

Coordinated EO Data Acquisition by CEOS Agencies for GEO FCT - Data Acquisition and Requirements in 2011

Frank Martin Seifert (ESA)

CEOS PoC for GEO FCT

Ake Rosenqvist (JAXA), Yves Crevier (CSA),
Tom Holm (USGS) and contributing space agencies



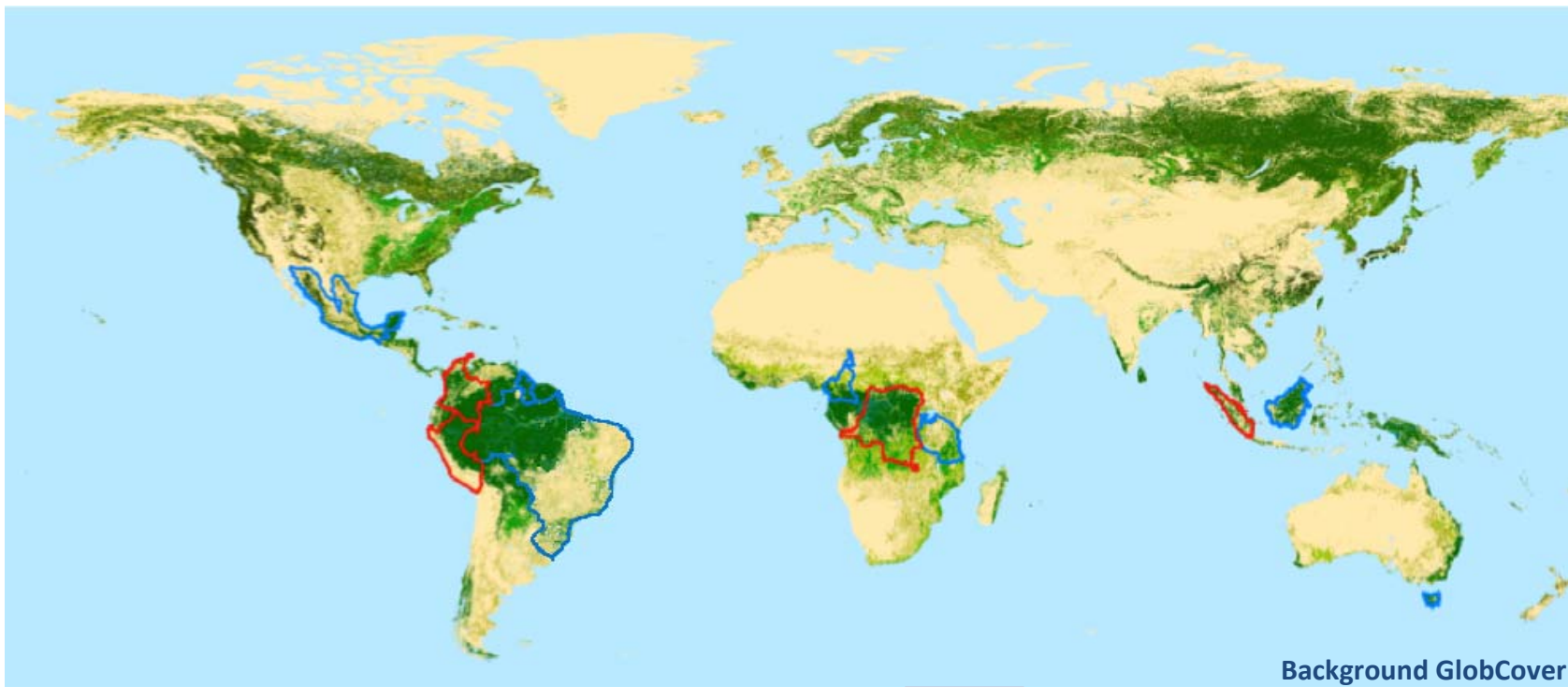
- **Requirements and Data Acquisitions**
 - FCT requirements
 - Contributing systems and acquisition reports
 - Future requirements and challenges
- **External Relations**
 - Co-operations
 - Events
- **Summary**



Requirements and Data Acquisitions

- FCT Requirements
- Contributing systems and acquisitions
- Future requirements and challenges





Background GlobCover

From 2009



- Brazil
- Guyana
- Mexico
- Indonesia (Borneo)
- Australia (Tasmania)
- Cameroon
- Tanzania

From June 2010



- Colombia
- DR Congo
- Peru
- and adding Sumatra to Indonesia

Nepal is ND candidate

From 2011 onwards progressive inclusion of countries from UN-REDD & World Bank FCPF is being planned.



ND	VS	Name	lat	long	Priority
Mexico	MEX-1	Chiapas-1	N17.00	W93.55	1
	MEX-2	Chiapas-2	N16.33	W90.65	2
	MEX-3	Campeche	N18.52	W92.25	2
	MEX-4	Oaxaca	N17.58	W96.46	2
	MEX-5	Hidalgo	N20.62	W98.62	1
	MEX-6	Nuevo León	N25.43	W98.52	2
	MEX-7	Michoacán	N19.57	W101.18	2
Colombia	COL-1	Andes-Huila	N1.74	W76.18	1
	COL-2	Choco-Cajambre	N3.40	W77.18	1
	COL-3	Pacifico-Bajo_Mira	N1.65	W78.76	2
	COL-4	Amazonia-Tinigua	N2.17	W74.15	1
	COL-5	Andes-Antioquia	N7.83	W76.45	2
Peru	PER-1	Bosques de Pomac	S6.48	W79.77	1
	PER-2	Alpahuayo Mishana	S3.93	W73.54	1
	PER-3	Manglares de Tumbes	S3.55	W80.32	2
	PER-4	San Matias San Carlos	S10.77	W74.93	2
	PER-5	Cordillera Azul	S6.97	W76.11	2
	PER-6	Cuenca baja del VRAE	S11.68	W73.84	2
	PER-7	Ambito de Barranquita	S6.12	W76.17	2
Brazil*	BRAX-1	Xingu-1	S11.91	W52.58	1
	BRAX-2	Xingu-2	S13.06	W52.38	1
Guyana	GUY-1	GFC-1	N6.00	W60.00	1
	GUY-2	GFC-2	N7.00	W59.00	1
	GUY-3	GFC-3	N3.00	W59.00	2
	GUY-4	Fairview	N4.65	W58.69	2
	GUY-5	Crashwater-N. Rupununi	N3.86	W59.05	2
	GUY-6	Apoteri	N4.04	W58.59	2

* Xingu in Brazil is a methodology development site



ND	VS	Name	lat	long	Priority
Cameroon	CAM-1	East Region (Ndelele)	N3.92	E14.99	2
	CAM-2	Adamawa Region (Tibati)	N6.52	E12.48	2
	CAM-3	Adamawa Region (Mbakaou)	N6.22	E12.76	1
	CAM-4	Pallisco Concession Area	N3.21	E13.74	1
	CAM-5	Direct Biomass Assessment 2	TBD in July 2011		2
	CAM-6	Direct Biomass Assessment 3	TBD in July 2011		2
D.R. Congo	DRC-1	Luki Reserve	S5.67	E13.17	2
	DRC-2	Bikoro	S0.25	E18.67	2
	DRC-3	Lisala Bumba	N2.83	E21.83	1
	DRC-4	Kisangani Sud	N0.17	E25.83	2
	DRC-5	Basankusu	N0.83	E20.17	2
	DRC-6	Mambasa Sud	N1.17	E29.67	1
	DRC-7	Oshwe	S4.17	E20.33	2
	DRC-8	Lubumbashi	S11.0	E27.33	2
Tanzania	TNZ-1	FAO_FRA-1	S4.00	E32.00	2
	TNZ-2	FAO_FRA-2	S10.00	E36.00	2
	TNZ-3	FAO_FRA-3	S10.00	E38.00	2
	TNZ-4	Nilo Forest Reserve	S4.92	E38.66	2
	TNZ-5	Amani	S5.13	E38.63	1
	TNZ-6	Liwale	S9.30	E38.00	1



ND	VS	Name	lat	long	Priority
Indonesia (Borneo)	BOR-1	E-Kalimantan/Sbh	N4.33	E117.01	2
	BOR-2	SW-Kalimantan	S1.82	E111.61	1
	BOR-3	SE-Kalimantan (KFCP REDD)	S2.24	E114.48	1
	BOR-4	C-Kalimantan/Srwk	N2.55	E115.08	2
	BOR-5	Berau	N1.91	E116.85	2
Indonesia (Sumatra)	SUM-1	Jambi REDD	S2.47	E101.53	1
	SUM-2	Harapan	S2.20	E103.38	1
	SUM-3	Riau Pelalawan	N0.0	E102.00	2
Tasmania	AU-1	Mathinna	S41.37	E147.76	1
	AU-2	Takone	S41.19	E145.60	2
	AU-3	Warra	S43.11	E146.90	2
Nepal	NEP-1	Bharatpur	N27.54	E84.60	1
	NEP-2	Kathmandu/Shivapuri	N27.80	E85.41	1
	NEP-3	Annapurna	N28.33	E84.16	2
	NEP-4	Bhang / Bajura	N29.68	E81.31	2
	NEP-5	Western Terai	N28.82	E80.82	2
	NEP-6	Gulmi / Baglung	N28.09	E83.28	2
	NEP-7	Taplejung	N27.29	E87.54	2

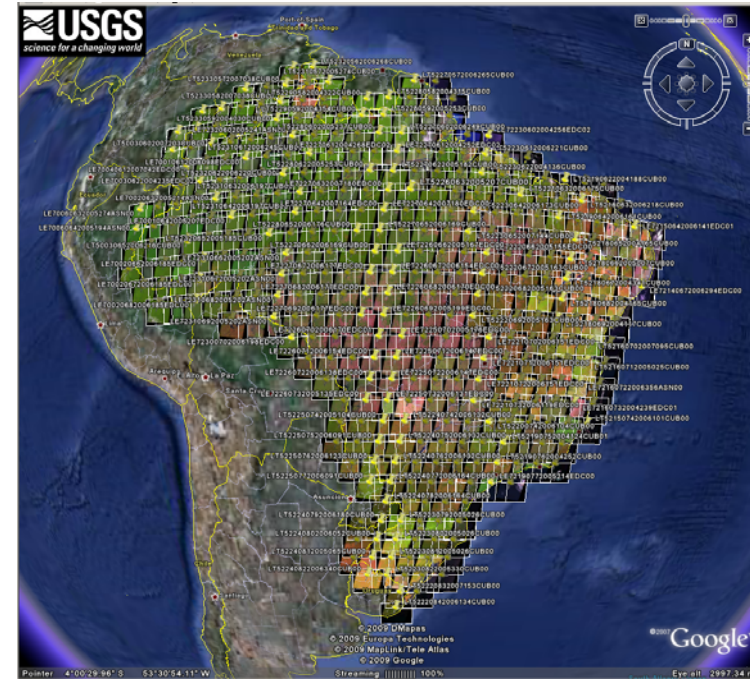


Satellite	Spectral Bands	Geometric Resolution	Swath Width	Repeat Cycle
Landsat 5, 7	VNIR, SWIR, TIR	30 m / 120 m (TIR)	185 km	16 days
IRS: AWiFS	VNIR, SWIR	56 m	740 km	4 days
IRS: LISS-III	VNIR, SWIR	23 m	140 km	24 days
CBERS 2b: CCD*	VNIR	20 m	114 km	26 days
SPOT 4, 5	VNIR, SWIR	20 m / 10 m	60 km	26 days

* Mission lost in May 2010



- Acquisition preferably close to nadir
- Cloud free observations (< 20% cloud coverage for individual scenes – total cloud removal by multiple scenes)
- All available spectral bands
- Time window – yearly, with preference during dry season
- Level-1 processing



GLS 2005: 423 TM Scenes in USGS Archive



National Demonstrator	Dry Seasons
Brazil	July / August for Xingu, none for overall Amazon basin
Guyana	July - September
Mexico	January - May
Peru	May - September in the Andes, rain (Selva) and cloud forest (Montaña) experiences a hot, humid tropical climate, whereas the coastal zone is dry
Colombia	generally high humidity, but less rainfall during December - March and July / August
Cameroon	November - March and additionally in the South from June - August
Tanzania	December - March and June - October
DR Congo	generally tropical wet climate, with 2 dryer seasons December - February and May- July at the equator and one dry season (May - Sept) in the South
Borneo (Indonesia)	June - September, but strong variations over the island
Sumatra (Indonesia)	generally tropical wet climate, with less precipitation in July - September
Tasmania	February / March (cool temperate climate)

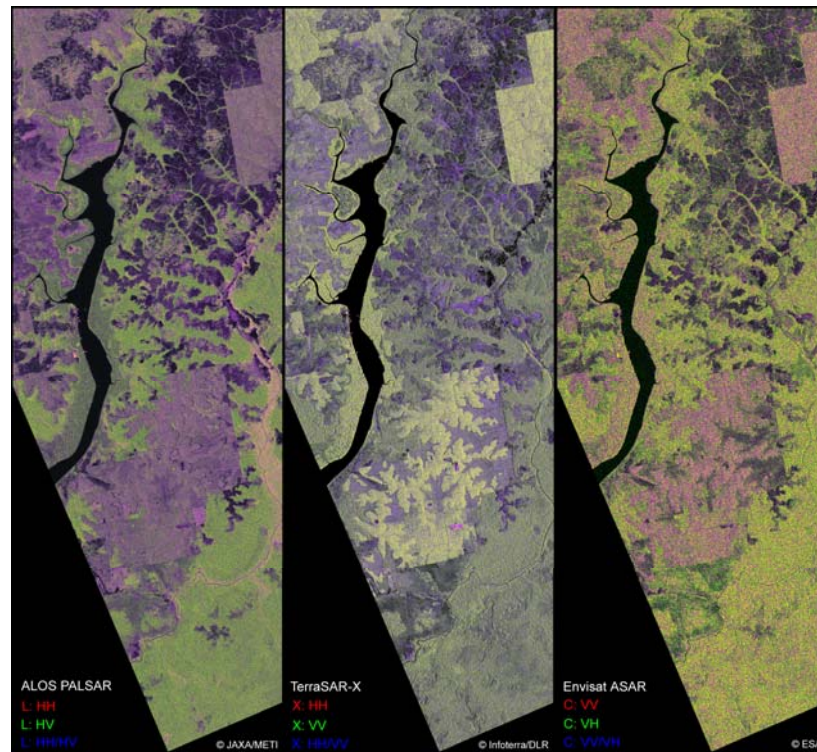


Satellite	Frequency / Polarisation	Geometric Resolution	Swath Width	Repeat Cycle
ALOS PALSAR*	L-band (23.6 cm) / full pol	7 m – 154 m	30 – 360 km	46 days
RADARSAT-1	C-band (5.6 cm) / HH	9 m – 100 m	45 – 500 km	24 days
RADARSAT-2	C-band (5.6 cm) / full pol	3 m – 100 m	20 – 500 km	24 days
ENVISAT ASAR	C-band (5.6 cm) / dual pol	30 m – 150 m	56 – 400 km	35 days
TerraSAR-X	X-band (3.1 cm) / full pol	1 m – 16 m	5 – 100 km	11 days
COSMO-SkyMed	C-band (3.1 cm) / full pol	1 m – 100 m	10 – 100 km	16 days

* Mission lost in April 2011



- Spatial and temporal consistency
- Fixed single observation mode
- Time window – twice annual during dry and wet season
- Level-1 processing (calibrated)
 - SLC
 - Multi-look



Polarimetric composites in L-, X- and C-band by ALOS PALSAR, TerraSAR-X and Envisat ASAR



GEO-FCT – EO Data Coordination

CEOS

Commercial

OPTICAL

LSI Constellation

- USGS (USA)
- CNES (France)
- INPE (Brazil)
- ISRO (India)
- GISTDA (Thailand)
- JAXA (Japan)

SAR

- JAXA (Japan)
- CSA (Canada)
- ESA (Europe)
- ASI (Italy)
- DLR (Germany)

(V)HR

- GeoEye
- Ikonos
- Quickbird
- RapidEye
- DMC
- (Spot)
- (TSX Infoterra)
- (RS-2 MDA)



Coordinate systematic acquisitions to ensure consistent data sets:

- Wall-to-wall acquisitions of National Demonstrators
 - **Annual to twice-annual** coverage with 20 – 30 m sensors
 - demonstrate **systematic acquisition capability**
 - develop **historical archive** of consistent time series (GFOI)
 - **anticipating data requirement** in support of UNFCCC post Kyoto agreement like **REDD+** and carbon markets
- Local scale acquisitions over FCT Validation Sites
 - increased **repetition frequency** (about monthly)
 - includes also **VHR sensors (increase coverage 2011)**
 - enable FCT **research** on key science questions and **methodology development (e.g. dense C-band series)**
 - act as **test-bed** for improved national mapping strategy



Campaign	Summer 2009	Spring 2010	Summer 2010	Spring 2011	Total
ALOS PALSAR	6189	7531	13746	15079	42545
RADARSAT-2	595	1278	875	1160	3908
ENVISAT ASAR	684	1419	2785	1389	6277
COSMO - Skymed	not planned	183	N/A	N/A	183
TerraSAR-X	not planned	247	16	N/A	539
Landsat 5 & 7	5280	5280	11362	11691	34621
SPOT	TPM by ESA, but restrictions related to repatriation		2252	2810	5062
CBERS-2B	3580	N/A	mission lost	mission lost	3580
IRS	not planned	100	13674	6015	19789

more than 116,000 scenes!!!



Summary of EO Data 2011

Acquisitions over NDs and VS

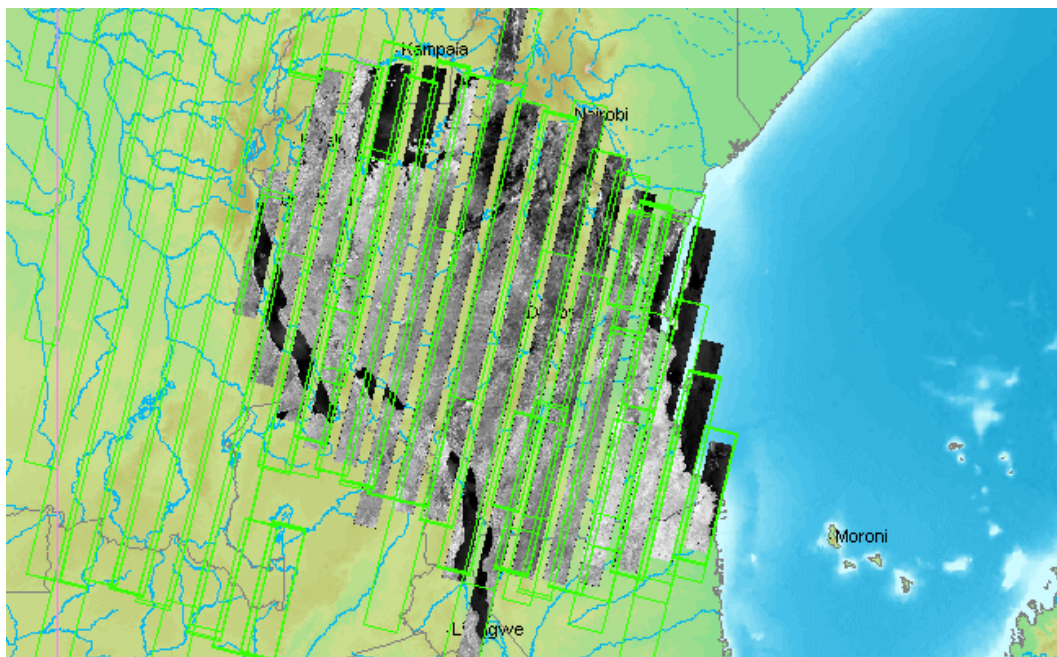
Sensor	Brazil	Guyana	Colombia	Peru	Mexico	Cameroon	DR Congo	Tanzania	Indonesia	Tasmania
ALOS PALSAR*	3457	248	1248	1199	1938	2861		616	3352	160
RADARSAT-2	37	76	251	248	137	35	0	60	263	53
ENVISAT ASAR	174	39	116	29	294	206	32	125	303	71
COSMO - Skymed	under discussion									
TerraSAR-X	24	12	0	0	44	24	0	18	36	12
Landsat 5 & 7	4162	244	1057	714	2765	297	1139	404	721	188
SPOT						2810				
IRS	5715	under discussion								

* mission lost April 2011

full coverage	not feasible	partially or some restrictions	under discussion
---------------	--------------	--------------------------------	------------------



- ALOS stopped operating on 22 April 2011
- ASAR IS4 in alternate polarisation



→ Gaps of some kilometres at the Equator!

- **ALL current missions are beyond predicted EoL!**



External Relations

- Co-operations
- Events



- **UN-REDD** with 9 pilot countries
 - UN-REDD/GEO Symposium in Mexico
 - 1st ND Summit and 2nd SDS at FAO in Rome
 - Challenge to increase acquisition area over **UN-REDD pilot countries** until end 2012

- World bank's **Forest Carbon Partnership Facility (FCPF)** with 37 REDD country participants
 - Future expansion countries
 - Challenge to start to cover them from end 2011 onwards ...



- **First FCT Science and Data Summit**, Woods Hole (USA), 11-12 May 2010
- **3rd FCT Space Data Coordination Meeting**, Woods Hole (USA), 13-14 May 2010
- **FCT side event at UNFCCC SBSTA**, Bonn (Germany), 3rd June 2010
- **MRV Workshop by NFC / UN-REDD / GEO**, Guadalajara, Jalisco, México, 22-24 June 2010
- **FCT session at ESA's Living Planet Symposium**, Bergen, Norway, 28 June 2010
- **FCT side event at CEOS Plenary**, Rio, Brazil, 12 Oct 2010



- **Carbon Demonstrator at GEO Plenary**, Beijing, China, 3-5 November 2010
- **FCT booth at 4th Forestry Day** organized by CIFOR in conjunction with COP-16, Cancun, Mexico, 5 December 2010
- **First National Demonstrator Workshop** at FAO, Rome (Italy), 7-8 February 2011
- **Second FCT Science and Data Summit**, FAO, Rome (Italy), 8-10 February 2011
- **4rd FCT Space Data Coordination Meeting**, ESRIN, Frascati (Italy), 11 February 2011
- **FCT side event at ISRSE**, Sydney (Australia), 15 April 2011



- **Coordinated acquisition** of satellite data over FCT National Demonstrators and Verification Sites: **more than 116,000 scenes acquired until April 2011**
- **Distribution of EO data: all required** 2009 data delivered to PD teams, **2010 on-going**
- **Expansion** of demonstration area: **> 10 Msqkm**



Demonstration phase extended until 2012/2013

- Continue to ensure **wall to wall** coverage (ideally semi-annual) of the **10 National Demonstrators**
- Include **Nepal** as National Demonstrator
- Continue optical and SAR data acquisition at monthly/bi-monthly repetition over the **Validation Sites** for **methodology development** and research on **key FCT science questions**
- **Full satellite coverage** of the **UN-REDD pilot countries** and **Congo basin countries** by end 2012
- Clear **distinction** between **acquisitions, data processing and distribution**



- Deepen current progress towards integration e.g. move from **remote sensing products** towards **emissions products**
- **Increase cooperation with ND organisations** e.g. **capacity building**
- **Global Forest Observations Initiative (GFOI)**
 - o Coordinated GFOI-FCT strategy
 - o GEO FCT as R&D component
- **Long term** acquisition is secured by upcoming satellites, but **short to mid term** is getting **more and more difficult!!!**

