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"COLLECTION OF STATISTICAL DATA FOR METEOROLOGICAL STUDIES OF THE UPPER ATMOSPHERE"

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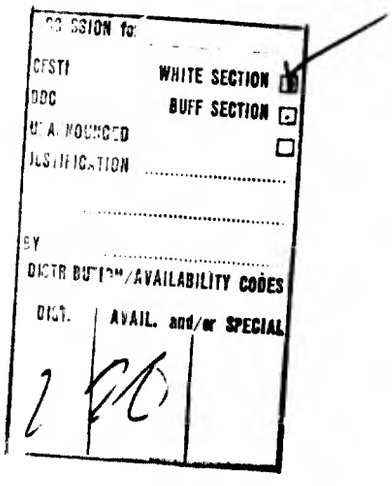

A B S T R A C T

The contract called for the compilation of complete aerological basic material for the surface, 700 mb., 500 mb., 300 mb., 200 mb., and 100 mb. over the North Atlantic, Europe and adjacent areas. Aerological data of 56 stations were collected and checked from all available sources for the months of January, February, March, July, August, and September of the 4-year period 1955 - 1958. Checking became necessary because the sources of data contained one or more of the following errors:

1. Missprints or errors in communication
2. Systematic or occasional measuring errors
3. Errors in the computation of the geopotential.

In order to eliminate such errors, the data were compared with charts of the German Weather Service; the soundings were re-computed by means of the hydrostatic equation. Missing data were supplemented from these charts, if contained. If not, they had to be interpolated from the analysis, the vertical structure and variations taken into account. Missing winds were determined from the pressure field by geostrophic approximation after a special procedure.

After it had been established that the analyses were sometimes rather poor over the eastern section of the charts, the 300, 200, and 100-mb. surfaces were re-analyzed (see Chapter 1). The checked and supplemented data were transferred onto punchcards and listed by machine.

CHAPTER 1

SUMMARY AND ANALYSIS OF THE RESEARCH

The research has been reported on in full detail in Technical (Scientific) Note No. 1 (= TSN) as of 31 July 1959, which dealt with the winter months. The evaluation of the summer months did not bring out any new aspects. The order of the different steps of work (compare TSN, Chapter 2) has been slightly changed and is now as follows:

1.01 Transcription into day sheets (first line of a station)
1.02 Preliminary examination
1.03 Plotting into the check maps
1.04 Analysis, smoothing, scientific checking and supplementing of the day sheets (second line of a station)
1.05 Coding of the day sheets (third line of a station)
1.06 Proof-reading
1.07 Punching and mechanical double-checking
1.08 Punchcard interpreting
1.09 Mechanical preparation of day sheets
1.10 Photographing of the printed day sheets on microfilm.

In order to avoid double work, the upper-air charts for the 300-mb, 200-mb, and 100-mb surfaces were re-analyzed from the data of the 56 stations considered (TSN Appendix 6). The data were in part based on measurements and partly interpolated from charts of the German Weather Service (preliminary checking 1.02). Missing observations were supplemented according to the new analysis. Approximate isotherms were drawn for the summer months also when there were no measurements available. For the winter months an extrapolation was in general only possible for stations located near the region with a good data coverage (TSN 3, 3d). A special extrapolation method, employing the advection of 24-hour tendency fields of geopotential and temperature, was only tried for a period of 12 days. It was discontinued because it proved too time-consuming. In supplementing missing data, preference was given to synoptic aspects rather than to the monthly variation of the parameters. The vertical structure of each sounding was checked and made to agree with the hydrostatic equation. It is evident that temperature data in the standard isobaric surfaces alone will not suffice to compute the geopotential at these levels, since generally the decrease of temperature with height will not be linear from one surface to the next.

CHAPTER 2

RESULTS AND CONCLUSIONS

The collection of aerological data, started in September 1958 and finished today, comprises a file of 81 648 punchcards. It represents an unprecedented basic material for Europe and the adjacent areas. For the first time a homogeneous and complete climatological set of data, disregarding a few exceptions, has been prepared according to hydrostatic and synoptic principles for a 4-year period. It shall be pointed out that the data are synoptically homogeneous for each single day; i.e., they can be used for the construction of consistent synoptic upper-air charts.

The experience gained in the process of this work is summarized below.

2.1 The aerological measurements treated are of very different quality, since in the region under consideration several types of radiosonde are flown. The measuring errors become important above all in the stratosphere and must be carefully considered.

2.2 Occasionally, corrections must also be applied to upper-air analyses in the troposphere and in the stratosphere. In cases with many measuring errors a completely new analysis is best. Continuity in both the vertical and time coordinate is of special importance, a fact sometimes not given due consideration.

2.3 Besides the hydrostatic equation and some rules about wind shift with height or about the advection of warm or cold air, there are hardly any other scientifically founded rules on the behavior of the atmosphere in the upper layers. Abrupt heating or cooling in the stratosphere can mostly not be explained by advection alone. Therefore, it is difficult to give a generally valid procedure for extrapolations. Doubtlessly, there must be connections of this kind; it would be desirable to have these problems investigated - on either a statistical or a theoretical basis.

2.4 Projects like the present one could be considerably facilitated if there were available from measurements for different periods statistics on wind, temperature and geopotential at the standard isobaric surfaces in the form of frequency distributions, mean values and standard deviations, so that the personnel can be oriented as to the normal seasonal frequencies and the range of variation of the occurrence of the respective quantities.

Regarding the auxiliary and technical means used in this research, reference is again made to TSN.