

# QUARTERLY BULLETIN ON SOLAR ACTIVITY

## I. SUNSPOTS

### Sunspot Relative-Numbers and Sunspot-Areas

Cooperating Observatories for Sunspot Relative-Numbers: Ankara, Arosa, Athens (National Observatory), Athens (Eugenides Planetarium), Bucarest, Catania, Helwan, Hurbanovo, Istanbul, Kandilli, Kanzelhöhe, Kiev, Kislovodsk, Locarno, Madrid, Manila, Mitaka-Tokyo, Potsdam, Quezon-City, Roma-Monte Mario, Roquetas-Tortosa, Santiago de Chile, Skalnaté Pleso, Taipei, Tashkent, Tokyo (Science Museum), Uccle, Zürich.

The first column gives the Relative-Numbers for the whole disk of the sun (R), the second that for the central zone ( $R_C$ ). The diameter of the central zone is half that of the sun's disk.

The Sunspot-Areas A are based upon measurements made at Catania  $A_C$ , Roma-Monte Mario  $A_R$ , and at Locarno and Zürich (combined values)  $A_Z$ . The apparent total area of the umbra plus penumbra is uncorrected for foreshortening and expressed in millionths of the solar disk.

1978	Jan.	R	$R_C$	$A_C$	$A_R$	$A_Z$
	1	90	13	--	--	--
	2	94	35	--	--	1388
	3	104	30	--	2033	--
	4	103	23	--	--	--
	5	91	23	--	--	--
	6	79	18	--	--	--
	7	55	7	--	--	--
	8	39	8	--	--	146
	9	36	14	--	--	17
	10	15	0	--	--	4
	11	20	12	--	--	--
	12	26	18	--	--	--
	13	33	19	--	--	--
	14	37	7	--	--	71
	15	34	0	--	--	--
	16	27	8	152	--	138
	17	26	9	148	--	--
	18	14	8	--	--	36
	19	8	8	32	--	12
	20	8	0	32	--	--
	21	19	0	90	--	112
	22	28	0	384	--	348
	23	40	0	367	--	264
	24	40	0	394	--	--
	25	38	20	331	--	357
	26	49	32	672	684	--
	27	67	14	798	892	701
	28	78	0	1040	1367	--
	29	90	0	--	--	--
	30	103	14	1276	1669	885
	31	118	54	1202	1633	1020
Mean		51.9	12.7	494	1380	367

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1978	Feb.	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	128	54	1533	1781	1047
	2	120	90	--	--	1373
	3	130	55	2369	--	--
	4	142	29	2348	2163	2076
	5	137	0	2133	--	1641
	6	129	11	1733	--	1627
	7	122	32	2305	--	--
	8	90	26	2925	3351	2458
	9	97	16	1449	3770	3077
	10	102	38	--	--	--
	11	112	47	2919	3858	--
	12	115	60	3319	--	--
	13	96	22	3461	--	3192
	14	82	14	2937	3230	2947
	15	65	9	2594	2961	--
	16	64	7	--	--	--
	17	58	7	1092	--	--
	18	57	0	930	975	--
	19	56	0	830	--	--
	20	58	0	714	982	--
	21	65	18	988	--	--
	22	73	16	988	--	968
	23	76	23	1087	1891	1029
	24	91	21	1067	--	--
	25	94	12	919	--	1222
	26	90	19	1204	--	--
	27	85	25	1241	--	1021
	28	88	39	1140	--	1164
	Mean	93.6	24.6	1769	2496	1774

1978	March	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	102	61	983	--	--
	2	92	27	--	--	923
	3	95	32	1077	1451	1172
	4	98	13	1483	--	--
	5	84	9	--	--	1317
	6	75	42	1460	1331	1361
	7	90	53	1801	--	1705
	8	99	41	2059	2545	1837
	9	94	14	2526	--	2310
	10	92	11	2646	2827	--
	11	88	12	3177	--	2841
	12	78	29	3140	--	3213
	13	73	25	--	2944	2671
	14	72	30	2988	--	--
	15	74	11	2385	2751	2352
	16	74	24	2133	--	--
	17	74	24	2016	--	--
	18	74	0	1723	--	1531
	19	65	17	1340	--	1330
	20	59	18	677	1104	--
	21	77	18	583	--	575
	22	84	17	364	726	483
	23	88	16	451	--	406
	24	85	14	363	--	432
	25	74	15	--	--	366
	26	60	35	278	--	228
	27	52	37	220	--	227
	28	49	20	136	425	228
	29	48	12	257	258	203
	30	45	12	262	175	--
	31	58	0	111	--	--
	Mean	76.5	22.2	1357	1503	1260

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The first column gives the Relative-Numbers for the whole disk of the sun ( $R$ ), the second that for the central zone ( $R_C$ ). The diameter of the central zone is half that of the sun's disk.

The Sunspot-Areas  $A$  are based upon measurements made at Catania  $A_C$ , Roma-Monte Mario  $A_R$ , and at Locarno and Zürich (combined values)  $A_Z$ . The apparent total area of the umbra plus penumbra is uncorrected for foreshortening and expressed in millionths of the solar disk.

1978	Apr.	$R$	$R_C$	$A_C$	$A_R$	$A_Z$
	1	70	0	448	--	--
	2	68	20	836	--	618
	3	71	18	971	--	902
	4	75	15	1124	--	1150
	5	94	21	1485	--	1463
	6	92	39	--	--	1536
	7	88	24	1413	--	1151
	8	105	41	1488	--	999
	9	126	30	1267	--	1125
	10	125	40	1240	--	--
	11	120	19	1302	--	--
	12	109	10	1266	--	--
	13	105	53	1307	--	783
	14	91	50	1014	--	707
	15	90	50	841	--	--
	16	95	43	1181	--	942
	17	99	12	1123	--	991
	18	103	0	1140	--	884
	19	111	0	--	--	1106
	20	115	19	1236	--	1150
	21	114	38	1214	--	927
	22	115	52	1225	--	1108
	23	119	78	1208	--	--
	24	106	39	1251	--	977
	25	136	11	1261	--	1062
	26	115	7	1651	--	1373
	27	99	7	1785	--	--
	28	83	0	2563	--	2249
	29	78	0	2741	--	2749
	30	75	41	2940	--	--
	Mean	99.7	25.9	1376	--	1180

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1978	May	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	85	45	2374	--	--
	2	89	56	2615	--	2795
	3	93	24	2258	2713	2551
	4	92	0	1817	2028	--
	5	89	0	1759	--	--
	6	85	20	1260	--	--
	7	75	30	1199	--	881
	8	63	25	819	--	594
	9	62	26	468	--	420
	10	60	19	573	698	599
	11	63	19	694	736	602
	12	66	10	783	702	--
	13	74	28	1061	--	--
	14	74	28	1035	--	997
	15	78	13	--	1086	952
	16	91	40	1218	--	1068
	17	86	17	1036	1003	--
	18	89	51	1003	1084	--
	19	84	35	657	--	763
	20	74	29	756	--	662
	21	76	8	658	--	--
	22	74	0	--	--	--
	23	73	8	1576	1192	1063
	24	82	24	1314	1279	1133
	25	85	8	1617	1664	1445
	26	88	50	2206	--	1658
	27	97	49	2059	--	1852
	28	93	75	2762	--	1993
	29	103	49	1936	2131	1852
	30	107	35	1713	--	1517
	31	113	46	1413	2055	1254
	Mean	82.7	28.0	1401	1413	1269
1978	June	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	119	50	1282	--	1151
	2	98	14	--	--	1004
	3	78	23	641	--	533
	4	60	9	462	--	333
	5	51	7	472	--	318
	6	31	0	284	--	214
	7	39	8	168	--	113
	8	45	14	224	201	103
	9	36	7	53	80	56
	10	29	7	80	--	39
	11	57	25	184	--	113
	12	62	30	168	397	130
	13	62	26	290	--	218
	14	64	7	425	--	351
	15	89	35	757	--	575
	16	94	40	1024	--	--
	17	103	40	882	--	--
	18	115	29	726	--	497
	19	109	32	772	--	478
	20	109	19	988	--	580
	21	154	48	2007	--	1870
	22	158	51	3046	--	2650
	23	158	52	3352	--	2931
	24	154	62	3009	--	2122
	25	135	93	2543	--	1890
	26	152	113	2679	--	1785
	27	143	123	2133	3192	--
	28	130	62	1283	2385	--
	29	115	28	1114	--	878
	30	103	13	894	--	680
	Mean	95.1	35.6	1101	1251	831

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1978	July	$R$	$R_C$	$A_C$	$A_R$	$A_Z$
	1	64	7	715	--	--
	2	61	16	499	--	340
	3	51	20	346	--	326
	4	48	29	488	--	--
	5	54	9	693	907	589
	6	63	10	593	--	513
	7	84	17	615	776	--
	8	105	16	668	--	--
	9	108	24	1297	--	990
	10	115	22	1923	2292	1739
	11	127	14	2950	2734	2467
	12	111	10	2809	2866	2425
	13	114	57	2662	--	2323
	14	109	53	2699	--	2286
	15	102	59	2001	--	2037
	16	110	66	1580	--	1701
	17	98	39	1580	1610	1407
	18	84	58	1302	1353	1199
	19	77	39	883	--	--
	20	76	34	604	--	551
	21	77	21	364	--	261
	22	48	0	190	--	157
	23	38	9	120	--	114
	24	38	7	43	--	57
	25	30	23	53	--	26
	26	13	7	16	--	5
	27	22	8	32	0	12
	28	31	8	138	--	76
	29	48	0	159	--	180
	30	39	0	215	--	198
	31	36	0	336	--	--
Mean		70.4	22.0	922	1567	879

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1978	Aug.	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	42	8	714	398	--
	2	48	18	--	--	394
	3	38	32	511	--	399
	4	62	25	--	--	321
	5	74	7	274	--	293
	6	66	0	200	--	277
	7	58	0	810	--	--
	8	62	0	1045	--	--
	9	64	8	982	597	849
	10	67	19	704	892	576
	11	58	19	510	--	537
	12	71	23	421	--	377
	13	93	11	517	--	373
	14	93	9	410	--	327
	15	77	8	478	--	439
	16	52	8	310	--	308
	17	50	0	483	--	437
	18	50	14	631	523	525
	19	42	7	504	583	520
	20	30	12	467	--	430
	21	30	14	384	--	354
	22	36	20	410	--	362
	23	45	19	316	--	303
	24	48	0	263	321	220
	25	55	0	253	347	219
	26	45	9	121	--	61
	27	57	22	205	--	92
	28	57	23	121	--	111
	29	59	7	321	--	248
	30	72	14	326	--	551
	31	100	34	872	--	--
	Mean	58.1	12.6	468	523	367
1978	Sep.	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	136	31	1166	2225	--
	2	167	77	2306	--	2762
	3	159	87	2570	--	2983
	4	162	46	2537	--	3204
	5	177	54	2771	--	2706
	6	177	19	2821	2828	2976
	7	147	7	3535	--	--
	8	120	0	1618	--	--
	9	109	7	1828	--	--
	10	99	7	1324	--	--
	11	84	24	1160	--	764
	12	72	32	1103	--	--
	13	92	43	1350	--	1310
	14	113	11	1491	1782	1312
	15	133	17	2252	--	2100
	16	143	29	2851	--	3075
	17	136	41	3218	--	3145
	18	156	37	3487	--	3263
	19	159	69	3717	--	3322
	20	163	30	3494	--	--
	21	171	32	3250	3993	3308
	22	148	74	2756	3532	2896
	23	156	46	4678	--	--
	24	163	28	1828	--	--
	25	168	47	1557	--	1375
	26	152	21	1302	1469	1090
	27	142	25	978	1093	--
	28	126	24	1095	1196	--
	29	122	34	1035	--	--
	30	94	36	909	--	658
	Mean	138.2	34.5	2200	2265	2347

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1978 Oct.	$R$	$R_C$	$A_C$	$A_R$	$A_Z$
1	96	10	710	--	585
2	112	29	589	--	--
3	105	27	656	--	--
4	100	52	684	--	--
5	73	50	630	--	--
6	74	47	631	940	293
7	95	8	815	1126	681
8	103	36	1377	--	1348
9	121	13	1687	1267	1278
10	149	24	--	--	1229
11	158	30	1698	1700	1524
12	158	39	1881	--	1674
13	156	69	1823	--	1665
14	170	54	1857	--	1857
15	166	41	1972	--	1769
16	163	63	2553	--	--
17	143	43	2295	--	--
18	135	20	1943	1981	--
19	154	34	2306	--	1707
20	151	49	--	--	1696
21	144	42	1635	--	--
22	125	20	1352	--	1295
23	116	58	--	1495	1210
24	104	48	1450	1394	1292
25	96	39	1587	1360	1364
26	102	18	1189	--	--
27	115	41	1349	--	--
28	117	47	--	--	1334
29	137	60	1236	--	1186
30	128	57	1150	--	879
31	111	9	1046	923	711
Mean	125.1	38.0	1411	1354	1266

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1978	Nov.	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	109	46	1003	--	779
	2	122	47	1109	1436	889
	3	125	55	1446	1999	1000
	4	129	43	2054	2311	1775
	5	121	48	2239	--	2022
	6	108	40	--	2037	2014
	7	112	51	2152	2443	--
	8	118	62	2442	2674	2093
	9	108	71	2336	2773	2128
	10	120	45	2646	2909	2374
	11	118	32	--	--	2496
	12	99	14	2720	--	1845
	13	90	27	1691	--	1612
	14	78	38	1586	--	1438
	15	59	27	798	--	868
	16	77	15	583	643	678
	17	92	10	731	--	--
	18	93	0	698	630	667
	19	85	0	773	--	801
	20	76	8	788	--	671
	21	68	14	652	--	737
	22	77	22	732	527	625
	23	55	30	536	478	484
	24	61	0	567	448	456
	25	85	14	583	--	493
	26	101	11	683	--	--
	27	118	19	899	--	--
	28	118	32	1345	--	--
	29	111	36	1859	--	--
	30	103	35	1827	--	1725
	Mean	97.9	29.7	1339	1639	1278
1978	Dec.	R	R <sub>C</sub>	A <sub>C</sub>	A <sub>R</sub>	A <sub>Z</sub>
	1	110	34	--	--	1542
	2	110	28	1680	2160	1892
	3	117	61	1838	--	1813
	4	115	46	2059	--	1914
	5	104	47	--	--	1989
	6	122	38	1892	--	1913
	7	138	50	1913	--	--
	8	148	46	2564	--	--
	9	152	43	2925	3460	--
	10	144	14	3639	--	--
	11	170	96	4268	--	--
	12	188	118	4243	--	--
	13	165	118	5492	--	--
	14	150	74	4757	--	--
	15	140	35	3077	3389	3365
	16	143	17	2190	--	--
	17	146	45	--	--	--
	18	132	18	2432	--	--
	19	95	11	1906	--	--
	20	84	29	1802	--	--
	21	68	22	1554	--	--
	22	63	10	1146	--	--
	23	59	10	--	--	--
	24	65	20	715	--	--
	25	81	30	--	--	770
	26	93	44	1114	--	--
	27	110	46	1124	--	--
	28	122	24	925	--	968
	29	135	44	1523	--	--
	30	159	89	1793	--	--
	31	177	68	2117	--	--
	Mean	122.7	44.4	2334	3003	1796