

4. 宇宙航空研究所による観測事業 1966—1976

4.1 ロケット・科学衛星による観測

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宇宙航空研究所で打上げているロケット・科学衛星は毎年 COSPAR に提出している National Report や、宇宙航空研究所要覧などに1年分ずつ記載されているが、これを5年、10年間にわたってまとめたものはない。またこれら飛翔体による観測の結果は多くの学術誌にはばらばらになって発表されていて、その全体はつかまえないのが実情である。飛翔体および観測成果の発表論文一覧はちょうど10年前に平尾氏が作られたもの [R 233] が最後になっている。そこで今回、宇宙航空研究所報告に宇宙科学特集号が作られるのを機に、過去10年間の観測一覧を作ることになった。

表 R-1 は 1966 年 4 月から 1976 年 3 月までの10年間に打上げられた観測ロケット一覧である。何等かの理由で観測がすべて不成功に終わったものは除いてある。記載したのは、通し番号、ロケット機名、打上げ年月日、時刻、到達高度、観測項目、関連論文番号である。観測項目は略号で示してあり、その意味するところは表 R-4 に示されている。また観測項目に [] 型括弧がついているのは、その項目の観測が不成功だったことを示す。

表 R-2 は同じ期間中に打上げられて科学観測を行った衛星の一覧で、ロケットの場合と同様の記載事項のほか軌道要素が示されている。

表 R-3 は同じ期間中に海外で行われた国際協力ロケット観測の一覧である。協力の相手国名、実験場所、ロケット機種、年月日、観測項目、参加研究機関、および関連論文番号を示してある。国際協力については全体の数も少いので、ロケット打上げ不調などによって失敗に終わったものも一応集めてある。

発表論文 (4.3 A に記載) としては飛翔体による観測の直接の報告と見られるものものに限る。搭載機器開発、室内実験、理論に関するものは除いてある。また、学会講演の予稿集や、宇宙航空研究所主催のシンポジウムのプロシーディングスも今回は除外した。和文の宇宙航空研究所報告 (Bull. ISAS) は英文名にして収録してある。本年3月、宇宙観測専門委員会に属する各班の班員の皆さんに論文リスト原案をお送りし、追加、訂正をして頂いてでき上ったのが今回の文献リストの [R1] ~ [R210] である。まだ調査もれのものがあると思われるが、時間的制約のため一応ここで打切った。国際協力関係は所内の平尾、小田、大林、田中各教授に資料を用意して頂いた。

資料の蒐集、追加、訂正、タイプなどを通じ多くの方の協力によってこの原稿が出来上がったことを記し、謝意を表したい。

表R-1 ロケット観測一覧

Rocket Observations (at Kagoshima Space Center)

No.	Rocket	Date	Time (JST)	Alt. (km)	Experiments	References
S 54	K-8-13	'66 4 20	2105	160	CCR, MGF	[R33]
55	K-9M-18	7 17	1110	326	CPI, MGF, CR, NNP(O ₃)	[R88]
56	K-9M-19	8 10	2137	330	PRW, RNW, AGL	[R51] [R53] [R56] [R57] [R58] [R131]
57	K-8L-10	8 11	2105	130	CCR	
58	K-8L-11	10 18	1817	145	CCR	[R77]
59	K-8-14	10 20	1120	191	NNP (O ₃), EFD, MGF	
60	K-9M-20	10 20	1725	353	ID, PW, AGL	[R48] [R59] [R62] [R64] [R69] [R82]
61	K-9M-21	12 5	1100	326	NEL (I), NNP (O ₃), SUV	[R61] [R64] [R76] [R78] [R82] [R93] [R110]
62	K-8L-12	12 10	1100	147	MGF, NNP (O ₃)	
63	K-10-2	12 10	2030	253	GXR, CR	[R54]
64	K-9M-22	'67 1 31	1105	327	MGF, RNW, ID	[R19]
65	L-3H-3	2 6	1110	2150	MGF, RPB, CR, RA	[R68] [R75] [R80] [R86]
				430	GXR, SUV, ID	
66	K-10-3	3 7	2000	248	GXR, UV, ZOL, CR, IR	[R70] [R72] [R73]
69	K-9M-25	'69 1 8	1110	343	MGF, RBP, PW	[R79] [R82] [R88] [R92]
70	K-8-15	9	1640	188	NEL (I), MGF, ID	[R71] [R79] [R81] [R82] [R88] [R92]
72	K-10-4	14	1900	229	UV, GXR, ID, CPI, MGF, ZOL	[R83] [R84] [R90] [R92] [R97] [R98] [R99] [R114] [R118] [R123] [R125] [R137] [R149]
74	K-9M-24	19	2100	328	NNP (O ₃), AGL, PW, MGF, ID	[R79] [R82] [R91] [R92]
75	K-9M-23	2 13	1105	310	MGF, UV	
76	K-9M-27	8 7	2115	327	PWA, GXR, MGW, RBP	[R74] [R89] [R104] [R105] [R106] [R107] [R114]
78	K-9M-26	8 24	1703	341	PNW, RNS	[R85] [R86] [R87]
79	K-10-5	9 6	2035	248	AIR, GAL, ZIR AGL (OH) TPI, TEL	[R108] [R116] [R156] [R195]

No.	Rocket	Date	Time (JST)	Alt. (km)	Experiments	References
S 81	L-3H-6	'70 1 21	1110	1848	[CPI, AUV ₁] RBP, NEL, AUV ₂ , TEL (Main Stage)	[R94] [R95] [R109] [R113] [R119] [R132]
				350	CDU, [TPI, TEL], RBP (Booster Stage)	
82	K-9M-28	1 25	1400	369	NNP (O ₂), CPI, NNP (O ₃), TEL	[R100] [R101] [R110] [R116] [R119] [R195]
83	K-9M-29	27	1920	357	NEL, RNW, PRW, PWC, PWA, TEL	[R100] [R101] [R102] [R103] [R112] [R119] [R121] [R141] [R166] [R195]
84	K-8-16	'70 9 2	1914	174	MIC, [TEL], NEL	[R23] [R112] [R124] [R129] [R130]
85	L-3H-5	19	2030	2017	AUV-IC, AUV- CH, NEL, [TEL], PWC, ESE, NEL (I)	[R95] [R96] [R111] [R115] [R120] [R123] [R125] [R128] [R133]
	(2nd Stage)			(329)	RBP, ASL, [TPI], GXR, RBP	
86	K-9M-32	27	1542	346	PRW, NEL, TEL, MGW	[R116] [R117] [R119] [R132] [R180]
87	K-9M-30	'71 1 16	1615	357	[CPI] NEL, TEL NNP (O ₂), NNP (O ₃)	[R119]
88	K-9M-35	23	2020	340	PWI, PWA, PRW, NEL	[R126] [R127] [R141]
89	K-9M-34	24	1100	328	GXR, SUV, TEL, MGF	[R119] [R132] [R160] [R195]
90	K-9M-31	8 18	2100	332	GXR[NEL, TEL]	[R143] [R160]
91	K-10-7	20	2110	271	ZOL, AIR, ASL, TEL	[R156] [R195]
93	K-9M-33	26	1935	340	TEL, NEL, MIC	[R134] [R135] [R163] [R175] [R176] [R178] [R204]
94	K-10-6	9 1	1110	228	SUV ₁ , SUV ₂ , TEL	[R147] [R148]
95	L-3H-7	3	2100	1718	TEL, CPI, PWC, RBS, GXR, ASL, PWA, RBS, TPI	[R125] [R128] [R138] [R139]
96	S-210-6	'72 1 21	1124	112	CPI, NEL, TEL	[R132] [R152] [R195]
98	S-210-7	2 17	1700	118	NNP (NO), NEL, TEL	[R121] [R122] [R196]

No.	Rocket	Date	Time (JST)	Alt. (km)	Experiments	References
S 99	K-9M-39	'72 2 18	1828	310	TEL, NEL, MGF, MIC	[R135] [R146] [R151] [R175] [R176] [R177] [R178] [R195] [R204]
100	S-160-4	21	1100	76.2	AEL	
101	K-9M-38	22	1500	352	CNP, NEL ₁ , NEL ₂ , NEL ₃ , RNW, TEL, NNP (O ₃)	[R140] [R195]
102	K-10-8	9 12	2010	259	GXR ₁ , GXR ₂ , ZIR	
103	K-9M-40	20	1400	326	NEL-TEL, ESE, PEX	[R142] [R144] [R145]
104	S-210-8	'73 1 16	840	121.8	[CPI], TEL, NEL(C), NNP(O)	
105	K-9M-41	19	1800	330	PWA, PRW ₁ , PRW ₂ , NPW, NEL	[R154] [R157] [R158] [R182] [R187] [R188] [R205] [R207]
106	K-10-9	2 19	922	236	TEL, [TPI], NNP (O ₂), NNP (O ₃), GXR, SUV ₁ , SUV ₂	[R160] [R164] [R173] [R194]
107	K-9M-42	2 23	1838	306	MIC (Ba) (Cs) (Na), NEL, TEL, MGW	[R162] [R175] [R176] [R177] [R178] [R193] [R204]
108	S-210-9	8 19	1855	115	NNP (NO), NNP (O), NEL(C, I), TEL	[R171] [R195] [R202]
109	K-9M-43	21	1600	335	PRW, MGF, NEL, TEL, CCR (Na)	[R159] [R162] [R175] [R195]
110	K-9M-44	27	2100	341	ESD, TEL, GXR	[R153] [R183] [R195] [R201]
111	K-10-10	9 22	1820	242	TPI [CNP-CPI], NEL, TEL ₁ , TEL ₂ , [GXR, NNP (O ₃)]	[R165] [R166] [R167] [R172] [R174] [R179] [R192] [R195] [R196] [R200] [R208] [R209]
112	K-9M-45	'74 1 16	1100	360	ESE(L), TED, TEL, SUV, PRE	[R155] [R161] [R196] [R208]
113	L-3H-8	22	2000	1571 329	3rd stage-PRT, NEL, AUV, TEL, PEX, RBS, NPI 2nd stage-AGL, [AIR], TNP, GUV, GAS, GXR	[R168] [R181] [R184]

No.	Rocket	Date	Time (JST)	Alt. (km)	Experiments	References
S114	S-210-10	8 20	1855	112	NNP (NO), NNP (O), NEL, TEL	
115	K-9M-46	'74 9 17	2040	336	SPA, PWP, [EFD], NEL, TEL	
116	K-9M-47	19	1100	328	[CPI-CNP], ESE TED, TEL, NEL	[R191]
117	K-9M-48	20	2032	348	TNP, TEL, ESE, XUV	[R186] [R207]
118	K-9M-49	'75 1 17	1835	363	AGL, AIR, NNP, PWE, TEL	[R165] [R197]
119	K-9M-50	23	2005	353	GXS, PWN, NEL, TEL	
120	K-9M-53	8 26	1940	351	NNP (O), PWN, DPL, PWE, NEL, TEL	[R165]
121	S-310-2	30	1310	191	NEL ₁ , NEL ₂ , TEL	
122	K-9M-51	9 2	2100	311	SPA, BWI	
123	K-9M-52	23	2100	336	TNP, GXS, [TEL]	
124	K-10-11	24	1400	196	SUV, GXR, TPI-TNP, TEL	
125	K-9M-54	'76 1 17	600	367	AGL, ESE, AUV, TED (TEL), NEL, NNP-N	
126	K-10-2	18	1420	216	PWE, ESP-CBE, EFD, AUV, CPI, MIC, NEL, SUV, TEL	
T 43	L-3H-2	'66 7 23	1535	1800	IP, RBP, LP, IC, RN-PR, PR-DP ID	[R25] [R47] [R49] [R63] [R65] [R67] [R76] [R78] [R82]
				340	MUV, OZO, SXU	
T 78	S-210-2	'69 8 8	2100	101	GXR	[R89] [R104] [R105] [R106] [R107] [R114]
T 89	S-210-3	'70 1 17	1020	119	GXR	
T 96	S-210-5	9 28	1020	108	CPI, TEL, NEL	
T 97	S-210-4	'71 1 16	1100	115	NEL, TEL	[R119] [R132] [R195]

表 R - 2 科学衛星観測一覽

Satellite Observations

No.	Satellite/Date/Time	Experiments	
	Elements of Orbit	References	
SA-1	M-4S-3 '71 9 28 1300 JST [Satellite 1971-080-A SHINSEI]	ID, RA, CR	
	Inclination	32.051 degrees	[R169]
	Semi-major Axis	7,750 km	[R201]
	Eccentricity	0.0643	[R210]
	Nodal Period	113.2 min	
	Apogee Height	1,870 km	
	Perigee Height	874 km	
SA-2	M-4S-4 '72 8 19 1140 [Satellite 1972-64A DENPA (REXS)]	NEL, TEL, ESP, PW, MGF/MGW	
	Inclination	31.02 degrees	[R136]
	Semi-major Axis	9,784.07 km	[R150]
	Eccentricity	0.3229	[R170]
	Nodal Period	160.52 min	
	Apogee Height	6,565.6 km	
	Perigee Height	246.2 km	
SA-3	M-3C-2 '75 2 24 1425 [Satellite 1975-014A TAIYO (SRATS)]	SXR, SUV, GMV, CPI, TEL, TPI, IMP	
	Inclination	31.5 degrees	[R185] [R189] [R190]
	Semi-major Axis	8,073.5 km	[R198] [R199] [R203]
	Eccentricity	0.1783	
	Nodal Period	120.3 min	
	Apogee Height	3,135.0 km	
	Perigee Height	255.0 km	

表 R-3 国際協力ロケット観測一覧

Rocket Observations (International Collaboration)

Country	Place	Rocket	Date	Experiments	Experimenters	References (Remarks)
USA/India	TERLS (India)	Nike-Apache	1968-4-22	GXR	} ISAS, DAE NASA	(failure)
"	"	"	4-25	"		} "
"	"	"	1969-4-26	"	} "	
"	"	"	4-28	"		} "
USA	Peru	Nike-Apache	1975-5-28	TEL ... TEL, NEL, etc. ...	ISAS U. Illinois, NASA	
India	TERLS (India)	Nike-Apache	1971-4-25	TEL, NEL (C), NEL (I)	} ISAS, ISRO	(failure)
"	"	"	"	"		"
"	"	Centaure	1973-7-3	TEL, NEL, NNP (NO), NPI, NEL	} ISAS, U. Tokyo (F. Sci.), ISRO, NPL	} (failure)
"	"	"	1976-3-24	"		
"	"	"	1976-3-26	"	"	
Netherlands	Kauai Test Range (Hawaii)	Nike-Tomahawk	1971-5-26	GXS (LEINAX I)	Nagoya U., Leiden U., Utrecht U.	[R212]
"	"	"	1972-5-22	GXS (LEINAX II)	"	[R213]
"	"	BT3-Sandhawk (with ACS)	1974-11-10	GXS (LEINAX III)	"	[R214]
"	"	"	1976-5-28	GXS (LEINAX IV)	Nagoya U., ISAS, Leiden U., Utrecht U.	[R215]
						[R216]
						[R217]
						[R218]
						[R219]
						[R220]
Denmark	Sondre Strömfjord (Greenland)	Nike-Tomahawk	1974-7-2	NEL (I), TEL	ISAS, DMI, DSRI, etc.(1)	[R221]
"	"	"	1974-7-8	"	"	[R222]
Canada	Cape Parry (Canada)	Black Brant V	1974-12-6	TEL ... NEL, AGL, etc. ...	ISAS ... NRC, York U., etc.(2)	failure disturbed by other experiments.

- (1) U. Texas (Dalls, U.S.A.) Roy. Inst. Tech. (Sweden), Norwegian Defence Res. Establishment (Norway), ESTEC Space Sci. Div. (Holland)
 - (2) Saskatchewan U., Liege U. (France), AES (USA)
- TERLS: Thumba Equatorial Rocket Launching Station
DAE: Department of Atomic Energy (India)
ISRO: Indian Space Res. Organization (India)
NPL: National Physical Laboratory (India)
DMI: Danish Meteorological Inst. (Denmark)
DSRI: Danish Space Res. Inst. (Denmark)
NRC: National Research Council (Canada)

表R-4 観測項目略号一覧

Abbreviations for Space Observations

AEL	Atmospheric Electricity
AGL	Airglow [AGL (OH), AGL (O ₂), etc.]
AIR	Atmospheric Infrared Glow (Infrared Airglow) [AIR (OH), etc.]
AUV	Atmospheric Ultraviolet Glow (Ultraviolet Airglow)
ASL	Aerosol
BWI	Beam Wave Interaction
CBE	Controlled Beam Emission
CCR	Chemical Cloud Release [CCR (Ba), CCR (Na), CCR (Cs), etc.]
CDU	Cosmic Dust
CNI	Composition of Negative Ions
CNP	Composition of Neutral Particles
CPI	Composition of Positive Ions
DPL	Doppler Experiment
*CR	Cosmic Ray
EFD	Electric Field
ESE	Energy Spectrum of Electrons [ESE (L), ESE (M), ESE (H), etc.]
ESP	Energy Spectrum of Particles
GAL	Galactic Light
GIR	Galactic Infrared Radiation
GMV	Geocorona and Medium Ultraviolet Radiation
GUV	Galactic Ultraviolet Radiation
GXH	Galactic Hard X-Rays
GXR	Galactic X-Rays
GXS	Galactic Soft X-Rays
GXV	Galactic Very Soft X-Rays
*ID	Ionospheric Plasma Parameters
*IR	Infrared Radiation
MGC	Magnetic Field (Cesium Magnetometer)
MGF	Magnetic Field (Fluxgate Magnetometer)
MGW	Magnetic Waves
MIC	Motion of Ionized Cloud
NEL	Number Density of Electrons [NEL (L), NEL (C), NEL (I), NEL (D), etc.]
NNP	Number Density of Neutral Particles [NNP (O ₃), NNP (NO), etc.]
NPI	Number Density of Positive Ions
NPW	Nonlinear Plasma Waves
PEX	Precipitating Electrons and X-Rays

PRE	Precipitating Electrons
PRT	Plasma Wave Turbulence
PRW	Propagation of Radio Waves
*PW	Plasma Waves
PWA	Plasma Wave Acoustic
PWC	Plasma Wave Cyclotron
PWE	Plasma Wave Excitation
PWI	Plasma Wave Instability
PWN	Natural Plasma Waves
PWP	Plasma Wave Propagation
*RA	Radio Astronomy
RBP	Radiation-Belt Particles
RBS	Subradiation-Belt Particles
RNH	Radio Noise Hiss
RNW	Radio Noise Whistler
RNS	Radio Noise Spectrum
SPA	Space Plasma Accelerator
SUV	Solar Ultraviolet Radiation
SXR	Solar X-Rays
TED	Thermal Energy Distribution of Electrons
TEL	Temperature of Electrons
TMP	Temperature of Neutral Particles
TPI	Temperature of Positive Ions
*UV	Ultraviolet Radiation
XUV	Extreme Ultraviolet Radiation
ZIR	Infrared Zodiacal Light
ZOL	Zodiacal Light (visible)

*The items with asterisk are old abbreviations and no more used.