Chinese Spaceborne Ocean Observing Systems and Onboard Sensors (1988-2025)

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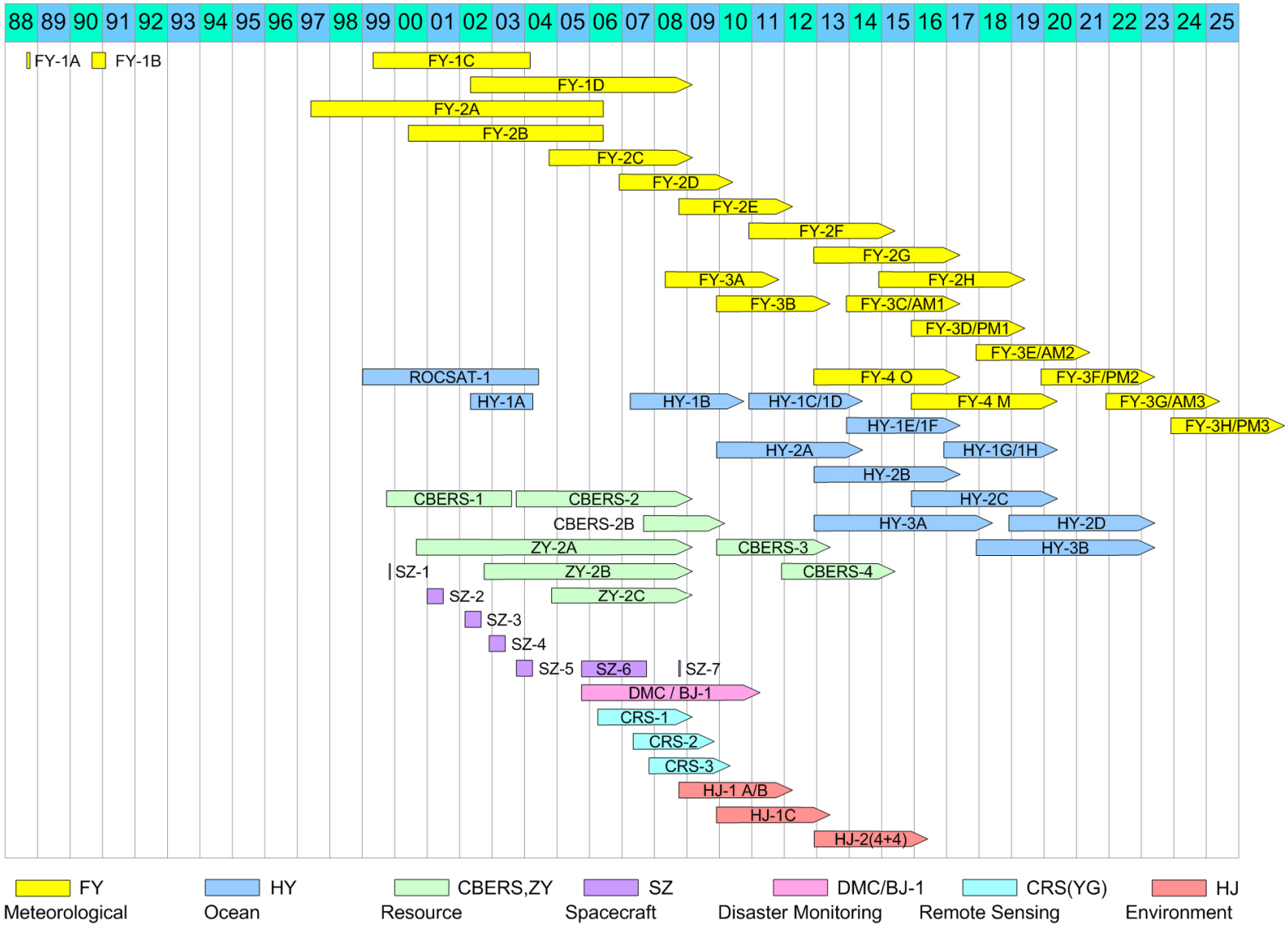
Outline

- Chinese Spaceborne Earth Observing Systems
- Chinese Spaceborne Ocean Observing Systems
- Comparison of Chinese and other international sensors for ocean observation
- Three cases of utilizing satellite data

Chinese Spaceborne Earth Observing Systems

Information on the Chinese spaceborne earth observing satellite (and spacecraft) missions between 1988 and 2025 are comprehensively collected, including historical, on-orbit and planned (or future) satellites. A detailed introduction of seven satellite (and spacecraft) series including FY-n, HY-n, ZY-n, HJ-n, SZ-n, CRS-n and DMC/BJ-1 is given.

CHINESE SPACEBORNE EARTH OBSERVING SYSTEM



Primary sensors and applications of Chinese spaceborne EOS

Meteological Satellites

Satellite series	Satellite	Orbit	Launch date	Design life / EOL date	Primary sensors	Primary applications
FY-n	FY-1A	Polar	1988-09-07	1988-10	MVISR-1	Meteorology
	FY-1B		1990-09-03	1991-02		
	FY-1C		1999-05-10	2004-03	MVISR-2	Meteorology, Ocean color, SST
	FY-1D		2002-05-15	2 years		
	FY-2A	Geostationary	1997-06-10	2006-06	VISSR-1	Meteorology,
	FY-2B		2000-06-25	2006-06	VISSR-1	
	FY-2C		2004-10-19	3 years	VISSR-2	Meteorology SST
	FY-2D		2006-12-08	3 years	VISSR-2	
	FY-2E		2008-10	3 years	VISSR-2	
	FY-2F		2010	4 years	VISSR-n	
	FY-2G		2012	4 years	VISSR-n	
	FY-2H		2014	4 years	VISSR-n	
	FY-3A	Polar	2008-05-27	3 years	VIRR, IRAS, MWTS, MWHS, SBUS, TOU, ERM, SIM, MWRI, MERSI, SEM	Meteorology, Ocean, Land, Space
	FY-3B		2009	3 years		
	FY-3C/AM1		2013	3 years		
	FY-3D/PM1		2015	3 years		
	FY-3E/AM2		2017	3 years		
	FY-3F/PM2		2019	3 years		
	FY-3G/AM3		2021	3 years		
	FY-3H/PM3		2023	3 years		
	FY-4 O	Geostationary	2012	4 years	IIS, MCSI, LM(CCD)	Meteorology, Ocean, Land
	FY-4 M		2015	4 years	GEO-MWRI	

Primary sensors and applications of Chinese spaceborne EOS

Ocean Satellites

Satellite series	Satellite	Orbit	Launch date	Design life / EOL date	Primary sensors	Primary applications
HY-n	ROCSAT-1	Polar	1999-01-27	2004-06-16	OCI, IPEI	Ocean color, Detection of charged particles in the ionosphere
	HY-1A	Polar	2002-05-15	2004-04-01	COCTS, CZI	Ocean color
	HY-1B		2007-04-11	3 years		
	HY-1C/D		2010	3 years		
	HY-1E/F		2013	3 years		
	HY-1G/H		2016	3 years		
	HY-2A		2009	4 years	SCA(Ku), ALT(Ku,C), RAD(5 bands)	Ocean dynamic environment
	HY-2B		2012	4 years		
	HY-2C		2015	4 years		
	HY-2D		2018	4 years		
	HY-3A		2012	5 years	SAR(X,1m),SAR(C,10m), CCD(3m)	Ocean watch and monitoring
	HY-3B		2017	5 years		

Primary sensors and applications of Chinese spaceborne EOS

	Satellite series	Satellite	Orbit	Launch date	Design life / EOL date	Primary sensors	Primary applications
Resource Satellites	CBERS, ZY-n	CBERS-1	Polar	1999-10-14	2003-08-13	CCD, IRMSS, WFI	Land, Coastal zone
		CBERS-2		2003-10-21	2 years		
		CBERS-2B		2007-09-19	2 years	CCD, WFI, HR	
		CBERS-3		2009	3 years	CCD, IRMSS, WFI, PAN-MUX (PAN-MS)	
		CBERS-4		2011	3 years		
		ZY-2A	Polar	2000-09-01	2 years	HR, PAN-MS	
		ZY-2B		2002-10-27	2 years		
		ZY-2C		2004-11-06	2 years		
Shenzhou Spacecrafts	SZ-n	SZ-1		1999-11-20	1 day		
		SZ-2		2001-01-10	6 days	The orbital module stayed in orbit, Space and earth environment sensor experiments. Such as CMODIS, M3RS, SBUS, TOU, ERM, SIM, etc.	
		SZ-3		2002-03-25	7 days		
		SZ-4		2002-12-30	5 days		
		SZ-5		2003-10-15	1 day		
		SZ-6		2005-10-12	5 days		
		SZ-7		2008-10	5 days		

Primary sensors and applications of Chinese spaceborne EOS

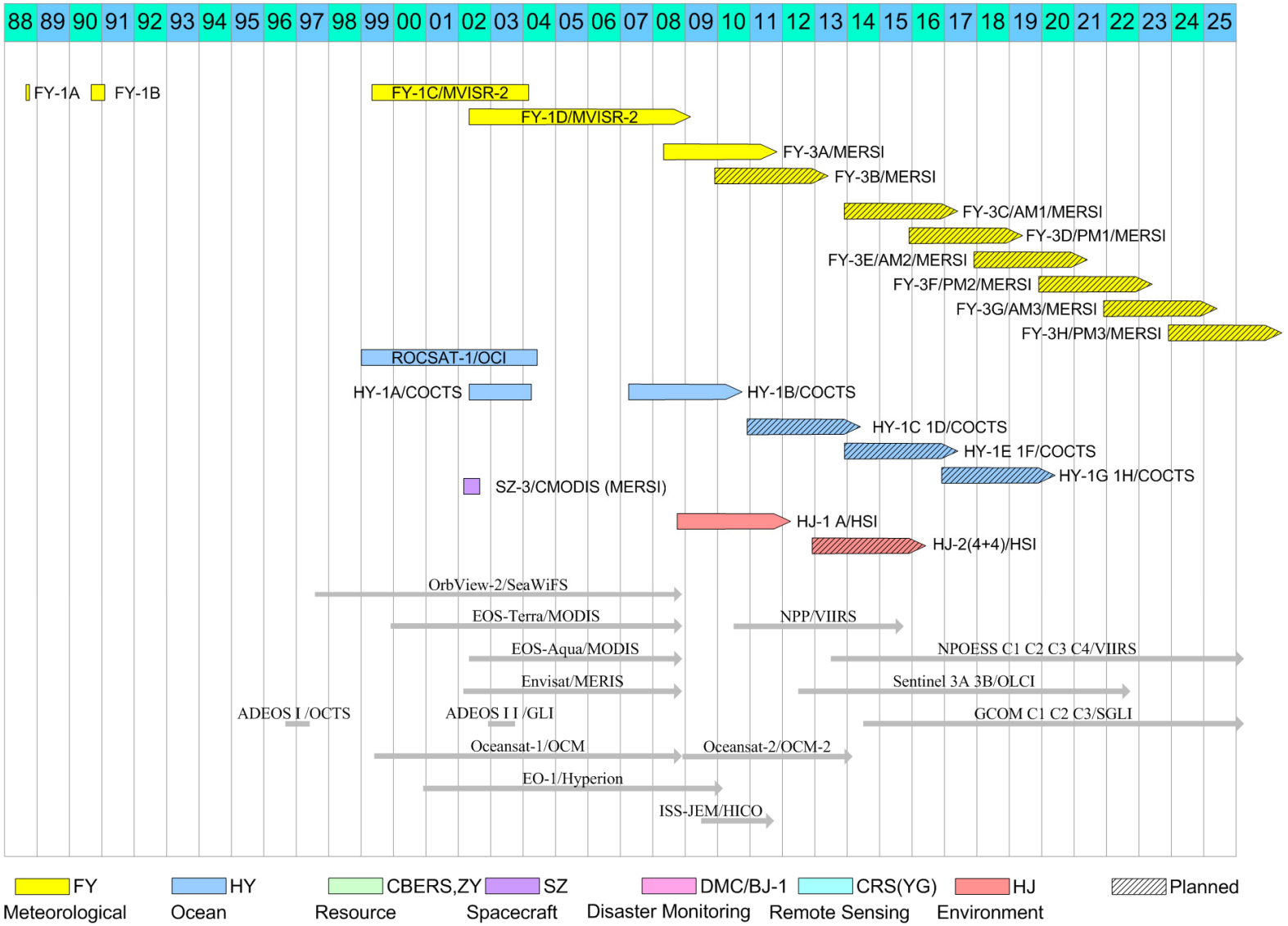
Disaster Monitoring Satellites & Chinese Remote Sensing Satellites & Environment Satellites

Satellite series	Satellite	Orbit	Launch date	Design life / EOL date	Primary sensors	Primary applications
DMC	DMC/BJ-1	Polar	2005-10-27	5 years	PAN-MS	Land, Coastal zone
CRS-n or YG-n	CRS-1	Polar	2006-04-27	2 years	L-band SAR	Land, Ocean
	CRS-2		2007-05-25	2 years	HR, PAN-MS	
	CRS-3		2007-11-12	2 years	L-band SAR	
HJ-n	HJ-1A	Polar	2008-09-06	3 years	CCD, HSI	Environment and disaster monitoring, Ocean
	HJ-1B		2008-09-06	3 years	CCD, IR	
	HJ-1C		2009	3 years	S-band SAR	
	HJ-2 (4+4)		2012	3 years	CCD, IR, HSI, SAR	

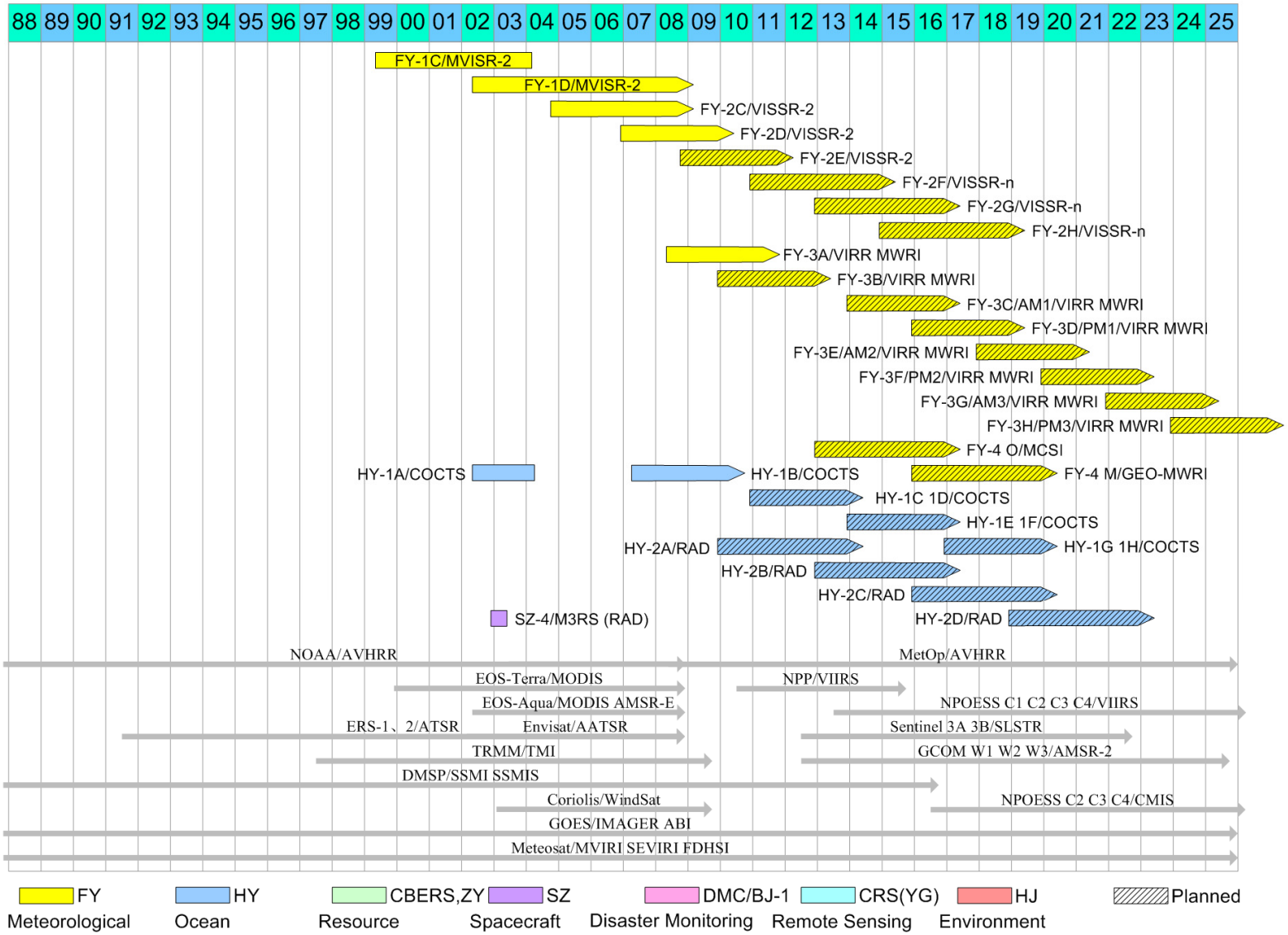
Chinese Spaceborne Ocean Observing Systems

All above satellite (and spacecraft) series are capable of ocean observation, and therefore comprise the Chinese satellite (and spacecraft) ocean observing system. Furthermore, the satellite (and spacecraft) observing systems for ocean color, sea surface temperature, sea surface height, sea surface vector winds and SAR are listed respectively according to onboard sensors.

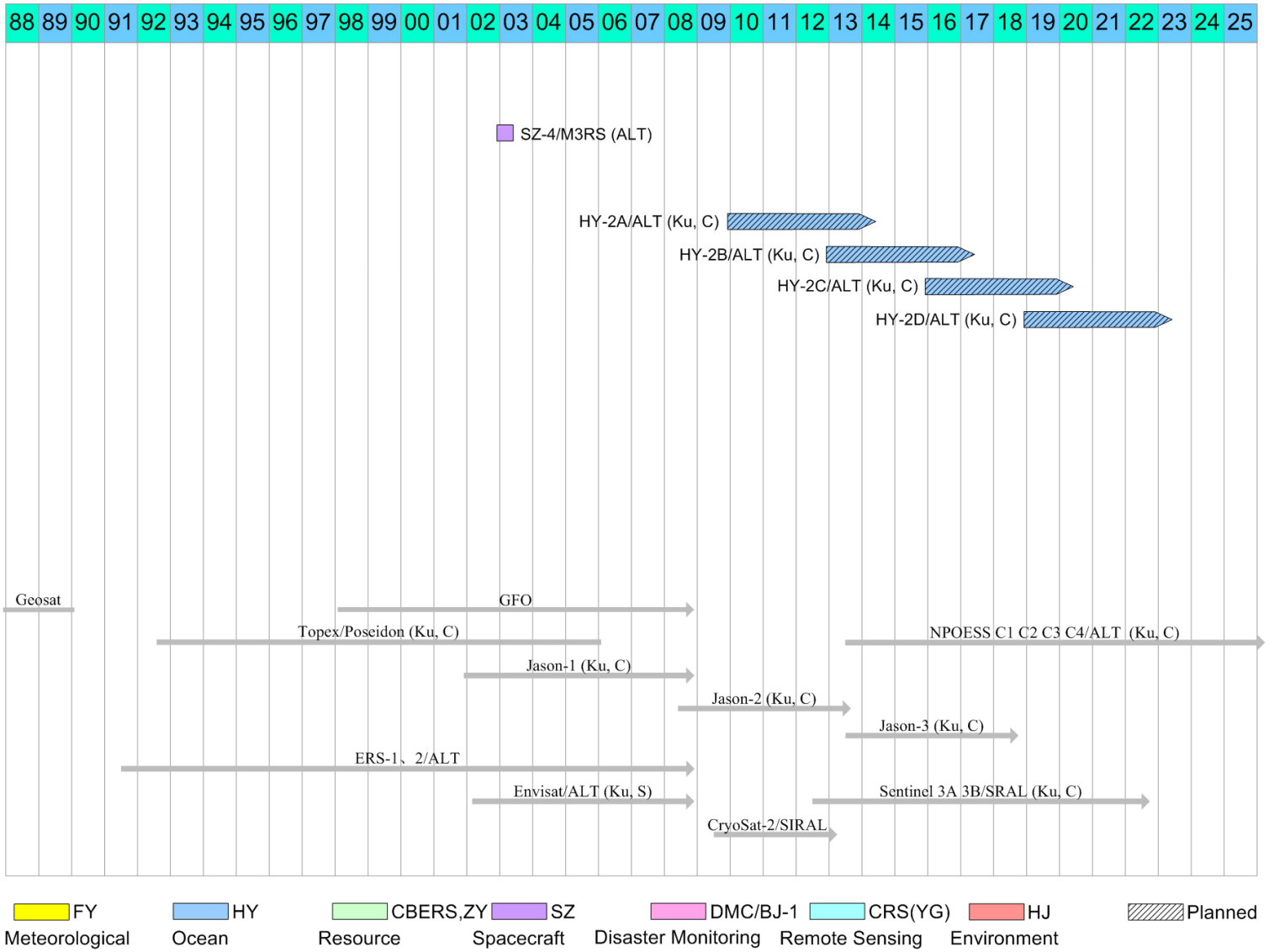
OCEAN COLOR


88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
FY-1A
FY-1B
FY-1C/MVISR-2
FY-1D/MVISR-2
FY-3A/MERSI
FY-3B/MERSI
FY-3C/AM1/MERSI
FY-3D/PM1/MERSI
FY-3E/AM2/MERSI
FY-3F/PM2/MERSI
FY-3G/AM3/MERSI
FY-3H/PM3/MERSI
ROCSAT-1/OCI
HY-1A/COCTS
HY-1B/COCTS
HY-1C 1D/COCTS
HY-1E 1F/COCTS
HY-1G 1H/COCTS
SZ-3/CMODIS (MERSI)
HJ-1 A/HSI
HJ-2(4+4)/HSI
OrbView-2/SeaWiFS
EOS-Terra/MODIS
NPP/VIIRS
EOS-Aqua/MODIS
NPOESS C1 C2 C3 C4/VIIRS
Envisat/MERIS
Sentinel 3A 3B/OLCI
ADEOS I /OCTS
ADEOS I I /GLI
GCOM C1 C2 C3/SGLI
Oceansat-1/OCM
Oceansat-2/OCM-2
EO-1/Hyperion
ISS-JEM/HICO
FY
HY
CBERS,ZY
SZ
DMC/BJ-1
CRS(YG)
HJ
Planned
Meteorological
Ocean
Resource
Spacecraft
Disaster Monitoring
Remote Sensing
Environment

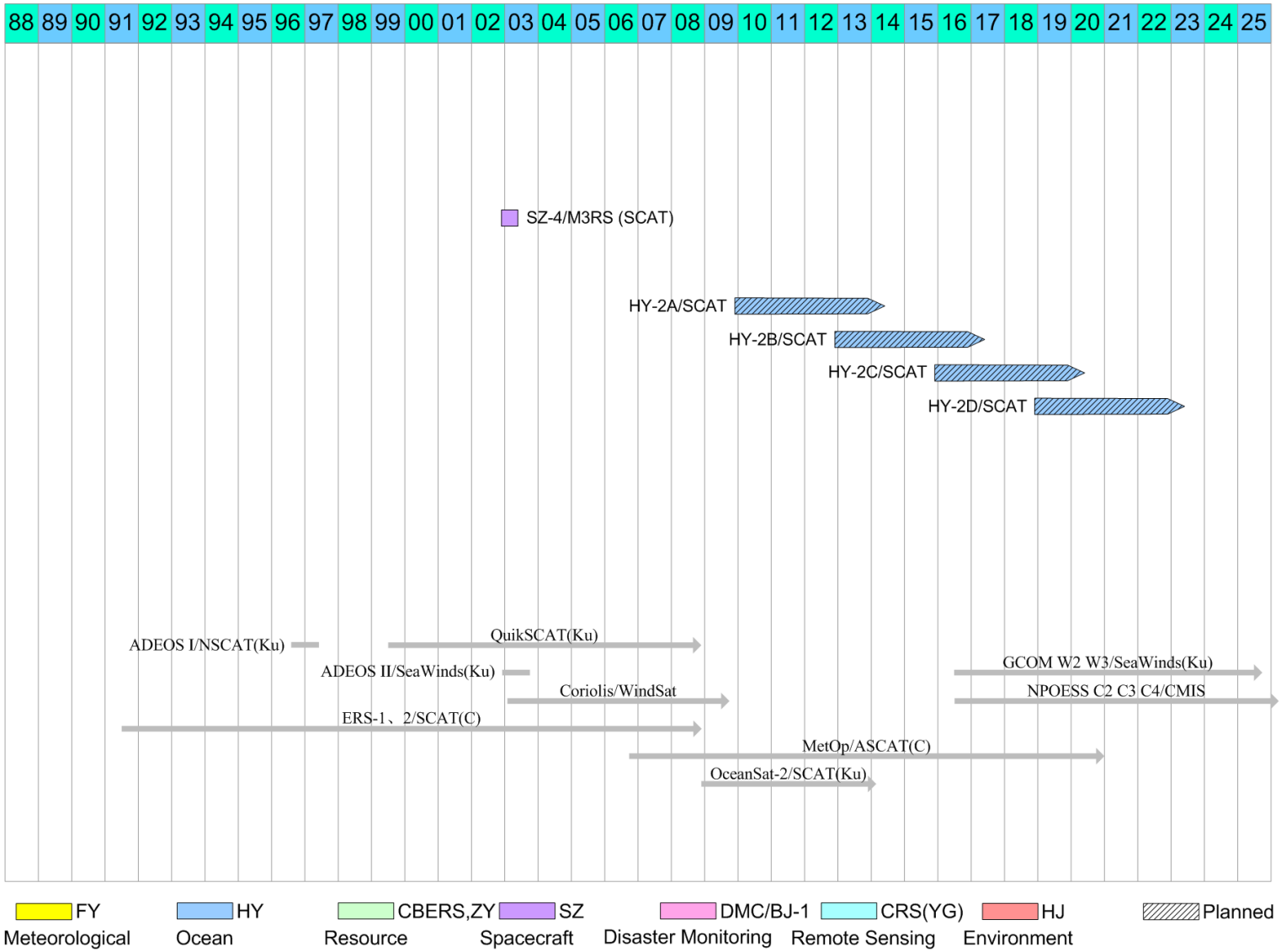
SEA SURFACE TEMPERATURE



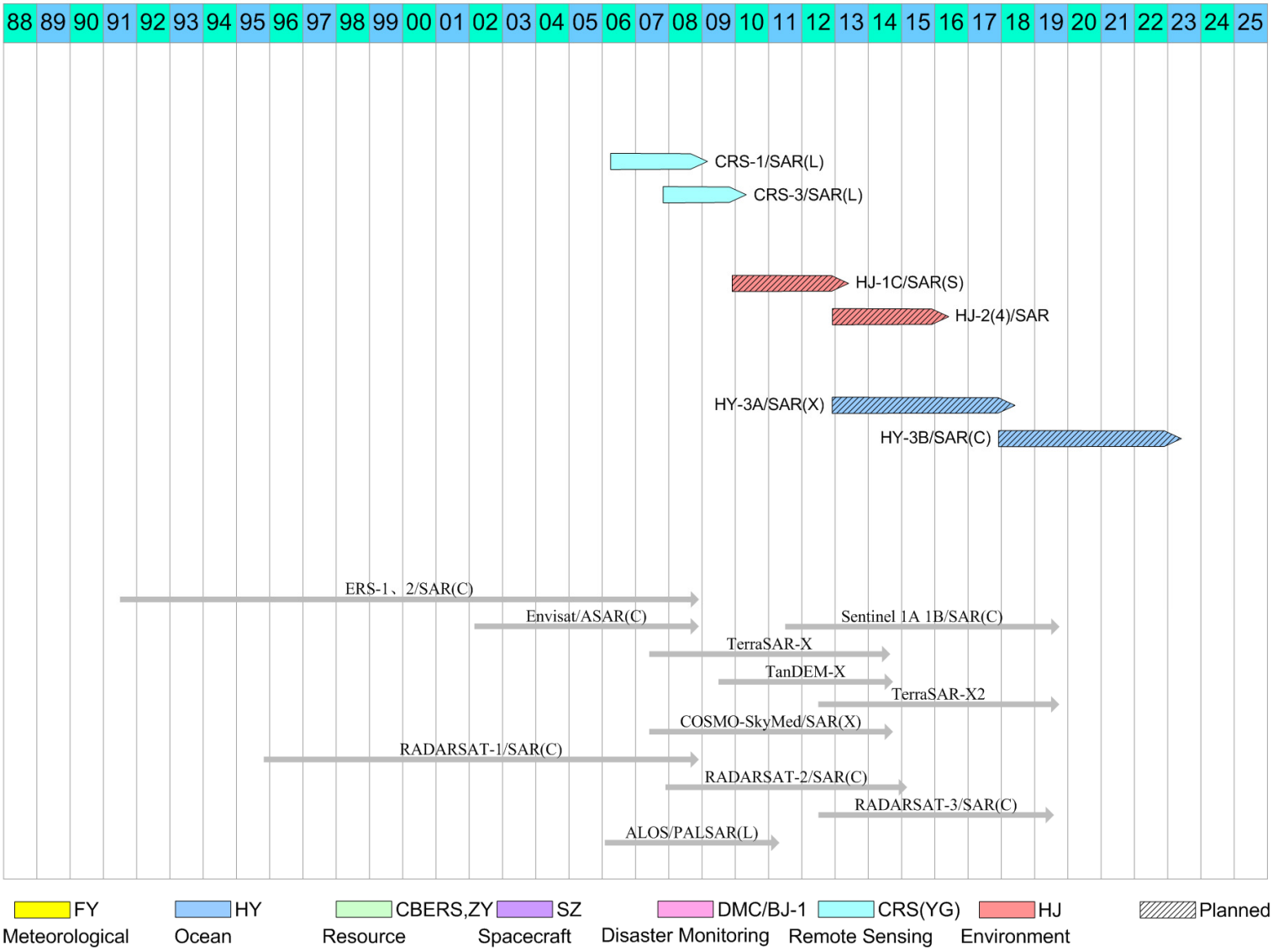
ALTIMETER


88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
SZ-4/M3RS (ALT)
HY-2A/ALT (Ku, C)
HY-2B/ALT (Ku, C)
HY-2C/ALT (Ku, C)
HY-2D/ALT (Ku, C)
Geosat
GFO
Topex/Poseidon (Ku, C)
NPOESS C1 C2 C3 C4/ALT (Ku, C)
Jason-1 (Ku, C)
Jason-2 (Ku, C)
Jason-3 (Ku, C)
ERS-1、2/ALT
Envisat/ALT (Ku, S)
Sentinel 3A 3B/SRAL (Ku, C)
CryoSat-2/SIRAL
FY Meteorological
HY Ocean
CBERS,ZY Resource
SZ Spacecraft
DMC/BJ-1 Disaster Monitoring
CRS(YG) Remote Sensing
HJ Environment
Planned

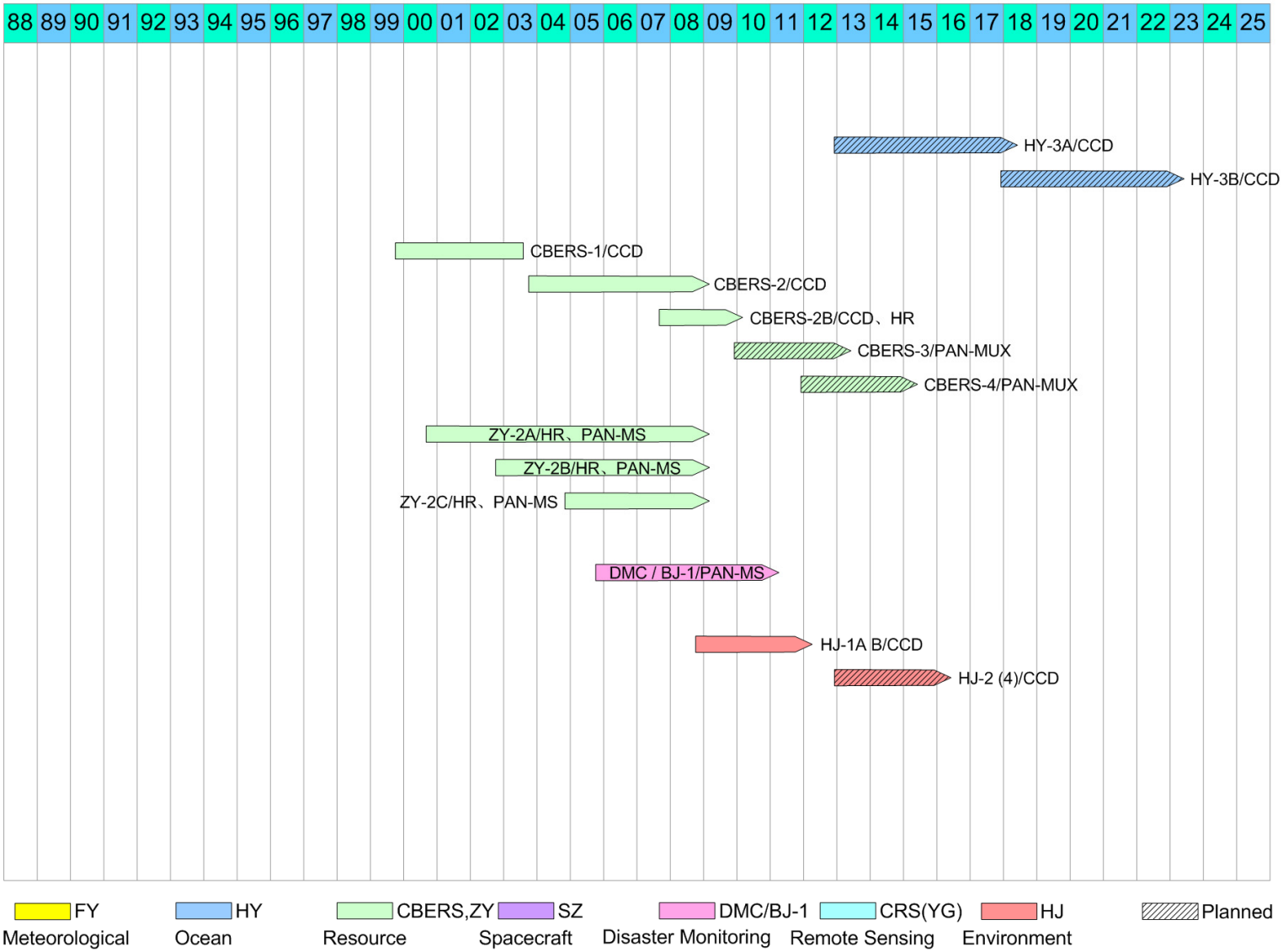
SEA SURFACE VECTOR WINDS



SAR


88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
CRS-1/SAR(L)
CRS-3/SAR(L)
HJ-1C/SAR(S)
HJ-2(4)/SAR
HY-3A/SAR(X)
HY-3B/SAR(C)
ERS-1、2/SAR(C)
Envisat/ASAR(C)
Sentinel 1A 1B/SAR(C)
TerraSAR-X
TanDEM-X
TerraSAR-X2
COSMO-SkyMed/SAR(X)
RADARSAT-1/SAR(C)
RADARSAT-2/SAR(C)
RADARSAT-3/SAR(C)
ALOS/PALSAR(L)
FY Meteorological
HY Ocean
CBERS,ZY Resource
SZ Spacecraft
DMC/BJ-1 Disaster Monitoring
CRS(YG) Remote Sensing
HJ Environment
Planned

HIGH SPATIAL RESOLUTION OPTICAL SENSORS



Among seven satellite and spacecraft series, HY-n, ZY-n, HJ-n and DMC/BJ-1 carry optical sensors with spatial resolution better than 30m as follows, which could be used for qualitative observation and monitoring of coastal zone and analysis of coastal SAR images.

Optical sensors	*Spatial resolution*
HY-3A, 3B/CCD	3m
ZY-2A, 2B, 2C/HR, PAN-MS	2m, 5m
CBERS-1, 2/CCD	20m
CBERS-2B/ CCD, HR	20m, 2m
CBERS-3, 4/ PAN-MUX	10m, 2m
HJ-1A, 1B/CCD	30m
HJ-2 (4)/CCD	< 30m
DMC/BJ-1/PAN-MS	32m, 4m

Comparison of Chinese and other international sensors for ocean observation

The performance of sensors onboard the Chinese and other similar ocean observing satellites is compared and discussed and the gap is pointed out. The 21 on-orbit sensors onboard Chinese ocean observing systems and other similar satellite sensors are listed.

Comparison of ocean color sensors

	HY-1B/COCTS	FY-3A/MERSI	Envisat/MERIS	EOS/MODIS	OrbView-2/SeaWiFS
Launch Agency	CNSA SOA	CNSA CMA	ESA	NASA	NASA
Orbit	polar, 798km, 98.8deg, 10:30±30min (D)	polar, 836km, 98.75deg, 10:00-10:20 (D)	polar, 800 km, 98.55deg, 10:00 (D)	polar, 705 km, 98.2deg, 10:30 (D, Terra) or 13:30 (A, Aqua)	polar, 705km, 98.2deg, 12:00 (D)
Swath	3100km	3200km	1150km	2330 km	2801km
Quantization	10 bits	12 bits	16 bits	12 bits	10 bits
Spatial Resolution	1100m	250m (bands 1-5) 1000m (bands 6-20)	300m/1200m (all bands)	250 m (bands 1-2), 500 m (bands 3-7), 1000 m (bands 8-36)	1100m
Radiometric Accuracy	10% (bands 1-8)	7% (bands 1-4, 6-14) 10% (bands 15-20)	< 4%	5% (bands 1-19, 26) 1% (bands 20-25, 27-36)	< 5%
SNR, NEΔρ, NEΔT	SNR Band 1, 440; 2, 600; 3, 590; 4, 560; 5, 525; 6, 390; 7, 400; 8, 415	NEΔρ Band 1, 0.45%; 2-3, 0.4%; 4, 0.45%; 6-7, 0.1%; 8-14, 0.05%	SNR (typical) 1700	SNR Band 1, 128; 2, 201; 3, 243; 4, 228; 8, 880; 9, 838; 10, 802; 11, 754; 12, 750; 13, 910; 14, 1087; 15, 586; 16, 516	SNR Band 1, 499; 2, 674; 3, 667; 4, 640; 5, 596; 6, 442; 7, 455; 8, 467
Bands	1 412 nm, 20 nm 2 443 nm, 20 nm 3 490 nm, 20 nm 4 520 nm, 20 nm 5 565 nm, 20 nm 6 670 nm, 20 nm 7 750 nm, 20 nm 8 865 nm, 40 nm 9 10350 nm, 100 nm 10 11950 nm, 1100 nm	6 412 nm, 20 nm 7 443 nm, 20 nm 1 470 nm, 50 nm 8 490 nm, 20 nm 9 520 nm, 20 nm 2 550 nm, 50 nm 10 565 nm, 20 nm 11 650 nm, 20 nm 3 650 nm, 50 nm 12 685 nm, 20 nm 13 765 nm, 20 nm 14 865 nm, 20 nm 4 865 nm, 50 nm 15 905 nm, 20 nm 16 940 nm, 20 nm 17 980 nm, 20 nm 18 1030 nm, 20 nm 19 1640 nm, 50 nm 20 2130 nm, 50 nm 5 11250 nm, 2500 nm	1 412 .5 nm, 10 nm 2 442.5 nm, 10 nm 3 490 nm, 10 nm 4 510 nm, 10 nm 5 560 nm, 10 nm 6 620 nm, 10 nm 7 665 nm, 10 nm 8 681.25 nm, 7.5 nm 9 708.75 nm, 10 nm 10 753.75 nm, 7.5 nm 11 760.625 nm, 3.75 nm 12 778.75 nm, 15 nm 13 865 nm, 20 nm 14 885 nm, 10 nm 15 900 nm, 10 nm	8 412 nm, 15 nm 9 443 nm, 10 nm 3 469 nm, 20 nm 10 488 nm, 10 nm 11 531 nm, 10 nm 12 551 nm, 10 nm 4 555 nm, 20 nm 1 645 nm, 50 nm 13 667 nm, 10 nm 14 678 nm, 10 nm 15 748 nm, 10 nm 2 858 nm, 35 nm 16 870 nm, 10 nm 17 905 nm, 30 nm 18 936 nm, 10 nm 19 940 nm, 25 nm 5 1240 nm, 20 nm 26 1375 nm, 30 nm 6 1640 nm, 24 nm 7 2130 nm, 50 nm	20 3750 nm, 180 nm 21 3959 nm, 60 nm 22 3959 nm, 60 nm 23 4050 nm, 60 nm 24 4466 nm, 65 nm 25 4515 nm, 67 nm 27 6715 nm, 360 nm 28 7325 nm, 300 nm 29 8550 nm, 300 nm 30 9730 nm, 300 nm 31 11030 nm, 500 nm 32 12020 nm, 500 nm 33 13335 nm, 300 nm 34 13635 nm, 300 nm 35 13935 nm, 300 nm 36 14235 nm, 300 nm	1 412 nm, 20 nm 2 443 nm, 20 nm 3 490 nm, 20 nm 4 510 nm, 20 nm 5 555 nm, 20 nm 6 670 nm, 20 nm 7 765 nm, 40 nm 8 865 nm, 40 nm

Comparison of ocean color sensors

Hyper Spectral Imagers

Hyper spectral imager	Spectral range	Band number	Bandwidth	Spatial resolution	Swath
HJ-1A/HSI	0.45-0.95 μ m	128	5 nm (average)	100m	50km
EO-1/Hyperion	0.4-1.0 μ m 0.9-2.5 μ m	220	10nm	30m	7.5km
ISS-JEM/HICO	0.38-1.0 μ m	124	5 nm	100m	50km

Comparison of Infrared sensors

	HY-1B/COCTS	FY-3A/VIRR	Envisat/AATSR	EOS/MODIS	NOAA-N/AVHRR
Launch Agency	CNSA SOA	CNSA CMA	ESA	NASA	NOAA
Orbit	polar, 798km, 98.8deg, 10:30±30min (D)	polar, 836km, 98.75deg, 10:00-10:20 (D)	polar, 800 km, 98.55deg, 10:00 (D)	polar, 705 km, 98.2deg, 10:30 (D, Terra) or 13:30 (A, Aqua)	polar, 854km, 98.74deg, 13:37 (A)
Swath	3100km	2900km	500km	2330 km	2900km
Quantization	10 bits	10 bits	12 bits	12 bits	10 bits
Spatial Resolution	1.1km	1.1km	1km	1km (bands 8-36)	1.1 km
Radiometric Accuracy	1K@300K (bands 9-10)	1K@270K (band 3-5)	better than 0.5 K (absolute, 50×50 km), better than 0.1 K (relative, 1×1km)	1% (bands 20-25, 27-36, absolute)	Traceable to NIST
SNR, NEΔρ, NEΔT	NEΔT Band 9-10, 0.2K@300K	NEΔT Band 3, 0.3K@300K; 4-5, 0.2K@300K	NEΔT Band 5, 0.08K@270K; 6-7, 0.05K@270K	NEΔT Band 20, 31-32, 0.05K@300K 22-23, 0.07K@300K	NEΔT Band 3B-5, 0.12 K @ 300K
Bands	1 412 nm, 20 nm 2 443 nm, 20 nm 3 490 nm, 20 nm 4 520 nm, 20 nm 5 565 nm, 20 nm 6 670 nm, 20 nm 7 750 nm, 20 nm 8 865 nm, 40 nm 9 10.3-11.4 μm 10 11.4-12.5 μm	7 455 nm, 50 nm 8 505 nm, 50 nm 9 555 nm, 50 nm 1 630 nm, 100 nm 2 865 nm, 50 nm 10 1.360 μm, 0.07 μm 6 1.600 μm, 0.09 μm 3 3.55-3.85 μm 4 10.3-11.3 μm 5 11.5-12.5 μm	1 555 nm, 20 nm 2 659 nm, 20 nm 3 865 nm, 20 nm 4 1610 nm, 300 nm 5 3.55-3.85 μm 6 10.35-11.35 μm 7 11.50-12.50 μm	8 412 nm, 15 nm 9 443 nm, 10 nm 3 469 nm, 20 nm 10 488 nm, 10 nm 11 531 nm, 10 nm 12 551 nm, 10 nm 4 555 nm, 20 nm 1 645 nm, 50 nm 13 667 nm, 10 nm 14 678 nm, 10 nm 15 748 nm, 10 nm 2 858 nm, 35 nm 16 870 nm, 10 nm 17 905 nm, 30 nm 18 936 nm, 10 nm 19 940 nm, 25 nm 5 1240 nm, 20 nm 26 1375 nm, 30 nm 6 1640 nm, 24 nm 7 2130 nm, 50 nm 20 3.66-3.84 μm 21 3959 nm, 60 nm 22 3959 nm, 60 nm 23 4050 nm, 60 nm 24 4466 nm, 65 nm 25 4515 nm, 67 nm 27 6715 nm, 360 nm 28 7325 nm, 300 nm 29 8550 nm, 300 nm 30 9730 nm, 300 nm 31 10.78-11.28 μm 32 11.77-12.27 μm 33 13335 nm, 300 nm 34 13635 nm, 300 nm 35 13935 nm, 300 nm 36 14235 nm, 300 nm	1 630 nm, 100nm 2 862 nm, 275 nm 3A 1.58-1.64 μm 3B 3.55-3.93 μm 4 10.3-11.3 μm 5 11.5-12.5 μm

Comparison of Microwave Radiometers

	HY-2/RAD	FY-3A/MWRI	EOS-Aqua/AMSR-E	TRMM/TMI	Coriolis/WindSat
Launch Agency	CNSA SOA	CNSA CMA	NASA JAXA	NASA JAXA	NRL AFRL
Orbit	Polar, 963/965km, 99.3deg, 6:00 or 18:00 (D)	Polar, 836km, 98.75deg, 10:00-10:20 (D)	Polar, 705 km, 98.2deg, 13:30 (A)	Polar, non-sun-synchronous, 402km, 35deg	Polar, 840 km,98.7deg, 17:59 (A)
Swath	1600km	1400km	1450km	878km	1000km
Center Frequency , Bandwidth , Polarization	Band 1-2, 6.6 GHz, 350MHz, VH; 3-4, 10.7GHz, 250MHz, VH; 5-6, 18.7GHz, 250MHz, VH; 7, 23.8GHz, 400MHz, V; 8-9, 37GHz, 1000MHz, VH	Band 1-2, 10.65GHz, 180MHz, VH; 3-4, 18.7GHz, 200MHz, VH; 5-6, 23.8GHz, 400MHz, VH; 7-8, 36.5GHz, 900MHz, VH; 9-10, 89 GHz, 2×2300MHz, VH;	Band 1-2, 6.925 GHz, 350MHz, VH; 3-4, 10.65GHz, 100MHz, VH; 5-6, 18.7GHz, 200MHz, VH; 7-8, 23.8GHz, 400MHz, VH; 9-10, 36.5GHz, 1000MHz, VH 11-12, 89.0GHz, 3000MHz, VH	Band 1-2, 10.65GHz, 100MHz, VH; 3-4, 19.35GHz, 500MHz, VH; 5, 21.3GHz, 200MHz, V; 6-7, 37.0GHz, 2000MHz, VH; 8-9, 85.5GHz 3000MHz VH	Band 1-2, 6.8GHz, 125MHz, VH; 3-8, 10.7GHz, 300MHz, V H ±45 L R; 9-14, 18.7GHz, 750MHz, V H ±45 L R; 15-16, 23.8GHz, 500MHz, V H; 17-22, 37.0GHz, 2000MHz, V H ±45 L R;
NEΔT	1-7 0.5K 8-9 0.8K	1-2 0.6K; 3-8 1K; 9-10 2K	1-2 0.34K; 3-6 0.7K; 7-8 0.6K; 9-10 0.7K; 11-12 1.2K	1 0.63K; 2 0.54K; 3 0.50K; 4 0.47K; 5 0.71K; 6 0.36K; 7 0.31K; 8 0.52K; 9 0.93K	1-2 0.63K; 3-14 0.44K; 15-16 0.60K; 17-22 0.42K
IFOV	1-2 100km; 3-4 62km; 5-6 36km; 7 30km; 8-9 18km	1-2 51 x 85 km; 3-4 30 x 50 km; 5-6 27 x 45 km; 7-8 18 x 30 km; 9-10 9 x 15 km	1-2 43 x 75 km 3-4 29 x 51 km 5-6 16 x 27 km 7-8 18 x 32 km 9-10 8.2 x 14.4 km 11 3.7 x 6.5 km 12 3.5 x 5.9 km	1-2 37 x 63 km 3-4 18 x 30 km 5 18 x 23 km 6-7 9 x 16 km 8-9 5 x 7 km	1-2 40 x 60 km; 3-8 25 x 38 km; 9-14 16 x 27 km; 15-16 12 x 20 km; 17-22 8 x 13 km
Pixel			1-10 9 x 10 km 11 4.5 x 4 km 12 4.5 x 6 km	1-7 9.1 x 13.9 km 8-9 4.6 x 13.9 km	1-2 40 x 50 km; 3-8 20 x 25 km; 9-14 10 x 25 km; 15-16 10 x 12.5 km; 17-22 5 x 12.5 km
Incidence Angle	40 deg	53 deg	1-11 55 deg; 12 54.5 deg	53 deg	1-2 53.5 deg; 3-8 49.9 deg; 9-14 55.3 deg; 15-22 53.0 deg;

Comparison of Microwave Altimeters

	HY-2A/ALT	Envisat/ALT	Topex/Poseidon	Jason-1	CryoSat
Launch Agency	CNSA SOA	ESA	NASA CNES	NASA CNES	ESA
Orbit	Polar, 963km, 99.3deg	Polar, 800km, 98.55deg	Polar,non-sun-synchronous, 1336km, 66deg	Polar,non-sun-synchronous, 1336km, 66deg	Polar,non-sun-synchronous, 717km, 92deg
Repeat Cycle (days)	14/168	35	10	10	369 (30 day sub-cycle)
Emitted Frequency (GHz)	Ku, 13.58 C, 5.25	Ku, 13.575 S, 3.2	Ku, 13.6 C, 5.3	Ku, 13.575 C, 5.3	Ku, 13.575 (LRM, SAR, SARIn)
Bandwidth (MHz)	320, 80, 20 (Ku) 320, 160 (C)	320, 80, 20 (Ku) 160 (S)	320 (Ku) 320, 100 (C)	320 (Ku, C)	350 (Ku)
Spatial resolution (km)	16	8	6	6	0.25
Altimeter Accuracy (cm)	5-8	4.5	4.2	3.3	1.6-2.7

Comparison of Microwave Scatterometers

	HY-2A/SCAT	ERS-2/SCAT	QuikSCAT	MetOp-A/ASCAT	GCOM W2 W3/SeaWinds
Launch Agency	CNSA SOA	ESA	NASA	ESA	JAXA NASA
Orbit	Polar, 963/965km 99.3deg, 18:00 (D)	Polar, 785km 98.5deg, 10:30 (D)	Polar, 803km 98.6deg, 6:00 (D)	Polar, 817km 98.7deg, 09:30 (D)	Polar, 699.6km 98.19deg, 13:30 (D)
Repeat Cycle	14/168 days	35 days	4 days	29 days	
Frequency	Ku	C	Ku	C	Ku
Polarization	HH VV	VV	HH VV	VV	HH VV
Spatial Resolution	50 km	25 km, 50 km	25 km	50 km	12.5 km, 25 km, 50 km
Swath	>1350 km（HH） >1700 km（VV）	500 km	1400 km（HH） 1800 km（VV）	550 km*2	1400 km（HH） 1800 km（VV）
Incidence Angle	38deg & 44deg	18deg～59deg	46deg & 54deg	45～65deg	46deg & 54deg
Wind Speed Range	2～24m/s	4～24m/s	3～30m/s	4～24 m/s	3～30m/s
Wind Speed Accuracy	2m/s or 10%	2m/s	2m/s	2m/s or 10%	2m/s
Wind Direction Accuracy	20deg	20deg	20deg	20deg	20deg

Comparison of Microwave SARs

	HJ-1C/SAR	HY-3A.B/SAR		TerraSAR-X/SAR	Envisat/ASAR	Radarsat-2/SAR
Launch Agency	CNSA MCA/MEA	CNSA SOA		DLR	ESA	CSA
Orbit	Polar，500km 97.37deg 6:00AM (D)	Polar，799.9Km 98.48 6:00AM (D)		Polar，514.8km 97.44deg 18:00PM (D)	Polar，800km 98.55deg 10:00AM (D)	Polar，789km 98.6deg 6:00AM (D)
Repeat Cycle	31days	29days		11days	35days	24days
NESZ		<-20dB		-16～-23dB	-19～-35dB	-22～-30dB
Radiometric Accuracy	3dB	<1.5dB		1～3.1dB	1.5～3.5dB	<1dB
Frequency	S-band	X-band	C-band	X-band	C-band	C-band
Operation mode，Resolution (m)，Swath (km)，Polarization，Incidence Angle (deg)	Stripmap， 5，40， VV or HH， 31～44 ScanSAR， 20，100， VV or HH， 31～44	Precise mode， 1，20～40， HH VV， 15～60 Strip mode， 5，60～80， HH VV， 15～60 ScanSAR， 10，120～150， HH VV， 15～60	Wave mode， 10，5， HH+VV or HH+HV or VV+VH， 15~60 Image mode， 25，150， HH+VV or HH+HV or VV+VH， 15～60 Wide swath mode， 100，650， HH+VV or HH+HV or VV+VH， 15～60 Global monitoring， 1000，650， HH+VV or HH+HV or VV+VH， 15～60	Spotlight， 1～2，10， HH+VV or HH+HV or VV+VH， 20～55 Stripmap， 3～6，30， HH+VV or HH+HV or VV+VH， 20～45 ScanSAR， 16，100， HH+VV or HH+HV or VV+VH， 20～45 Dual Receive Antenna Mode， 300 MHz Mode	Wave mode， 30，5， HH or VV， 15～45 Image mode， 30，56～100， HH or VV， 15～45 Alternating Polarization mode， 30，100， VV+HH or HV+HH or VH+VV， 15～45 Wide Swath mode， 150，400， HH or VV， 15～37 Globe Monitoring mode， 1000，400， HH or VV， 15～37	Ultra-Fine， 3(Range)*3(Azimuth)，20， HH or HV or VV or VH，30～49 Multi-Look Fine， 8(Range)*8(Azimuth)，50， HH or HV or VV or VH，30～50 Fine， 8(Range)*8(Azimuth)，50， HH or HV or VV or VH or HH+HV or VV+VH，30～50 Fine Quad-Pol， 12(Range)*8(Azimuth)，25， HH+HV+VV+VH，20～41 Standard Quad-Pol， 25(Range)*8(Azimuth)，25， HH+HV+VV+VH，20～41 Extended High， 18(Range)*26(Azimuth)，75， HH or HV or VV or VH，49～60 Standard， 25(Range)*26(Azimuth)，100， HH or HV or VV or VH or HH+HV or VV+VH，20～49 Wide， 30(Range)*26(Azimuth)，150， HH or HV or VV or VH or HH+HV or VV+VH ，20～45 ScanSAR Narrow， 50(Range)*50(Azimuth)，300， HH or HV or VV or VH or HH+HV or VV+VH ，20～46 ScanSAR Wide， 100(Range)*100(Azimuth)，500， HH or HV or VV or VH or HH+HV or VV+VH ，20～49

As mentioned above, there are at least 21 Chinese sensors in orbit. These Chinese satellite sensors and other international satellite sensors are listed as follows. It shows that the number of microwave sensors and active sensors are less than optical sensors.

Chinese satellite sensors	Retrieval parameters	Similar sensors
FY-1D / MVISR-2	Ocean Color, SST	AVHRR, CZCS
FY-2C / VISSR-2	SST	GOES / IMAGER
FY-2D / VISSR-2	SST	GOES / IMAGER
FY-3A / VIRR	Ocean Color, SST	AVHRR, CZCS
FY-3A / MERSI	Ocean Color	MODIS
FY-3A / MWRI	SST, Wind speed	TMI
HY-1B / COCTS	Ocean Color, SST	OTCS, SeaWiFS
CRS-1 / SAR (L)	Ocean	
CRS-3 / SAR (L)	Ocean	
HJ-1A / HSI	Ocean Color	Hyperion, HICO
HJ-1B / CCD	Coastal Zone	Landsat 7 / ETM+
CBERS-2 / CCD	Coastal Zone	Landsat 7 / ETM+, SPOT 5
CBERS-2B / CCD, HR	Coastal Zone	Landsat 7 / ETM+, SPOT 5 QuickBird
ZY-2A / PAN-MS, HR	Coastal Zone	QuickBird, IKONOS
ZY-2B / PAN-MS, HR	Coastal Zone	QuickBird, IKONOS
ZY-2A / PAN-MS, HR	Coastal Zone	QuickBird, IKONOS
DMC-BJ 1 / PAN-MS	Coastal Zone	Landsat 7 / ETM+

Three cases of utilizing satellite data

The data assimilation into an ENSO prediction system using improved monthly extended reconstructed SST (ERSST V3) and AVIOS Ssalto/Duacs multi-mission altimeter products. (IAP)

Development of a Chinese regional high resolution sea surface temperature system within the framework of GHRSST using AVHRR and AMSR-E SST merging products. (ORSI)

Monitoring of floating algae by MODIS data in Qingdao Olympic sailing area in 2008 are introduced. (ORSI)

In above three application cases, the international satellite data products are utilized. However, how to utilize Chinese satellites data for ocean applications is an important issue. This needs to be further investigated.


谢谢！
Thank you for your attention