

Data Acquisition Strategy for **ALOS PALSAR**

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Kyoto & Carbon Initiative - 3rd Science Advisory Panel meeting
Friedrich-Schiller Universität Jena, Germany
October 14-15, 2002



K&C Acquisition Strategy **Operational PALSAR modes selected***

K&C Operational Mode 1: Dual-pol (HH/HV) @ $\theta = 34.3^\circ$

- HH: surface- and double-bounce scat. (linear structures, inundation)
- HV: volume scattering (vegetation structure/biomass)
- HV ch. more important than resolution (single pol: 10m, dual-pol: 20m)
- Quad-pol: reduced swath and small inc. angle only - not feasible.
- $\theta = 34.3^\circ$ best trade-off angle (low θ : surface features, high θ : veg.)
- θ continuity with JERS-1 (35°)

K&C Operational Mode 2: ScanSAR (HH @ 100m)

- For improved temporal resolution

* Science Panel meeting #1
(Tokyo, Nov.2001)



K&C Acquisition Strategy

General features

K&C Mode 1 (HH/HV 34.3° 20m)

- Annual coverage of all land areas
- 2 data takes during 2 consecutive cycles (2*46 days)
 - InSAR
 - Gap-filling
- Summer/dry season targeted

K&C Mode 1x (HH 34.3° 10m)

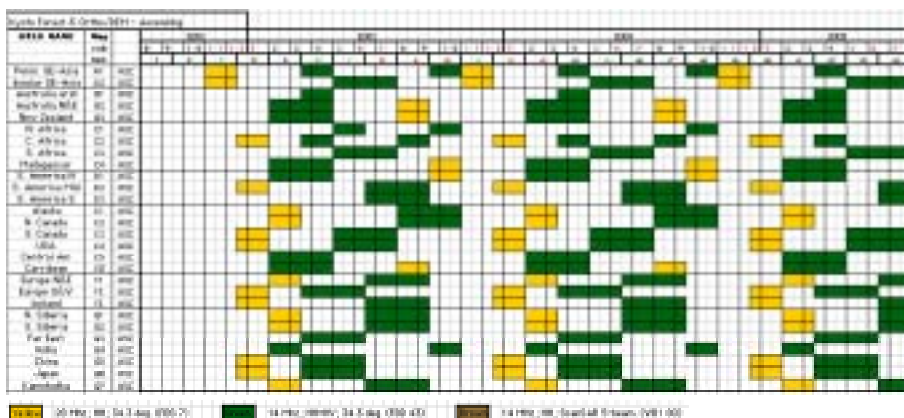
- Annual coverage of non-arid land areas
- Winter/wet season targeted

K&C Mode 2 (ScanSAR HH 100m)

- For intensive mapping of wetlands, rice paddy & freeze/thaw
- 1 data take each (46 d) cycle during 1 year

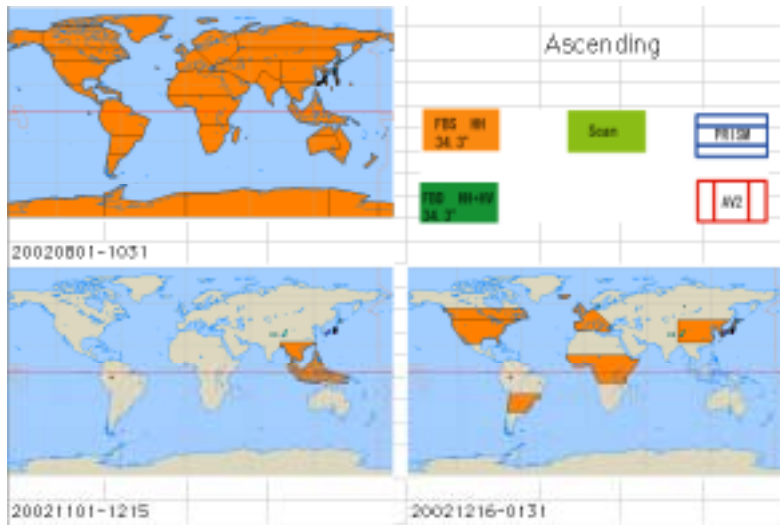


PALSAR Scenario (v.10/07/2002) - Ascending



ALOS - Ascending

Cycle 1-4

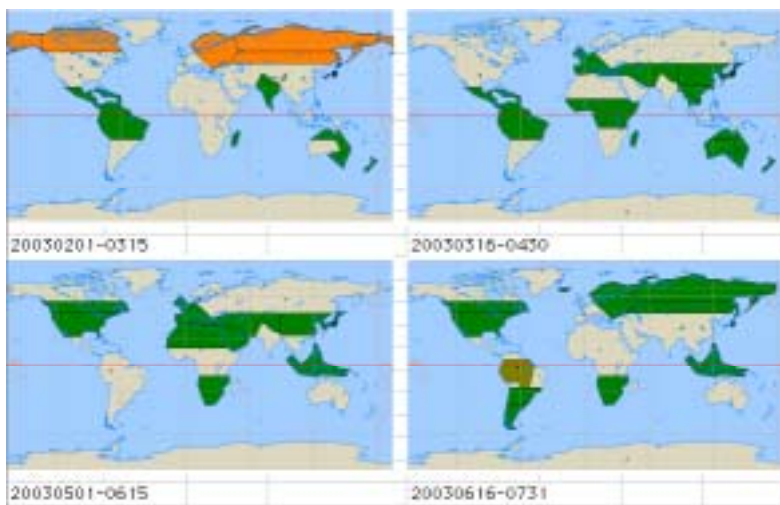


PALSAR Observation Scenario v.10/07/2002



ALOS - Ascending

Cycle 5-8

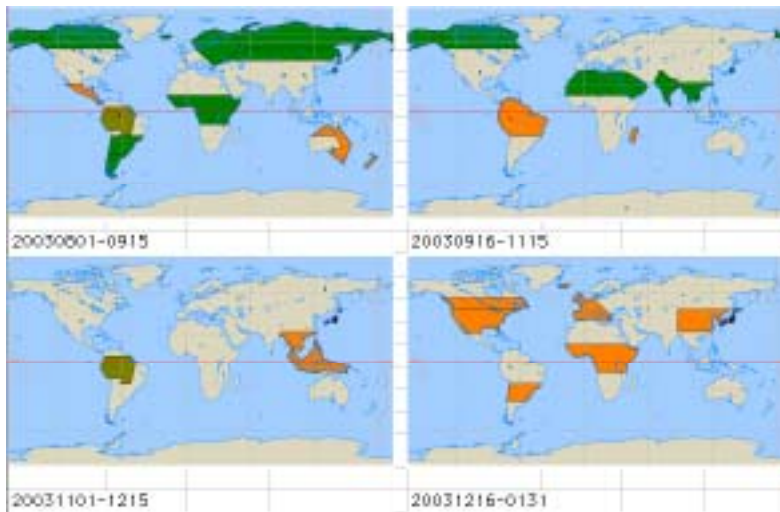


PALSAR Observation Scenario v.10/07/2002



ALOS - Ascending

Cycle 9-12

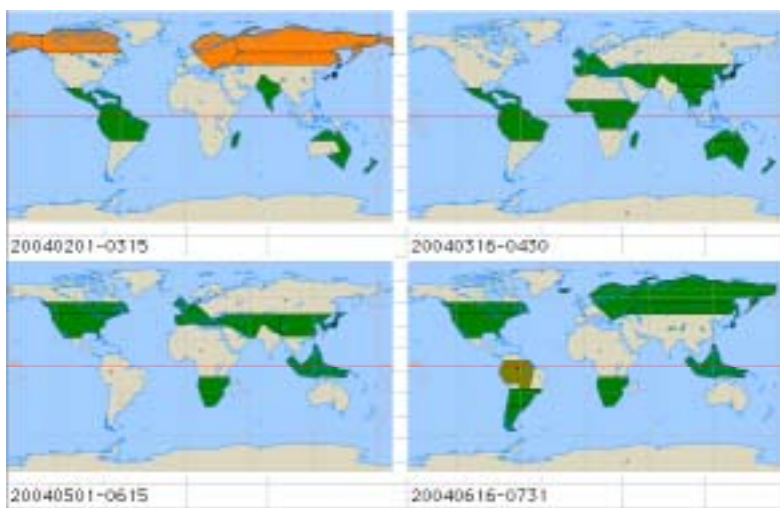


PALSAR Observation Scenario v.10/07/2002



ALOS - Ascending

Cycle 13-16

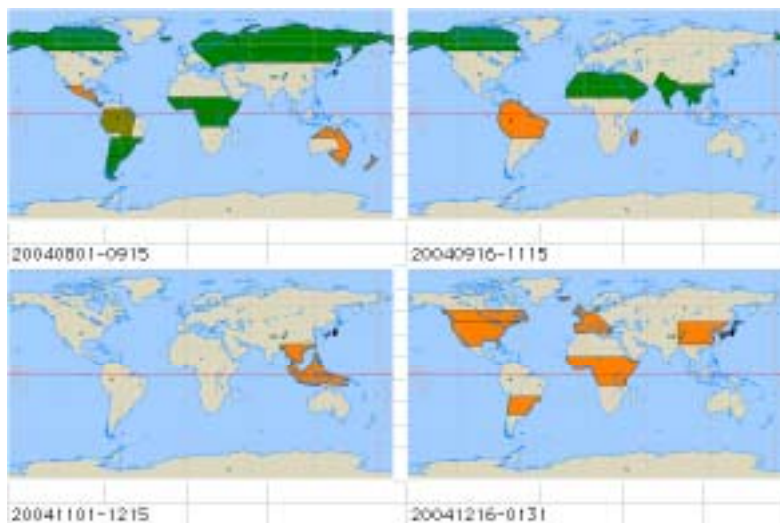


PALSAR Observation Scenario v.10/07/2002



ALOS - Ascending

Cycle 17-20

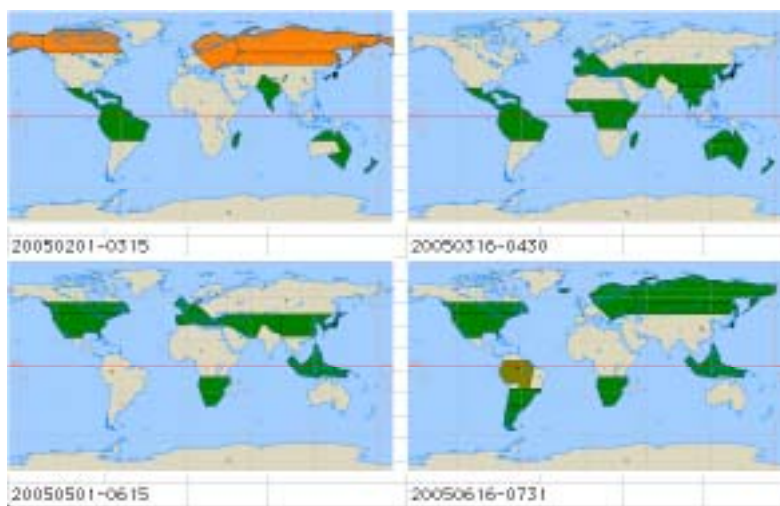


PALSAR Observation Scenario v.10/07/2002



ALOS - Ascending

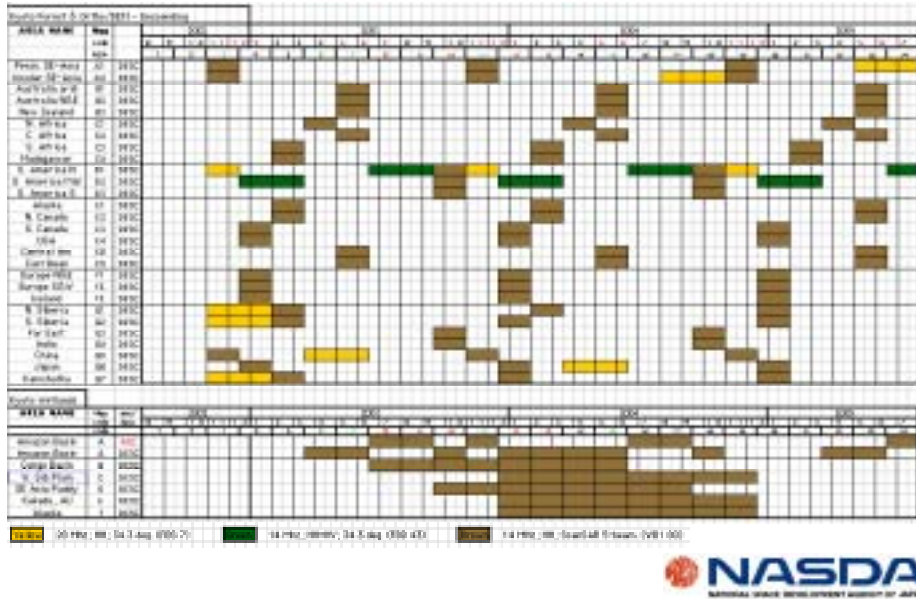
Cycle 21-24



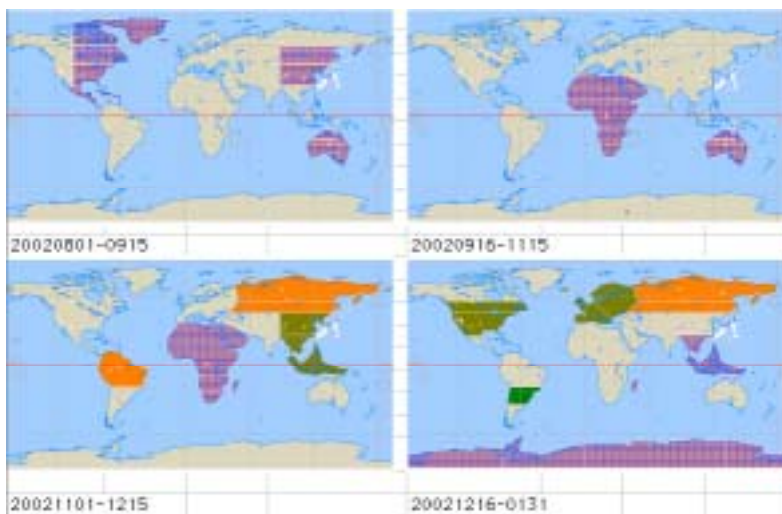
PALSAR Observation Scenario v.10/07/2002



PALSAR Scenario (v.10/07/2002) - Descending

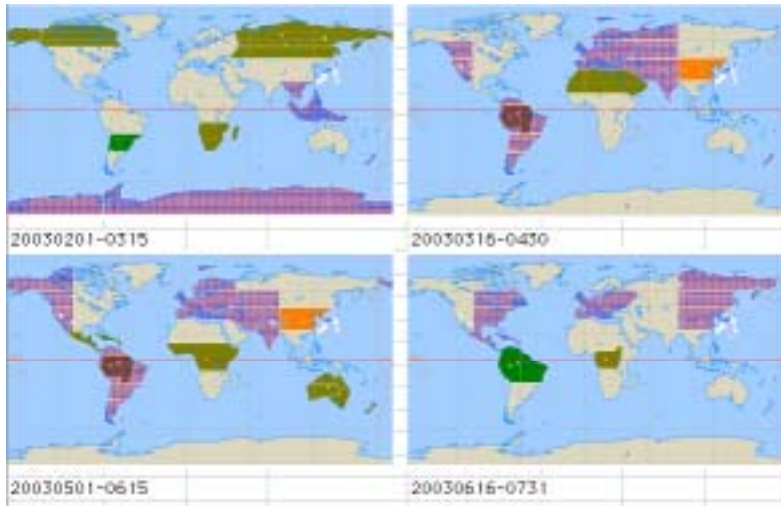


ALOS - Descending Cycle 1-4



ALOS - Descending

Cycle 5-8

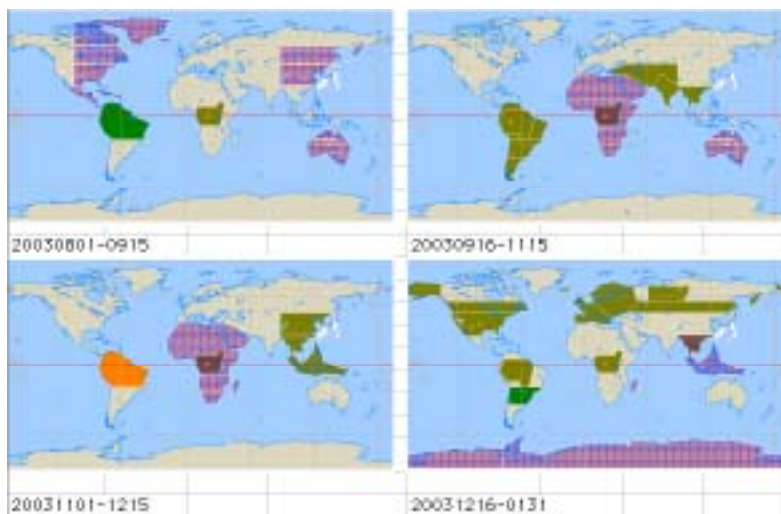


PALSAR, PRI SM AVNIR-2 Obs. Scenario v.10/07/2002



ALOS - Descending

Cycle 9-12

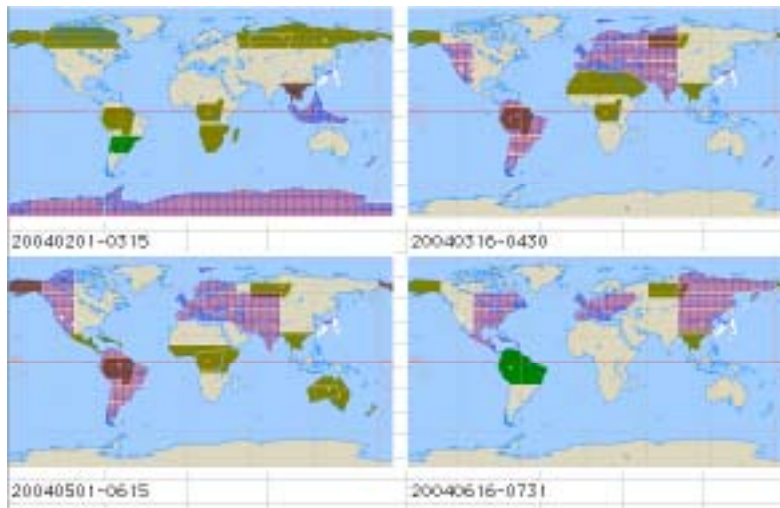


PALSAR, PRI SM AVNIR-2 Obs. Scenario v.10/07/2002



ALOS - Descending

Cycle 13-16

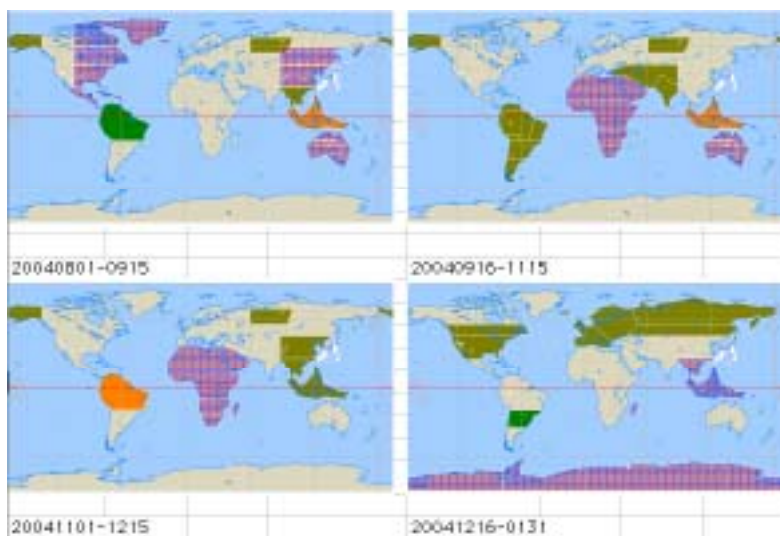


PALSAR, PRI SM AVNIR-2 Obs. Scenario v.10/07/2002



ALOS - Descending

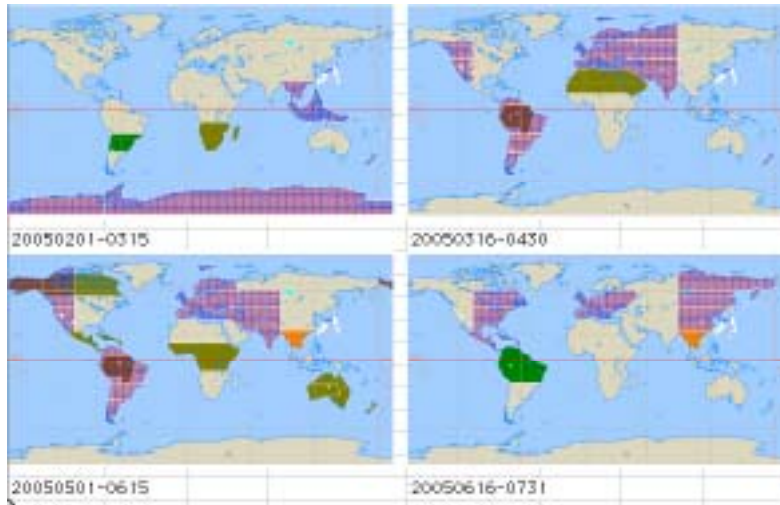
Cycle 17-20



PALSAR, PRI SM AVNIR-2 Obs. Scenario v.10/07/2002



ALOS - Descending Cycle 21-24



PALSAR, PRI SM AVNIR-2 Obs. Scenario v.10/07/2002



Implementation of the ALOS PALSAR Acquisition Strategy

- ALOS acquisition simulations are currently on-going at NASDA on an iterative basis.
- Acquisition plan is in a "state of evolution" as the effects of conflicts and technical constraints that are revealed, are attempted to be by-passed or minimised.
- Alignment of the plan with other internal and external observation requests attempted.
- Over-all "rules" for meaningful data acquisitions are still being observed.



PALSAR Scenario (v.10/07/2002) - Ascending

Kyoto Forest & Or-tho/DEM - Ascending																									
AREA NAME	Map code	2002												2003											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Penin. SE-Asia	A1 ASC																								
Insular SE-Asia	A2 ASC																								
Australia arid	B1 ASC																								
Australia N&E	B2 ASC																								
New Zealand	B3 ASC																								
N. Africa	C1 ASC																								
C. Africa	C2 ASC																								
S. Africa	C3 ASC																								
Madagascar	C4 ASC																								
S. America N	D1 ASC																								
S. America Mid	D2 ASC																								
S. America S	D3 ASC																								
Alaska	E1 ASC																								
N. Canada	E2 ASC																								
S. Canada	E3 ASC																								
USA	E4 ASC																								
Central Am	E5 ASC																								
Caribbean	E6 ASC																								
Europe N&E	F1 ASC																								
Europe S&W	F2 ASC																								
Iceland	F3 ASC																								
N. Siberia	G1 ASC																								
S. Siberia	G2 ASC																								
Far East	G3 ASC																								
India	G4 ASC																								
China	G5 ASC																								
Japan	G6 ASC																								
Kamchatka	G7 ASC																								

Yellow 28 MHz; HH; 34.3 deg. (FBS 7) Green 14 MHz; HH+HV; 34.3 deg. (FBD 43) Brown 14 MHz; HH; ScanSAR S-beam. (WB1 80)



Data Acquisition Strategy for ADEOS-II GLI 250 m

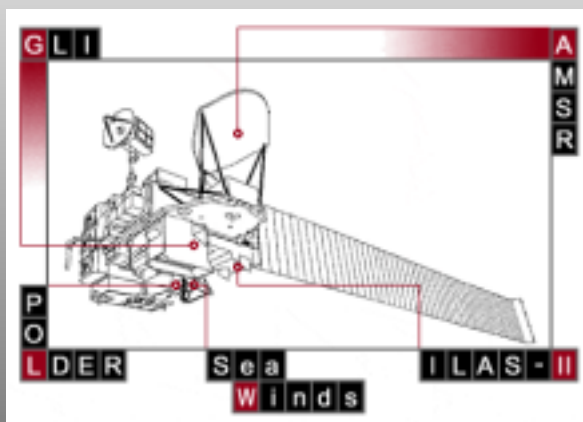
A. Rosenqvist, T. Igarashi, M. Matsuoka,
H. Yamamoto, H. Hashimoto
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Y. Nakajima
RESTEC

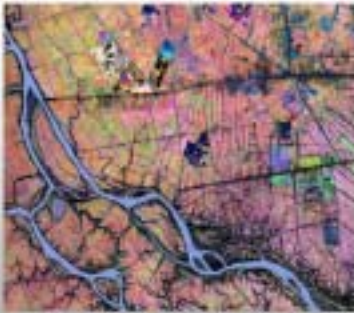
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ADEOS-II GLI-250m was incorporated into the
K&C Initiative in 2002, complementing the SAR
observations with medium resolution, 6 channel
(B, G, R, NIR, MIR*2) optical data.



GLI-250 Products

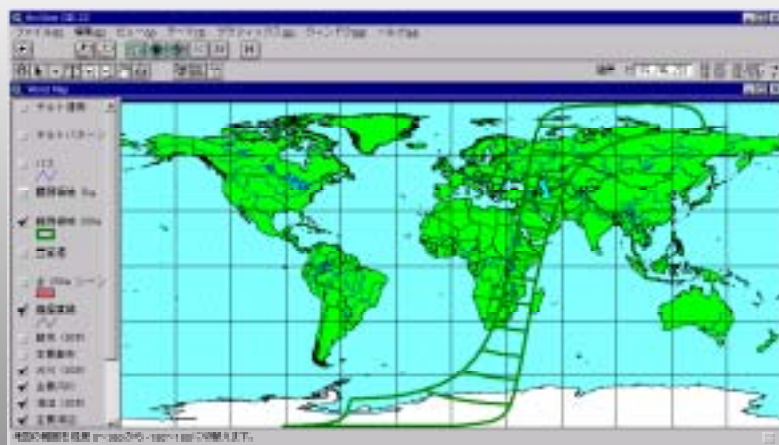


250 m resolution Land Cover
Classifications:
Continental -> Global
(K&C collaboration with Chiba
University)

Annual GLI-250 image (6 ch) mosaics
of all continents.
Corresponding in time with PALSAR mosaics

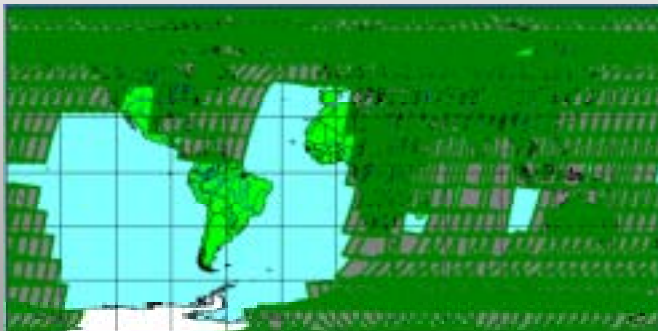


ADEOS-II GLI 250 m



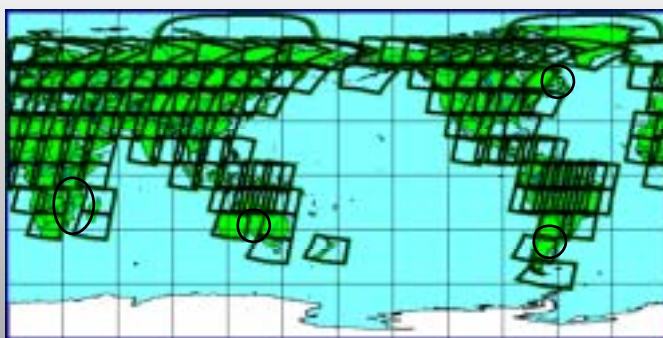
- Global coverage (land & water): 741 scenes
- Land only: ~335 scenes
- Land, excl. Arctic, Antarctic and isolated island: ~240 scenes

GLI regional coverage
using DRTS (E 90°) and direct down-link (DT) to the
4 main ground stations (EOC, ASF, KRNS & WFF)



Insufficient coverage over South America, Western USA, South Europe, West Africa & Central Siberia.

K&C Observation plan for GLI 250 m
Version 1.0 (Feb-02)



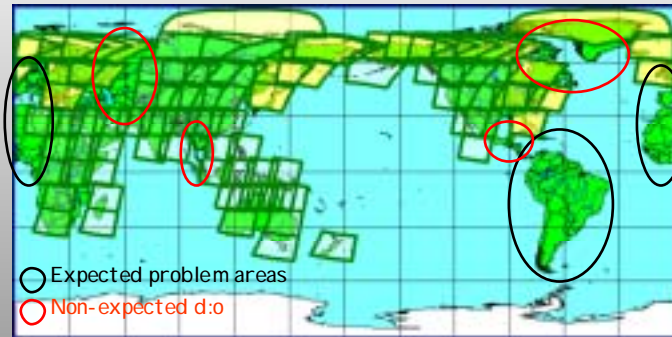
K&C request v.1.0:

- DT and DRTS: 1,866 scenes
- ODR: 328 scenes
- TOTAL: 2,194 scenes



ODR approved regions

First simulation results (Feb-2002)
Simulation period: 2003/02/03 - 07/13 (40 cycles)



- Simulation success rate:
- DT/DRTS: 57~63%
 - ODR: 36~47%
 - Success rate geogr. dependent
 - ODR operation poor (why?)
 - v.0.1 plan non-optimal
 - Effect of MMO background mission?

Default background mission: 13,149 scenes (DT/DRTS)

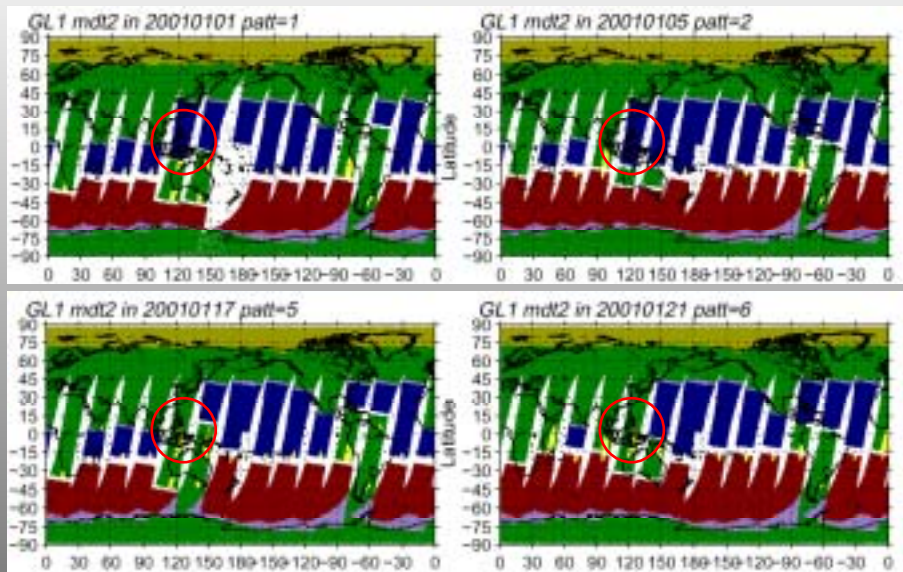
K&C Observation Strategy for GLI 250 m
Version 0.2 (Oct-02)

- All land areas covered;
- Acquisition time window latitude dependent
 - arctic/antarctic: summer solstice +/- 1 month;
 - boreal: April 1 - September 30;
 - temperate/tropical: all year.
- Acquisition priority for a scene is assigned sequentially within each pass, using a rotating scheme (effect of tilt-mode **not** taken into account);
- ODR use max 1 scene/orbit, in non-DT/DRTS areas;
- DT/DRTS: 13,469 scenes
- ODR: 1,557 scenes
- TOTAL: 15,026 scenes/year

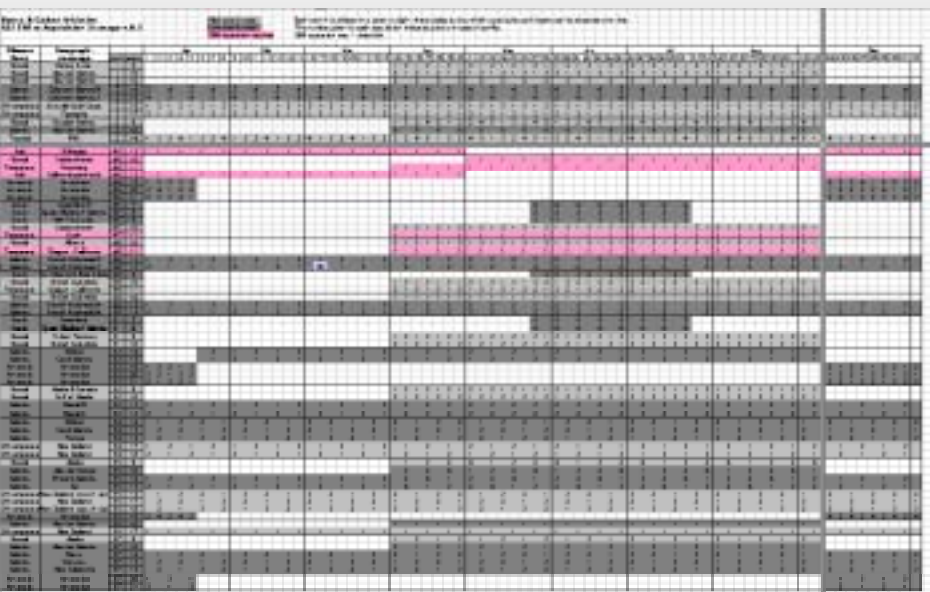
In comparison:

Default background mission (Feb-02 simulation):
13,149 scenes/40 cycles -> ~29,900 scenes/year
~2X K&C Obs. Strategy v.0.2

GLI sensor off-nadir tilting
 Reduced # useful scenes in coastal areas



K&C Observation Strategy for GLI 250 m
 Version 0.2 (Oct-02)



K&C Observation Strategy for GLI 250 m
Version 0.2 (Oct-02)

Kyoto & Carbon Initiative
GLI 250 m Acquisition Strategy v.0.2

High priority area
Low priority area
ODR operation reduced

All 92 (4-day) cycles

All land scenes

Climate Zone	Geograph. coverage	path	scene	Jan	Feb	Dec
Boreal	Bering Strait	1	9			
Boreal	Aleutian Islands	1	10			
Boreal	Aleutian Islands	2	10			
Islands	Solomon Islands N	2	14	1	4	3
Islands	Solomon Islands S	2	15	3	4	3
SH temperate	Australia Gold Coast	2	16	2	1	2
SH temperate	Tasmania	2	17	1	2	1
Boreal	Russian Bering	3	9			
Islands	Aleutian Islands	3	10			
Tropical	PNG	3	14	1	2	3
Tropical	N Australia	3	15	2	3	4
SH temperate	Australia	3	16	3	4	1
SH temperate	Australia	3	17	4	1	2
SH temperate	New Zealand (south tip)	55	18	3	1	2
Antarctic	Antarctica	55	19	4	3	4
Islands	Aleutian Islands	56	10			
SH temperate	New Zealand	56	17	1	1	1
Boreal	Alaska	57	9			
Islands	Aleutian Islands	57	10			
Islands	Nauru	57	14	1	2	3
Islands	Vanuatu	57	15	2	3	1
Islands	New Caledonia	57	16	3	1	2
Antarctic	Antarctica	57	20	1	2	1
Antarctic	Antarctica	57	21	2	1	2

K&C Observation Strategy for GLI 250 m
Version 0.2 (Oct-02)

Climate Zone	Geograph. coverage	path	scene	Mar	Apr	May	Jan
Boreal	Bering Strait	1	9	18	19	20	21
Boreal	Aleutian Islands	1	10	21	22	23	24
Boreal	Aleutian Islands	2	10	25	26	27	28
Islands	Solomon Islands N	2	14	29	30	31	1
Islands	Solomon Islands S	2	15	1	2	3	4
SH temperate	Australia Gold Coast	2	16	5	6	7	8
SH temperate	Tasmania	2	17	8	9	10	11
Boreal	Russian Bering	3	9	12	13	14	15
Islands	Aleutian Islands	3	10	15	16	17	18
Tropical	PNG	3	14	19	20	21	22
Tropical	N Australia	3	15	22	23	24	25
SH temperate	Australia	3	16	25	26	27	28
SH temperate	Australia	3	17	28	29	30	31
Boreal	Kala peninsula	25	9	1	2	3	4
Boreal	Belarus	25	10	2	3	4	5
Temperate	Balkan	25	11	3	4	5	6
LD	Lbya	25	12	4	5	6	7
LD	Chad	25	13	5	6	7	8
Tropical	Congo Basin W	25	14	6	7	8	9
SH temperate	Angola	25	15	7	8	9	10
Antarctic	Antarctica	25	16	8	9	10	11
Temperate	Baltic states	26	9	9	10	11	12
Temperate	Balkan	26	10	10	11	12	13
LD	Lbya	26	11	11	12	13	14
LD	Lake Chad	26	12	12	13	14	15
Tropical	Liban	26	13	13	14	15	16
ARCTIC	New Zealand Islands	27	7	1	2	3	4
ARCTIC	Finnish Arctic Land	27	8	2	3	4	5
Boreal	Finnish Arctic Land	27	9	3	4	5	6
Temperate	Finland	27	10	4	5	6	7
Temperate	Italy	27	11	5	6	7	8
LD	Algeria - Libya	27	12	6	7	8	9
LD	Libya	27	13	7	8	9	10
Tropical	East of Sudan	27	14	8	9	10	11

Rotating priority

ODR scenes : max 1/orbit



K&C v.0.2 Data flows

K&C Observation Strategy v.0.2 (100% success rate case):

- Average data flow: ~41 scenes/day
- Peak flow: ~57 scenes/day

(MMO background mission Feb-02: ~82 scenes/day)

Current capacity for 250 m Level 1B processing at EOC:

~30 scenes/day

Required capacity: 45/60 scenes/day for average/peak flow.

Current capacity for higher level (geom-corr, atm-corr, composit) processing at EORC: <5 scenes/day -> **Bottle-neck!**

Improved EORC processing capacity must be considered.



Kyoto & Carbon Initiative GLI 250 m Processing Flow

NASDA EOC

- Level 1B processing (EOC standard product)

NASDA EORC

- Geometric (DEM) correction;
- 16-day compositing (cloud elimination);
- Atmospheric correction (Rayleigh + O³)

NASDA EORC/Chiba Univ.

- Regional 16-day mosaic assembly

Chiba Univ.

- Continental -> Global 250 m Land Cover Classification



Acquisition plan - Time schedule

Oct. '02

K&C v.0.2 simulation

Nov. '02

v.0.2 plan revision -> K&C v.0.3

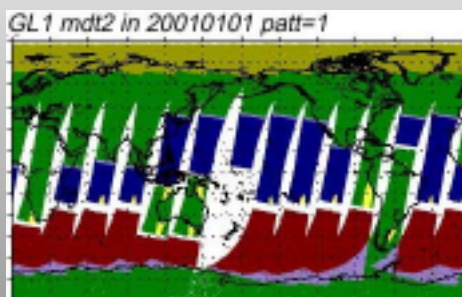
- Include additional obs. requests from GLI PI's and K&C collaborators
- Modify ODR mask
- Modify priority settings
- Consider tilt-mode bias effects

Dec. '02 (Jan. '03)

- K&C v.0.3 simulation
- v.0.3 plan revision -> K&C v.1.0 (FINAL)

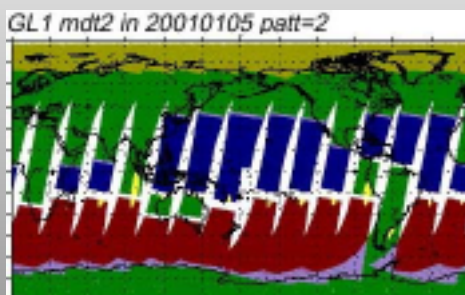
ADEOS-II launch

GLI tilt-patterns Satellite cycle 1 (day 1)

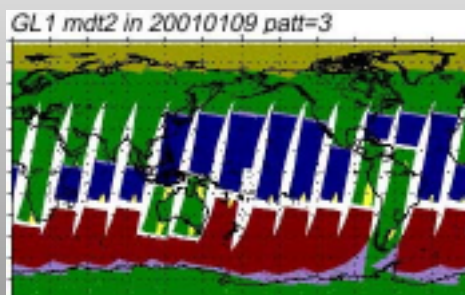


Tilting of the GLI sensor $\pm 20^\circ$ off-nadir
applied to minimise sun glint in ocean and coastal scenes.
Nadir/Off-nadir tilting cycle-dependent.

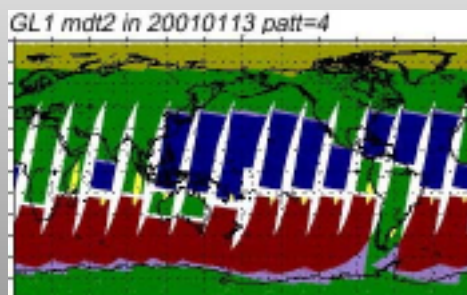
GLI tilt-patterns
Satellite cycle 2 (day 1)



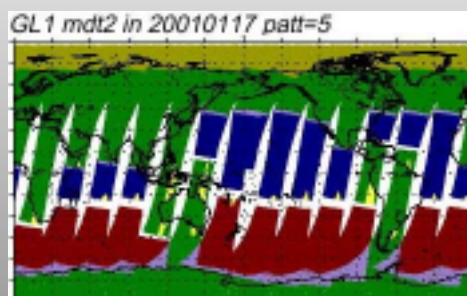
GLI tilt-patterns
Satellite cycle 3 (day 1)



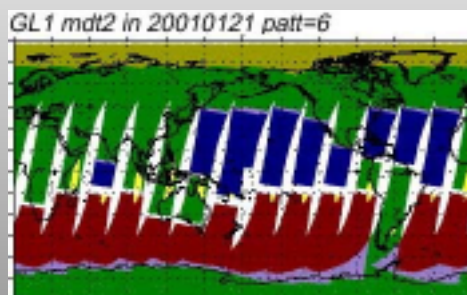
GLI tilt-patterns
Satellite cycle 4 (day 1)



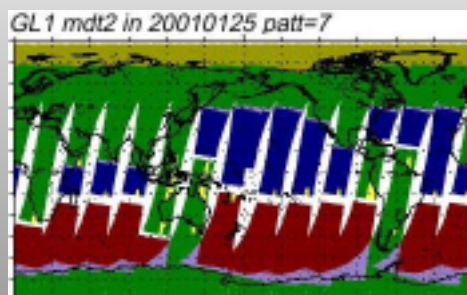
GLI tilt-patterns
Satellite cycle 5 (day 1)



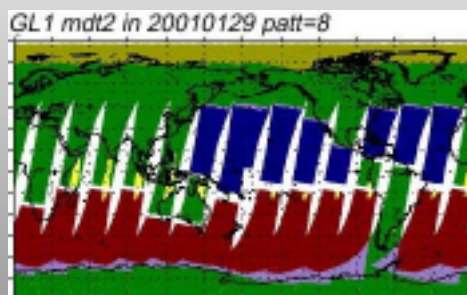
GLI tilt-patterns
Satellite cycle 6 (day 1)



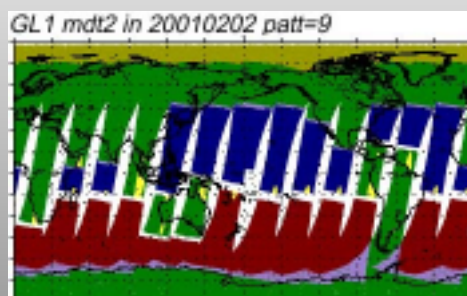
GLI tilt-patterns
Satellite cycle 7 (day 1)



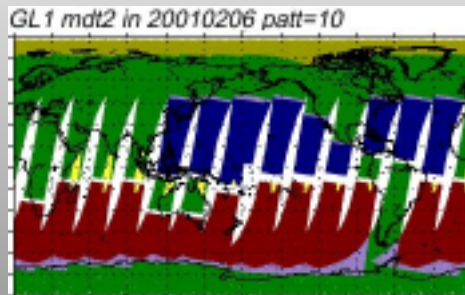
GLI tilt-patterns
Satellite cycle 8 (day 1)



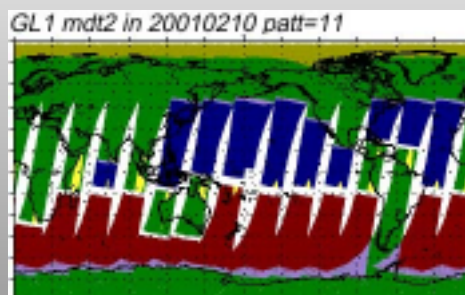
GLI tilt-patterns
Satellite cycle 9 (day 1)



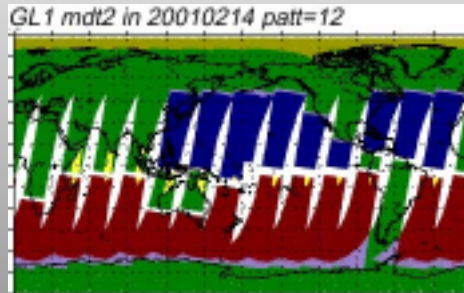
GLI tilt-patterns
Satellite cycle 10 (day 1)



GLI tilt-patterns
Satellite cycle 11 (day 1)



GLI tilt-patterns Satellite cycle 12 (day 1)



Global Imager - Spectral characteristics

National Space Development Agency of Japan

NASDA

VNIR		SWIR		MTIR	
ch1	480(10) O A C	ch24	1090(20) E A C	ch30	1.7140(1.5) O A C
ch2	480(10) O	ch25	1135(50) A	ch31	6.700(0.5) A
ch3	480(10) O	ch26	1140(20) E A C	ch32	7.300(0.5) A
ch4p	445(10) O E A C	ch27	1180(40) A	ch33	7.500(0.5) A
ch5p	460(10) O E A C			ch34	8.600(0.5) O E A C
ch6	490(10) O	ch28	1640(200) E A C	ch35	15.00(1.0) O E A C
ch7p	520(10) O A C	ch29	2100(120) E A C	ch36	12.00(1.0) O E A C
ch8p	545(10) O A C				
ch9	565(10) O				
ch10	625(10) O				
ch11	640(10) O				
ch12	680(10) O				
ch13	670(10) E A C				
ch14	710(10) O				
ch15	710(10) E A C				
ch16	740(10) O				
ch17	765(0) E A				
ch18	865(20) O				
ch19	865(10) E A C				
(quasi-simultaneous images)					
ch20	440(70) E A C				
ch21	545(50) E A C				
ch22	640(60) E A C				
ch23	825(110) E A C				
	unit [nm]				

GLI

Cross tracking scan

Altitude : 803 km

Inclination : 98.6 deg.

Swath width : 1600 km

Resolution (nadir) : 1 km

Resolution (equator) : 250 m

Tilt angle : 20 deg.

Period : 100 min.

Recurrent Period : 4 days

Local time : 10:30 AM

Data rate : 4.1Mbps

APPLICATION CODE

O = OCEAN

L = LAND

A = ATMOSPHERE

C = CRYOSPHERE

NASDA/GLI/GAIT

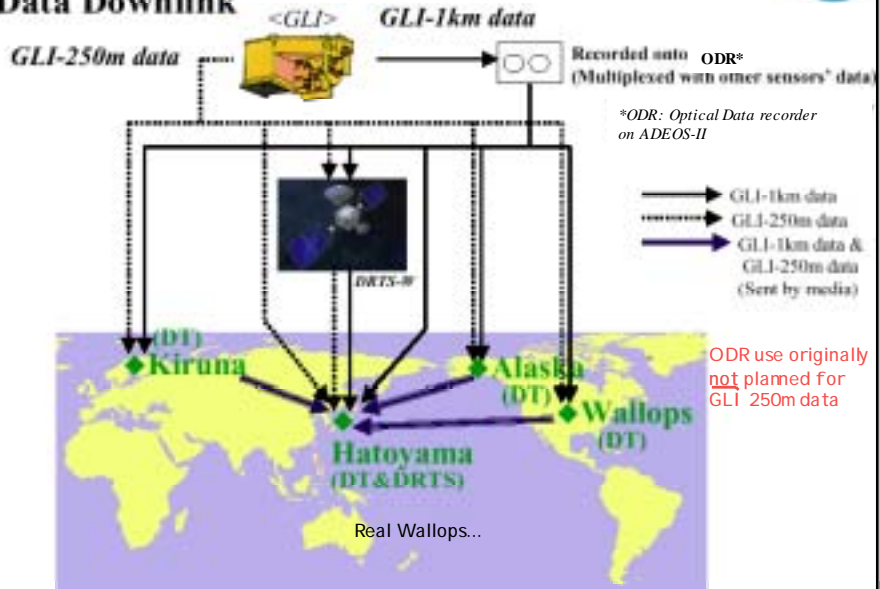
30 bands @ 1 km

6 bands @ 250 m

1. ADEOS-II Mission Operation



1.2 Data Dinklink



Version 0.2 (Oct-02)

High priority area	
Low priority area	

All 92 (4-day) cycles

Kyoto & Carbon Initiative													High priority area		Low priority area		All 92 (4-day) cycles																									
GLI 250 m Acquisition Strategy v.0.2													ODR operation required																													
Climate		Geograph.		Jan													Feb													Dec												
Zone	coverage	path	scene	1	2	3	4	5	6	7	8	9	10	11	12	13	86	87	88	89	90	91	92																			
Boreal	Bering Strait	1	9																																							
Boreal	Aleutian Islands	1	10																																							
Boreal	Aleutian Islands	2	10																																							
Islands	Solomon Islands N	2	14	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3																				
Islands	Solomon Islands S	2	15	4	3	4	3	4	3	4	3	4	3	4	3	4	4	3	4	3	4	3																				
SH temperate	Australia Gold Coast	2	16	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1																				
SH temperate	Tasmania	2	17	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2																				
Boreal	Russian Bering	3	9																																							
Islands	Aleutian Islands	3	10																																							
Tropical	PNG	3	14	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3																				
Tropical	N Australia	3	15	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4																				
SH temperate	Australia	3	16	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1																				
SH temperate	Australia	3	17	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2																				
SH temperate	New Zealand (south tip)	55	18	3	3	1	2	2	3	3	1	2	2	3	3	2	3	1	2	2	3	2																				
Antarctic	Antarctica	55	19	3	4	3	4	3									4	3	4	3	4	3																				
Islands	Aleutian Islands	56	10																																							
SH temperate	New Zealand	56	17	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1																						
Boreal	Alaska	57	9																																							
Islands	Aleutian Islands	57	10																																							
Islands	Nauru	57	14	1	2	2	3	3	1	2	3	2	3	3	2	3	1	2	3	3	2	3																				
Islands	Vanuatu	57	15	2	3	3	1	2	2	3	2	3	3	1	2	3	2	3	3	1	2	3																				
Islands	New Caledonia	57	16	3	1	1	2	2	3	3	3	1	2	3	2	3	3	1	2	3	2	3																				
Antarctic	Antarctica	57	20	1	2	1	1										2	1	2	2	1	2																				
Antarctic	Antarctica	57	21	2	1	1	2	2									1	2	2	1	2	1																				

K&C Observation Strategy for GLI 250 m

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Climate Zone	Geograph. coverage	path	scene	Mar							Apr							May							Jun						
				18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
Boreal	Bering Strait	1	9							1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Boreal	Aleutian Islands	1	10							2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	1	2	1	2		
Boreal	Aleutian Islands	2	10							3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
Islands	Solomon Islands N	2	14							4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	4	3	4	3	4		
Islands	Solomon Islands S	2	15							3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	4	3	4	3		
SH temperate	Australia Gold Coast	2	16	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1		
SH temperate	Tasmania	2	17	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Boreal	Russian Bering	3	9							1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
Islands	Aleutian Islands	3	10							0	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
Tropical	PNG	3	14	2	3	4	1	2	3	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1		
Tropical	N Australia	3	15	3	4	1	2	3	4	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2		
SH temperate	Australia	3	16	4	1	2	3	4	1	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3		
SH temperate	Australia	3	17	1	2	3	4	1	2	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4		
Boreal	Kola peninsula	25	9							1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6		
Boreal	Belorussia	25	10							2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
Temperate	Balkan	25	11							3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1		
Arid	Libya	25	12	2	3	4	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2		
Sahel	Chad	25	13	3	4	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3		
Tropical	Congo Basin W	25	14	4	1	2	3	4	1	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4		
SH temperate	Angola	25	15	1	2	3	4	1	2	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5		
Antarctic	Antarctica	25	19																												
Temperate	Baltic states	26	10							2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3		
Temperate	Balkan	26	11							3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2		
Arid	Libya	26	12																												
Sahel	Lake Chad	26	13	1						1							1							1					1		
Tropical	Gabon	26	14	1						1							1							1					1		
Arctic	New Siberian Islands	27	7																												
Arctic	Franz Josef Land	27	8																												
Boreal	Fennoscandia N	27	9							2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3		
Temperate	Poland	27	10							3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2		
Temperate	Italy	27	11							2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3		
Arid	Algeria - Libya	27	12							1							1							1					1		
Sahel	Nigeria	27	13																												
Tropical	Gulf of Guinea	27	14	1						1							1							1					1		