Part IV

COOPERATIVE STUDY OF SOLAR ACTIVE REGIONS (CSSAR)

https://doi.org/10.1017/S0074180900021707 Published online by Cambridge University Press

COOPERATIVE STUDY OF SOLAR ACTIVE REGIONS

Introductory Report

R. MICHARD
(Observatoire de Paris-Meudon, France)

1. Introduction

The 'Cooperative Study of Solar Active Regions' (or CSSAR) originated from a suggestion of E. R. Mustel at the IQSY General Assembly in Rome, 1963. Later on it was also endorsed by IAU Commission 10, and a special Working Group of this Commission, under chairmanship of the writer, had the duty to organize this project, an experiment in both solar physics and international cooperation.

Our general purpose was to study in detail the evolution of a small number of selected Active Regions (AR) using the material obtained throughout the world, by all techniques of optical and radio-astronomy (and possibly also indirect information from interplanetary and geophysical effects). It was thought that 1965 would be a convenient period because the small number of ARs would limit interferences between their respective evolutions, particularly in their declining phase. Also the International Years of the Quiet Sun would form a natural frame for this cooperative project.

A total of 72 observing stations from 27 different countries announced their readiness to take part in CSSAR. Collection of the material was undertaken by the various World Data Centers in the field of solar activity, each of them taking care of a particular type of data. A final collection was achieved in Meudon in February 1967.

In such a project, one of the most difficult tasks is to make the material available to interested scientists in such a form and at such a time that it is effectively used. It was, at first, thought that some kind of publication of the data, for instance by circulation of microfilms, would be the best way. Later on, we realized that this would not be feasible due to enormous amount of work involved, and to the great loss of information in repeated copying of the photographs which form the bulk of CSSAR data. Therefore we tried to encourage direct study of the original and/or first copies. The 'collectors' of each sort of material were asked to analyse it, if they thought valuable. Further a large number of astronomers were invited to come to Meudon during spring 1967 for examining the whole collected information.* A total of 7 colleagues from 5 institutions accepted this invitation; a few local scientists also took part in the study of the CSSAR data.

* We thank the Centre National de la Recherche Scientifique, Paris, and the Director of the Observatoire de Paris for their generous support in this programme.

Kiepenheuer (ed.), Structure and Development of Solar Active Regions, 307–310.

Table 1

CSSAR n°	QBSA n°	McMath n°	KAO n°	Mt. Wilson n°	Coordinates	CMP 1st transit	Birth	Remarks
1	1492-1	7718	76	15903	348, 30 N	March 16	March 11 on disk	Cycle 20, well isolated, 12 flares in 1st transit, traceable at 3rd transit
2	1493-4	7771	79	15909-12	277, 4 N	April 18	?	Cycle 19, well isolated at 1st transit. 15 flares at 1st transit. Very doubtful return of plage QBSA 1492-3 (McMath 7736)
3	1494-6	7809	87	15918	200, 23 N	May 21	?	Cycle 20, large AR, close to n° 4, 15 flares. Small new region born west of it at 3rd transit
4	1494-9	7812	88	15919	173, 25 N	May 23	?	Cycle 20, rather large, close to n° 3, 30 flares. Traceable at 3rd transit
5	1494-17	7840	91?	15923	15, 10 S	June 3	June 1 on disk	Cycle 19. Nice case for growing phase of isolated AR. 7 flares
6	1495-4	7863	95	15926	210, 28 S	–	June 16 on disk	Cycle 20, 10 flares, 3rd transit perturbated by new AR West of n° 6
7	1496-4	7886	102	15935-6	270, 20 N	July 8–9	July 5–6 on disk	Cycle 20, 10 flares. Born on disk in existing old plage. Faint, well-isolated plage at 3rd transit
8	1498-5	7971	112-3	15953	185, 26 N	September 8	September 4 on disk	Cycle 20, 14 flares at 1st transit. Well isolated at 2nd transit
9	1499-4	8005	118	15957	218, 20 N	October 2	?	Cycle 20, 27 flares at 1st transit. Large AR young at east limb.
10	1499-1	8012	120	15961	230, 18 S	–	October 2 on disk	Cycle 20, 3 flares. Large flare on October 4

https://doi.org/10.1017/S0074180900021707 Published online by Cambridge University Press

It would be clear that this study could start only in February 1967 and is still continuing in some cases. Therefore the various scientific reports presented below represent only preliminary results of the CSSAR project.

2. Review of CSSAR data

On the basis of their intrinsic interest and of the world-wide availability of good observations, 10 ARs were selected for data collection. These are listed in Table 1.

Sunspots photographs were also collected for a few other regions of interest at the initiative of WDC-C for sunspots (Eidgenössische Sternwarte in Zürich).

The available material for the ARs of Table 1 may be summarized as follows (with name of data 'collector').

(a) Sunspot photographs with average time interval of 1 hour (Waldmeier, Zürich).

(b) K_2 spectroheliograms with average time interval of 3–4 hours (Godoli, Florence).

(c) Daily Hα spectroheliograms, plus nearly continuous cinematographic Hα patrol for days of important flare activity in the selected regions (Michard, Meudon).

(d) Miscellaneous prominences photographs (Kleczek, Ondřejov).

(e) Mount Wilson whole-disk magnetograms, detailed maps of AR magnetic fields, sunspot magnetic data (Severny, Crimean Astrophysical Observatory).

(f) K-coronameter records and white-light photographs of corona (Newkirk, High Altitude Observatory).

(g) Coronal lines records (Leroy, Pic-du-Midi).

(h) Radioastronomical data (Fokker, Utrecht).

(i) X-rays flux and miscellaneous geophysical data (Miss Lincoln, ESSA, Boulder).

Part of the data, specially for topics (h) and (i), is published in the *Quarterly Bulletin on Solar Activity* and in the *Solar Geophysical Data* of ESSA. A large part will be conserved in Meudon, and requests for communication should be addressed to the writer. However, original photographs, such as part of Hα-patrol films, are being sent back to their owners.

3. Remarks about the CSSAR data and the 1965 solar patrol

CSSAR may have been the first opportunity to review the completeness and average quality of the worldwide survey of solar phenomena. The writer was interested in the following points:

(a) The many white-light pictures of the photosphere obtained at various stations allow the study of the evolution of sunspot groups with an average resolving power superior to that of other types of observations, such as magnetographic or spectroheliographic. More studies of the detailed evolution of sunspots would be feasible and useful.

(b) While the usual Hα cinematographic patrol is satisfactory for the detection and

evaluation of solar flares – that is for its main purpose – its average resolving power is often insufficient for the detailed study of ARs and of flare events. As often advocated by Kiepenheuer and Giovanelli, efforts are needed to obtain better Hα surveys of selected solar regions.

(c) The detailed study of longitudinal magnetic fields in ARs is still very difficult. Only two stations, K.A.O. and Meudon, produced a significant number of isogauss maps for the CSSAR project (although a few others were available from Mount Wilson 'fine scans' and from IZMIRAN). An unwanted number of errors was found in the Meudon maps, while the saturation of the photoelectric magnetograph is a significant limitation in the study of ARs.

Progresses are still needed in order to produce detailed magnetic maps in much larger number, of better quality, and easier to compare between themselves or with other solar information. In the future it seems likely that two different approaches should be undertaken:

(1) on the one hand the mass production of rather qualitative magnetic 'pictures' for patrol purposes (and flare prediction) with techniques more or less based on image substraction like Leighton's one.

(2) on the other hand the obtention of precise quantitative maps for a lesser number of cases, with techniques allowing the measurement of a large *range* of fields and preferably also of the three field parameters.

4. Conclusion

Although the above remarks mainly deal with some limitations of the CSSAR data, it will be seen from forthcoming papers in this volume (and other publications) that significant scientific results could be obtained from it! This was due to the generous cooperation of many observatories providing their photographs and records of solar phenomena, to the 9 data 'collectors' who, in many cases, spent much work to arrange the raw material in an homogeneous way, to the excellent advice received from the CSSAR Working Group. I express to them the gratitude of the scientists who used the data, and also my own.