SOTERIA WP2
2008-2011

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Web-page of the Work Package 2:

http://fenyi.solarobs.unideb.hu/SOTERIA/WP2

Issues to be discussed here:

1. Overview (A. Ludmány)
2. Sunspot databases (A. Ludmány)
3. Database of white-light faculae (A. Ludmány)
4. Meudon plans of NaD1 magnetograms (J. Aboudarham)
5. Development of the sunspot index by space-born input (F. Clette)
6. Overview of possible research subjects (all participants)
7. Schedule of common events, meetings

The objectives of the WP2 :

1. **Most complete sunspot database** - KO wants to produce a sunspot database which is more complete than any datasets before, this will be the SDD (SOHO-Debrecen Sunspot Data), the 1996-2010 material will be completed until the end of the project, a milestone will be the 14. month, when the 2008 year will be available.

2. The first **catalogue of continuum faculae** will be produced on the basis of the SOHO/MDI full disc images for the years 1996-2010, milestone: start of online publishing after the 12th month.

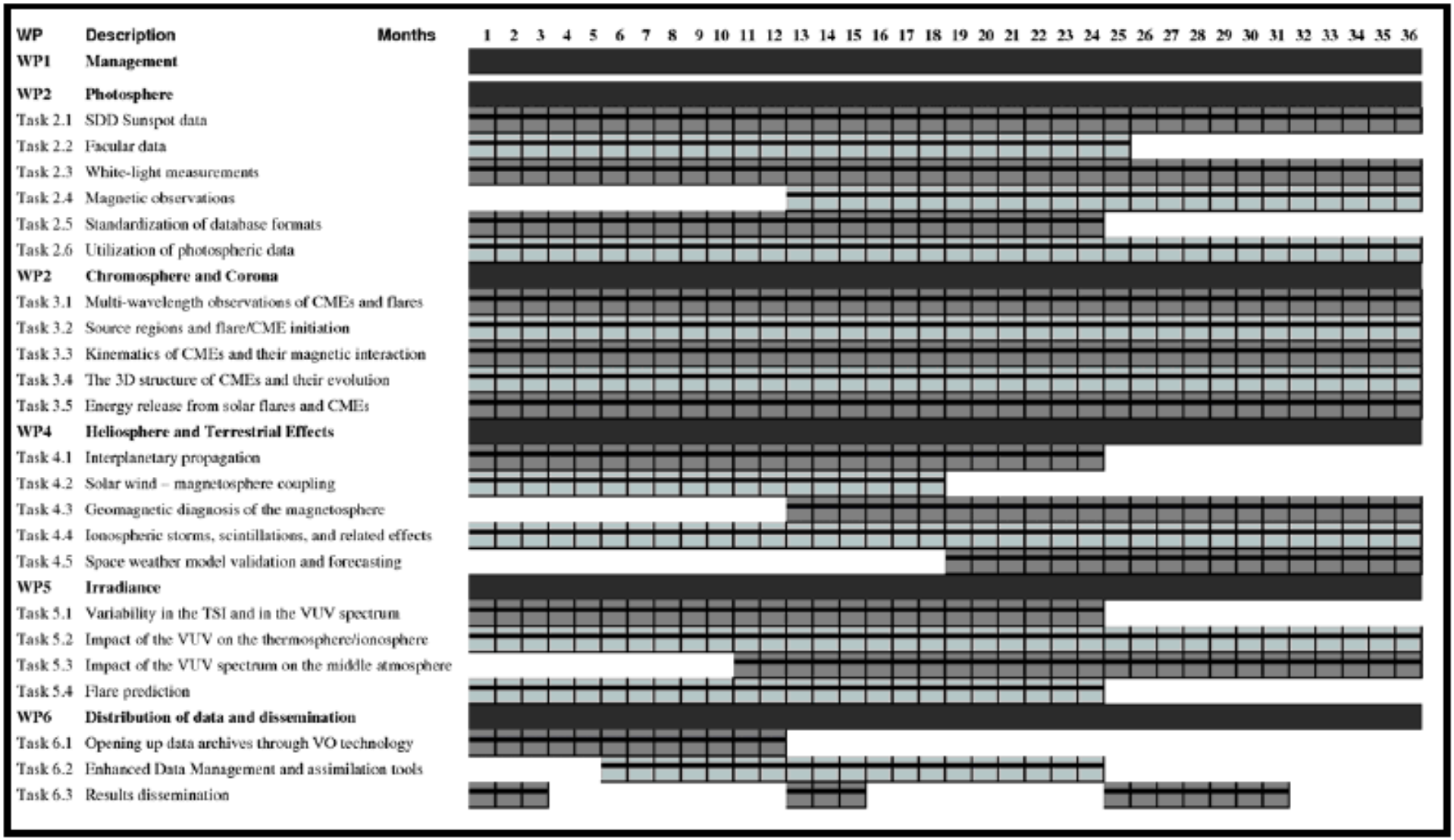
3. **High cadence NaD1 magnetograms** and their online database will be made by OBSPARIS, during the entire project, milestone: start of online publishing after 12 month.

4. **Four papers** of investigations based partly on the new data will be published by the cooperating participants of the WP2, as a milestone, the first paper can be expected at the 20th month.

Development of the **sunspot index** by space-born input

Publication of these new data in collaboration with WP6

B1.3.2 Timing of work packages and their components



B1.3.4 Deliverables List

Deliv. No.	Deliverable name	WP No.	Lead Beneficiary	Est. indicat. pers.-months	Nature	Dissemination Level	Delivery date (proj. months)
1.1	Establishment of the consortium and formulation of the rules of collaboration	1	KU Leuven	3	O	PP	3
1.2	Final plan for the use and dissemination of foregound		KU Leuven	3	O	PU	12
1.3	Formation of the Advisory Board and of the Steering Board		KU Leuven	4	O	PU	10
1.4	Organization of the Summer School and annual meetings, minutes of the meetings		KU Leuven	4	O	PU	12,24,36
1.5	Awareness and wider societal implications		KU Leuven	9	O	PU	36
1.6	Project webpage		KU Leuven	8	O	PU	36
1.7	Yearly reports		KU Leuven	3	R	PU	12,24,36
1.8	Budget (re)alloction		KU Leuven	1	O	PU	12
1.9	Final Report		KU Leuven	1	R	PU	36
2.1	SOHO/MDI Continuum faculae	2	KO	80	O	PU	30
2.2	SOHO/MDI Sunspot data (SDD)		KO	166	O	PU	36
2.3	NaD1 magnetograms		OBSPARIS	70	O	PU	36
2.4	4 peer-reviewed publications		KO	87	R	PU	36

B1.3.5 Work Package description

Work package number	2		Start date or starting event		1	
Work Package Title	Photosphere					
Activity type	RTD					
Participant number	2	4	6	7	11	13
Participant short name	UNIGRAZ	KO	ROB	OBSPARIS	UOulu	HVAR
Person-months per participant	25	206	42	74	20	36

B1.3.7 List of milestones and planning of reviews

List and schedule of milestones					
Milest. Nr.	**Milestone name**	**WP no's.**	**Lead beneficiary**	**Delivery date from Annex I**	**comments**
1.1	Establishment of the consortium and formulation of the rules	1	KU Leuven	3	online report
1.2	Formation of the Advisory Board and of the Steering Board		KU Leuven	6	online report
1.3	Organization of the Summer School		KU Leuven	18	online report
1.4	On-time annual report submission		KU Leuven	12,24,36	report
1.5	On-time final report		KU Leuven	36	report
1.6	Steering group meetings		KU Leuven	24	online report
2.1	White-light faculae, start of publications	2	KO	12	online report
2.2	SDD catalogue for 2008		KO	14	online database
2.3	NaD1 magnetograms, start of publication		OBSPARIS	12	online database
2.4	results of photospheric studies		KO	20	journal papers, conference reports

Task 2.1. SDD Sunspot data (KO)

- The SDD catalogue work will be continued and published on-line until full coverage of the SOHO era.

Task 2.2. Facular data (KO, UNIGRAZ, ROB)

- Modification of the sunspot-processing procedure for measuring photospheric faculae derived from SOHO/MDI images.
- Comparison of continuum and CaK faculae

Task 2.3. White-light measurements (KO, UNIGRAZ, ROB, HVAR)

- Software and hardware development to handle the white-light observations of all other involved participants.
- Comparison of data derived with different methods, data validation.
-Inserting sunspot data of KO into the sunspot index of ROB.
-Digitalisation of the observations available in non-digitised form

Task 2.4. Magnetic observations (KO, OBSPARIS)

- Testing magnetograms obtained by the ground-based GONG experiment about suitability for substitution of MDI magnetograms during gaps.

- Providing high cadence NaD1 magnetograms with 4' x 4' field of view, pixel 0.5", within an exceptional temporal resolution of 1 mn, allowing to investigate fast changes of the magnetic field.

Task 2.5. Standardisation of database formats (KO, ROB, UNIGRAZ)

- Transformation of all existing photospheric databases to easily accessible and exploitable formats in cooperation with WP6 and according to the EC guiding principles.

Task 2.6. Utilization of photospheric data in solar and space weather analyses (KO, UOulu, ROB, HVAR, UNIGRAZ)

- Study of the possibility of flare forecast based on the unprecedented time-resolution of the photospheric data and also on the complexity data of sunspot groups.

- Study of the so-called active longitudes based on the new sunspot data and their relationships with the heliospheric anisotropy along with their temporal variations (in cooperation with WP4).

- Investigation of the solar rotation and related phenomena by comparing the sunspot rotation with the rotation of coronal bright points traced in SOHO-EIT 28.4 nm images measured by automatic and an interactive method.

- Study of magnetic flux emergence by detailed monitoring of individual active regions and their temporal evolution: area, morphology, internal motions and rotation rate, etc.

Task 2.6. (continued)

- Derivation of extended global indices (sunspot hemispheric index, sunspot classification per cycle to which they belong, facular index), the study and selection of the most appropriate observables (counts, area, contrast, etc.) or combinations thereof. This task is essential to provide the necessary contraints to the last generation of solar dynamo models, which can reproduce the chaotic variations of the solar cycle (amplitude, duration, meridional drifts of "dynamo wave"). It also provides more elaborate proxies to help in the reconstruction of the total solar irradiance or spectral irradiances in specific wavelength ranges.

- Extension of standard photospheric indicators backwards in time, recovery from images/photographic archives of unexploited information leading to present an future standard indices (e.g. hemispheric sunspot numbers, facular index). This work can be only extended by the combination of multiple ground-based data collections.
This project offers a perfect international context to initiate this long-term effort.

Deliverables

- SOHO/MDI Continuum faculae Public, Delivery date 30 months

- SOHO/MDI Sunspot data (SDD)- derived from SOHO/MDI images for the whole SOHO era, Public, Delivery date: 36 m

- NaD1 magnetograms, Public, Delivery date: 36 m

- 4 papers – peer-reviewed publications of research results based on the new data, Delivery date: 36 m.

Photospheric data programs at Debrecen

1. Debrecen Photoheliographic Data (DPD)
   Continuation of Greenwich Photoheliographic Results

2. SOHO/MDI - Debrecen Sunspot Data (SDD) - part of the SOTERIA project
   Application of DPD-procedure to MDI images

3. Catalogue of white-light faculae - part of the SOTERIA project
   A quite new kind of database

4. Historical Solar Image Database (HSID)
   Digitized historical (graphical) full disc solar images.

5. Digitized photographic full-disc observations on a daily basis
   Made by H.Yoshimura for the Greenwich plates, to be continued in Debrecen

All data are (and will be) accessible at http://fenyi.solarobs.unideb.hu

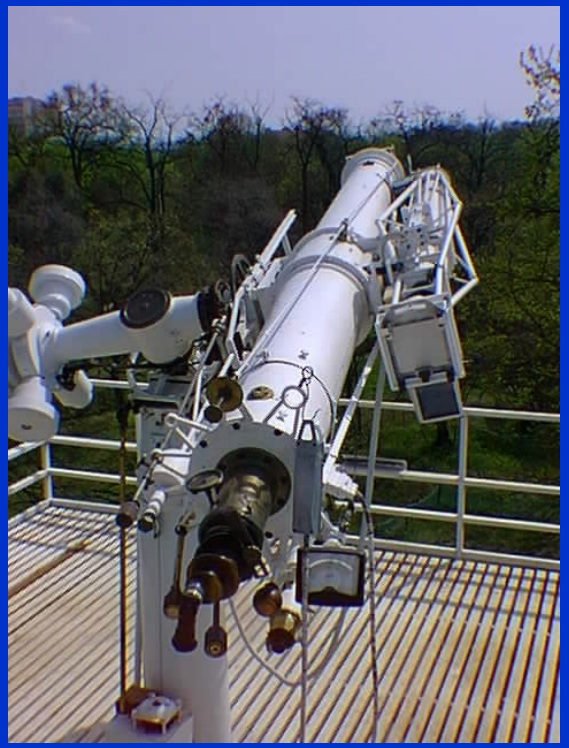
1. Debrecen Photoheliographic Data (DPD)

Continuation of Greenwich Photoheliographic Results (GPR)

Photoheliograph program at two stations since 1957. Archive: more than 200,000 full-disc plates

Debrecen

highest number of sunlit hours in Hungary



Gyula

telescope at 43m above ground, high image quality

Cooperation with 16 observatories to provide full coverage

Abastumani (Georgia), Boulder (USA). Ebro (Spain), Helwan (Egypt), Holloman (USA), Kanzelhöhe (Austria), Kiev (Ukraine), Kislovodsk (Russia), Kodaikanal (India), Mount Wilson (USA), Ramey (USA), Rome (Italy), SOHO/MDI (NASA/ESA), Tashkent (Uzbekistan), Tokyo Mitaka (Japan), Valasské Mezirici (Czech)

Unique features of DPD

completeness - all observable spots by sunspot groups on a daily basis

precision - this is the only database with a position precision of 0.1 degrees,
area data also among the most reliable ones

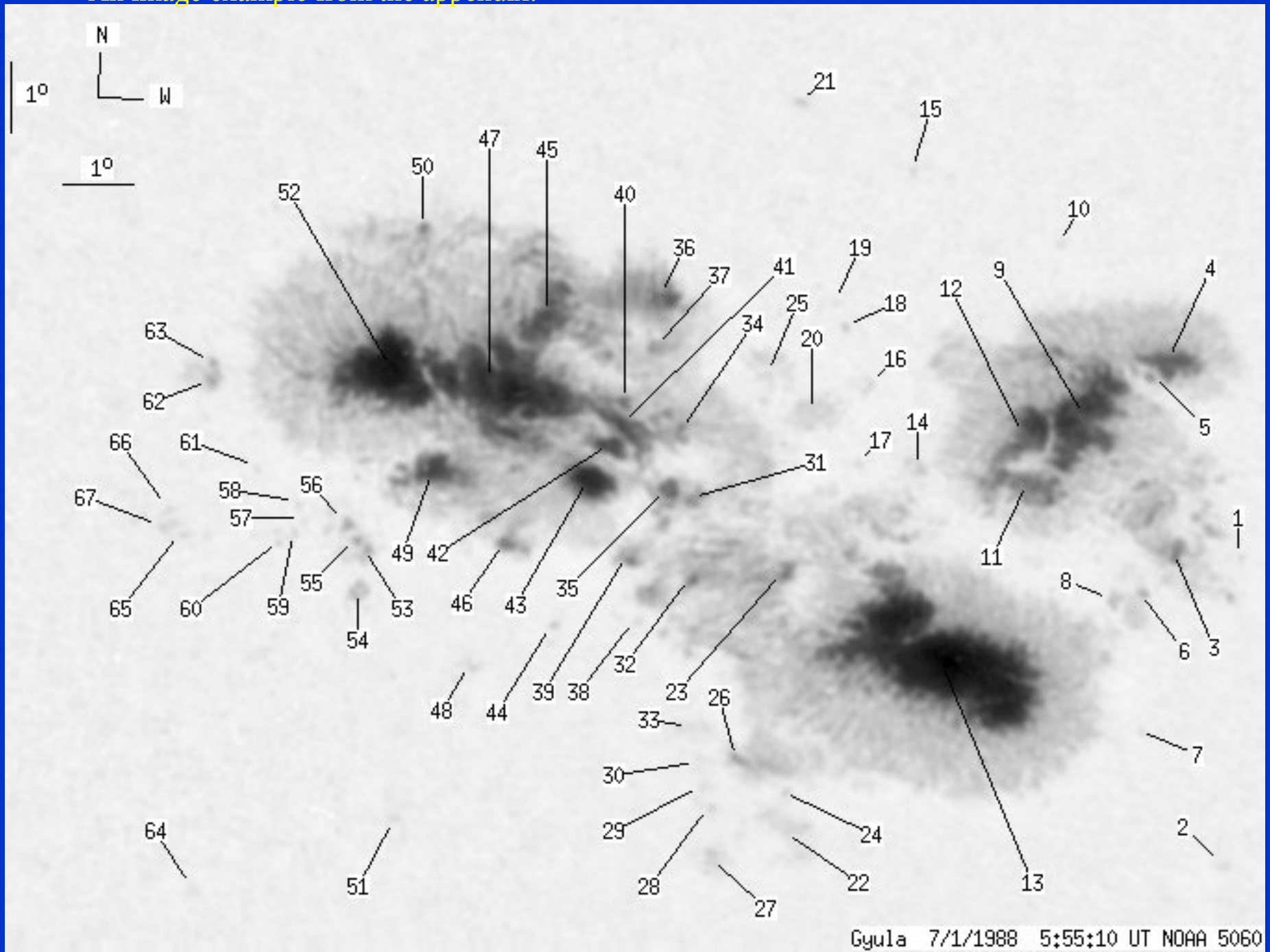
presentation - numerical database
active region images appended (jpg, fits)
full disc images appended
magnetograms appended
html-presentation

The DPD is the first catalogue containing the data of each spot and group.

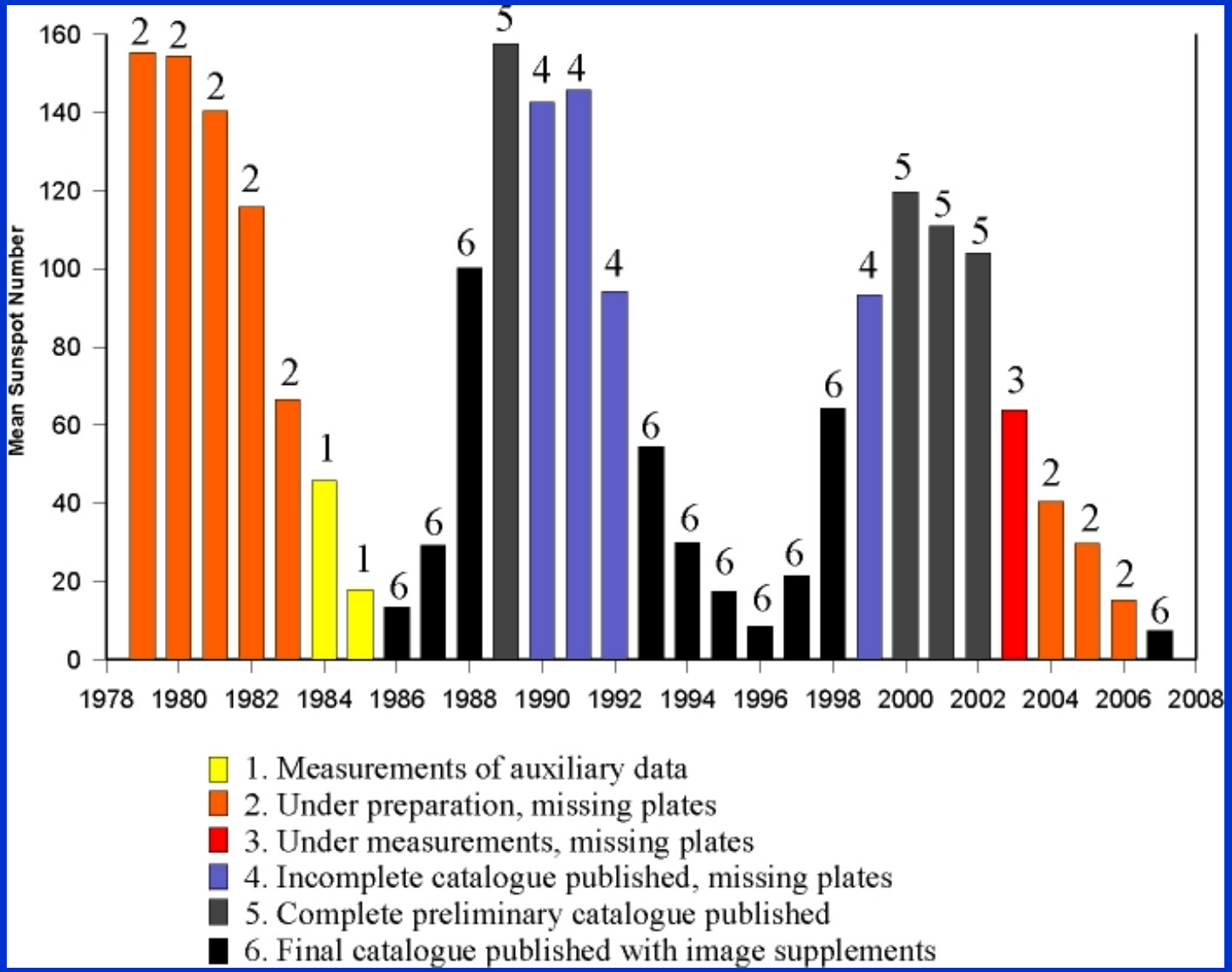
An example from the tables of the 1987 year

date	NOAA	No	U p	U+P p	U c	U+P c	B	L	dL	fi	r
d1987 1 1.357	GYUL		26	98	14	50		2446796.857	2.12	-3.04	
g1987 1 1.357	4763		26	98	14	50	5.61	12.35	-18.83	65.25	0.3554
s1987 1 1.357	4763	1	2	5	1	2	6.89	11.30	-19.87	63.37	0.3791
s1987 1 1.357	4763	2	2	5	1	2	7.04	11.95	-19.22	62.22	0.3708
s1987 1 1.357	4763	3	0	2	0	1	6.80	13.20	-17.97	61.23	0.3511
s1987 1 1.357	4763	4	0	2	0	1	6.59	13.57	-17.61	61.25	0.3442
s1987 1 1.357	4763	5	5	10	3	5	6.25	13.71	-17.47	61.96	0.3396
s1987 1 1.357	4763	6	7	23	4	12	5.94	13.68	-17.50	62.83	0.3378
s1987 1 1.357	4763	7	5	9	3	5	5.40	13.36	-17.82	64.68	0.3386
s1987 1 1.357	4763	8	0	2	0	1	5.23	13.15	-18.03	65.39	0.3405
s1987 1 1.357	4763	9	0	5	0	2	4.76	11.65	-19.53	68.30	0.3601
s1987 1 1.357	4763	10	5	33	2	18	4.98	11.01	-20.17	68.38	0.3712
s1987 1 1.357	4763	11	0	2	0	1	5.18	10.01	-21.17	68.81	0.3874
d1987 1 2.347	KISL		20	89	10	45		2446797.847	1.64	-3.15	
g1987 1 2.347	4763		20	89	10	45	5.91	13.14	-5.02	28.68	0.1814
s1987 1 2.347	4763	1	12	63	6	32	5.57	13.93	-4.23	25.82	0.1691
s1987 1 2.347	4763	2	6	-1	3	-1	6.36	13.70	-4.45	25.03	0.1830
s1987 1 2.347	4763	3	0	10	0	5	7.14	11.25	-6.90	33.79	0.2154
s1987 1 2.347	4763	4	2	10	1	5	4.97	10.75	-7.40	42.35	0.1914
s1987 1 2.347	4763	5	0	2	0	1	5.11	11.69	-6.47	38.06	0.1828
s1987 1 2.347	4763	6	0	4	0	2	6.71	13.13	-5.02	26.95	0.1927

An image example from the appendix:



Current status of the Debrecen Photoheliographic Data



2. SOHO/MDI - Debrecen Sunspot Data (SDD)

Numerical data of all spots observed by SOHO/MDI (1996-2007) have been produced in an ESA-project (project No. C98017), including magnetic data.

The entire SOHO-era will be covered with a complete catalogue (including groups) during the recent SOTERIA project.

```
h 1997 04 30 00 00 35 SOHO            0     8     0    17 2450568.50040   0.00  -4.31
g 1997 04 30 00 00 35   1997          0     8     0    17 -17.65   4.87  72.86 249.28 0.9159   199.0   133.3
s 1997 04 30 00 00 35   1997     1    0     5     0    15 -17.00  12.55  80.54 253.49 0.9847   205.0   125.2
s 1997 04 30 00 00 35   1997     2    0     3     0     2 -22.51 307.29  15.27 217.70 0.3996   193.0   199.0
h 1997 04 30 00 59 35 SOHO            0    18     0    33 2450568.54138   0.00  -4.30
g 1997 04 30 00 59 35   1997          0    18     0    33 -17.72   4.95  73.47 249.16 0.9166   182.0   139.7
s 1997 04 30 00 59 35   1997     1    0    10     0    29 -17.05  12.92  81.44 253.41 0.9872   154.0   134.4
s 1997 04 30 00 59 35   1997     2    0     8     0     4 -22.58 307.19  15.72 218.35 0.4049   210.0   175.3
h 1997 04 30 01 59 35 SOHO            0     9     0    17 2450568.58304   0.00  -4.30
g 1997 04 30 01 59 35   1997          0     9     0    17 -17.95   5.36  74.43 249.27 0.9239   -51.5    94.0
s 1997 04 30 01 59 35   1997     1    0     5     0    15 -17.17  12.94  82.01 253.27 0.9887   183.0   140.7
s 1997 04 30 01 59 35   1997     2    0     4     0     2 -23.82 308.49  17.56 219.30 0.4377  -286.0  -268.6
```

3. Catalogue of white-light faculae

Part of the recent SOTERIA project.

Planned: comparison with later CaII-faculae data.

The procedure of sunspot recognition is applied to negative SOHO/MDI images.

An important input in irradiance studies.

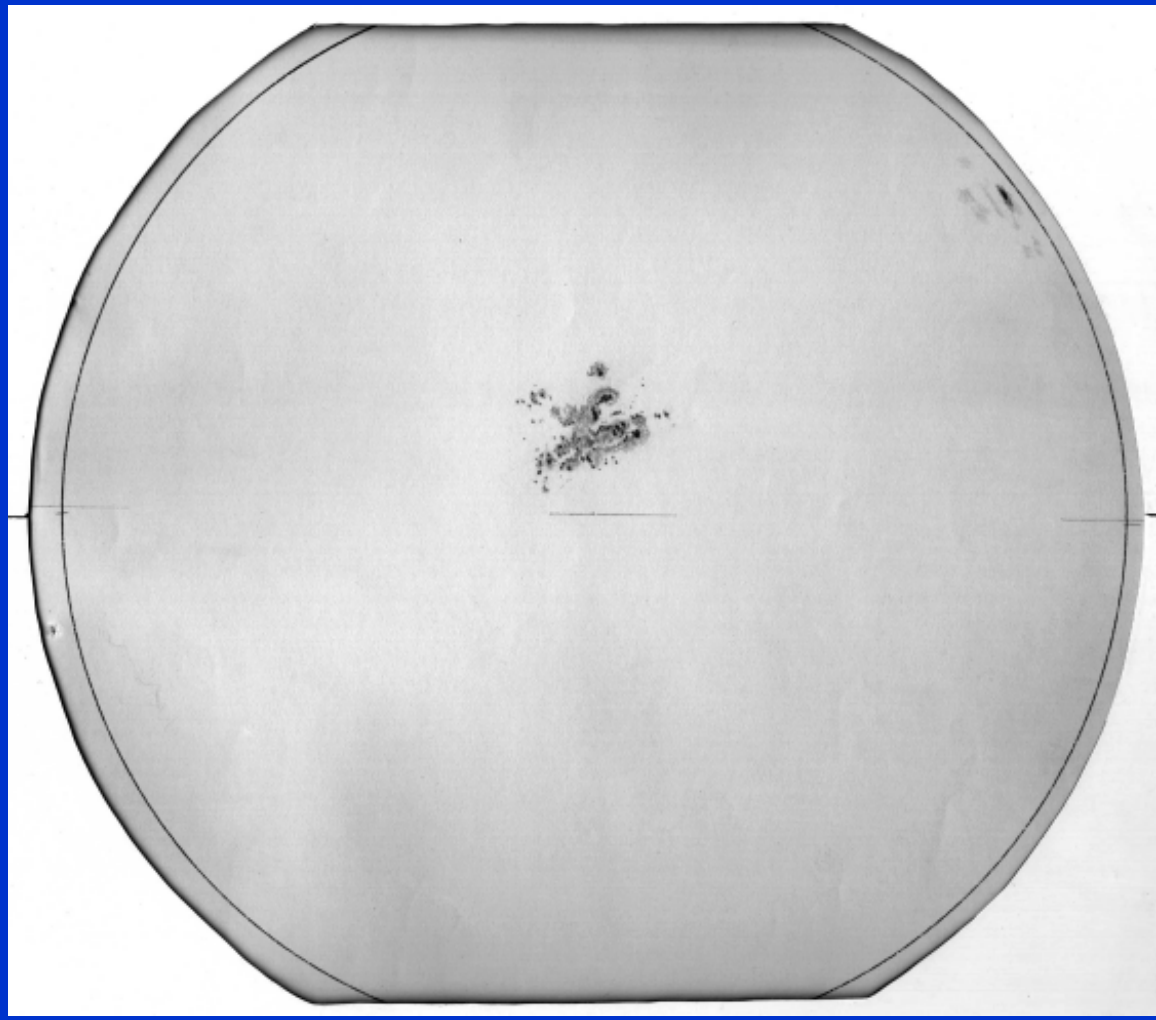
The 2.-3. programs will be continued on future space observations
(SDO - Solar Dynamics Observatory)

4. Historical Solar Image Database (HSID)

Aim: Digital archive of all existing historical (graphical) full disc solar images
We need partners.

The Hungarian material (1873-1919) is close to be completed

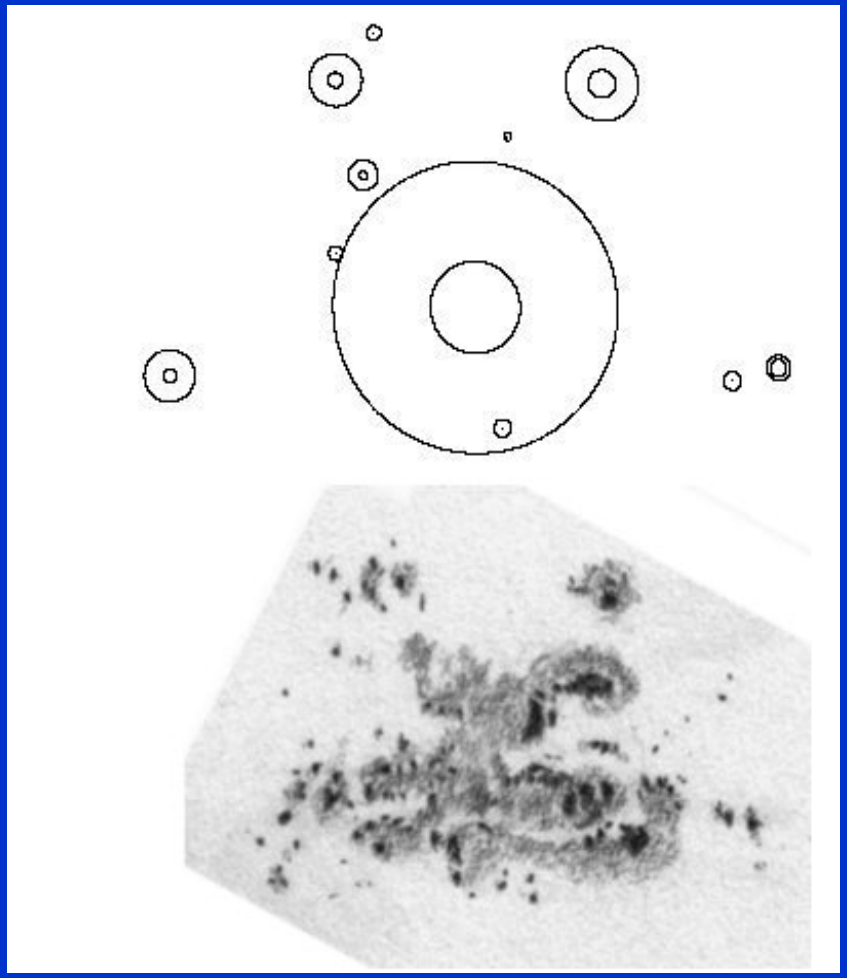
An example: 20. October 1905
(by J.Fenyi, Kalocsa, Hungary):



The big active region of 20. Oct. 1905

Schematic reconstruction of the active region by using Greenwich (GPR) data ⇒

Graphical observation (J.Fenyi) of the same sunspot group ⇒



Earlier numerical sunspot data are incomplete,

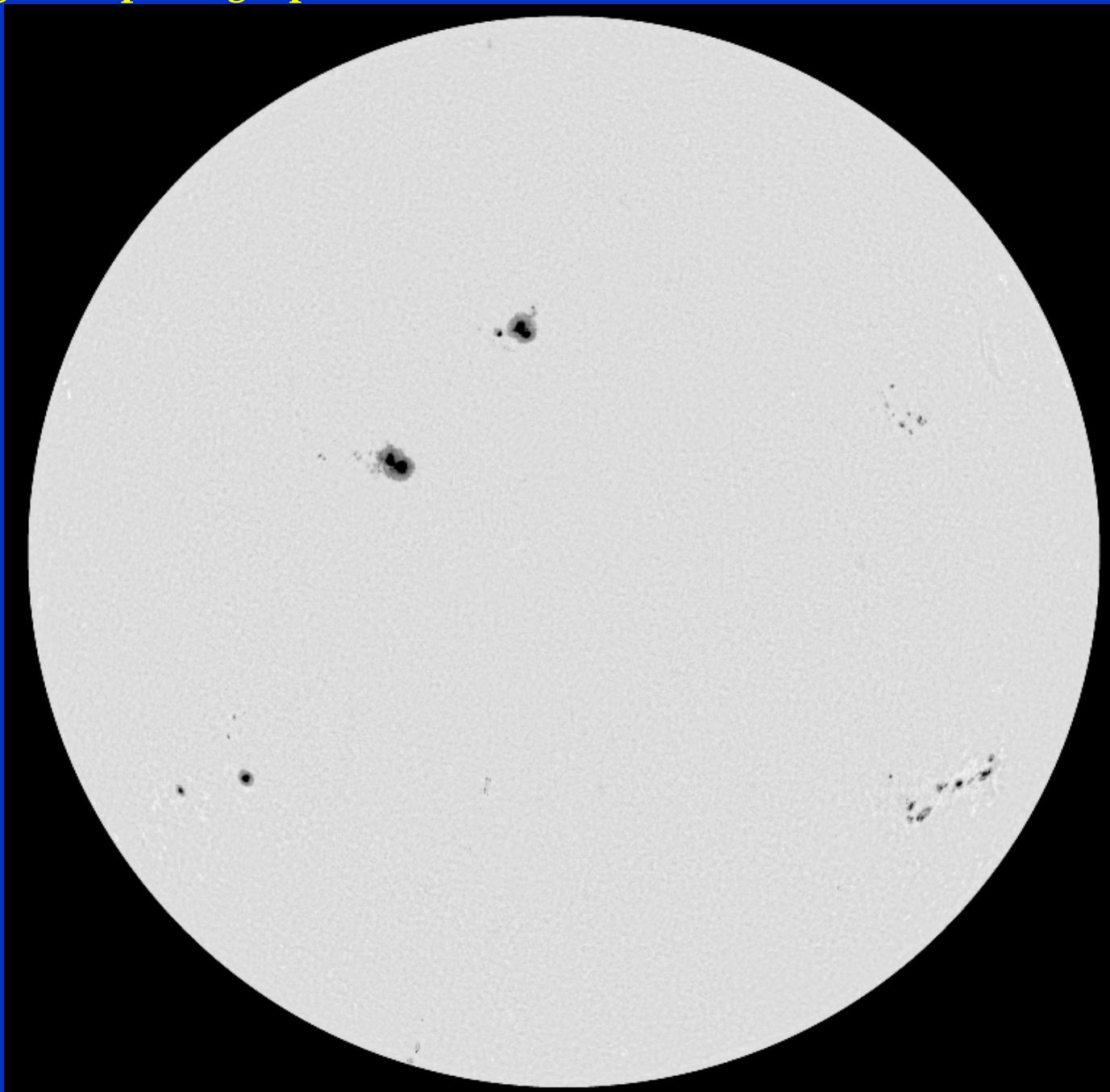
5. Digitized photographic full-disc observations

The Greenwich plates have been digizited by H.Yoshimura with 4kx4k resolution

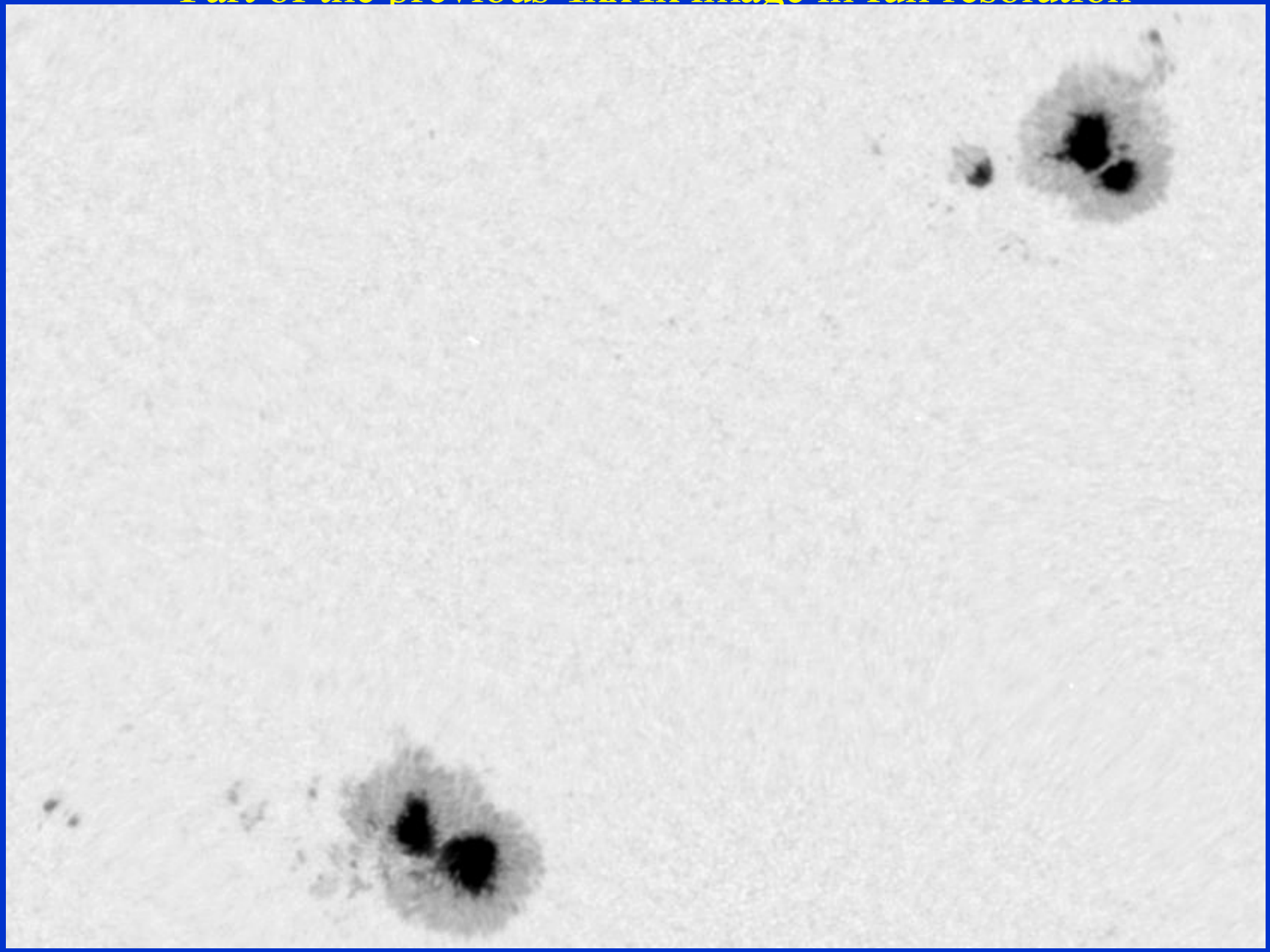
The Debrecen/Gyula observations will also be digitized on a daily basis with 4kx4k resolution.

An example from the DPD appendix ⇒

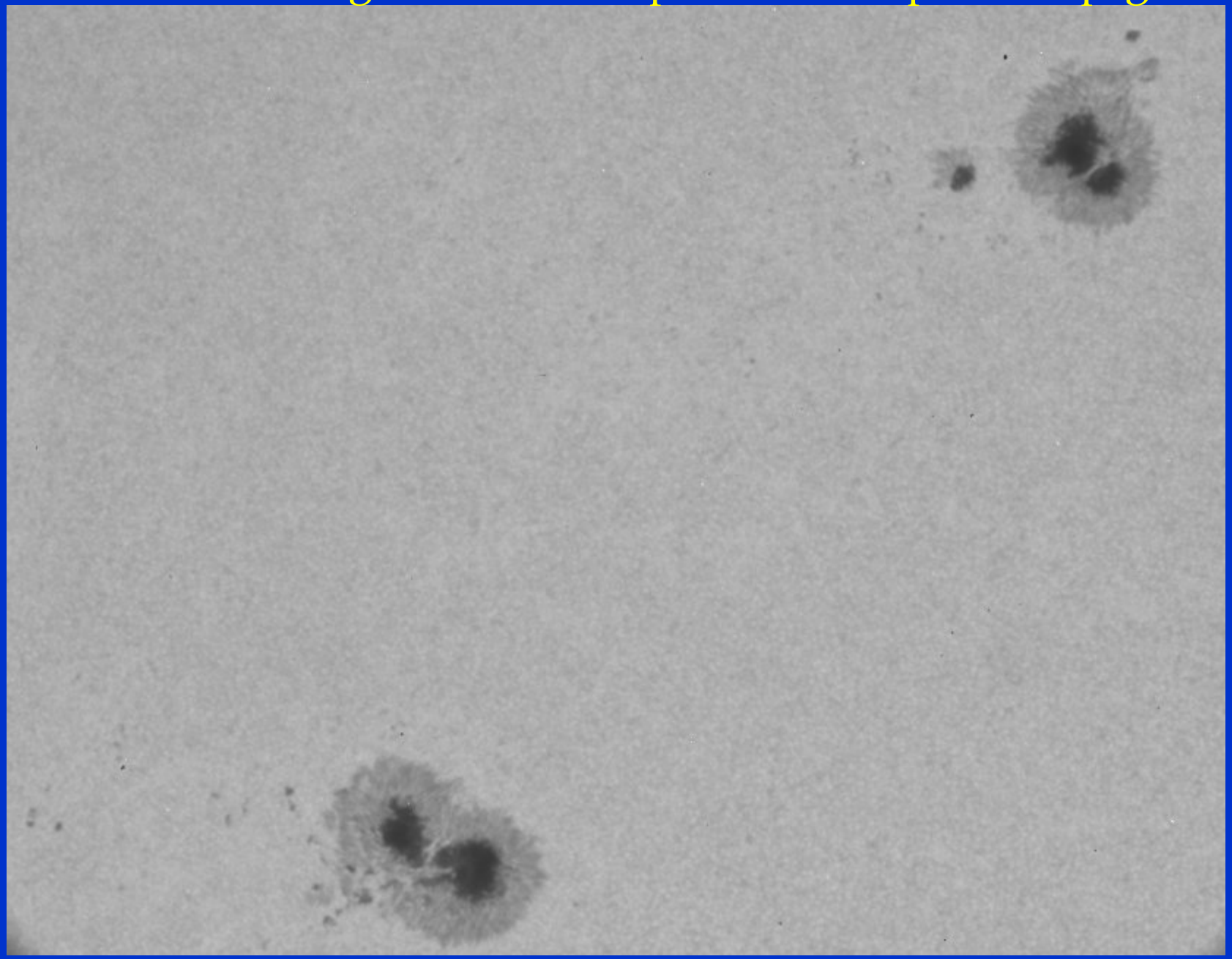
(12.Aug.1998, Gyula)



Part of the previous 4kx4k image in full resolution



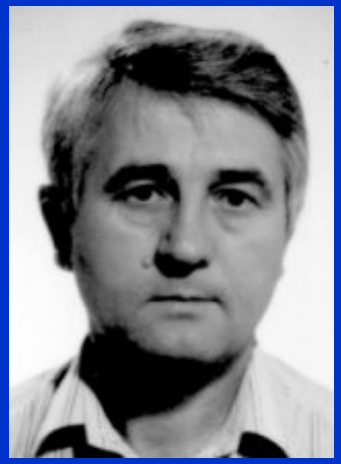
TRACE image of the same spots as in the previous page



Thank you for your attention on behalf of the Debrecen/Gyula staff members involved in SOTERIA

András LUDMÁNY

Tünde BARANYI



Lajos GYŐRI

Judit MURAKÖZY