

3rd MEDARE Workshop

Contribution of Cyprus Meteorological Service to MEDARE

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Presentation Outline

1. History of Meteorological Observations in Cyprus
2. Station Network
3. ENVIS Database System
4. Temperature
 - Max Min Average Temperature
 - Digitization of Thermographs
 - Inventories
5. Precipitation
 - Daily Precipitation
 - Digitization of Thermographs
6. Data to be provided to MEDARE
7. Problems with data
8. Further work to improve contribution

Milestones

1866-1870: First meteorological observations – Ottoman Empire

1878: First meteorological Observations under British Rule

1881-1882: Climatological Stations in Lefkosia, Ammohostos, Larnaka, Pafos, Keryneia, Lemesos

1900-1956: The department of Public Works had the responsibility of the meteorological observations

1957: Establishment of Meteorological Service and expansion of network

1968: A specialist from WMO organizes the Meteorological Service

1970: Decade of intensive development and expansion of network

1976: Establishment of the Meteorological Office (synoptic unit) in Larnaka Airport

1983: Establishment of the radiosonde unit at Athalassa

1997: Installation of an Automatic system for upper air observation measurements

1998: New instruments of measurement for radiation in Athalassa

2000: Establishment of a network of Automatic weather stations

2003:

- ◆Development of a Climate Database system
- ◆Key-entry data of existing ASCII or EXCEL files and various meteorological forms.

Evolution of Station Network

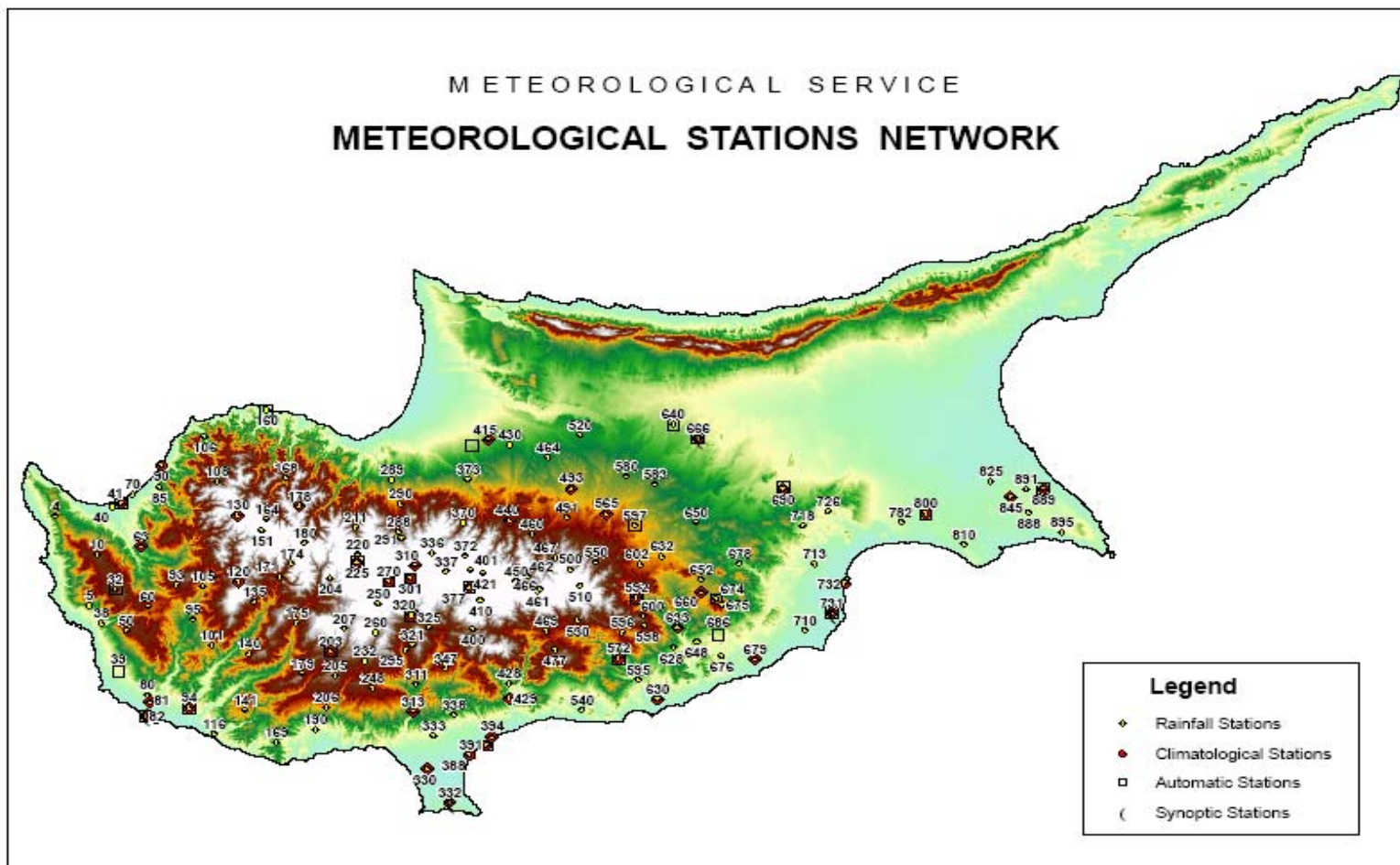
Climatological and Rainfall Stations

| <u>YEAR</u> | <u>No of climatological stations</u> | <u>No of rainfall stations</u> |
|-------------|--------------------------------------|--------------------------------|
| 1881 | 5 | 5 |
| 1882 | 6 | 6 |
| 1901 | 9 | 17 |
| 1902 | 9 | 36 |
| 1910 | 10 | 55 |
| 1931 | 7 | 60 |
| 1951 | 21 | 61 |
| 1961 | 28 | 90 |
| 1974 | 31 | 101 |
| 1980 | 45 | 105 |
| 1990 | 47 | 112 |
| 2000 | 40 | 105 |

Current Meteorological/Climatological Network

1. Rainfall Stations (105)
2. Climatological Stations (45)
3. Synoptic Stations (3)
4. Upper Air Observations (1)
5. Automatic Weather Stations(18)
6. Radiation Stations (1)

Climatic/Synoptic Station Network



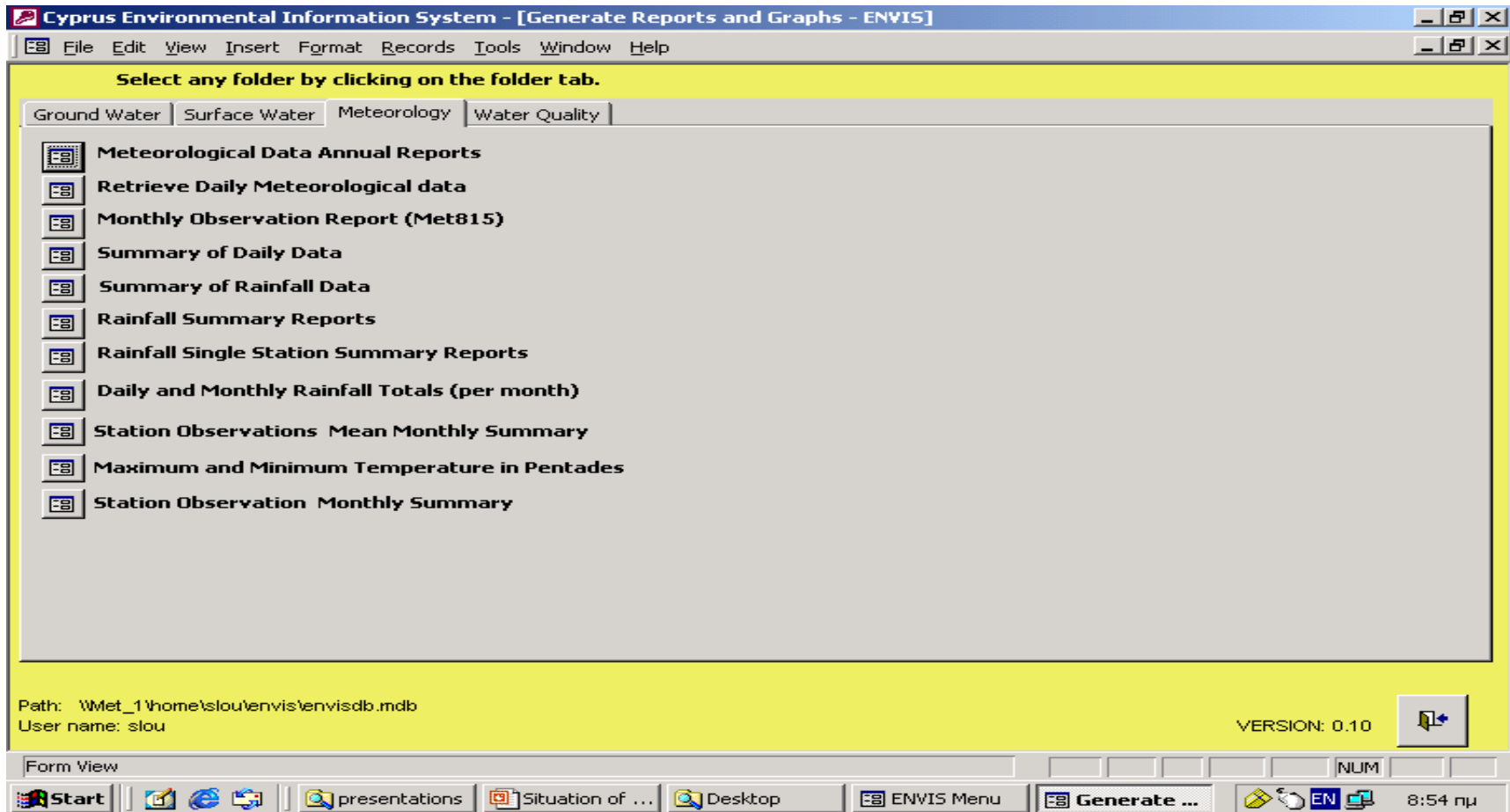
Current data base

Cyprus Environmental Information System (shared between different departments)



Istanbul, Turkey 27-28 September 2012

Envis – Data Base SQL



Moving to SQL

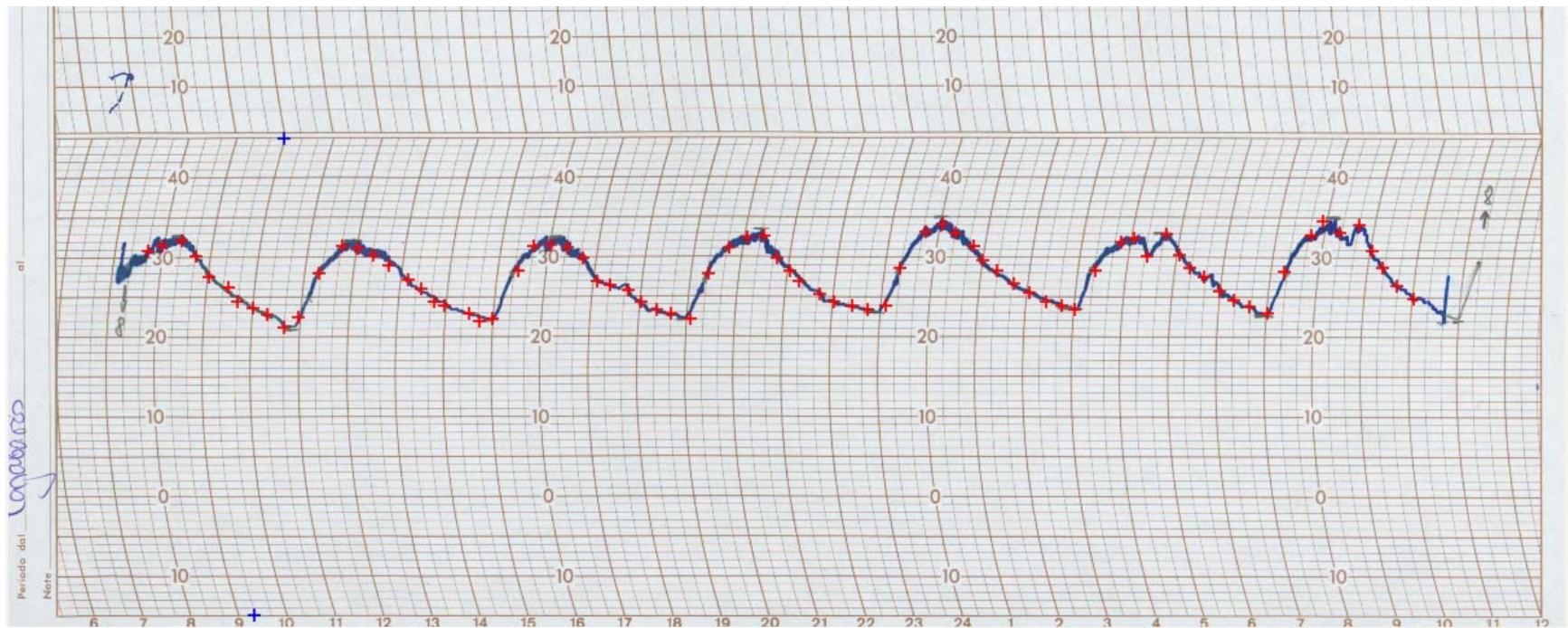
Today intensive efforts are made to transfer the data base to an SQL-based system. The existing ENVIS system will be maintained for a few years at least, running in parallel with SQL.

Temperature

Temperature records are based on daily records from the network (thermometers), extracted from thermographs, automatic weather stations

- **Hourly temperatures**
- **Daily Maximum and Minimum Temperatures**
- **Mean Daily Temperatures**

Digitization of thermographs



Istanbul, Turkey 27-28 September 2012

Temperature records

Two-Hourly Temperatures

METEOROLOGICAL SERVICE

AIR TEMPERATURE (°C) - INSTANTANEOUS VALUES

STATION: 572-2692 - KALAVASOS (DAM)

MONTH: August

YEAR: 2007

Lat.: 34°48'N Long.: 33°16'E Elev.: 185m

| Day | 02:00 | 04:00 | 06:00 | 08:00 | 10:00 | 12:00 | 14:00 | 16:00 | 18:00 | 20:00 | 22:00 | 24:00 | Aver. | Max. | Min. |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|
| 1 | 27.2 | 26.8 | 26.0 | 29.8 | 33.2 | 34.6 | 33.6 | 33.0 | 31.7 | 29.6 | 28.6 | 27.8 | 30.2 | 34.6 | 26.0 |
| 2 | 27.5 | 26.5 | 25.7 | 28.9 | 32.2 | 32.4 | 32.8 | 31.9 | 29.4 | 27.5 | 26.7 | 25.9 | 29.0 | 32.8 | 25.7 |
| 3 | 24.7 | 24.6 | 25.1 | 29.6 | 32.8 | 33.5 | 33.2 | 33.3 | 31.9 | 29.6 | 28.6 | 27.2 | 29.5 | 33.5 | 24.6 |
| 4 | 25.1 | 24.2 | 23.4 | 29.1 | 31.9 | 33.5 | 33.8 | 33.0 | 30.7 | 28.0 | 26.5 | 24.1 | 28.6 | 33.8 | 23.4 |
| 5 | 22.5 | 21.6 | 25.2 | 28.3 | 29.3 | 30.2 | 29.8 | 28.3 | 26.5 | 25.2 | 23.6 | 21.0 | 26.0 | 30.2 | 21.0 |
| 6 | 24.9 | 23.8 | 22.7 | 27.2 | 29.2 | 30.7 | 30.7 | 30.5 | 29.2 | 26.7 | 25.1 | 24.0 | 27.1 | 30.7 | 22.7 |
| 7 | 22.3 | 21.5 | 21.4 | 28.2 | 29.7 | 31.0 | 30.5 | 29.8 | 27.5 | 24.6 | 23.0 | 21.5 | 25.9 | 31.0 | 21.4 |
| 8 | 21.0 | 20.5 | 22.3 | 27.4 | 29.3 | 29.5 | 30.2 | 29.0 | 27.6 | 25.3 | 23.6 | 22.5 | 25.7 | 30.2 | 20.5 |
| 9 | 21.2 | 21.2 | 22.2 | 27.7 | 30.2 | 31.1 | 30.5 | 29.5 | 27.6 | 25.9 | 24.1 | 23.5 | 26.2 | 31.1 | 21.2 |
| 10 | 22.8 | 21.5 | 21.0 | 28.2 | 30.5 | 32.9 | 32.6 | 32.3 | 30.2 | 28.2 | 26.4 | 24.8 | 27.6 | 32.9 | 21.0 |
| 11 | 24.0 | 23.0 | 22.5 | 29.2 | 32.1 | 32.8 | 34.2 | 33.8 | 31.6 | 29.2 | 28.4 | 25.8 | 28.9 | 34.2 | 22.5 |
| 12 | 24.1 | 22.8 | 23.0 | 29.7 | 32.3 | 32.3 | 33.3 | 33.3 | 30.2 | 27.2 | 25.6 | 24.1 | 28.2 | 33.3 | 22.8 |
| 13 | 23.1 | 22.3 | 21.8 | 28.7 | 30.8 | 31.5 | 32.1 | 30.2 | 27.6 | 26.3 | 24.5 | 23.6 | 26.9 | 32.1 | 21.8 |
| 14 | 22.8 | 21.2 | 22.5 | 28.0 | 31.5 | 31.1 | 30.3 | 29.0 | 27.2 | 26.1 | 24.5 | 24.0 | 26.5 | 31.5 | 21.2 |
| 15 | 23.0 | 22.0 | 22.3 | 28.4 | 31.5 | 31.6 | 31.3 | 30.0 | 27.1 | 26.6 | 25.9 | 24.5 | 27.0 | 31.6 | 22.0 |
| 16 | 23.5 | 23.0 | 22.3 | 28.0 | 31.3 | 32.6 | 32.8 | 30.0 | 28.4 | 27.1 | 25.4 | 24.5 | 27.4 | 32.8 | 22.3 |
| 17 | 24.0 | 23.5 | 24.0 | 28.7 | 33.3 | 34.2 | 33.1 | 31.5 | 29.7 | 28.4 | 26.7 | 25.6 | 28.6 | 34.2 | 23.5 |
| 18 | 24.5 | 24.0 | 23.5 | 28.4 | 32.0 | 32.4 | 30.2 | 32.9 | 30.3 | 28.7 | 27.6 | 25.8 | 28.4 | 32.9 | 23.5 |
| 19 | 24.6 | 23.8 | 23.0 | 28.2 | 32.8 | 34.6 | 33.1 | 34.1 | 30.8 | 28.7 | 26.4 | 24.8 | 28.7 | 34.6 | 23.0 |
| 20 | 24.1 | 22.2 | 22.2 | 29.0 | 31.7 | 32.4 | 32.0 | 31.8 | 29.1 | 26.1 | 23.5 | 22.7 | 27.2 | 32.4 | 22.2 |
| 21 | 22.6 | 21.9 | 21.7 | 29.4 | 31.5 | 32.3 | 33.2 | 32.3 | 30.1 | 27.9 | 25.8 | 25.0 | 27.8 | 33.2 | 21.7 |
| 22 | 24.0 | 23.2 | 23.6 | 30.1 | 32.3 | 32.9 | 34.2 | 34.1 | 31.3 | 29.8 | 28.3 | 26.5 | 29.2 | 34.2 | 23.2 |
| 23 | 25.2 | 23.9 | 24.3 | 30.5 | 34.8 | 34.1 | 34.6 | 34.6 | 32.4 | 30.5 | 28.4 | 26.9 | 30.0 | 34.8 | 23.9 |
| 24 | 32.8 | 32.7 | 31.3 | 35.0 | 36.8 | 37.1 | 35.4 | 32.8 | 30.5 | 28.7 | 26.6 | 25.6 | 32.1 | 37.1 | 25.6 |
| 25 | 25.6 | 25.7 | 27.4 | 33.9 | 34.9 | 28.8 | 31.0 | 32.3 | 29.1 | 27.5 | 26.3 | 25.6 | 29.0 | 34.9 | 25.6 |
| 26 | 25.2 | 24.9 | 26.9 | 33.1 | 33.3 | 34.6 | 32.4 | 33.1 | 30.5 | 28.7 | 26.7 | 25.6 | 29.6 | 34.6 | 24.9 |
| 27 | 24.7 | 23.5 | 24.7 | 30.5 | 34.3 | 34.7 | 34.7 | 31.1 | 29.6 | 28.0 | 27.4 | 25.6 | 29.1 | 34.7 | 23.5 |
| 28 | 24.8 | 23.4 | 24.0 | 31.2 | 31.7 | 32.8 | 33.5 | 32.8 | 30.2 | 28.6 | 27.4 | 26.3 | 28.9 | 33.5 | 23.4 |
| 29 | 24.8 | 23.8 | 23.1 | 30.8 | 33.0 | 33.2 | 33.2 | 32.4 | 31.1 | 29.4 | 28.1 | 28.0 | 29.2 | 33.2 | 23.1 |
| 30 | 25.5 | 23.8 | 23.9 | 30.9 | 34.1 | 34.6 | 35.9 | 34.5 | 32.5 | 29.3 | 28.3 | 27.8 | 30.1 | 35.9 | 23.8 |
| 31 | 25.5 | 24.0 | 23.8 | 30.9 | 34.5 | 35.4 | 36.1 | 35.6 | 33.0 | 30.4 | 27.8 | 26.6 | 30.3 | 36.1 | 23.8 |
| Avg | 24.4 | 23.6 | 23.8 | 29.6 | 32.2 | 32.8 | 32.7 | 32.0 | 29.8 | 27.9 | 26.3 | 25.1 | 28.3 | | |
| Max | 32.8 | 32.7 | 31.3 | 35.0 | 36.8 | 37.1 | 36.1 | 35.6 | 33.0 | 30.5 | 28.6 | 28.0 | | 37.1 | |
| Min | 21.0 | 20.5 | 21.0 | 27.2 | 29.2 | 28.8 | 29.8 | 28.3 | 26.5 | 24.6 | 23.0 | 21.0 | | | 20.5 |

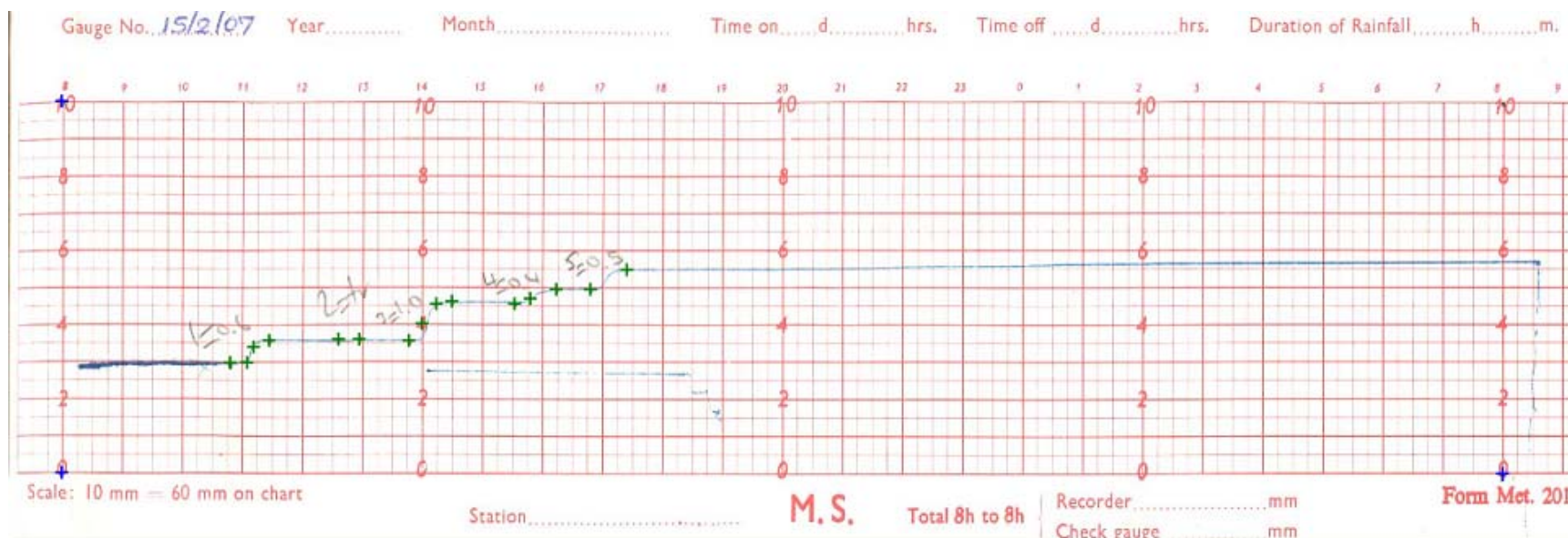
Summary Table Daily Maximum and Minimum Temperatures

| Period | Format of Data | Stations |
|---------------|-----------------------|-----------------|
| ≤1950 | Paper | 26 |
| 1951 - 1960 | Paper | 30 |
| 1961 - 1975 | Paper | 16 |
| ≥ 1976 | Digital | |

Precipitation

- **Precipitation records are based on daily records from rain-gauges, extracted from rain-recorders and automatic weather stations**
- **Hourly Precipitation and Intensities**
- **Daily Precipitation**

Digitization of Rain recorders



Digitization of Rain recorders

1

METEOROLOGICAL SERVICE

PRECIPITATION INTENSITIES

Type of rain recorder : (Type A)

Unit: mm

STATION: 592-4130 - LEFKARA (DAM)

MONTH: February YEAR: 2007

Lat.: 34°54'N Long.: 33°18'E Elev.: 420m

| Day | Check gauge total | Chart total | Correction factor | Storm characteristics | | | | Storm Total (corrected) | Είδος προβιψήματος | Maximum amounts for duration indicated | | | | | | | |
|------|-------------------|-------------|-------------------|-----------------------|------------|----------|-------------------|-------------------------|--------------------|--|--------|--------|--------|-------|-------|-------|-------|
| | | | | Storm Nb. | Start Time | End Time | Duration Hrs. Min | | | 5 min | 10 min | 15 min | 30 min | 1 hrs | 2 hrs | 3 hrs | 6 hrs |
| 2 | 12,0 | 14,2 | 0,845 | 1 | 22,34 | 23,37 | 1,03 | 0,2 | | 0,5 | 1,1 | 1,6 | 3,0 | 3,9 | 4,4 | 4,8 | 5,1 |
| | | | | 2 | 0,25 | 4,10 | 3,45 | 5,1 | | | | | | | | | |
| | | | | 3 | 4,30 | 8,00 | 3,30 | 6,8 | | | | | | | | | |
| 15 | 3,0 | 2,6 | 1,149 | 1 | 10,48 | 11,28 | 0,40 | 0,7 | | 6,8 | | | | | | | |
| | | | | 2 | 12,37 | 12,58 | 0,21 | TR | | | | | | | | | |
| | | | | 3 | 13,47 | 14,30 | 0,43 | 1,2 | | | | | | | | | |
| | | | | 4 | 15,32 | 16,14 | 0,42 | 0,5 | | | | | | | | | |
| | | | | 5 | 16,48 | 17,25 | 0,37 | 0,7 | | | | | | | | | |
| SUMS | 15,0 | 16,8 | | | | | 15,0 | | | Highest Amounts of rain in a specific period and Dates | | | | | | | |
| | | | | | | | | | | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 |
| | | | | | | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

METEOROLOGICAL SERVICE

HOURLY RAINFALL (mm)

STATION: 592-4130 - LEFKARA (DAM)

MONTH: February YEAR: 2003

Lat.: 34°54'N Long.: 33°18'E Elev.: 420m

| Day | 09:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 | 24:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 | 6:00 | 7:00 | 8:00 | Total | | |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|-------|---------------|-------|
| 2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,1 | 0,4 | 2,3 | 0,4 | 1,6 | 0,9 | 0,2 | 0,0 | 0,0 | 0,0 | 1,5 | 1,4 | 0,0 | 0,0 | 0,4 | 0,0 | 9,3 | |
| 3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,5 | 0,0 | 0,0 | 0,7 | 0,1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 1,3 | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | 0,6 | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | 6,2 | |
| 12 | 0,0 | 1,9 | 7,0 | 4,7 | 5,5 | 5,1 | 4,2 | 10,2 | 20,0 | 30,2 | 9,4 | 2,0 | 5,9 | 6,5 | 3,6 | 4,0 | 0,9 | 0,0 | 0,2 | 0,1 | 0,1 | 1,1 | 3,9 | 2,9 | | 129,3 | |
| 13 | 0,2 | 0,2 | 0,2 | 0,9 | 1,0 | 0,1 | 0,3 | 0,8 | 1,5 | 1,6 | 0,4 | 0,8 | 0,1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 7,9 | |
| 17 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,2 | |
| 19 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,7 | 0,1 | 0,6 | 0,8 | 0,0 | 0,2 | 0,1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,5 | |
| 22 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,2 | 0,7 | | 0,9 | |
| 23 | 0,3 | 0,4 | 0,8 | 0,5 | 0,9 | 0,8 | 0,5 | 0,3 | 0,4 | 0,4 | 0,5 | 0,0 | 0,0 | 0,1 | 0,0 | 0,3 | 0,0 | 0,0 | 0,3 | 0,2 | 1,5 | 0,1 | 0,1 | 2,4 | | 10,8 | |
| 24 | 1,6 | 0,2 | 0,0 | 0,8 | 0,3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | | 2,9 | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | | 0,2 | |
| 27 | 0,0 | 0,0 | 0,0 | 1,0 | 8,6 | 3,2 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | | 15,7 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | MONTHLY TOTAL | 187,8 |

Summary of Daily Precipitation Data

| Period | Format of Data | Number of Stations |
|----------------|-----------------------|---------------------------|
| 1881 - 1900 | Paper | 7 |
| 1900 - 09/1916 | Paper | 72 |
| 10/1916 - | Digital | |

Rainrecorders Data Summary

| Period | Format of the Data | Stations | Records (Stations * years * months) |
|-------------|---------------------------|----------|---------------------------------------|
| <1971 | Charts | 25 | $25 \times 8 \times 12 = 2400$ |
| 1971-1990/9 | Paper (Met 826 & Met 827) | 52 | $52 \times 20 \times 12 = 12480$ |
| 1991/10 -- | Digital | 44 | |

Available data for use in MEDARE are (for selected stations):

- **daily maximum, minimum and mean temperature (in °C),**
- **daily precipitation amounts (in mm),**
- **mean daily sunshine duration (in hours and tenths)**
- **mean daily sea level pressure (in hPa), relative humidity at 0800 UTC (%),**
- **mean daily wind speed and direction as well as daily gust.**

The metadata for the respective stations can include:

- the number and name of station,
- the type of station,
- the starting date of operation,
- longitude and latitude, elevation,
- year of installation or removal or change and observing program for each station
- parameters measured,
- times at which observations/measurements are reported
- the type of instruments for measuring temperature and rainfall, the sensor type, the manufacturer, the frequency of observations,
- the calibration information for the each instrument.

The most common problems regarding the data are:

- Data for temperature (Max T, Min T) are available from 1881 but since 1960 are digitized, depending on the available time that the employees have,
- Some stations have been removed from their position and placed on a nearby location due to some problems. So, the metadata for the station are changed, although we are talking about the same station (e.g. elevation, longitude, latitude),
- Data have small differences due to the change in position. Some stations have also different numbers
- Changes in the instruments of the station (e.g. manufacturer) resulting in the change of the type of the storage data file. Also, the reports are different when you change the instrument from one manufacturer to another

Plans for improving the contribution to MEDARE are:

- Data from removed stations should be put together with the data from the original location,
- Data in a different storage formats should be stored in a common form in order to make the analyzing procedure more easy
- Automatic stations should be added to the data base
- Comparison of data automatic/conventional stations

We are ready for co-operation within
MEDARE

Thank you