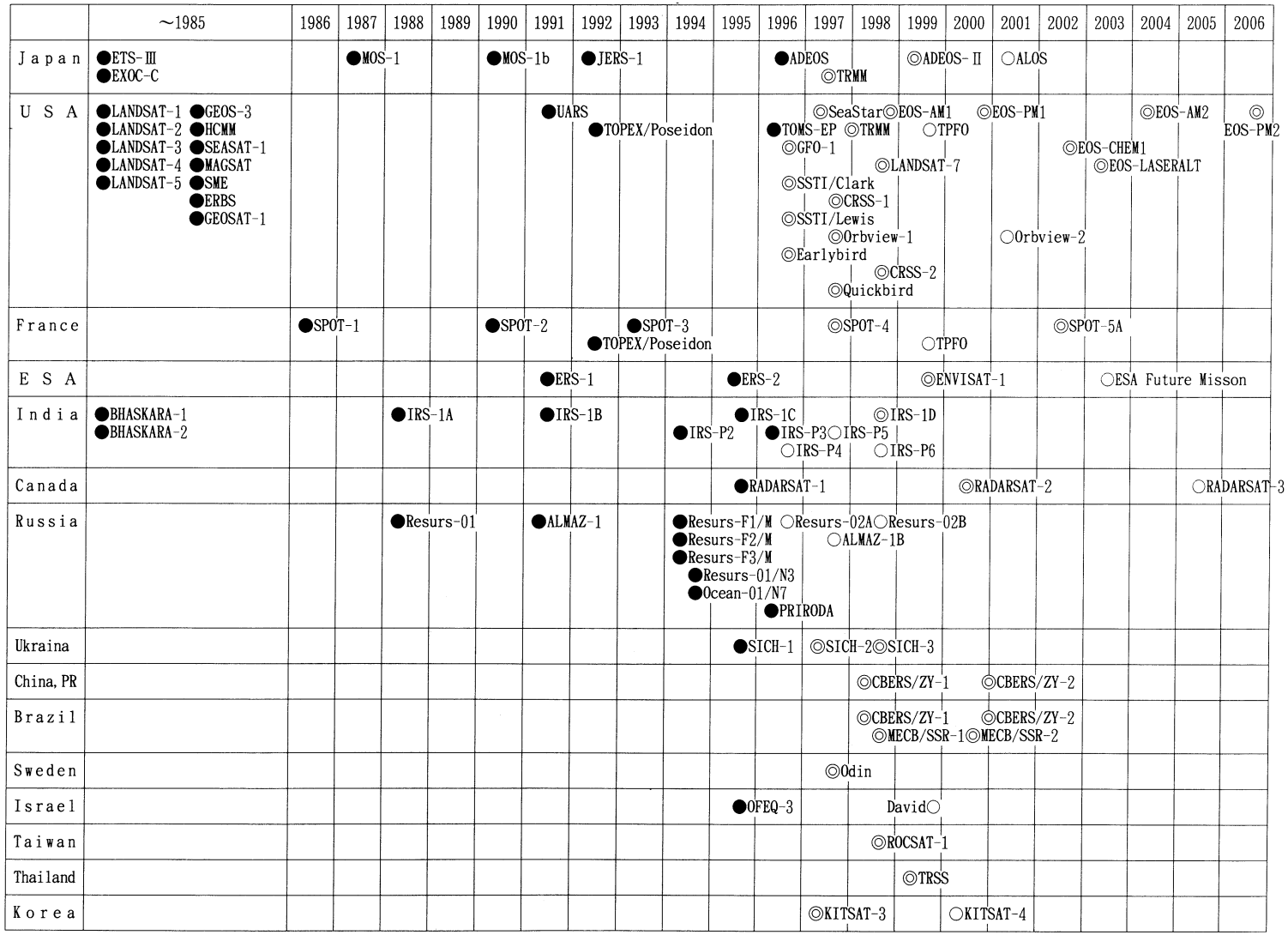
Appendix-1 Time table of earth observation satellites(except for meteorological satellites) (as of 1996)



Time table of meteorological satellites

(as of 1996)

	～1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
〔Geosynchronus Meteorological Satellite〕																						
Japan	●GMS、-2、3				●GMS-4						●GMS-5				◎MTSAT					○MTSAT-2		
U S A	●SMS-1、2 ●GOES-1～6		●GOES-7							●GOES-8	●GOES-9				◎GOES-K	◎GOES-L				◎GOES-M		
E S A	●METEOSAT-1、2			●METEOSAT-3	●METEOSAT-4		●METEOSAT-5		●METEOSAT-6				◎METEOSAT-7									
EUMETSAT																◎MSG-1		◎MSG-2				
India	●INSAT-1A、1B			●INSAT-1C		●INSAT-1C		●INSAT-2A	●INSAT-2B				○INSAT-2E									
Russia										●Electro-1		○Electro-2		○Electro-3								
China, PR													◎FY-2									
〔Polar Orbiting Meteorological Satellite〕																						
U S A	●TIROS-1~10 ●ESSA-1~9 ●ITOS-1 ●NOAA-1~5 ●TIROS-N ●NOAA-6~9 ●NIMBUS-1~7		●NOAA-10 ●DMSP/S8	●NOAA-11 ●DMSP/S9		●DMSP/S10	●NOAA-12 ●DMSP/S11		●NOAA-13	●NOAA-14 ●DMSP/S12	●DMSP/S13		◎NOAA-K ◎NOAA-L ◎DMSP/5D3-01(F15) (First one of 5 satellites series)		◎NOAA-M	◎NOAA-N		◎NOAA-N'	◎First Converged Spacecraft ○DMSP/6-01		
Russia	●METOR1/1~30 ●METEOR2/1~13 ●METEOR 3-1		●METEOR2-14 ●METEOR2-15 ●METEOR2-16	●METEOR2-17 ●METEOR2-18 ●METEOR2-19 ●METEOR3-2	●METEOR3-3	●METEOR2-20	●METEOR3-4	●METEOR3-5	●METEOR2-21	●METEOR3-6		○METEOR3-7		○METEOR3M-1 ○METEOR3M-2	○METEOR3M-3 ○METEOR3M-4							
China, PR				●FY-1A		●FY-1B								◎FY-1C		◎FY-1D						
EUMETSAT																	○METOP-1				○METOP-2	

●: launched ◎: developing ○: planning

Time table of earth observation by Space Shuttle

(as of 1996)

	～1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
U S A	●OSTA-1(STS-2) ●OSTA-3(STS-17)				●SSBUV-1(STS-34)					●SIR-C1(STS-59)											○SRTM	
						●SSBUV-2(STS-41)				●SIR-C2(STS-68)												
							●SSBUV-3(STS-43)															
								●ATLAS-1/SSBUV-4(STS-45)														
									●ATLAS-2/SSBUV-5(STS-56)													
										●SSBUV-6(STS-62)												
										●LITE(STS-64)												
										●ATLAS-3(STS-66)												
E S A	●MRSE(STS-9)							●ATLAS-1(STS-45)														
									●ATLAS-2(STS-56)													
										●ATLAS-3(STS-66)												
Germany	●MOMS01-1(STS-7) ●MOMS01-2(STS-11)								●MOMS02-1(STS-55)													
											●MOMS02-P(by Mir station)											
										●X-SAR1(STS-59)												
										●X-SAR2(STS-68)												
										●CRISTA			◎CRISTA									
Italy										●X-SAR1(STS-59)												
										●X-SAR2(STS-69)												

●: launched ◎: approved ○: planning

Appendix-2 List of Remote Sensing Satellites

Index

List of Remote Sensing Satellites (1)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
LANDSAT-1(1972) 〃 -2(1975) (USA)	sun sync. alt. : 915km inc. : 99° recurrent: 18days	MSS (Multispectral Scanner System)	0.5～0.6μm 0.6～0.7 0.7～0.8 0.9～1.1	80m	185km
		RBV (Return Beam Vidicon Camera)	0.475～0.575μm 0.580～0.680 0.690～0.830	80m	
LANDSAT-3(1978) (USA)	sun sync. alt. : 915km inc. : 99° recurrent: 18days	MSS (Multispectral Scanner System)	0.5～0.6μm 0.6～0.7 0.7～0.8 0.9～1.1 10.4～12.6	80m 240m	185km
		RBV	0.505～0.750μm	38m	98km×2
LANDSAT-4(1982) 〃 -5(1984) (USA)	sun sync. alt. : 705km inc. : 98° recurrent: 17days	TM (Thematic Mapper)	0.45～0.52μm 0.52～0.60 0.63～0.69 0.75～0.90 1.55～1.75 2.08～2.35 10.40～12.50	30m 120m	185km
		MSS (Multispectral Scanner System)	0.5～0.6μm 0.6～0.7 0.7～0.8 0.9～1.1	80m	
LANDSAT-7(1998) (USA)	sun sync. alt. : 705km inc. : 98.2° recurrent: 16days	ETM+ (Enhanced Thematic Mapper) Plus	0.50～0.90μm 0.45～0.52μm 0.52～0.60 0.63～0.69 0.76～0.90 1.55～1.75 2.08～2.35 10.40～12.50	15m 30m 60m	185km

List of Remote Sensing Satellites (2)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
SPOT-1(1986) 〃 -2(1990) 〃 -3(1993) (France)	sun sync. alt. : 832km inc. : 99° recurrent: 26days	HRV (High Resolution Visible)	0.50～0.59 μm 0.61～0.68 0.79～0.89 0.51～0.73	20m 10m	1) 60km×2
SPOT-4(1997) 〃 -5A(2002) 〃 -5B(2007) (France)	sun sync. alt. : 822km inc. : 99° recurrent: 26days	HRVIR (High Resolution Visible and Middle Infrared)	0.50～0.59 μm 0.61～0.68 0.79～0.89 1.55～1.75 0.61～0.68	20m 10m	2) 60km×2
		VEGETATION	0.43～0.47 μm 0.50～0.59 0.61～0.69 0.78～0.89 1.58～1.75	1.15km	2200km
ERS-1(1991) 〃 -2(1995) (ESA)	sun sync. alt. : 785km inc. : 99° recurrent: 3days 35days 176days	AMI(Active Microwave Instrumentations) SAR mode	5.3 GHz	30m (3 look)	100km
		wave mode		5km x 5km	—
		wind mode		50km	500km
		RA(Radar Altimeter)	13.8 GHz	beam width :1.3°	—
		ATSR/M (Along Track Scanning Radiometer/Microwave Sounder) Infrared Radiometer	1.58-1.64 μm 3.55-3.93 10.4-11.3 11.5-12.5	1km	500km
		Microwave sounder	23.8 GHz 36.5 GHz	22km	—
		GOME[3] (Global Ozone Monitoring Experiment)	0.240～0.268 μm (0.22nm)[4] 0.268～0.295 (0.22nm) 0.290～0.312 (0.24nm) 0.310～0.405 (0.24nm) 0.400～0.605 (0.4nm) 0.590～0.790 (0.4nm)	40km ×320km	960km

1) off-nadir view angle : ±27° by 0.6° pitch
2) 4km pixel is assembled 4 pixels of 1km data
3) installed at ERS-2
4) spectral resolution

List of Remote Sensing Satellites (3)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
MOS-1 (1987) 〃 -1b(1990) (Japan)	sun sync. alt. : 909km inc. : 99° recurrent: 17days	MESSR (Multispectral Electronic Self Scanning Radiometer)	0.51～0.59 μm 0.61～0.69 0.72～0.80 0.80～1.10	50m	100kmx2
		VTIR (Visible and Thernal Infrared Radiometer)	0.5～0.7 μm 6 ～ 7 10.5～11.5 11.5～12.5	0.9km 2.7km	1,500km
		MSR (Microwave Scanning Radiometer)	23.8 GHz 31.4 GHz	31km 23km	317km
JERS-1(1992) (Japan)	sun sync. alt. : 568km inc. : 98° recurrent: 44days	OPS(Optical Sensor) VNIR (Visible and Near Infrared Radiometer)	0.52～0.60 μm 0.63～0.69 0.76～0.86	18mx24m	75km
		SWIR (Short Wavelength Infrared Radiometer)	1.60～1.71 μm 2.01～2.12 2.13～2.25 2.27～2.40		
		SAR (Synthetic Aperture Radar)	1.275GHz, HHpolarization	18mx18m (3 look)	
IRS-1A(1988) 〃 -1B(1991) (India)	sun sync. alt. : 904km inc. : 99° recurrent: 22days	LISS－I (Linear Imaging Scanner System)	0.45～0.52 μm 0.52～0.60 0.63～0.69 0.76～0.90	73m	146km
		LISS－II	0.45～0.52 μm 0.52～0.60 0.63～0.69 0.76～0.90	36.5m	73kmx2
IRS-P2(1944) (India)	sun sync. alt. : 817km inc. : 98.7° recurrent: 24days	LISS－II (Linear Imaging Scanner System II)	0.45～0.52 μm 0.52～0.60 0.63～0.69 0.76～0.90	32mx37m	131km

List of Remote Sensing Satellites (4)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
IRS-1C(1995) 〃 -1D(1998) (India)	sun sync. alt. : 817km inc. : 98.7° recurrent: 24days	LISS－Ⅲ (Linear Imaging Scanner System Ⅲ)	0.52～0.59μm 0.62～0.68 0.77～0.86 1.55～1.75	23.4m 73m	141km
		PAN (Panchromatic Camera)	0.50～0.70μm	＜10m	70.5km
		WiFS (Wide Field Sensor)	0.62～0.68μm 0.77～0.89	188m	774km
IRS-P3(1996) (India)	sun sync. alt. : 817km inc. : 98.7°	WiFS (Wide Field Sensor)	0.62～0.68μm 0.77～0.89 1.55～1.64	188m 188mx246m	770km 804km
		MOS－A (Modular Optoelectronic Scanner A)	0.755～0.768μm 4 bands	1569m x 1395m	195km
		MOS－B	0.408～1.01μm 13bands (band width 10nm)	523mx523m	200km
		MOS－C	1.50～1.70μm 1 band	523mx644m	192km
ZY-1/CBERS (1998) ZY-2/CBERS (2000) (China, PR/Brazil)	sun sync. alt. : 778km inc. : 98.5° recurrent: 26days	CCD Camera	0.52～0.59μm 0.63～0.69 0.79～0.89 0.5 ～0.73	19.5m (at nadir)	113km
		IR－MSS (Infrared Multispectral Scanner)	0.50～1.10μm 1.55～1.75 2.35～2.88 10.4～12.5	77.8m 156m	119.5km
		WFI (Wide Field Imager)	0.63～0.69μm 0.77～0.89	256m	885km
KITSAT-3(1997) (korea)	sun sync. alt. : 800km inc. recurrent: 16days	Remote Sensing Payload	Visible and near infrared 3 bands	15m	70km
TRSS(1999) (Thailand)	non sun-sync. alt. : 600km inc. : 28° recurrent: 5days	VIS／NIR Pushbroom Camera	0.45～0.52μm 0.52～0.60 0.63～0.69 0.76～0.90	30m	185km (range of off-nadir view: ±275km)

List of Remote Sensing Satellites (5)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
RESURS-01 〃 (1988) (Russia)	sun sync. alt. : 650km inc. : 98° recurrent: 21days	MSU-E1	0.5～0.6μm 0.6～0.7 0.8～0.9	45m	2x45km (off-nadir view: ±350km)
		MSU-SK	0.5～0.6μm 0.6～0.7 0.7～0.8 0.8～1.1 10.4～12.6	170m x 240m 600m	600km
RESURS-02 -A (1996) -B (1998) (Russia)	sun sync. alt. : 690km inc. : 98.5° recurrent:	MSU-E1	0.5～0.6μm 0.6～0.7 0.8～0.9	45m	2x45km (off-nadir view: ±350km)
		MSU-SK	0.5～0.6μm 0.6～0.7 0.7～0.8 0.8～1.1 10.4～12.6	170m x 240m 600m	600km
		MINZA[1]	UHF	40km	2,000km
		Ultra-violet Multichannel Scanner	0.28～0.38μm (2 bands)	240m	250km
		KOVRET (Sidelooking Radar)	8.5 GHz	200～300m	2x450km
		ABRIS (Radar)		2～5m (fine mode) 20～100m (normal mode)	2x450km
SSTI/Lewis(1996) (USA)	sun sync. alt. : 523km inc. : 97.4°	HSI (Hyper Spectral Imager)	0.4～2.5μm (385bands band width 10nm) panchro.	30m 5m	
		LEISA (Linear Etalon Imaging Spectral Array)		300m	

1) UHF radiometer for integral atmosheric humidity sounding

List of Remote Sensing Satellites (6)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
SSTI/Clark (1996) (USA)	sun sync. alt. : 476km inc. : 97.3° recurrent: 20days		0.45～0.80 μm 0.50～0.59 0.61～0.68 0.79～0.89	3m 15m	6km 30km pointing ±30° (along-and cross-track)
		Atmosheric Tomography			
		Corner refrector	4.7 μm		
Earlybird(1996) (USA Commercial)	sun sync. alt. : 476km inc. : recurrent: 20days		0.45～0.80 μm 0.50～0.59 0.61～0.68 0.79～0.89	3m 15m	6km 30km pointing ±30° (along-and cross-track)
Quickbird(1997) (USA Commercial)	sun sync. alt. : 470km inc. : recurrent: 20days			1m～1.7m	37km～61km pointing ±30° (along-and cross-track)
CRSS-1(1997) -2(1998) (USA Commercial)	sun sync. alt. : 680km inc. : 98.1° recurrent: 11days		0.45～0.9 μm 0.45～0.52 0.52～0.60 0.63～0.69 0.76～0.90	1m 4m	11km (max110km)[1] pointing ±45° (along-and cross-track)
Orbview-1(1997) (USA Commercial)	sun sync. alt. : 700km inc. : recurrent: 16days		0.5～0.9 μm (panchro.) multi-spectral	1m 8m	8km pointing ±45° (cross-track)

1) in case of limited scene length

List of Remote Sensing Satellites (7)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
SEASAT-1(1978) (USA)	non sun-sync. alt. : 790km inc. : 108° recurrent: 105～165days	SMMR (Scanning Multichannel Microwave Radiometer)	6.6 GHz 10.69 18.0 21.0 27.0	121x79km² 74x49 44x29 39x25 21x14	660km
		ALT(Altimeter)	13.5 GHz	1.6～12km	2.4～12km
		SASS (SEASAT-A Scatterometer System)	14.595 GHz	50x50km²	1,500km
		SAR(Synthetic Aperture Radar)	1.2748 GHz	25x25m² (4 look)	100km
		VIRR (Visible and Infrared Radiometer)	0.5～0.7 μm 10.5～12.5 μm	2km 4km	2,280km
GEOSAT-1(1986) (USA)	non sun-sync. alt. : 800km inc. : 108° recurrent: 17days	GEOSAT Radar Altimeter	13.5 GHz	beam width 2.0°	—
TOPEX/Poseidon (1993) (USA/France)	non sun-sync. alt. : 1334km inc. : 63.13° recurrent: 10days	TOPEX Radar Altimeter	13.6 GHz 5.3	spot dia 2-12km	—
		Poseidon Radar Altimeter	13.65GHz	spot dia 2-10km	—
		Microwave Radiometer	18.0 GHz 21.0 37.0	spot dia 42km 35 22	—
GFO-1(1987) (USA)	non sun-sync. alt. : 800km inc. : 108° recurrent:	Radar Altimeter	13.5 GHz	beam width 2.0°	—
		Microwave Radiometer			—
ALMAZ-1 (1991) (Russia)	non sun-sync. alt. : 300km inc. : 72.7°	SAR (Synthetic Aperture Radar)	9.6cm HH polarization off-nadir angle 32° ～50° (normal mode) 20° ～32° (experimental)	11～18m	40km

List of Remote Sensing Satellites (8)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
ALMAZ-1B(1997) (Russia)	non sun-sync. alt. : 600km inc. : 73°	SAR-10 (Synthetic Aperture Radar 10)	3.125GHz VV, V/HV, H/HV, HH polarization off-nadir angle: 25～51°	VVpolarization 15～40m V/HV, H/HV polarization 15m HHpolarization 5～7m	100~150km 60~100km 25～50km
		SAR－70 (Synthetic Aperture Radar 70)	0.429GHz H/HV, V/HV polarization off-nadir angle: 25～46°	15 ～60m	100~150km
		4-Channel Optical Stereo Imager	0.5～0.8μm	2.5～4m	70km
		MSU－E (2sets)	0.5～0.6μm 0.6～0.7 0.8～0.9	10m	24kmx2
		MSU－SK	0.53 ～0.59μm 0.61 ～0.69 0.7 ～0.8 0.9 ～1.0 10.4 ～12.6	80m 100m 300m	300km
		Sea Surface Rediometer	0.4～11μm (11bands)	300m (at nadir)	300km
		Balcan 2 Lidar	5320Å	beam width :40″ vertical : 3～10m	FOV: ≠10°
RADARSAT-1(1995) 〃 -2(2000) (Canada)	sun sync. alt. : 約793km ～821km inc. : 約99° recurrent: 24days	SAR(Synthetic Aperture Radar) Standard Mode incidence angle:20-49°	5.3 GHz HHpolarization	25mx28m (4 looks)	100km
		Wide(1)Mode incidence angle:20-31°		0-48mx28m (4 looks)	165km
		Wide(2)Mode incidence angle:31-39°		25-32mx28m (4 looks)	150km
		Fine Resolution Mode incidence angle:37-48°		9-11mx9m (1 looks)	45km
		ScanSAR(N)Mode incidence angle:20-40°		50mx50m (2-4looks)	305km
		ScanSAR(W)Mode incidence angle:20-49°		100mx100m (4-8looks)	510km
		Extended(H)Mode incidence angle:50-60°		19-22mx28m (4 looks)	75km
		Extended(H)Mode incidence angle:10-23°		28-63mx28m (4 looks)	170km

List of Remote Sensing Satellites (9)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
NIMBUS-7(1978) (U S A)	sun sync. alt. : 955km inc. : 99.3° recurrent:	C Z C S (Coastal Zone Color Scanner)	0.433～0.453 μm 0.510～0.530 0.540～0.560 0.660～0.680 0.700～0.800 10.5～12.5	0.865mrad (0.825km at nadir)	1566km
		E R B (Earth Radiation Budget)	Solar radiation 0.2～3.8 μm (2 bands) <0.2～>50 0.526～2.8 0.698～2.8 0.395～0.508 0.344～0.46 0.3～0.41 0.275～0.36 <0.25～>50	0.46rad (solar disk)	—
			earth radiation <0.2～>50 μm (2 bands) 0.2～3.8 0.695～2.8	2.32rad	—
			Solar radiation 0.2～4.8 μm (4 bands) 4.5～50 (4 bands)	4.4mrad x 89.4mrad (4.2km～ X 85km at nadir)	horizon 〉 horizon
		L I M S (Limb Infrared Monitoring of the Stratosphere)	6.08～6.39 μm 6.41～7.25	vertical 3.6km horizontal 2.8km	altitude 15～60km
			8.64～10.64 μm 10.87～11.76 13.16～17.24 14.71～15.75	vertical 1.8km horizontal 18km	
		S A M－Ⅱ(Stratospheric Aerosol Measurement Radiometer)	0.97～1.03 μm	vertical 0.145mrad	—
		S A M S (Stratospheric Aerosol Measurement Sounder)	14.4～15.7 μm 4.1～ 5.4 (3 bands) 2.5～ 2.6 25～100 14.5～15.7 7.6～ 7.8 (2 bands)	vertical 10km horizontal 100km	altitude 10～90km

List of Remote Sensing Satellites (10)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
NIMBUS-7(1978) (USA) (cont.)		SBUV/TOMS (Solar Backscatter Ultra-Violet and Total Ozone Mapping Spectometer)	SBUV 0.255 ~0.256 μm 0.273 ~0.274 0.2825~0.2835 0.2871~0.2881 0.2922~0.2932 0.297 ~0.298 0.3014~0.3024 0.3053~0.3063	191km	188km
			TOMS 0.3112~0.313 μm 0.317 ~0.318 0.3307~0.3317 0.3383~0.3413	523mrad (50km at nadir)	3000km
		SMMR (Scanning Multichannel Microwave Radiometer)	6.33 GHz 10.69 18.00 21.00 37.00	96kmx153km 59 x 91 41 x 55 30 x 46 18 x 27	
		THIR (Temperature Humidity Infrared Radiometer)	6.5~ 7 μm	21mrad (20km at nadir)	horizon ⟆ horizon
			10.5~12.5 μm	7mrad (6.7km at nadir)	
SeaStar(1997) (USA)	sun sync. alt. : 705km inc. : 98.2° recurrent:1day	SeaWiFS (Sea-viewing Wide Field Sensor)	0.402~0.422 μm 0.433~0.453 0.480~0.500 0.510~0.530 0.555~0.575 0.655~0.675 0.745~0.785 0.845~0.855	LAC data: 1.13km GAC data: 4.5km	2800km
ROCSAT-1(1998) (Taiwan)	non sun-sync. alt. : 600km inc. : 35° recurrent:	OCI (Oean Color Imager)	0.433~0.453 μm 0.480~0.500 0.500~0.520 0.545~0.565 (2 bands) 0.660~0.680 0.765~0.865	800m	690km

List of Remote Sensing Satellites (11)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
TIROS-N/NOAAseries TIROS-N(1978) NOAA-6 (1979) 〃 -7 (1981) 〃 -8 (1983) 〃 -9 (1984) 〃 -10(1986) 〃 -11(1988) 〃 -12(1991) 〃 -13(1993) 〃 -14(1994) (USA)	sun sync. alt. : 833km or 870km inc. : 99°	AVHRR (Advanced Very High Resolution Radiometer) or AVHRR/2	0.58 ～0.68μm[1)] 0.725～1.10[2)] 3.55 ～3.93 10.30 ～11.30 11.50 ～12.50[3)]	1.1km	2,700km
		TOVS－SSU (TIROS Operational Vertical Sounder Stratospheric Sounding Unit)	15μm 15 15	147km	736km
		TOVS－HIRS/2 (High Resolution Infrared Radiation Sounder, Model 2)	14.96, 4.71μm 14.49, 14.22 13.97, 13.64 13.35, 11.11 9.71, 8.16 7.33, 6.72 4.57, 4.52 4.46, 4.40 4.24, 4.00 3.76, 0.69	20km	2,200km
		TOVS－MSU (Microwave Sounding Unit)	50.31 GHz 53.73 54.96 57.95	110km	2,347km
		SBUV/2[4)] (Solar Backscatter Ultra-Violet Experiment)	0.2520 ～0.3398μm 12bands	169.3km	－
		ERBE[5)] (Earth Radiation Budget Experiment)	0.2～50.0μm 8bands	67.5km	－

1)0.58～0.90μm, installed at TIROS-N
2)addition to AVHRR/2
3)10.5～11.5μm as of NOAA-8
4)installed at NOAA-9, 12
5)installed at NOAA-9, 10

List of Remote Sensing Satellites (12)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
NOAA-Next series NOAA-K(1996) -L(1997) -M(1999) -N(2000) -N'(2003) (USA)	sun sync. alt. : 833km or 870km inc. : 99°	AVHRR／3 (AVHRR Model 3)	0.58～0.68 μm	0.5km	2,700km
			0.82 ～ 0.87 μm 1.57 ～ 1.78[1)] 3.55 ～ 3.93[1)] 10.30 ～11.30 11.50 ～12.40	1.0km	
		TOVS－ HIRS／2	14.96, 4.71 μm 14.49, 14.22 13.97, 13.64 13.35, 11.11 9.71, 8.16 7.33, 6.72 4.57, 4.52 4.46, 4.40 4.24, 4.00 3.76, 0.69	20km	2,200km
		AMSU－A (Advanced Microwave Sounding Unit-A)	23.0 ～90.0 GHz 15bands	40km	2,240km
		AMSU－B	90.0 ～183.0 GHz 5bands	15km	
		SBUV／2 (Solar Backscatter Ultra-Violet Experiment)	0.2520 ～0.3398 μm 12bands	169.3km	－
DMSP Block 5D2 series -S8 (1987) -S9 (1988) -S10(1990) -S11(1991) -S12(1994) -S13(1995) (USA)	sun sync. alt. : 833km inc. : 98.8° recurrent: 16days	SSM／I (Special Sensor Microwave Imager)	19.35 GHz 22.23 37.0 85.5	70kmx45km 60 x40 38 x30 16 x14	1,400km
		OLS (Operational Linescan System)	0.40～1.10 μm 0.47～0.95 10.0～13.4	0.55km 2.7 km 0.55km	3,000km

1) channel 1.57～1.78 μm and channel 3.55～3.93 μm divided by observation time

List of Remote Sensing Satellites (13)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
UARS(1991) (USA)	non sun-sync. alt. : 600km inc. : 57° recurrent: 33days	SOLSTICE (Solar Steller Irradiance Comparison Experiment)	1200～4400Å 3 bands band width : 0.12～0.25Å (sun) 5～10Å (star)	full solar disk	full solar disk
		SUSIM (Solar Ultraviolet Spectral Irradiance Monitor)	1200～4400Å band width : 1.5Å, 5Å	full solar disk	full solar disk
		ACRIM (Active Cavity Radiometer Irradiance Monitor)	0.001 ～1000μm 3 bands	full solar disk	full solar disk
		CLAES (Cryogenic Limb Array Etalon Spectrometer)	3.5 ～12μm 3 bands	horizontal : 500km vertical : 2.8km	altitude : 10～80 km
		ISAMS (Improved Stratospheric and Mesospheric Sounder)	4～15μm 11bands	horizontal : 400km vertical : 4 km	altitude : 15～80 km
		MLS (Microwave Limb Sounder)	63, 183, 205GHz band width : 50MHz	vertical : 3～6 km	altitude : 15～50 km
		HALOE (Halogen Occultation Experiment)	2～10μm 8 bands	vertical : 2 km	altitude : 10～65 km
		HARDI (High Resolution Doppler Imager)	3000～8000Å band width : 8 Å	vertical : < 5 km	altitude : 10～ 110km
		WINDII (Wind Imaging Interferometer)	5000～7000Å band width : 10Å	horizontal : 20km vertical : 3 km	altitude : 70～ 300km
TOMS-EP(1996) (USA)	sun sync. alt. : 500km inc. : 97.4°	TOMS (Total Ozone Mapping Spectrometer)	μm 304.0, 312.5 317.5, 325.0 332.6, 360.0	50km	2,800km

List of Remote Sensing Satellites (14)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
ADEOS(1996) (Japan)	sun sync. alt. : 797km inc. : 98.6° recurrent: 41days	OCTS (Ocean Color and Temperature Scanner)	0.402～0.422 μm 0.433～0.453 0.480～0.500 0.510～0.530 0.555～0.575 0.655～0.675 0.745～0.785 0.845～0.885 3.55 ～3.85 8.25 ～8.75 10.5 ～11.5 11.5 ～12.5	LAC data 700m GAC data 6km (4bands)	1,400km
		AVNIR (Advanced Visible and Near Infrared Radiometer)	0.40～0.50 μm 0.52～0.62 0.62～0.72 0.82～0.92 0.52～0.72 μm	16m 8m	80km[1]
		NSCAT (NASA Scatterometer)	13.995 GHz	25km	600km x2
		TOMS (Total Ozone Mapping Spectrometer)	304.0, 312.5 μm 317.5, 325.0 332.6, 360.0	42km	2,795km
		IMG (Interferometric Monitor for Greenhouse Gases)	3.3～4.3 μm 4.0～5.0 5.0～14 ($0.1cm^{-1}$)[3]	8km	–
		POLDER (Polarization and Directionality of the Earth's Reflectance)	0.433～0.453 μm[2] 0.480～0.500 0.510～0.530 0.555～0.575 0.660～0.680[2] 0.760～0.770 0.860～0.900[2] 0.945～0.955	5km	1,440kmx 1,920km
		ILAS (Improved Limb Atmospheric Sounder)	0.753～0.784 μm (0.1nm)[3] 6.21 ～11.77 μm (0.129 μm)[3]	2km(hor.) 2km(ver.) 13km(hor.) 2km(ver.)	altitude : 10～60 km
		RIS (Retroreflector In Space)	0.400 μm～IR	–	–

1) pointing angle : ±40° , 2) polarization measurement , 3) spectral resolution

List of Remote Sensing Satellites (15)

Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
ADEOS-Ⅱ(1999) (Japan)	sun sync. alt.:803km inc. : 98.6° recurrent: 4days	AMSR (Advanced Microwave Scanning Radiometer)	6.9 GHz 10.7 18.7 23.8 36.5 50.3 52.8 89.0	50km 25km 15km 10km 7km	1,600km
		GLI (Global Imager)	0.375～0.865 μm (19bands band width 10nm) 0.425～0.495 0.520～0.570 0.640～0.700 0.770～0.880 1.40 ～1.07 1.09 ～1.11 1.23 ～1.25 1.36 ～1.40 1.54 ～1.74 2.10 ～2.32 3.55 ～3.88 6.45 ～6.95 6.75 ～7.25 7.05 ～7.65 8.05 ～8.55 10.3 ～11.3 11.5 ～12.5	1km 250m 1km 250m 1km	1,600km
		SeaWindS (Sea Winds Scatterometer)	13.4 GHz	50km	1,800km
		POLDER (similar to ADEOS/POLDER)	0.443～0.910 μm (8bands)[2]	[1] 7km x 6km	1,700km
		ILAS-Ⅱ	3.0 ～ 5.7 μm 6.2 ～11.76 12.80～12.83 0.753～0.784	[1] 1kmx13km [1] 1kmx20km [1] 1kmx 1km	Altitude : cloud top～ 200km

1) (vertical)×(horizontal)
2) include 3 bands for polarization measurement

List of Remote Sensing Satellites (16)

Satellite	Orbit	observation sensor				
		sensor name	wave length / frequency	No.of band	IFOV	swath width
TRMM (1997) (Japan／USA)	non sun-sync. alt. : 350km inc. : 35°	PR (Precipitation Radar)	13.8 GHz		4.3km vertical :250m	220km
		VIRS (Visible Infrared Scanner)	0.58～0.68 μm 1.57～1.73 3.56～3.94 10.30～11.30 11.50～12.50		2km	720km
		TMI (TRMM Microwave Imager)	10.65 GHz 19.35 21.3 37.0 85.5		km km 63.2x 38.5 30.4x 18.4 27.2x 16.5 16 x 9.7 7.2x 4.4	630km
		CERES (Cloud and Earth's Radiation Energy system)	0.3～3.5 μm 8～12 0.3～50		25km	earth disk
		LIS (Lightning Imaging Sensor)	0.7774 μm		5km	550km
EOS-AM1 (1998) 〃 -AM2 (2004) (USA)	sun sync. alt. : 705km equator crossing 10:30AM (descending)	MODIS (Moderate Resolution Imaging Spectrometer)	0.659～0.865 μm 0.470～2.13 0.415～0.865 0.905～0.940 3.75 ～14.24	2 4 9 3 17	250m 500m 1000m 1000m 1000m	2,330km
		ASTER (Advanced Spaceborne Thermal Emission and Reflectance Radiometer)	0.52～0.86 μm 1.60～2.43 8.3 ～11.3	3 6 5	15m 30m 90m	60km
		MISR (Multi-angle Imaging Spectro Radiometer)	0.400～0.880 μm	4	240m 1.92km	408km
		CERES	2.5～3.5 μm 6～25 0.2～100	1 1 1	25km	±82°
		MOPITT (Measurements of Pollution in the Troposphere)	4.7 μm 2.4 2.3	1 1 1	22km 66km 120km	—

List of Remote Sensing Satellites (17)

Satellite	Orbit	observation sensor				
		sensor name	wave length / frequency	No.of band	IFOV	swath width
EOS-PM1 (2000) 〃 -PM2 (2006) (USA)	sun sync. alt. : 705km equator crossing 1:30PM (ascending)	MODIS	0.659～0.865 μm 0.470～2.13 0.415～0.865 0.905～0.940 3.75 ～14.24	2 4 9 3 17	250m 500m 1000m 1000m 1000m	2,330km
		CERES	2.5～3.5 μm 6～25 0.2～100	1 1 1	25km	±82°
		AIRS (Atmospheric Infrared Sounder)	Visible 3.3～15.4 μm	6 4000	12km	±49°
		AMSU	23.8～89.0 GHz	15	40km	±49.5
		MHS (Microwave Humidity Sounder)	89.0～183.3 GHz	5	13km	±49.5
EOS-CHEM1 (2002) (USA)	sun sync. inc. : 98.2°	HIRDLS (High Resolution Dynamic Limb Sounder)	6 ～18 μm (21channels)		400km vertical : 1 km	–
		TES (Tropospheric Emisson Spectrometer)	600～4,350cm^{-1} (2.3～16.7 μm) spectral resolution: 0.025cm^{-1}		5kmx 50km (global) 5kmx0.5km (local)	50km x 180km (global) 5kmx18km (local)
		MLS (Microwave Limb Sounder)	215 GHz 310 640 1.25 THz 2.5		(vertical) 4.0km ～ 1.5km (horizontal) 10km	–
EOS-LASERALT (2003) (USA)	sun sync.	GLRS (Geoscience Laser Ranging System)	0.355 μm 0.532 1.064		spot dia. 70m (at 1.064 μm)	– pointing angle ±50° (along- and cross-track)

List of Remote Sensing Satellites (18)

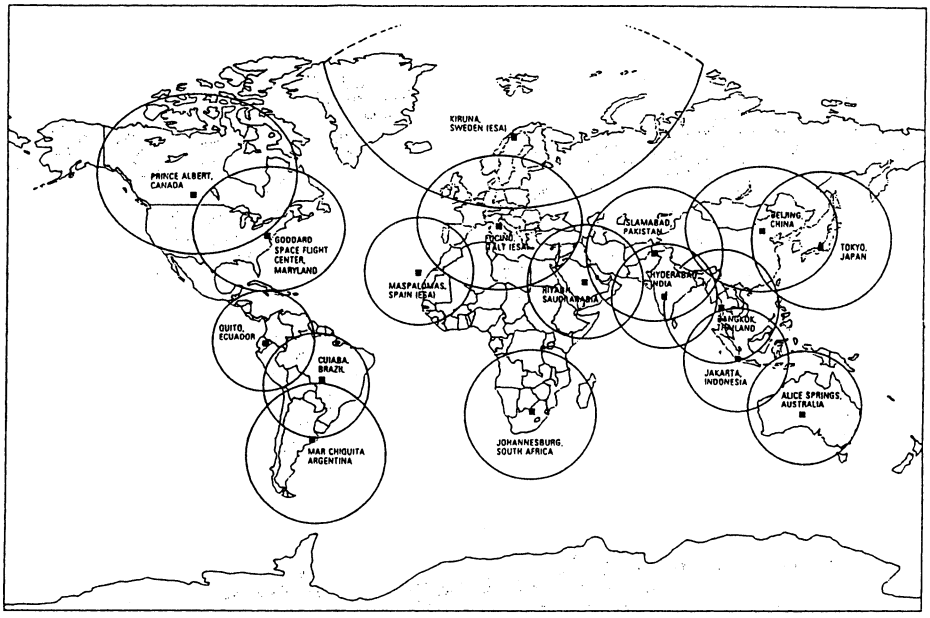
Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
ENVISAT-1(1998) (ESA)	sun sync. alt. : 約800km recurrent: 35days	ASAR (Advanced Synthetic Aperture Radar)	5.3 GHz (C-band) image mode VV or HH pol. incident angle 15° ～45° (variable) polarization mode VV および HH pol. incident angle 15° ～45° (variable) wide swath mode VV or HH pol. incident angle 17° ～43° global monitoring mode VV or HH pol. incident angle 17° ～43° wave mode VV or HH pol. incident angle 15° ～45° (variable)	約30m 約30m 約100m 約1000m 約30m 5km (every 100km or 200km)	1,400km 56～120 km 56～120 km 406km 406km –
		MERIS (Medium Resolution Imaging Spectrometer)	0.40～1.05 μm (spectral resolution 2.5nm) 15band selectable	300m	1,450km
		MIPAS (Michelson Interferometric Passive Atmospheric Sounder)	685～2410cm^{-1} (14.6～4.15 μm) (spectral resolution 0.035cm^{-1})	3km(ver.) ×30km (hor.)	altitude 5～150km
		RA－2 (Radar Altimeter)	13.5 GHz 3.2		–
		MWR (Microwave Radiometer)	23.8 GHz 36.5	20km	–
		AATSR (Advanced Along-Track Scanning Radiometer)	3.7 μm 1.61 10.85 12.00 0.555 0.659 0.865	1km	500km

List of Remote Sensing Satellites (19)

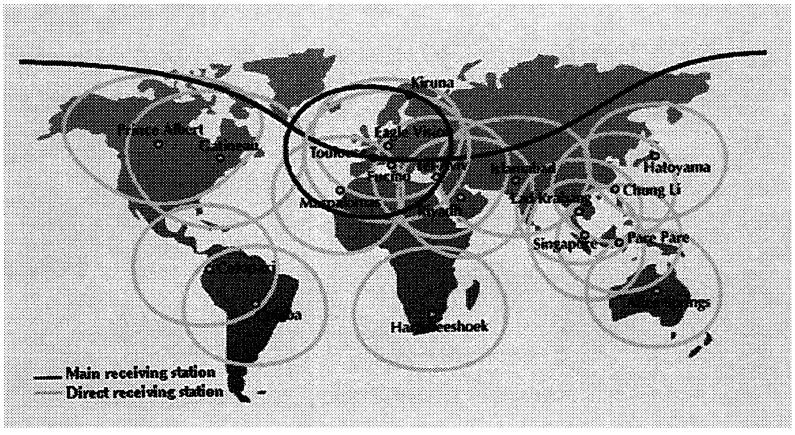
Satellite	Orbit	observation sensor			
		sensor name	wave length / frequency	IFOV	swath width
ENVISAT-1(1998) (ESA) (cont.)		ScaRaB (Scanner for Radiation Budget)	0.5～0.7μm 0.2～4 0.2～50 10.5～12.5	40km	2200km
		GOMOS (Global Ozone Monitoring System)	250～675nm (0.9nm)[1)] 756～773 (0.12nm) 926～952 (0.16nm) 650～700 470～520	vertical 2km	altitude 20～90km
		SCIAMACY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography)	0.240～2.38μm spectral resolution UV : <0.25nm visible & IR : 0.22～1.48nm	0.25km (nadir mode) vertical 1km (limb sounding mode)	1000km (nadir mode)
		LRR (Laser Retro-Reflector)			
		DORIS (Doppler Orbitography and Radio-positioning Integrated by Satellite)	VHF S band	accuracy of satellite position 10cm	

1) spectral resolution

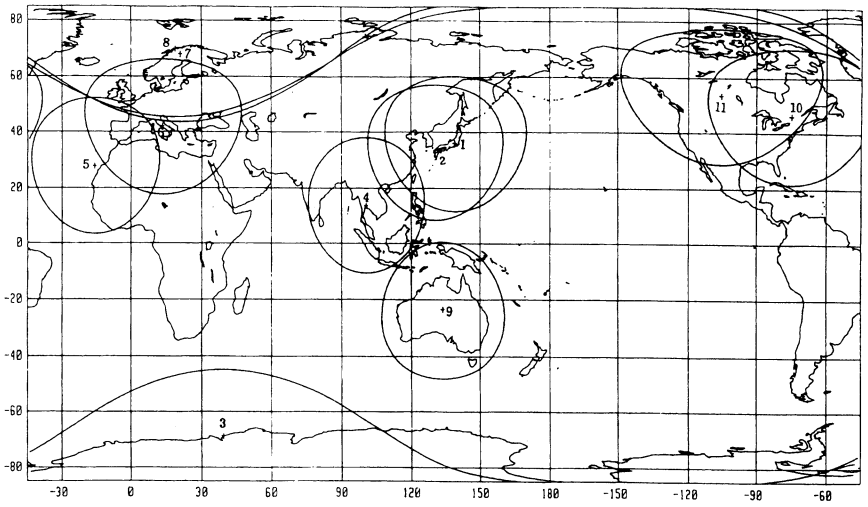
Appendix-3 Ground receiving stations & coverages of earth ofservation satellite



Ground stations & coverages of LANDSAT-4 and 5

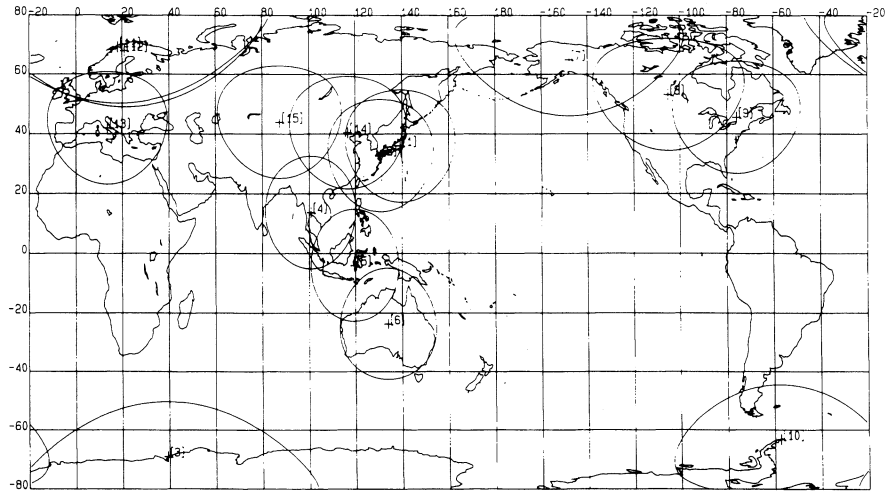


Ground stations & coverages of SPOT



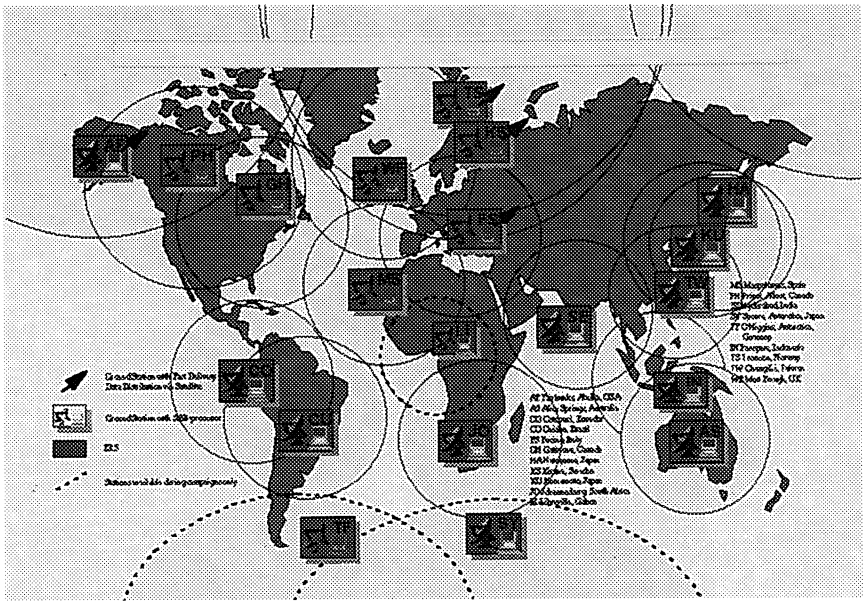
1) Hatoyama (Japan)
2) Kumamoto (Japan)
3) Showa Station (Japan/Antarctica)
4) Bangkok (Thailand)
5) Fucino (Italy)
6) Maspalomas (Spain/Canary Is.)
7) Kiruna (Sweden)
8) Tromso (Norway)
9) Alice Springs (Austraria)
10) Gateneau (Canada)
11) Prince Albert (Canada)

Ground stations & coverages of MOS-1 and MOS-1b

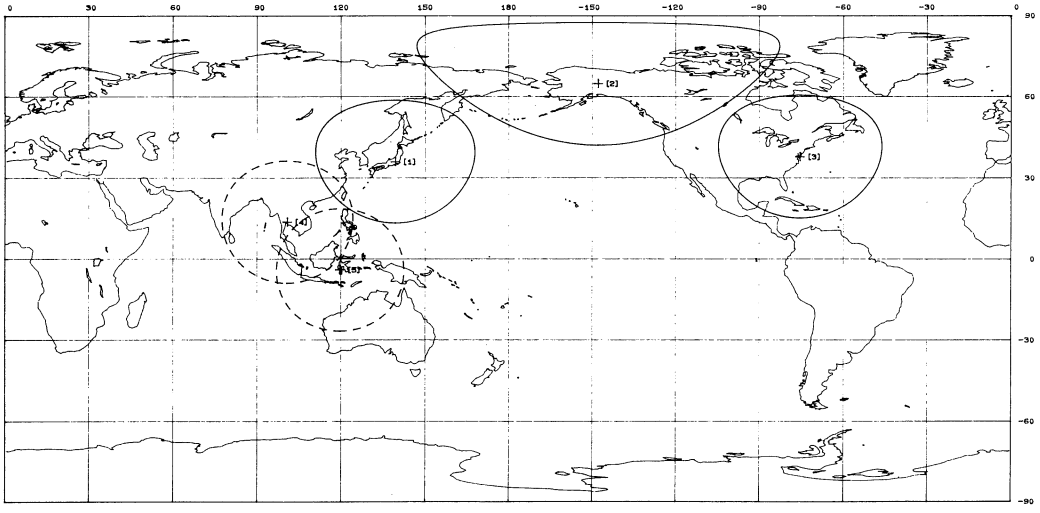


Ground stations & coverages of JERS-1

ASA: Alice Springs, Australia
BEI: Beiling. China.
COT: Cotopaxi, Ecuador
CUB: Cuiaba. Brazil
FUI: Fucino, Italy
GAT: Gatibeneau. Canada
HAJ: Hatoyama. Japan
HOB: Hobart. Australia
IND: Jakarta. Indonesia
ISL :Islamabad. Pakistan
KIR : Kiruna. Sweden
KUJ: Kumamoto. Japan
MCA: Mar Chiquita. Argentina
PAC: Prince Albert. Canada
SAU: Riyahd. Saudi Arabia
SEI : Secunderabed. India
SPA: Maspalomas, Spain
SYO: Showa. Jap: Antarctica
THA: Bangkok. Thailand
TGS: Greenbell. USA
TOL: Aussaguel. France
TRA: Esperanza. Arg./Antarctica
TTS: Tromsō. Norway
ULA: Fairbanks. Alaska
WFS: West Freugh. UK



Ground stations & coverages of ERS-1



[1] Hatoyama (Japan)
[2] Alaska (USA)
[3] Wallops (USA)
[4] Bangkok (Thailand) (planning)
[5] Parepare (Indonesia) (planning)

Ground stations & coverages of ADEOS

Appendix-4 Main distributer of remote sensing data

Organization・adress・Tel・Fax	Satellite
Remote Sensing Technology Center of Japan User Service Department Roppongi First Bldg. 2F, 1-9-9, Roppongi Minato-ku, Tokyo 106, JAPAN Tel +81-3-5561-9777, Fax +81-3-5574-8515	Landsat SPOT, MOS-1/1b JERS-1*, ERS-1 RADASAT, IRS
Japan Weather Association Data Processing Department 4-5, Koji-machi, chiyoda-ku, Tokyo 102, JAPAN Tel +81-3-3238-0480, Fax +81-3-2262-9549	NOAA GMS
EOSAT Customer Service 4300 Forbes Blvd, Lanham, Maryland 20706, USA Tel +1-301-552-0528, Fax +1-301-552-3762	Landsat* IRS
USGS/EROS Data Center Mundt Federal Bldg. Sioux Falls, SD 57198-0001, USA Tel +1-605-594-6151, Fax +1-605-594-6589	Landsat NOAA
NOAA/NESDIS National Climatic Data Center Climate Services Division 151 Patton Avenue Asheville, NC28801-5001, USA Tel +1-704-271-4800, Fax +1-704-271-4876	NOAA GOES
SPOT IMAGE Customer Service Department 5rue des Satellites, B. P. 4539 F-31030 Toulouse cedex, France Tel +33-5-62-19-40-86, Fax +33-5-62-19-40-55	SPOT* ERS-1
ESA-ESRIN. ERS Services Helpdesk Via Galieo Galilei, 00044 Frascati, Italy Tel +39-6-94180-666, Fax +39-6-94180-652	NOAA, MOS-1 ERS-1* JERS-1
EURIMAGE Customer Service ESRIN Via Galieo Galilei, 00044 Frascati, Italy Tel +39-6-94180218, Fax +39-6-9426285	Landsat ERS-1
RADARSAT International Inc. Satellite Data Distribution Centre 3851 Shell Road, Suite 200 Richmond, British Columbia V6X 2W2, Canada Tel +1-604-231-4948, Fax +1-604-244-0404	Landsat SPOT NOAA RADASAT* JERS-1
Thailand Remote Sensing Centre National Research Council of Thailand(NRCT) 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand Tel +66-5790345, Fax +66-5613035	Landsat SPOT MOS-1
NRSA Data Centre National Remote Sensing Agency Balanagar, Hyderabad-500 037, Andra Pradesh. India Tel +91-262960, +91-262572～262577 ext.2318, Fax +91-261850, +91-263648	Landsat SPOT IRS

*:The satellite whose data are arranged for distribution by the organization