OBSERVATORI ASTRONÒMIC DEL GARRAF

ANNUAL OAG SOLAR H-Alfa DAILY ELEMENTAL PROGRAM REPORT

Year 2009 / CR nº 2079-2091 / www.oagarraf.net / info@oagarraf.net

1. Introduction.

The solar program developed by the OAG since January 2009 aims to regulate the observation of solar activity cycle 24. As an Elemental Program it has a dimension of teaching, although observations can provide usable tools for studies on other levels. We consider this first year as a trial period for instruments, methods and publications. We are working in a new fixed solar station, equipped with a double refractor 150mm aperture at F/8 and 102mm aperture at F/10 to observe in White Light (Herschel Prism) and wide band K-Line (390-398nm, resolution 9nm) filter, and a refractor 40/60mm aperture at F/9 Coronado Solar Max (656nm, 0.7A resolution) in order to make visual, digital and electronic observations at various wavelengths.

2. Classification morphology: evaluation and revision of the Völker system (1970)

Our fundamental objective is the classification of prominences in morphological and dynamic types, establishing possible statistic relationships between different types depending on the development of the solar cycle. Currently we only have a amateur-visual modern morphological classification made by Völker (1970) that also includes the types, set traditionally by solar physics as eruptives and quiescents. Thus the S-type and B-type can be regarded as eruptives, and F as quiescent. As we can see in Fig.1, this classification establishes three main categories: Columns, Arches and Areas with a progressive succession depending of the development of each other. The observation and classification of more than 1.200 groups and 2.000 components of prominences between January and December 2009 by the OAG team has achieved some interesting conclusions about this system, evaluating the advantages and disadvantages presented. The classification of Völker is functional and practical and it is appropriate for an elementary program of tracking prominences.

Generally achieves good results, although here are some particular changes that can improve your application. The experience shows that there are types they are hardly observed in the original classification so it is needed to add some new types to allow a better statistical analysis of the observations. The same author already warns of the limitations of his system, but we will work on the assumption that due to its good original concept it can evolve as a dynamic elementary classification consistent with actual knowledge in physics of solar prominences. This question is similar to discussion between Zürich, Waldmeier and McIntosh sunspots classification systems.

2.1. General criteria: group classification

The first issue to be established is whether it really needs to classify the prominences in groups and components. According Völker (1991), when a prominence shows various morphologic components, they can be classified individually. Therefore a Coronal SB and a cloud would give rise to a classification as SB (all prominence) and two components, a SB and SD. We have not ever used the classification for components, because we do not consider it relevant and bring confusion about the true type assigned to the prominence as a whole. Establishing certain parallel with the classification of sunspots, it would be equivalent to classify each of the components of a spot group with the same nomenclature that the whole group.

The criterion used by the OAG has been to classify the group as the dominant components. Thus a prominence in SB type column wich has two next small columns is simply a SB with three components, not a SB-SA-SA. It could be found some kind of naming assistant, such as SB-3c, but it would only complicate a classification that has the merit of being simple and easy to apply.

In the tracking of eruptive protuberances, the classification of a group changes depending on time. We therefore makes no sense to classify the different components as they were appeared, On the contrary we establish whether the phase changes in a succession of type SA or SA-SB-SB-SC SD as response to dynamic changes and morphological resulting of plasma expansion The classification of components not in the case of the quiescents prominences is even more evident. They are large structures where you can find almost every type of morphology, but they do not respond at all to the criterion of dominant component. It makes no sense to classify a database column of type FC prominence, as SB, although it is similar. Rationally used and only referred to the set, the classification of Völker reflects the more dynamic appearance and easily allow separate groups in eruptives and quiescents, in a way consistent with the classifications based on solar physics.

2.2 Eruptive prominences: arches, clouds and coronal nodules or knots.

The subtype "D" (detached) from the Völker classification can lead to major mistakes and it is needed some critical analysis. The SA prominence type, level immediately above the spicules (a typical SA is about 2 times higher) are often the initial focus of eruptive prominences (also called solar *surges* in the literature) with a vertical or curved very fast development The material is ejected as a jet and returned the same way, with speeds between 100-200 km / sec, reaching elevations of 10.000 to 20.000 km, with a lifetime of 10 to 20 minutes. When two SA are connected between the two or more active centres (which may also correspond to active regions (AR) of the chromosphere or photosphere) that form plasma arches, horizontal or slightly curved, but less pronounced than the category "B" witch evolve in nodules and condensations remaining suspended over the chromosphere, at levels typical of internal coronal zone.

The eruptive prominences (and indeed also quiescents) tend to disappear suddenly (the term used is of French origin: *disparition brusque*, abbreviated DB). In many cases, the nodules and the arches remain on the chromosphere when the foundations have already disappeared. When we observe daily, usually do not see the whole process of prominence as a whole, but we do so at any given time. Faced with the presence of a bulge suspended over the chromosphere, according to the classification of Völker (1970) we have to decide for the subtype "D" but also choosing the type S, B or F. The only criterion we have in this case is morphological, i.e., the shape of the cloud. The rapid evolution and morphological changes of the ejected plasma is that distort the classification so that we can both attribute a SD to a rest of a eruptive process or quiescent component. We have said we are interested here enhance the qualities of dynamic Völker classification to establish elemental statistical studies on the two basic types of prominences (eruptive and quiescent) to study the possible correlations with others indicators that may have the solar cycle. Therefore, we have to distinguish in the D subtype the plasma remains as the possible dynamic origin. In this sense we have added two new categories: "CA" corresponds to the apparent horizontal coronal arches and CK to coronal clouds and the nodules or knots, associated to eruptive phenomena The subtype included are:

1. CAA: plasma arcs between two or more SA prominences
2. CAB: plasma arcs between two or more SB. Prominences Intense nodules coronal clouds are produced
3. CAC: plasma arcs between two or more large SC prominences Complex structures and coronal abundance of nodules and clouds.
4. CAD: Rest of plasma arch that maintains the apparent horizontality after a phenomena DB (sudden disappearance), variable intensity.

The presence of observed coronal nodules or knots alone or together indicates the existence of eruptive processes normally associated with prominences of S or B categories.   We set the CK category corresponding to various states of the nodules, when we look them of its original arches, or when they are product of prominences type *surge.*

The subtype that includes are:

1. CKA: Small Coronal Nodule or Knots, usually isolated or in pairs, either in a vertical u horizontal. High or medium intensity.
2. CKB: Coronal Nodules or Knots forming a small group of not more than three components. either in a vertical u horizontal. High or medium intensity.
3. CKC: Coronal Nodules or Knots forming major groups with different levels of condensation, either in a vertical u horizontal intensity variable.
4. CCD: typical Coronal Cloud, usually circular or elliptical, also irregular, which can not be classified into other types.

2.3 Some ambiguities and gaps in the types B and F.

The B-type in Völker classification emphasizes precisely the arcs that appear remarkably curved, differentiating them from the horizontal arcs of C type as described. It is a good criterion, but it happens frequently that two SA connected to a CA of small size may be confused with a BA and classify a group BA as a SA. Since the CA have a more limited development in high that large prominences in arch, the confusion does not occur by the most advanced type BB or BC.

In F type occurs also some ambiguity between an FA and a SA eruptive that may show a more extensive base in a given time. In fact, if we follow the development of the prominence we can choose one kind or another. However, cases of FA that have showed a quick eruptive phenomena have been observed frequently in the campaign of 2009, so it is possible that the type of AF in Völker classification also include eruptive prominences more similar to SA but with a wider basis. In this case we opt to classify them according to their dynamics (it is advisable to tracking it for a period of 10 to 30 minutes).

One factor that may help to establish whether we are facing an eruptive or a small quiescent SA is the light intensity. Indeed, the SA prominences show a notable increase in the brightness shortly before entering the phase of eruption, so that we can predict with security even a SA (this phenomenon can also occur in the spicules and the SB) is ready to erupt just by visual estimation. During the 2009 campaign we have noted frequently the increasing light intensities SA (SA +1, SA +2, SA+3) or in the opposite direction (SA -1, SA -2, SA -3) . As an initial criterion is sufficient to compare the intensity of the chromosphere (= 0) and set 3 intensity levels of linear proportionality the prominences usually trigger the eruptive state between +2 and +3 intensities. In the comparative degree flares would be located to +6 or more and can be detected in pre, eruptive, and post-flare steps with relative ease.

2.4 The special types

Some of the more spectacular prominences due to their dynamic behaviour has no place in the classification of Völker (1970). So-called *spray* with dramatic and rapid evolution, which can reach speeds of 500 to 1200 km /sec can be confused with a small and intense FA, as a result of a DB (*disparition brusque*) of a plage filament , or the named w*hirlpools*, observed rarely, have a structure in a vertical braid really unique. There is a kind of prominence linked to eruptive phenomena, perhaps the most relevant, not included in the Völker classification (1970), called *loops*. They are produced by flares, showing circular structures in the form of rings where circulating plasma is trapped in the magnetic fields. When it does rain intermittently they are called c*oronal rain*, coinciding with post flare stage, that does not fit in the original classification. Finally, the presence of prominences detached from the base in the form of curtains, reminiscent of apparent terrestrial auroras, are included in this category. These special types are gathered in the special category that we call ET, and that includes the following subtypes:

1. ETS: halfway between SA and FA but with rapid and intense eruptive processes. Give rise to other types (SB, SC ...) and can produce coronal arches, clouds and nodules or knots. These are called spray.
2. ETW: They present braided structures and can be confused with SB or SC if not observed in detail. These are called whirpools.
3. ETL / ETR: Correspond to loops, perfectly distinct from any other. Set also ER (Coronal Rain).
4. ETA: They have a curtain of aurora apparence structure in the form of bars with no contact with the base of the chromosphere.

Fig.1a Völker (1970) ORIGINAL CLASSIFICATION

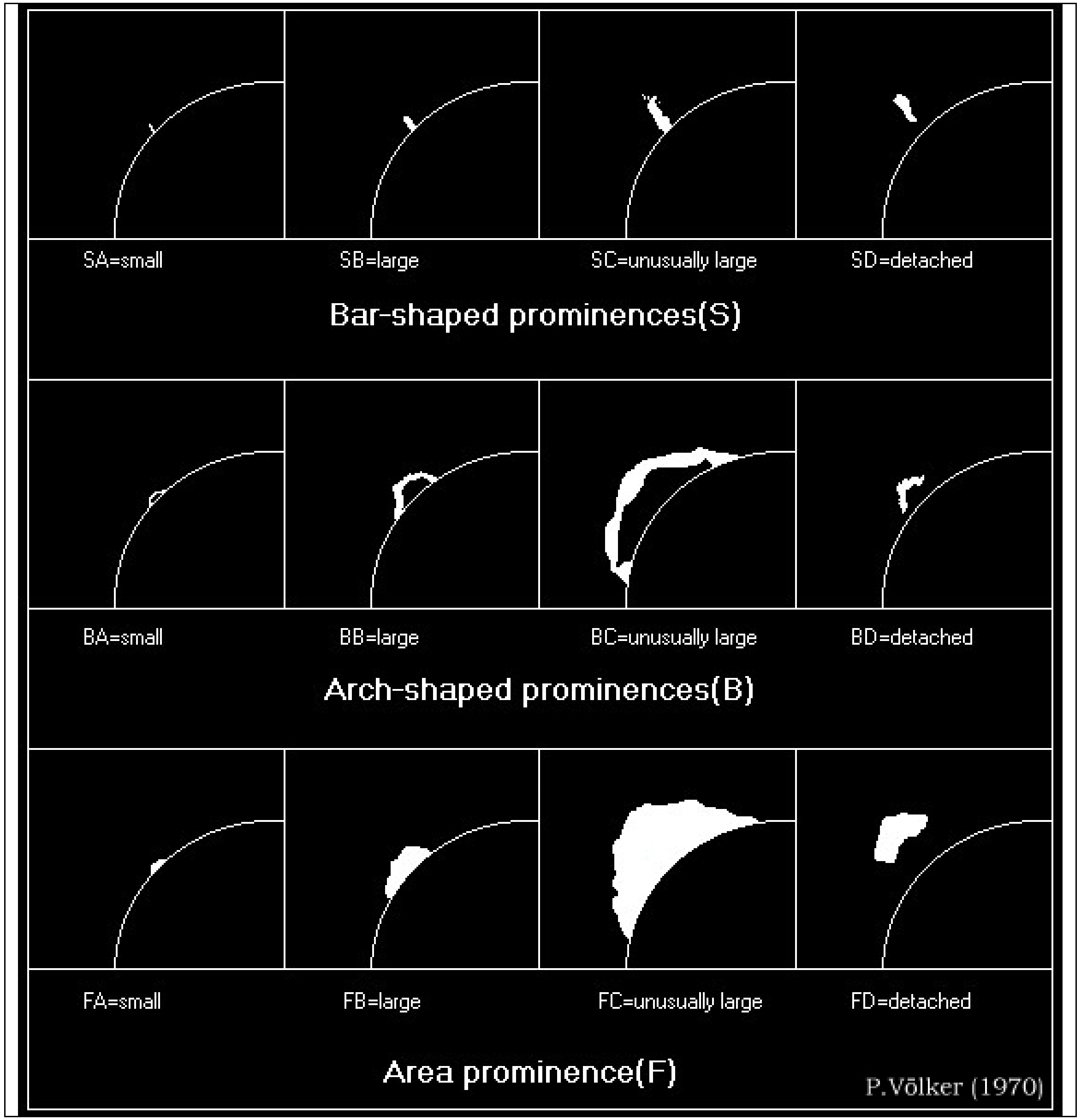


Fig. 1b Tobal (2009) EXTENSION

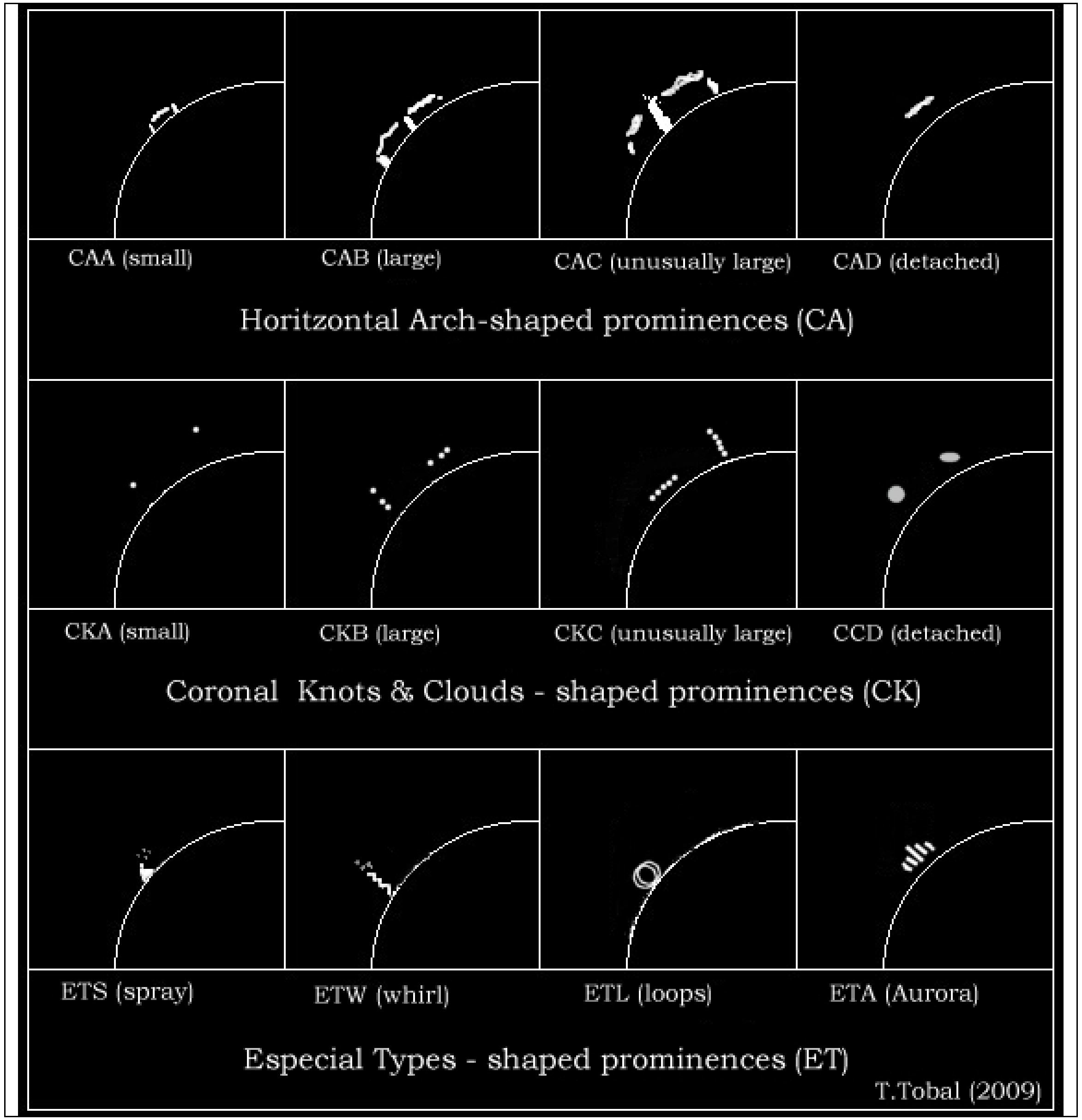


Fig.2 Calleja (2008) TYPE EVOLUTION

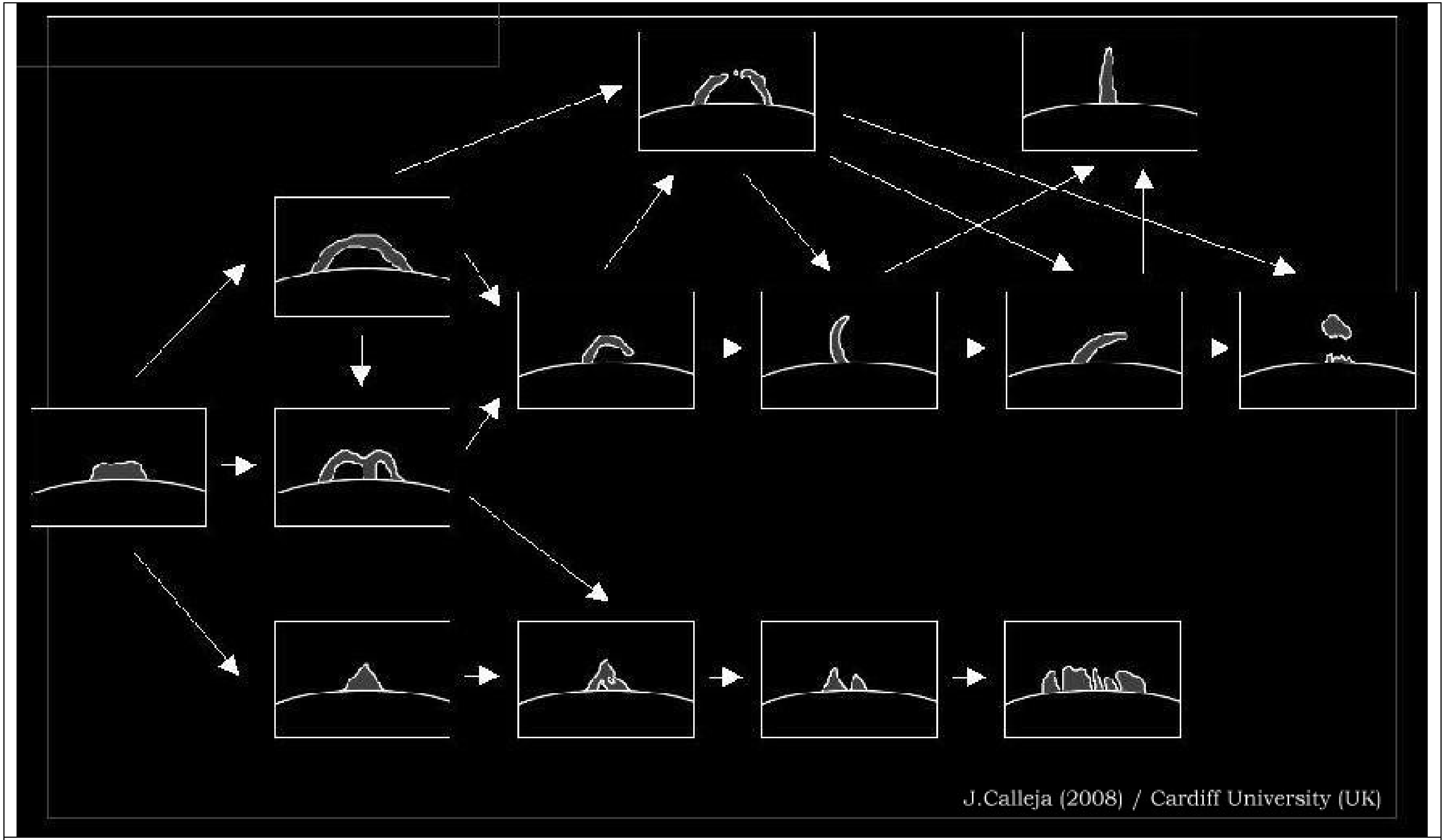


Fig.1c Relationship between morphology and dynamics of some types of prominences by solar observatory at the University of Cardiff

2009 DATA: CR 2079 – CR 2091

3.1 Monitoring and observation conditions

Following there are a series of graphs that synthesize the observations made between Carrington rotations 2079 to 2091, representing the initial stages of transition between Solar Cycles 23 and 24. The tracking increase from the beginning, reaching a maximum coverage at CR 2084, 2085 and 2088 with values above 80%. The annual average coverage for a solar rotation was 57.5% and the total days of observation was 202. The conditions were generally medium quality except for the CR 2082 an 2085 that we enjoyed great chromosferic images. The conditions deteriorate significantly between CR 2089 to 2091 as shown in Table A and Fig.2.. Under S / Q = 2 conditions the speckles are easily visible and measurable and the detection of *Dark Mottles* in the chromospheric network disk is possible

Taula A

CR nº	Inici CR	D obs	Cob. %	S	Q
2079	Gen. 13,94	00	00,0	ND	ND
2080	Feb. 10,28	05	18,5	2,5	3,0
2081	Mar. 09,62	17	62,9	2,1	2,3
2082	Abr. 05,92	20	74,1	1,7	2,1
2083	Mai. 03,18	19	70,3	2,1	2,2
2084	Mai. 30,39	22	81,4	2,2	2,4
2085	Jun. 26,59	23	85,1	1,9	2,2
2086	Jul. 23,80	13	48,1	2,0	2,4
2087	Ago. 20,02	20	74,1	2,3	2,6
2088	Set. 16,28	22	81,4	2,4	2,7
2089	Oct. 13,56	14	51,8	2,6	2,8
2090	Nov. 09,86	18	66,6	2,9	3,3
2091	Dec. 07,17	09	33,3	2,5	2,7
Average		**15,5d/CR**	**57,5%**	**2,3**	**2,6**
Total 2009		**202d**			

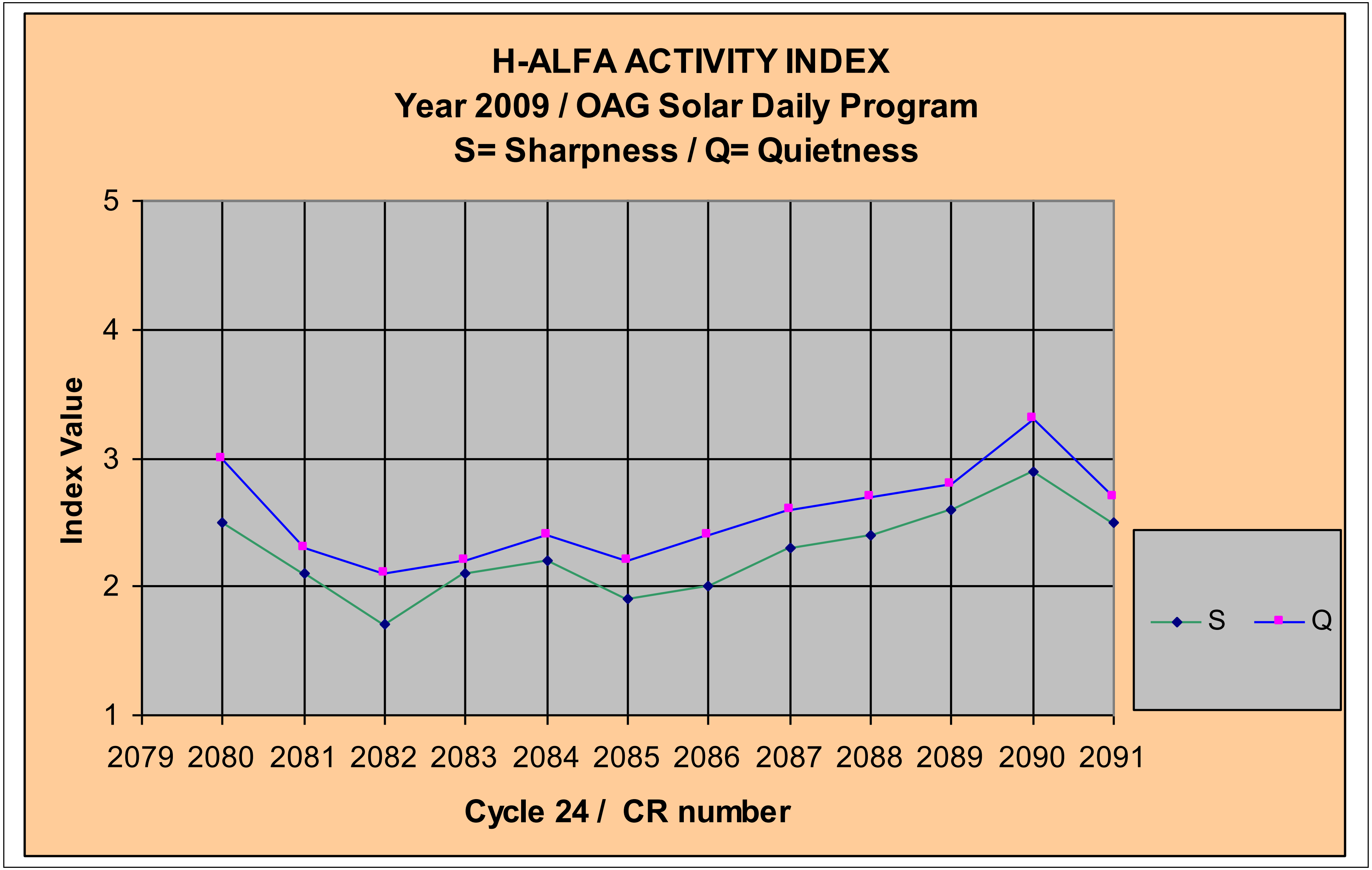

H-ALFA ACTIVITY INDEX
Year 2009 / OAG Solar Daily Program
S= Sharpness / Q= Quietness
Index Value
5
4
3
2
1
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
Cycle 24 / CR number
S
Q

Fig.2a

3.2 Chromospheric activity index

The different chromospheric activity indexes were assessed following the formulas laid out by Beck et al (1995), basically similar to those used internationally for the calculation of the Wolf number (R). Thus we have:

R-Pr	**Limb Prominence Index (RPr= 10H+E)**
R-Fil	**Filaments Index (RFil= 10H+E)**
R-Fac	**Chromospheric Faculae Index . (RFac= 10Ft+FI)**
RFlare	**Average or Total Number of Flares detected**
H	**Number of Groups**
E	**Number of Individual Components**

The following tables provide the different levels of calculated activity and the total of groups and components observed

Taula B. Index d'Activitat / CR

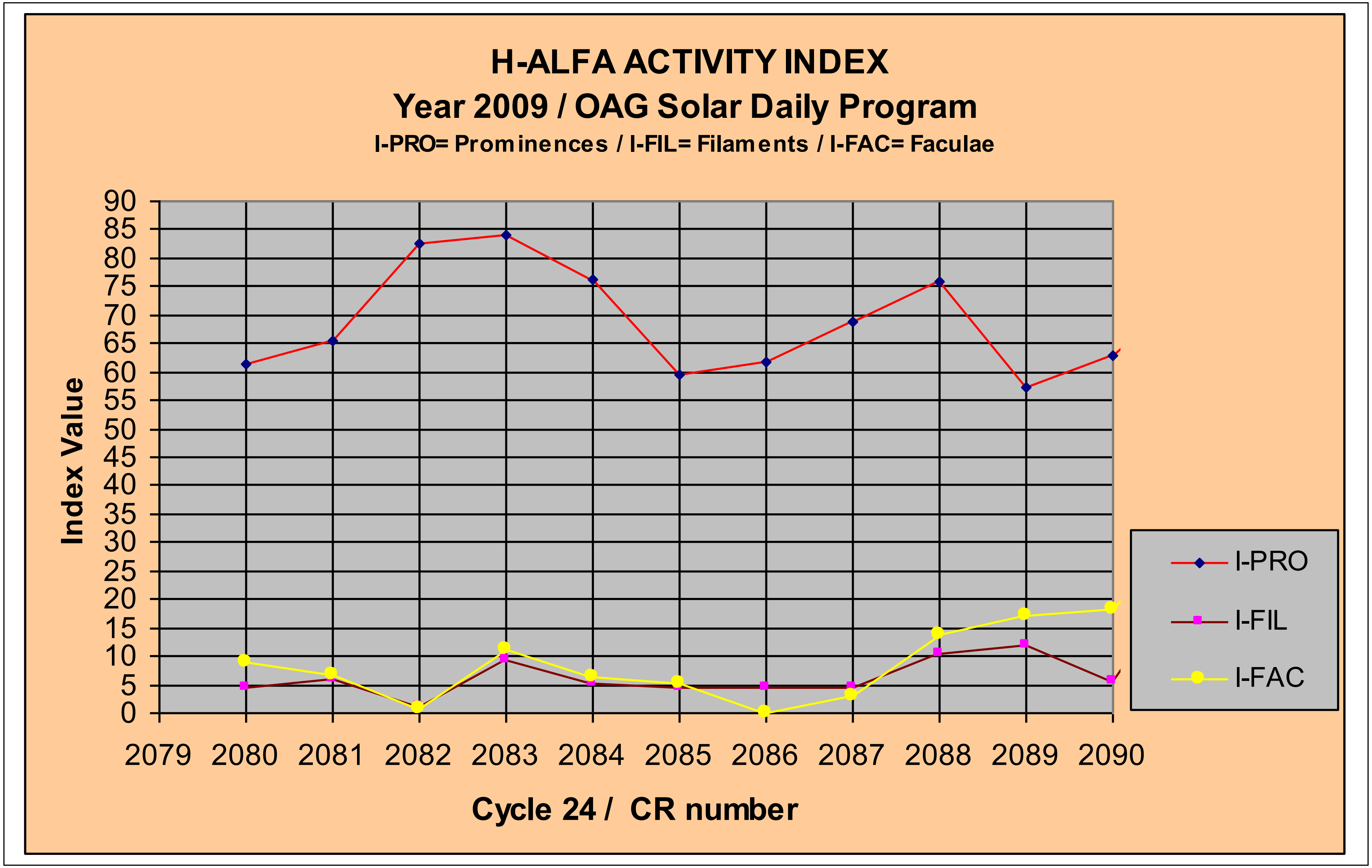
RCnº	S	Q	H Pro	E Pr	R-Pr	R-Fil	H Fil	E-FIL	R-Fac	H Fac	E Fac	FLARE
2079	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
2080	2,5	3,0	5,2	9,4	61,4	4,4	0,4	0,4	8,8	0,6	0,8	0,0
2081	2,1	2,3	5,5	10,7	65,4	5,8	0,5	0,6	6,6	0,5	0,6	0,0
2082	1,7	2,1	7,1	11,6	82,7	1,2	0,1	0,1	0,6	0,1	0,1	0,0
2083	2,1	2,2	7,0	11,7	84,0	9,4	0,8	1,1	11,0	0,9	1,8	0,0
2084	2,2	2,4	6,5	10,8	76,3	5,1	0,5	0,6	6,5	0,5	1,0	0,0
2085	1,9	2,2	5,1	8,5	59,6	4,5	0,4	0,7	5,2	0,3	0,6	0,0
2086	2,0	2,4	5,3	8,8	61,9	4,3	0,4	0,5	0,0	0,0	0,0	0,0
2087	2,3	2,6	5,9	10,0	68,9	4,4	0,4	0,5	3,1	0,3	0,4	0,0
2088	2,4	2,7	6,8	10,6	75,9	10,4	0,9	1,3	13,7	1,2	1,9	0,0
2089	2,6	2,8	4,9	8,3	57,3	11,9	1,0	1,9	17,0	1,4	2,8	0,2
2090	2,9	3,3	5,4	8,9	62,8	5,5	0,5	0,5	18,3	2,0	7,1	0,1
2091	2,5	2,7	6,6	10,1	75,7	27,6	2,4	3,1	34,6	2,7	2,9	0,2
CR Average	**2,3**	**2,6**	**5,9**	**10,0**	**69,3**	**7,9**	**0,7**	**0,9**	**10,5**	**0,9**	**1,7**	**0,04**

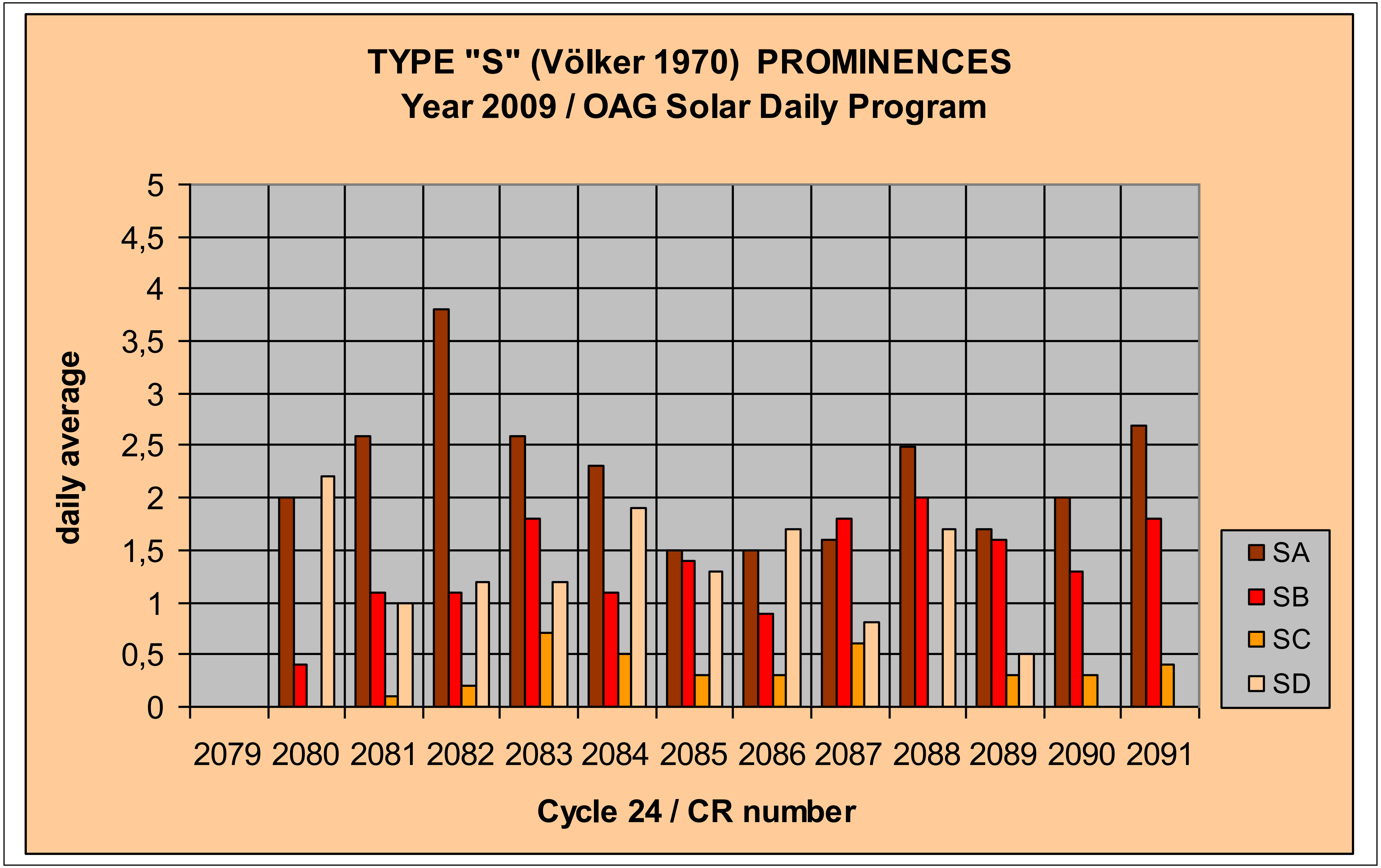
Table C: Prominence type / CR

RCnº	SA	SB	SC	SD	BA	BB	BC	BD	FA	FB	FC	FD
2079	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
2080	2,0	0,4	0,0	2,2	0,4	0,0	0,0	0,0	0,2	0,0	0,0	0,0
2081	2,6	1,1	0,1	1,0	0,2	0,1	0,0	0,1	0,3	0,1	0,0	0,0
2082	3,8	1,1	0,2	1,2	0,2	0,1	0,0	0,1	0,6	0,0	0,0	0,0
2083	2,6	1,8	0,7	1,2	0,1	0,3	0,0	0,0	0,2	0,0	0,0	0,1
2084	2,3	1,1	0,5	1,9	0,0	0,1	0,0	0,0	0,4	0,1	0,0	0,0
2085	1,5	1,4	0,3	1,3	0,1	0,1	0,0	0,0	0,3	0,1	0,0	0,0
2086	1,5	0,9	0,3	1,7	0,0	0,0	0,0	0,0	0,5	0,1	0,0	0,2
2087	1,6	1,8	0,6	0,8	0,0	0,3	0,0	0,0	0,6	0,2	0,0	0,1
2088	2,5	2,0	0,0	1,7	0,0	0,1	0,0	0,0	0,4	0,0	0,0	0,0
2089	1,7	1,6	0,3	0,5	0,0	0,0	0,0	0,0	0,5	0,3	0,0	0,1
2090	2,0	1,3	0,3	0,8	0,0	0,1	0,0	0,1	0,4	0,3	0,1	0,1
2091	2,7	1,8	0,4	0,7	0,1	0,1	0,0	0,1	0,3	0,2	0,0	0,0
CR Average	**2,2**	**1,4**	**0,3**	**1,3**	**0,1**	**0,1**	**0,0**	**0,0**	**0,4**	**0,1**	**0,0**	**0,1**

Table C-bis: Prominces and Coronal Phenomena from Tobal Extension (2009) classification

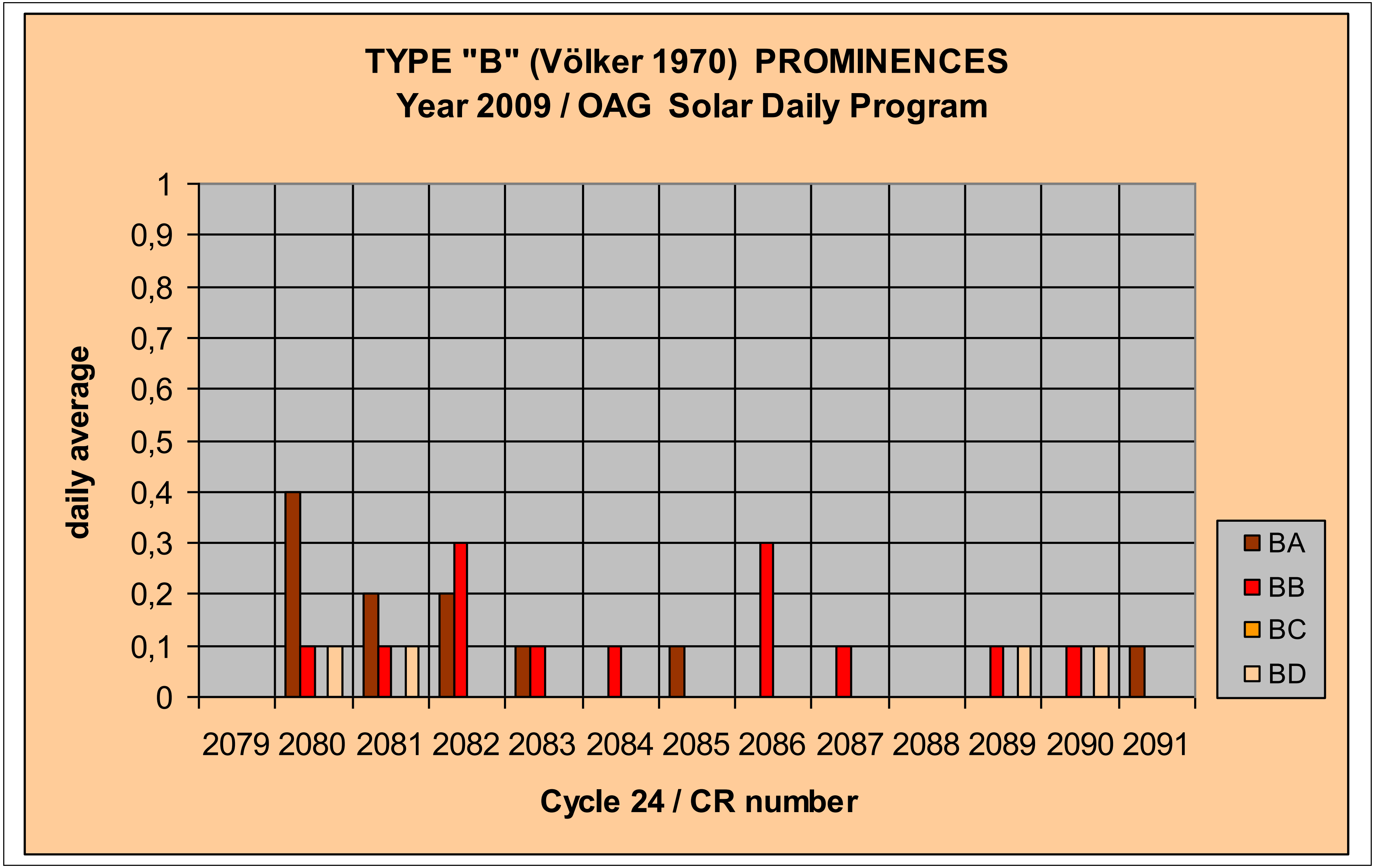
Rotació	CAA	CAB	CAC	CAD	CKA	CKB	CKC	CCD	ETS	ETW	ETL/R	ETA
2079	**ND**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2080	1	0	0	0	0	1	0	0	0	0	0	1
2081	2	2	0	0	1	0	1	6	0	0	0	0
2082	3	4	0	0	2	1	0	7	0	0	0	2
2083	4	1	0	0	3	1	0	8	0	0	0	0
2084	3	0	0	0	5	0	0	14	0	0	0	1
2085	1	0	0	1	4	1	0	13	0	0	0	0
2086	1	0	0	0	1	0	0	4	0	0	0	2
2087	1	2	1	0	3	1	0	5	0	0	0	0
2088	2	1	1	0	4	2	0	8	0	0	0	1
2089	1	2	1	0	2	0	0	3	0	0	0	2
2090	5	1	0	0	0	0	0	6	0	0	0	1
2091	3	2	0	1	3	0	0	2	0	0	0	0
Total	**27**	**15**	**3**	**2**	**28**	**7**	**1**	**76**	**0**	**0**	**0**	**10**
Average	**2,3**	**1,3**	**0,3**	**0,2**	**2,3**	**0,6**	**0,1**	**6,3**	**0,0**	**0,0**	**0,0**	**0,8**


H-ALFA ACTIVITY INDEX
Year 2009 / OAG Solar Daily Program
I-PRO= Prominences / I-FIL= Filaments / I-FAC= Faculae
Index Value
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
Cycle 24 / CR number
I-PRO
I-FIL
I-FAC
Fig. 2b



TYPE "S" (Völker 1970) PROMINENCES
Year 2009 / OAG Solar Daily Program
daily average
5
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091
Cycle 24 / CR number
SA
SB
SC
SD

Fig.2c



TYPE "B" (Völker 1970) PROMINENCES
Year 2009 / OAG Solar Daily Program
daily average
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091
Cycle 24 / CR number
BA
BB
BC
BD

Fig.2d

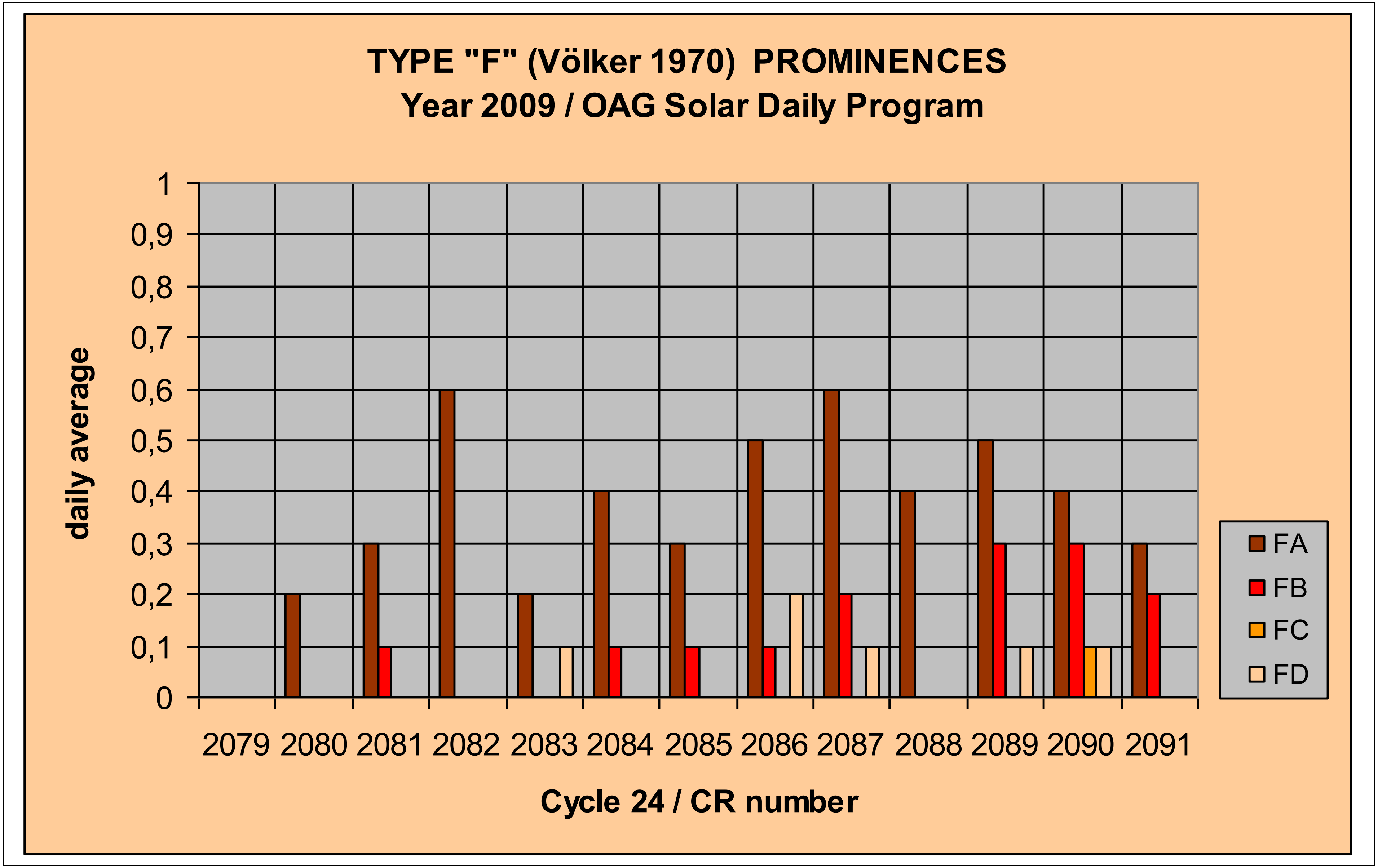

TYPE "F" (Völker 1970) PROMINENCES
Year 2009 / OAG Solar Daily Program
daily average
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091
Cycle 24 / CR number
FA
FB
FC
FD

Fig.2e

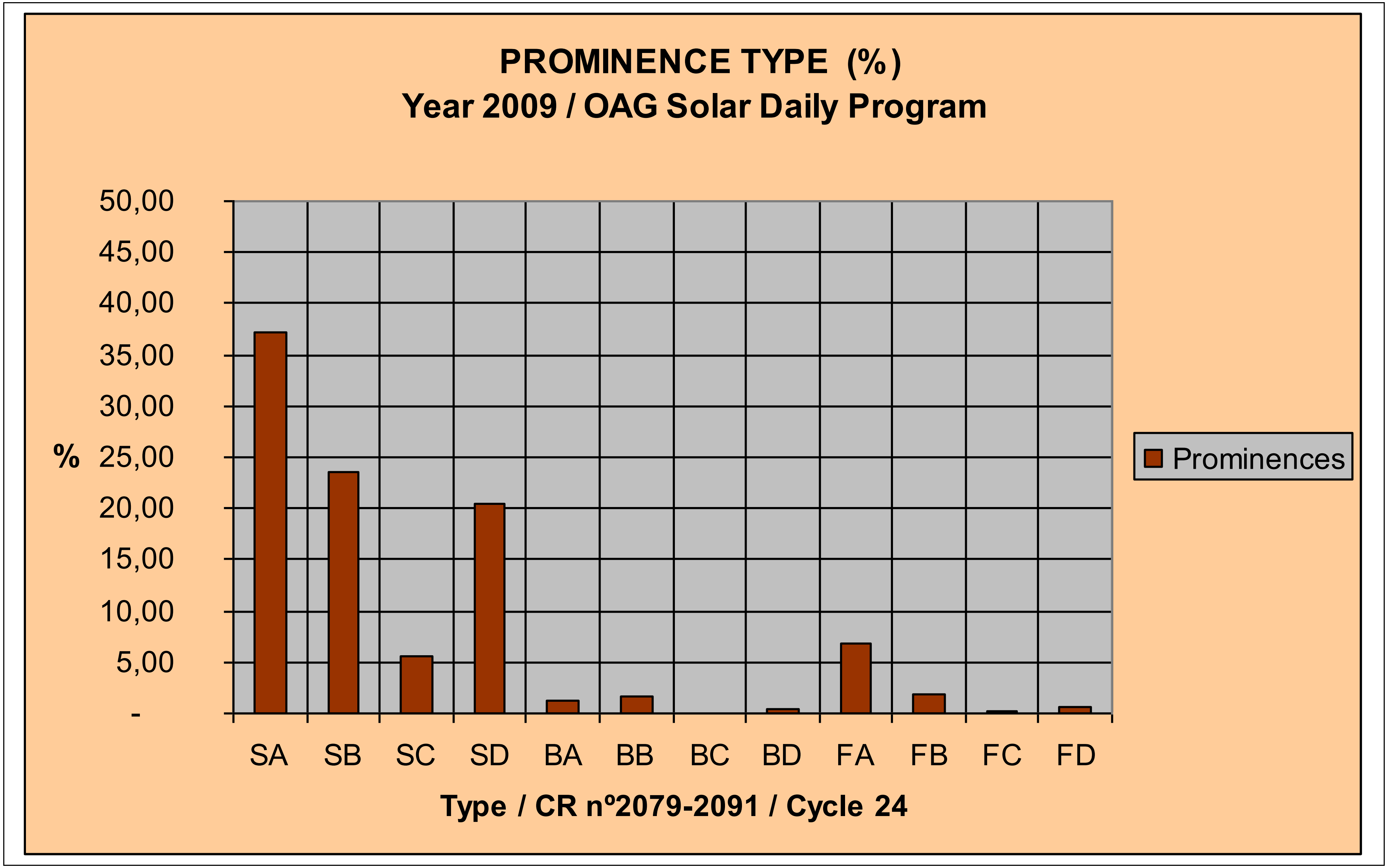
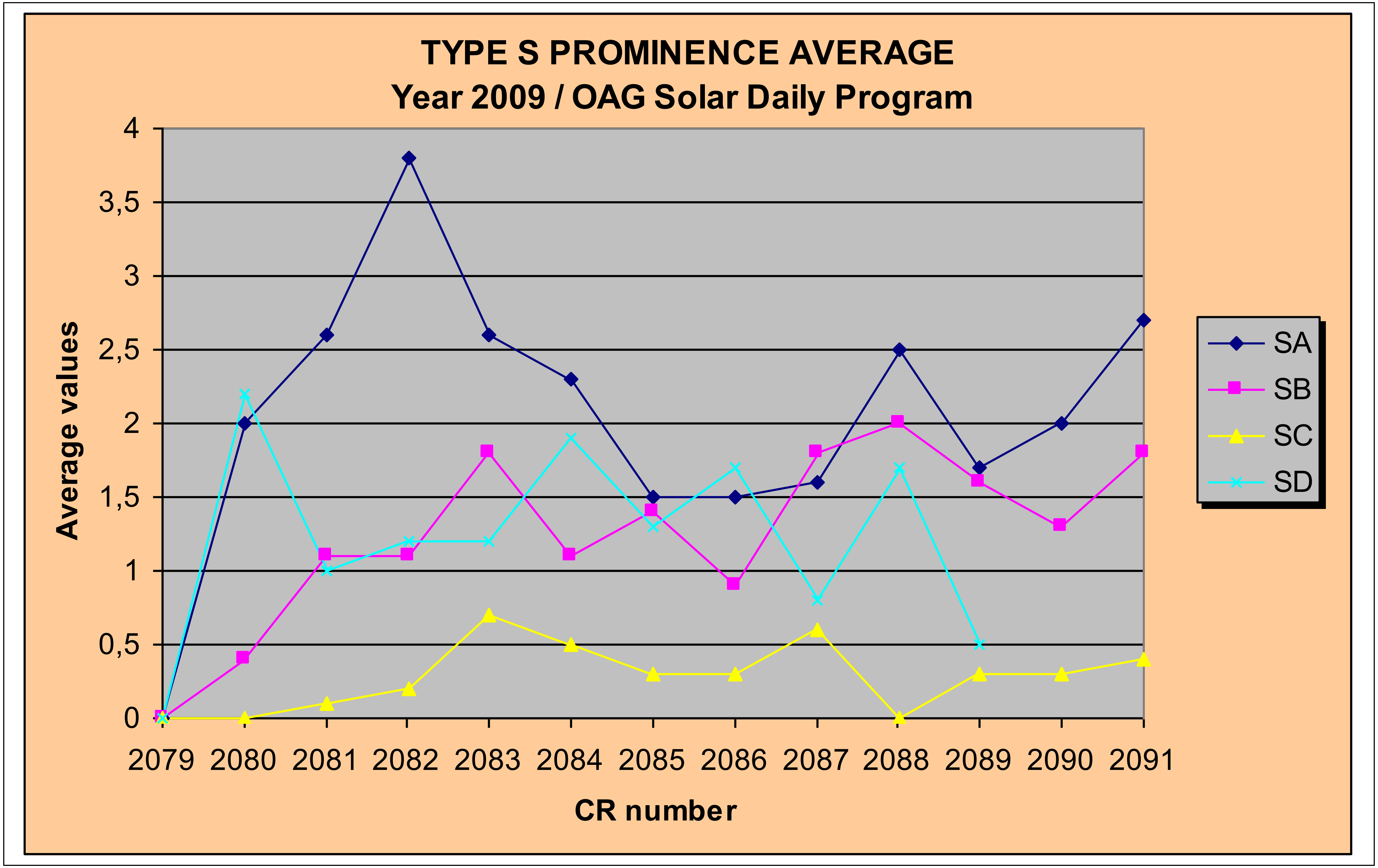
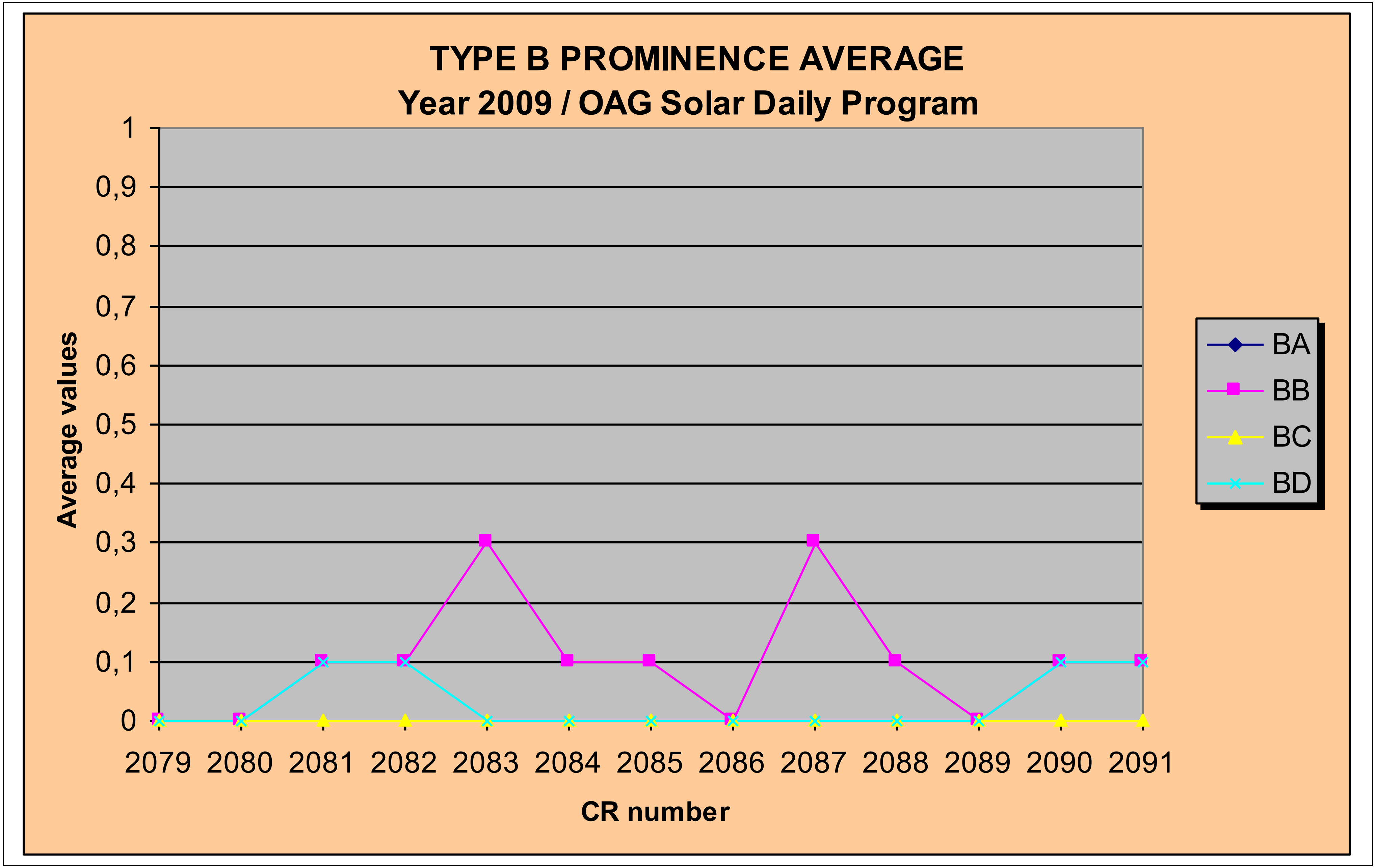

PROMINENCE TYPE (%)
Year 2009 / OAG Solar Daily Program
50,00
45,00
40,00
35,00
30,00
%
25,00
20,00
15,00
10,00
5,00
-
SA
SB
SC
SD
BA
BB
BC
BD
FA
FB
FC
FD
Type / CR nº2079-2091 / Cycle 24
Prominences

Fig. 2f

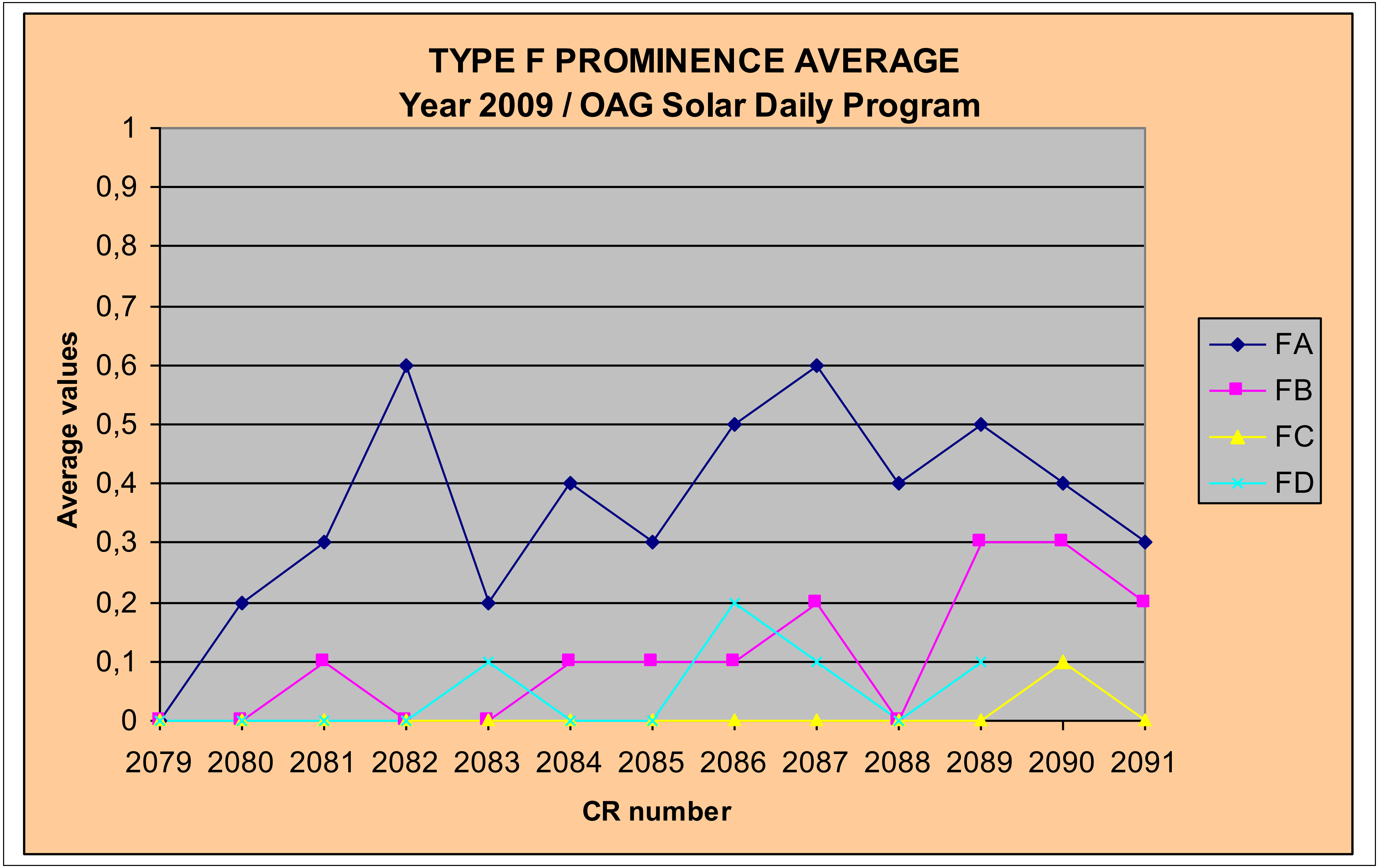

TYPE S PROMINENCE AVERAGE
Year 2009 / OAG Solar Daily Program
Average values
4
3,5
3
2,5
2
1,5
1
0,5
0
2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091
CR number
SA
SB
SC
SD

Fig, 2g



TYPE B PROMINENCE AVERAGE
Year 2009 / OAG Solar Daily Program
Average values
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091
CR number
BA
BB
BC
BD

Fig.2h


TYPE F PROMINENCE AVERAGE
Year 2009 / OAG Solar Daily Program
Average values
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
CR number
FA
FB
FC
FD

Fig,2i

Table D. Active Regions (AR) / CR nº and observed flare stages

RCnº	nº AR	NOAA nº	nº FLARE
2079	0	no data	no data
2080	1	no AR	0
2081	1	11015	0
2082	2	11016	0
2083	2	11017-18	0
2084	4	11019-22	0
2085	0	11023-24	0
2086	1	no AR	0
2087	2	11025	0
2088	2	11026-27	0
2089	3	11029-30	3
2090	2	11031-33	2
2091	3	11034-36	1
Total	**23**		**6**
Avergae	**1,8**		**0,5**

Table / Figures	Comments to CR 2079 – 2091 / YEAR 2009
Table A-Fig.2a Coverage Image quality	From OAG were covered 202 days of observation in H-Alpha with 15.5 days / CR, reaching a coverage of 57.5%, with a image quality of S = 2.3 / Q = 2.6.
Table B-Fig. 2b Activity Índex	The frequency of prominence groups has ranged between 4.9 (2089) and 7.1 (2082) (Delta = 2.2) with 5.9 groups / CR. The frequency of prominence components has ranged between 8.3 (2089) and 11.7 (2083) (Delta = 3.4) with an average of 10.0 / CR. The index R-PR (Prominences) has ranged between 57.3 (2089) and 84.0 (2083) (Delta = 26.7) with 75.7 / CR. The frequency of groups of filaments has varied between 0.1 (2082) and 2.4 (2091) (Delta = 2.3) with 0.9 / CR. The frequency component of filaments has ranged between 0.1 (2082) and 3.1 (2091) (Delta = 3.0) with 0.7 / CR. The index R-FIL (filaments) has ranged between 1.2 (2082) and 27.6 (2091) (Delta = 26.4) with 7.9 / CR. The frequency of faculae groups has ranged between 0.0 (2086) and 2.7 (2091) (Delta = 2.7) with 0.9 / CR. The frequency of faculae components has ranged between 0.0 (2086) and 7.1 (2090) (Delta = 7.1) with 1.7 / CR. The index R-FAC (Faculae) has ranged between 0.0 (2086) and 34.6 (2091) (Delta = 34.6), with an average of 10.5 / CR. Flare stage detection was positive in CR 2089, 2090 and 2091 with values of 0.2 to 0.1 -0.2 respectively (delta: 0.1) with 0.04 / CR. The activity index FIL-PR-FAC showed a ascendent trend during the year 2009, showing a notable increase in the last three CR (2089-90-91), from the last minimum values of Cycle 23.

Table C- Figs. 2c,2d,2e, 2f, 2g, 2h, 2i, Prominence types	The the most abundant class S was SA (2.2), followed by SB (1.4) SC (1.3) and SD (0.3) showing a good correlation of the evolution of SA as representatives types of eruptive prominences. The presence of class B has been minimal: BA (0.1) and BB (0.1). Class F was the second most frequent: FA (0.4) and FB (0.1). For other values were situated below 0.1. No such type BC was observed. In 2009 shown a minimal presence of some types, especially the large quiescents prominences of type B and F, as well as special types associated to flares. A moderate activity was represented by the eruptions of the class S, with presence of coronal arches and nodules.
Table C-bis Prominences and coronal phenomena	ARCHES: The most common types were the CAA (2.3), followed by the CAB (1.3) associated with SA and SB respectively. The type CAC and CAD have been few in number, with values of 0.3 and 0.2. Nodules and Clouds: The irregular clouds (CCD) have been very frequent with values of 6.3. The presence of small bright nodules shows good correlation with the in SA and SB, with values of 2.3 and 0.6 and the lowest frequency of type 0.1 with CKC. SPECIAL TYPES: Only the type ETA "auroral apparence" has been recorded, although some cases might be peculiar BD or FD. The value was 0.8. The presence of other types associated with a more energetic phenomena probably will increase in the next rotations.
Table D Active Regions	A total of 23 AR were observed between 2080 and HR 2091, with 1.8 AR / CR. The only rotation was no AR 2085.

Flares	A total of 6 flares stages (pre, eruptive steep and post) were observed, all in CR 2089 (3), 2090 (2) and 2091 (1), being a good indicator of the ascendent trend of solar activity in the last rotation of 2009 , correlated with increased staining photosferics groups.
Table E Wolf number White Light from J.M.Bullon (2009)	From La Cambra observatory (Valencia) werw covered 310 days of observation in White Light (average 23d/mes), reaching a coverage 84,9% , with a image quality of S = 2.2 / Q = 2.3, very similar to OAG (see Table A). The two observatories are localized in typycal mediterranean climate in the southern european regions. Rw. The Wolf number index has ranged of 0.0 (March an August) to (16.47) December (Delta = 16.5) in good correlation with the increase in chromospheric activity started in October. The annual average Rw index has been 5.2.

Photospheric activity (Wolf number) from J.M.Bullon (La Cambra observatory, València, Spain) for the year 2009

Taula E. Wolf Number 2009

Month	Rw average	D (days)	S	Q
January	1,60	25	2,3	2,4
February	0,55	20	2,4	2,6
March	0,00	23	2,2	2,4
April	2,23	22	2,3	2,3
May	4,93	29	2,1	2,2
June	6,66	29	1,9	2,0
July	5,77	31	2,0	2,1
August	0,00	31	2,1	2,1
September	7,32	28	2,3	2,3
October	9,31	29	2,3	2,5
November	8,21	24	2,5	2,7
December	16,47	19	2,6	2,8
Average	**5.25**	**310 Average: 23%**	**2,2**	**2,3**

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