

ΣΥΝΕΔΡΙΑ ΤΗΣ 4ΗΣ ΔΕΚΕΜΒΡΙΟΥ 1975

ΠΡΟΕΔΡΙΑ ΠΑΝ. ΖΕΠΟΥ

---

ΑΣΤΡΟΝΟΜΙΑ.— **Power Spectrum Analysis of the Zonal Mean Annual Excess Precipitation Total over the Southern Hemisphere**, by *B. P. Tritakis* \*. Ἀνεκοινώθη ὑπὸ τοῦ Ἀκαδημαϊκοῦ κ. Ι. Ξανθάκη.

A B S T R A C T

Power Spectrum Analysis was applied to zonal averages of the annual excess precipitation total in 7 latitude zones of the Southern Hemisphere each 10° deg wide, using Xanthakis' unpublished data.

The results showed a great similarity between the Southern and the Northern Hemisphere (Zerefos, C. - Cosmas, G., 1975) as regards the distribution of the periodicities of the zonal mean annual excess precipitation total.

They also confirm Xanthakis' previous research on the relation between solar activity and precipitation.

Figures No. 1 to 7 represent the various spectra, for each 10 deg. latitude zone of the Southern Hemisphere, of the zonal mean annual excess precipitation total,  $\overline{R - R_0}$ .

Figure No. 8 summarizes the results obtained in figures No. 1 to 7.

Figure No. 9 is the summary picture corresponding to the Northern Hemisphere (Zerefos, C. - Cosmas, G., 1975).

In order to achieve both high resolution and sufficient confidence

---

\* Β Π. ΤΡΙΤΑΚΗ, Φασματική ἀνάλυσις τοῦ ὑπὲρ τὸ κανονικὸν μέσου ὕψους τῆς βροχοπτώσεως εἰς τὸ Νότιον Ἡμισφαίριον. Research Center for Astronomy and Applied Mathematics of the Academy of Athens.

level the maximum time lag used in the data processing was about one third of the whole length of the zonal time-series.

Markov's red-noise of the zones 10-20° S, 50-60° S, 60-70° S has been corrected so that there is no significant difference between the null-continuum and the spectral estimates.

Although this correction reduces the confidence limits, it increases the validity of the results.

#### CONCLUSIONS

From figures No. 1 to 7 it is evident that there are significant peaks with periods of about 10 to 12 years only in the high latitude zones 50° - 70° deg and the latitude zone 20 - 30° S. Higher harmonics of the 11-year period are evident in the southern equatorial zone 0 - 10° S and the latitude zones 20 - 30° S, 40 - 50° S, as well.

There are also significant periodicities close to the 11-year cycle (8 - 10, 12 - 12,5 years) in the zones 30 - 40° S and 40 - 50° S deg.

These conclusions show a great similarity between the Northern and the Southern Hemisphere of the earth as regards precipitation periodicities.

In addition it is beyond any doubt that the close correlations between solar activity and the mean annual excess precipitation totals ( $\overline{R} - R_0$ ) found by Xanthakis are strongly confirmed through the application of the Power Spectrum Analysis.

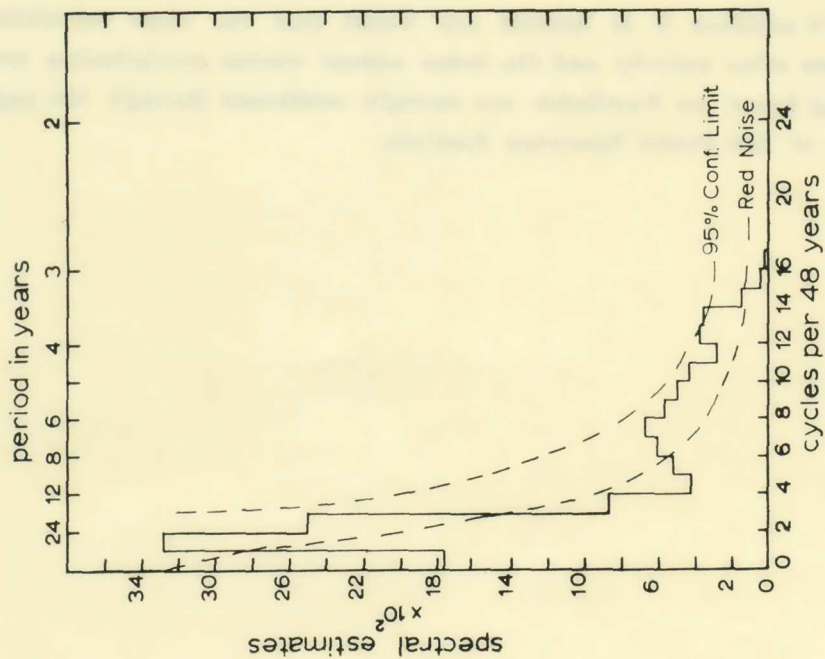


Fig. 1. Power spectrum of  $R - R_0$  for the southern equatorial zone  $0^\circ - 10^\circ S$ .

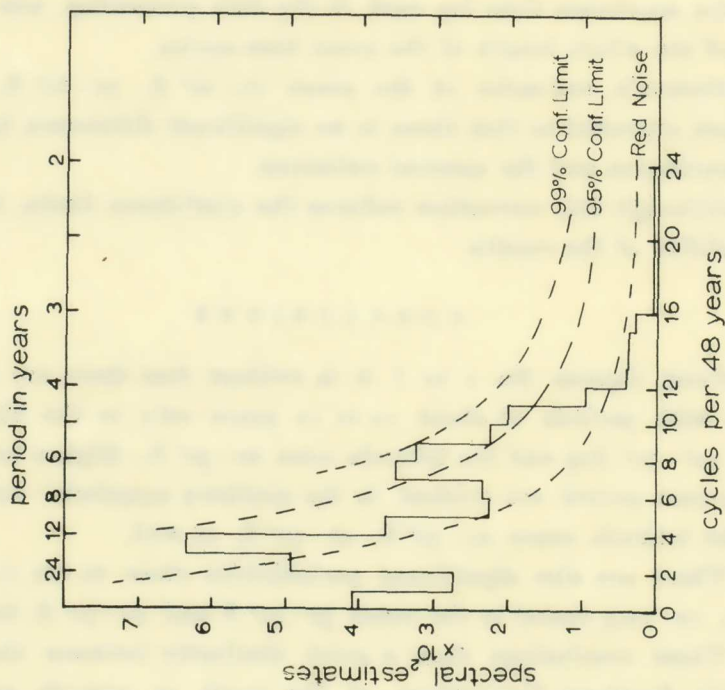


Fig. 2. Power spectrum of  $R - R_0$  for the latitude zone  $10^\circ - 20^\circ S$ .

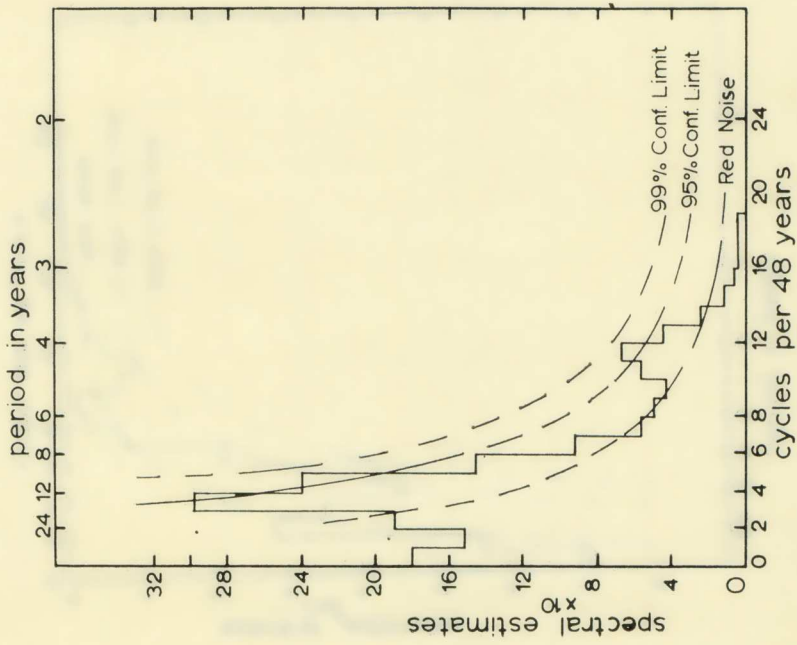


Fig. 3. Power spectrum of  $R - R_0$  for the latitude zone  $20^\circ - 30^\circ$  S.

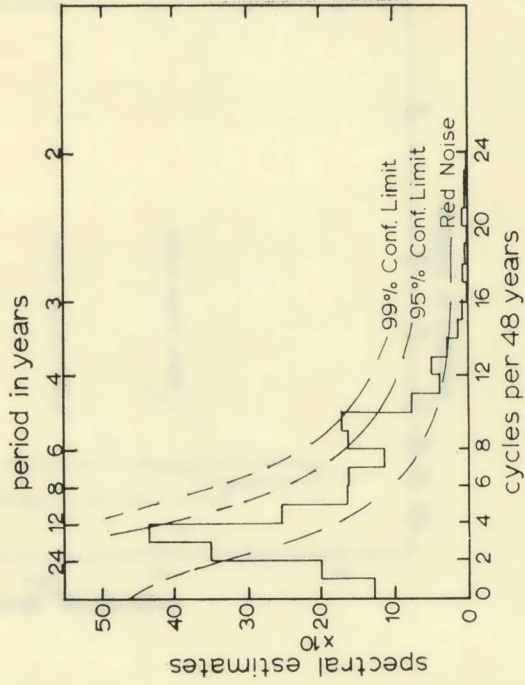


Fig. 4. Power spectrum of  $R - R_0$  for the latitude zone  $30^\circ - 40^\circ$  S.

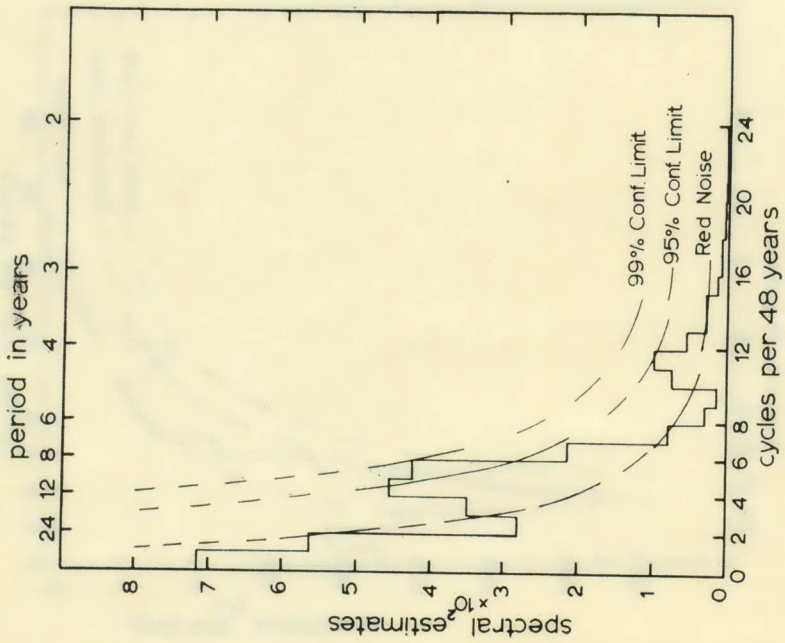


Fig. 5. Power spectrum of  $R - \bar{R}_0$  for the latitude zone  $40^\circ - 50^\circ$  S.

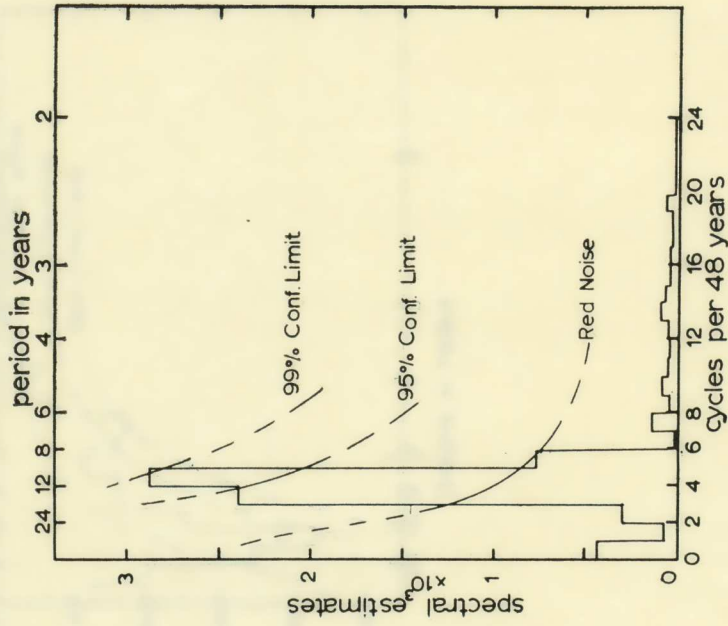


Fig. 6. Power spectrum of  $R - \bar{R}_0$  for the latitude zone  $50^\circ - 60^\circ$  S.

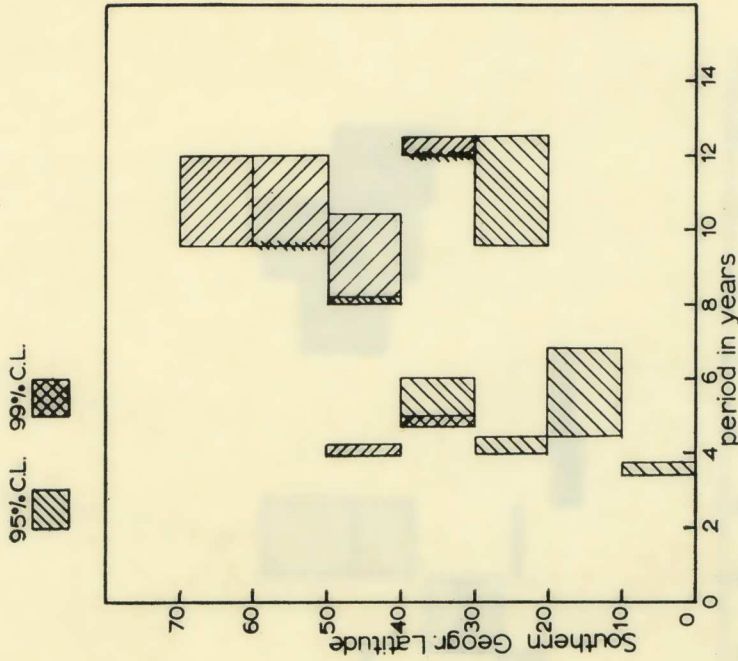


Fig. 8. Distribution of the significant periodicities throughout the Southern Hemisphere.

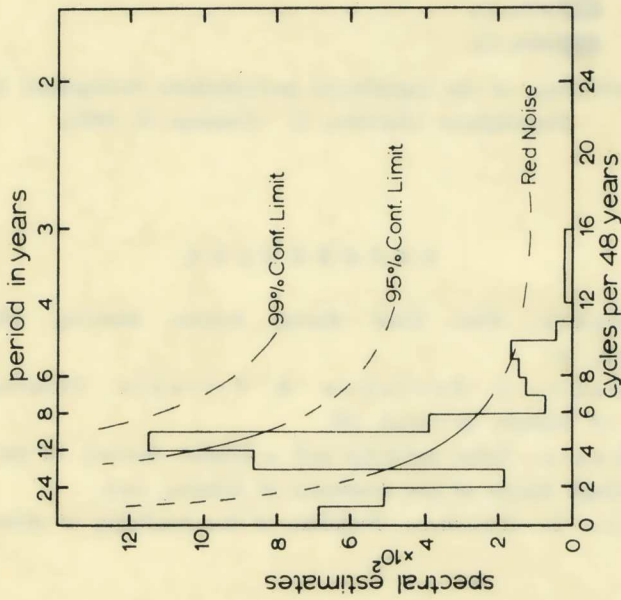


Fig. 7. Power spectrum of  $\bar{R} - \bar{R}_0$  for the latitude zone 60° - 70° S.

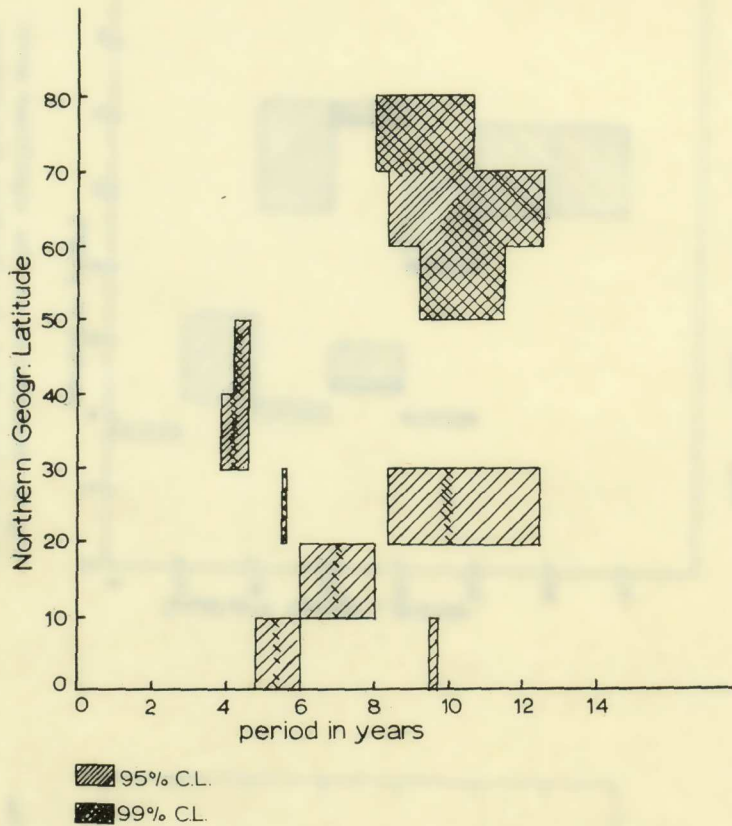


Fig. 9. Distribution of the significant periodicities throughout the Northern Hemisphere (Zerefos, C. - Cosmas, G. 1975).

#### REFERENCES

1. J. Xanthakis, Proc. First Europ. Astron. Meeting Athens, Greece, 1 (1972), 20.
2. J. Xanthakis - C. Poulakos - B. Tritakis, Praktika of the Academy of Athens, 49 (1974), 187.
3. J. Xanthakis, Solar Activity and a Global Survey of the Precipitation (printing). Essay of the Academy of Athens, 1975.
4. C. Zerefos - G. Cosmas, Praktika of the Academy of Athens (printing), 1975.

Ὁ Ἀκαδημαϊκὸς κ. **Ι. Ξανθάκης** παρουσιάζων τὴν ἀνωτέρω μελέτην εἶπε τὰ ἑξῆς :

Ἔχω τὴν τιμὴν νὰ ἀνακοινώσω εἰς τὴν Ἀκαδημίαν Ἀθηνῶν τὰ πορίσματα τῆς ἐρεῦνης τοῦ κ. Β. Τριτάκη, βοηθοῦ τοῦ Κέντρου Ἐρευνῶν Ἀστρονομίας καὶ Ἐφαρμοσμένων Μαθηματικῶν τῆς Ἀκαδημίας Ἀθηνῶν ὑπὸ τὸν τίτλον «Φασματικὴ ἀνάλυσις τοῦ ὑπὲρ τὸ κανονικὸν μέσου ὕψους τῆς βροχοπτώσεως εἰς τὸ Νότιον Ἡμισφαίριον».

Ὁ κ. Τριτάκης δι' ἐφαρμογῆς τῆς μεθόδου τῆς φασματικῆς ἀναλύσεως ἐρευνᾷ τὴν ὑπαρξίν περιοδικότητων εἰς τὰς μεταβολὰς τῆς μέσης ἐτησίαις ζωνικῆς τιμῆς τῆς βροχοπτώσεως εἰς ἑπτὰ ζώνας τοῦ Νοτίου Ἡμισφαιρίου, ἐκάστη τῶν ὁποίων ἔχει εὖρος  $10^\circ$  γεωγραφικοῦ πλάτους.

Τὰ χρησιμοποιηθέντα δεδομένα ἐλήφθησαν ἀπὸ προγενεστέραν ἐργασίαν τοῦ ὁμιλοῦντος, ἡ ὁποία εὐρίσκεται ὑπὸ ἐκτύπωσιν εἰς τὰς «Πραγματείας τῆς Ἀκαδημίας Ἀθηνῶν».

Τὰ πορίσματα τῆς ἐρεῦνης τοῦ συγγραφέως εἶναι τὰ ἀκόλουθα :

1. Ὑφίστανται σημαντικαὶ περιοδικότητες εἰς τὰς ἐρευνηθείσας χρονοσειράς, εἰς ἐπίπεδον ἐμπιστοσύνης ἀνώτερον τοῦ 95%, εἰς τινὰς δὲ περιπτώσεις τοῦ 99%.

Αἱ περιοδικότητες αὗται ἔχουν ὡς ἀκολούθως :

α) Περίοδοι 10 - 11 ἐτῶν ἐνετοπίσθησαν εἰς τὰς ζώνας  $50^\circ - 60^\circ$  S,  $60^\circ - 70^\circ$  S καὶ  $20^\circ - 30^\circ$  S.

β) Περίοδοι γειτονικαὶ τῆς 11ετοῦς, ὅπως 8 - 10 ἐτῶν ἢ 12 - 12,5 ἐτῶν ἀνευρέθησαν εἰς τὰς ζώνας μέσου πλάτους  $30^\circ - 40^\circ$  S καὶ  $40^\circ - 50^\circ$  S.

γ) Τέλος δέ, ἀνώτεροι ἀρμονικαὶ τῆς 11ετοῦς περιόδου 3,5 - 4,5 ἐτῶν ἀνευρέθησαν εἰς τὴν ἰσημερινὴν ζώνην  $0^\circ - 10^\circ$  S καὶ τὰς ζώνας  $20^\circ - 30^\circ$  S,  $40^\circ - 50^\circ$  S.

2. Τὰ ἀνωτέρω ἀποτελέσματα δεικνύουν ὅτι ὑφίσταται ὁμοιότης μεταξὺ Βορείου καὶ Νοτίου Ἡμισφαιρίου, εἰς τὴν κατανομὴν τῶν περιοδικότητων τῆς βροχοπτώσεως, σιμγώνως πρὸς προηγουμένην ἐργασίαν (Zerefos C. - Cosmas G. 1975).

Τὰ ἐξαγόμενα ταῦτα ἐπιβεβαιοῦν πλήρως τὰ συμπεράσματα, εἰς τὰ ὁποῖα κατελήξαμεν εἰς προγενεστέραν ἐργασίαν ἡμῶν. Ἐπειδὴ τὸ θέμα τοῦτο, δηλαδὴ ἡ ἀναζήτησις περιοδικότητων εἰς τὰς μεταβολὰς τῆς βροχοπτώσεως, παρουσιάζει ἰδιαίτερον ἐνδιαφέρον ὄχι μόνον ἀπὸ ἀπόψεως θεωρητικῆς, ἀλλὰ καὶ πρακτικῆς, προτιθέμεθα ὁμοῦ μετὰ τοῦ συγγραφέως νὰ συνεχίσωμεν τὰς ἐρεῦνας ταύτας πρὸς ὁλοκλήρωσιν τῶν ἀποτελεσμάτων τούτων καὶ δι' ἄλλων μεθόδων.