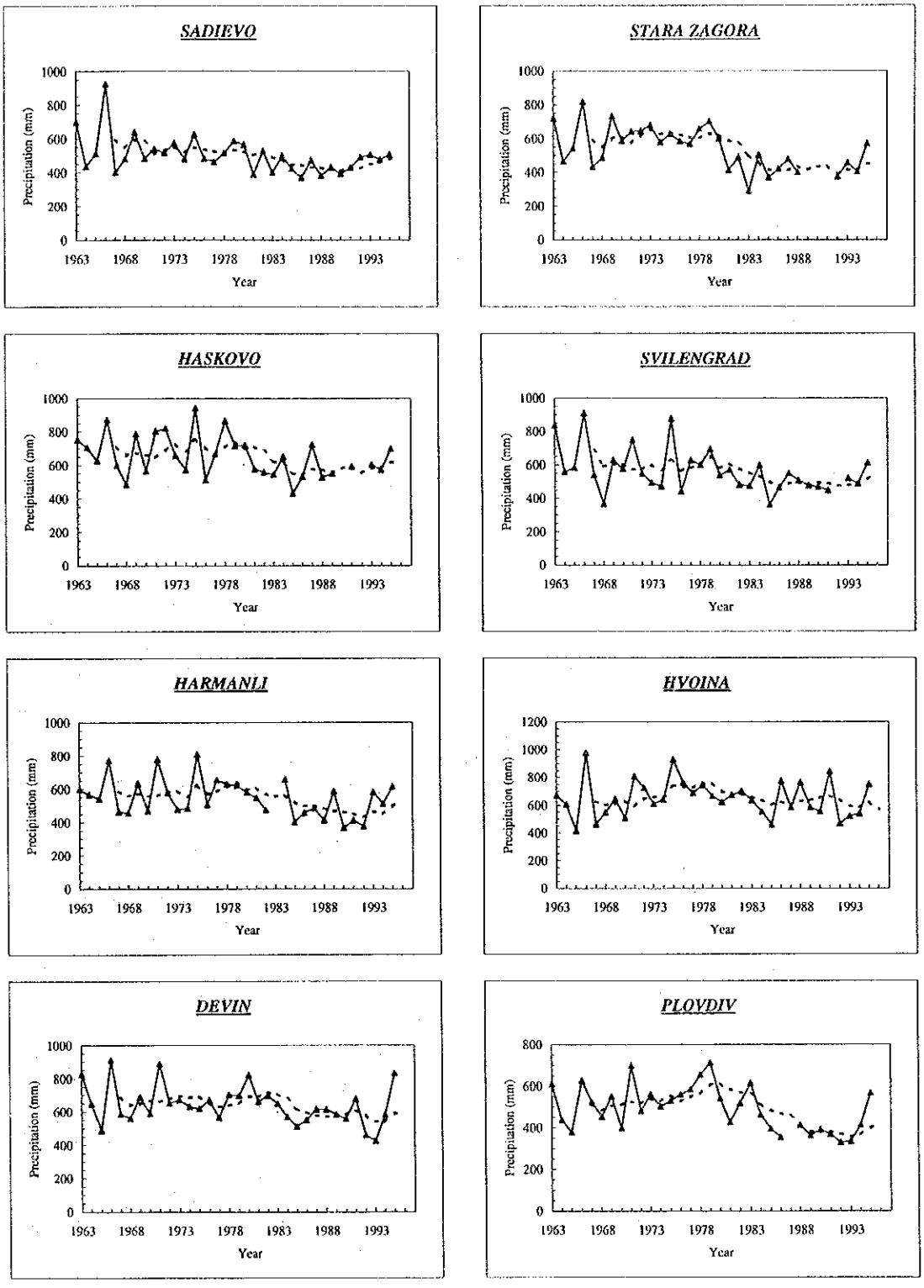


FIG. D.4.6 YEARLY VARIATION IN ANNUAL PRECIPITATIONS (1963 - 1995) (1/3)

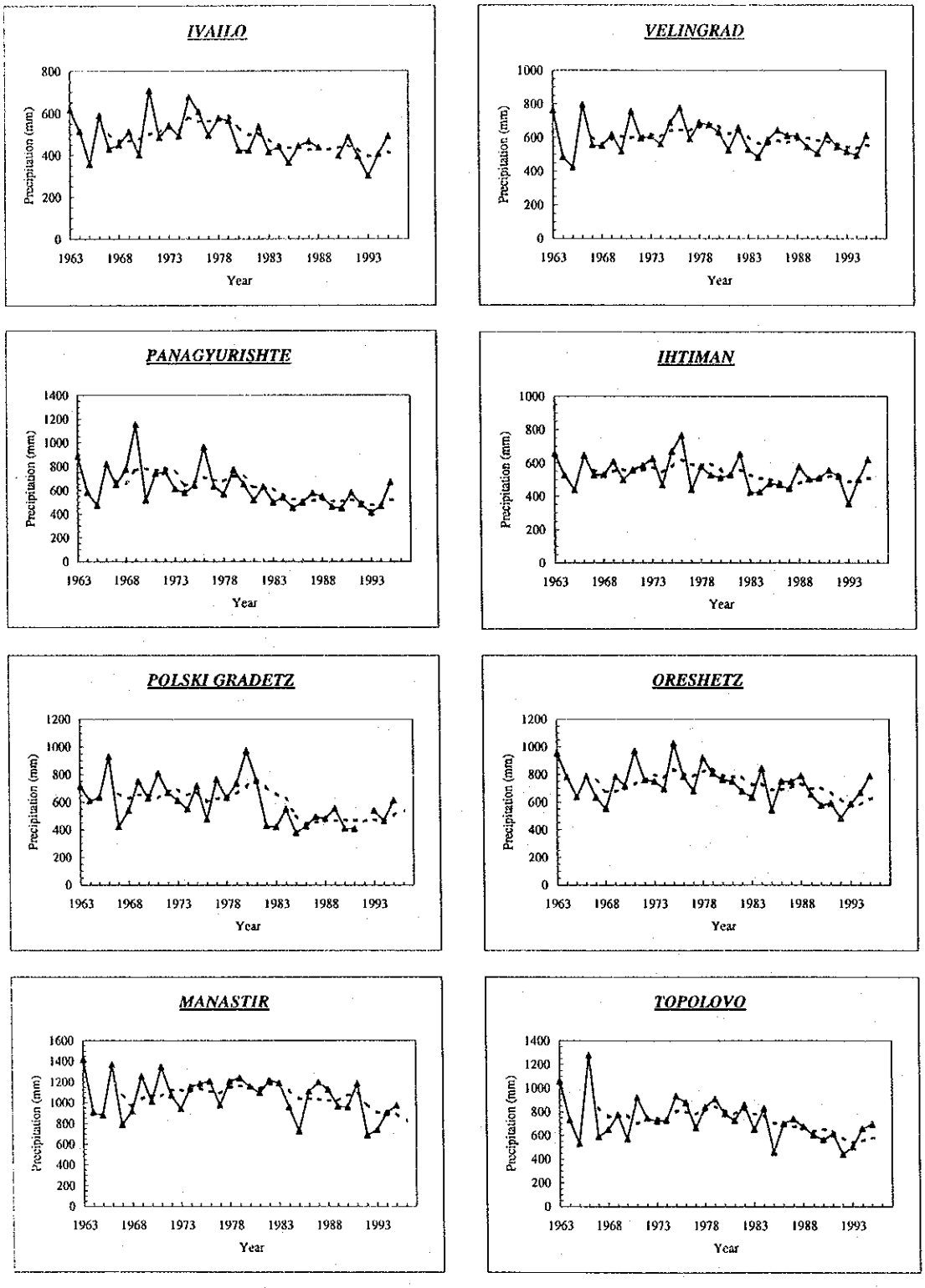
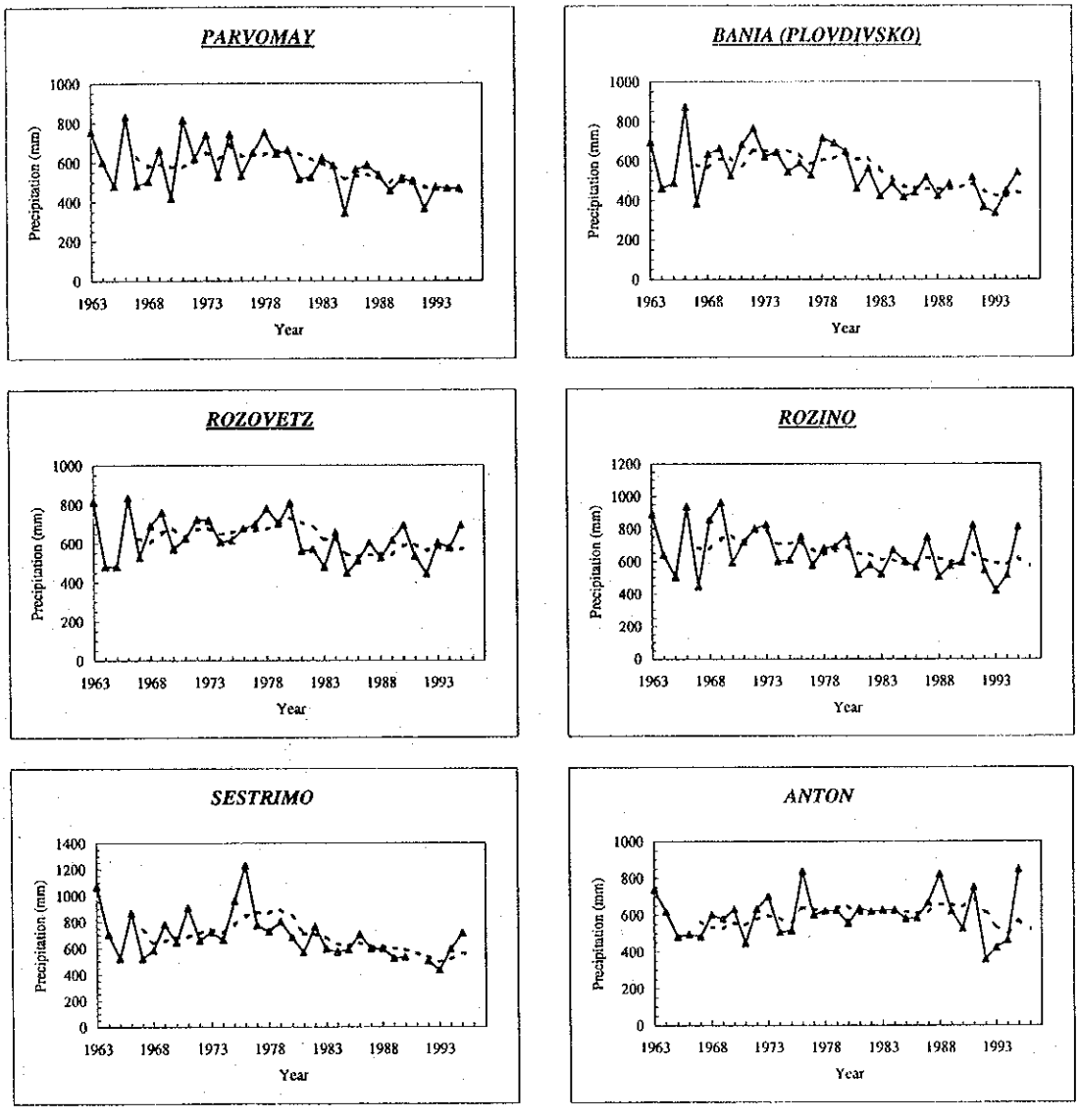


FIG. D.4.6 YEARLY VARIATION IN ANNUAL PRECIPITATIONS (1963 - 1995) (2/3)



---------- *5-year moving average trendline*

FIG. D.4.6 YEARLY VARIATION IN ANNUAL PRECIPITATIONS (1963 - 1995) (3/3)

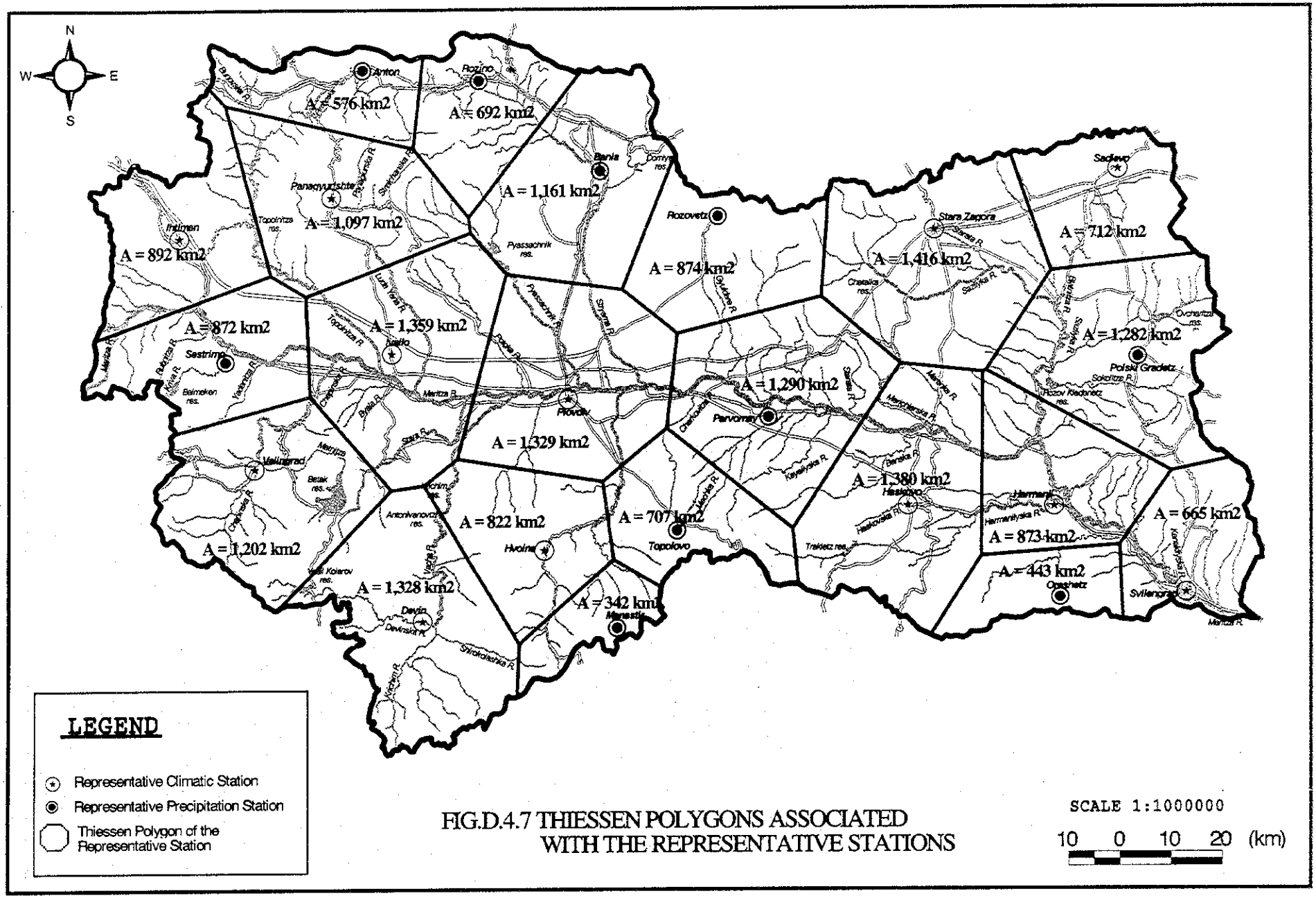
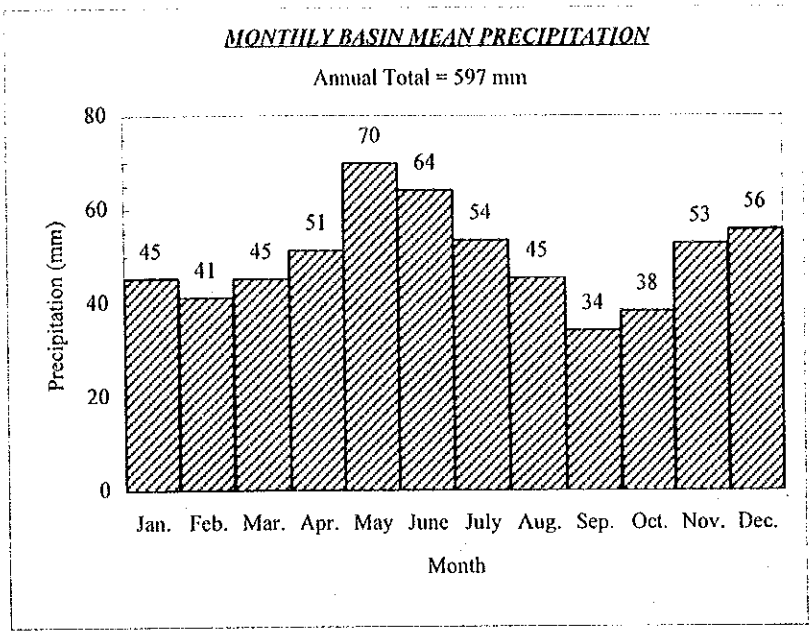
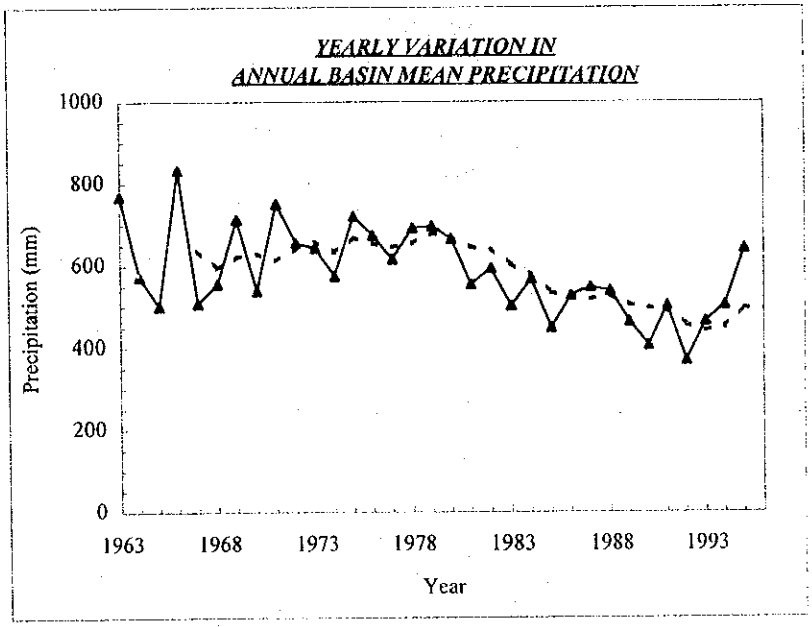


FIG.D.4.7 THIESSEN POLYGONS ASSOCIATED WITH THE REPRESENTATIVE STATIONS



YEARLY VARIATION IN ANNUAL BASIN MEAN PRECIPITATION

Year	Precipitation (mm)
1963	769
1964	573
1965	502
1966	834
1967	508
1968	557
1969	714
1970	539
1971	752
1972	656
1973	643
1974	575
1975	721
1976	675
1977	617
1978	692
1979	697
1980	666
1981	555
1982	594
1983	502
1984	568
1985	449
1986	527
1987	548
1988	539
1989	464
1990	406
1991	503
1992	369
1993	465
1994	504
1995	642

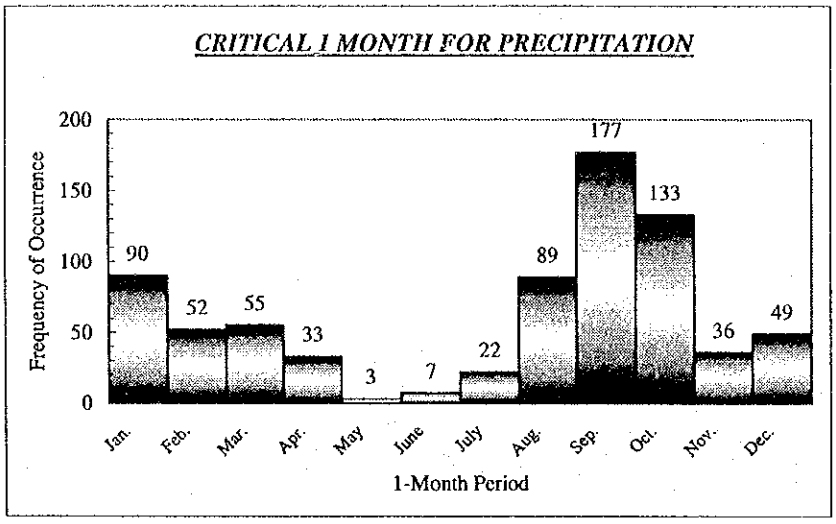


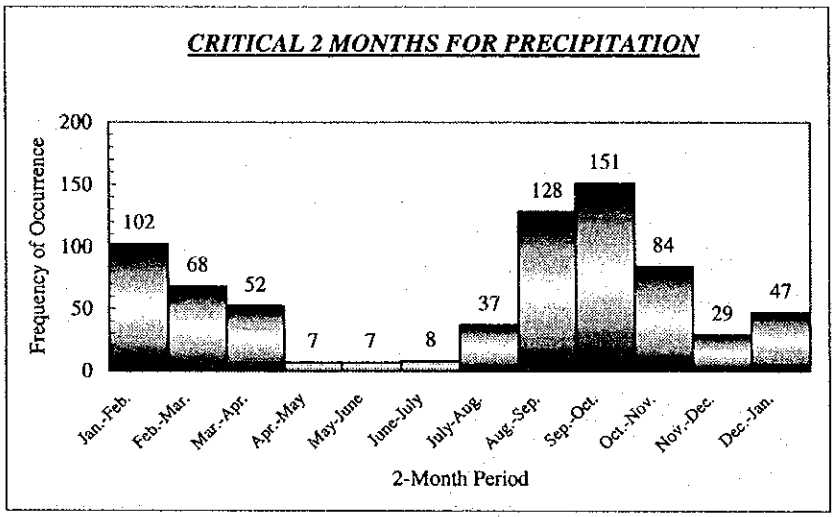
AVERAGE BASIN MEAN PRECIPITATION FOR DIFFERENT TIME PERIODS

Period	Mean Precipitation (mm)
1963 - 1995	597
1963 - 1973	641
1973 - 1989	590
1989 - 1995	479

5-year moving average trendline

FIG. D.4.8 BASIN MEAN PRECIPITATION (1963 - 1995)





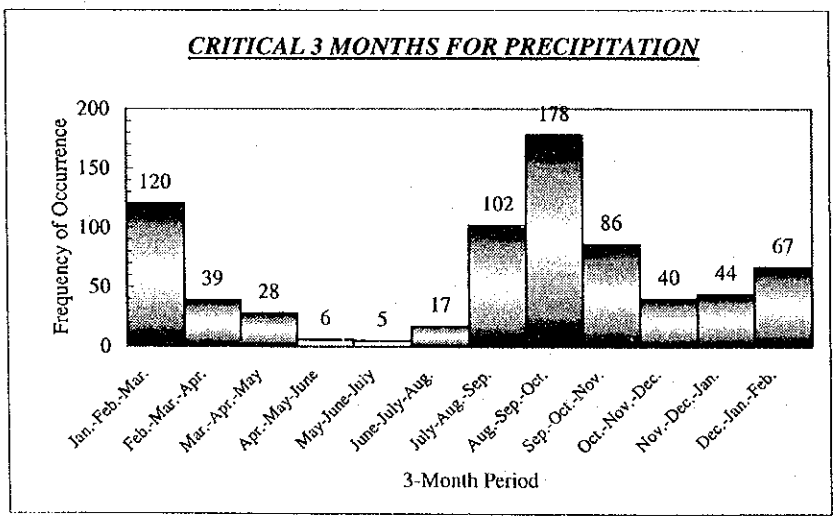
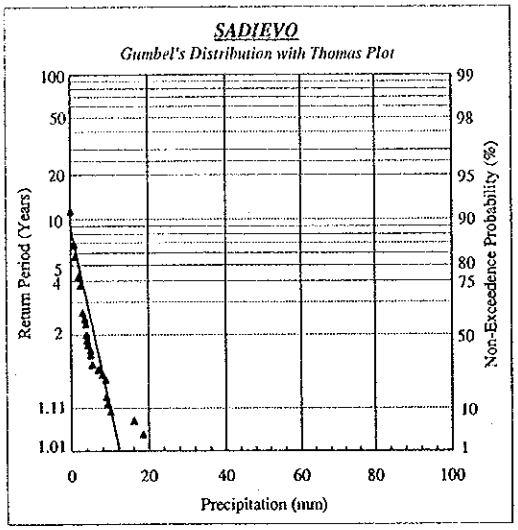
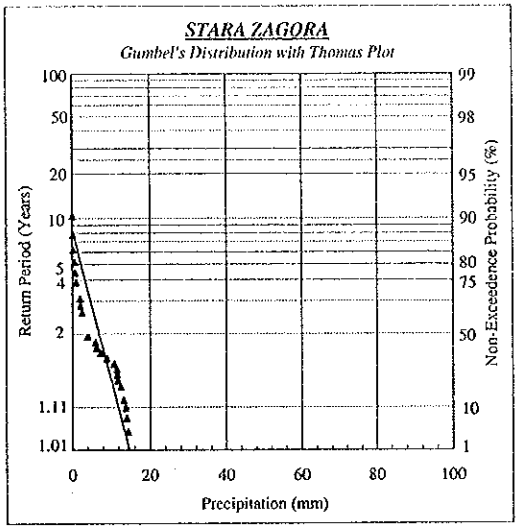
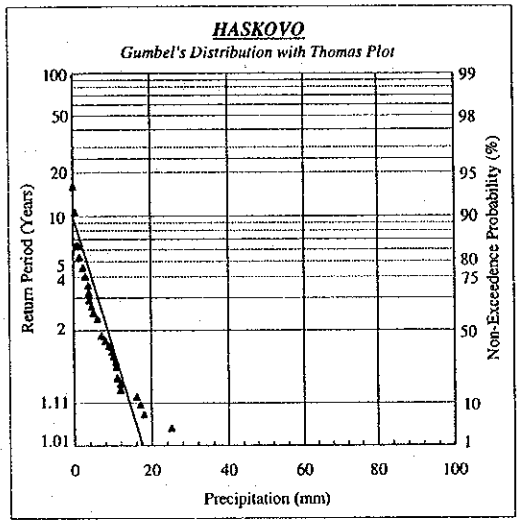
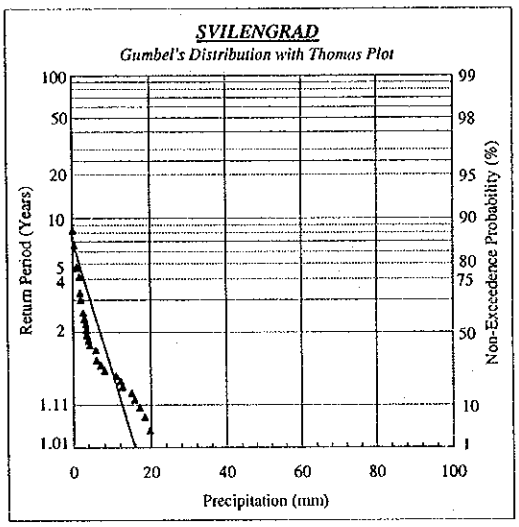


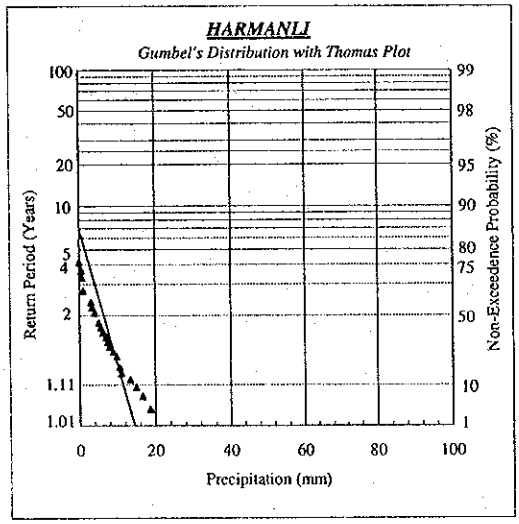
FIG. D.4.9 FREQUENCY HISTOGRAMS OF DROUGHT MONTHS (1963 - 1995)











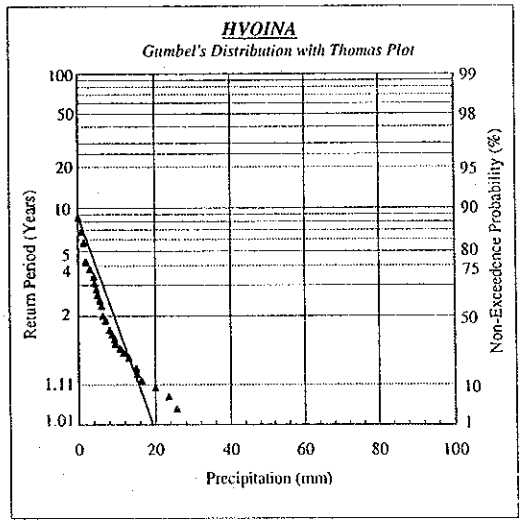
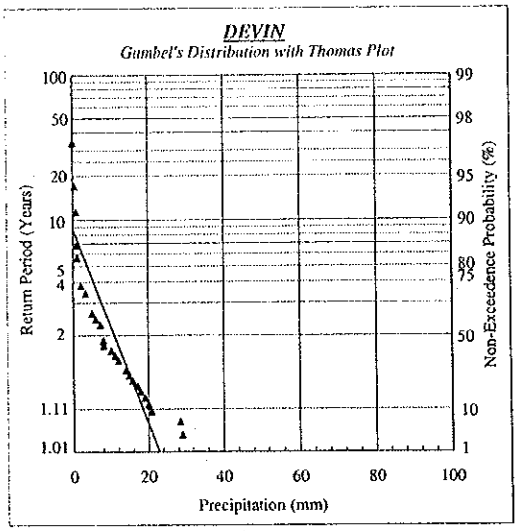
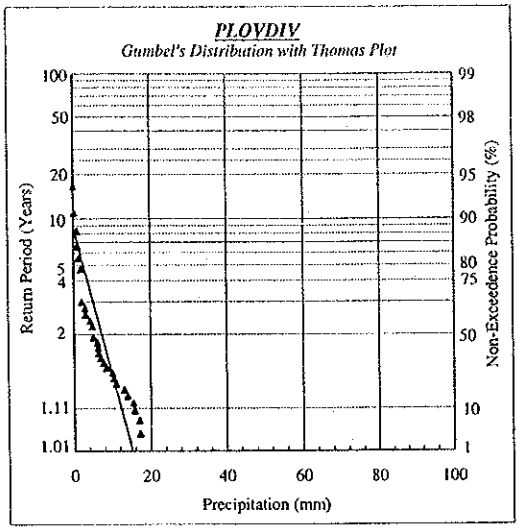
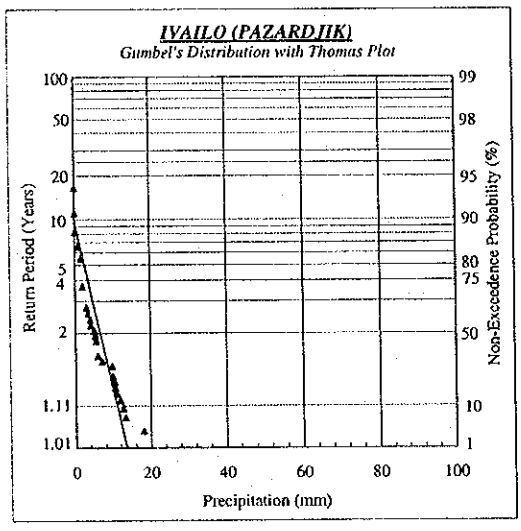
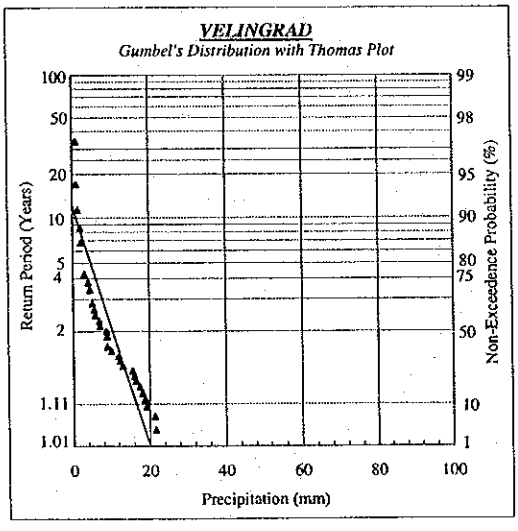


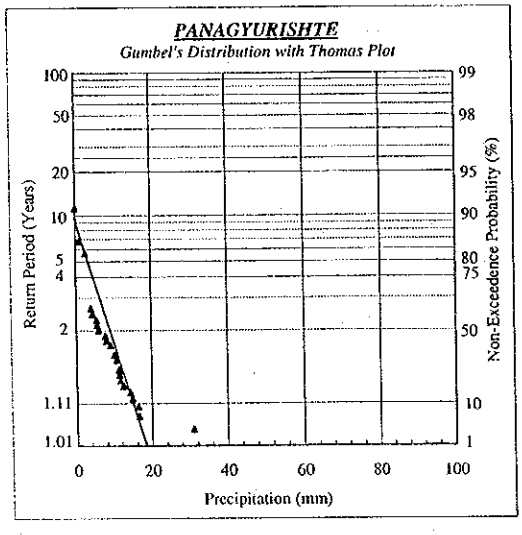
FIG. D.4.10 PROBABLE MINIMUM 1-MONTH PRECIPITATION (1963-1995) (1/4)











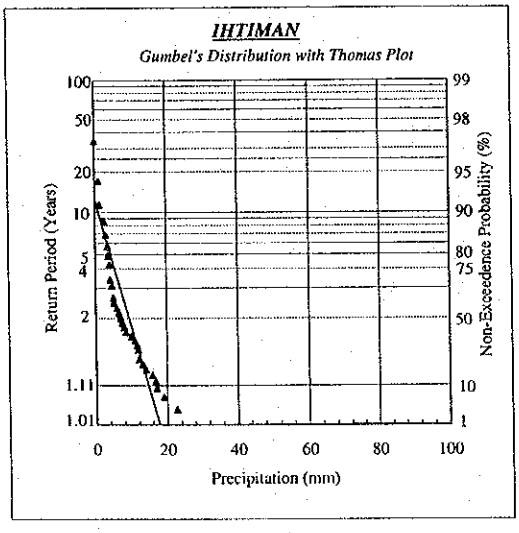
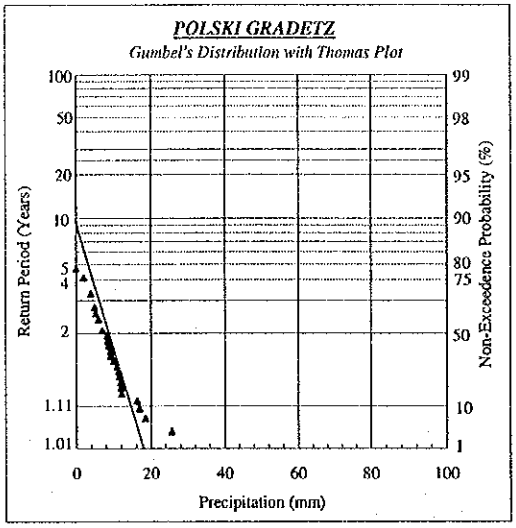
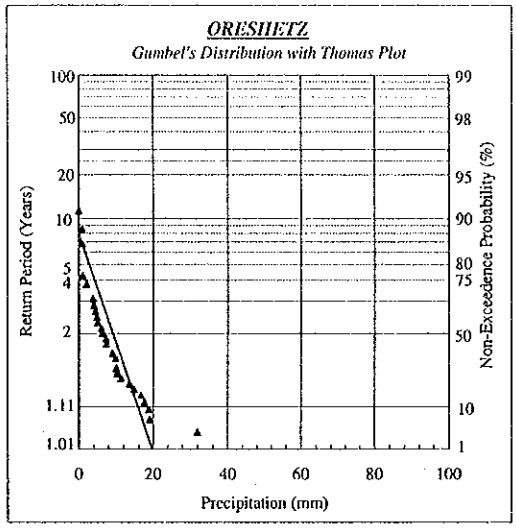
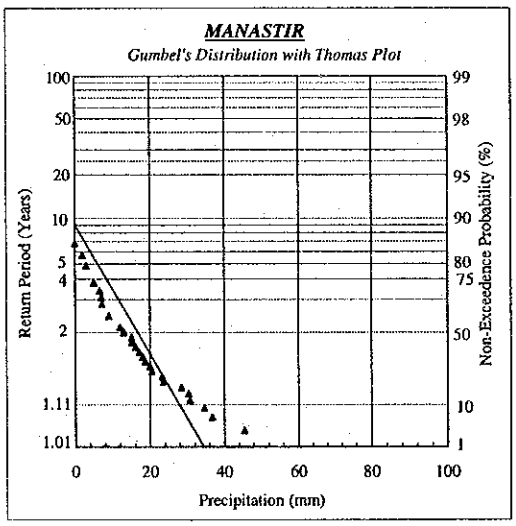
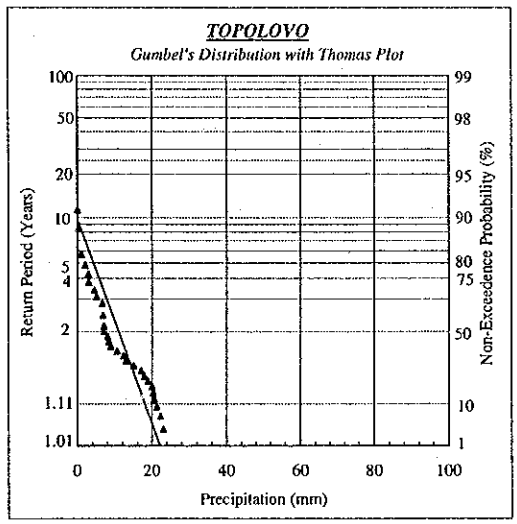


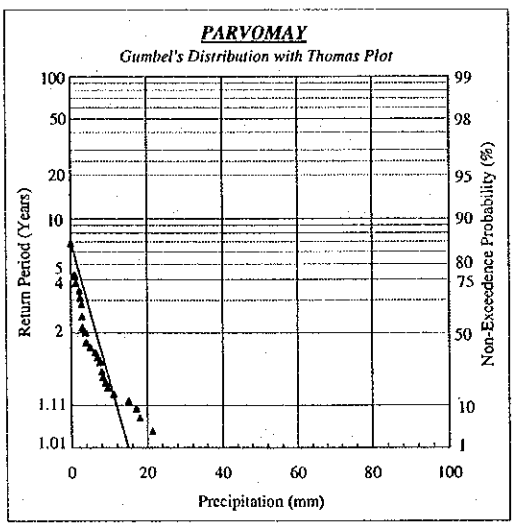
FIG. D.4.10 PROBABLE MINIMUM 1-MONTH PRECIPITATION (1963-1995) (2/4)











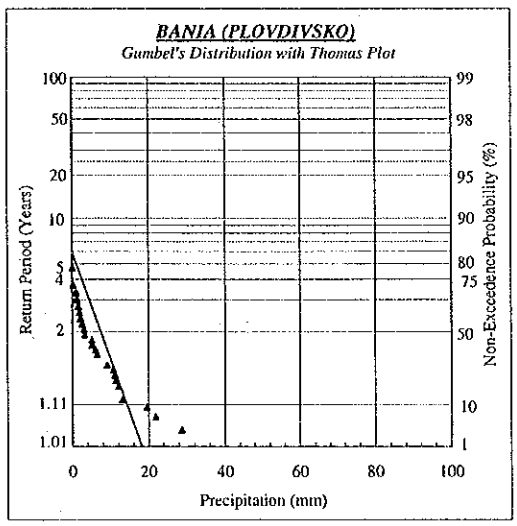
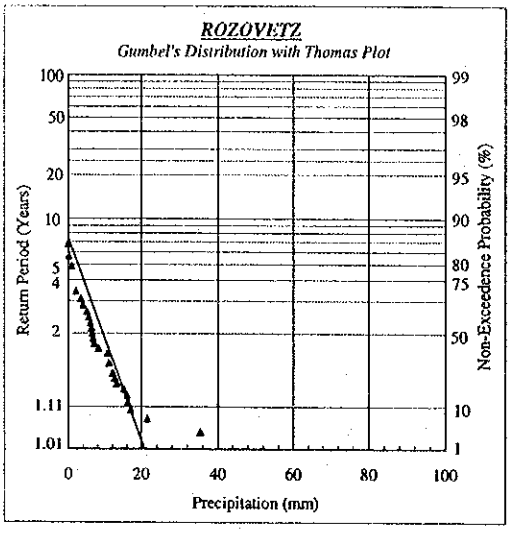
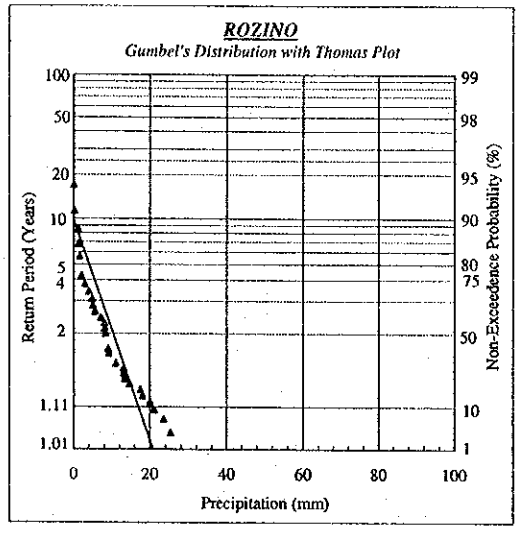
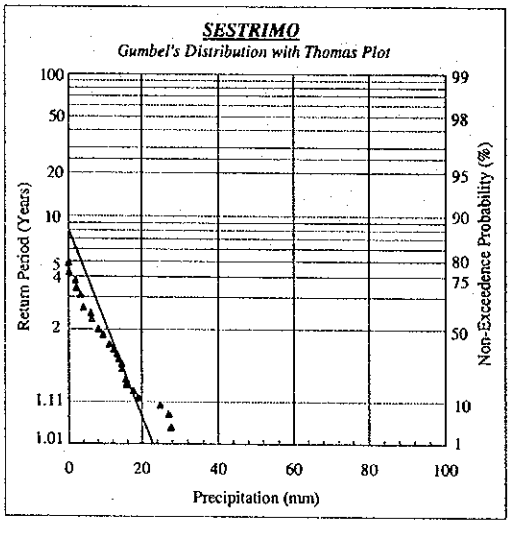


FIG. D.4.10 PROBABLE MINIMUM 1-MONTH PRECIPITATION (1963-1995) (3/4)







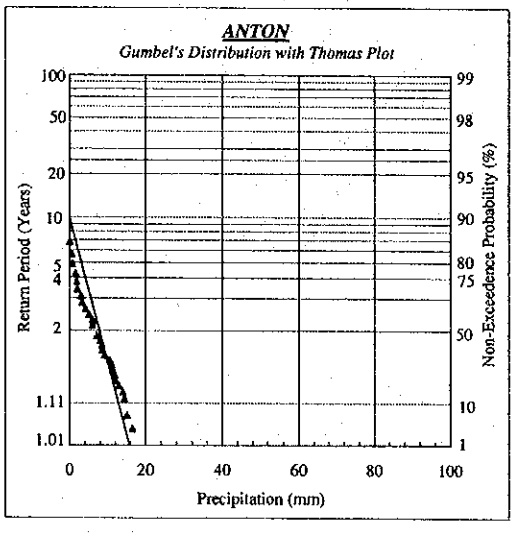
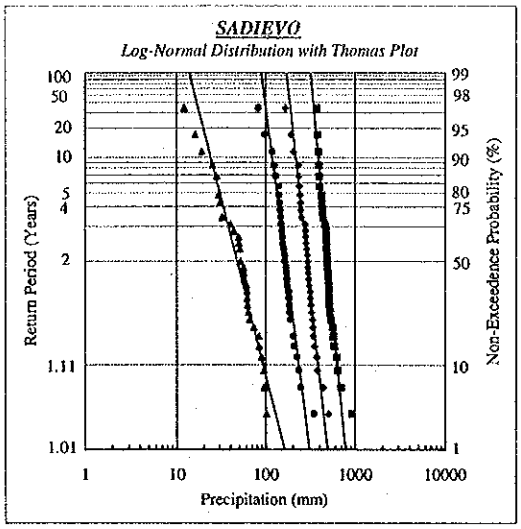
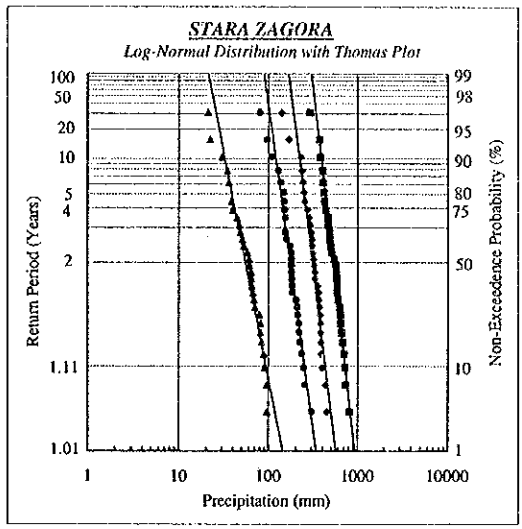
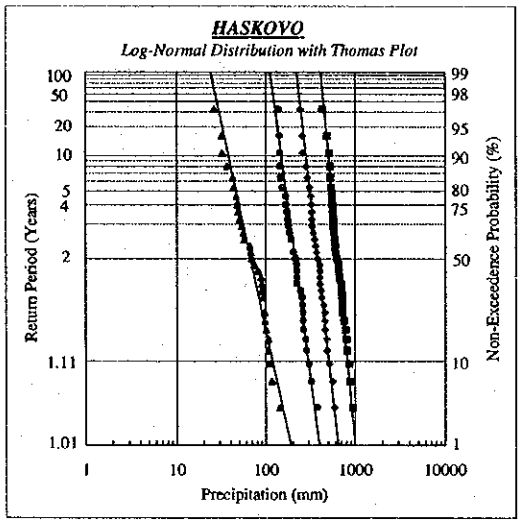
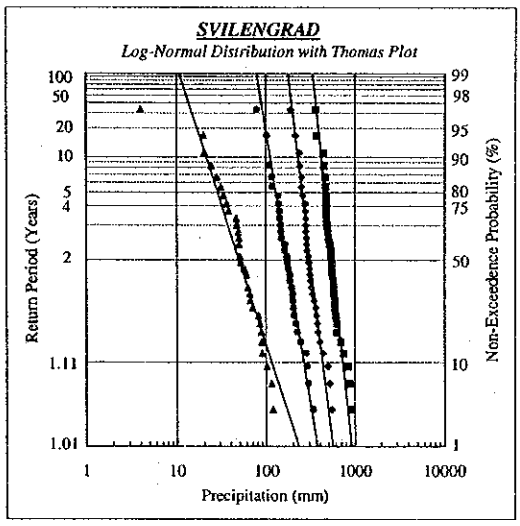


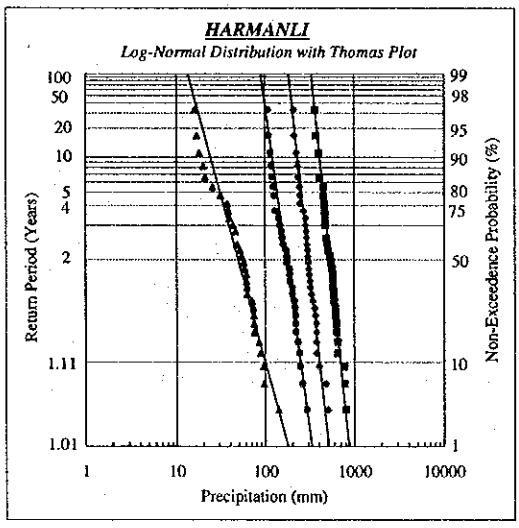
FIG. D.4.10 PROBABLE MINIMUM 1-MONTH PRECIPITATION (1963-1995) (4/4)











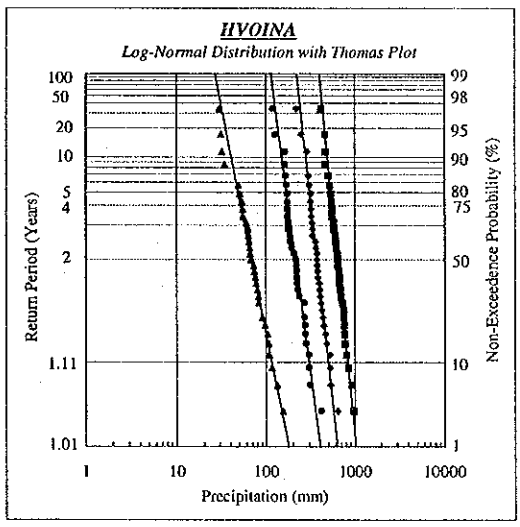
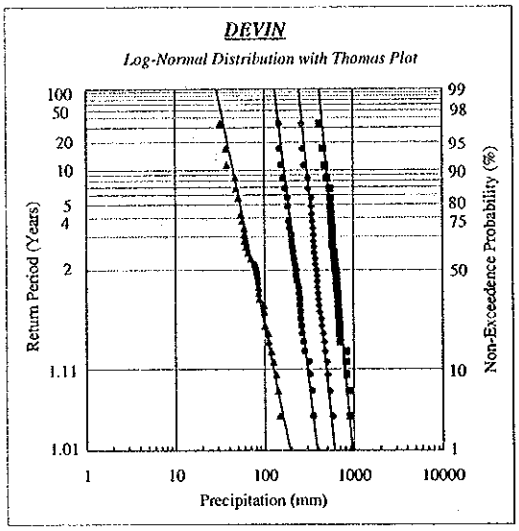
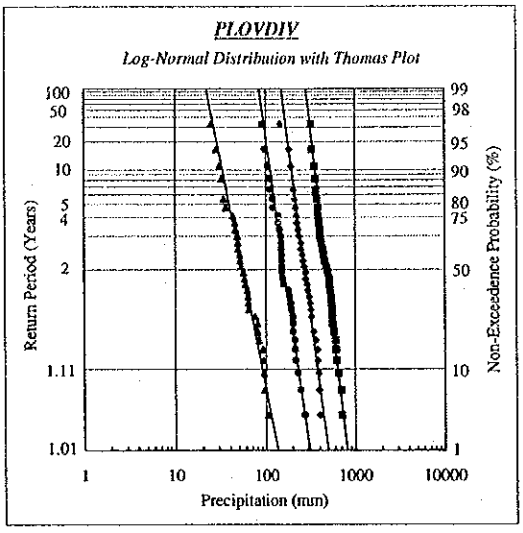
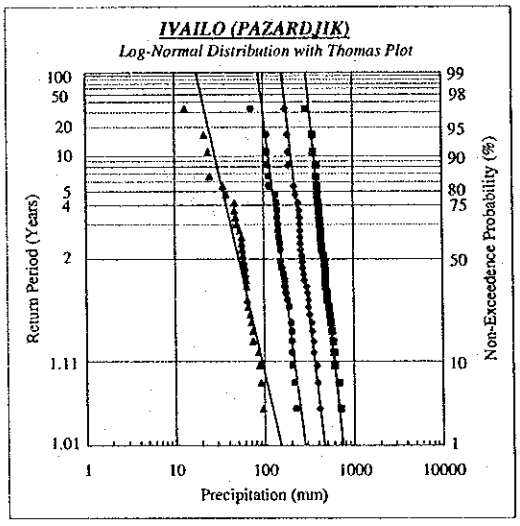
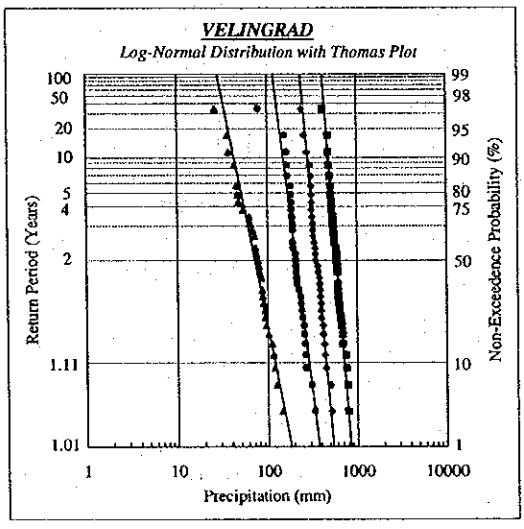


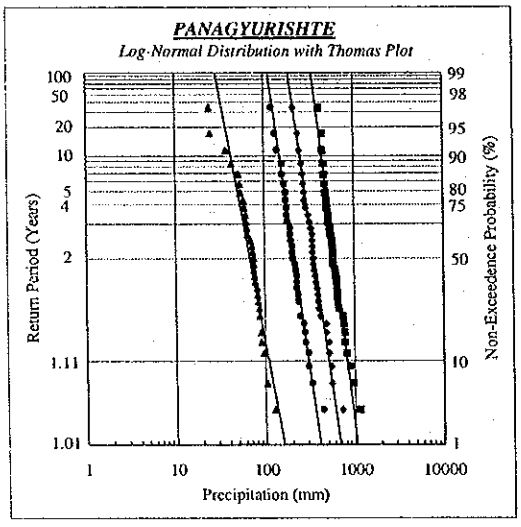
FIG. D.4.11 PROBABLE MINIMUM 3, 6, 9 AND 12-MONTH PRECIPITATIONS (1963-1995) (1/4)











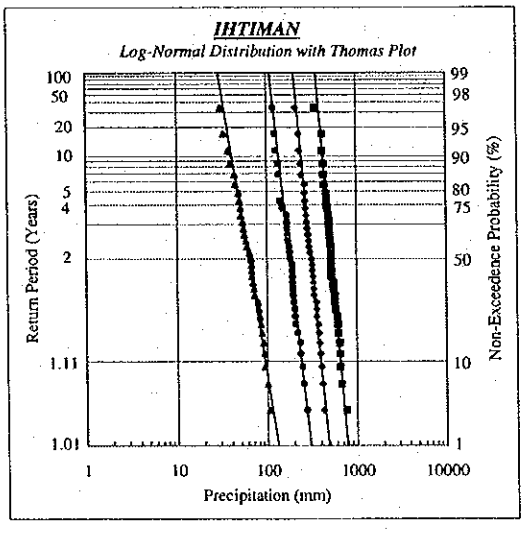
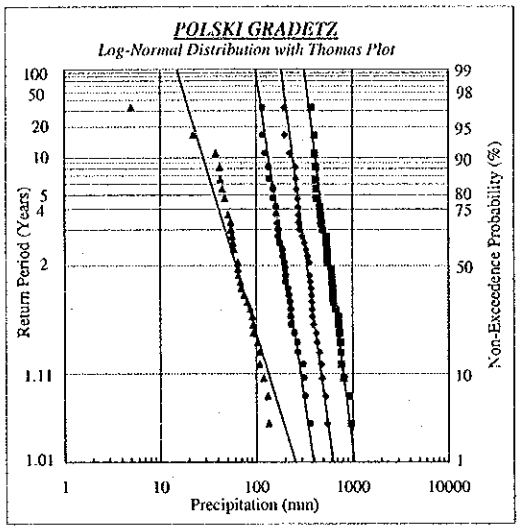
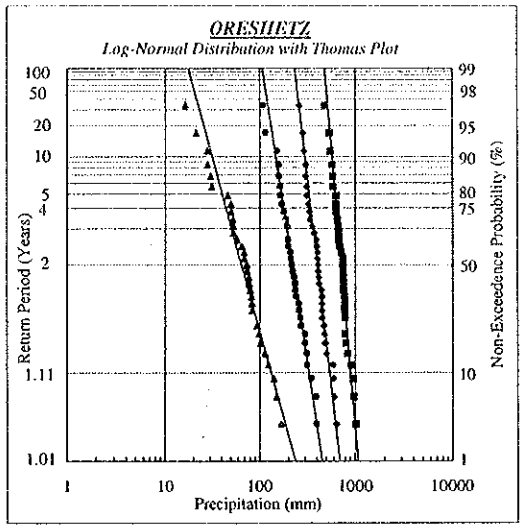
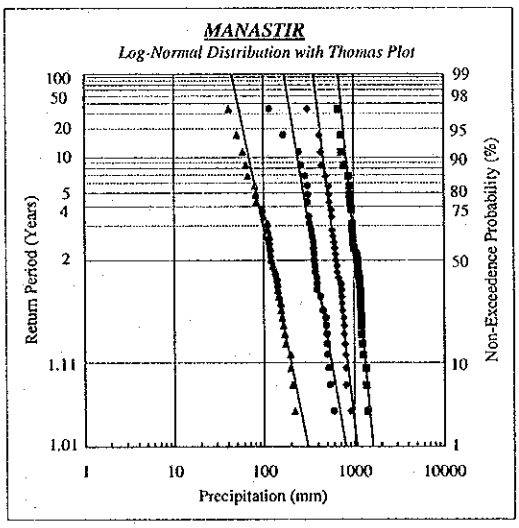
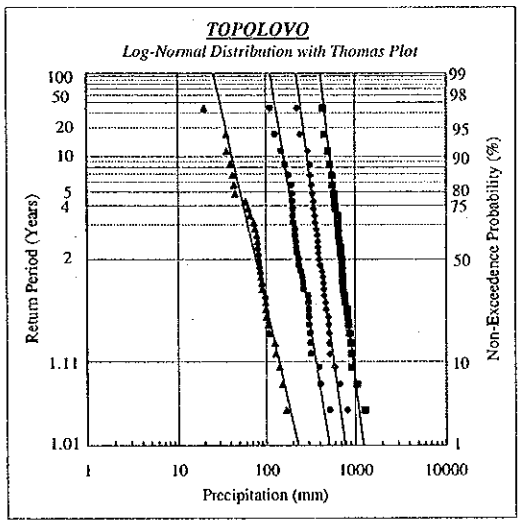


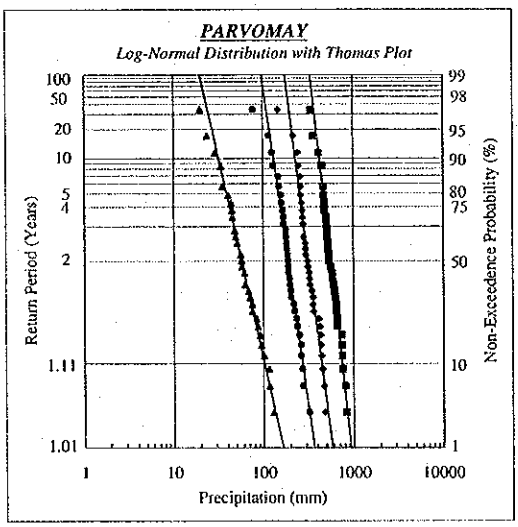
FIG. D.4.11 PROBABLE MINIMUM 3, 6, 9 AND 12-MONTH PRECIPITATIONS (1963-1995) (2/4)











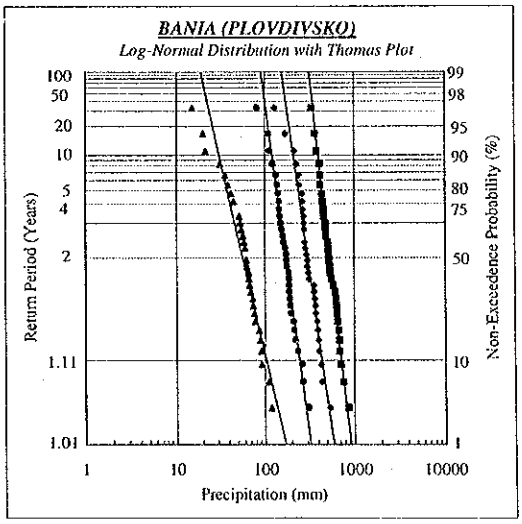
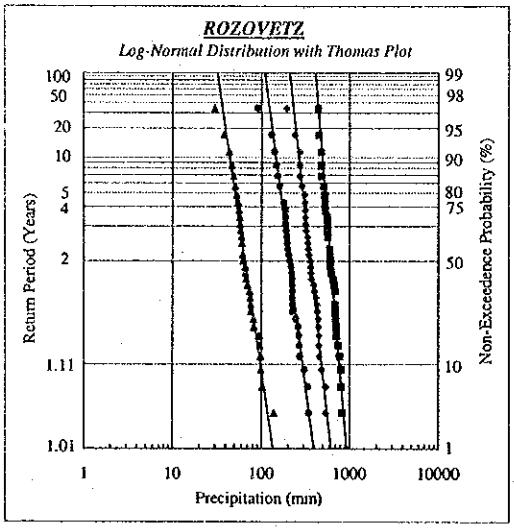
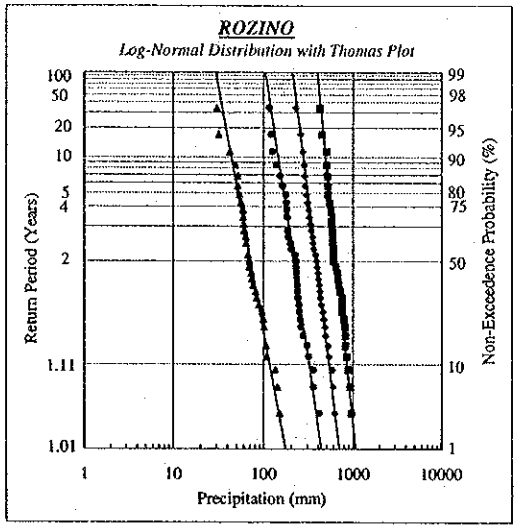
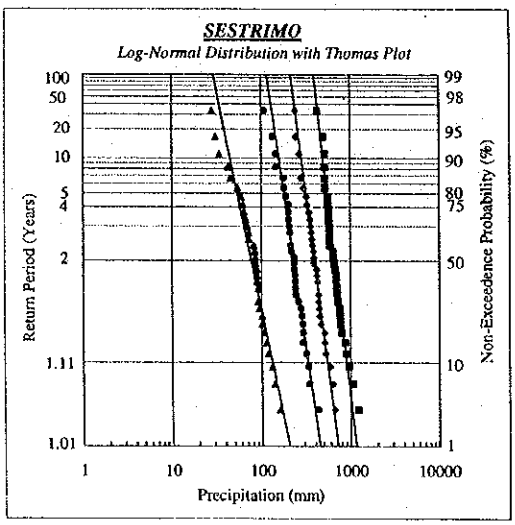


FIG. D.4.11 PROBABLE MINIMUM 3, 6, 9 AND 12-MONTH PRECIPITATIONS (1963-1995) (3/4)







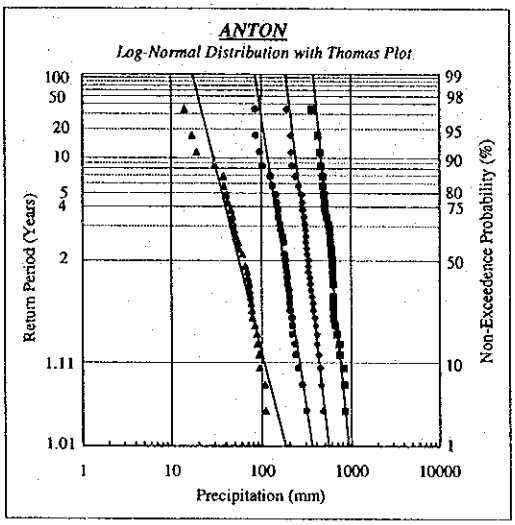


FIG. D.4.11 PROBABLE MINIMUM 3, 6, 9 AND 12-MONTH PRECIPITATIONS (1963-1995) (4/4)