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LONDON, METEOROLOGICAL OFFICE  
Met.O.3 Technical Note No. 34

Homogeneity of U.K. climatological data 1901-1980.

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MET O 3 TECHNICAL NOTE NO 34

Homogeneity of U.K. Climatological Data 1901-1980

by

F A Crummay



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Advisory Services Branch (Met O 3)

Meteorological Office

London Road

Bracknell

Berkshire

RG12 2SZ

May 1986

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## Summary

A modified version of the routine to monitor the homogeneity of monthly climatological data (Crummay, 1985) was applied to annual means of daily maximum and minimum temperature and maximum-minimum temperature for the period 1901-1980. Stations containing homogeneous sections within this period were identified and the genuine data from 1891-1980 for these climatological variables and total annual sunshine investigated to identify stations considered suitable to monitor climatic trends.

## Introduction

The need to investigate climatological data before the calculation of long period averages or the selection of specific stations to monitor climatic change was discussed by Crummay (1985, 1986). A routine was described and used to study mean monthly maximum and minimum temperatures and total monthly sunshine for 577 stations between 1951-80. The majority of inhomogeneities identified consisted of gradual trends in the data for which corrections could not be made although some step changes were identified as a result of site changes.

Crummay (1986) considered that the nomination of specific 'Climatological Reference Stations' as defined by the World Meteorological Organisation (WMO, 1981), to monitor climatic trends, might result in the inclusion of unrepresentative inhomogeneities. Instead, two alternatives were suggested:

- i. the calculation of regional series to monitor climatic trends, as developed by Manley (1974) and
- ii. a thorough investigation into the homogeneity of stations for different time periods to assist in the construction of a composite series of data using individual station records which are considered representative for specific periods of time.



With reference to the latter, 22 stations were identified as suitable for the monitoring of climatic change in the period 1951-80 but the study period was constrained by the lack of machineable data prior to 1951.

In the following discussion the monitoring technique for monthly data has been modified to analyse annual means of daily maximum and minimum temperature, maximum minus minimum temperature and total annual sunshine for the period 1901-1980. The data is divided into thirty-year sections 1901-30, 1911-40, 1931-60, 1951-80 with the 1951-80 study used to compare the two analyses, that is, monthly vs annual data.

Those stations considered to contain a long period of homogeneous data will be investigated using the genuine data to identify any trends too small to be observed over 30 years but significant over 80 and inhomogeneities masked by <sup>the</sup> monitoring routine in areas with sparse data.

#### Data

Annual values for the climatological variables required are available in paper archives and the annual summaries of the Monthly Weather Review (MWR) after 1903, and from 1931, for selected stations in machineable form.

The stations at which observations of maximum and minimum temperature were recorded fall into two groups after 1921

- i. Those that observe extremes for 24 hours terminating usually at 09Z or 21Z.
- ii. Those that observe day maxima and night minima.

The terminal hours of both types of station have changed over the study period, for example, for day maximum temperature prior to August 1944 the thermometers were set at 07Z and read at 18Z in contrast to 09Z and 21Z after January 1945. These changes are considered relatively unimportant and corrections have not been applied. Several stations have however changed

the type of observation recorded, from 'day' maximum and 'night' minimum to 24 hour extremes. The values recorded may differ by up to 1°C for minimum temperatures at an inland site with the 'night' minima generally greater than the 24 hour minima and the 'day' maxima less than the 24 hour maxima. Corrections have been calculated using 38 stations in the period 1957-70 (Meteorological Office, 1975) comparing 24 hour extremes to 'day' maxima and 'night' minima terminating at 09Z and 21Z. The differences are most marked in winter but on an annual basis corrections of +0.15°C and -0.3°C have been applied to 'day' maximum and 'night' minimum temperatures respectively.

No inhomogeneities have been observed when the same corrections are applied to observations with an 07Z terminal hour.

Various other peculiarities occur within the data extracted, for example, differences in the type of screen used to shield the thermometers. The majority of stations consist of thermometers contained within a Stevenson Screen at a height of 4 feet above short grass. A few stations however employ the use of a 'North Wall' screen, frequently at a height of 10 feet. Examples include Kew Observatory, Falmouth and Stonyhurst and although of little significance if the screen remains constant throughout the study period, marked inhomogeneities may occur when the type of screen changes.

At Camden Square in London, a Glaisher stand was in operation until 1922. The thermometers were therefore not protected from indirect radiation, a feature which would influence the values recorded (Margary, 1924).

#### Method

As described by Crummay (1985) the monitoring technique involves the calculation of estimates of the variable using a Principal Component Analysis, the derivation of residuals (observation - estimate) and the subjecting of this time-series of residuals to statistical analysis to identify



inhomogeneities in the data record.

The decision to divide the study period into 30 year sections was based on the requirement of a complete correlation or covariance matrix for the 'Analysis'. Estimates of missing data were made using a near neighbour technique described by Tabony (1983) with the division into 30 year segments permitting the limiting of each study to stations containing at least 20 and preferably 25 years data in that segment. This improved the reliability of estimates produced both for the missing values and in turn, those for comparison with the observations.

Up to 100 stations were used in each 30 year period with the emphasis on complete records of data and a selection of station types such as rural and urban to facilitate the identification of trends due to urbanisation.

The limitation of using 100 stations in contrast to the 577 used for the monthly analysis influenced the optimum number of components selected to produce estimates. This optimum number should identify the systematic differences between the stations whilst random differences are consigned to higher order components and hence are illustrated by the residuals. The correlation between the stations is important with 8% of the total possible number of components used for monthly temperatures but 12% of the sunshine components due to the lower inter-station correlation. In the present study an analysis of stations flagged in the 1951-80 period in comparison to those flagged by the monthly routine determined that 14% of components should be used to produce the required estimates for temperature, a result of the lower correlation due to the greater distances between stations.

The marked variability in total bright sunshine recorded, the low correlation between stations and the fewer stations available precluded the identification of an optimum number of components for the annual data. As a result the sunshine data prior to 1951 was excluded from the analysis

although the genuine observations minus the station means were plotted for the long period stations.

### Results

A total of 176 stations were investigated by the monitoring routine and the results for each 30 year segment illustrated in Table 1. Only 24 stations were considered to contain no inhomogeneities, the majority of these consisting of short period (ie 30 years) stations.

For the period 1951-80 the results have been compared with those obtained by the analysis of monthly data (Crummay, 1985). Some slight differences occur, with the monthly technique apparently more sensitive than that using annual data and flagging slightly more stations. There is generally good agreement between the two sets of results.

74 long period stations containing homogeneous sections were further analysed by an investigation of the genuine data over the eighty-year study period, the maximum-minimum values being illustrated in Figure 1. In addition 58 stations were analysed from 1891. Sunshine data was also investigated for these stations and the total annual sunshine minus the station mean for each station is illustrated in Figure 2. Again the level of 'noise' to a large extent prevents the detection of inhomogeneities but several major discontinuities and trends have been identified (Table 2).

A summary of the results obtained from the temperature analysis with the periods for which each station is considered homogeneous is provided in figure 3. This may be used in conjunction with Table 1 to identify long period homogeneous stations and assist in the selection of representative stations for specific purposes.

### Discussion

The results obtained from the analysis of annual means of daily maximum and minimum temperature together with maximum-minimum temperature



and total annual sunshine again highlight the problems associated with the specification of individual 'reference stations' as discussed by Crummay (1985, 1986). Inhomogeneities may be attributed to any of four reasons:

- i. step discontinuities due to changes in site location
- ii. gradual trends due to changes in site exposure or character.
- iii. deterioration of screen or instruments.
- iv. small cumulative changes in site or varying accuracy between observers.

The majority of inhomogeneities consist of gradual trends for which corrections cannot easily be made. In addition a fifth possible cause has been identified in this study, that is, changes in the type of screen used. Examples include the change from a Glaisher Stand to Stevenson Screen at Camden Square in 1922; the change from a North Wall screen to a Stevenson Screen at Falmouth in 1912 and a change from a North Wall screen to a Bilham Screen at Stonyhurst (Figure 4).

As might be expected the longer the station record the greater the likelihood that at least one inhomogeneity will be observed in the data series. In the United States for example, Mitchell (1953) identified an average of 6 moves per station over the period 1873-1950. Although for other countries the average number of station site changes is considered to be much less (Jones et al, 1986), when the other sources of inhomogeneities are included it is apparent that almost every long period station has been affected at least once.

#### Conclusion

Crummay (1985) as a result of the monthly analysis of UK climatological data 1951-80 suggest two possible alternatives for the monitoring of climatic trends.

- i. the calculation of regional series based on data from several stations to reduce the impact of any individual inhomogeneities.
- ii. the construction of a composite series of data from sections of individual station records considered to contain representative trends for specified periods of time.

The annual study has investigated selected climatological stations from 1901-1980 in 30 year sub-sets and from 1891-1980 for those containing homogeneous sections. This facilitates the construction of a composite series as described above and with this aim a summary of the results obtained is provided (Figure 3) with stations considered homogeneous for specified periods indicated.

#### References

- |                       |      |  |
|-----------------------|------|--|
| Crummay, F A          | 1985 | 'Monitoring the homogeneity of UK climatological data' Met O 3 Tech. Note No 32 and appendices (January 1986).               |
| Crummay, F A          | 1986 | 'Monitoring the homogeneity of UK climatological data'. Met Mag v 115 pp 133-142.  |
| Jones, P D et al      | 1986 | 'Northern Hemisphere Surface Air Temperature Variations: 1851-1984'. J of Climate and Applied Meteorology. Vol 25 pp 161-179 |
| Manley, G             | 1974 | Central England temperatures: monthly means 1659 to 1973. Q J R Met Soc 100, 389-405   |
| Margary, I D          | 1924 | 'Glaisher Stand vs Stevenson Screen' Q J Roy Met Soc 50 pp 209-226   |
| Meteorological Office | 1975 | 'Maps of mean and extreme temperature over the UK 1941-70'. Climatological Memorandum No 73.                                 |



- Mitchell, J M 1953 'On the causes of instrumentally observed secular temperature trends'.  
J Meteor. v 10 pp 244-261.
- Tabony, R C 1983 'The estimation of missing climatological data',  
J of Climatology v 3 pp 297-31 .
- World Meteorological Organisation 1981 Manual on the Global Observing System v 1.  
Geneva, WMO No 544.

Table 1 Summary of results for temperature parameters in 30 year sections

Key to Table 1

- station considered homogeneous using annual means.
- \* station considered inhomogeneous using annual means.
- station flagged as inhomogeneous for 1951-80 using monthly means.
- ( ) Inhomogeneity marginal

blank Station not included in this study section.



| STATION<br>NAME            | DCNN<br>OR<br>REF | MAXIMUM<br>TEMPERATURE |       |       |       | MINIMUM<br>TEMPERATURE |       |       |       | MAX-MIN<br>TEMPERATURE |       |       |       |       |
|----------------------------|-------------------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|-------|
|                            |                   | NUMBER                 | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 | 51-80 |
|                            |                   |                        |       |       |       |                        |       |       |       |                        |       |       |       |       |
| Lerwick                    | 0044              |                        | -     | -     | -     |                        | -     | -     | -     |                        | -     | -     | -     |       |
| Baltasound                 | 0088              |                        |       | -     | *     |                        |       | -     | (*)   |                        |       | (*)   | -     |       |
| Wick                       | 0293              | -                      | *     | *     | -     | *                      | -     | -     | -     | *                      | -     | -     | *     |       |
| Stornoway                  | 0425              | *                      | -     | *     | (*)   | -                      | -     | -     | (*)   | -                      | -     | -     | *     |       |
| Fortrose                   | 0482              |                        | -     | *     | (*)   |                        | -     | *     | (*)   |                        | -     | *     | -     |       |
| Fort Augustus              | 0575              |                        | (*)   | -     | -     |                        | -     | -     | -     |                        | -     | -     | -     |       |
| Nairn                      | 1008              | *                      | (*)   | -     | (*)   | -                      | -     | -     | (*)   | -                      | -     | -     | -     |       |
| Gordon Castle              | 1095              | (*)                    | -     | -     | (*)   | *                      | -     | -     | *     | -                      | -     | -     | -     |       |
| Braemar                    | 1215              | *                      | -     | -     | (*)   | -                      | *     | -     | -     | *                      | -     | -     | -     |       |
| Balmoral                   | 1226              | -                      | *     | *     | -     | *                      | -     | -     | -     | *                      | -     | -     | *     |       |
| Craibstone                 | 1272              |                        |       | -     | (*)   |                        |       | -     | *     |                        |       | -     | *     |       |
| Aberdeen                   | 1280              | *                      |       |       | -     | -                      |       |       | *     | *                      |       |       | -     |       |
| Dundee                     | 1361              | -                      | *     | *     | (*)   | -                      | *     | -     | -     | -                      | *     | -     | -     |       |
| Arbroath                   | 1393              |                        | -     | -     | (*)   |                        | -     | -     | (*)   |                        | -     | -     | *     |       |
| Perth                      | 1482              |                        | *     | *     | (*)   |                        |       | -     | (*)   |                        |       | *     | -     |       |
| Leuchars                   | 1577              |                        |       | -     | (*)   |                        |       | -     | (*)   |                        |       | -     | *     |       |
| Edinburgh - Blackford Hill | 1646              |                        | -     | -     | (*)   |                        |       | -     | (*)   |                        | -     | -     | -     |       |
| North Berwick              | 1678              |                        |       | -     |       |                        |       | *     |       |                        |       | *     |       |       |
| Marchmont                  | 1744              | *                      |       |       | (*)   | -                      |       |       | (*)   | *                      |       |       | -     |       |
| West Linton                | 1838              | -                      | *     | -     | -     | *                      | -     | -     | -     | (*)                    | -     | -     | -     |       |
| Cockle Park (Morpeth)      | 2084              | *                      | -     | *     | *     | -                      | -     | -     | (*)   | *                      | *     | -     | -     |       |
| Tynemouth                  | 2091              |                        | -     | *     | -     |                        | -     | (*)   | (*)   |                        | -     | -     | -     |       |
| Chopwellwood               | 2138              |                        |       |       | (*)   |                        |       |       | (*)   |                        |       |       | -     |       |
| Durham                     | 2165              | -                      | -     | *     | -     | -                      | -     | *     | -     | -                      | -     | -     | -     |       |
| York                       | 2261              | -                      | -     | -     |       | -                      | -     | -     | -     |                        | (*)   | -     | -     |       |
| Scarborough                | 2292              | -                      | -     | -     |       | -                      | -     | -     | -     | *                      |       | -     | -     |       |
| Hull                       | 2361              | *                      | -     | -     | (*)   | *                      | -     | -     | -     | -                      | -     | -     | -     |       |
| Cranwell                   | 2432              |                        |       | -     | (*)   |                        |       | -     | (*)   |                        |       | -     | -     |       |
| Cleethorpes                | 2478              |                        |       | -     |       |                        |       | -     | -     |                        |       | -     | -     |       |
| Skegness                   | 2494              |                        |       | (*)   | -     |                        |       | -     | (*)   |                        |       | -     | *     |       |
| Cromer                     | 3069              |                        |       | *     | -     |                        |       | -     | *     |                        |       | -     | -     |       |
| Yarmouth (Gorleston)       | 3093              | -                      | -     | (*)   | (*)   | -                      | *     | *     | -     | -                      | -     | -     | *     |       |
| Lowestoft                  | 3197              | -                      | -     | -     | (*)   | -                      | -     | -     | -     | -                      | -     | -     | -     |       |
| Cambridge (Bot. Gar.)      | 3253              | -                      | -     | -     | -     | *                      | -     | -     | -     |                        | -     | (*)   | *     |       |
| Woburn                     | 3414              | -                      | -     | -     | (*)   | -                      | -     | -     | (*)   | (*)                    | -     | -     | -     |       |
| Rothamsted                 | 3537              | -                      | -     | -     | -     | -                      | -     | -     | (*)   | *                      | -     | -     | (*)   |       |
| St Albans                  | 3544              |                        |       | -     | -     |                        |       | -     | -     |                        |       | -     | -     |       |
| Shoeburyness               | 3671              |                        |       | (*)   | -     |                        |       | (*)   | (*)   |                        |       | *     | (*)   |       |
| Huddersfield               | 4041              |                        |       | (*)   | -     |                        |       | -     | -     |                        |       | *     | -     |       |
| Huddersfield (Oakes)       | 4043              |                        |       | -     | -     |                        |       | -     | -     |                        |       | -     | -     |       |
| Bradford                   | 4045              |                        | -     | -     | (*)   |                        | -     | -     | (*)   |                        | -     | -     | -     |       |
| Ilkley                     | 4047              | -                      | -     | -     | -     | *                      | -     | -     | (*)   | *                      | -     | -     | -     |       |
| Sheffield                  | 4061              |                        |       | -     | -     |                        |       | -     | (*)   |                        |       | -     | -     |       |
| Buxton                     | 4112              | *                      | -     | -     | -     | *                      | -     | -     | -     | *                      | -     | *     | -     |       |
| Belper                     | 4164              | *                      |       |       |       | -                      |       | -     | -     | -                      | -     | -     | -     |       |
| Nottingham                 | 4223              | -                      | -     | -     | -     |                        | (*)   | -     | -     | -                      | -     | *     | -     |       |
| Edgbaston                  | 4406              | -                      | -     | -     | (*)   | -                      | -     | -     | -     | -                      | -     | -     | -     |       |
| Coventry                   | 4477              | -                      |       |       |       | -                      |       | -     | -     | -                      |       |       | -     |       |
| Oxford                     | 4522              | *                      | (*)   | -     | -     | -                      | -     | -     | -     | *                      | -     | (*)   | -     |       |
| Shrewsbury                 | 4746              |                        |       | (*)   | (*)   |                        |       | -     | (*)   |                        | -     | -     | -     |       |
| Newport (Salop)            | 4787              |                        |       | -     | -     |                        |       | -     | -     |                        | -     | -     | -     |       |
| Malvern                    | 4813              |                        |       |       | (*)   |                        |       |       | (*)   |                        |       | -     | -     |       |
| Ross-on-Wye                | 4882              | *                      | *     | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     |       |
| Kensington Palace          | 5025              |                        | -     | -     | -     |                        | -     | *     | -     |                        | -     | -     | -     |       |
| Hampstead                  | 5028              |                        |       | -     | -     |                        |       | -     | -     |                        |       | -     | -     |       |
| St James' Park             | 5034              |                        |       |       | -     |                        |       |       | -     |                        |       |       | -     |       |
| Camden Square              | 5038              | *                      | (*)   | *     |       | -                      | -     | -     |       | -                      | -     | -     | -     |       |



| STATION<br>NAME       | DCNN<br>OR<br>REF | MAXIMUM<br>TEMPERATURE |       |       |       | MINIMUM<br>TEMPERATURE |       |       |       | MAX-MIN<br>TEMPERATURE |       |       |       | STATION<br>NAME        | DCNN<br>OR<br>REF | MAXIMUM<br>TEMPERATURE |        |       |       | MINIMUM<br>TEMPERATURE |       |       |       | MAX-MIN<br>TEMPERATURE |       |       |       |       |       |
|-----------------------|-------------------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|------------------------|-------------------|------------------------|--------|-------|-------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|-------|-------|
|                       |                   | NUMBER                 | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 |                        |                   | 51-80                  | NUMBER | 01-30 | 11-40 | 31-60                  | 51-80 | 01-30 | 11-40 | 31-60                  | 51-80 | 01-30 | 11-40 | 31-60 | 51-80 |
|                       |                   |                        |       |       |       |                        |       |       |       |                        |       |       |       |                        |                   |                        |        |       |       |                        |       |       |       |                        |       |       |       |       |       |
| Wisley                | 5237              | -                      | -     | -     | *     | -                      | -     | -     | *     | -                      | *     | -     | -     | Exmouth                | 8881              | -                      | -      | -     | *     | -                      | -     | -     | *     | -                      | -     | -     | -     | -     |       |
| Kew (NWS)             | 5259              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | *     | -     | Sidmouth               | 8891              | -                      | -      | -     | *     | -                      | -     | -     | *     | -                      | -     | *     | -     |       |       |
| Croydon (Waddon)      | 5287              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Scilly                 | 8902              | -                      | -      | *     | *     | *                      | -     | -     | *     | -                      | -     | *     | -     |       |       |
| Addington             | 5297              | -                      | *     | -     | -     | -                      | *     | -     | -     | -                      | -     | -     | -     | Penzance               | 8913              | *                      | -      | -     | -     | -                      | -     | -     | *     | -                      | -     | -     | -     |       |       |
| Tunbridge Wells       | 5321              | *                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Gulval                 | 8915              | -                      | -      | (*)   | -     | -                      | -     | *     | (*)   | -                      | -     | -     | -     |       |       |
| East Malling          | 5336              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Falmouth               | 8942              | -                      | -      | *     | -     | -                      | *     | -     | -     | -                      | -     | -     | (*)   |       |       |
| Dungeness             | 5370              | -                      | -     | -     | -     | *                      | -     | -     | -     | -                      | -     | -     | -     | Newquay                | 8946              | *                      | -      | -     | -     | (*)                    | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Wye                   | 5375              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Fowey                  | 8971              | -                      | -      | -     | (*)   | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Dover                 | 5390              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Aldergrove             | 9142              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | *     | -     | -     |       |       |
| Margate               | 5399              | *                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | *     | Hillsborough           | 9238              | -                      | -      | *     | (*)   | *                      | (*)   | (*)   | -     | -                      | -     | -     | -     |       |       |
| Bognor Regis          | 5411              | -                      | -     | -     | *     | -                      | -     | *     | -     | -                      | -     | -     | -     | Armagh                 | 9336              | -                      | -      | -     | (*)   | *                      | (*)   | -     | -     | -                      | -     | -     | -     |       |       |
| Worthing              | 5431              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Kelso                  | 9901              | -                      | -      | -     | -     | -                      | -     | *     | -     | -                      | -     | *     | -     |       |       |
| Hastings              | 5490              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | *     | -     | Rothsay                | 9902              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Shinfield             | 5575              | -                      | -     | (*)   | -     | -                      | -     | (*)   | -     | -                      | -     | -     | -     | Deerness               | 9903              | -                      | -      | -     | -     | -                      | -     | -     | *     | -                      | -     | -     | -     |       |       |
| Reading (University)  | 5578              | *                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Kettins                | 9904              | -                      | *      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Southampton (E.Park)  | 5643              | -                      | -     | -     | -     | *                      | -     | -     | -     | -                      | -     | -     | -     | Montrose (Asylum)      | 9905              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Ventnor (Hosp + Park) | 5771              | -                      | -     | -     | -     | -                      | -     | -     | *     | -                      | -     | -     | -     | Crieff                 | 9906              | -                      | -      | -     | -     | *                      | -     | -     | *     | -                      | -     | -     | -     |       |       |
| Sandown               | 5790              | -                      | -     | (*)   | (*)   | -                      | *     | -     | (*)   | -                      | -     | -     | *     | Wolfelee               | 9908              | -                      | -      | *     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Ryde                  | 5798              | -                      | -     | -     | -     | -                      | -     | -     | (*)   | -                      | -     | -     | -     | -                      | -                 | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Larkhill              | 5863              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Cardross               | 9910              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Boscombe Down         | 5872              | -                      | -     | -     | (*)   | -                      | -     | -     | -     | -                      | -     | -     | -     | Dungavel               | 9911              | -                      | *      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Marlborough           | 5877              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Thorntonhall           | 9912              | -                      | -      | -     | -     | -                      | -     | -     | -     | (*)                    | -     | -     | -     |       |       |
| Tiree                 | 6007              | -                      | -     | (*)   | -     | -                      | *     | -     | -     | -                      | -     | *     | (*)   | Ruthwell               | 9913              | -                      | *      | -     | -     | -                      | *     | -     | -     | -                      | *     | -     | -     |       |       |
| Greenock              | 6318              | -                      | -     | -     | (*)   | -                      | -     | -     | (*)   | -                      | -     | -     | -     | Strathpeffer           | 9916              | -                      | -      | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     |       |       |
| Paisley               | 6366              | -                      | -     | -     | -     | -                      | -     | -     | (*)   | -                      | -     | -     | -     | Spurn Head             | 9923              | -                      | -      | -     | -     | -                      | -     | -     | (*)   | -                      | -     | -     | -     |       |       |
| Colmonell             | 6505              | -                      | -     | -     | -     | *                      | -     | -     | -     | *                      | -     | -     | -     | Lincoln                | 9924              | -                      | -      | -     | -     | -                      | -     | -     | (*)   | *                      | -     | -     | -     |       |       |
| Dumfries              | 6641              | -                      | -     | -     | (-)   | -                      | -     | -     | -     | -                      | -     | -     | -     | Geldeston              | 9925              | -                      | -      | -     | -     | *                      | -     | -     | -     | *                      | -     | -     | -     |       |       |
| Eskdalemuir (L Hut)   | 6678              | -                      | -     | (*)   | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Bennington             | 9927              | *                      | -      | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     |       |       |
| Glenlee               | 6745              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Berkhamsted            | 9928              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Douglas               | 6951              | -                      | (*)   | (*)   | -     | -                      | (*)   | *     | (*)   | -                      | -     | *     | -     | Harrogate              | 9929              | -                      | -      | -     | -     | *                      | *     | -     | -     | *                      | -     | -     | -     |       |       |
| Newton Rigg           | 7071              | -                      | (*)   | -     | -     | (*)                    | (*)   | -     | (*)   | -                      | *     | -     | -     | Cheadle                | 9930              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Southport             | 7223              | -                      | -     | *     | (*)   | -                      | -     | -     | (*)   | *                      | -     | *     | -     | Norwich                | 9932              | *                      | -      | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     |       |       |
| Morecombe             | 7239              | -                      | -     | -     | (*)   | -                      | -     | -     | -     | -                      | -     | -     | -     | Copdock                | 9933              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | *     | -     | -     |       |       |
| Darwen                | 7266              | -                      | (*)   | *     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Halstead               | 9934              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Stonyhurst            | 7269              | -                      | -     | -     | -     | (*)                    | -     | (*)   | -     | *                      | -     | -     | -     | Meltham                | 9936              | -                      | -      | -     | -     | *                      | -     | -     | -     | -                      | *     | -     | -     |       |       |
| Liverpool (Bidston)   | 7307              | -                      | -     | -     | -     | *                      | -     | -     | -     | -                      | *     | -     | -     | Belvoir Castle         | 9938              | -                      | -      | -     | -     | *                      | -     | -     | (*)   | -                      | -     | -     | -     |       |       |
| Macclesfield          | 7384              | *                      | -     | -     | (*)   | -                      | (*)   | -     | -     | *                      | -     | -     | (*)   | Oundle                 | 9939              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Rhyl                  | 7408              | -                      | -     | -     | -     | *                      | (*)   | *     | *     | -                      | -     | -     | -     | Sparkhill              | 9940              | -                      | -      | (*)   | -     | *                      | -     | -     | -     | -                      | *     | -     | -     |       |       |
| Hawarden Bridge       | 7467              | (*)                    | -     | -     | -     | *                      | -     | -     | *     | -                      | -     | -     | -     | Rugby                  | 9941              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Holyhead/Valley       | 7511              | (*)                    | -     | *     | *     | -                      | -     | -     | (*)   | -                      | -     | *     | -     | Mayfield               | 9942              | -                      | -      | -     | -     | -                      | -     | *     | -     | -                      | -     | -     | -     |       |       |
| Aber                  | 7768              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Hereford               | 9943              | *                      | -      | -     | -     | *                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Llandudno             | 7798              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | East Ham               | 9944              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Aberystwyth (1)       | 8056              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Tottenham              | 9945              | -                      | -      | -     | -     | -                      | -     | -     | *     | -                      | -     | -     | -     |       |       |
| Aberystwyth (2)       | 8058              | -                      | -     | (*)   | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Eastbourne             | 9946              | (*)                    | -      | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     |       |       |
| Haverfordwest         | 8154              | -                      | *     | -     | -     | -                      | -     | -     | -     | -                      | *     | -     | -     | Totland Bay            | 9947              | -                      | -      | -     | -     | -                      | *     | -     | -     | -                      | -     | -     | -     |       |       |
| Swansea               | 8413              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Brighton               | 9948              | *                      | -      | -     | -     | -                      | -     | -     | (*)   | -                      | -     | -     | -     |       |       |
| Cardiff               | 8492              | -                      | (*)   | (*)   | -     | -                      | -     | -     | -     | -                      | -     | *     | -     | Portsmouth             | 9951              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Weston Super Mare     | 8648              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Scaleby                | 9953              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Long Ashton           | 8678              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Blackpool              | 9954              | -                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Bath                  | 8698              | -                      | -     | (*)   | -     | -                      | *     | -     | -     | -                      | -     | -     | -     | Keswick                | 9955              | -                      | *      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Shaftsbury            | 8768              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Burnley                | 9956              | -                      | -      | -     | -     | -                      | *     | -     | -     | -                      | -     | -     | -     |       |       |
| Mt Batten             | 8811              | -                      | -     | -     | *     | -                      | -     | -     | (*)   | -                      | -     | -     | -     | Lancaster              | 9957              | -                      | *      | -     | -     | *                      | -     | -     | *     | -                      | -     | -     | -     |       |       |
| Plymouth Hoe          | 8812              | -                      | -     | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     | Manc. (Whitworth Park) | 9958              | -                      | *      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Ilfracombe            | 8829              | -                      | -     | -     | -     | -                      | -     | *     | -     | -                      | -     | -     | (*)   | Manc. (Oldham Park)    | 9959              | (*)                    | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |
| Torbay (Torquay)      | 8864              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | Hoylake                | 9960              | -                      | -      | -     | -     | -                      | *     | -     | (*)   | *                      | -     | -     | -     |       |       |
| Teignmouth            | 8871              | *                      | -     | *     | -     | -                      | -     | -     | (*)   | *                      | -     | -     | -     | St Ann's Head          | 9961              | *                      | -      | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     |       |       |



| STATION<br>NAME      | DCNN<br>OR<br>REF | MAXIMUM<br>TEMPERATURE |       |       |       | MINIMUM<br>TEMPERATURE |       |       |       | MAX-MIN<br>TEMPERATURE |       |       |       |       |
|----------------------|-------------------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|------------------------|-------|-------|-------|-------|
|                      |                   | NUMBER                 | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 | 51-80                  | 01-30 | 11-40 | 31-60 | 51-80 |
| Arlington            | 9962              | -                      | -     | -     | -     | -                      | -     | -     | -     | *                      | -     | -     | -     | -     |
| Barnstaple           | 9963              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Cullompton           | 9964              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Woolacombe           | 9965              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Redruth              | 9966              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Ashburton            | 9967              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Jersey               | 9968              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |
| Donaghadee (C. Down) | 9969              | -                      | -     | -     | -     | -                      | -     | -     | -     | -                      | -     | -     | -     | -     |

Table 2 Inhomogeneities identified in the total annual sunshine records for selected climatological stations 1901-1980

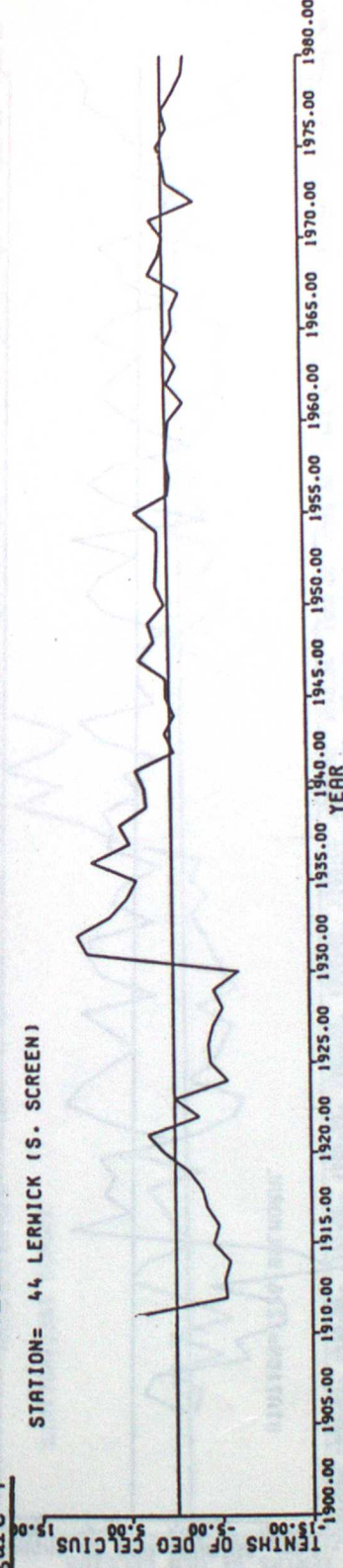
| Station          | Dates   | Type of inhomogeneity |
|------------------|---------|-----------------------|
| Wick             | 1945-80 | Trend                 |
| Fort Augustus    | 1947-55 | Step                  |
| Edinburgh        |         |                       |
| (Blackford Hill) | 1957-58 | Step                  |
| York             | 1905-45 | Trend                 |
| Hull             | 1925/7  | Step                  |
| Lowestoft        | 1903-80 | Trend                 |
| Woburn           |         |                       |
| Rothamsted       | 1950-80 | Various               |
| Buxton           | 1907-72 | Trend                 |
| Edgbaston        | 1927/8  | Step                  |
| Wisley           | 1925    |                       |
|                  | 1947    |                       |
| Kew (NWS)        | 1906-76 | Trend                 |
| Tunbridge Wells  |         | Various               |
| Greenock         | 1937-75 | Trend                 |
| Southport        |         | Various               |
| Stonyhurst       | 1907-29 |                       |
| Rhyl             | 1903-73 | Trend + step?         |
| Valley/Holyhead  | 1924/5  | Step                  |
| Cardiff          |         | Various               |
| Long Ashton      | 1950    | Settled down          |
| Bath             | 1916-20 | Step                  |
|                  | 1920-40 | Trend                 |
| Ilfracombe       | 1930-50 | Trend                 |
| Scilly           | 1923-24 | Step                  |
| Falmouth         | 1947-49 | Step                  |
|                  | 1949-65 | Trend                 |
| Aldergrove       | 1960    | Becomes more variable |
| Armagh           | 1957/9  | Step                  |
|                  | 1959-80 | Trend                 |
| Rothesay         | 1948-51 | Step                  |



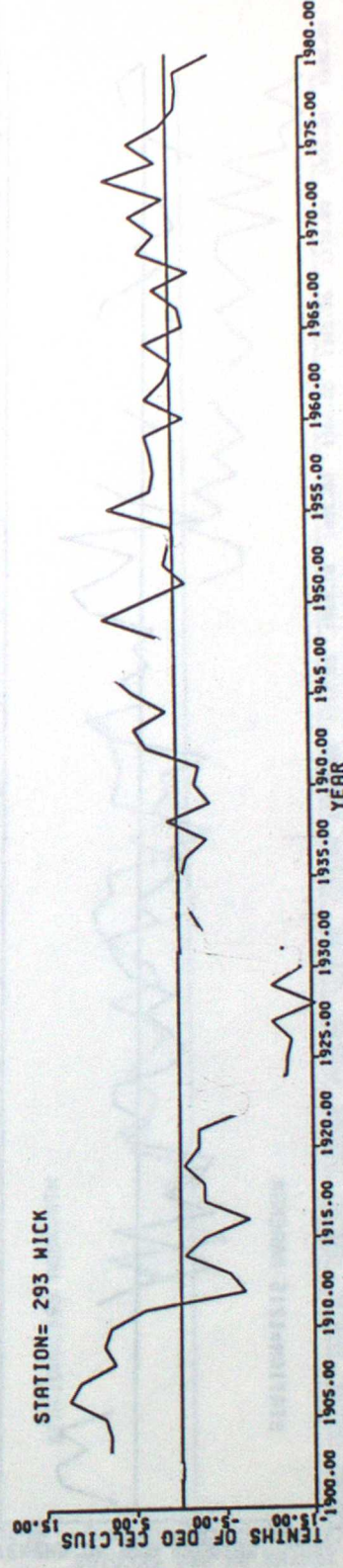
Figure 1

RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

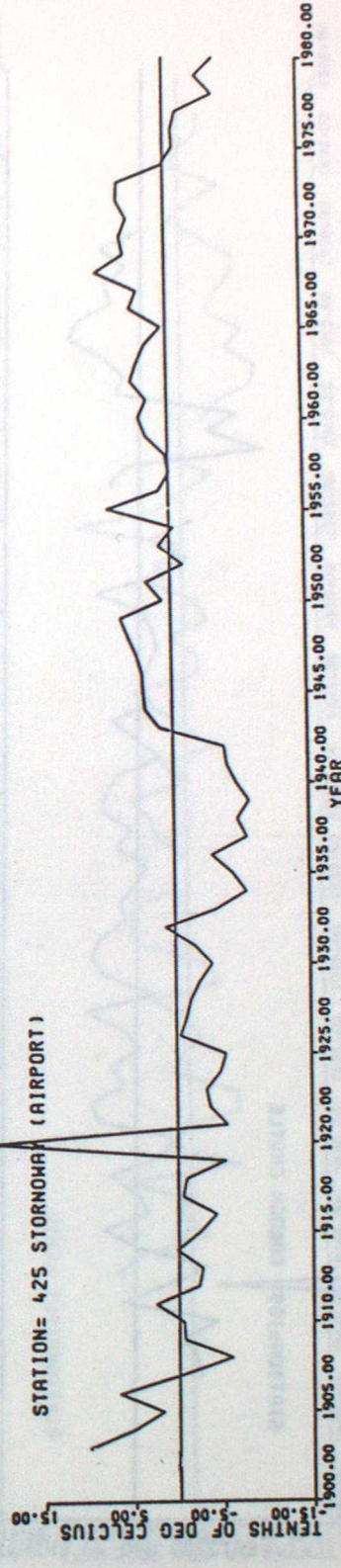
STATION= 44 LERWICK (S. SCREEN)



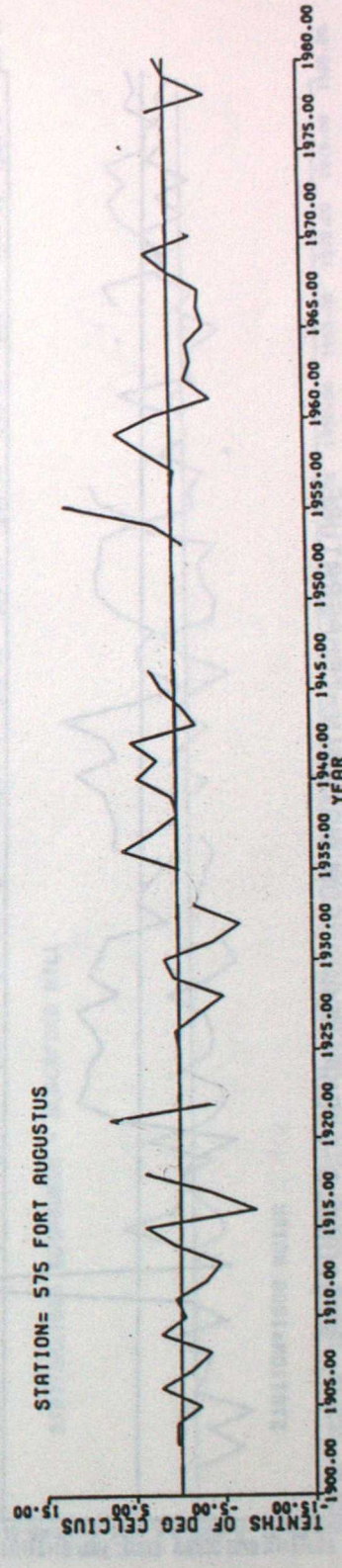
STATION= 293 WICK



STATION= 425 STORNOWAY (AIRPORT)

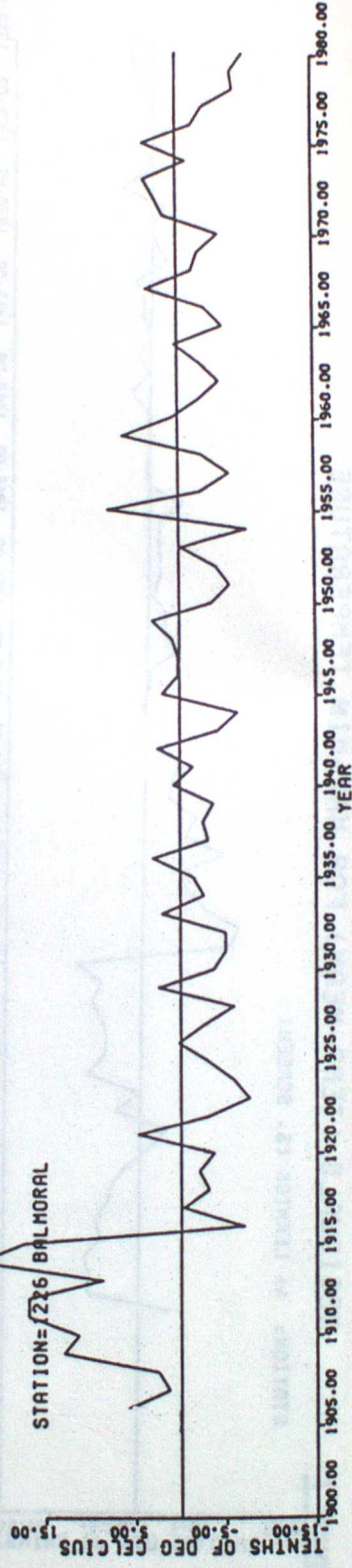
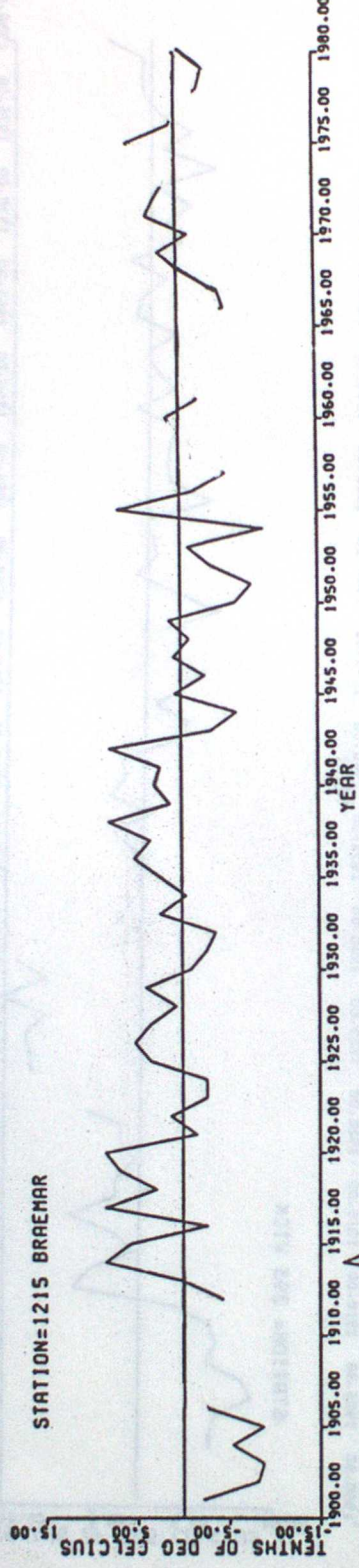
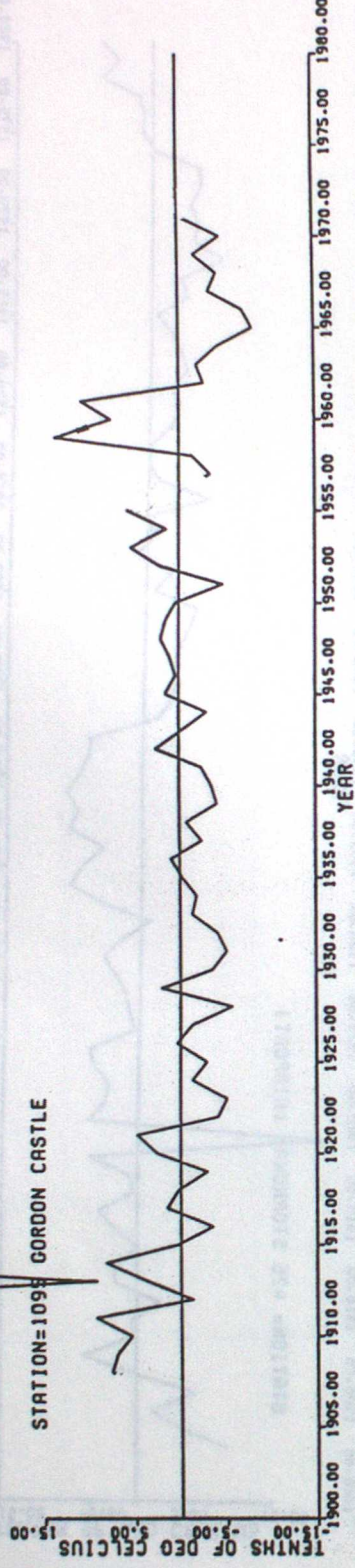
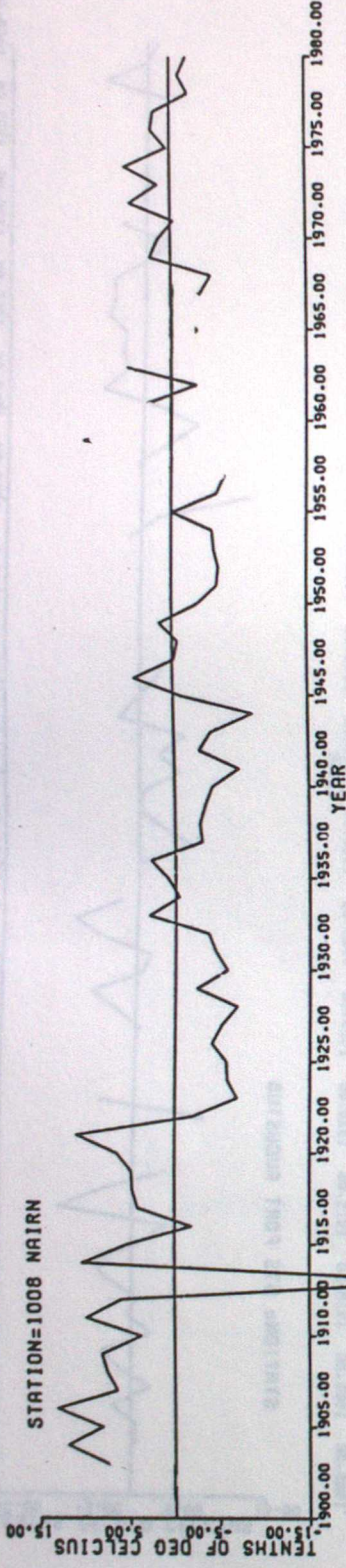


STATION= 575 FORT AUGUSTUS

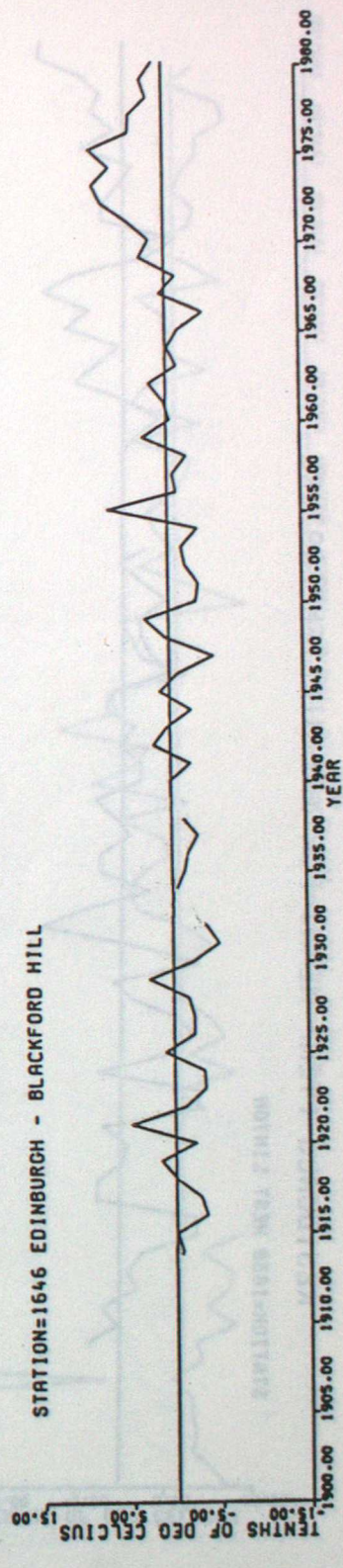
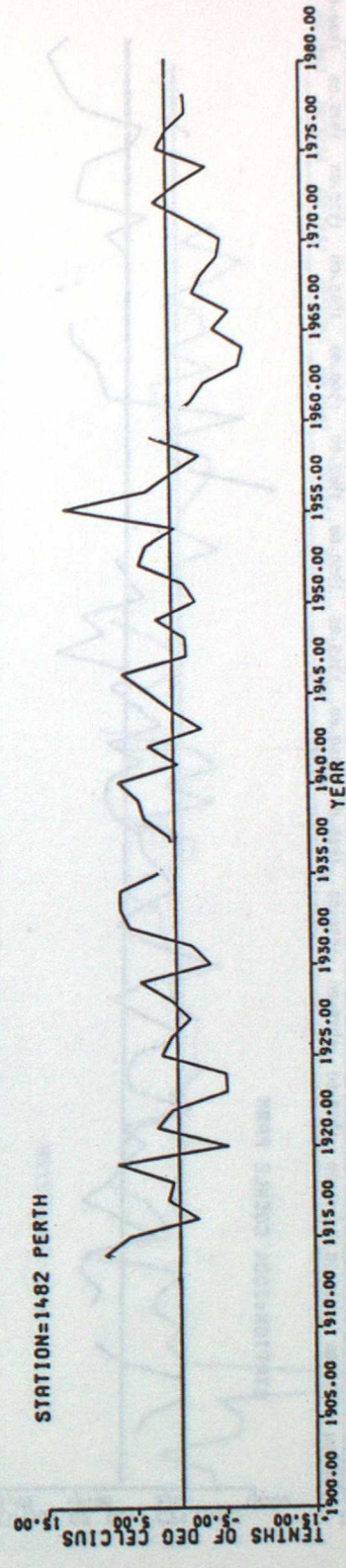
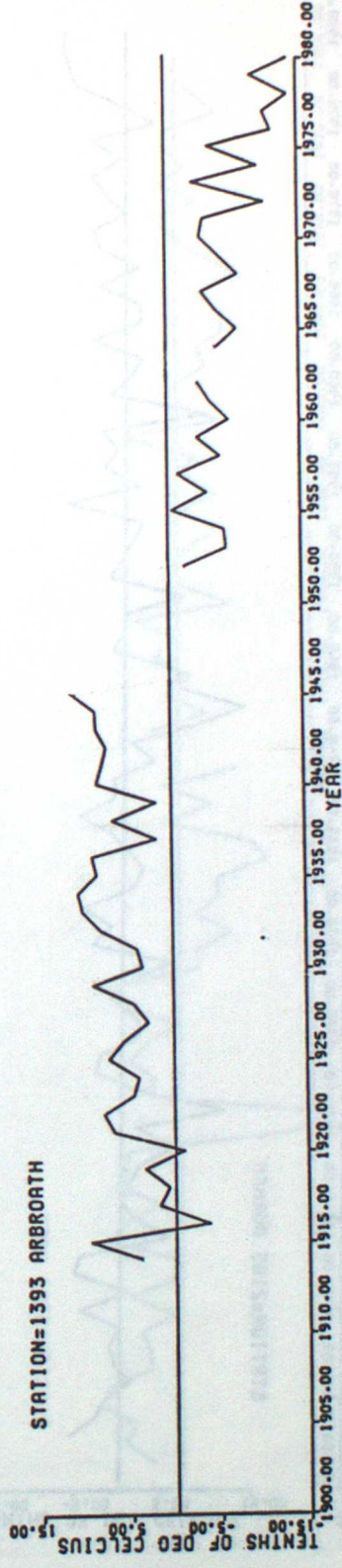
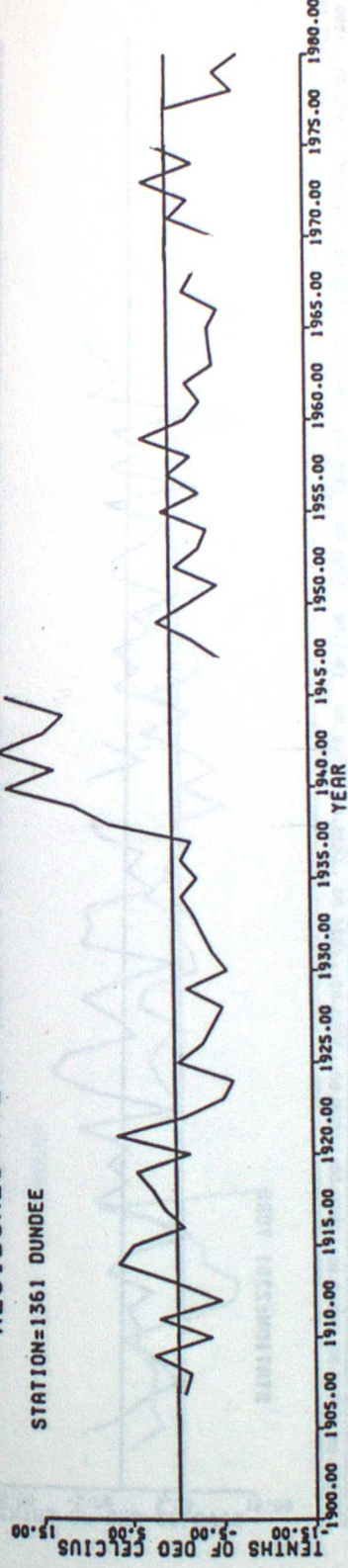




# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



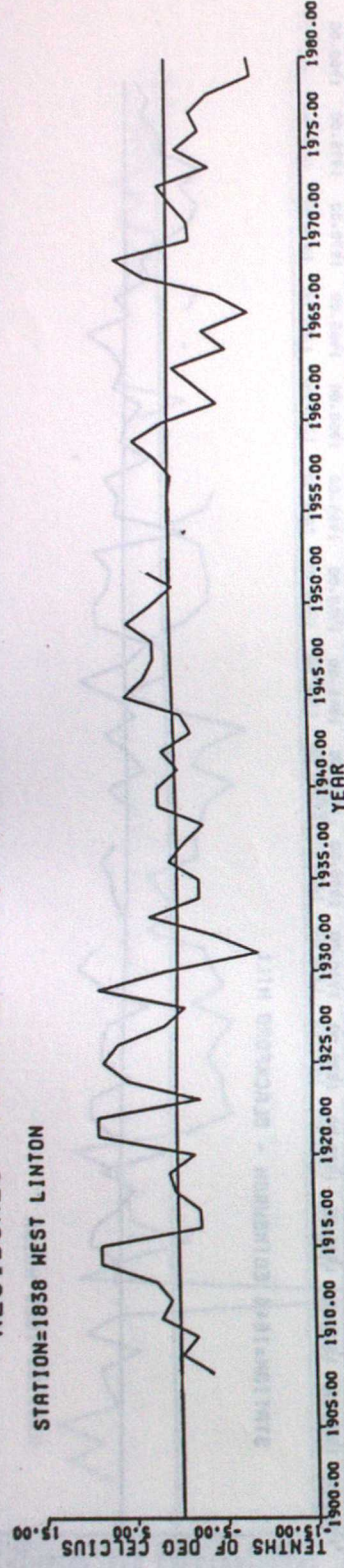
# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



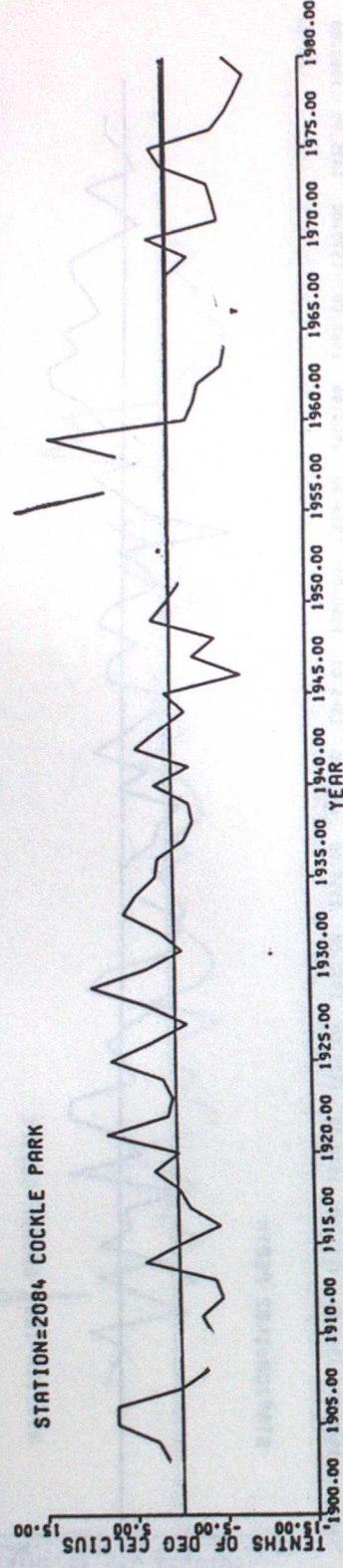


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

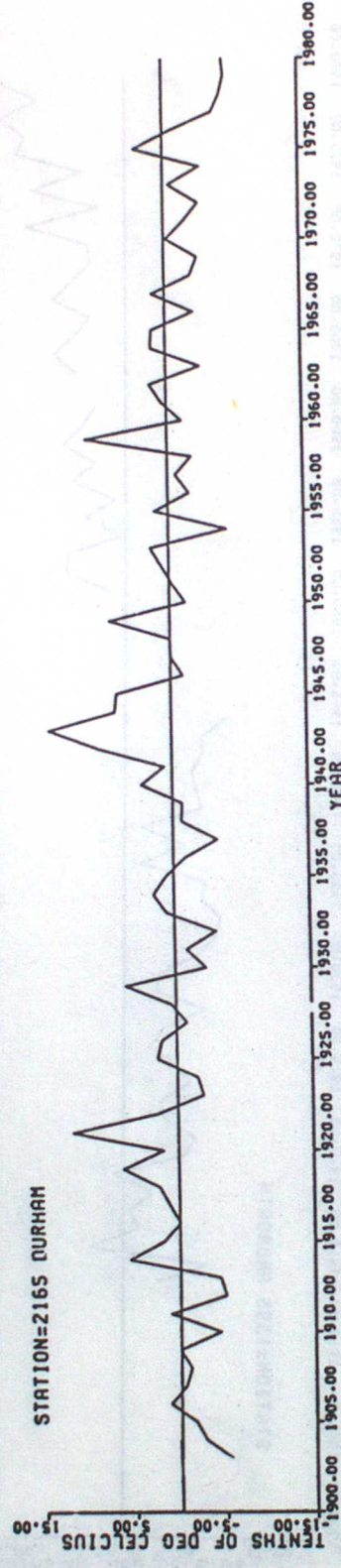
STATION=1838 WEST LINTON



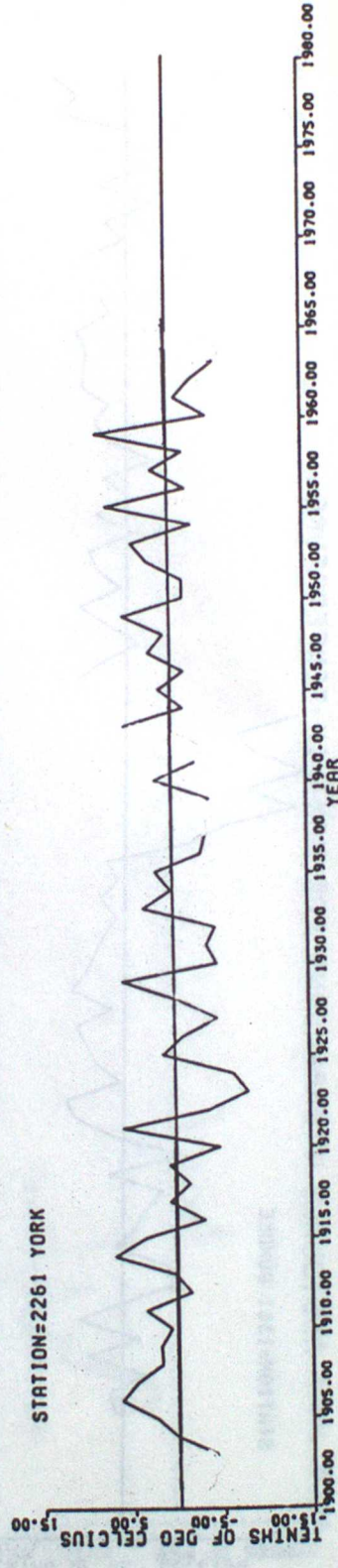
STATION=2084 COCKLE PARK



STATION=2165 DURHAM

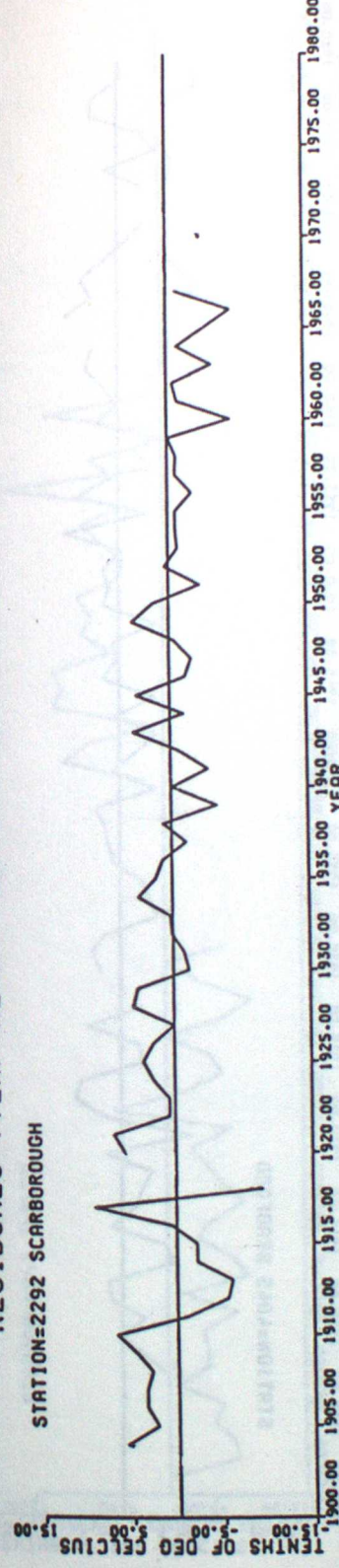


STATION=2261 YORK

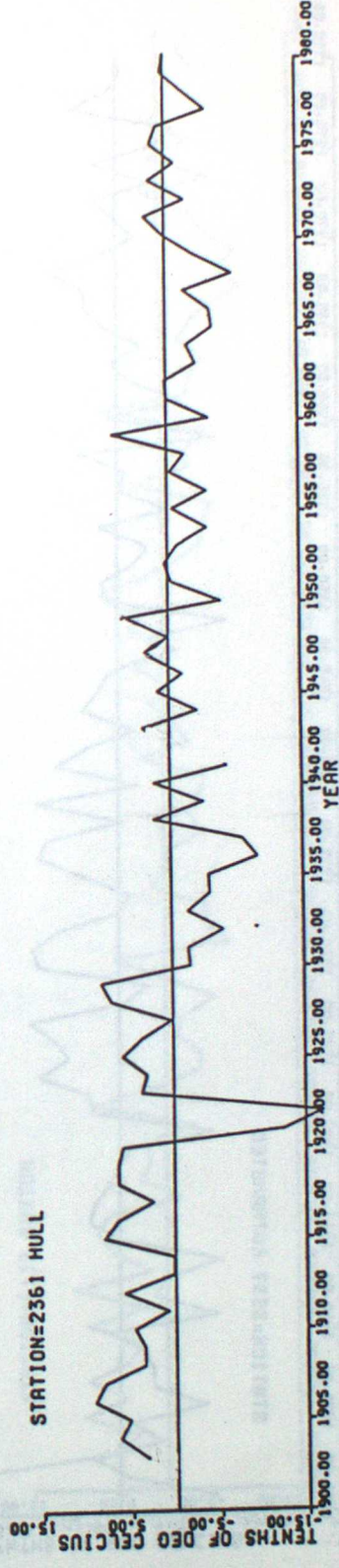


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

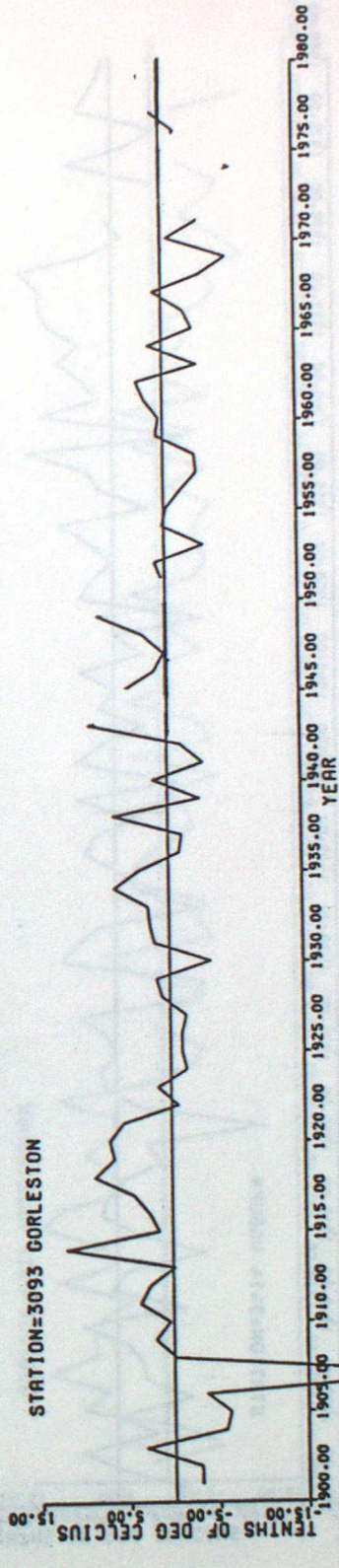
STATION=2292 SCARBOROUGH



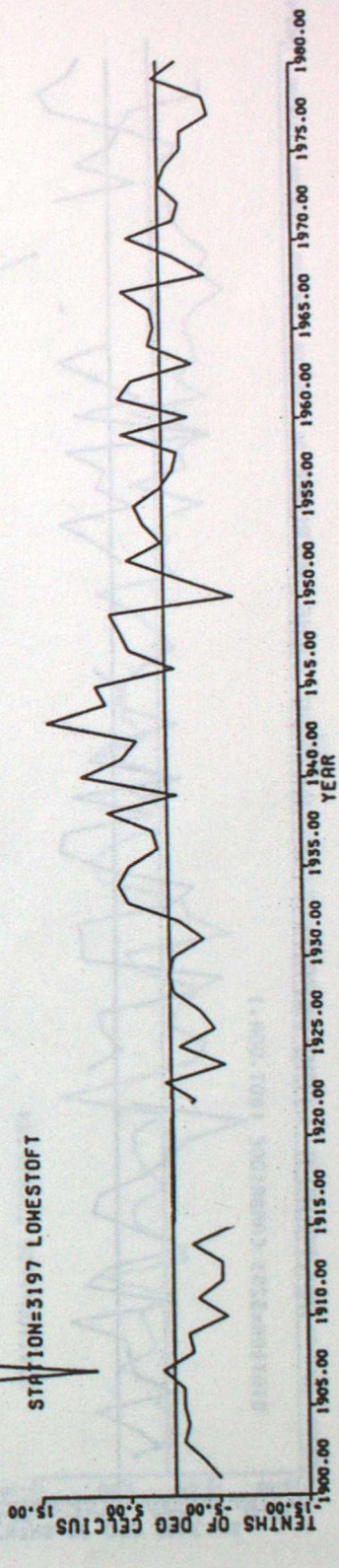
STATION=2361 HULL



STATION=3093 GORLESTON

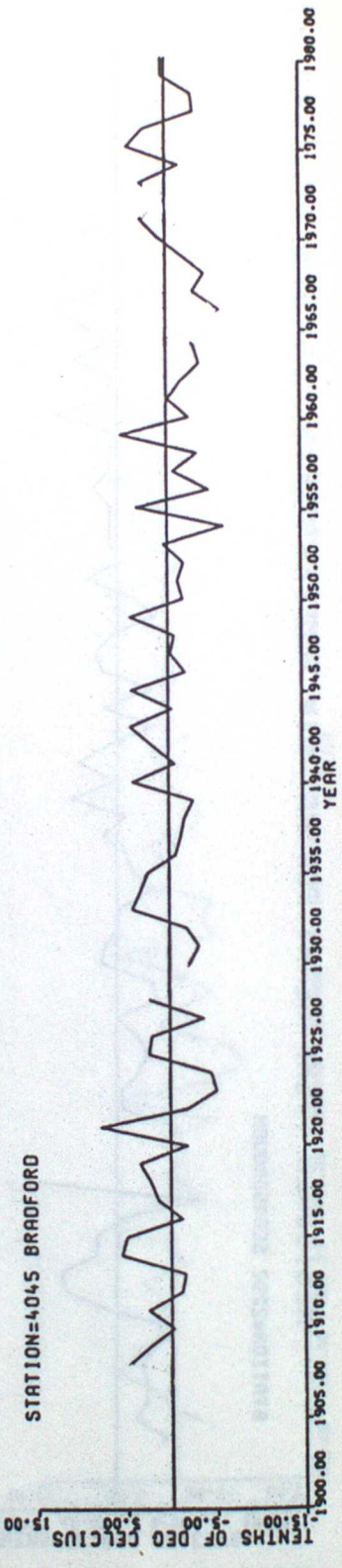
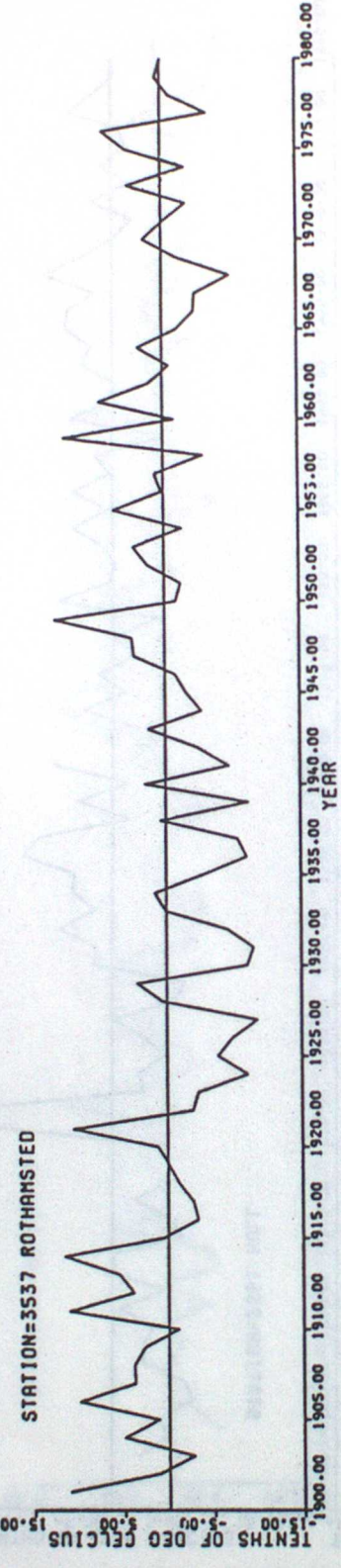
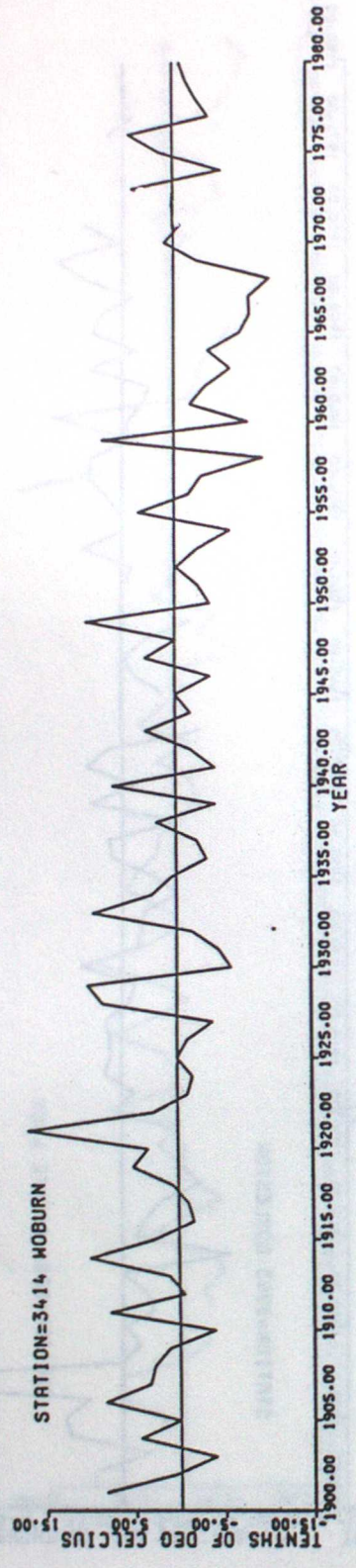
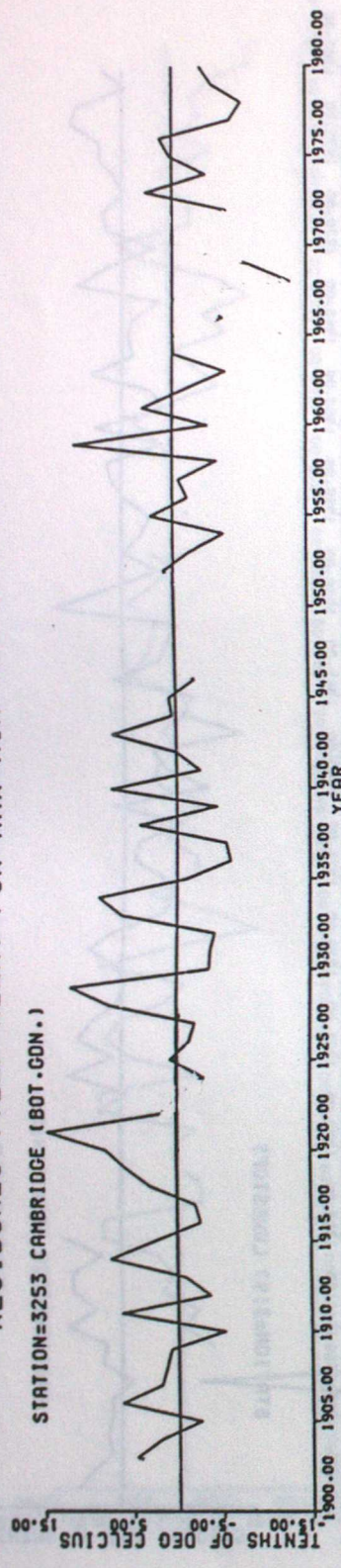


STATION=3197 LOWESTOFT

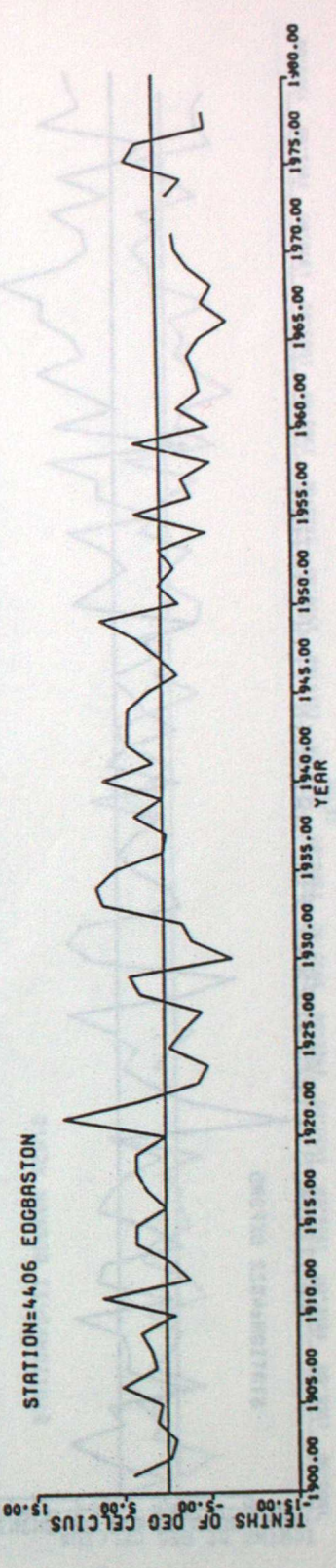
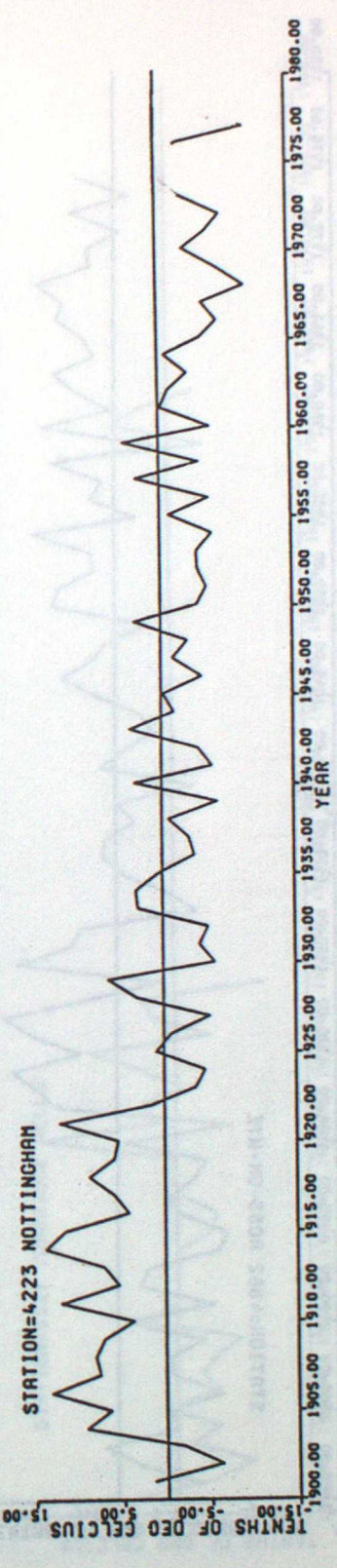
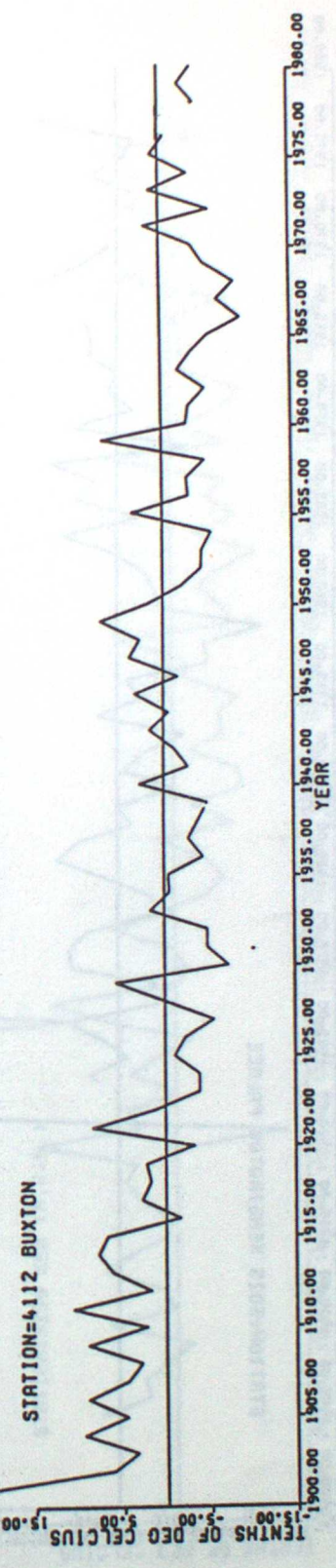
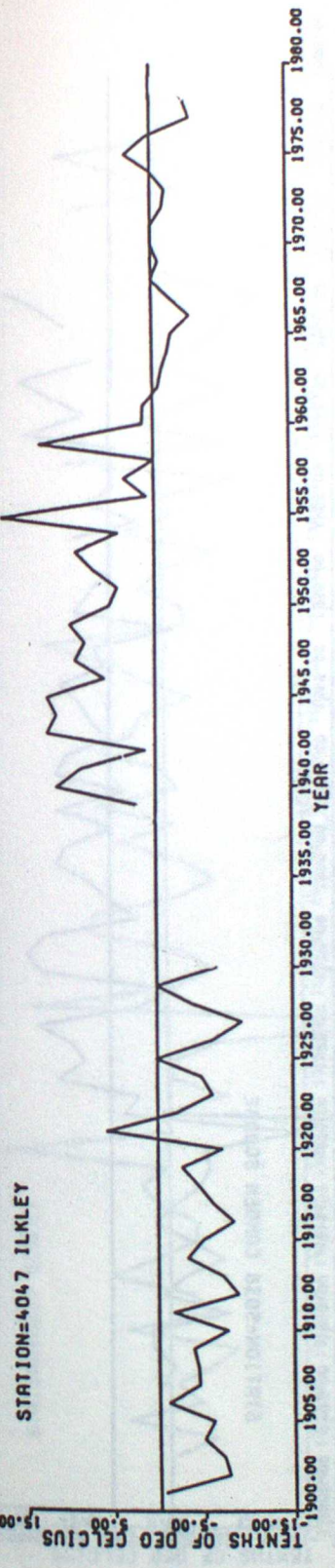




# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

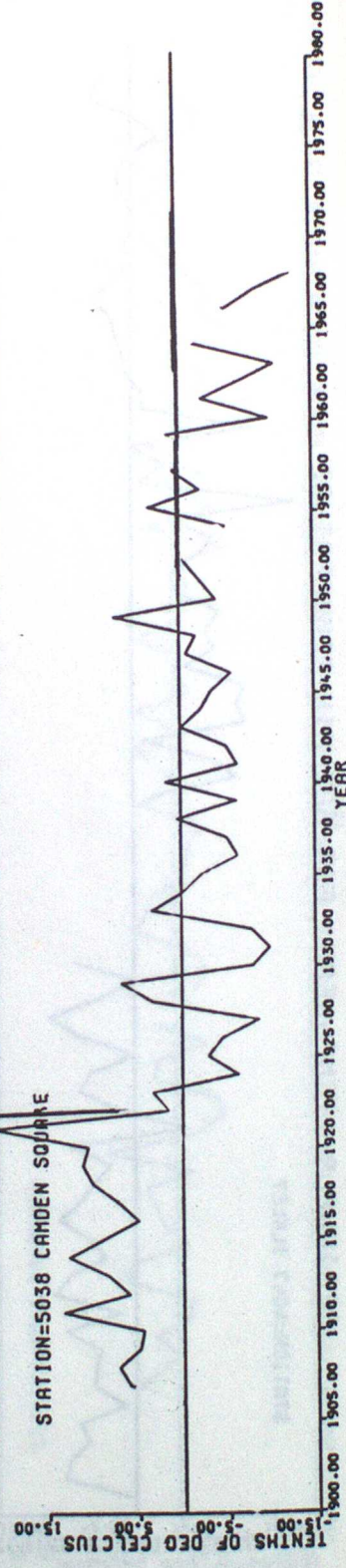
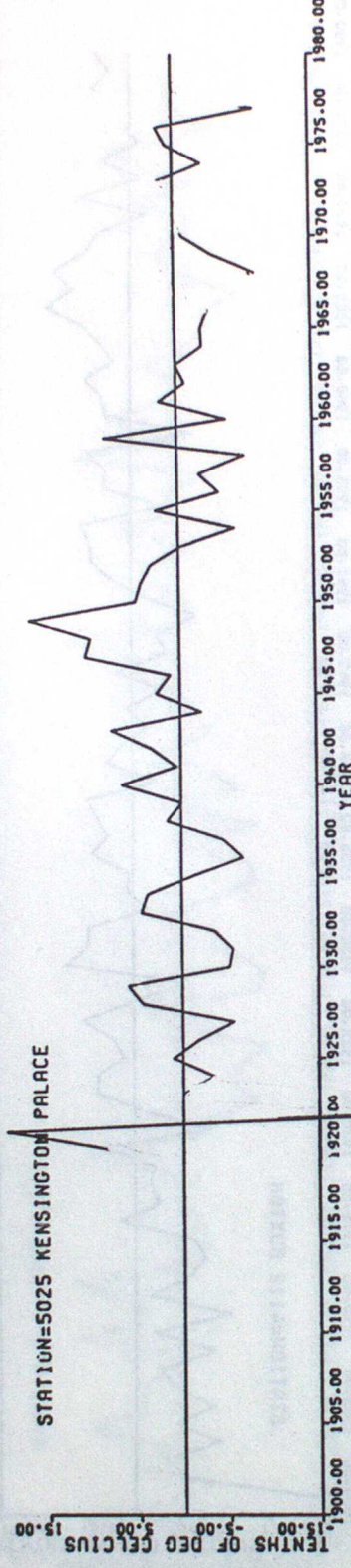
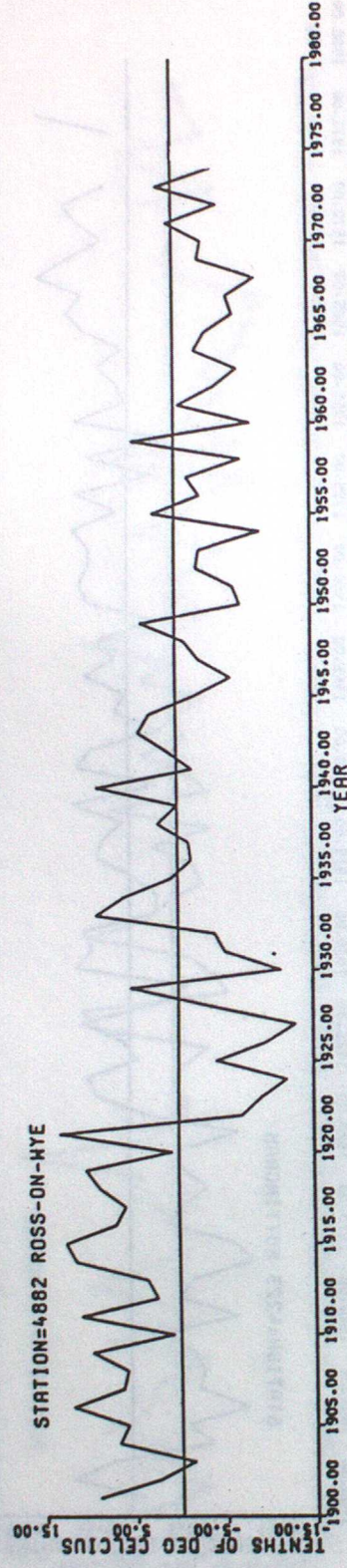
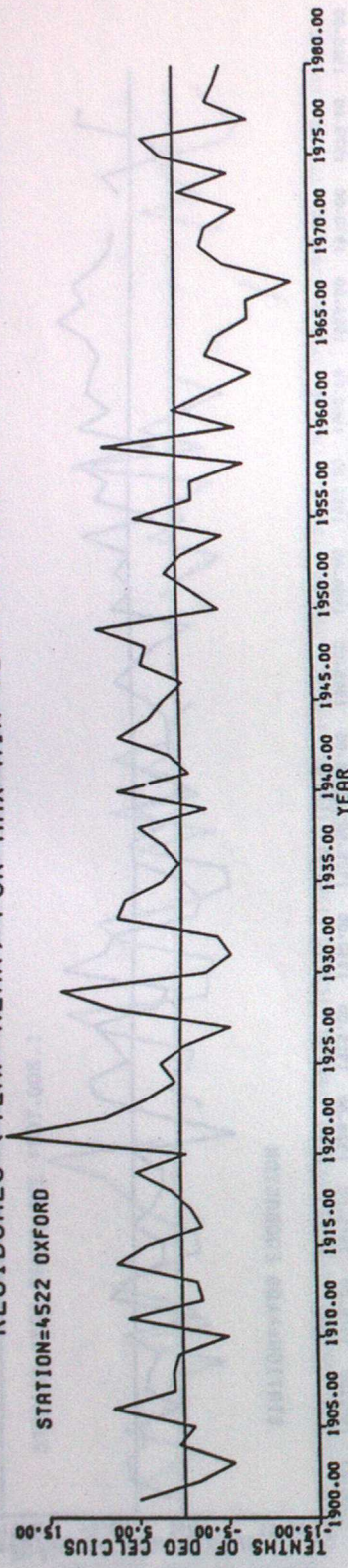


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

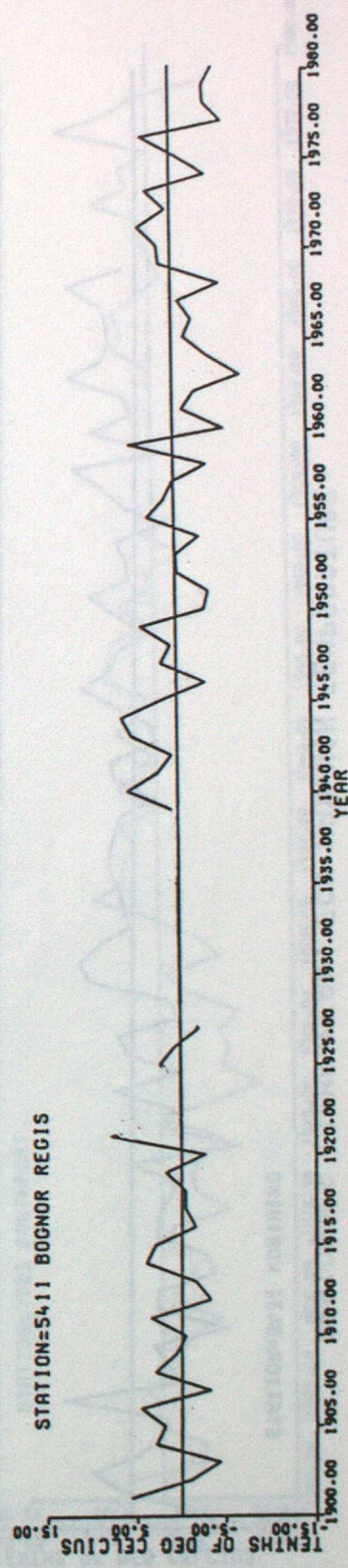
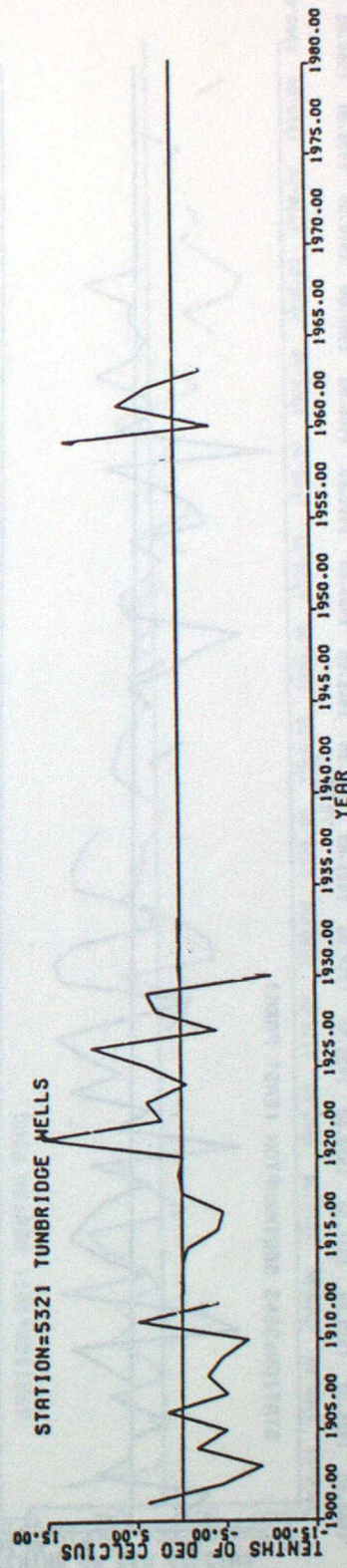
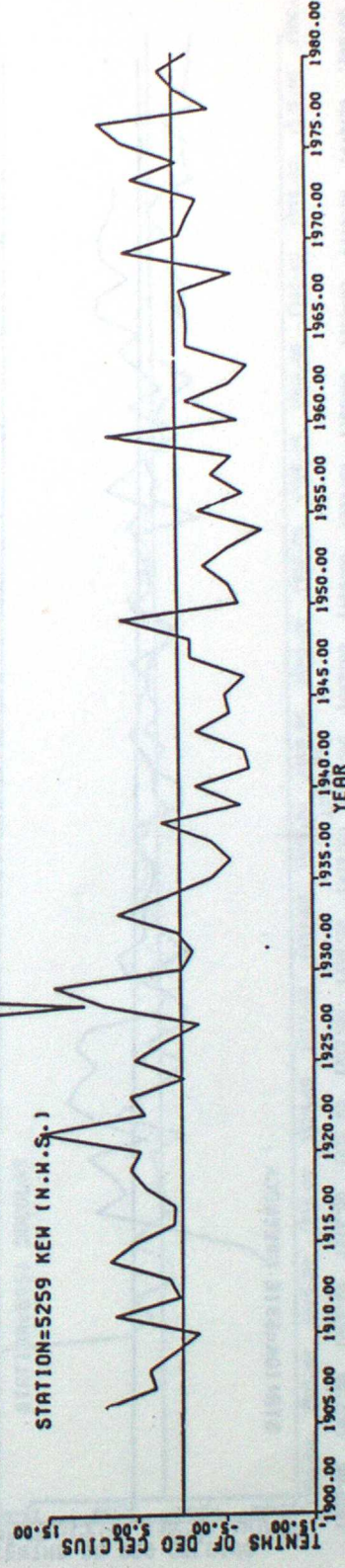
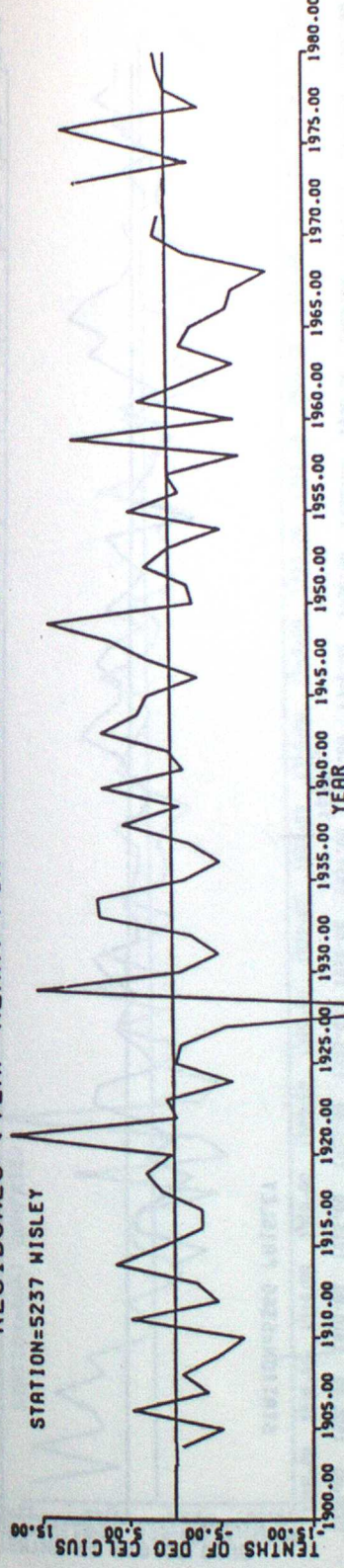




# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



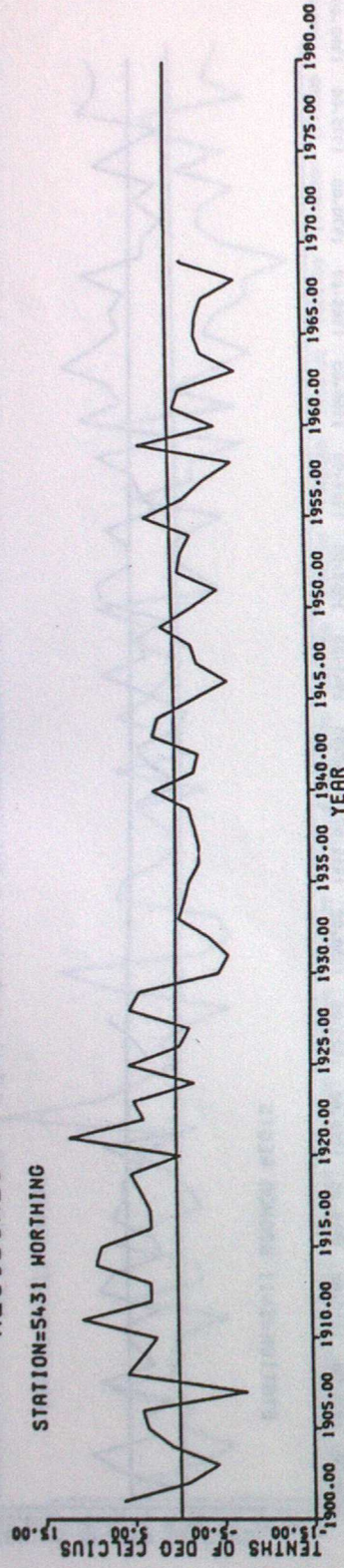
# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



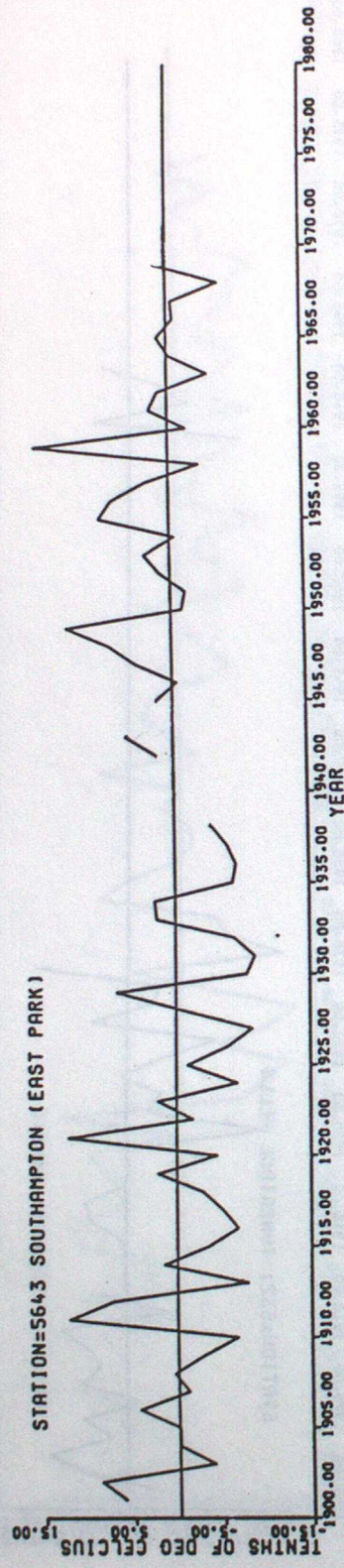


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

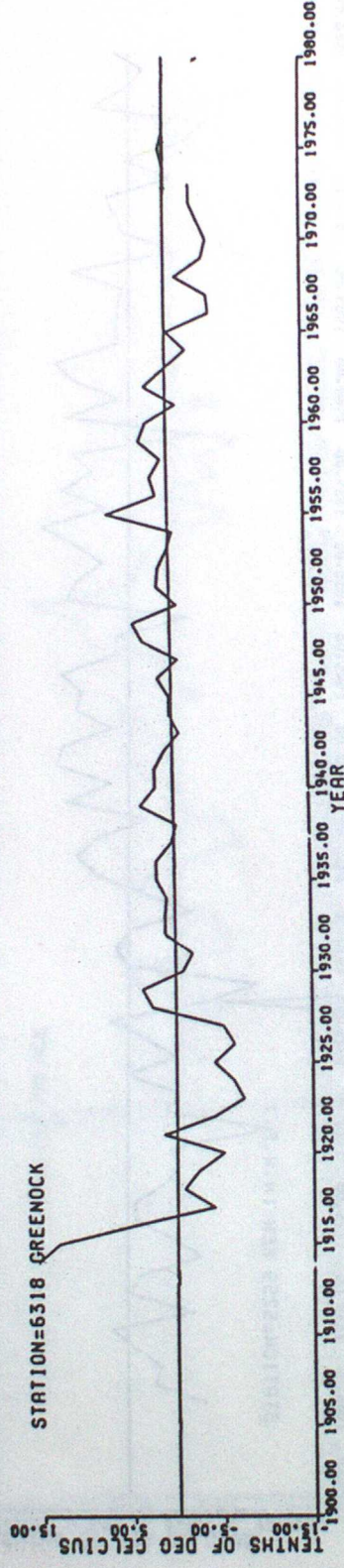
STATION=5431 WORTHING



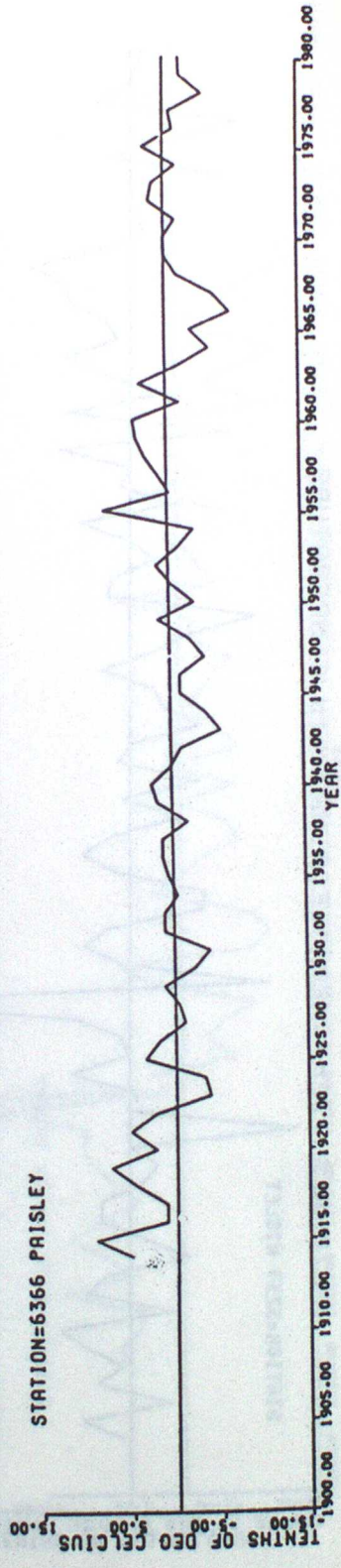
STATION=5643 SOUTHAMPTON (EAST PARK)



STATION=6318 GREENOCK

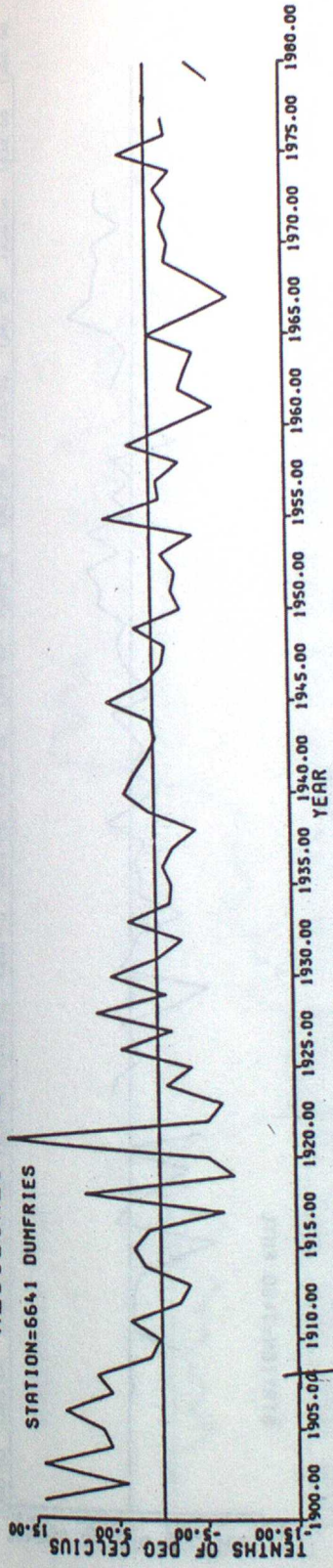


STATION=6366 PAISLEY

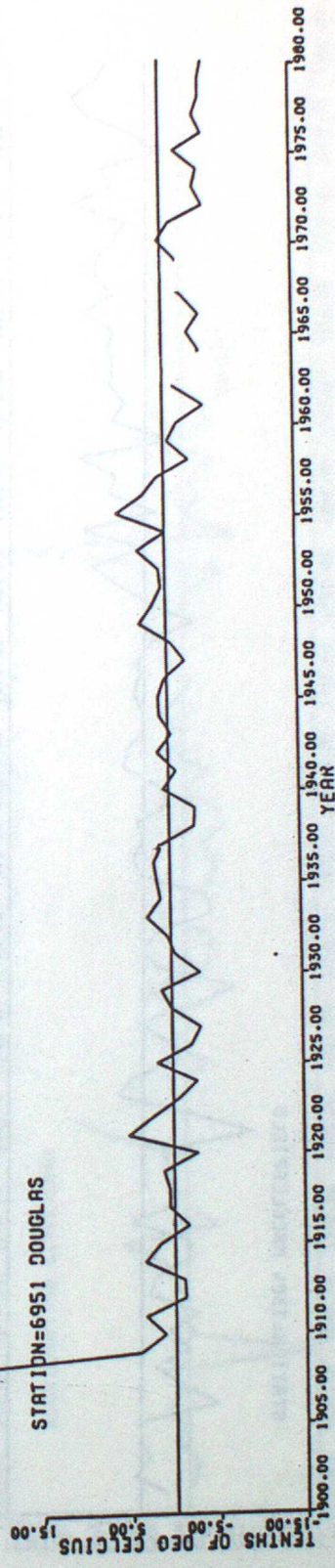


## RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

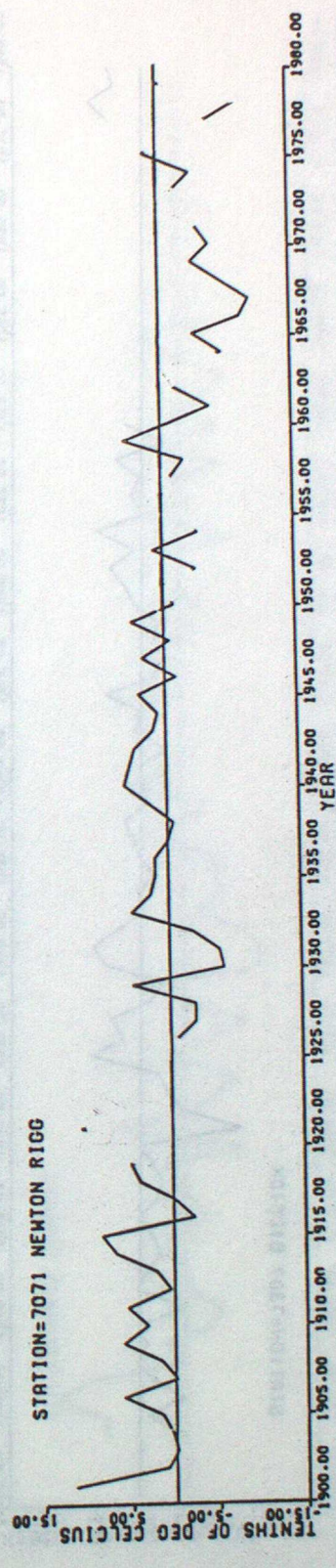
STATION=6641 DUMFRIES



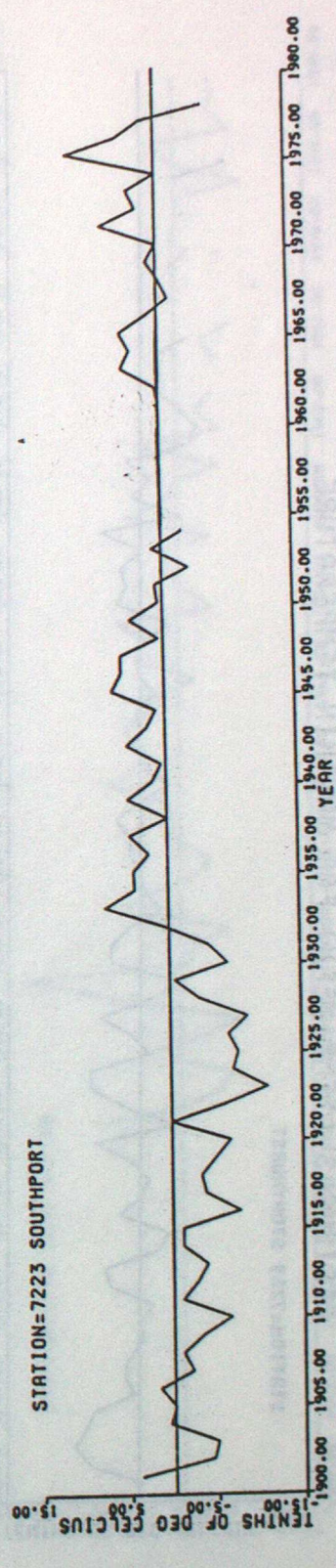
STATION=6951 DOUGLAS



STATION=7071 NEWTON RIGG



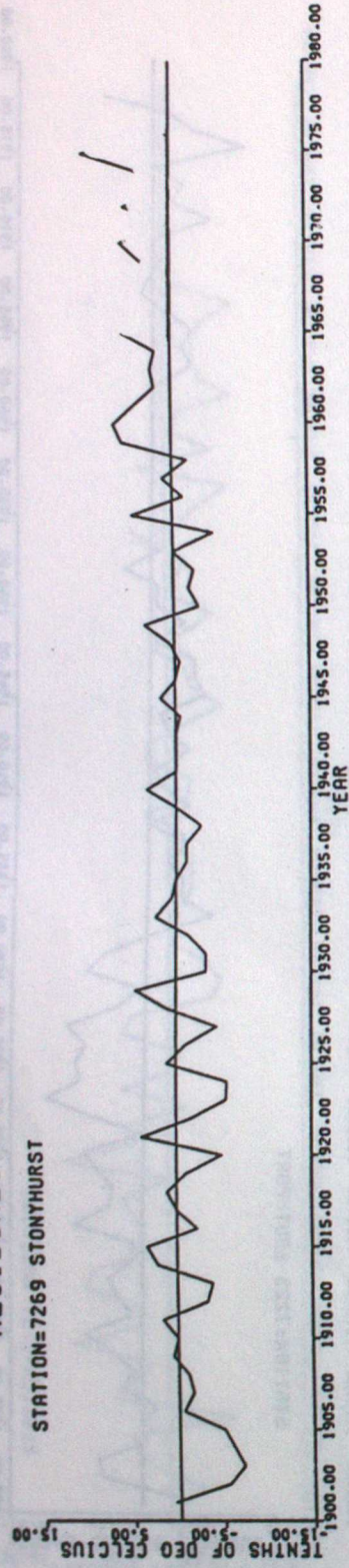
STATION=7223 SOUTHPORT



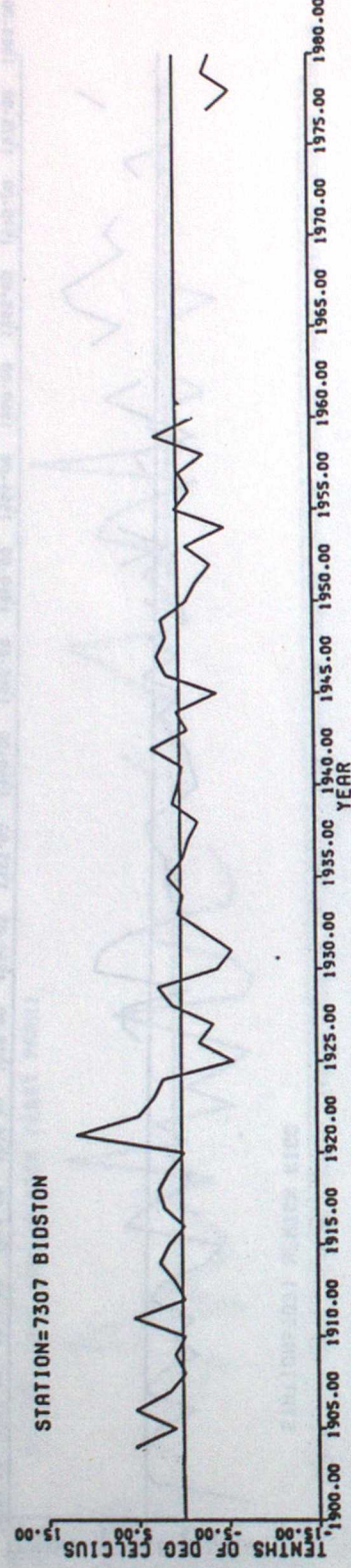


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

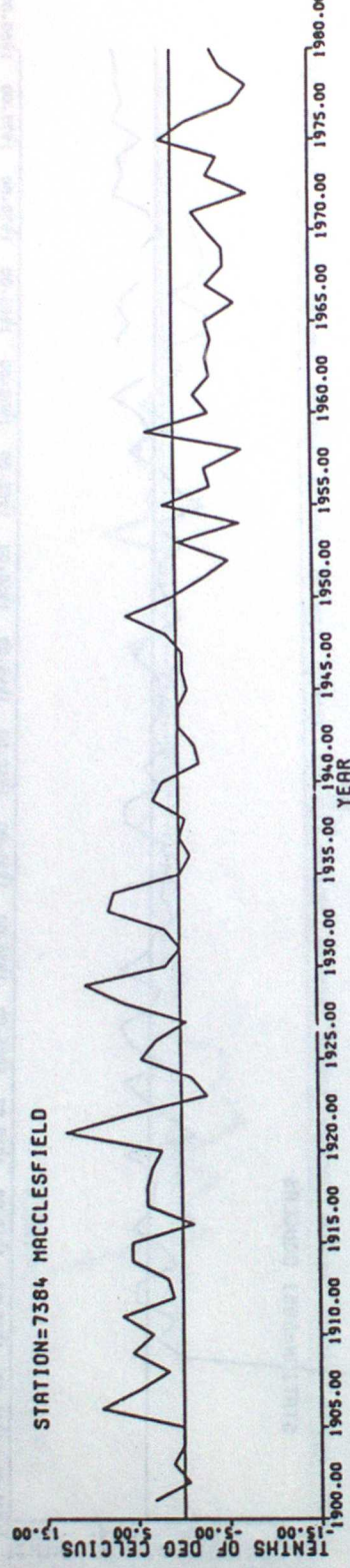
STATION=7269 STONYHURST



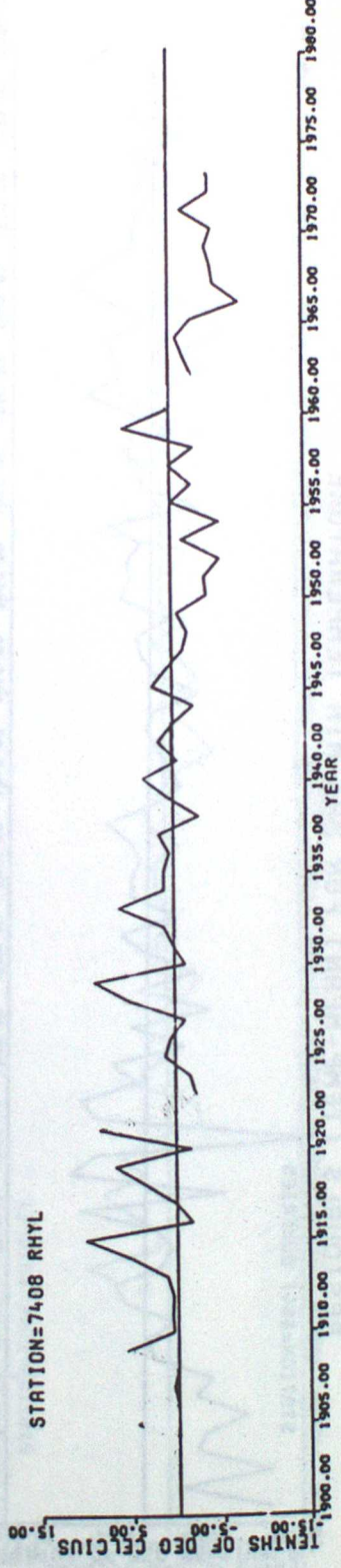
STATION=7307 BIDSTON



STATION=7384 MACCLESFIELD

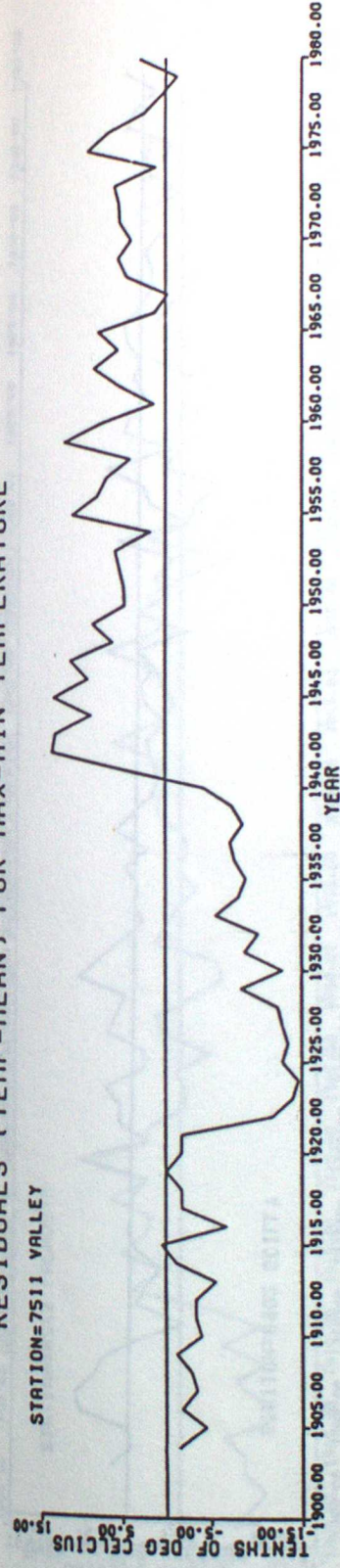


STATION=7408 RHYL

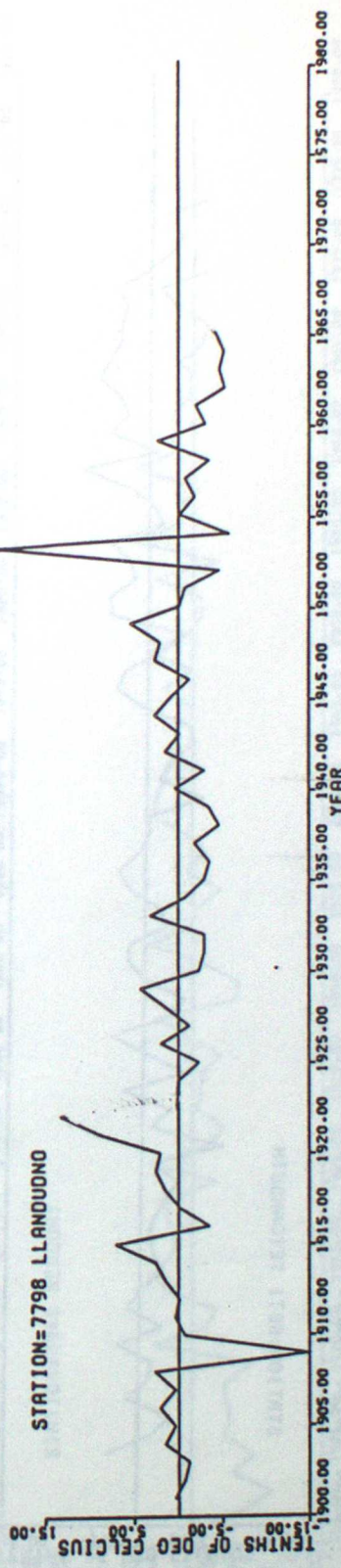


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

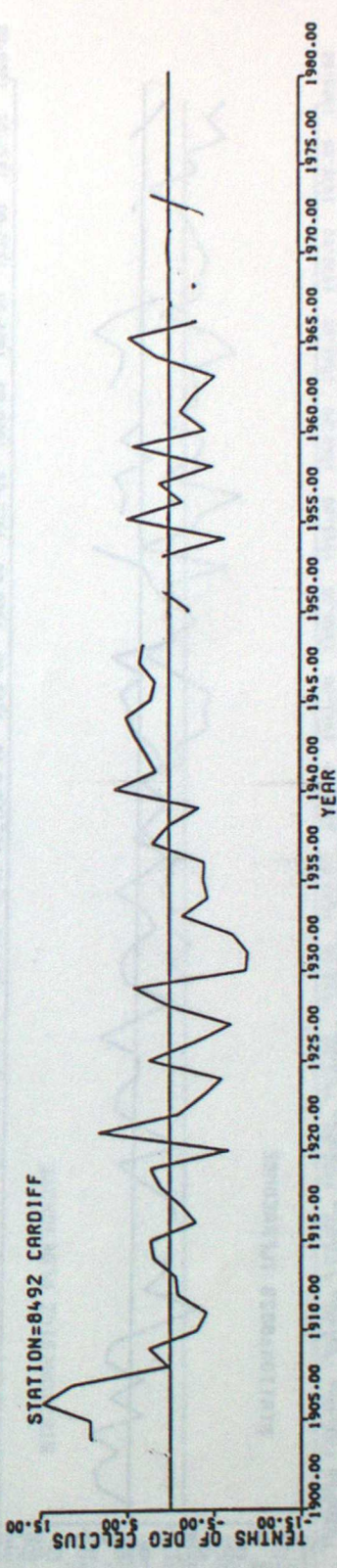
STATION=7511 VALLEY



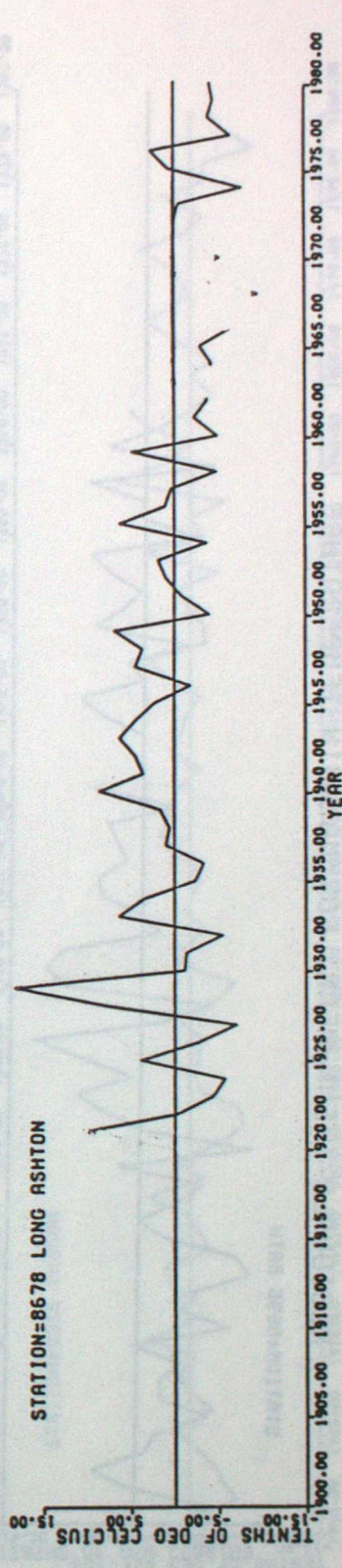
STATION=7798 LLANDUDNO



STATION=8492 CARDIFF

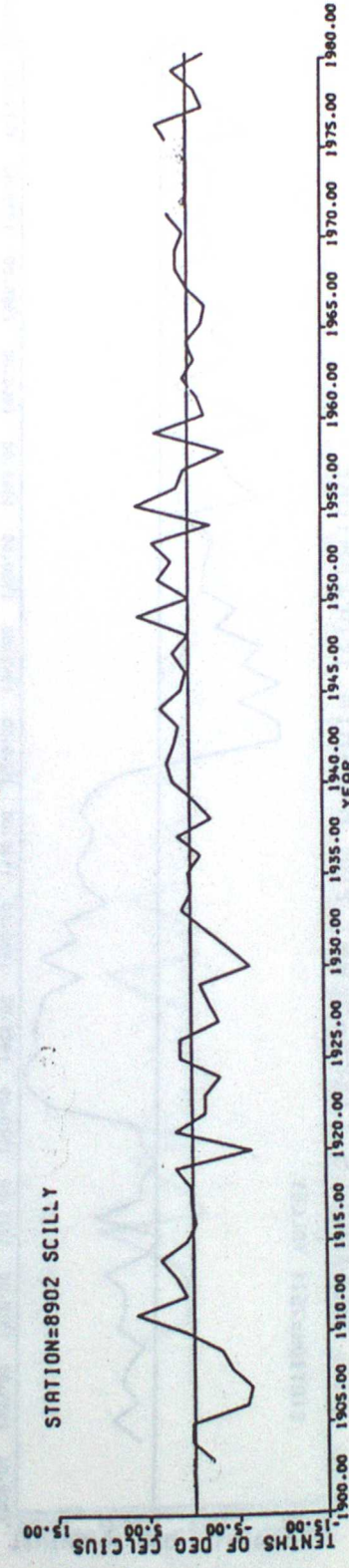
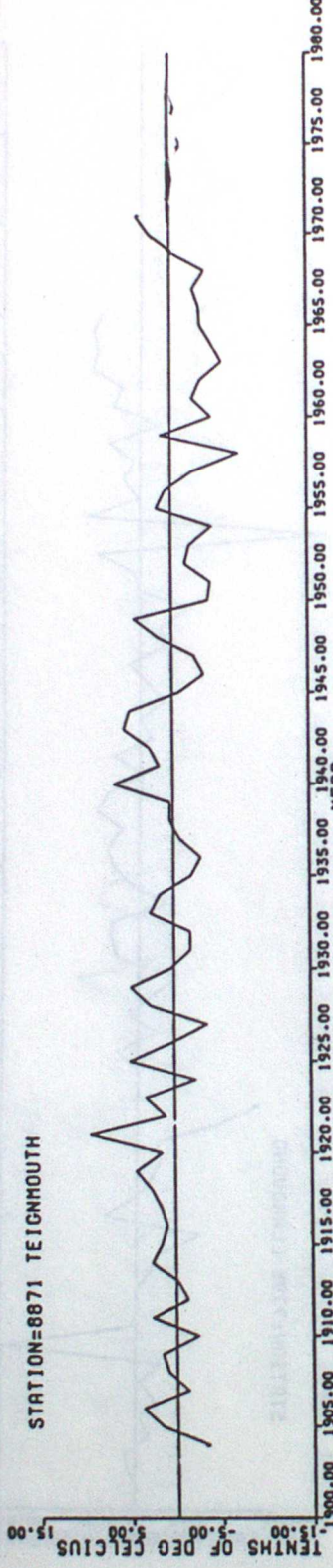
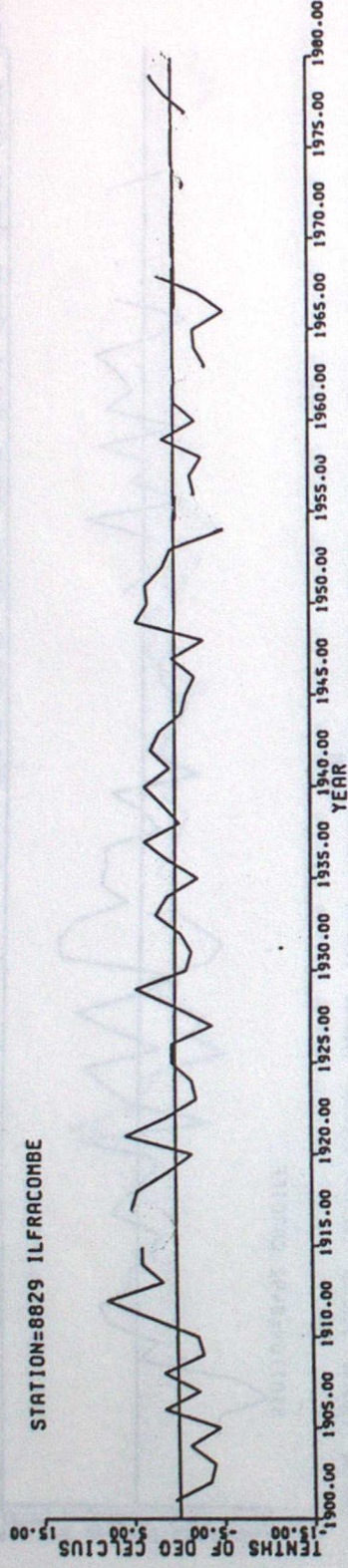
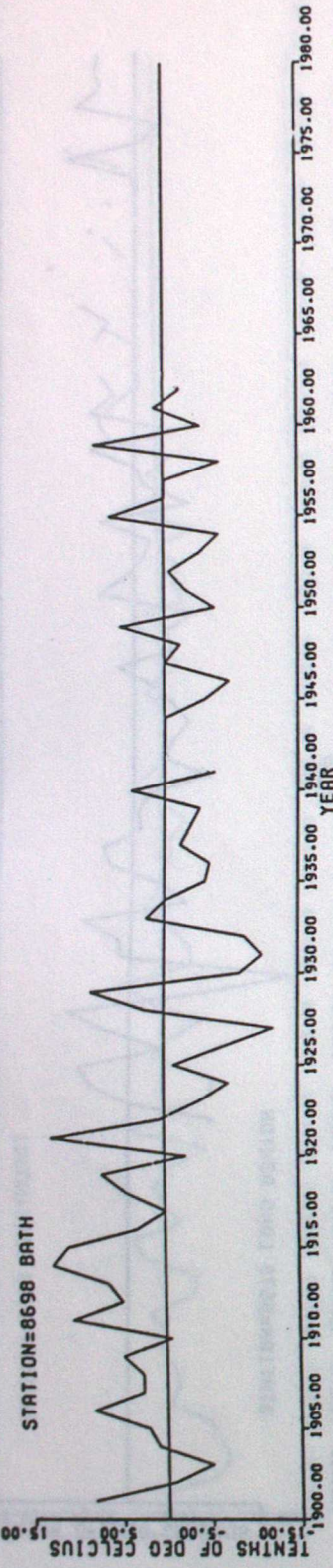


STATION=8678 LONG ASHTON

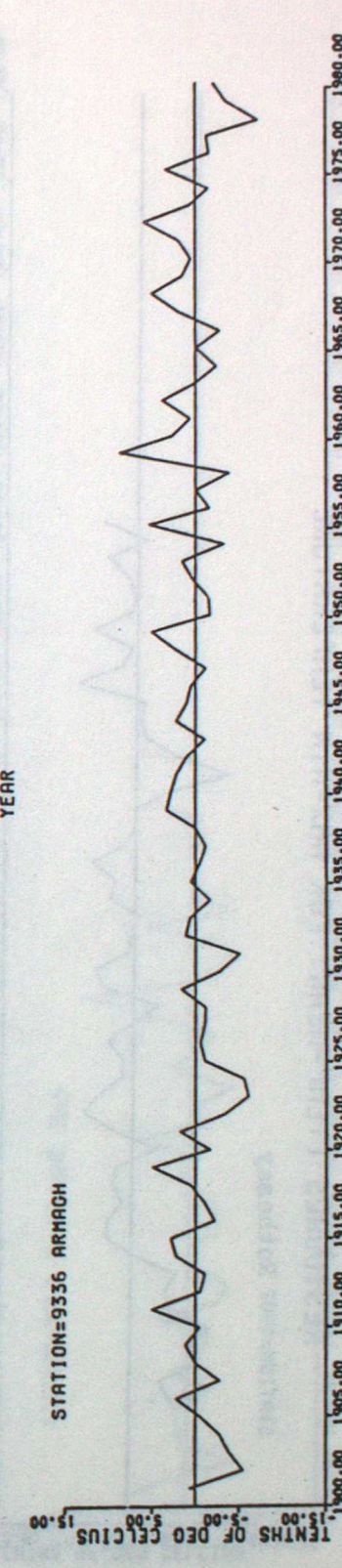
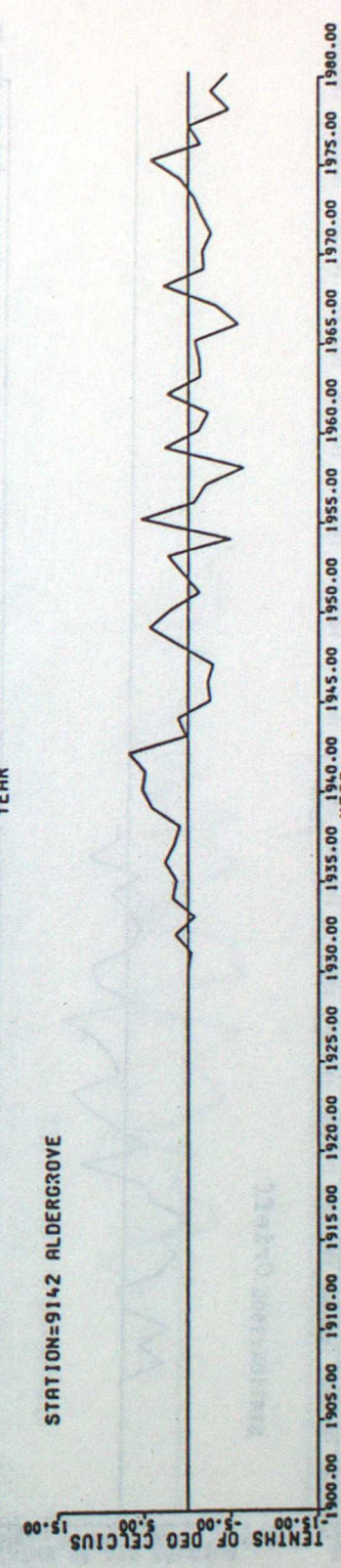
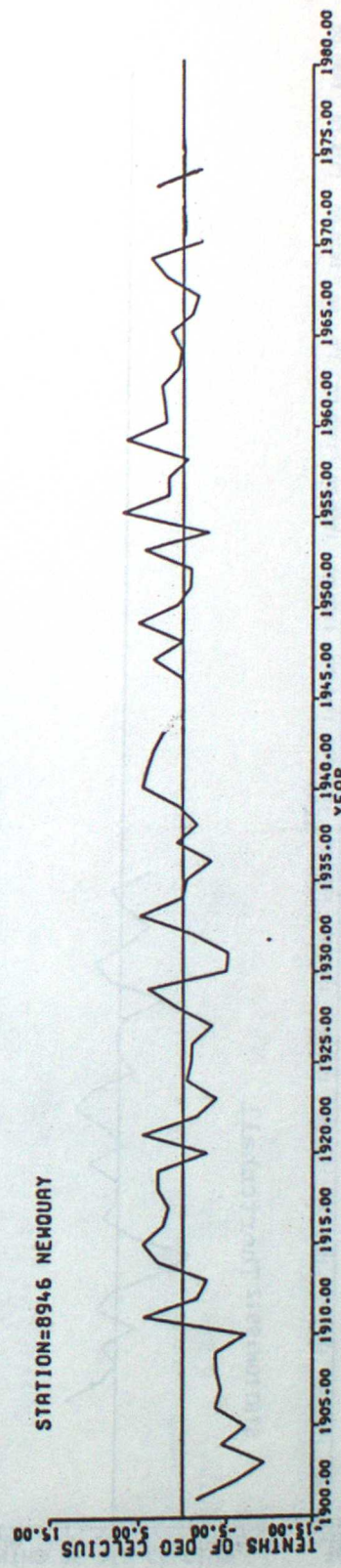
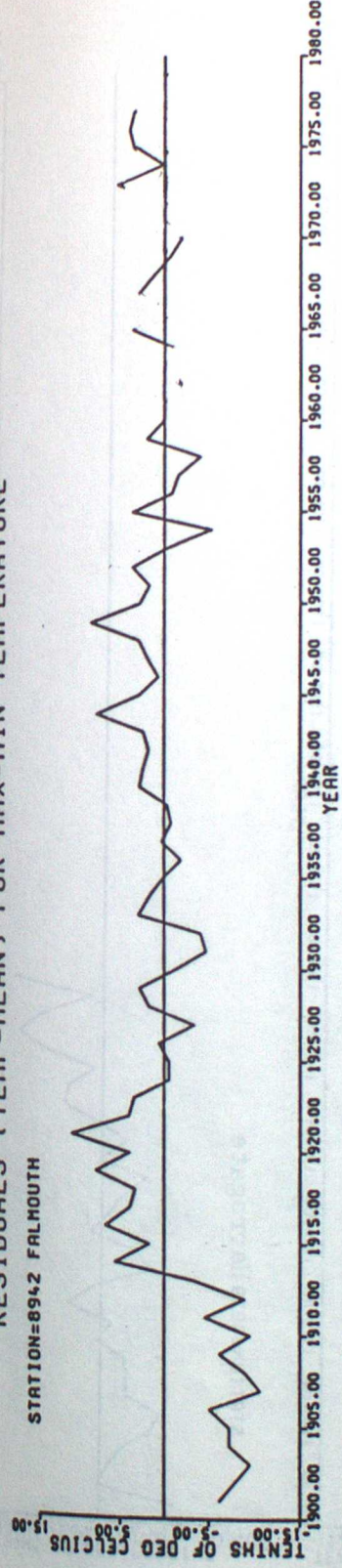




# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



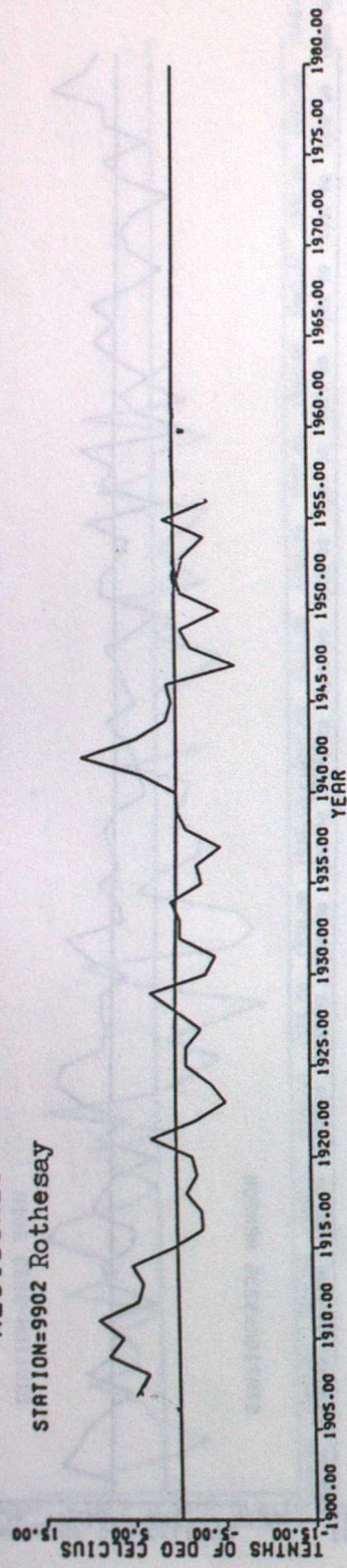
# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE



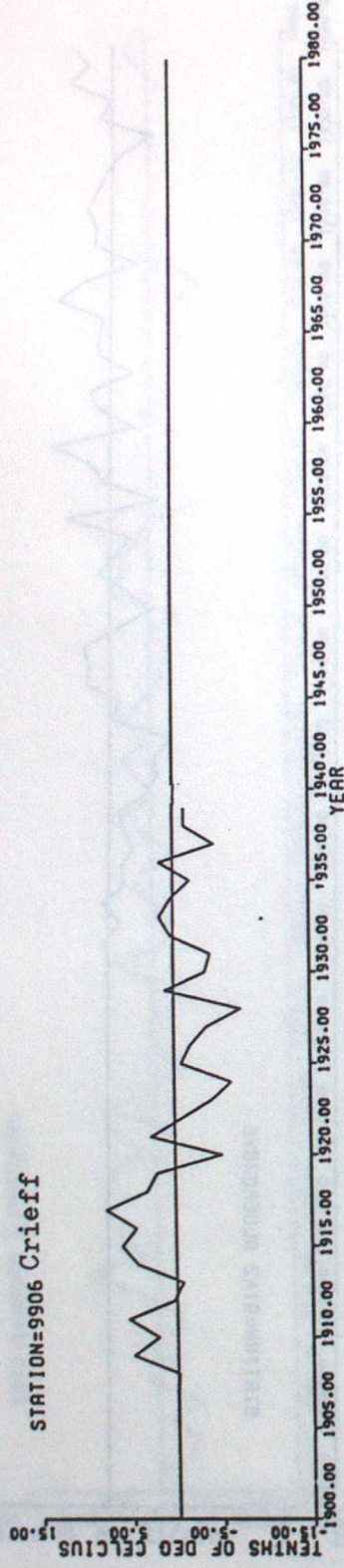


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

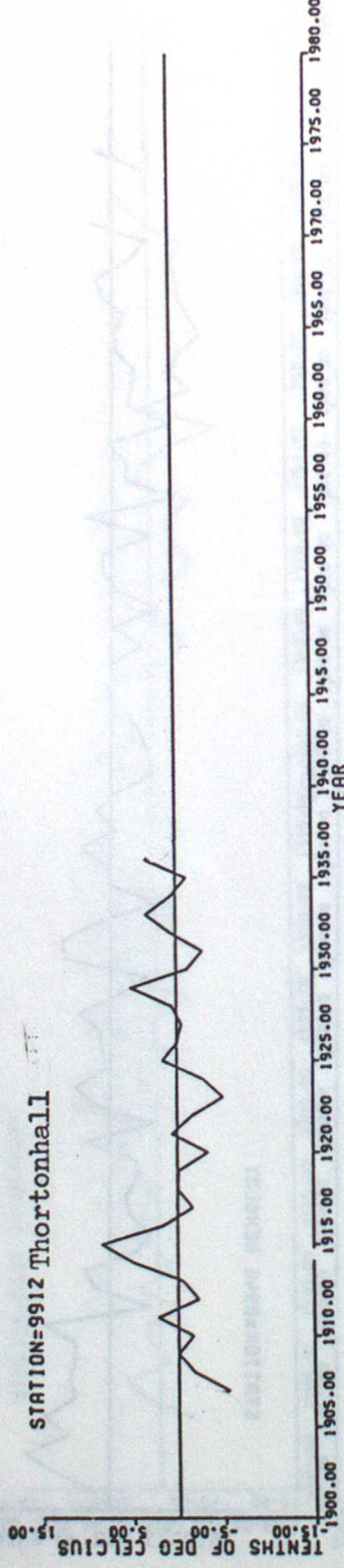
STATION=9902 Rothesay



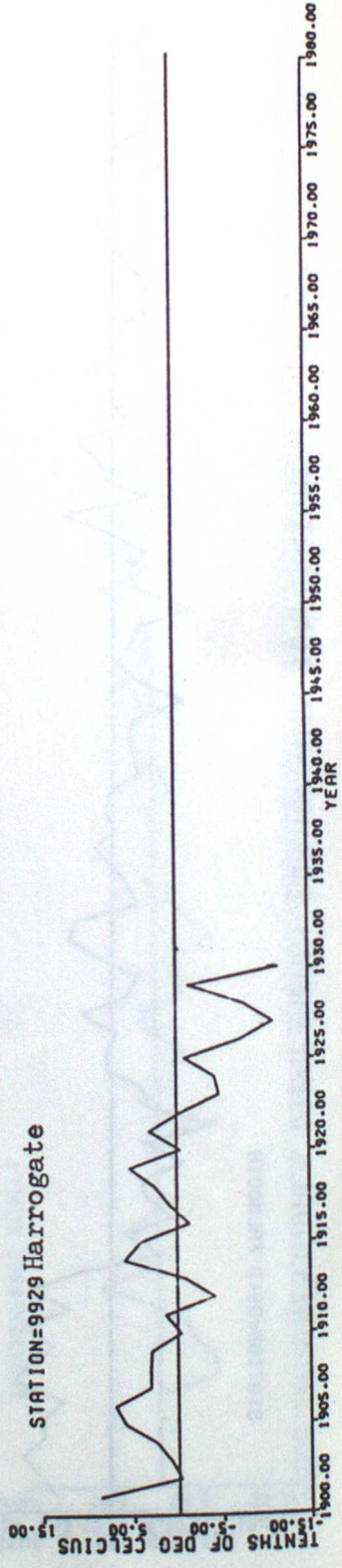
STATION=9906 Crieff



STATION=9912 Thortonhall

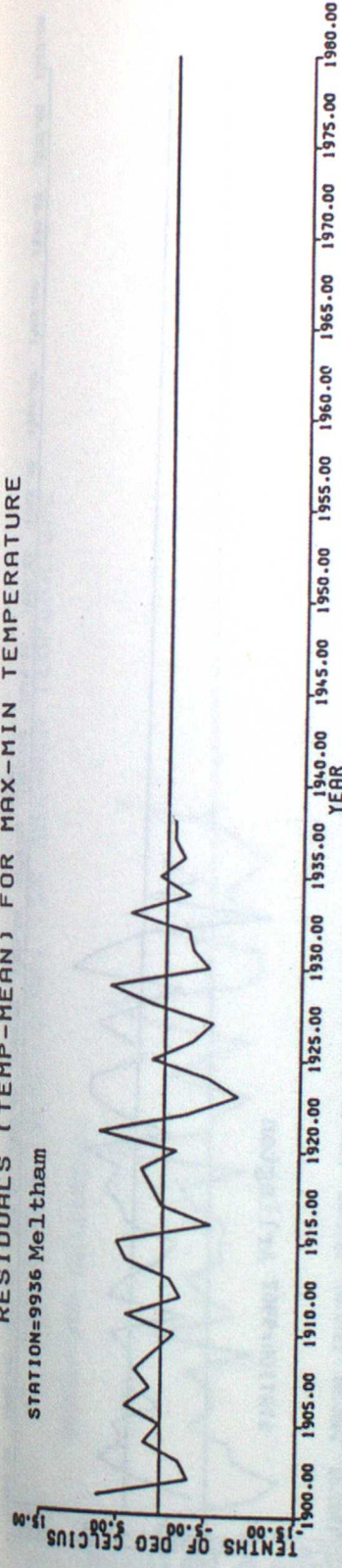


STATION=9929 Harrogate

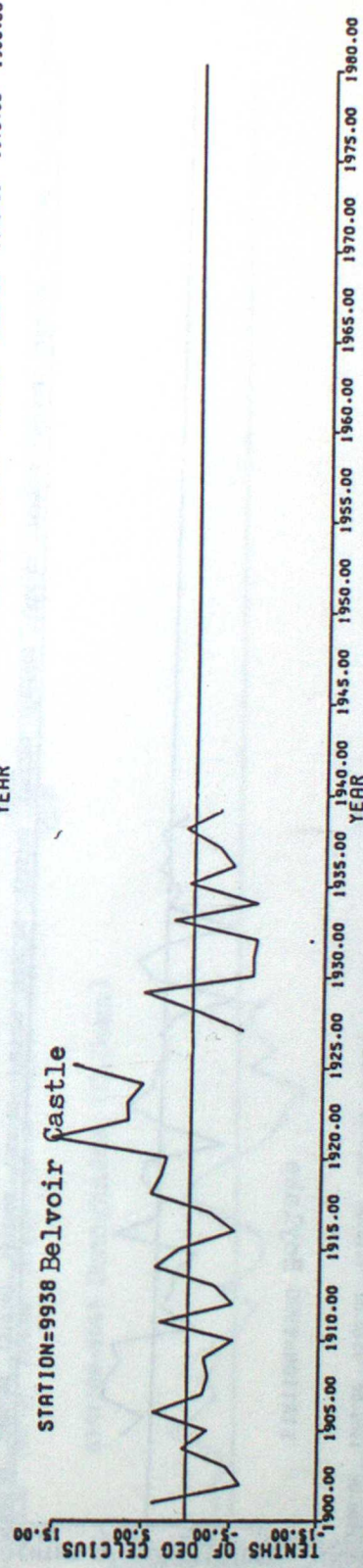


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

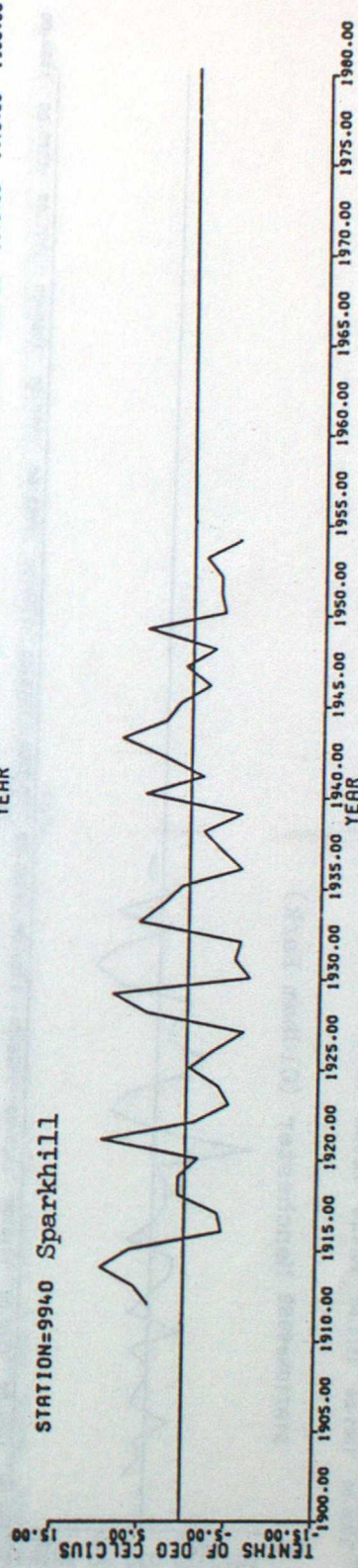
STATION=9936 Meltham



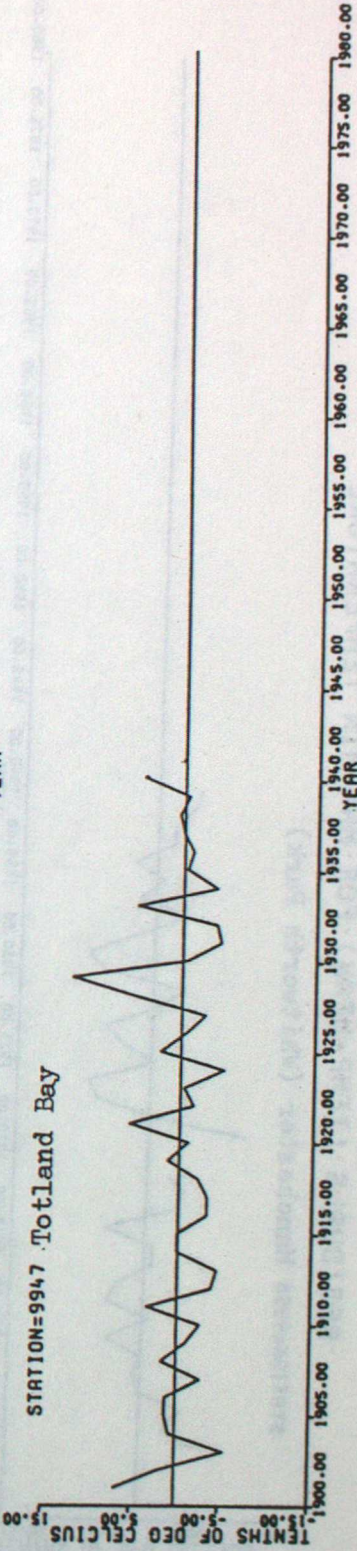
STATION=9938 Belvoir Castle



STATION=9940 Sparkhill



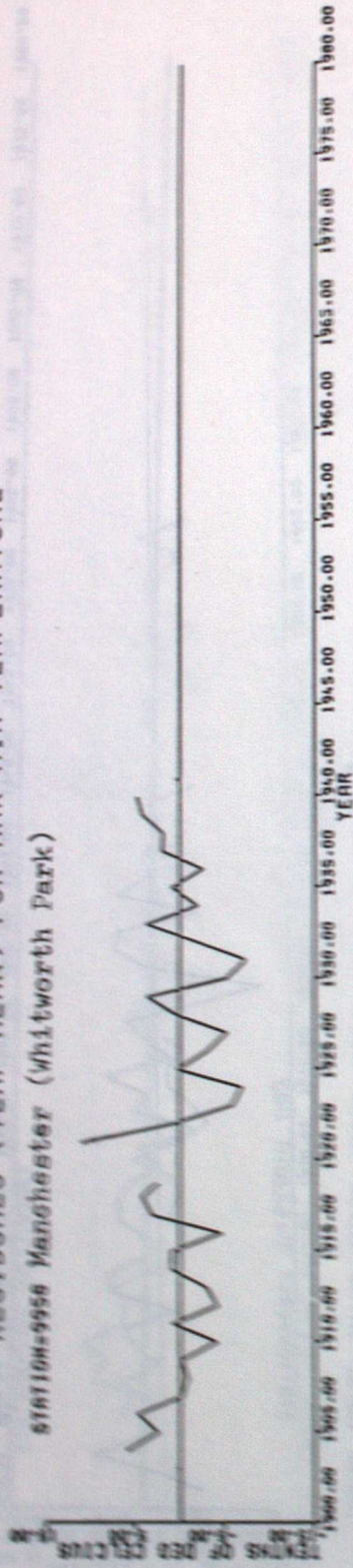
STATION=9947 Totland Bay



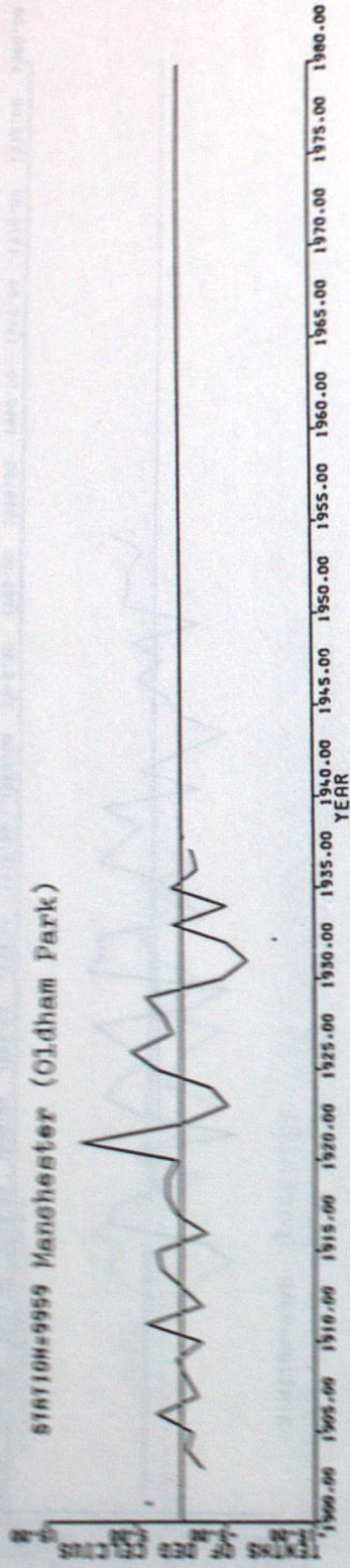


# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

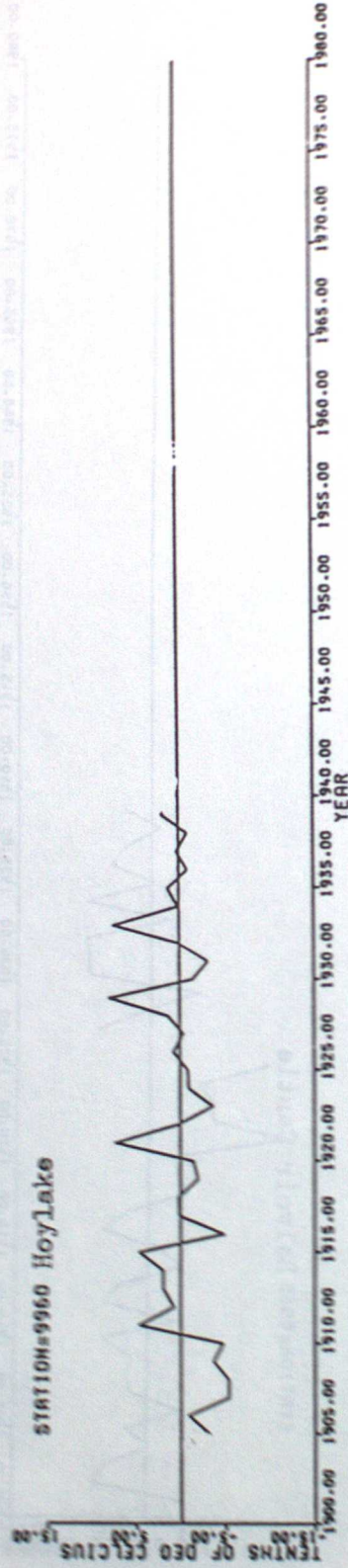
STATION=9958 Manchester (Whitworth Park)



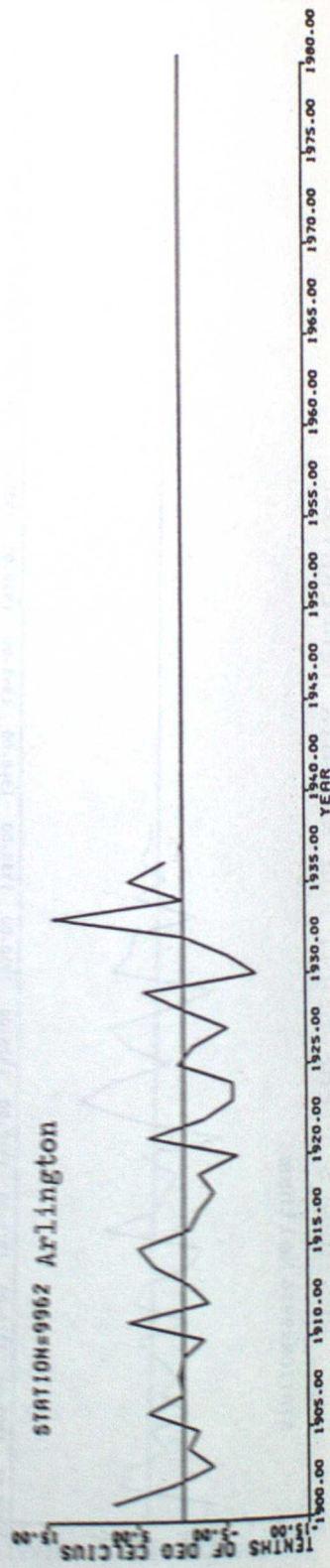
STATION=9959 Manchester (Oldham Park)



STATION=9960 Hoylake

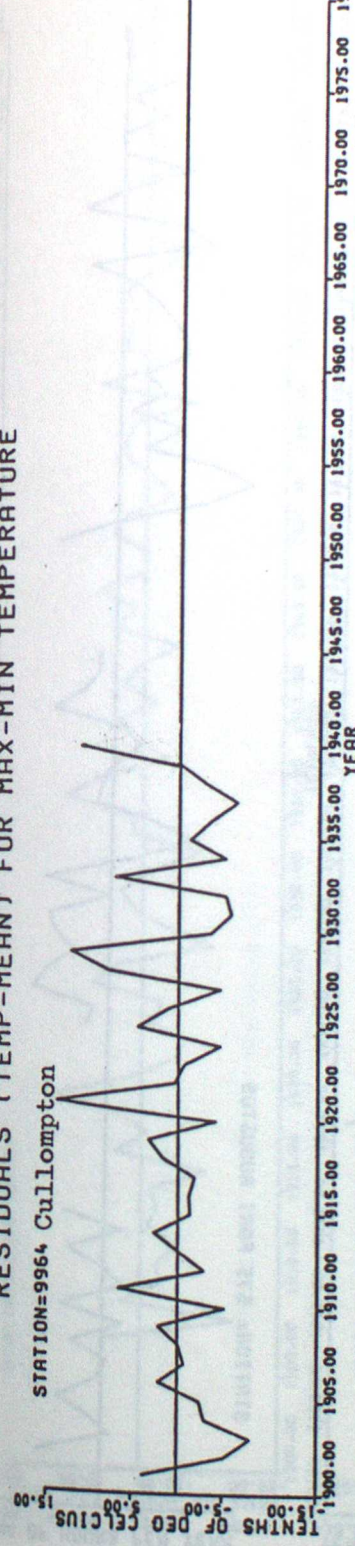


STATION=9962 Arlington



# RESIDUALS (TEMP-MEAN) FOR MAX-MIN TEMPERATURE

STATION=9964 Cullompton



STATION=9969 Donaghadee (C.Down)

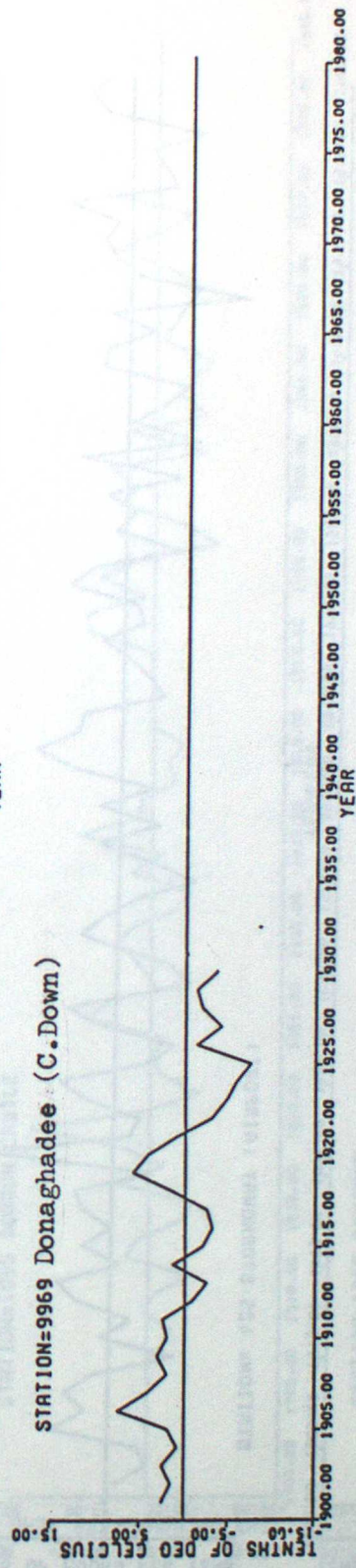
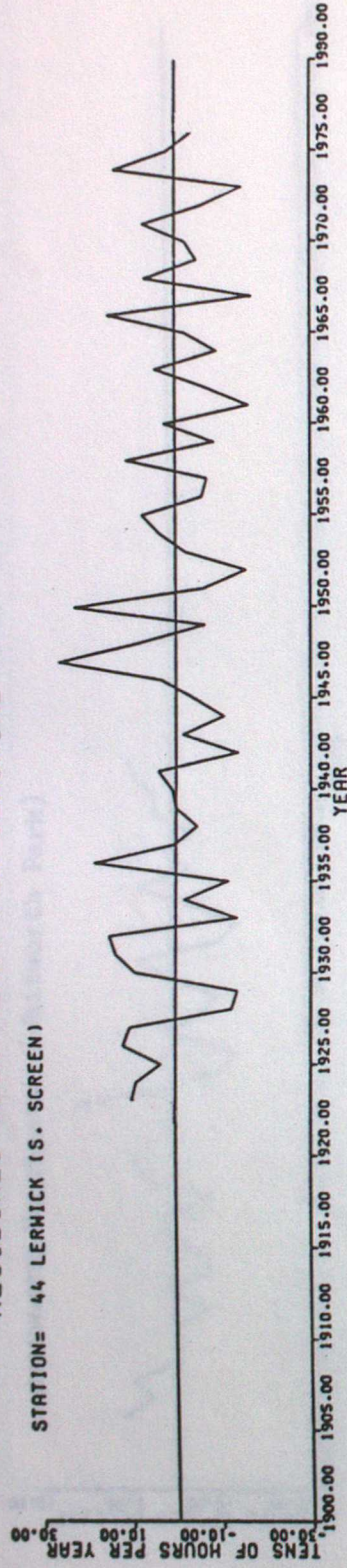




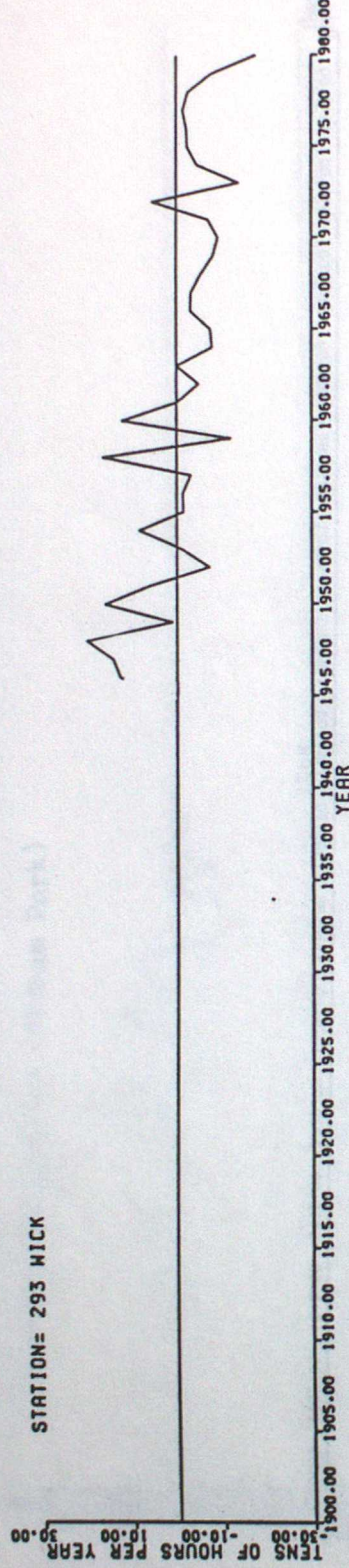
Figure 2

# RESIDUALS (SUN-MEAN) FOR SUNSHINE

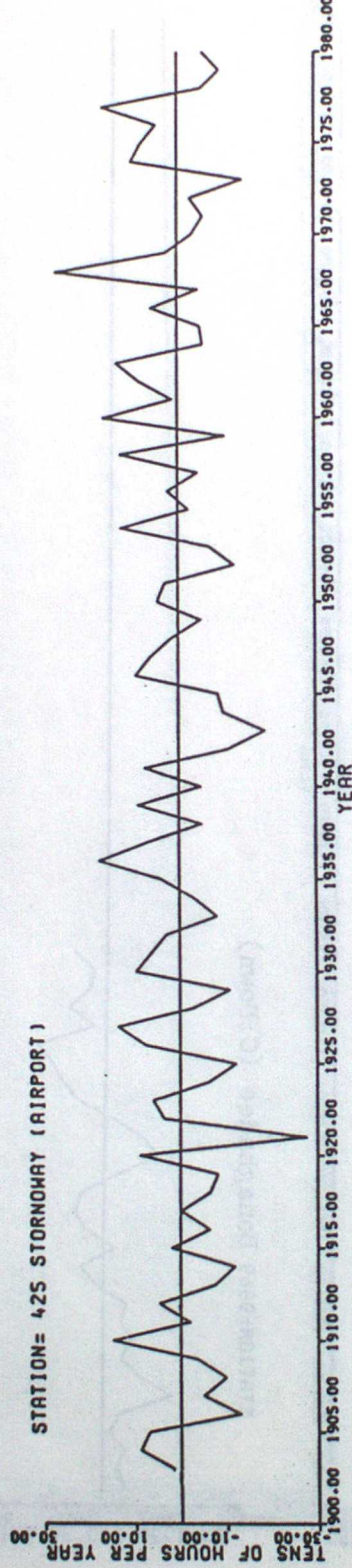
STATION= 44 LERWICK (S. SCREEN)



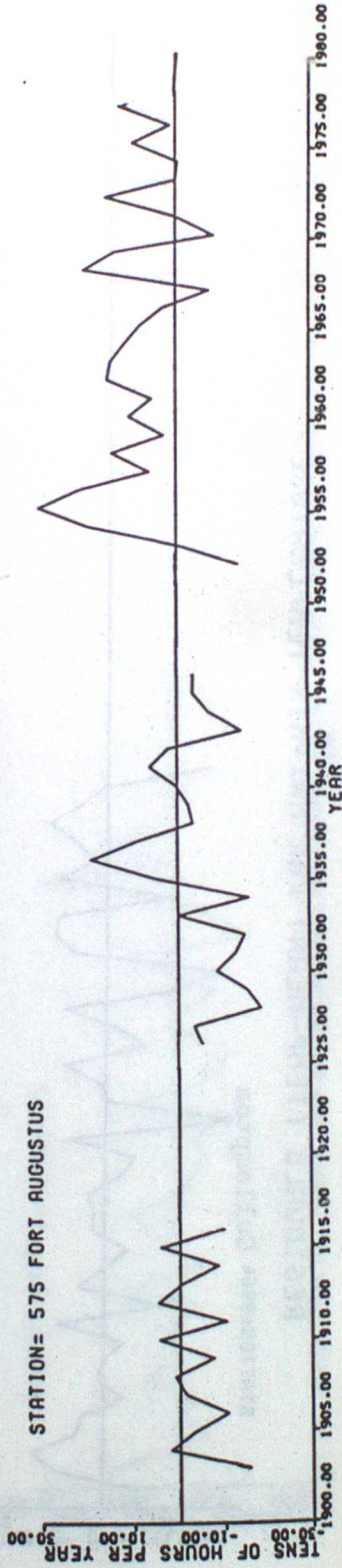
STATION= 293 WICK



STATION= 425 STORNOWAY (AIRPORT)

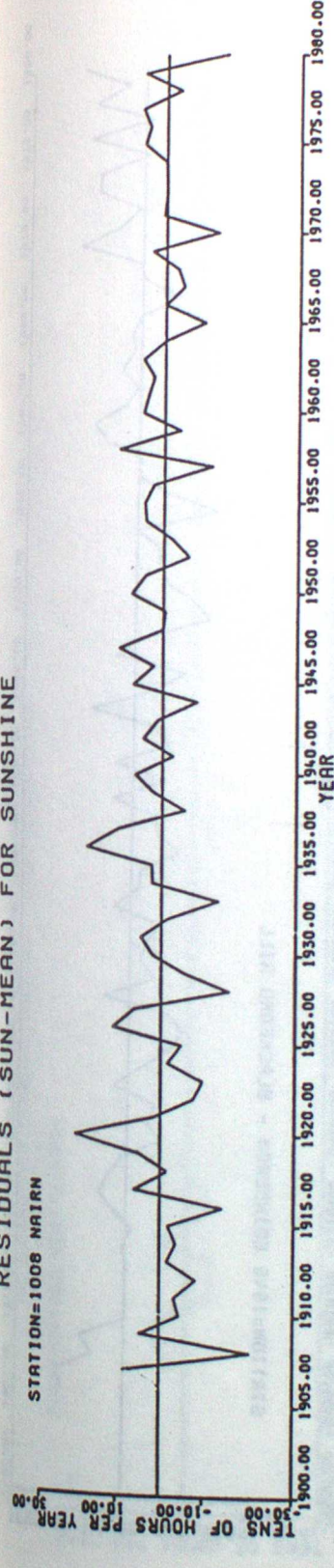


STATION= 575 FORT AUGUSTUS

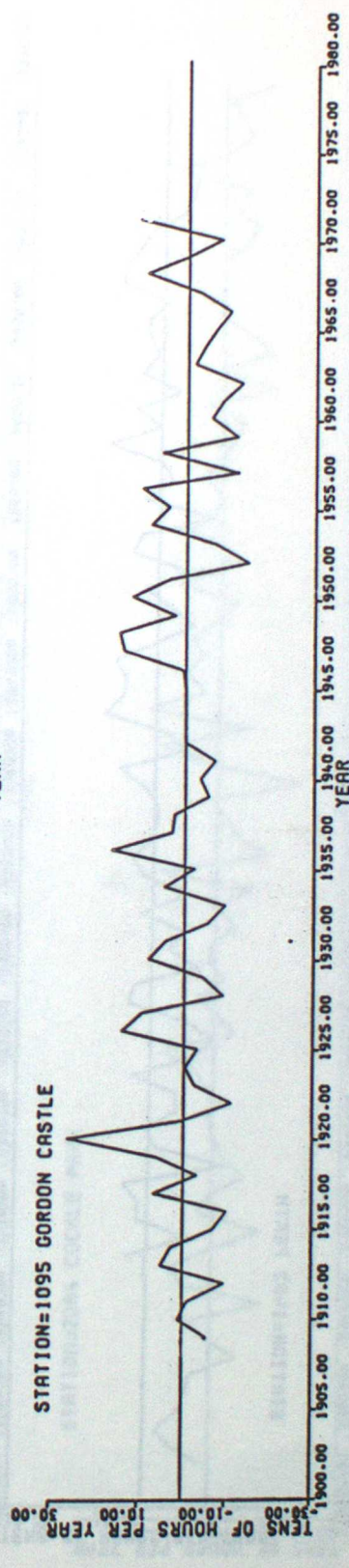


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

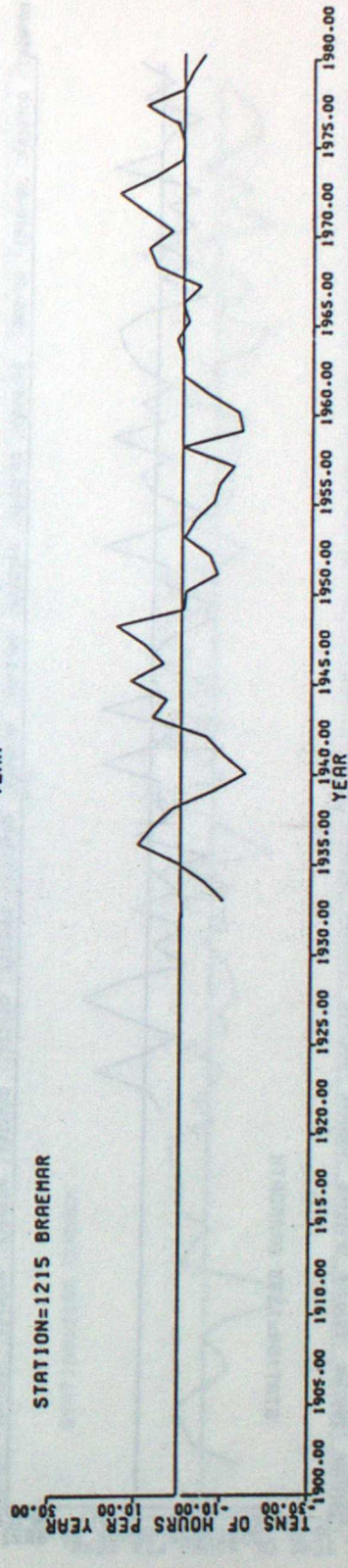
STATION=1008 NAIRN



STATION=1095 GORDON CASTLE



STATION=1215 BRAEMAR

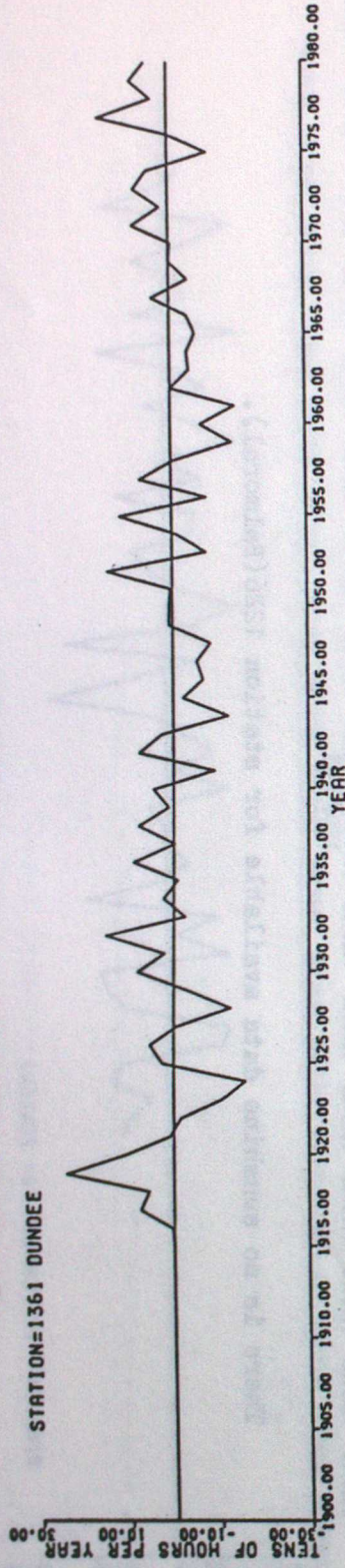


There is no sunshine data available for station 1226(Balmoral).

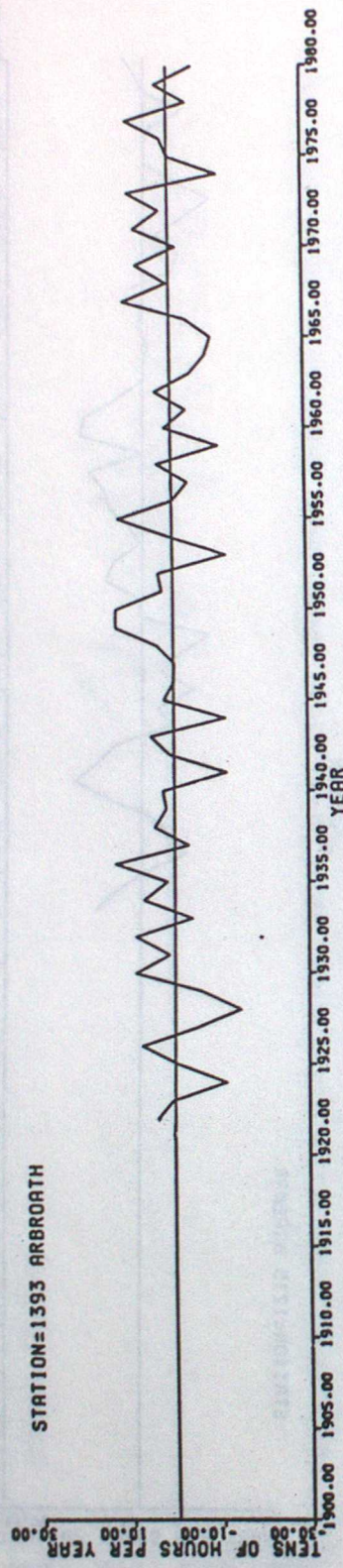


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

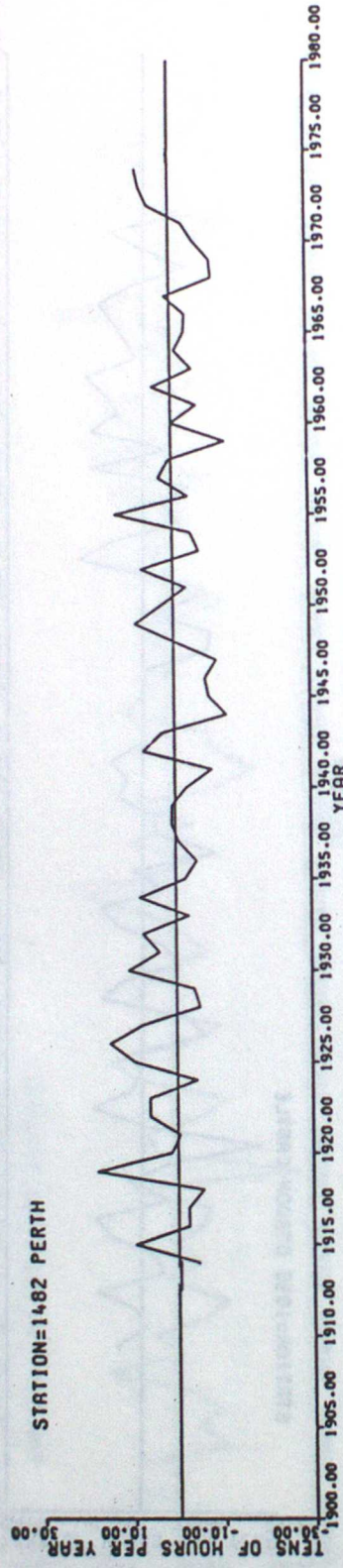
STATION=1361 DUNDEE



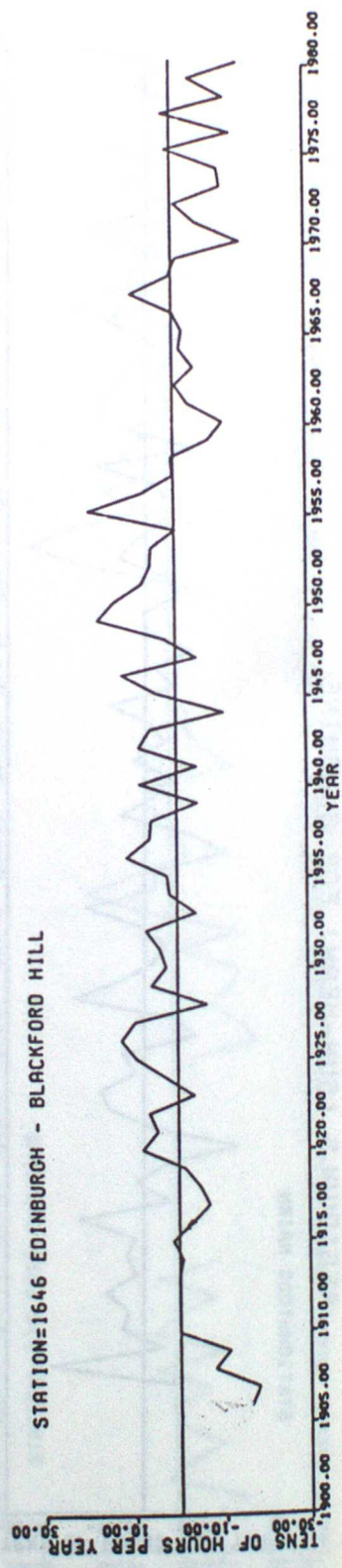
STATION=1393 ARBROATH



STATION=1482 PERTH

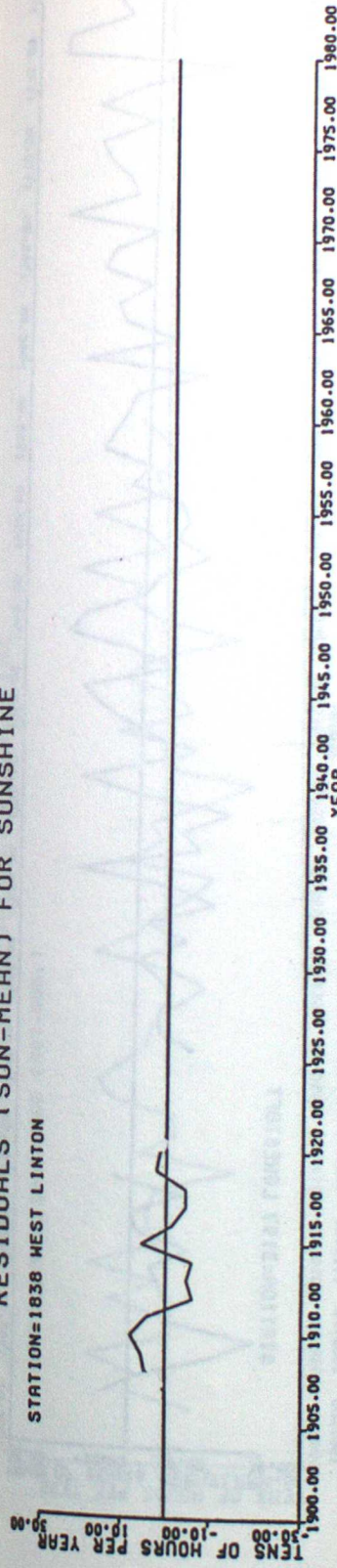


STATION=1646 EDINBURGH - BLACKFORD HILL

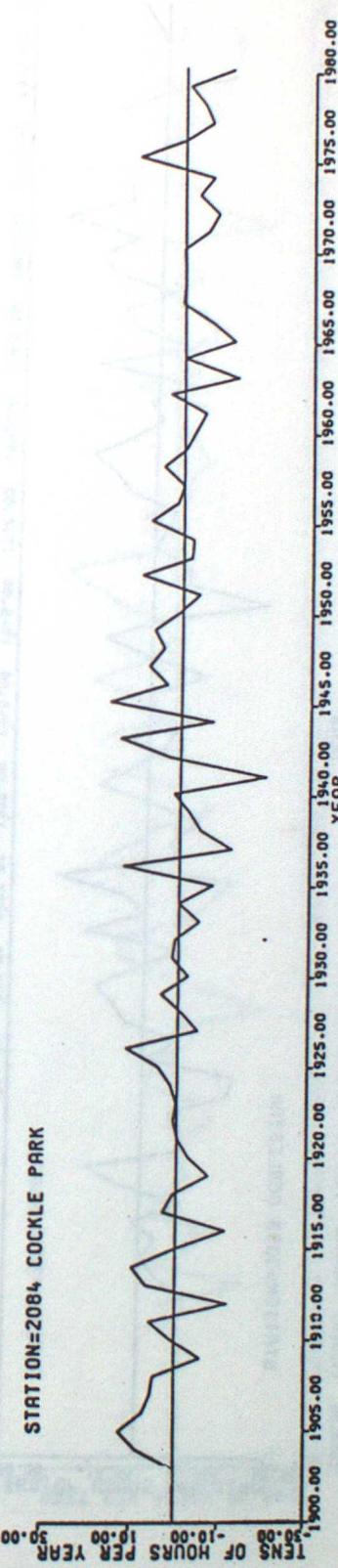


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

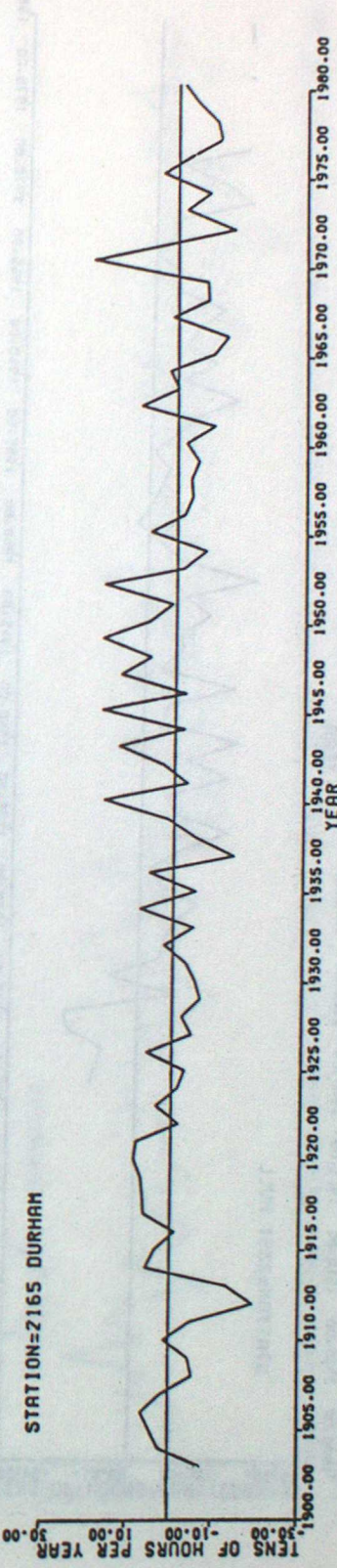
STATION=1838 WEST LINTON



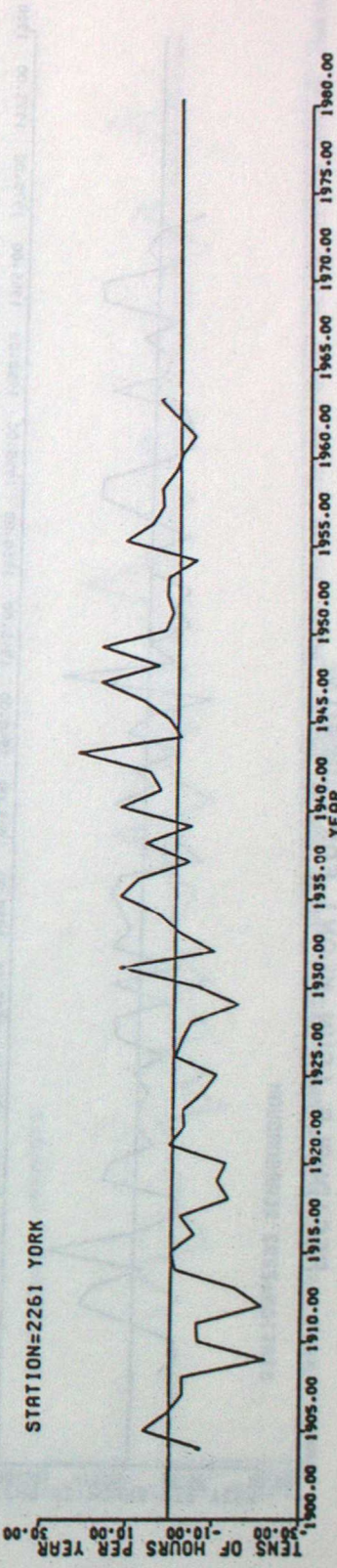
STATION=2084 COCKLE PARK



STATION=2165 DURHAM



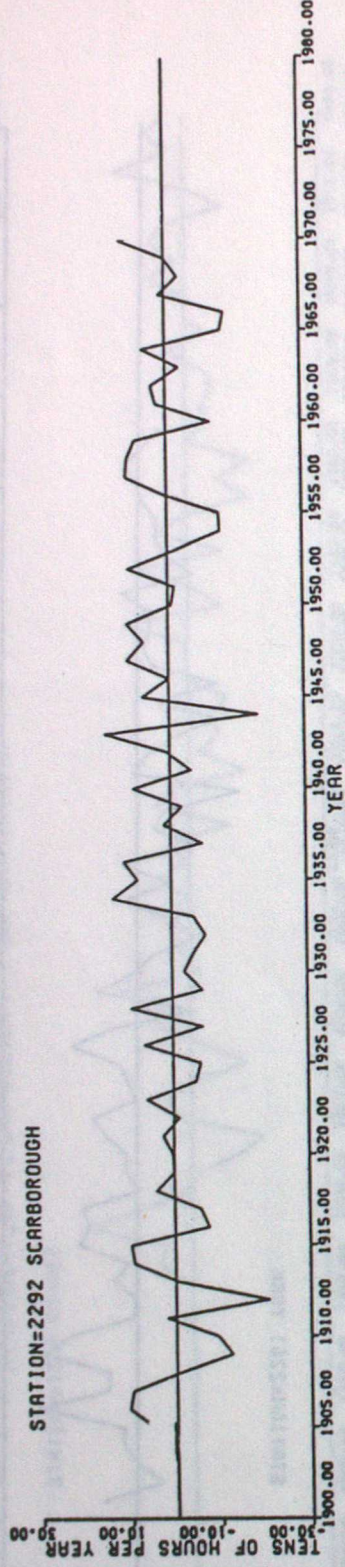
STATION=2261 YORK



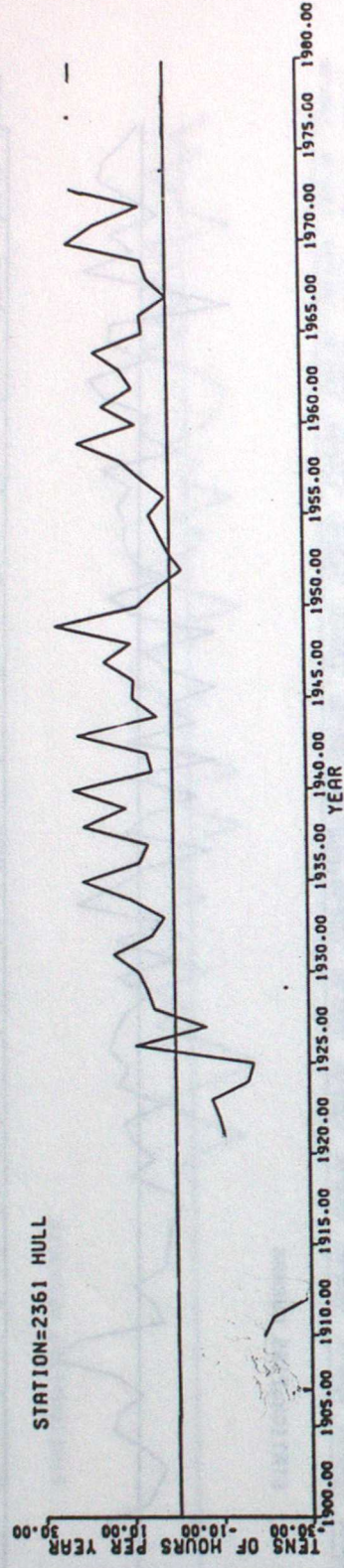


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

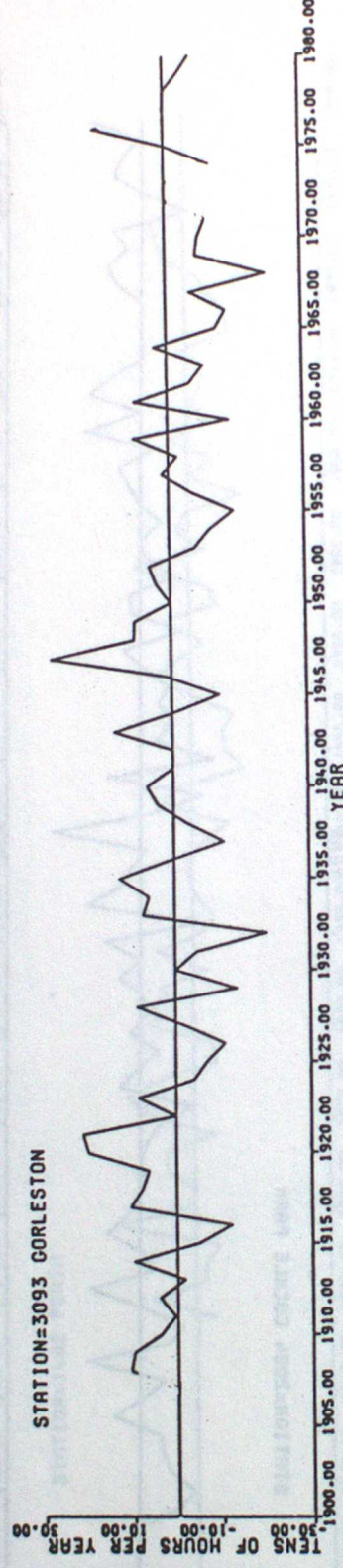
STATION=2292 SCARBOROUGH



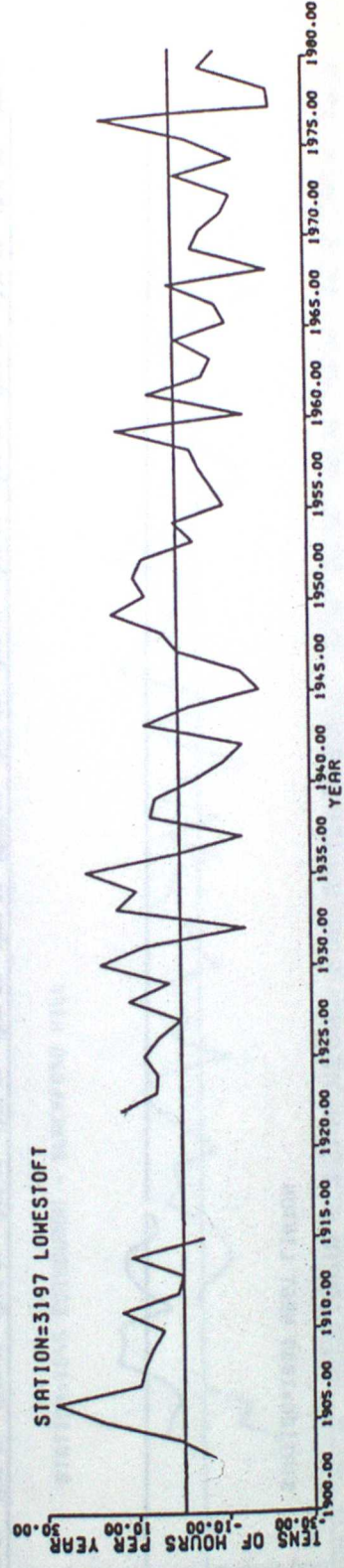
STATION=2361 HULL



STATION=3093 CORLESTON

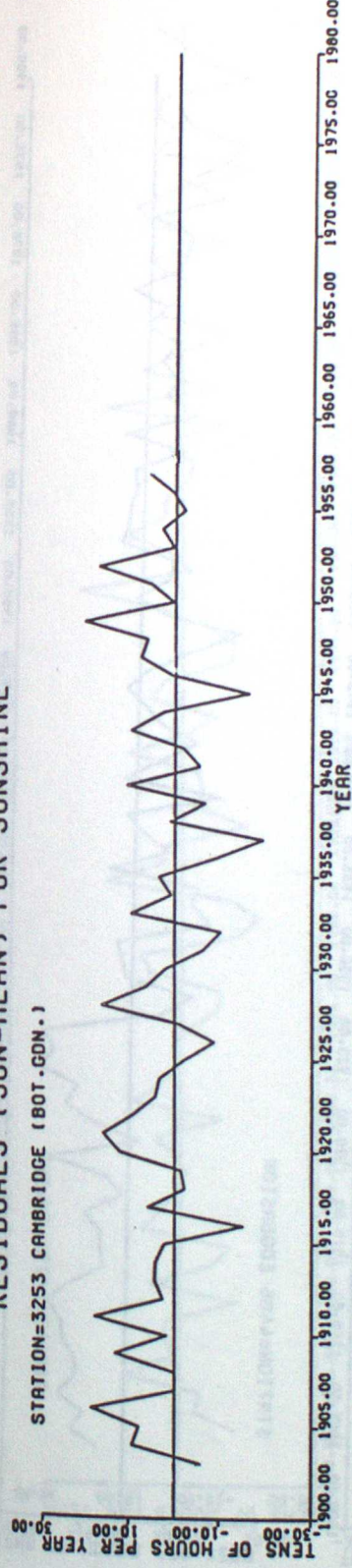


STATION=3197 LOWESTOFT

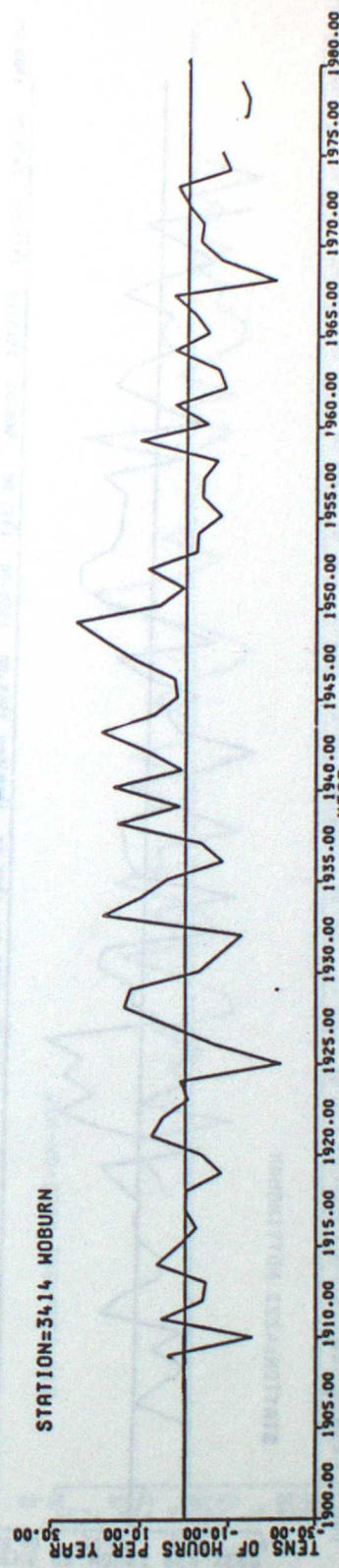


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

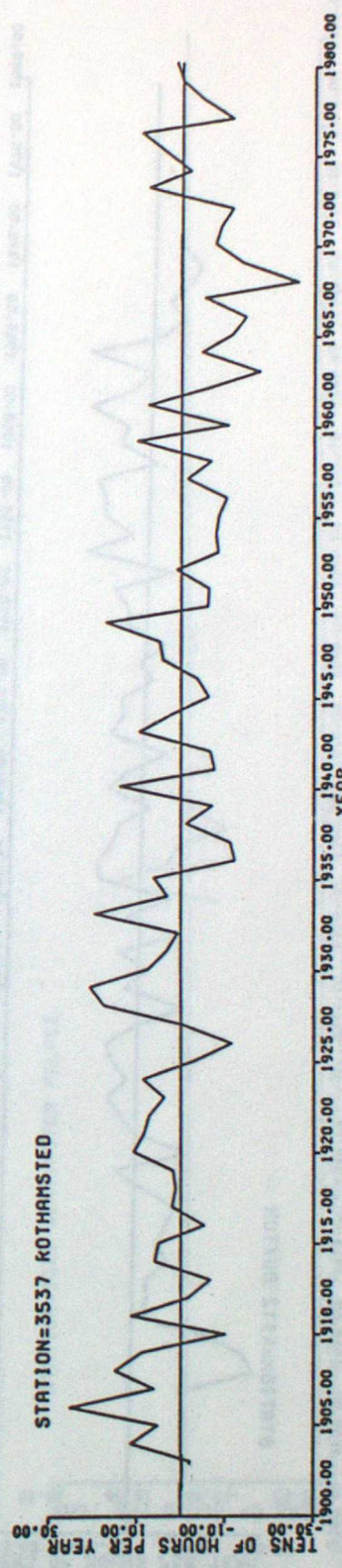
STATION=3253 CAMBRIDGE (BOT.GDN.)



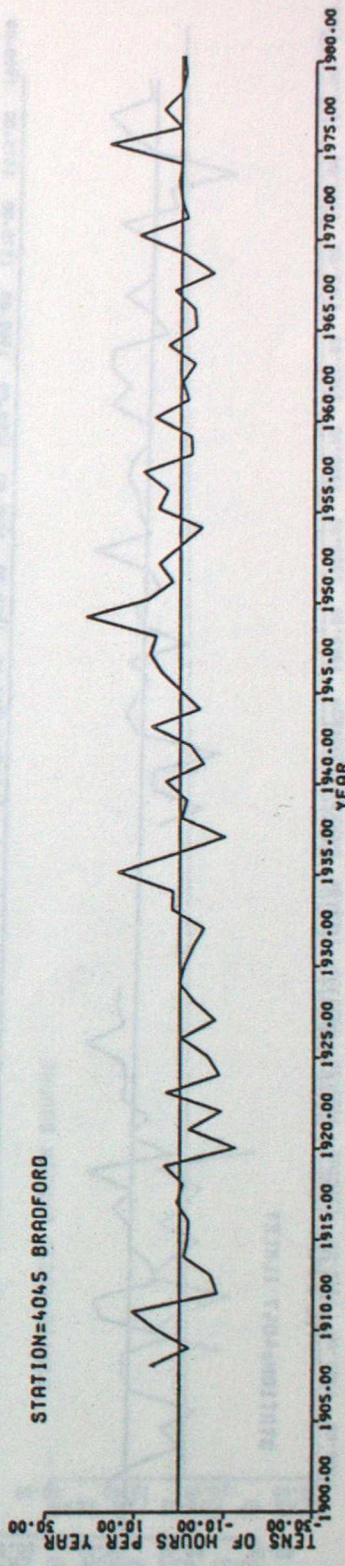
STATION=3414 HOBURN



STATION=3537 ROTHAMSTED



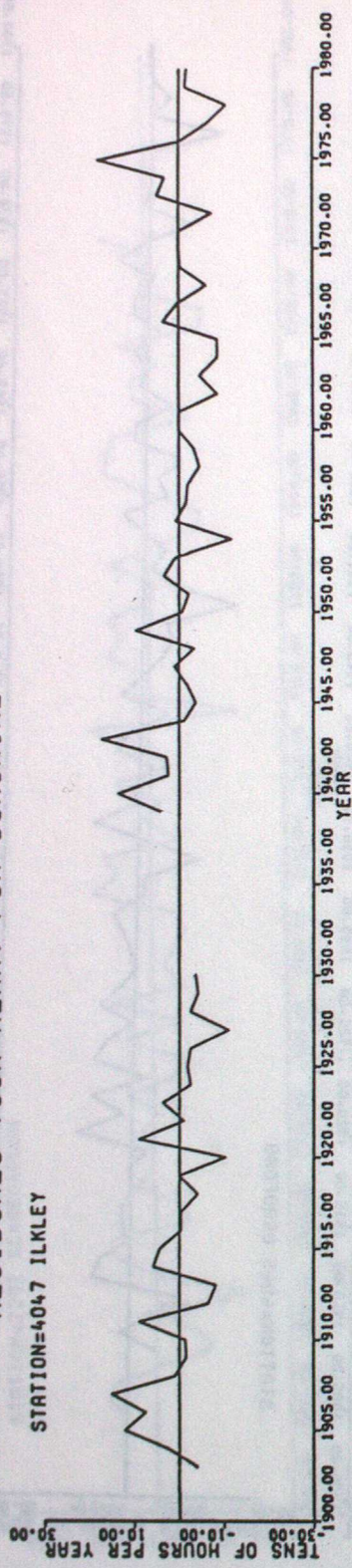
STATION=4045 BRADFORD



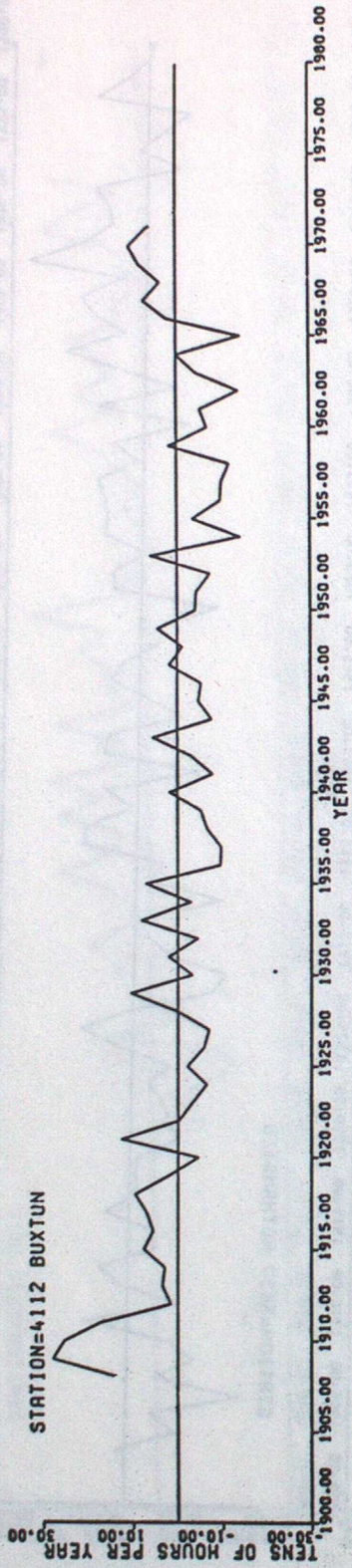


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

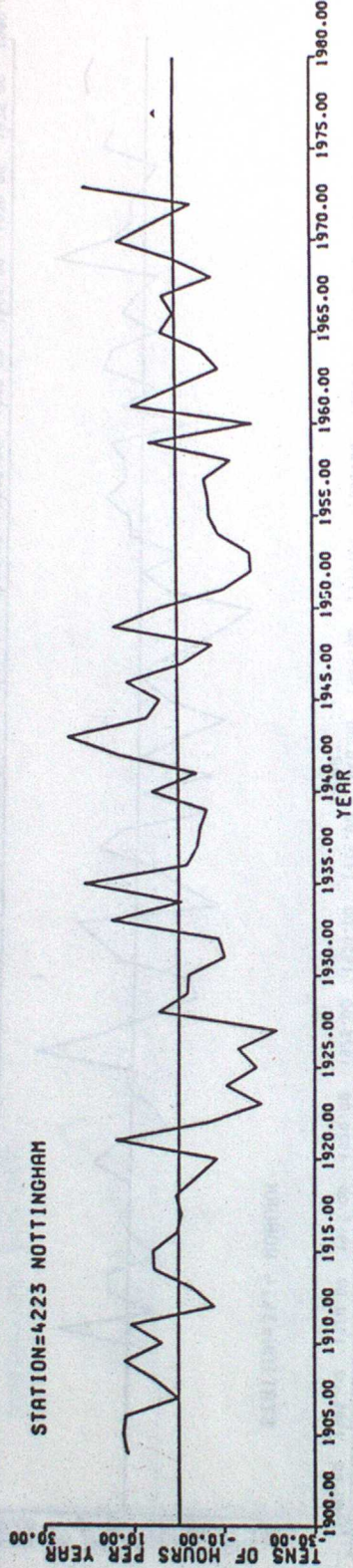
STATION=4047 ILKLEY



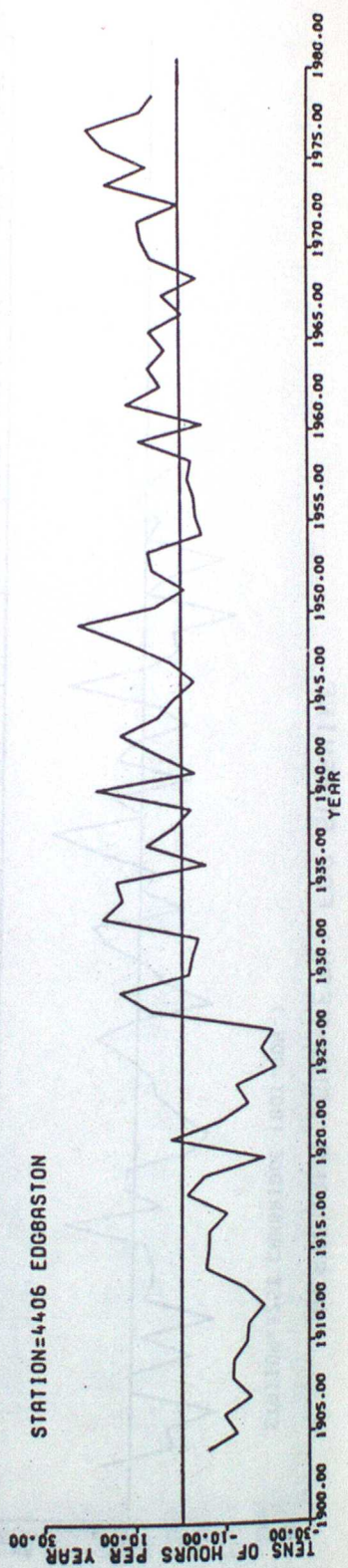
STATION=4112 BUXTON



STATION=4223 NOTTINGHAM

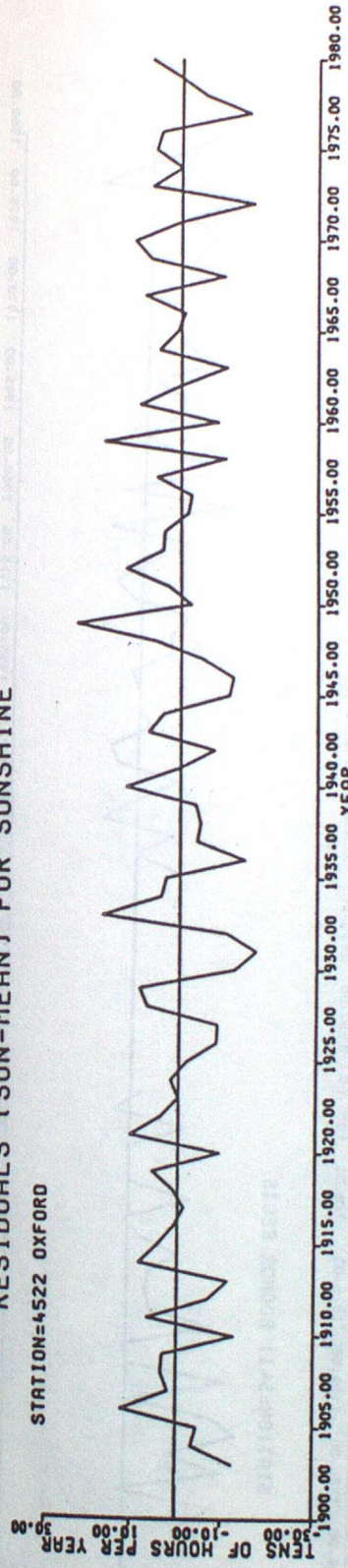


STATION=4406 EDGBASTON

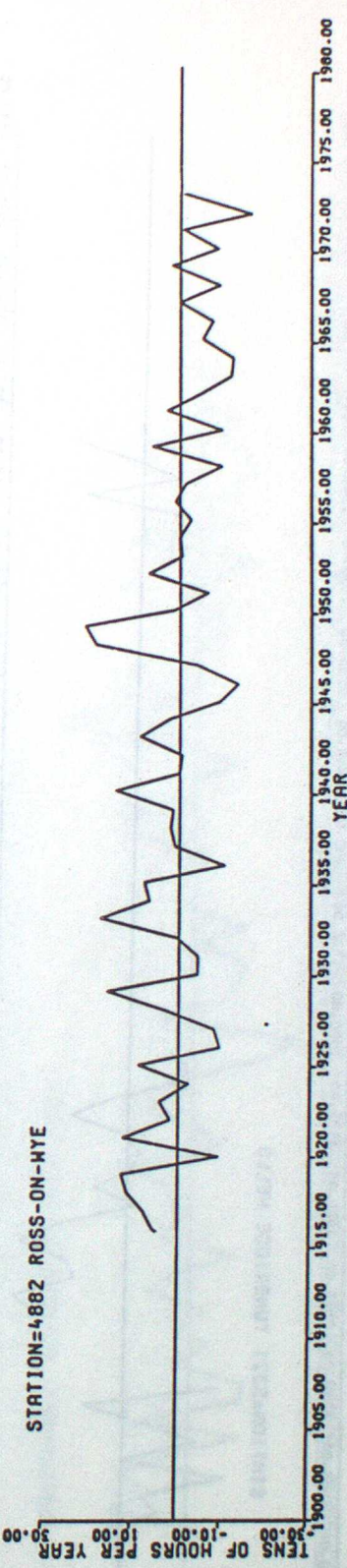


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

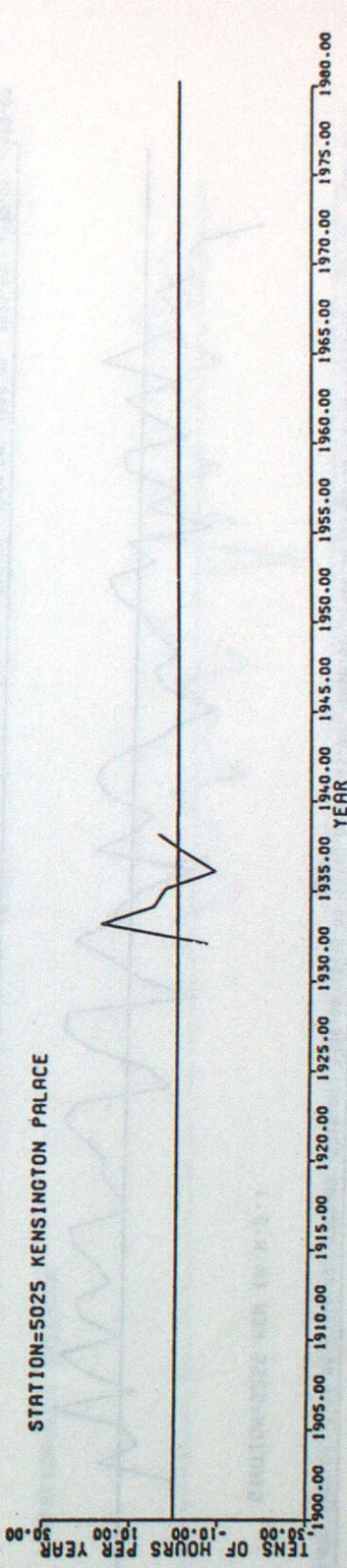
STATION=4522 OXFORD



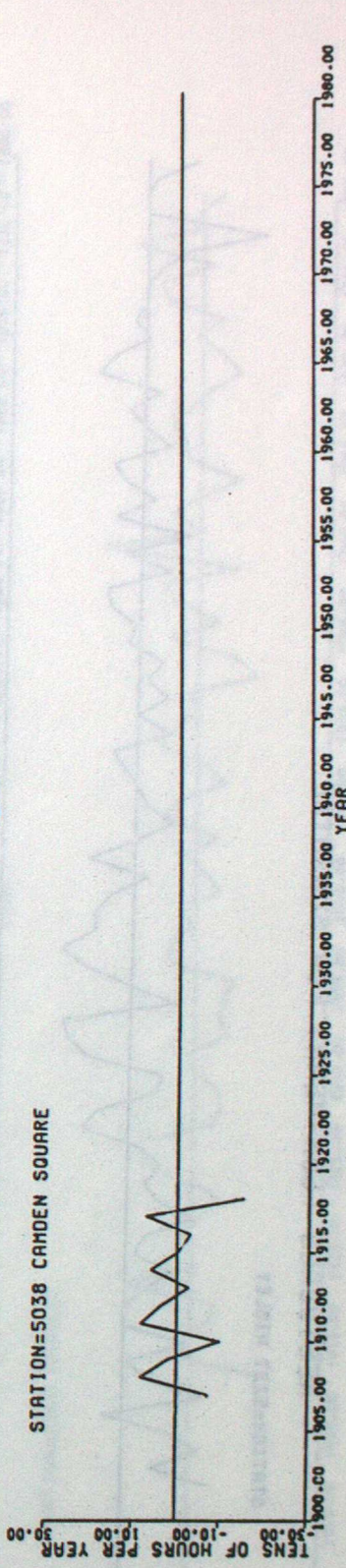
STATION=4882 ROSS-ON-WYE



STATION=5025 KENSINGTON PALACE



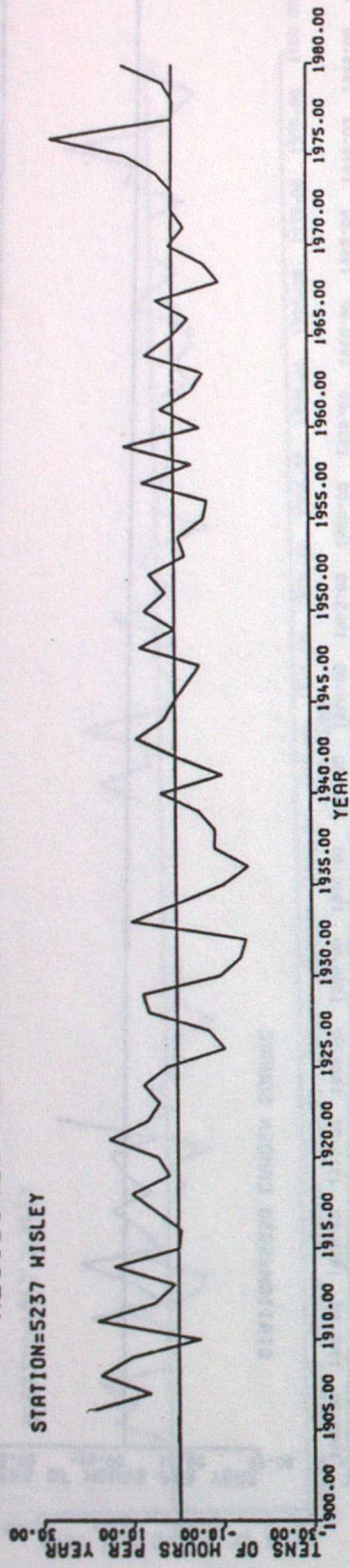
STATION=5038 CAMDEN SQUARE



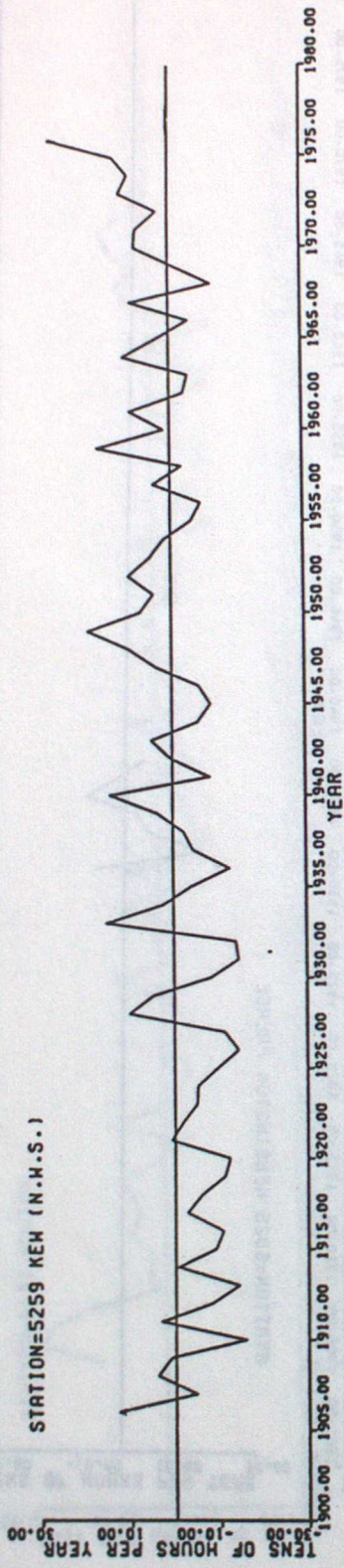


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

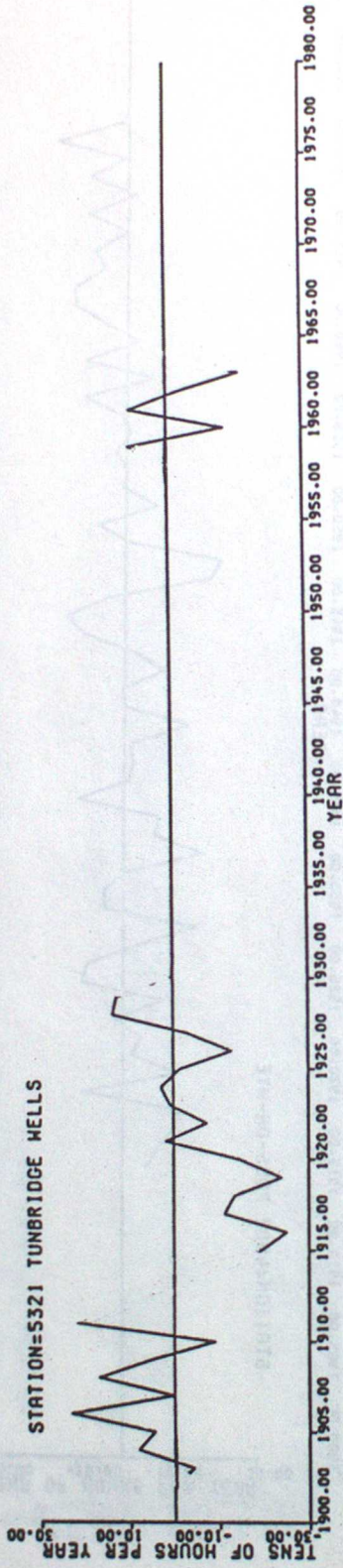
STATION=5237 WISLEY



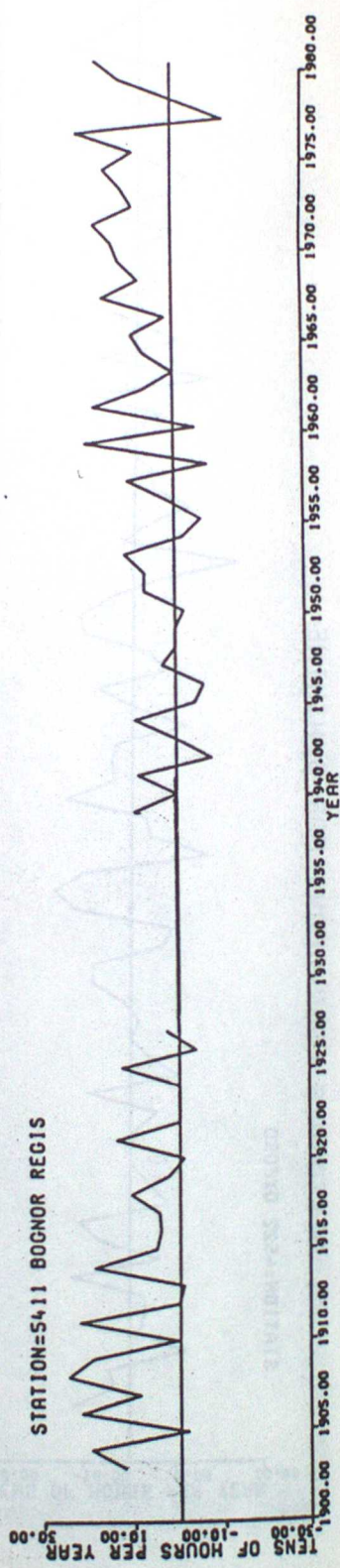
STATION=5259 KEW (N.H.S.)



STATION=5321 TUNBRIDGE WELLS

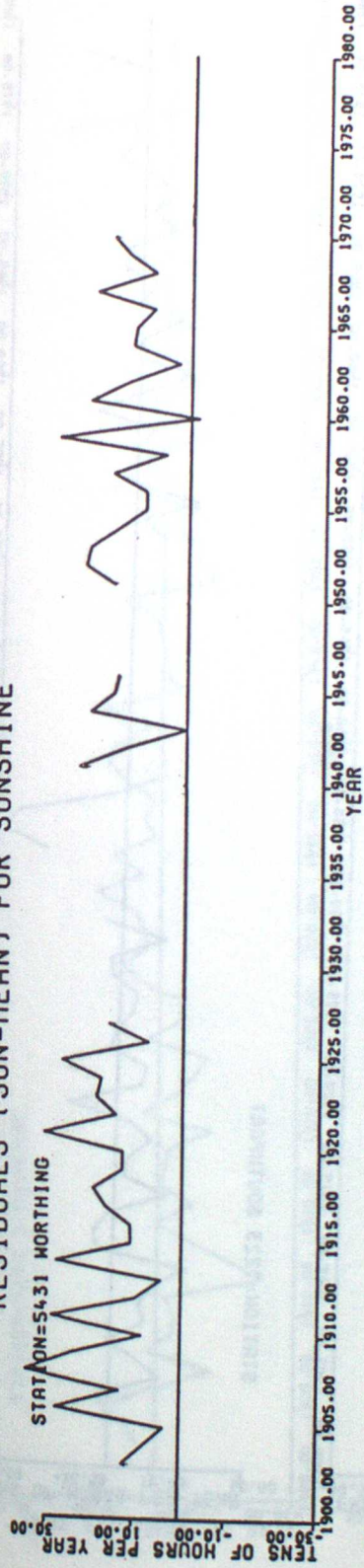


STATION=5411 BOGNOR REGIS

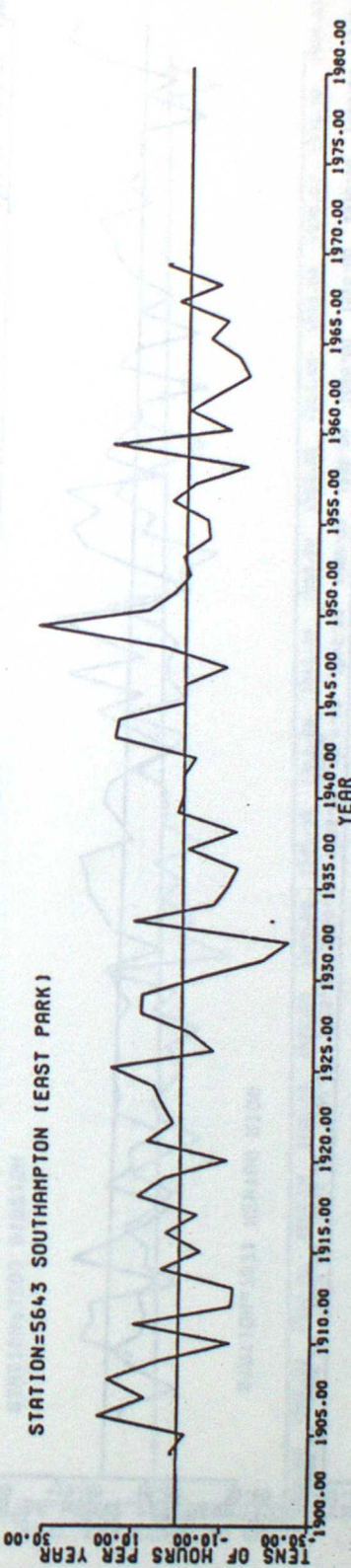


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

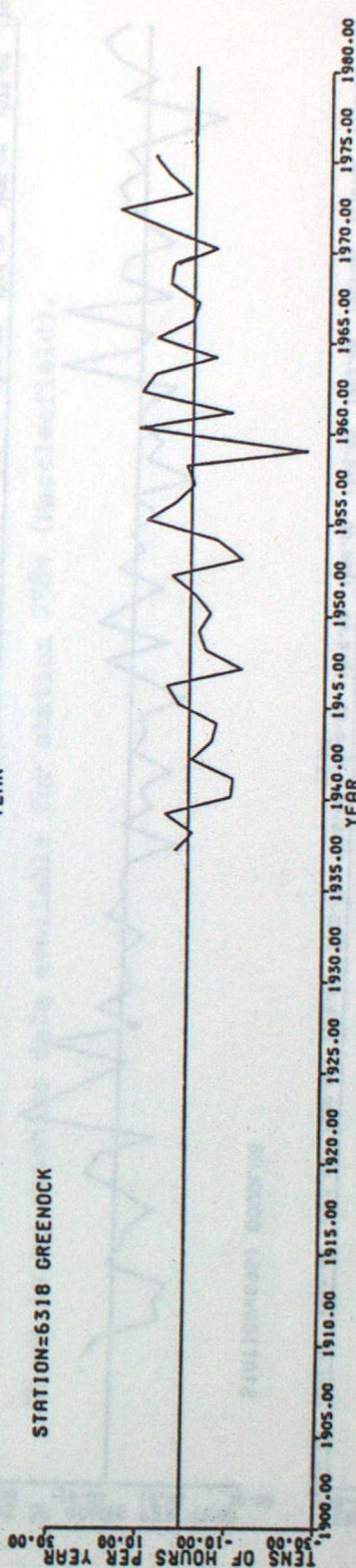
STATION=5431 WORTHING



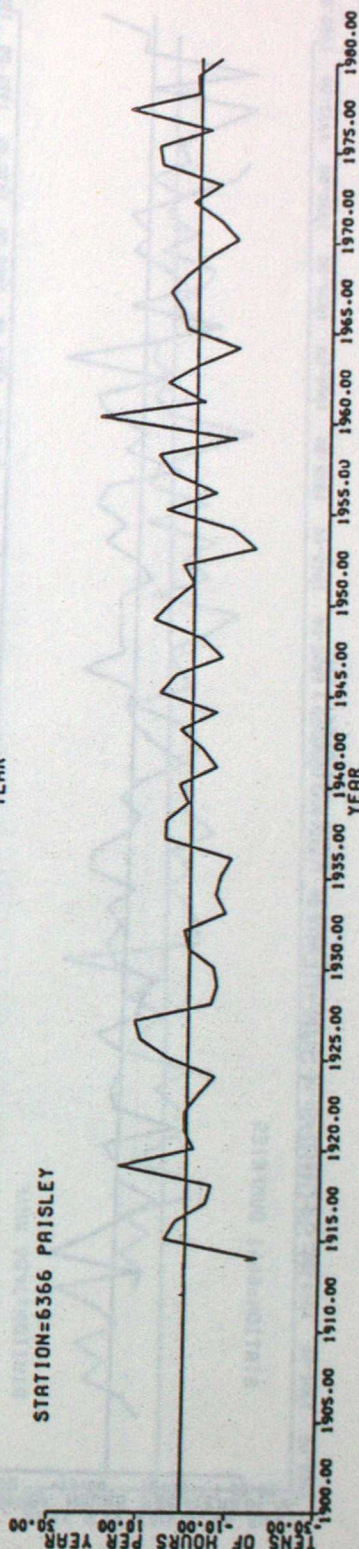
STATION=5643 SOUTHAMPTON (EAST PARK)



STATION=6318 GREENOCK



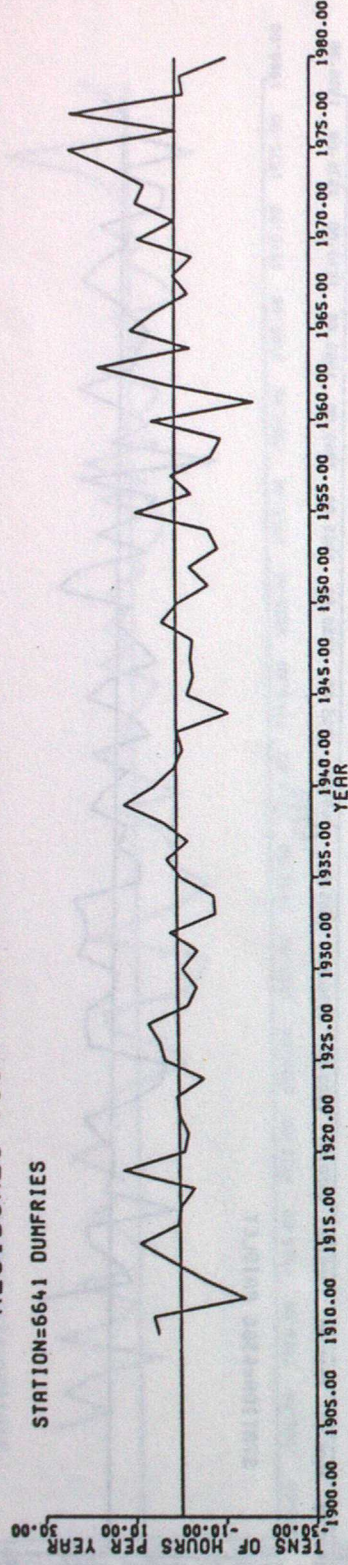
STATION=6366 PAISLEY



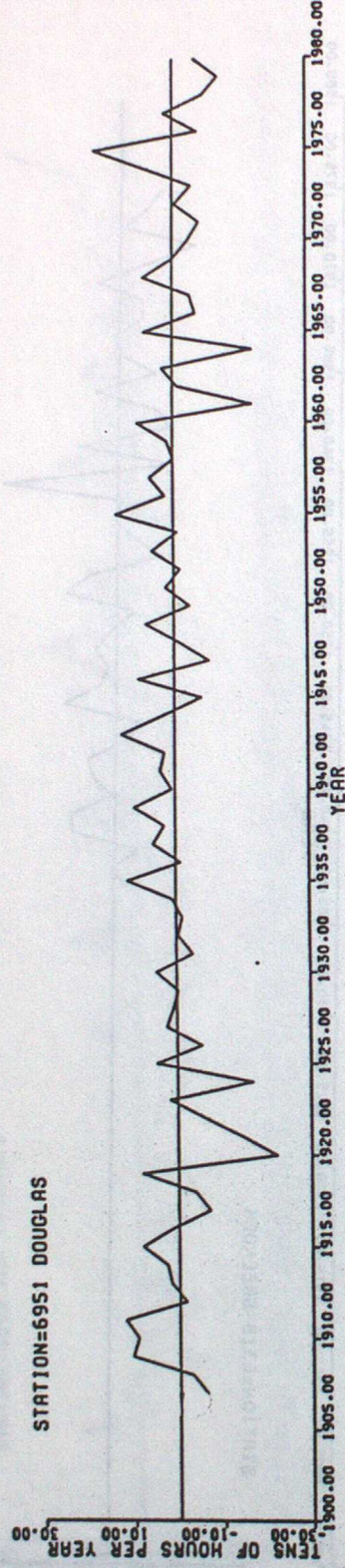


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

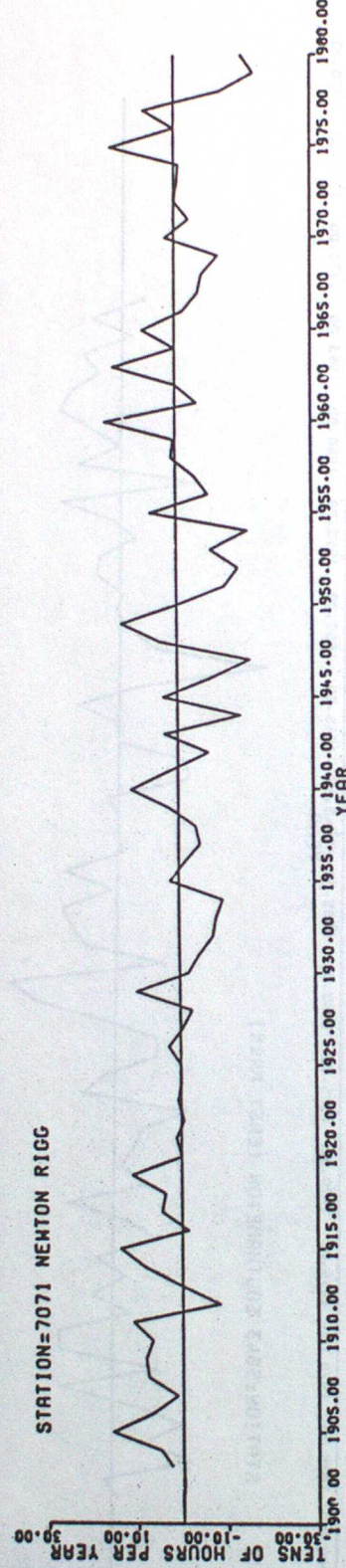
STATION=6641 DUMFRIES



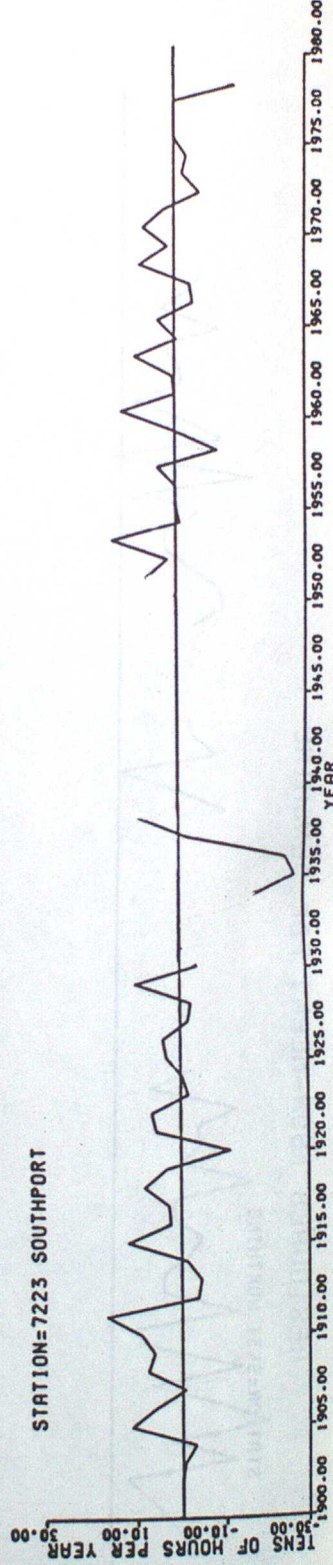
STATION=6951 DOUGLAS



STATION=7071 MEKTON RIGG

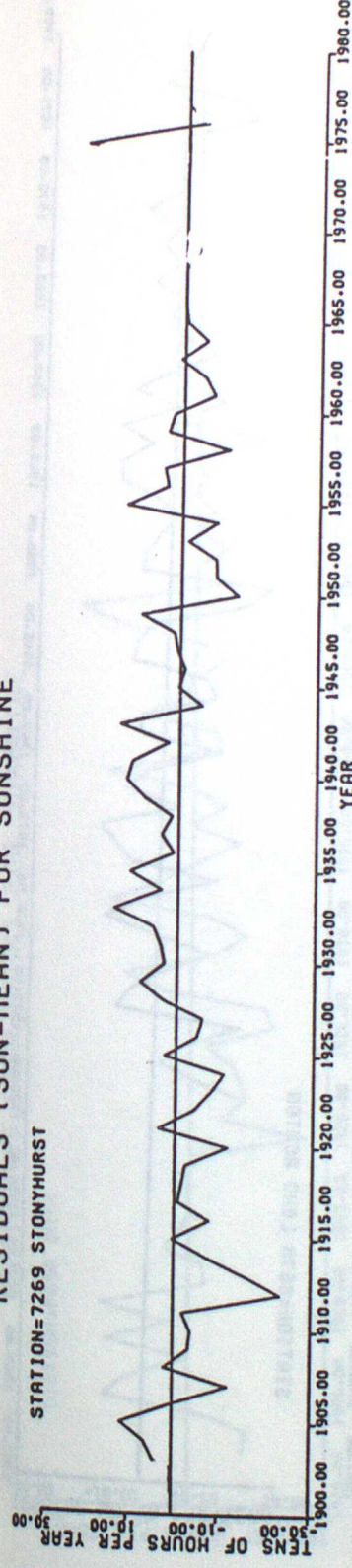


STATION=7223 SOUTHPORT

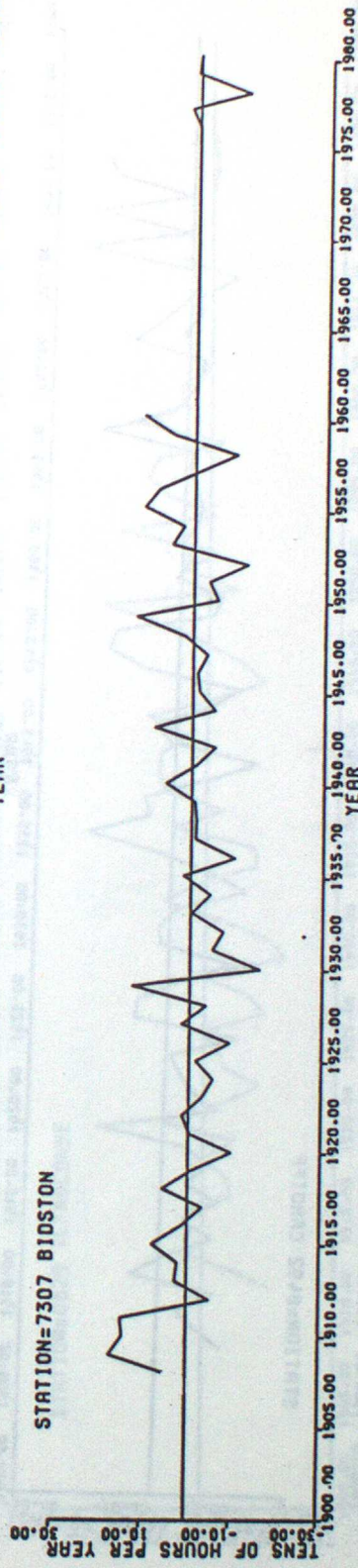


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

STATION=7269 STONYHURST

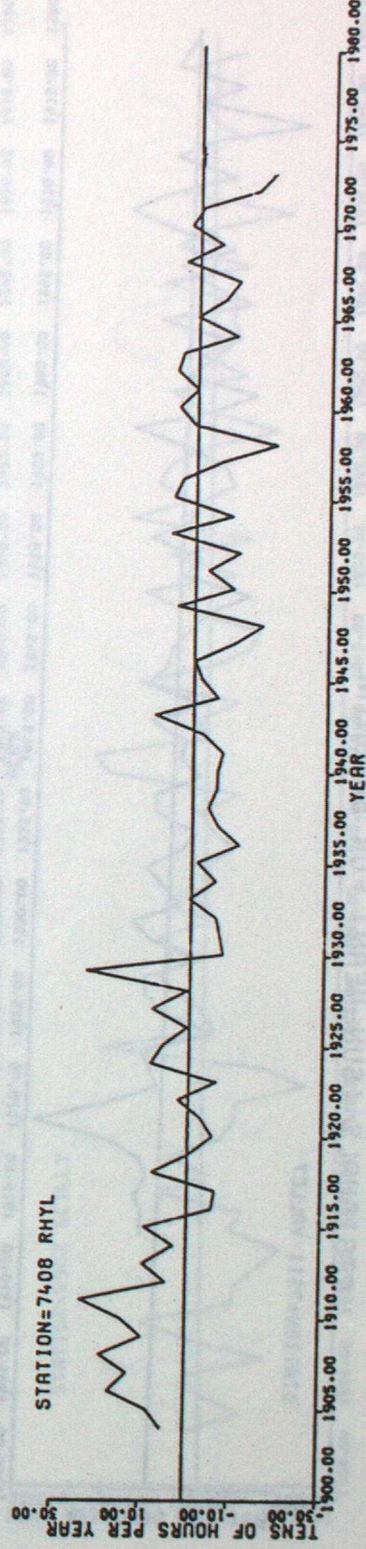


STATION=7307 BIDSTON



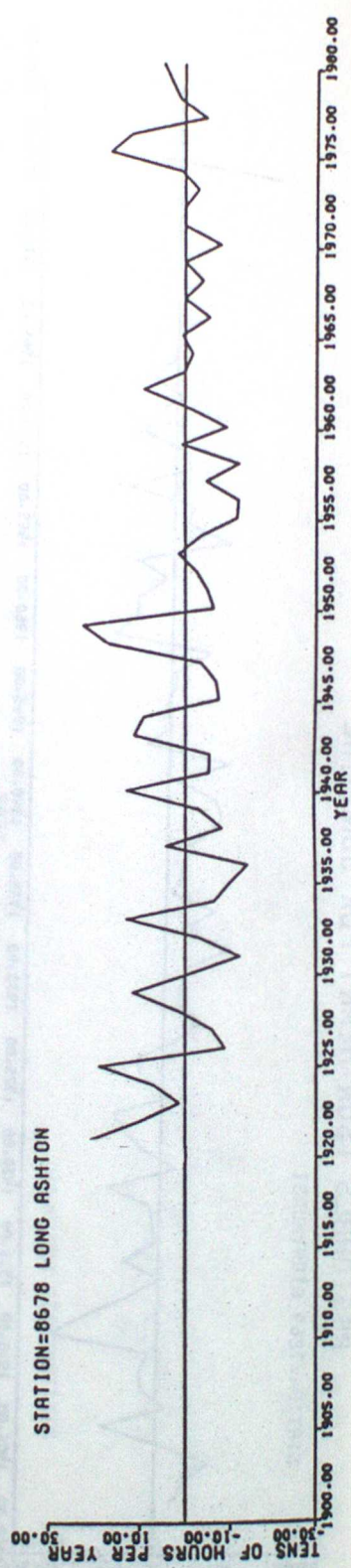
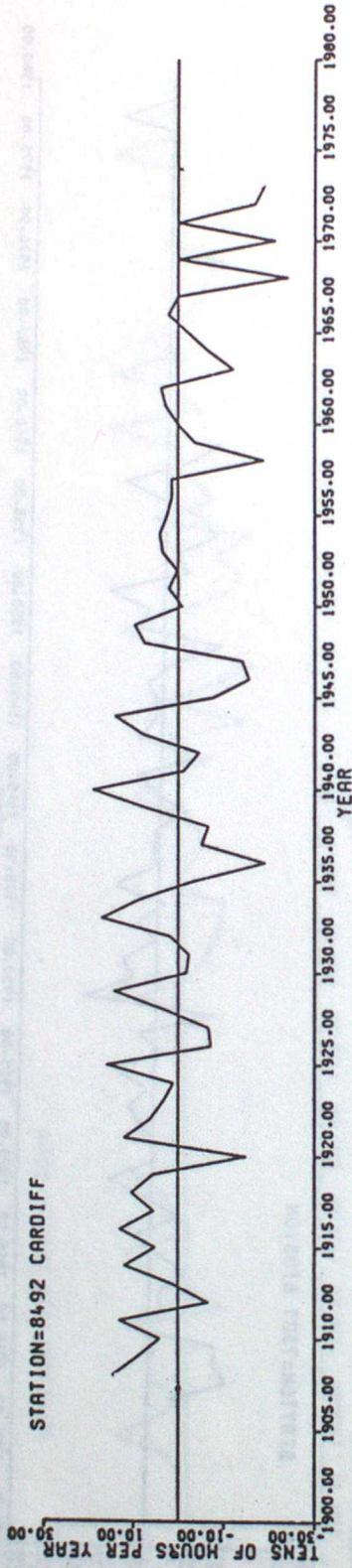
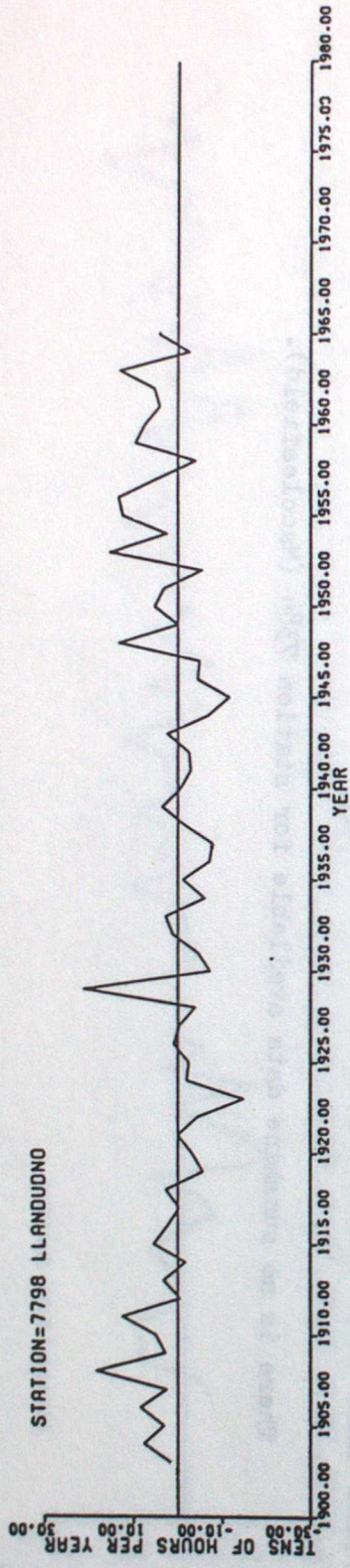
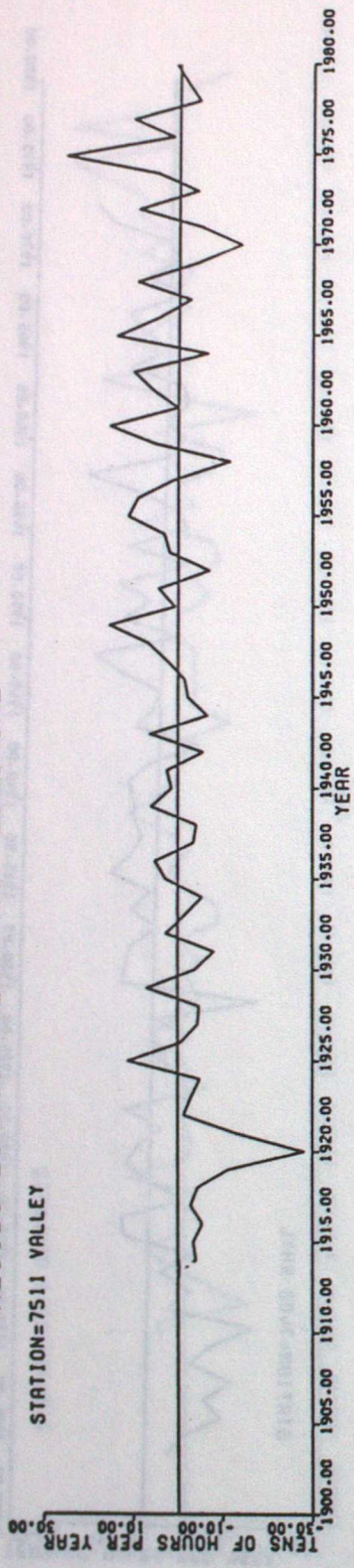
There is no sunshine data available for station 7384 (Macclesfield).

STATION=7408 RHYL

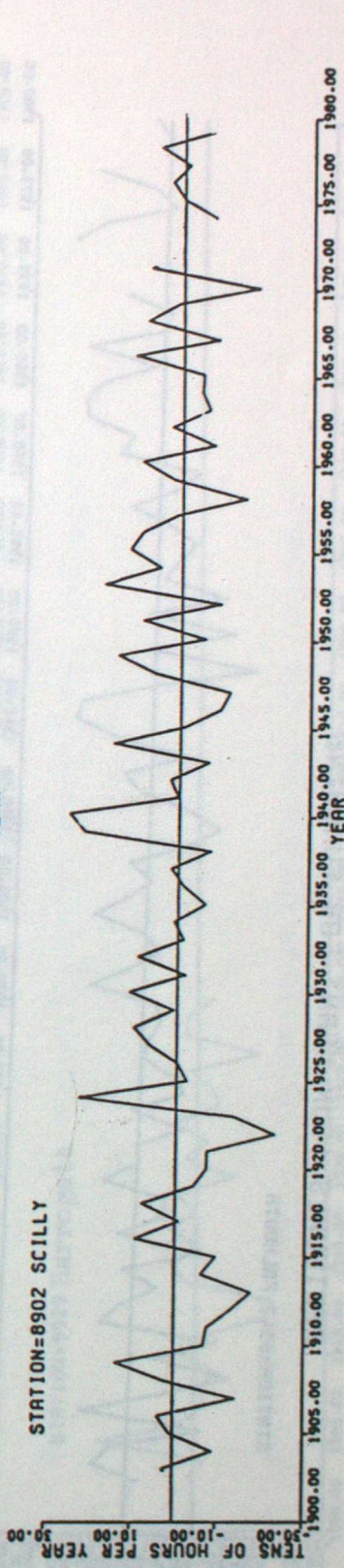
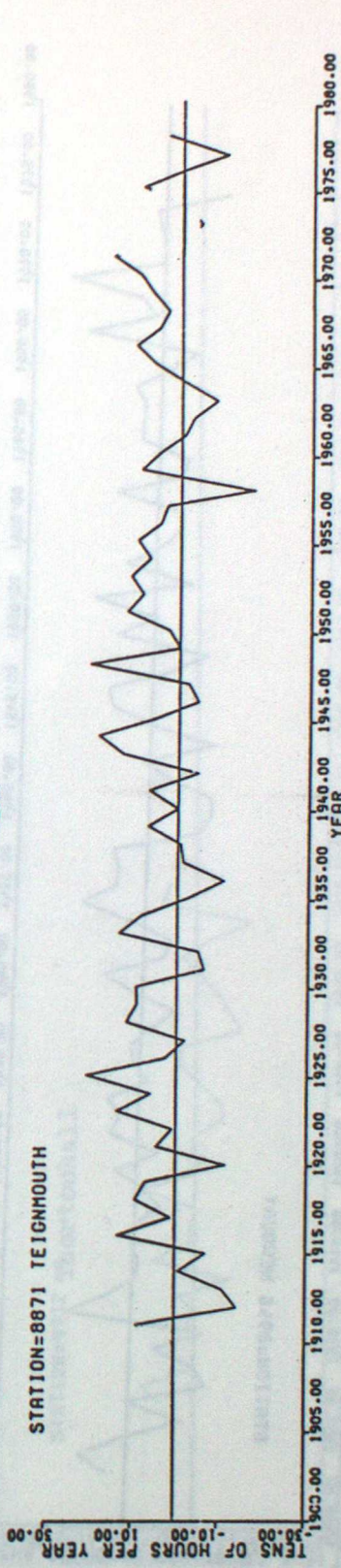
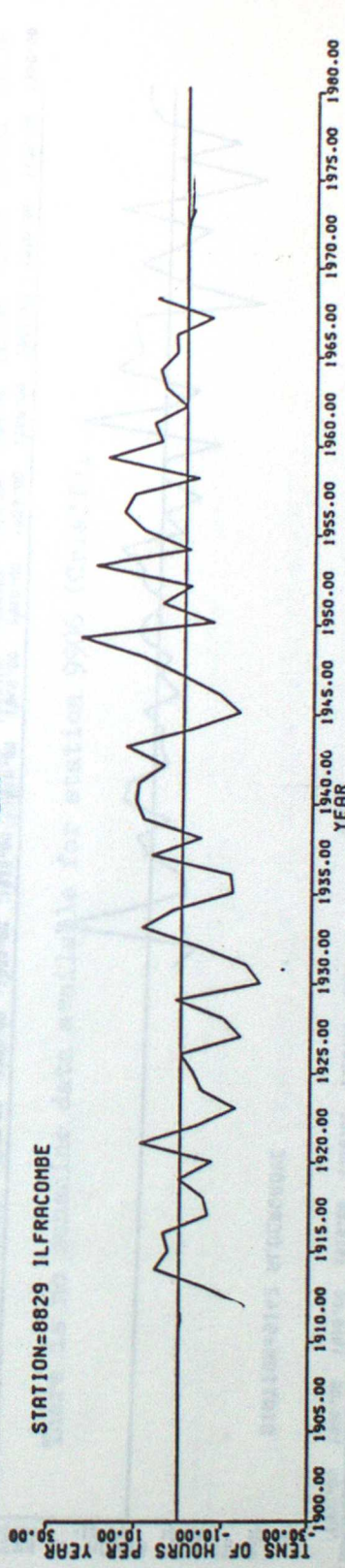
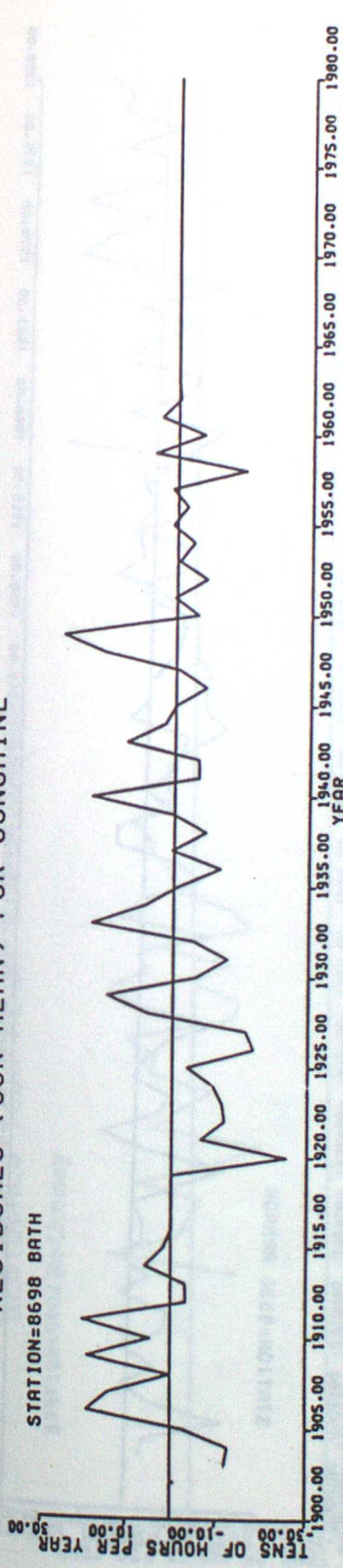




# RESIDUALS (SUN-MEAN) FOR SUNSHINE



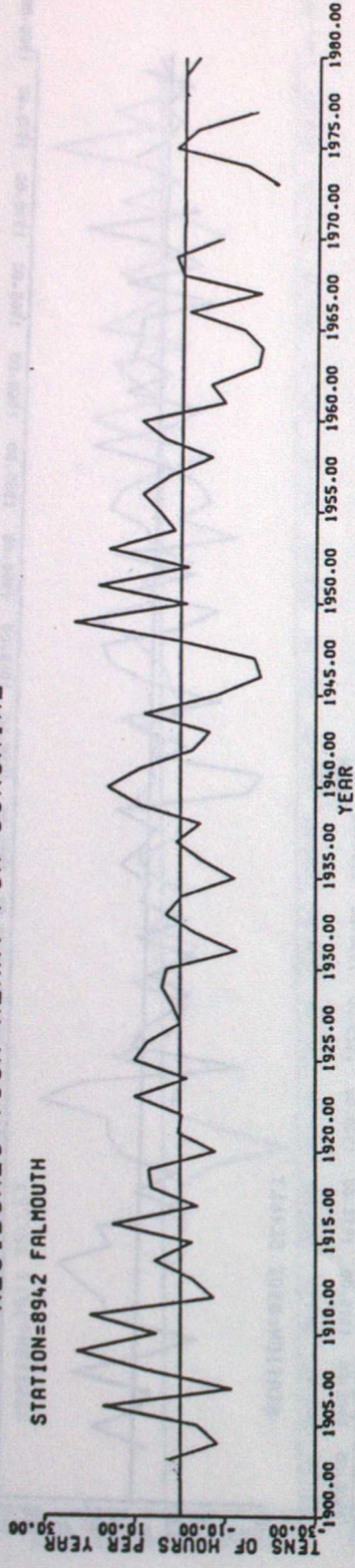
# RESIDUALS (SUN-MEAN) FOR SUNSHINE



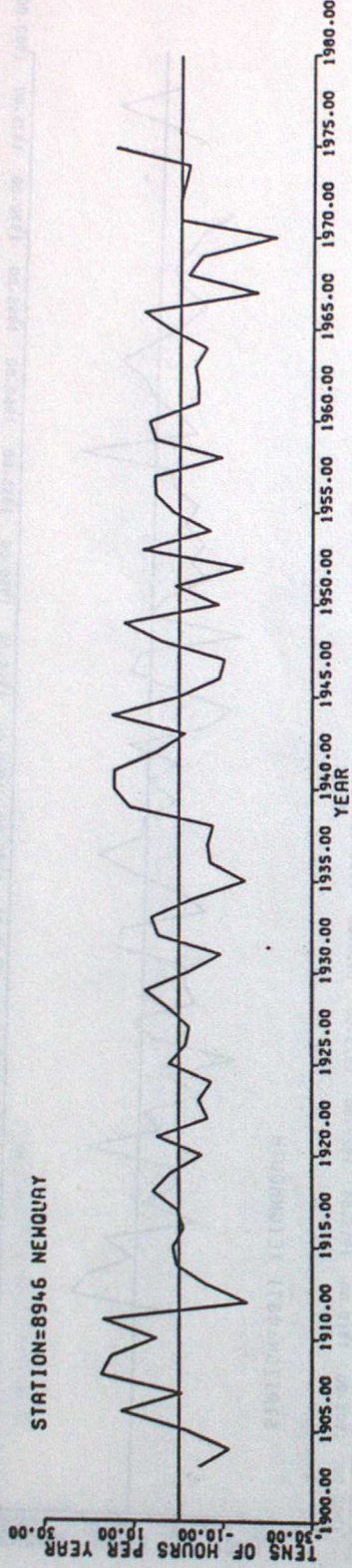


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

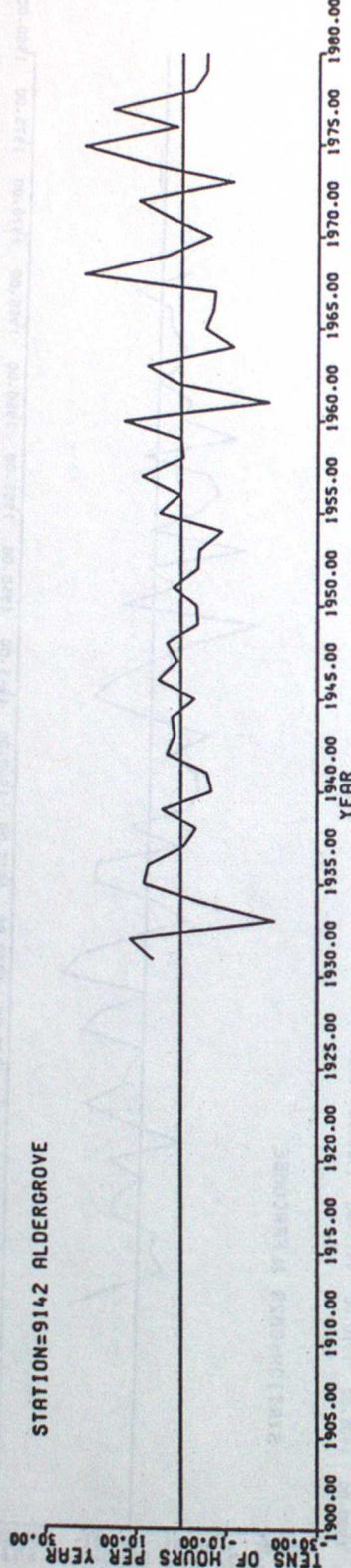
STATION=8942 FALMOUTH



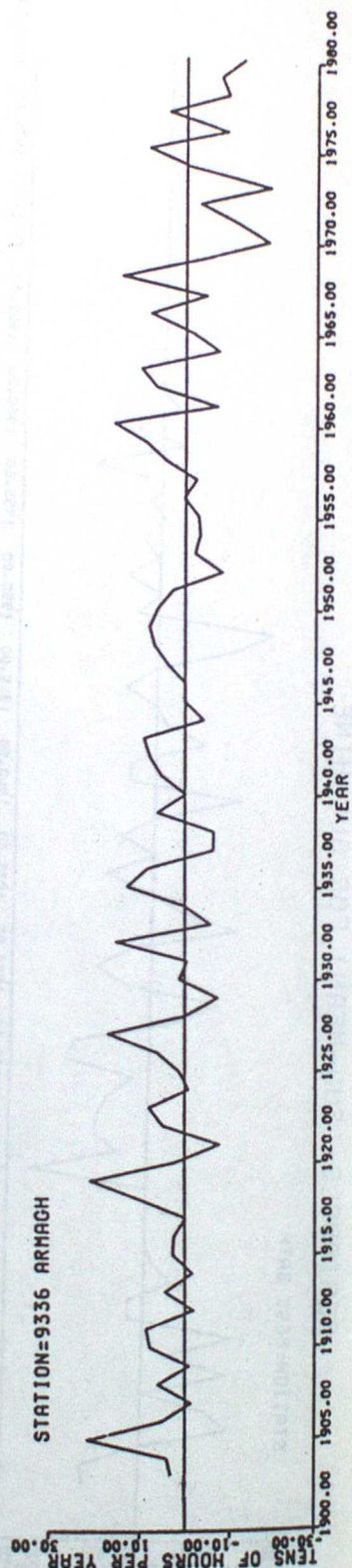
STATION=8946 NEWQUAY



STATION=9142 ALDERGROVE

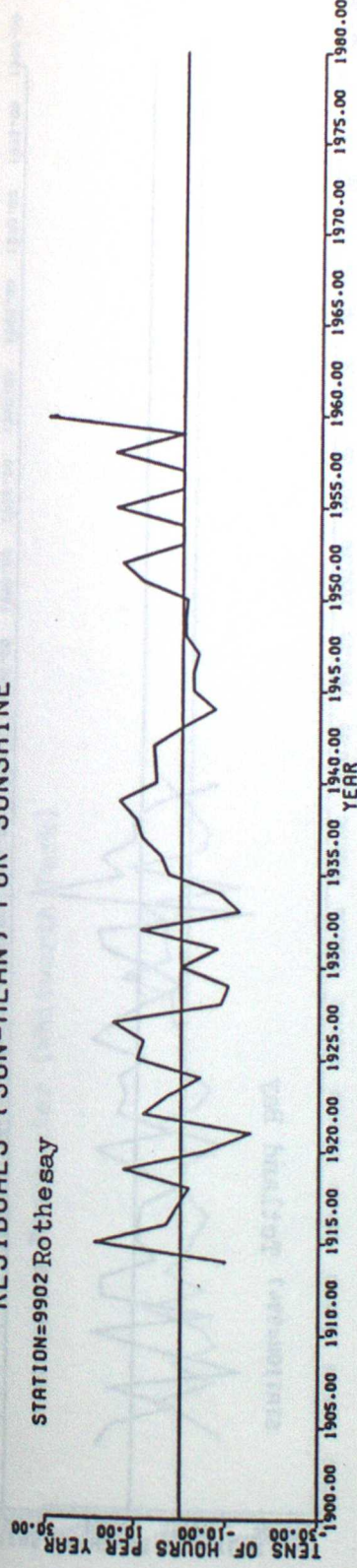


STATION=9336 ARMAH



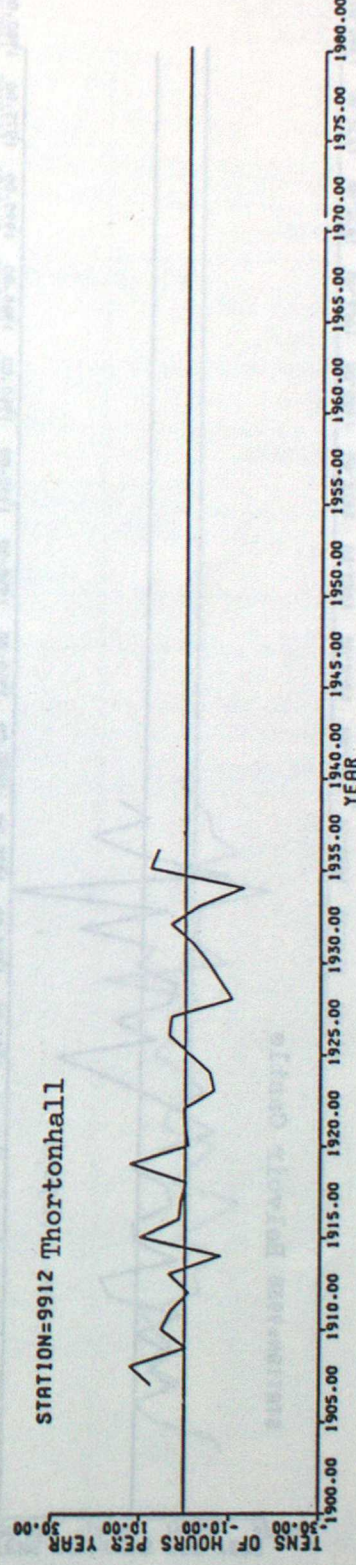
# RESIDUALS (SUN-MEAN) FOR SUNSHINE

STATION=9902 Rothesay

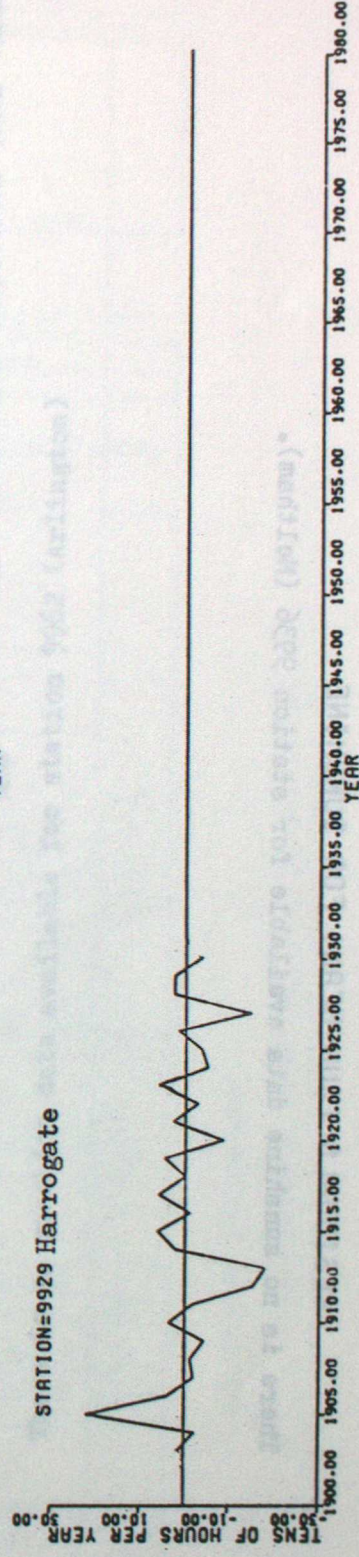


There is no sunshine data available for station 9906 (Crieff).

STATION=9912 Thortonhall



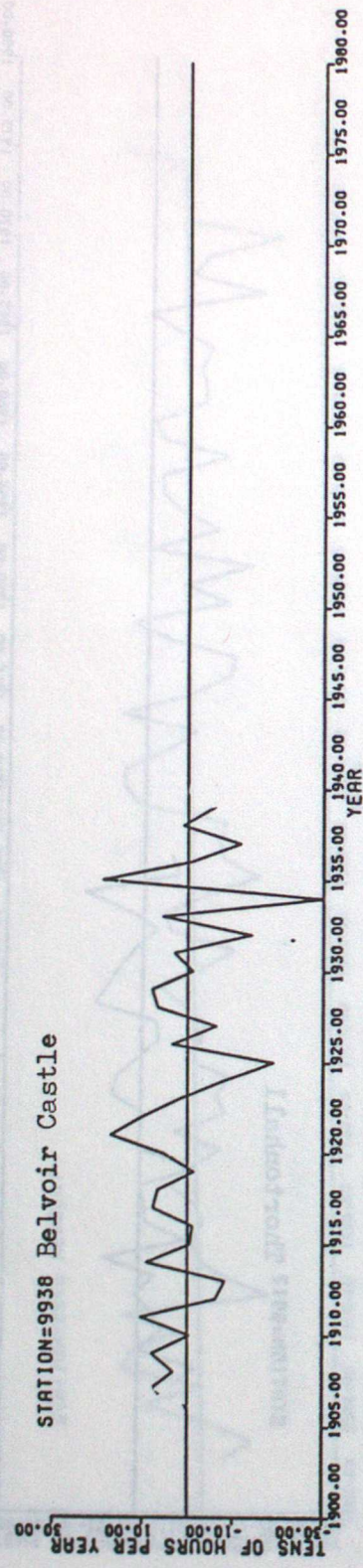
STATION=9929 Harrogate



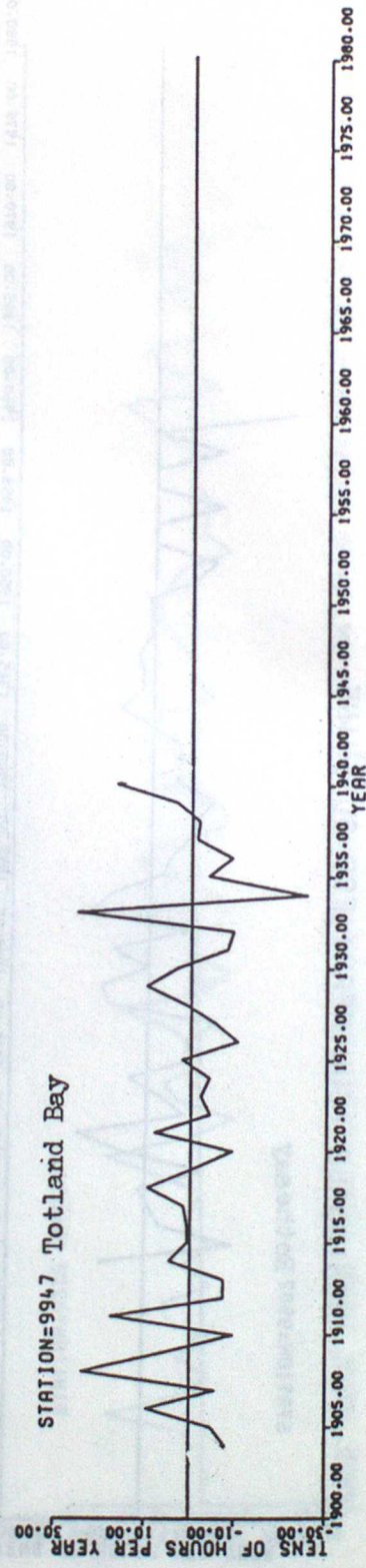


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

There is no sunshine data available for station 9936 (Meltham).

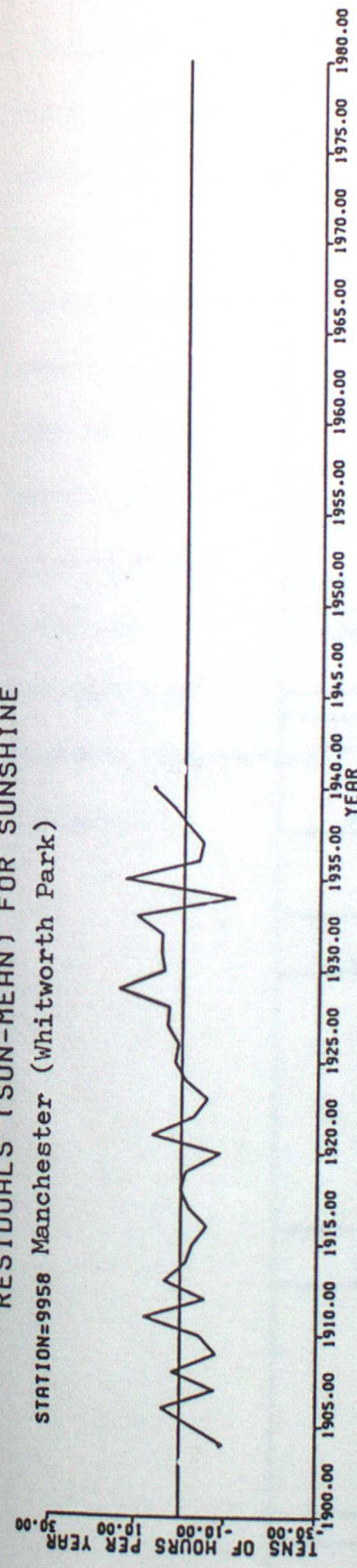


There is no sunshine data available for station 9940 (Sparkhill)

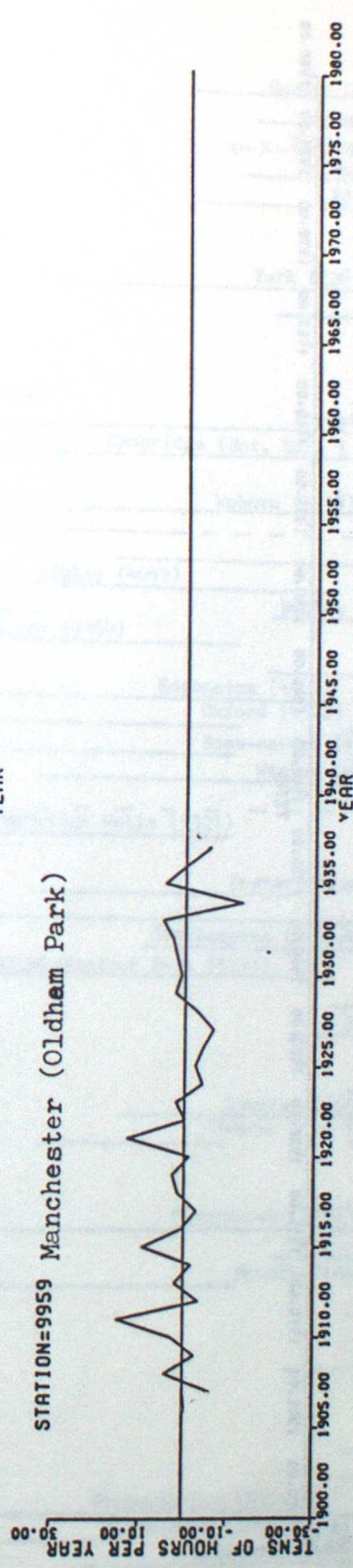


# RESIDUALS (SUN-MEAN) FOR SUNSHINE

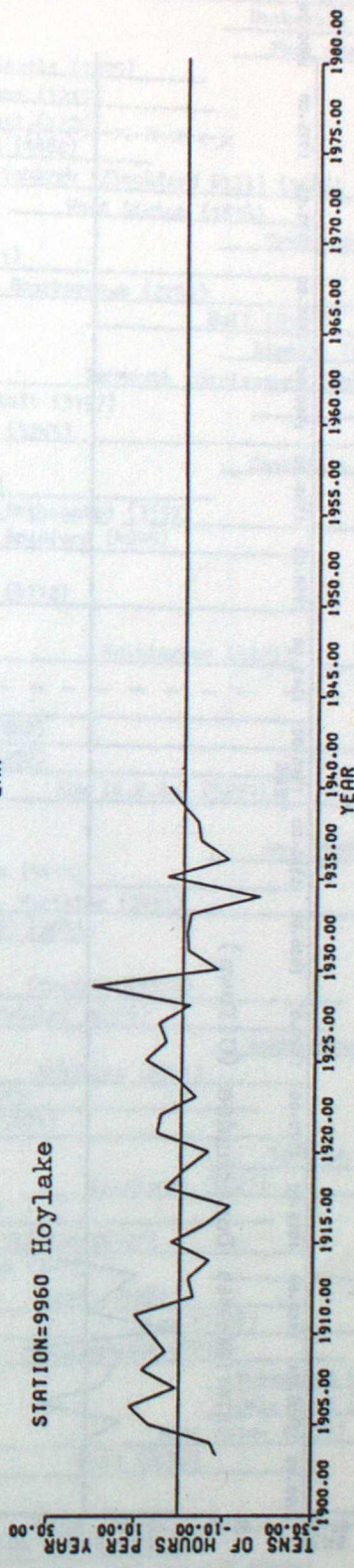
STATION=9958 Manchester (Whitworth Park)



STATION=9959 Manchester (Oldham Park)



STATION=9960 Hoylake

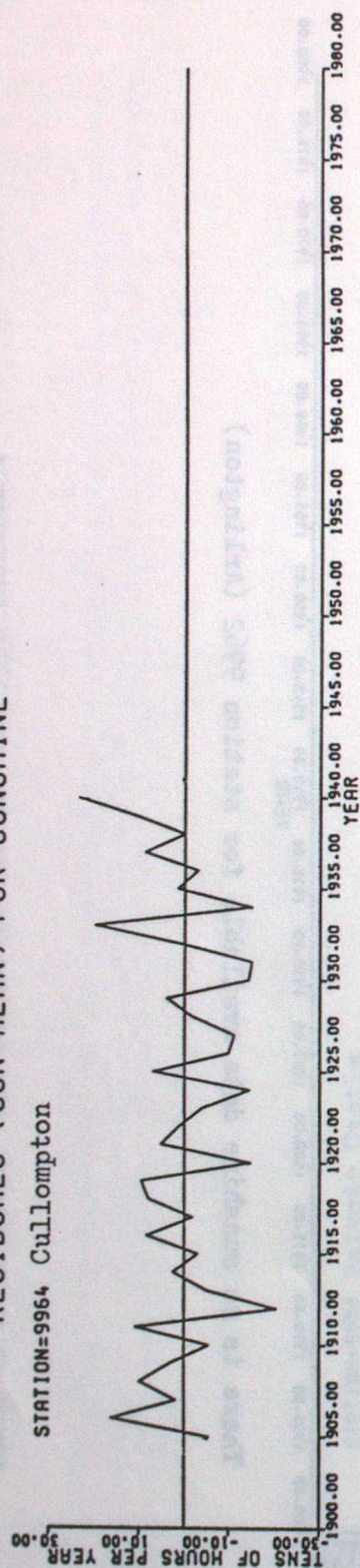


There is no sunshine data available for station 9962 (Arlington)



# RESIDUALS (SUN-MEAN) FOR SUNSHINE

STATION=9964 Cullompton



STATION=9969 Donaghadee (C. Down)

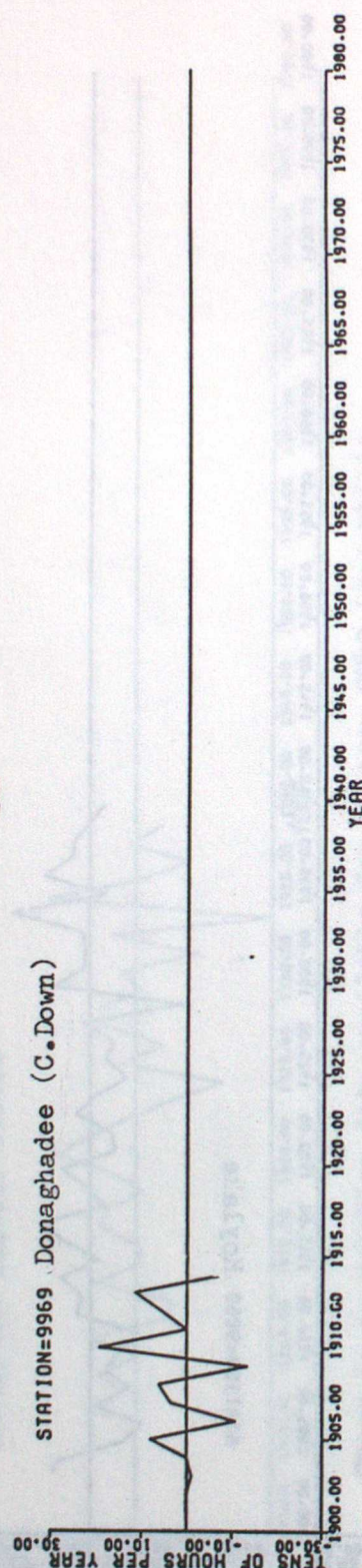


Figure 3 Summary of stations considered to contain a homogeneous period of data (excluding sunshine)

## Key

- = homogeneous
- = homogeneous but with a slight trend in the real data (possibly due to increased urbanisation effects)
- X-X- = homogeneous with the exception of maximum temperature (Balmoral)

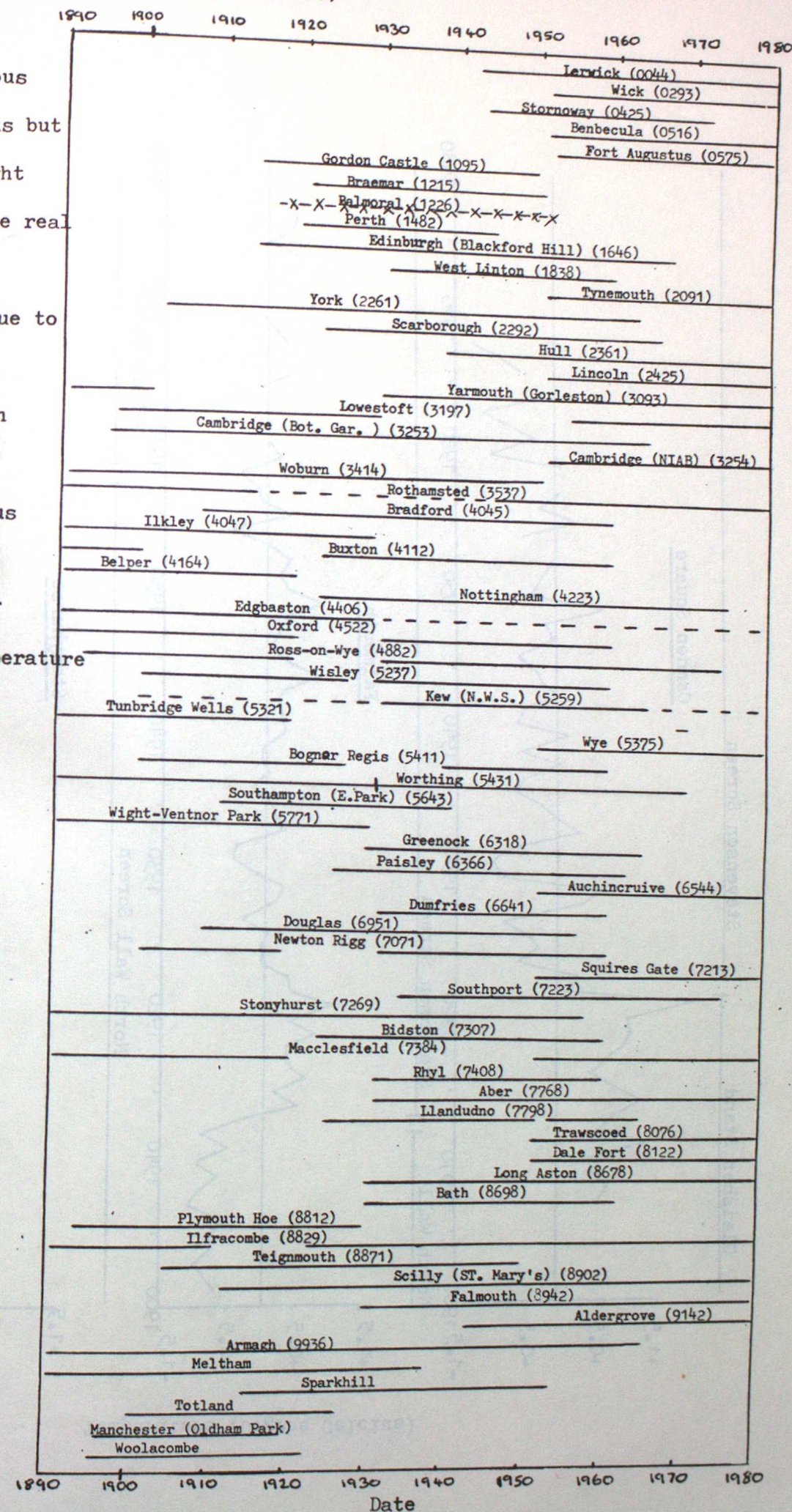




Figure 4 Inhomogeneities identified as occurring due to changes in thermometer screen

