

FLUCTUATIONS IN THE DEGREE OF CONTINENTALITY OF
NORTHERN EUROPE IN 1866—1965

by

ILMO HELLA

Institute of Marine Research, Helsinki

As pointed out by the present author some years ago (HELLA, [2]), the character of the annual course of the air pressure over northern Europe must be applicable to the determination of the fluctuating degree of continental or maritime influence in this area. This fact is simply based upon the reverse annual cycle of air pressure over northern Europe and northern Atlantic: the annual cycle of air pressure of the continental type is characterized by a winter maximum and a summer minimum, while the maritime type shows an opposite cycle. (*Cf.* ALT, [1]).

The original air pressure data for Stockholm, covering the years 1866—1965, were kindly submitted to the present author by the Sveriges Meteorologiska och Hydrologiska Institut. Stockholm is ideally situated between the two large areas showing a continental and a maritime type of air pressure cycle. In the earlier paper, *loc.cit.*, it had been shown that the fluctuations are more or less independent of the selection of the station over a limited distance. Stockholm was now selected because of the long series of air pressure records.

Firstly, every monthly mean value was given as the deviation from the annual mean value of the same year since this way the effects of possible changes in the reference height were eliminated. The actual smoothing was done as follows. For all the January monthly mean values, given as the deviations as indicated above, the consecutive 10-

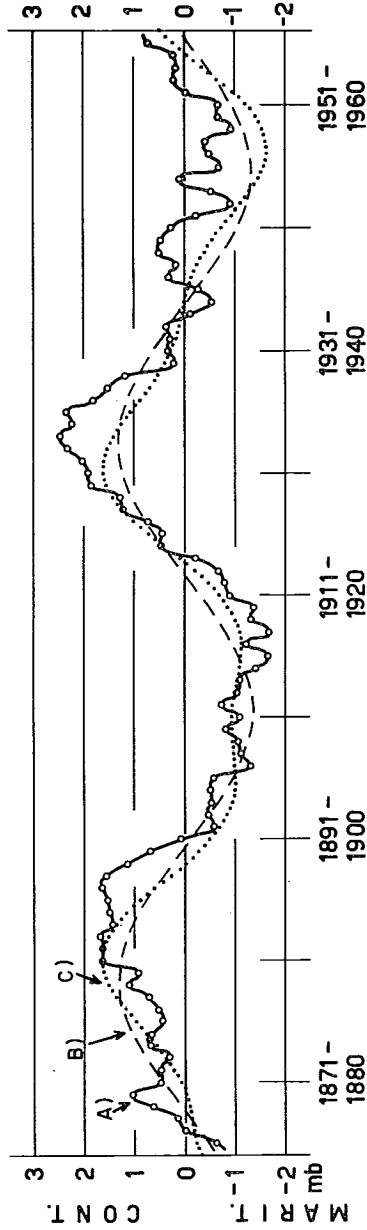


Fig. 1. Fluctuations in the degree of continentality based upon changes in the type of annual cycle of air pressure in Stockholm.

A) Original yearly constants.

B) Smoothed march based on 42-year period only.

C) Smoothed march based on the sum of the 42-year and the 19-year period.

years mean values were computed. The same was done also for all the other 11 months of the year. On basis of these smoothed monthly values the harmonic constants of the annual cycle were computed for every year between 1866—1875, that is, 1871.0, and 1956—1965, that is, 1961.0. Since the maxima and minima of the annual cycle of the air pressure appear on an average, both in the continental and the maritime type, in January and in July, the degree of continentality and/or maritimity is obtained simply as the January-July component of the amplitude of the harmonic wave of the first order.

Fig. 1 shows secular changes of the degree of continentality thus determined. The periodogram analysis (Fig. 2) rather clearly indicates that the maxima appear at some 42 and 19 years, Making use of these two periods, the fluctuations in the degree of continentality can be given as

$$c(t) = 1.33 \sin 2\pi \left(\frac{t - 1873.5}{42} \right) + 0.40 \sin 2\pi \left(\frac{t - 1882.3}{19} \right). \quad (1)$$

The original January-July components of the amplitude of the harmonic wave of first order, computed as indicated above, are given as open circles A) in Fig. 1. The dashed line B) shows the 42-year wave alone while the dotted line C) gives the sum of the same and of the 19-year wave.

When an analogous computation was performed some 16 years ago [1], more or less identical results were obtained, the lengths of the periods corresponding to the above ones being 44 and 21 years.

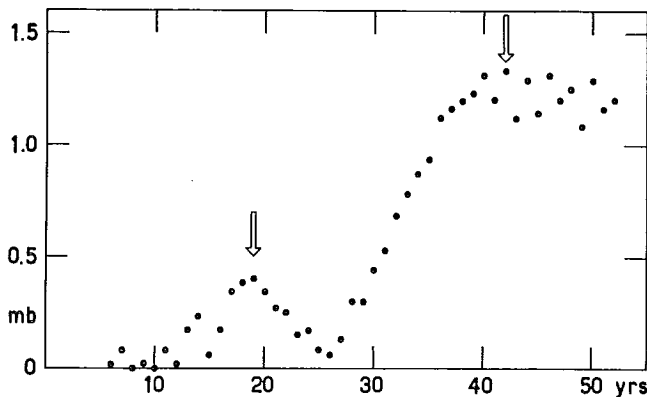


Fig. 2. Periodogram analysis of the values A) in Fig. 1.

The present results indicate a regular periodicity of some 42 years in the recent climatic fluctuations, at least on basis of data covering only 100 years, though one has to admit that the degree of maritimity obviously was around 1941—1950 less pronounced than the harmonically smoothed curve would have given. Should one wish to make use of the presented analysis for prediction purposes, the climatic trend of northern Europe seems to be towards another peak of continentality, that is, towards warm summers and severe winters.

REFERENCES

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2. HELÄ, ILMO, 1950: On the periodicity of the recent changes in our climate. *Ann. Acad. Sci. Fenn. A I*, **84**. Helsinki. 1—11.