DEVELOPMENT OF THE CURRENT 24 SOLAR CYCLE AND THE REAL SCENARIO OF THE SOLAR CYCLICITY

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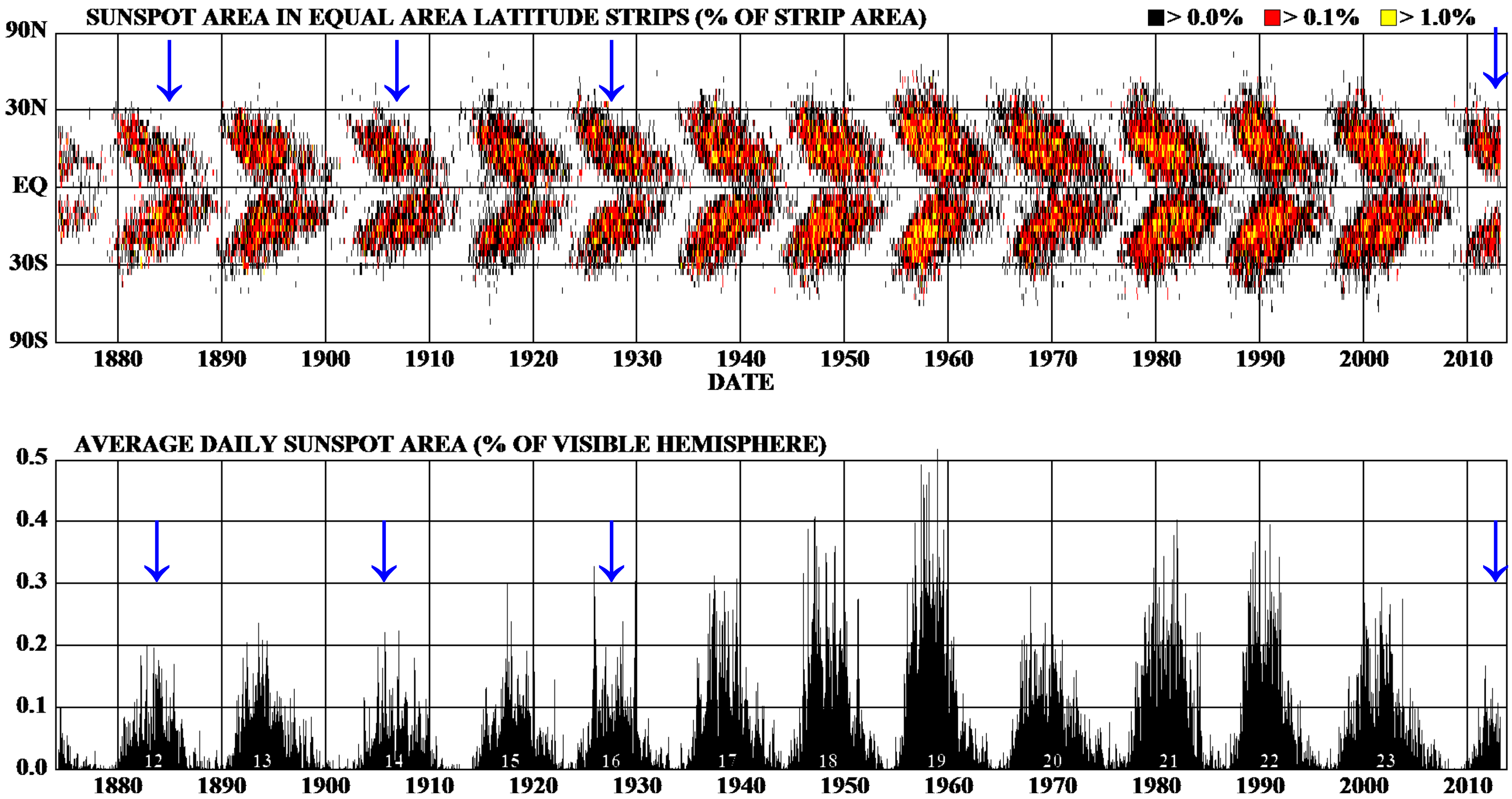


1. A reliable series of the relative Wolf numbers (165 years) it leads to the only scenario of solar cycles (SC) the regular change of the magnetic field generation regime in the Sun's convective zone when going from periods of increased solar activity (SC18 – 22) to periods of solar activity reduced and vice versa – from reduced to increased. The first period of reduced solar activity has already been observed and fell on SC12 –16. The second such period starts with the current SC 24 and likely will last the 5 SC. Before each this period is taking place the regime generating a magnetic field change, which occurs within 1.5 − 2 SC. In reliable SC such restructurings, apparently, could be observed in the SC 10 – 11 when solar magnetic fields of the convective zone recovered to reduced solar activity. In SC 16 – 17 magnetic fields adjustment reorganized to the period of increased solar activity. It led to significant growth sunspot areas and appearing giant sunspot groups on the solar cycle growth branch of SC 18.

Table 1. The authentic solar cycles.

N	T_0	W^*_{min}	T_{max}	W^*_{max}	$T\uparrow^Y$	$T\downarrow^Y$	T^Y
8	1833.9	7.3	1837.2	146.9	3.3	6.3	9.6
9	1843.5	10.5	1848.1	131.6	4.6	7.9	12.5
10	1856.0	3.2	1860.1	97.9	4.1	7.1	11.2
11	1867.2	5.2	1870.6	140.5	3.4	8.3	11.7
12	1878.9	2.2	1883.9	74.6	5.0	5.7	10.7
13	1889.6	5.0	1894.1	87.9	4.5	7.6	12.1
14	1901.7	2.6	1907.0	64.2	5.3	6.6	11.9
15	1913.6	1.5	1917.6	105.4	4.0	6.0	10.0
16	1923.6	5.6	1928.4	78.1	4.8	5.4	10.2
17	1933.8	3.4	1937.4	119.2	3.6	6.8	10.4
18	1944.2	7.7	1947.5	151.8	3.3	6.8	10.1
19	1954.3	3.4	1957.9	201.3	3.6	7.0	10.6
20	1964.9	9.6	1968.9	110.6	4.0	7.6	11.6
21	1976.5	12.2	1979.9	64.5	3.4	6.9	10.3
22	1986.8	12.3	1989.6	158.5	2.8	6.8	9.7
23	1996.4	8.0	2000.4	120.7	3.8	8.9	12.7
24	2009.1	1.7	2013.11+2		5.0	6.9	11,5

2. Only reliable epoch "increased" SA includes 5 SC (18 – 22), which became highest according to the Wolf numbers and flare activity among reliable SC. This epoch includes one super-cycle (19), three high ($W^* > 135$ − SC 18, 21, and 22) and one SC of average value ($80 < W^* \leq 135$ – SC 20), in which flare activity was at the high level, compared with adjacent high SC. The number of large groups of spots with the complex magnetic configuration significantly grows in these epochs and the number of large and powerful solar events, as a result, sharply grows.

Table 2. The cycles of the "increased" epoch SA.

N	To	W^*_{min}	Tmax	Te	W^*_{max}	$T_Y\uparrow$	$T_Y\downarrow$	T_Y	T_{1min}	T_{2min}	Б/П
18	*1944/2*	*7.7*	*1947/5*	*1954/3*	*151.8*	*3.2*	*7.0*	*10.2*	*33^m*	*33^m*	*444*
19	1954/4	3.4	1958/3	1964/9	201.3	3.9	6.5	10.4	33^m	38^m	221
20	1964/10	9.6	1968/11	1976/6	110.6	4.1	7.8	11.8	38^m	69^m	269
21	1976/6	12.2	1979/12	1986/8	164.5	3.5	6.8	10.2	69^m	33^m	273
22	*1986/9*	*12.3*	*1989/7*	*1996/5*	*158.1*	*2.9*	*6.7*	*9.6*	*33^m*	*40^m*	*308*
Σ		9.2			157.2	3.5	7.0	10.4	41.2^m		302

T_0 − began SC; W^*_{min} − initial W^*; T_{max} − the time of maximum SC; W^*_{max} − maximum value W^*; $T\uparrow^Y$ − the duration of the increase branch (in the years); $T\downarrow^Y$ − the duration of the decrease branch (in the years); T^Y − duration SC (in the years); T_{1min}, T_{2min} − the length of the minimum phase before and after this SC (in the months).

Fundamental characteristics SC of this epoch in comparison with "lowered":
– the higher on the average initial values of W*min;
– are shorter on the average of duration SC (10.44^{Y});
– the shortest on the average (less than 3.7^{Y}) branches of increase;
– one and two apical phases of maximum, moreover the first peak usually appears W*max, and the second coincides with the maximum of flare activity;
– the branch of the decrease on the average (6.96^{Y}) is longer, but the phases of the minimum between high SC are very short (34.25^{M}), besides the minimum 20–21 SC (69^{M});
– the more extended zone of spot-formation ± of 45º;
– average summary according to the data SC the smoothed area of the sunspot groups–~2100 mvh [2];
– the relative percentage of larger sunspots significantly is increased, the number of sunspot groups with the areas ≥1000 mvh in all SC the epoch – 487 [2].

Subsequent five cycles of solar activity have the highest relative number of sunspot and solar flare activity among reliable solar cycles. And in one among them is formally an average solar cycle # 20 flare activities was high, comparable with neighboring solar cycles.

SC	B	S	G	Total
18	64	29	9	102
19	102	56	3	161
20	49	23	3	75
21	51	18	4	73
22	40	17	6	63

B – >1000 mvh
S – >1500 mvh
G – >2500 mvh

Janssens, 2012

3. The first epoch “lowered” SA was 5 SC, three of which were low ($W^* \leq 80$ –SC 12, 14, 16) and two average values (SC 13, 15). It is necessary to note that for investigating the characteristics SC we in principle cannot use the restored number (1755–1849), since the reliable and restored series of the Wolf numbers have completely different spectral characteristics [1]. It is the consequence of poor restoration and the fact that for 9 restored SC, the branch of increase exceeded the branch of the decrease in three cycles of solar activity, but for 14 reliable SC this was observed not to time. In the epochs “lowered” SA predominate the small quite, short-lived sunspot groups of simple magnetic configuration, the level of flare activity is low – the number of powerful solar flare events is extremely small. The second such epoch began from a maximum solar cycle 22 and to the end of solar cycle 23 gave rise to a new period of "reduced" SA – the epoch of medium and low values solar cycles.

Table 2. The cycles of solar activity of the epoch “lowered” solar activity

N	To	W^*_{min}	Tmax	Te	W^*_{max}	$T_Y\uparrow$	$T_Y\downarrow$	T_Y	T_{1min}	T_{2min}	Б/П
12	1878/12	2.2	1883/12	1890/2	74.6	5.0	6.3	11.3	64^m	59^m	732
13	1890/3	5.0	1894/1	1901/12	87.9	4.5	8.2	12.1	59^m	77^m	937
14	1902/1	2.6	1906/2	1913/7	64.2	4.1	7.6	11.7	77^m	59^m	1045
15	1913/8	1.5	1917/8	1923/7	105.4	4.0	6.1	10.1	59^m	*48^m*	*526*
16	*1923/8*	*5.6*	*1928/4*	*1933/8*	*78.1*	*4.7*	*5.6*	*10.3*	*48^m*	*54^m*	*666*
Σ						4.5	6.5	10.9	61.4^m		781
24	2009 I	1.7	*13/12–14/02*	*20V–IX*	*72*	*5+.5*	*5.9*	*11,3*	68^m	*59^m*	

Fundamental characteristics SC of epoch “lowered” SA in comparison with “that increased”:

− the lower initial values W^*_{min} (3.38);

− more are prolonged in average SC (10.9^Y);

− the more prolonged on the average ($4,5^Y$) branches of increase;

− multimodal of the phase of maximum for low SC, moreover the peak largest in the value becomes W^*_{max};

− the shorter (6.5^Y) branches of decrease;

− the narrower zone of spot-formation on the latitude of ±30º;

− the average smoothed area of the groups of the spots of ~1200 of mvh. [2];

− the number of sunspot groups with the areas of ≥1000 m.v.h. in all SC of epoch − 147 [2];

− the tightened phases of the minimum between the SC ($56 - 60^m$) and, especially, before extensive phases of the

SC	B	S	G	Total
12	32	11		43
13	35	13	4	52
14	20	11	4	35
15	34	13	3	50
16	49	15	3	67

B − >1000 м.д.п.

S − >1500 м.д.п.

G − >2500 м.д.п.

Janssens, 2012

4. Before each such epoch there is occurs the change of the magnetic field generation regime in the spot-forming zone of the Sun, which lasts 1.5–2 SC and it leads to the principally different picture of the sunspot group's formation. Period of this reconstruction, apparently, rests on one SC, but are included and some portions and adjacent, when processes the change of the magnetic field generation regime already or still are manifested.

Table 3. The cycles of the solar activity change periods

N	To	W^*_{min}	Tmax	Te	W^*_{max}	$T_Y\uparrow$	$T_Y\downarrow$	T_Y	T_{1min}	T_{2min}	Б/П
10	1855/12	3.2	1860/2	1867/2	97.9	4.2	7.2	11.4		34^m	402
11	**1867/3**	**5.2**	**1870/8**	**1878/11**	**140.5**	**3.4**	**8.5**	**11.9**	**34^m**	**65^m**	**1025**
Σ						3.8	7.85	11.65	34		
16	*1923/8*	*5.6*	*1928/6*	*1933/8*	*78.1*	*4.7*	*5.6*	*10.3*	*48^m*	*54^m*	*666*
17	**1933/9**	**3.4**	**1937/4**	**1944/1**	**119.2**	**3.6**	**6.9**	**10.5**	***54^m***	***33^m***	***262***
18	1944/2	7.7	1947/5	1954/3	151.8	3.2	7.0	10.2	33^m	33^m	444
Σ						3.4	6.95	10.85	45^m		
22	1986/9	12.3	1989/7	1996/5	158.1	2.9	6.7	9.6	33^m	40^m	308
23	**1996/6**	**8.0**	**2000/4**	**2008/12**	**120.7**	**3.8**	**8.9**	**12.7**	**40^m**	**68^m**	**821**
Σ						3.35	7.8	11.15	36.5		

The characteristics of solar cycle XXII (highest of the even) gave the influential arguments of incipient reconstruction of the solar magnetic field generation regime in the convective zone of the Sun [2], which changed the conditions for the appearance of active regions (AR). The signs of such a reconstruction could be:

– the appearance of large sunspot groups on the high for sunspot formation latitudes (≥35º);

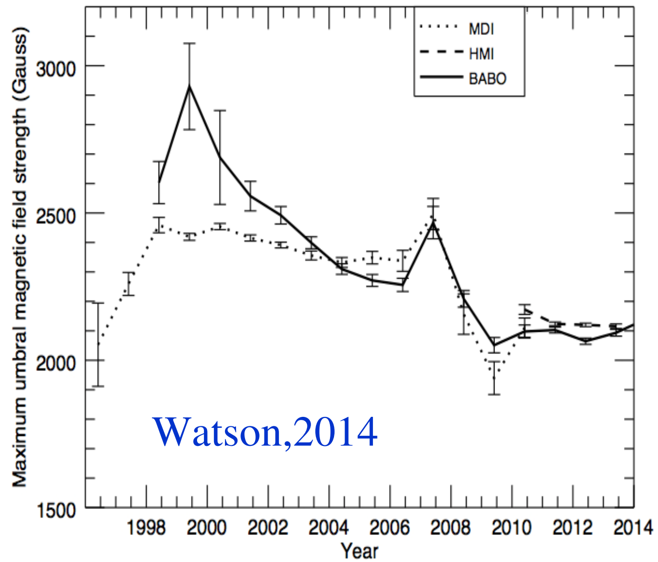
– the realization of the most powerful solar flares in the phase of maximum, but not on the decrease phase;

– the complete absence of class X solar flare on the decrease phase, the first time from the time of the solar flares observations;

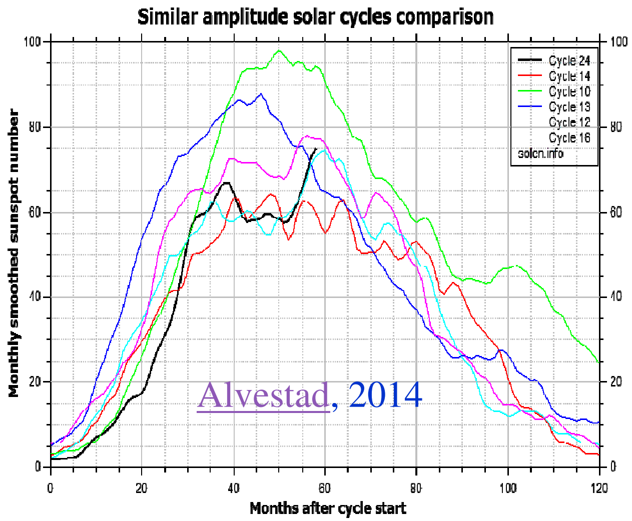
– the only case (XXII – XXIII) of violating of the Gnevyshev – Ol rule, on which odd cycle of SA must be higher than previous even.

The basic consequence of such a reconstruction it became the significant weakening of magnetic fields in the sunspot umbra and, correspondingly, an increase in the brightness of the sunspot umbra, as shown into [3], which began in the phase of the solar cycle XXIII maximum and continues up to now.

The second possible consequence of this process became the record tightened phase of the cycles XXIII – XXIV minimum. The minimum, which was begun in May 2005, was prolonged until December 2010 *after taking the first 2 years of the current cycle development*. During this period for the first time made possible to estimate and to analyze solar active phenomena under the conditions for the minimum generation of solar magnetic fields to obtain the smallest, background values of the basic observant parameters in the Sun and in the interplanetary space [4]. In the previous similar period between the cycles of SA XIV – XV was at the beginning of 20 centuries, and its detailed study it was impossible.



Annual average MF field in the darkest part of sunspot umbrae for the MDI, HMI and BABO data sets. Error bars indicate the standard deviation of all measurements for that year.



In the transition periods are manifested the uncommon properties SC, such as the violation of the Gnevyshev – Ol' rule (22 – 23), the concentration of the most powerful flare events in the phase of maximum and the uncommon calmness of the SC 22 decrease phase. Thus far all extreme solar flare super-events (VIII – IX 1859 – 10 SC; VI 1991 – 22 SC; X – XI 2003 – 23 SC) were occurred precisely in the transition periods. In the reliable cycles of SA such reconstructions, apparently, could be observed in SC 10 – 11 (few data), when the magnetic fields of the solar spot-forming zone were reconstructed to the regime of epoch “lowered” SA. In SC 17 – 18, apparently, was observed the period of magnetic field reconstructed to the epoch “increased” SA. This led to the fact that the relative percentage of the small and quite sunspot groups significantly decreased: the parameter q= SU/S (ratio of the penumbra area to the area of entire sunspot) reached the minimum at the beginning of the 30's of 20 centuries [3]. On the phase of an increase in 18 SC, for the first time in all time of observations, appeared the sunspot groups of gigantic areas (~4 – $6 \cdot 10^3$ m.v.h.), and a quantity of spotless days in the phase of the minimum returns to its average level of ~485^d.

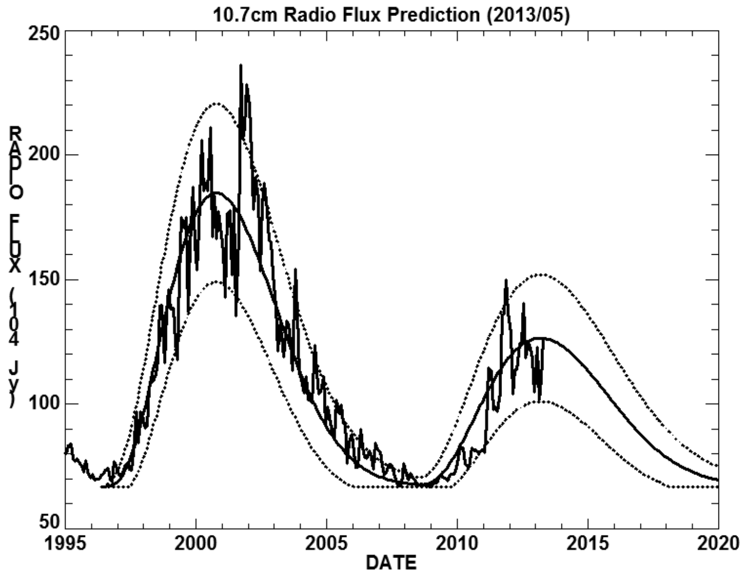
5. Begun under such conditions current 24 solar cycle after 64 months of its development into the phase of maximum.. The current cycle is the first component of physical 22-year cycle of SA and according to the Gnevyshev – Ohl rule following 25 solar cycle must be higher. Up to now the cycle is developing as the cycle of low height (W*max≤80). There were only three low cycles (12, 14, 16) among the authentic ones and all of them were even. Let us consider the fundamental characteristics of the current cycle SA :

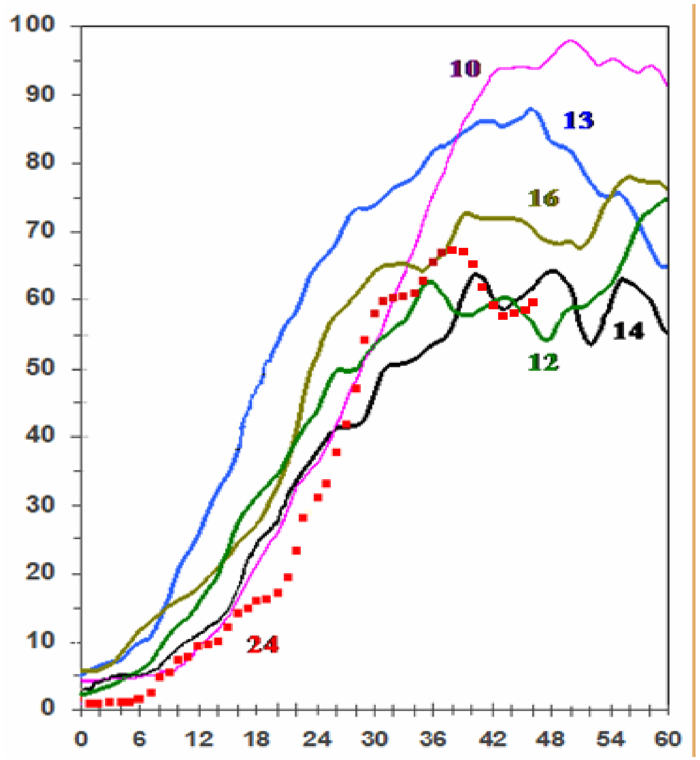
– the formal beginning of the current cycle is January 2009, and the initial value of the W*min=1.7;

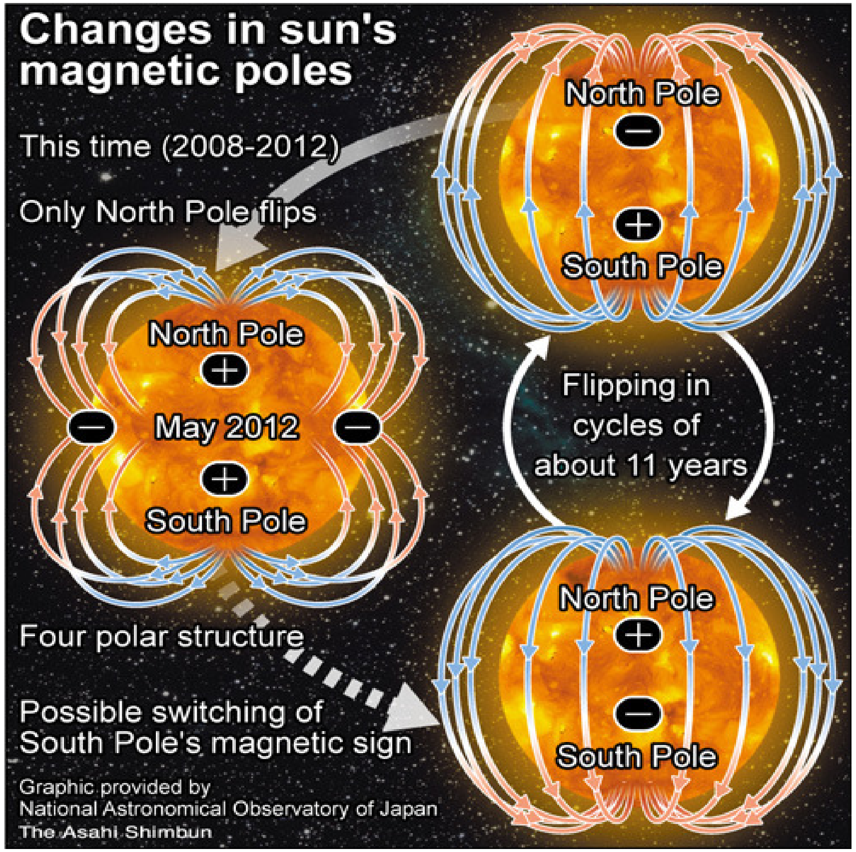
– the first group appeared in January 2009;

– the beginning of the rise phase – April 2011. (W=54.4, F10.7=112.6), when 3 sunspots groups of middle (>300 m.v.h.) size simultaneously passed through the solar disk;

– the appearance of the first large (Sp ≥ of 500 m.v.h.) sunspot group – February 2011, and the first very large sunspot group (Sp ≥ 1500 m.v.h.) – beginning November 2011;

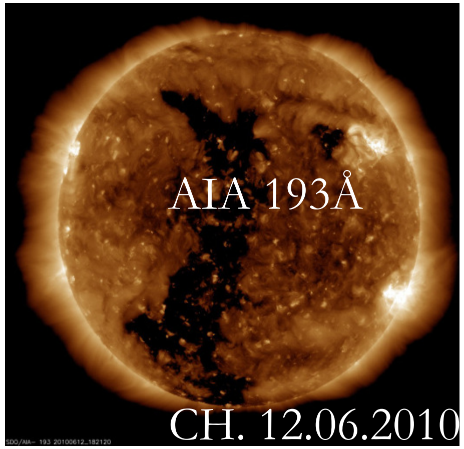






– since the beginning of the current solar cycle the explicit predominance of the solar northern hemisphere sunspot forming activity is observed: for three and half of the years of development (to 10.05.2012) 477 sunspot groups appeared on the solar disk, from which 292 were formed in the northern hemisphere and 185 – in south;

– the expected maximum of the Wolf number – 2013, October - December.



By 75 CH (162 passages) were passed solar visible disk for this period, moreover one rotation were observed 47 CH, two rotations was 10 CH, 3 rotations –3 CH, 4– 9 CH, 5 – 2 CH, 6 – 2 CH and 9 – 1 CH. From CH with the lifetime one solar rotation in the northern hemisphere they were formed by 23 CH, in the southern hemisphere – 25 CH, and transequatorial – 19 CH. Among CH, existed 2 rotations, 6 CH were localized in the northern hemisphere, one in south and 3 were transequatorial. More long-lived CH (17) was localized both on the hemispheres and passed into the discharge of transequatorial and, sometimes, returned to the hemisphere, where they were conceived.

5. Conclusion

From the preceding follows that the current cycle is developed on the scenario typical for the normal cycles SA: the most powerful flare events usually occur on the decrease phase and sometimes on the rise phase. The special features of the last two solar cycles evolution confirm the occurred change of the magnetic fields generation regime in the convective zone of the Sun. One may speculate that the Sun entered the period of low and middle solar cycles, which can be prolonged 5–6 cycles of SA (50–70 years). Significant reduction in the number of flare events will lead to the decrease of the number of stronger sporadic geomagnetic disturbances and an increase in the periods of quite geomagnetic conditions. Weakening the regime of the extension of solar magnetic fields it led to a significant increase in cosmic ray intensity in environment and, correspondingly, to an increase in the radiation background for entire duration solar cycles, but not only in the epoch of the minimum. The sporadic heating of the earth's atmosphere significantly decreased, which leads to the larger pollution the environment by space debris and other unfavorable consequences

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FLARE ACTIVE REGIONS OF XXIV SOLAR CYCLE

– AR11041 (S25L052; CMP Sp=200) ; XRI= 1.18; $M_6^{3.4}$; ПВЭ (14^h)– 20.01.10

– AR11045 (N24L250; CMP Sp=420); XRI= 1.52; $M_8^{6.4}$+C; ПВЭ (72^h)6– 9.02.10

– AR11046 (N24L186; CMP Sp=190); XRI= 0.83; $M_1^{8.3}$+C; Rapid evolution after 10.02 and flare M8.3 — 12.02.2010

– AR11079 (S26L117; CMP Sp= 010); XRI= 0.3; $M_2^{2.0}$+C; ПВЭ(29^h) 12–13.06.10

– AR11081 (N22L098, 11.06_{W43}; Sp=090); XRI=0.3; $M_2^{2.0}$;
ПВЭ(29^h) 12-13.06

– AR11093 (N10L355; CMP 10,1.08.10; Sp=250.); XRI = 0.1; M1+C1; П ВЭ(45^h) 6 -7.08

– AR11112 (S20L204, CMP 14.10,5.10, Sp= 180); XRI=0.29; $M_1^{2.6}$.

– AR11121 (S19L121, CMP 10.11.10, Sp= 090); XRI=0.74; $M_3^{5.4}$; ПВЭ(16^h) 5-6.10;

– AR11166 (N10L095, CMP 8.03.11;Sp=750 m.v.h.); XRI=2.16; $X_1^{1.5}+M_4+C_{24}$; ПВЭ (45^h) 8-9.03

– AR11149 (N18L070, CMP 20.01.11, Sp=160); XRI=0.13; M11.3;

– AR11153 (N15L172, CMP 03.02.11, Sp=180); XRI=0.19; M11.9; Appearance at 04.02 on W18, flare M1.9 - 09.02

– AR 11158 (S19L036, CMP 13,4.02.11), Sp=620); XRI=3.59; X12.2+M66.6+C48; ПВЭ (69h) 13-16.02; Appearance at 11.02 on E25;

– AR11165 (S22L181, CMP 2,3.03.11; Sp=420) XRI=1.53; M65.3+C25 ПВЭ (22h) 7-8.03; Appearance at 26.02 on E43;

– AR11166 (N10L095, CMP 8.03.11;Sp=750); XRI=2.16; X11.5+M4+C24; ПВЭ (45) 8-9.03;

–AR11261 (N16L330, CMP 01.08.11; Sp=390); XRI=2.71; M59.3+C36 ПВЭ1 30.04 - M9.3; ПВЭ 2 (23h) 3-4.08 - M2 ;

–AR11263 (N17L301, CMP 3.08.11, Sp=720); XRI=7.67; X16.9+M3+C33 ПВЭ (13h) 8–9.08 - X16.9+M2;

– AR11283 (N12L227, CMP 6.09.11, Sp=230; XRI= 5.60; X22.1+M5), ПВЭ (61h) 6–8.09 - X21.8+M2;

– AR11302 (N13L280, Sp=1300; XRI=8.73; X21.9+M17+C72 ПВЭ (66h)

– AR11339 (N19L103, Sp=1540; XRI=4.18; X11.9+M9+C38),
ПВЭ (59h) 2 -5.11 - X11.9+M5

DATE y m d	TIME to	tm	te	IMP Xray/opt	L J*m-2	LOCAL-N lt lg L	AR	RADIO		SWEEP	CME to/pa
100207	0220	0234	0303	M6.4/1N	.037	N20E09L250	11045	IV/2	0354/		
100212	1119	1126	>1140	M8.3/1N	.019	N26E11L186	11046				
101106	1527	1536	1711	M5.4/1N	.026	S19E58L211	11121				
111128	0044	0103	>0110	M1.3/	.093	N18W90L070	11149	II/1			Pr/2
110213	1728	1738	1846	M6.6/1N	.04	S20E04L036	11158	II/1			
110215	0144	0156	>0206	X2.2/	.16	S20W15L036	11158	II/2	CME/H		Pr/2.6
110218	0955	1011	>1015	M6.6/SF	.019	N22E10L336	11162				
110308	1035	1044	>1055	M5.3/1F	.034	S17W86L181	11165				
110309	2313	2323	0016	X1.5/2B	.067	N08W09L095	11166				
110730	0204	0209	>0212	M9.3/SF	.020	N21W68L330	11161			R/0209/50-100	
110804	0341	0 357	0505	M9.3/2B	.054	N19W36L358	11261	II/2		R3/0347/50-100	
110809	0748	0805	0904	X6.9/2B	.190	N17W69L3O1	11263	II/1		R3/0805/25-50	Pr
110906	0135	0150	0236	M5.3/1B	.054	N14W07L224	11283	II/3 IV/1		R/0146/25-50	
110906	2212	2220	0029	X2.1/2B	.058	N14W18L224	11283	II/2 IV/3	CME	R2220/100-300	
110907	2232	2238	>2348	X1.8/3B	.069	N14W28L224	11283	II/1 IV/1	CME	R 2303/06-12	
110908	1532	1546	1632	M6.7/1N	.042	N14W40L224	11283	IV/1		R/1544/50-100	
110922	1029	1101	1227	X1.4/2N	.450	N13E78L279	11302	II/2		R3/1054/25-50	
110924	0921	0940	1010	X1.9/2B	.110	N12E60L279	11302	II/2 IV/3		R2/0940/100-300	
110924	1233	1320	>1410	M7.1/1B	.290	n12e58L279	11302			R2/1310/12-25	
110924	2029	2036	>2042	M5.8/	.024	n13e52L279	11302			R2/2035/25-50	
110925	0431	0450	0541	M7.4/2N	.096	N11E47L279	11302	IV/2		R /0445/25-50	
111103	2016	2027	2140	X1.9/2B	.100	N22E63L117	11339		CME/2312		
120123	0256	0359	0553	M8.7/2B	.2	N28W21L212	11402	IV/2	CME/H		Pr6310
120127	1737	1837	1913	X1.7/1F	.15	N27W71L212	11402	II/3 IV/2	CME/H		Pr796

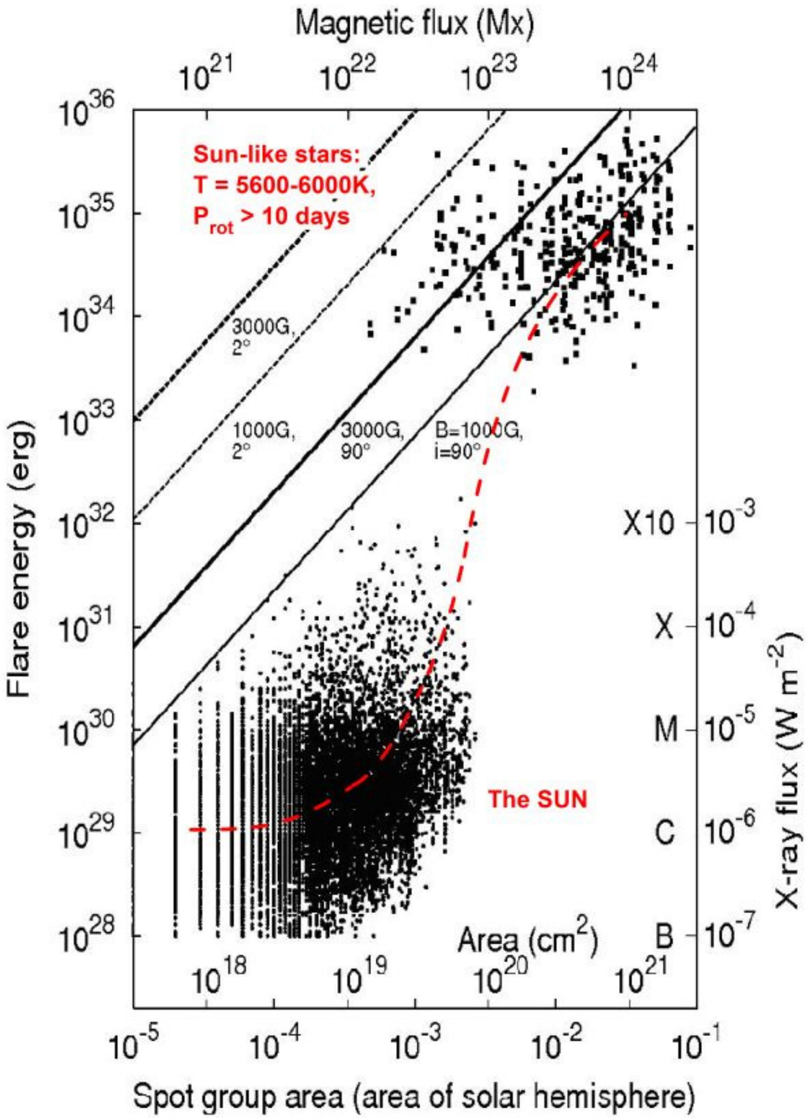
SUMMA SINE LAUDA

Если бы это было так, это бы еще ничего, А если бы ничего, оно бы так и было. Но так как это не так, так оно и не этак! Такова логика вещей

(*Л.Кэролл Алиса в Зазеркалье*)

**СПАСИБО
ЗА ВНИМАНИЕ!**

Большие вспышки на Солнце (и звездах)

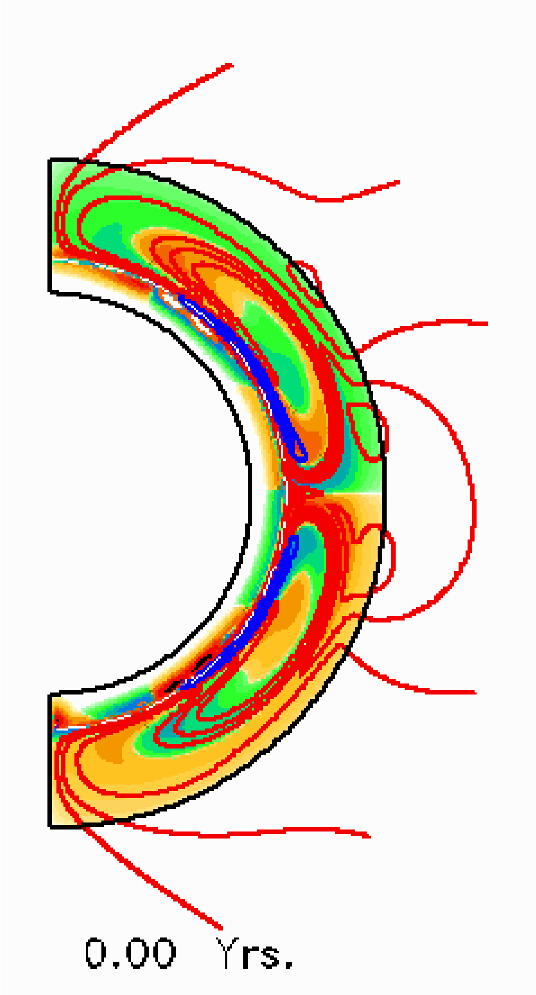


H. Maehara etal, Nature, 2012 (КА «Кеплер»):
Вероятность вспышки на солнцеподобных звездах
с E = 10^{34} - 1 раз за 800 лет,
с E = 10^{35} – 1 за 5000 лет.

K. Shibata etal, PASJ, 2013:
на Солнце E = 10^{34} - 1 за 800 лет, вспышки 10^{35} – маловероятны.

Наши данные:
$10^{33.5}$ – 1 за 60-100 лет,
10^{34} – 1 за 600-1000 лет,
$10^{34.5}$ – 1 за 1 млн.лет.

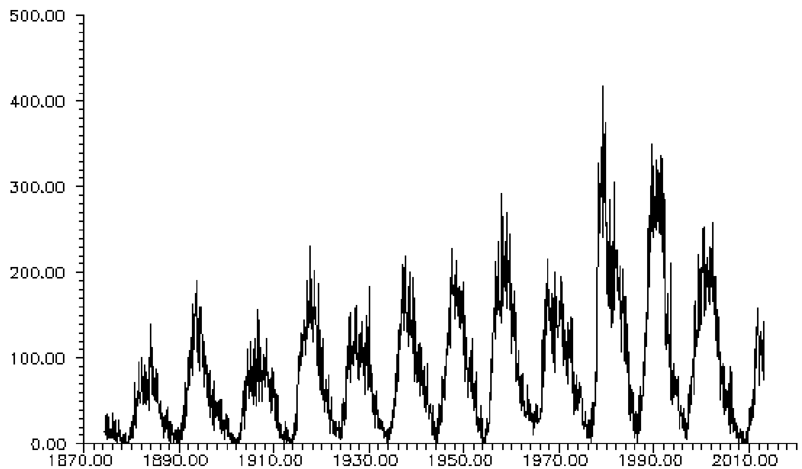
Evolution of magnetic field in the flux-transport dynamo models



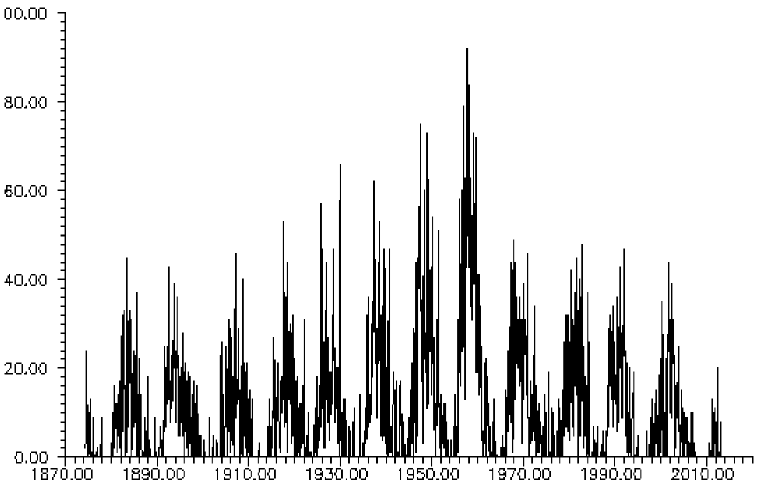
- **Flux-transport models are now divided into two classes:**
  - **Low-diffusion model**: "conveyor-belt" of several solar cycles stored in the tachocline – "long-memory" model (Dikpati & Gilman). Waldmeier's effect is not explained.
  - **High-diffusion model**: "short-memory" model, but explains the correlation between the polar field strength at the solar minimum and the next cycle, observed for the past 3 cycles (Choudhuri et al). Waldmeier's effect is explained by fluctuations of the meridional circulation speed.

Изменения с циклом крупных и мелких групп пятен

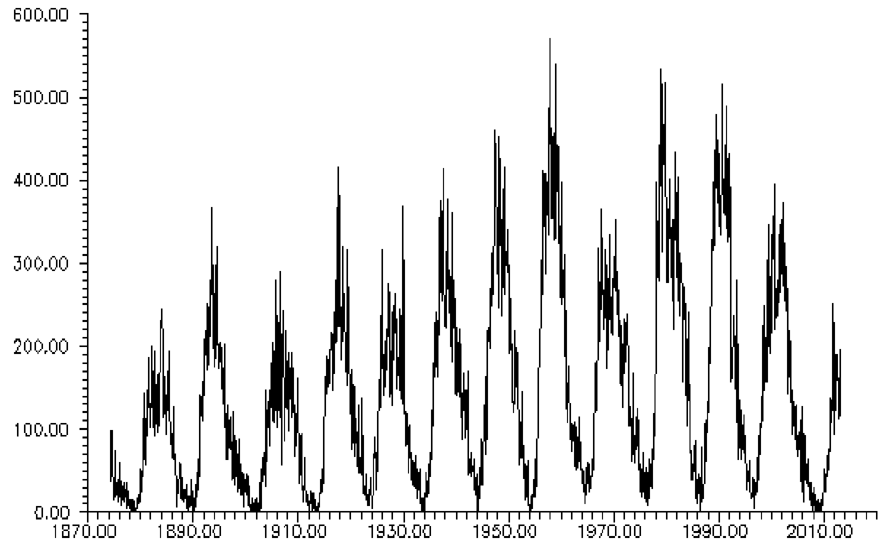
S>500 m.p.h



S<100 m.p.h



All sunspot groups



Средние магнитные поля крупных пятен демонстрируют циклические изменения, а мелких – имеют тенденцию к более длительным вариациям, что позволяет интерпретировать т.н. «эффект Ливингстона-Пенна» длительного уменьшения средних напряженностей магнитных полей пятен в последние 15 лет как феномен увеличения относительной доли мелких пятен в активности. Это обстоятельство с одной стороны свидетельствует о возможном наступлении в ближайшее десятилетие глубокого минимума солнечной активности, а с другой – о действии на Солнце двух динамо-механизмов, отвечающих за формирование крупных и мелких пятен соответственно. – ГАО, ИЗМИРАН, NSO (США), IKIT (Болгария).

– the longest average (not less than 4 years) branch of rise;
– multimodal of maximum phase, and the largest in size peak becomes the point of cycle maximum;
– in two cases out of three (23 – 24 and 14 – 15) the cross-town branches droop with the extended phase of solar activity minimum. Perhaps this is one of the signs of the beginning or ending of restructuring of generating solar magnetic fields.

For the first time such a protracted period of minimum phase in the era of space research on solar cycles 23-24. It became possible to understand that from a peak of #22 and end of #23 solar cycles, generating magnetic fields on the Sun significantly changed and gave rise to a new period of "reduced" SA-era cycles of medium and low values (150 recession-year cycle). With the start of cycle 24 SA, in our view, the restructuring is over and restores famous observation rules, such as rule Gnevysheva-Olya, on which the next solar cycle 25 should be higher.