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SUNSHINE DURATION IN ATHENS - GREECE (I).

by

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Abstract: *Sunshine duration at the National Observatory of Athens (φ 37°58'λ 23°43' elev. 107 m), is studied for the period 1897 - 1973, that is 77 years in all.*

The annual mean of the period examined is 2.779,0 ± 188,9 hours/year; also extreme annual values are given.

The study of the course of the annual sunshine duration at the National observatory of Athens indicates, in support of the views of former studies, that this has a long period trend; the actual curve as well as the 5 and 10-year running mean, clearly showing a fluctuation of a Brückner-like cycle.

INTRODUCTION.

The subject of Sunshine duration in Athens has been examined by a number of research scientists studying the climate of Greece, such as *Aeginitis*[1], *Livathinos*[10], *Mariolopoulos*[13,14,15], *Philippson*[19], *Karapiperis*[6,7], *Macris*[11,12], *Livadas - Pennas*[8] and others. Besides the same subject is examined within general studies on the climate of Mediterranean, like those by *Friedemann*[4], *Alt*[2], *Met. Office*[17,18], *Gorczynski*[5], *Biel*[3], *Mariolopoulos*[16].

This is a favorite subject because the meteorological station of the National Observatory of Athens has the longest uninterrupted series of observations in the area of Greece. The city of Athens had the good luck to remain outside of the adventures of war ever since it became the capital city of Greece. A short break to the rule, due to fights that took place in this area in December 1944, produced a few days' interruption in the recording of sunshine. These missing values were filledin from the corresponding data of Historical Weather Maps[20] and from the personal diary of the former of the authors. We had to resort to this means because in that December 1944 the whole meteorological network of Greece was out of function.

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Sunshine duration in the meteorological station of the National Observatory of Athens for the 77 year period between 1897-1973 is studied herein as part of the «Sunshine Duration in Greece» project of the Institute of Meteorology and Climatology of the Aristotelian University of Thessaloniki.

Sunshine Duration

Observations of sunshine duration were started at the Meteorological Institute of the National Observatory of Athens in 1894, with a Campbell sunshine recorder placed on the meridional side of the flat roof of the Observatory building[1], (Photo I). In this work however we used data from the year 1897 onwards, because as we can see from the files and the Annales of the N.O.A. as well as from Table Π.Γ, (p. 492) by *Aeginitis*[1], the instrument was not in operation during the first quarter of 1896 (Jan. - April).

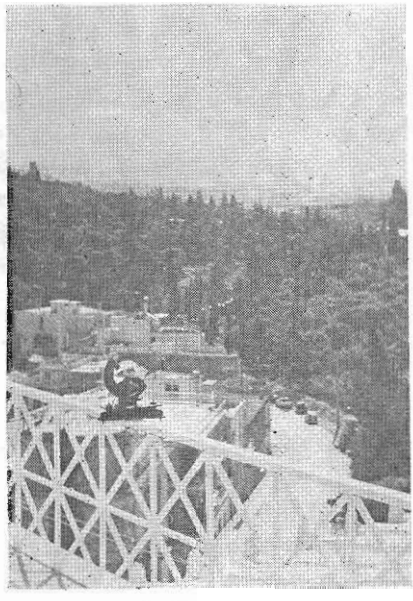

PHOTO I

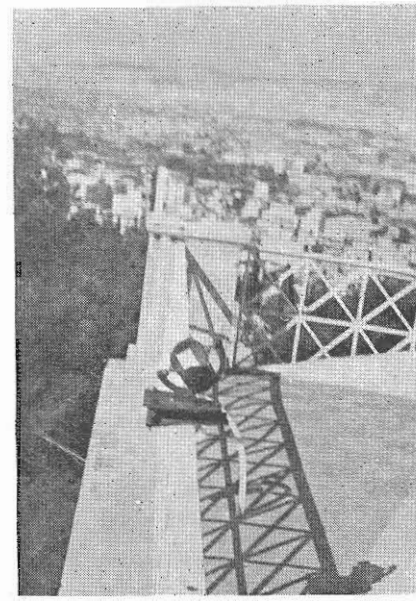

PHOTO II

The Sunshine-Recorder at the National Observatory of Athens.

The sunshine recorder remained during the whole period examined on the roof of the observatory, and was only slightly moved from one place to another by 1 or 2 m; still in the authors' opinion such displace-

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ments could not possibly produce any change in the sunshine recorded[6,115]. Besides the instrument has been stable on the same spot ever since the year 1900 (N.O.A. certification N° 90/17.10.1974). For all the above reasons we consider this a unique and continuous series.

a. The mean annual sunshine duration at the National Observatory of Athens, from the 77 years (1897-1973), as well as the maximum and the minimum annual duration are given in *Table I.*

TABLE I

Annual sunshine duration at the National Observatory of Athens (N.O.A.) (in hours).

Maximum	3216.8	1952	
Mean	2779.0	±188.9	l. of Coef. 6,8%
Minimum	2370.3	1931	

The frequency distribution of annual sunshine duration values is given in *Table II.*

The standard deviation is $\sigma = \pm 188.9$, with 52 years out of 77 (67,5%) standing in the interval of $\pm 1\sigma$.

DISCUSSION

Studying sunshine duration at the National Observatory of Athens, we observe that the annual mean resulting from an observational period

TABLE III

Annual mean sunshine duration values according to various scientists.

Scientist	Period of observations	Annual mean duration
Aeginitis[1]	1894-1903	2523 hours
Aeginitis	1897-1903	2658 »
Mariolopoulos[2]	1900-1929	2737 »
Livathinos[3]	1896-1920	2773 »
Livadas - Karakostas	1897-1973	2779 »

of 77 years (1897-1973), fully agrees with the annual mean, but also with the monthly mean values of the following two authors.

a) *Livathinos*[10], who based his study on a 25-year period (1896-1920).

b) *Mariolopoulos*[14], who based his own on a 30-year period (1900-1929).

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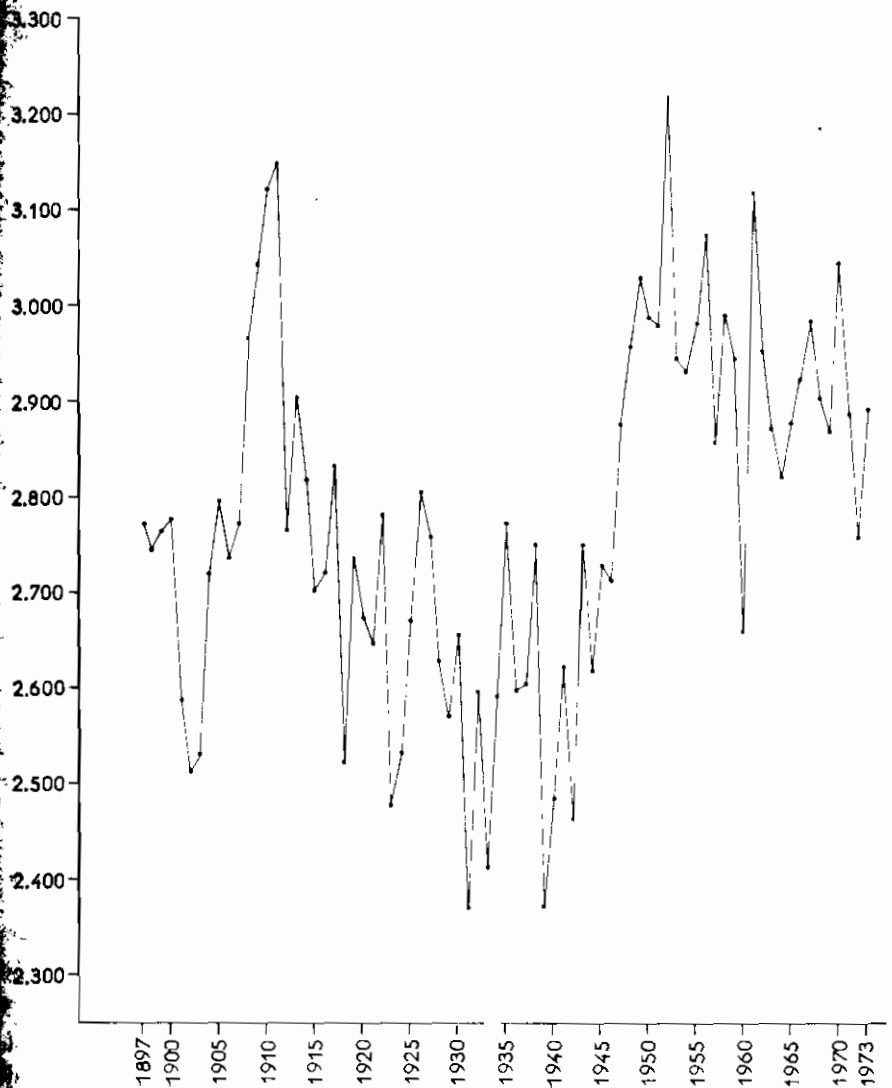
TABLE II

Frequency distribution of annual sunshine duration values at N.O.A.

Duration in hours	3.300 3.201	3.200 3.101	3.100 3.001	3.000 2.901	2.900 2.801	2.800 2.701	2.700 2.601	2.600 2.501	2.500 2.401	2.400 2.300
No of years	1	3	4	14	11	20	9	9	4	2

GRAPH 1

TIME SERIES OF ANNUAL SUNSHINE DURATION
OF PERIOD 1897–1973 (MET. ST. OF N.O.A)



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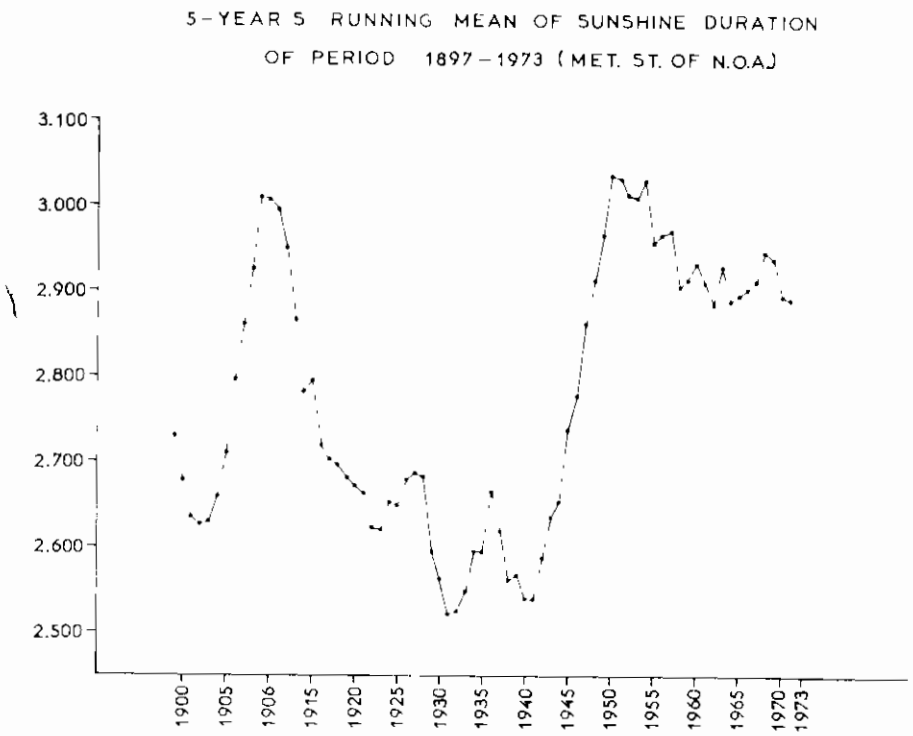
However, studying sunshine duration values for each year, during the 77-year period examined, we observe on first sight a change in sunshine duration:

Thus we have a maximum of sunshine duration in the beginning of the century (1905-1915); this was succeeded by a period of small annual values (1930-1945), then again we have a considerable increase of sunshine duration around the fifties, followed by yet another decrease of sunshine duration at the National Observatory of Athens.

GRAPH 2



If we examine now the curves of 5- and 10-years running mean, we observe the same general picture but more pronounced here.

This trend of sunshine duration at the National Observatory of Athens was first observed by *Ph. Karapiperis*[7], studying the period 1901-1960 for Athens, in the form of overlapping 10-year intervals. The longer period examined in the present work backs the view of an existing

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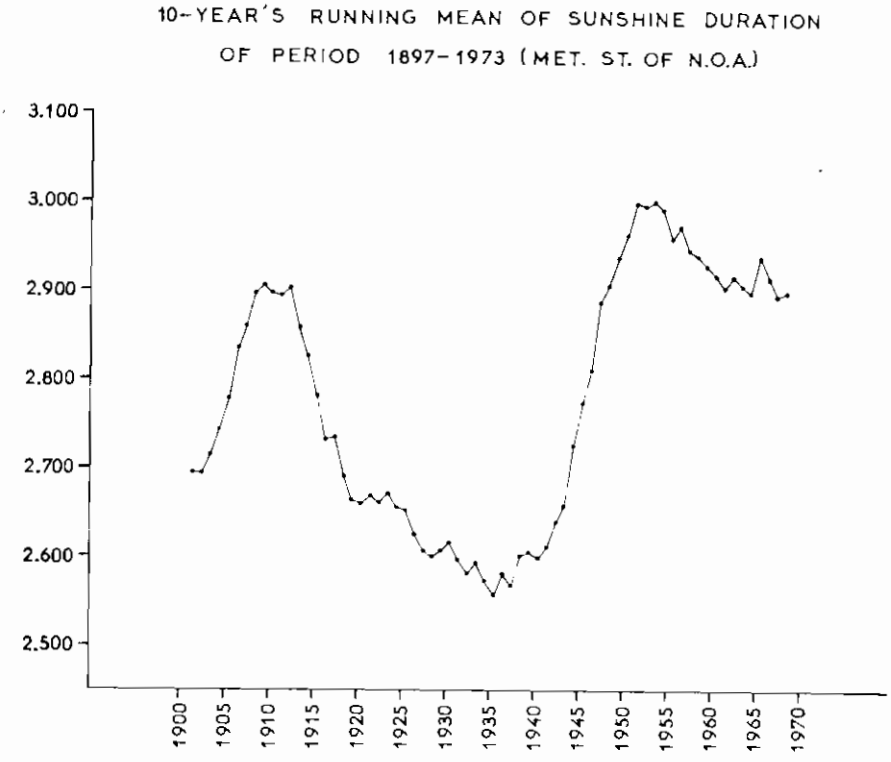
trend in sunshine duration at the National Observatory of Athens.

Especially during these last years (the 70's) there is a decreasing trend of sunshine duration for the whole area of Greece as compared with the decade of the 60's. The same trend is observed in the city of Thessaloniki *Livadas - Pennas*[8] and in the city of Ioannina (*Livadas-Pennas - Maldoyannis*[9]).

GRAPH 3



Studying the distance between the two maxima, in annual curves as well as in curves of 5 - and 10-years running means (with the reserve always that these last might lead to erroneous conclusions), we may say that there is a Brückner-like cycle in the period examined.

It is our belief that a more inclusive research for the whole Mediterranean or an even wider area, would prove of a certain importance, since sunshine duration depends from a number of meteorological parameters.

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ΠΕΡΙΛΗΨΙΣ

Η ΔΙΑΡΚΕΙΑ ΤΗΣ ΗΛΙΟΦΑΝΕΙΑΣ ΕΙΣ ΑΘΗΝΑΣ

ὑπὸ

ΓΕΩΡΓΙΟΥ Κ. ΛΙΒΑΔΑ καὶ ΘΕΟΔΩΡΟΥ Σ. ΚΑΡΑΚΩΣΤΑ

Μελετᾶται ἡ κατ' ἔτος διάρκεια τῆς ἡλιοφανείας εἰς τὰς Ἀθήνας, μὲ τὰ στοιχεῖα τοῦ ἡλιογράφου τοῦ Ἐθνικοῦ Ἀστεροσκοπείου Ἀθηνῶν (Ν.Ο.Α.), διὰ τὴν χρονικὴν περίοδον 1897-1973, ἤτοι διὰ 77 ἔτη.

Δίδεται ἡ μέση ἐτησία τιμὴ τῆς διαρκείας τῆς ἡλιοφανείας, 2.779,0 $\pm$ 188,9 ὧραι, καθὼς καὶ ἡ μεγίστη καὶ ἐλαχίστη διάρκεια τῶν ἐτῶν τῆς ὡς ἄνω χρονικῆς περιόδου. Συγκρίνονται αἱ προκύψασαι τιμαί, μὲ τιμὰς ποὺ ἔδωσαν προηγούμεναι μελέται, ἐπὶ τοῦ αὐτοῦ θέματος.

Μελετᾶται ἐπίσης, ἡ πορεία τῆς ἡλιοφανείας ἀπὸ ἔτους εἰς ἔτος, κατὰ τὴν ὑπὸ μελέτην περίοδον. Ἐκ τῆς ἐρεύνης ταύτης, ἐπαληθεύονται προηγούμενα συμπεράσματα, ὅτι ὑφίσταται μία μεταβολὴ εἰς τὴν διάρκειαν τῆς ἡλιοφανείας εἰς τὰς Ἀθήνας.

Συγχρόνως ἐνδυναμοῦται ἡ ἄποψις, ὅτι ὑφίσταται μία κύμανσις διαρκείας 40-45 ἐτῶν, ἤτοι μία περιοδικότης προσομοιάζουσα πρὸς τὰς καλουμένας περιόδους **Brückner**.

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