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IMPLICATIONS FOR PREFERRED LONGITUDES IN THE CORONAL OPTICAL INTENSITIES

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ABSTRACT

From the analysis of the optical intensities of the solar corona in various spectral emissions obtained by the Pic-du-Midi and Kislovodsk observatories has been derived that systematic North-South and East-West asymmetries appear in all the data sets. The combination of these two asymmetries makes the Northeast/Southeast solar quarters to appear brighter than the rest in most of the cases of all the data sets. It is very possible the excess of the Northeast/Southeast solar quarter to coincide with the preferred longitudes effect which has been mentioned by several authors in the past.

INTRODUCTION

There are many references for solar constructions which occur within certain solar longitudes /1/, /2/, /3/, /4/, /5/, /6/, /7/. Althought the preferred longitude effect has been determined in various solar and interplanetary phenomena a reasonable explanation about what could trigger it does not exist, yet. In the present report, we try to support the aspect that a longitudinal preference in the appearence of a solar phenomenon constitutes to a secondary effect, caused by a combination of the North-South and the East-West asymmetries which are evident mainly in the solar activity distribution but in many manifestations of it, as well.

DATA AND PROCESSING

Data sets which have been analysed in this report are the daily values of the green line,red line and white light intensities obtained by the Pic-du-Midi observatory and the green line intensity obtained by the Kislovodsk observatory. In the Figures 1,2,3 the North-South and the East-West asymmetries of the intensities of all the optical emissions of the solar corona which have been obtained by the Pic-du-Midi observatory, have been depicted. In addition, in the Figure 4 green line intensities obtained by the Kislovodsk observatory have been also depicted. From all these figures an almost permanent and positive N-S asymmetry is evident as well as a small but permanent in most of the cases E-W asymmetry. These asymmetries are very obvious in the representation of the Pic-du-Midi data (Figures 1, 2, 3) but less in the Kislovodsk data (Figure 4). It is very possible that the asymmetries mentioned above are not very clear in the Kislovodsk data because a polarity change of the general magnetic field of the Sun, which is implied that occur around 1972-73 and

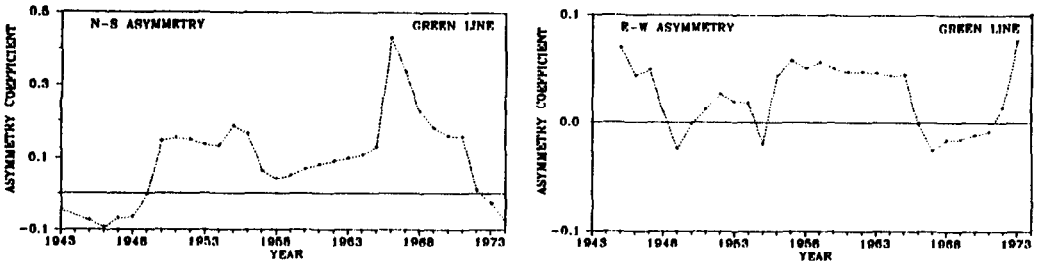

Fig. 1. Variation of the Nort-South (N-S) and East-West (E-W) asymmetry coefficient of the green line intensity, which has been obtained by the Pic-du-Midi observatory.

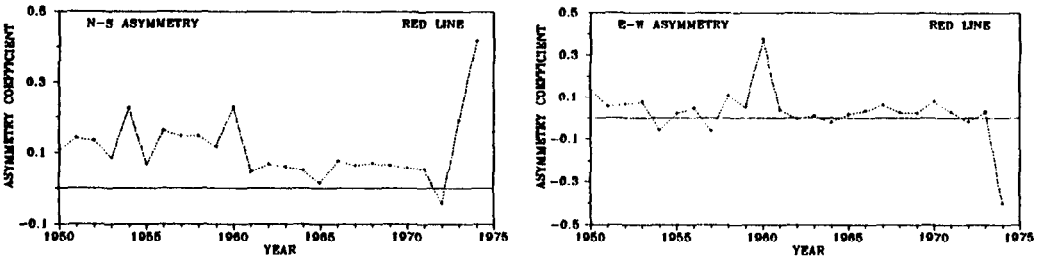

Fig. 2. The same with Figure 1 but red line intensities have been used.

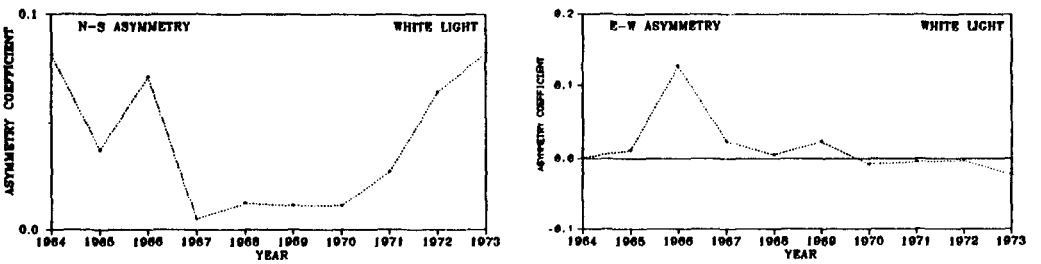

Fig. 3. The same with Figure 1 but white light intensities have been used.

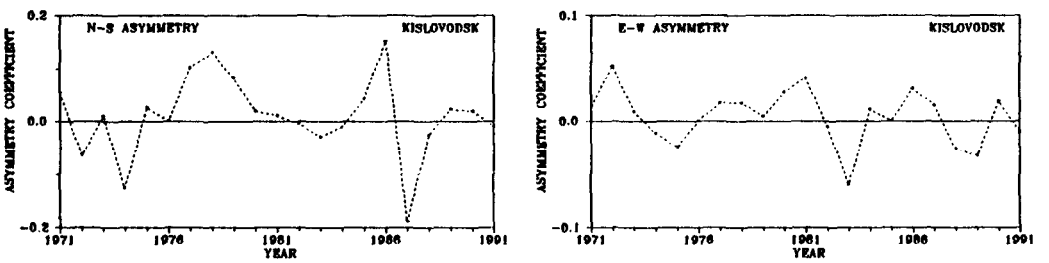

Fig. 4. The same with Figure 1 but green line intensities obtained by the Kislovodsk observatory have been used.

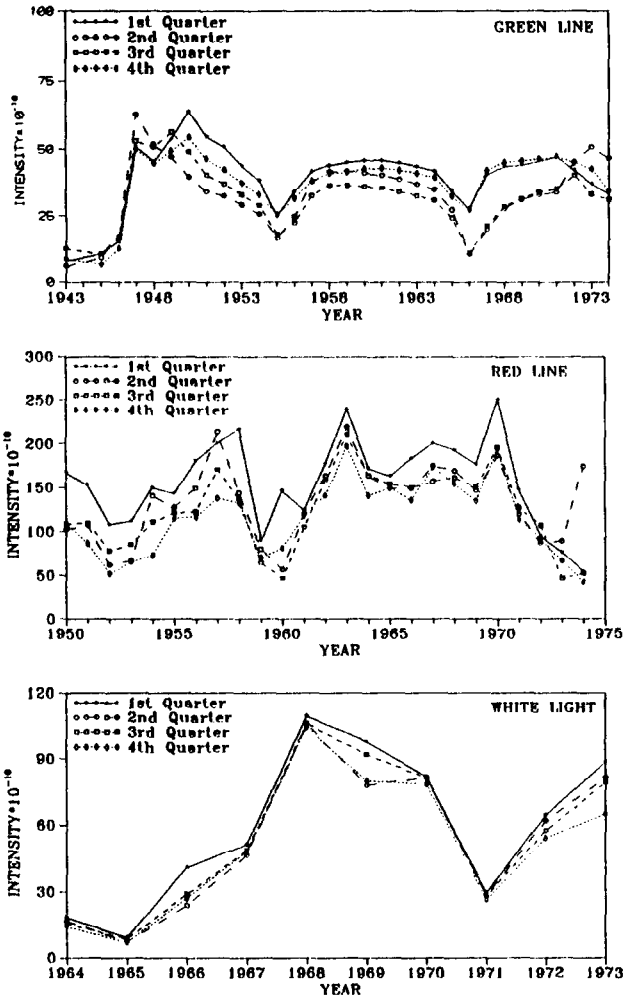

Fig. 5. Yearly values of the green line (upper), red line (intermediate) and the white light intensities (lower), of the Northeast (1st), Northwest (2nd), Southwest (3rd) and Southeast (4th) quarter of the solar corona, obtained by the Pic-du-Midi observatory.

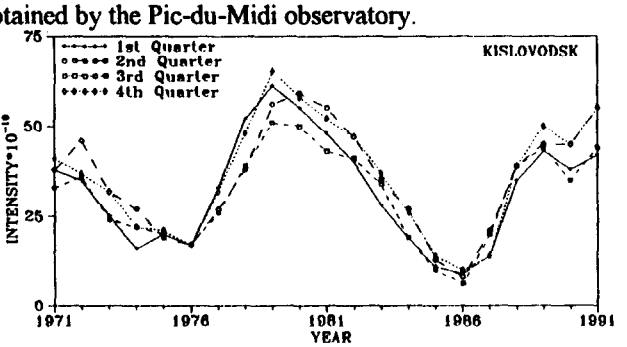

Fig. 6. The same with the Figure 5 but green line intensities obtained by the Kislovodsk observatory have been used.

overturned the N-S solar polarity into S-N has masked the final result (Figures 1, 4). From the figure 4 (upper) it is clear that during the 22-year solar magnetic cycle which extents between 1971-1991 the N-S asymmetry of the green line intensity has not got the stability of the Pic-du-Midi data. In the following, we have calculated for each solar quarter separately, the mean yearly values of the intensity expressed in millionths of the photospheric brightness in the center of the solar disk for all the optical emissions obtained by the Pic-du-Midi and the Kislovodsk observatories (Figures 5, 6). If we take in mind the correspondance: 1st quarter = Northeast, 2nd quarter = Northwest, 3rd quarter = Southwest, 4th quarter = Southeast, it is evident that the Northeast quarter predominates in all the panels of the Figure 5 between the beginning of the fifties and seventies where a full 22-year solar cycle extents. In contrast between 1971-1991, where the polarity of the solar magnetic field has been reestablished, the 4th or Southeast solar quarter predominates, something which is very obvious in the Figure 6 where green line intensities obtained by the Kislovodsk observatory have been depicted.

DISCUSSION

A North-South asymmetry of the solar activity and related phenomena is a very well-known solar effect which has been attributed to the time lag mediated in the development of the solar activity in the North and the South solar hemisphere. Solar activity has been determined to develop 1-2 years earlier in the hemisphere with positive polarity in relation to the other. In addition, an excess in brightness of the solar corona but in the distribution of various solar constructions have been also determined in the east hemisphere as well. The combination of the above mentioned N-S and E-W asymmetries makes the Northeast and the Southeast solar quarters to predominate during successive 22-year solar cycles, respectively. It is very possible that the predominance of these solar quarters gives the impression of what it is named "preferred solar longitudes effect" or "active solar longitudes" which has been already determined by several authors.

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