



DLR/TerraSAR-X: development of IPY portofolio since the SAR coordination workshop (CSA, March 2008)

Dana Floricioiu

Acquisitions themes

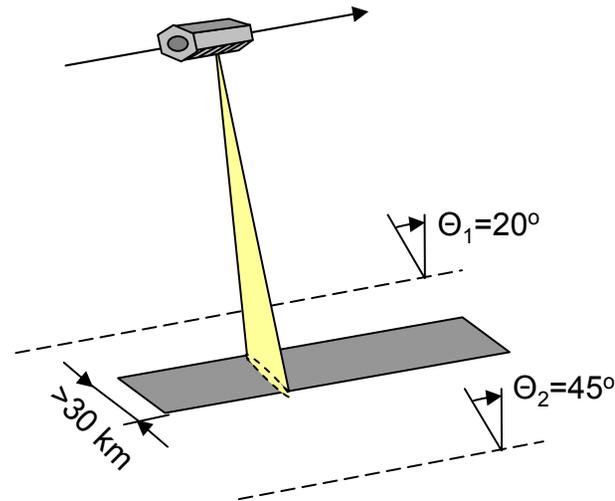
adopted at the SAR coordination workshop 5/6 March'08 where TerraSAR-X can contribute:

1. Antarctica: pole to coast InSAR coverage in high resolution mode (4 consecutive cycles in asc and desc) in winter; pole hole mapping
2. Greenland and major Canadian icefields: InSAR acquisitions in high resolution mode (3,4 consecutive cycles in asc and desc) in winter
3. Multi- and full-polarimetric data acquisitions over common supersites



Theme 1. Antarctica: pole to coast InSAR coverage in high resolution mode

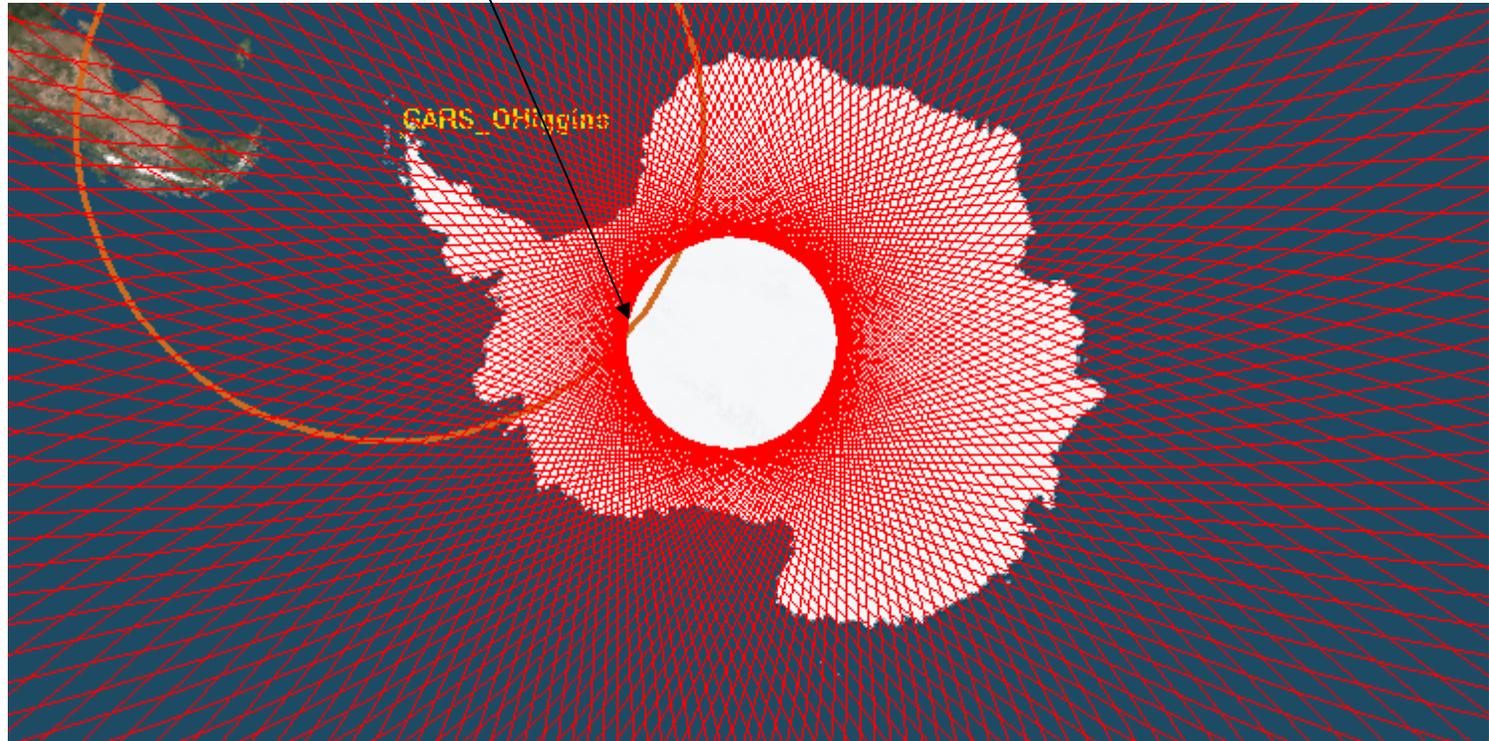
Suggested TSX acquisition mode: Stripmap (SM)



- swath width (range): **30 km** single pol. (15 km dual pol.)
- full performance incidence angle range: 20 - 45 deg (access range 15 - 60 deg)
- azimuth resolution: **3.3 m** single pol. (6.6 m dual pol.)
- ground range resolution 150 MHz chirp BW: **1.7 m - 3.5 m** (45 – 20 deg)
- nom. product length: 8 sec. (50 km). **For IPY up to 60 sec. possible (350 km)**
- polarizations*: **single** HH or **VV**, dual (HH/VV), (HH/HV) or (VV/VH)

TerraSAR-X maximum coverage towards the South pole

sub satellite track 82.6°S



Stripmap mode:

Nominal mode: **right looking** and full performance beam (inc. angle 20 deg, strip_003) up to **81°S** possible

Left looking and full performance beam (inc. angle about 45 deg, strip_014) up to **87.1°S** possible

Left looking and max. access range (inc. angle 60 deg, strip_027) up to **89.7°S**

Left looking EOWEB Request simulation (1):

1 day (05.5.2008), one beam/orbit (no conflicts) 60°inc. angle (max.possible);

Region of interest: South of **89.0°S**

Result: 15 scenes, scene length 30" (190 km).

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Catalogue | **Future Products / Acquisitions** | **User Set**

Collections :

- Deselect all
- Expand/collapse
- 1 Collection selected
- TSX-1 Future Products**
 - TSX-1 SAR L0 Spotlight future products
 - TSX-1 SAR L0 High Resolution Spotlight future products
 - TSX-1 SAR L0 Stripmap future products**
 - TSX-1 SAR L0 Stripmap future coverages
 - TSX-1 SAR L0 Stripmap future scenes**
 - TSX-1 SAR L0 ScansAR future products

Acquisition Window: Choose a Date | From: 2008-05-05 00:00:00,000 | To: 2008-05-05 23:59:59,999 | Step by range

Region of Interest: Polygon | Import | Export

Nr.	Latitude	Longitude
1	-89.029	-14.676
2	-89.015	-59.605
3	-89.034	-97.217
4	-88.974	-131.046
5	-88.988	-165.989

Acquisition Criteria:

Incidence Angle [degree]	0 - 90
Pass Direction	Ascending/Descending
Looking Direction	Left
Polarization Mode	Single

1 record selected

Start Date	End Date	Sensor Mode	Polarization Mode	Start Orbit	Stop Orbit	Beam	Full Perf.	Min. Inc.	Angle
2008-05-05T01:09:13.7...	2008-05-05T01:09:42.7...	Stripmap	Single	90	90	strip_027L	59.558629150439636		6
2008-05-05T02:44:04.7...	2008-05-05T02:44:34.7...	Stripmap	Single	91	91	strip_027L	59.562551707957006		6
2008-05-05T04:18:55.7...	2008-05-05T04:19:26.7...	Stripmap	Single	92	92	strip_027L	59.559828026119256		6
2008-05-05T05:53:46.7...	2008-05-05T05:54:16.7...	Stripmap	Single	93	93	strip_027L	59.55930134960268		6
2008-05-05T07:28:37.7...	2008-05-05T07:29:07.7...	Stripmap	Single	94	94	strip_027L	59.5556762357796		6
2008-05-05T09:03:27.7...	2008-05-05T09:03:57.7...	Stripmap	Single	95	95	strip_027L	59.5580055626617		6
2008-05-05T10:38:19.7...	2008-05-05T10:38:47.7...	Stripmap	Single	96	96	strip_027L	59.558847770331354		6
2008-05-05T12:13:10.7...	2008-05-05T12:13:39.7...	Stripmap	Single	97	97	strip_027L	59.558277113338654		6
2008-05-05T13:48:00.7...	2008-05-05T13:48:31.7...	Stripmap	Single	98	98	strip_027L	59.55589587838138		6
2008-05-05T15:22:51.7...	2008-05-05T15:23:22.7...	Stripmap	Single	99	99	strip_027L	59.556614863729486		6
2008-05-05T16:57:43.7...	2008-05-05T16:58:12.7...	Stripmap	Single	100	100	strip_027L	59.5574325141091		6
2008-05-05T18:32:35.7...	2008-05-05T18:33:04.7...	Stripmap	Single	101	101	strip_027L	59.5580550027034		6
2008-05-05T20:07:26.7...	2008-05-05T20:07:55.7...	Stripmap	Single	102	102	strip_027L	59.56023871860679		6
2008-05-05T21:42:16.7...	2008-05-05T21:42:45.7...	Stripmap	Single	103	103	strip_027L	59.55941146460808		6
2008-05-05T23:17:07.7...	2008-05-05T23:17:37.7...	Stripmap	Single	104	104	strip_027L	59.55876212588096		6

89.0°S | **89.7°S**

Submit Query

Left looking EOWEB Request simulation (2):

1 day (05.5.2008), one beam/orbit (no conflicts) 44° inc. angle (nominal product)

Region of interest : South of **86.0°S**

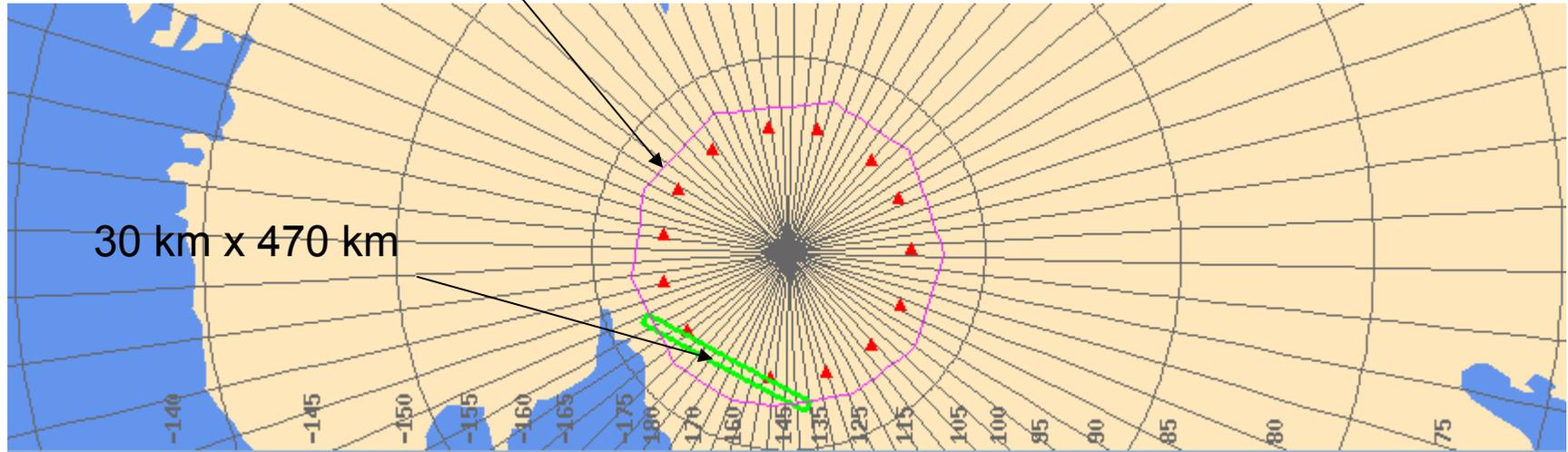
Result: 15 scenes, scene length 1' 15" (470 km).

86°S

87.1°S

Lat 86.0S

30 km x 470 km



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Choose a

From

To

Step by range

10	-86.041	58.939
11	-85.995	18.544
12	-86.029	-14.676

Acquisition Criteria:

Incidence Angle [degree]	43 - 46
Pass Direction	Ascending/Descending
Looking Direction	Left
Polarization Mode	Single

2008-05-05T09:03:02.7...	2008-05-05T09:04:23.7...	Stripmap	Single	95	95	strip_014L	43.68442049373587	45.6
2008-05-05T10:37:55.7...	2008-05-05T10:39:13.7...	Stripmap	Single	96	96	strip_014L	43.68374492638458	45.6
2008-05-05T12:12:46.7...	2008-05-05T12:14:01.7...	Stripmap	Single	97	97	strip_014L	43.67057250090721	45.6
2008-05-05T13:47:33.7...	2008-05-05T13:48:54.7...	Stripmap	Single	98	98	strip_014L	43.69059116773415	45.6
2008-05-05T15:22:25.7...	2008-05-05T15:23:47.7...	Stripmap	Single	99	99	strip_014L	43.69096202393962	45.6
2008-05-05T16:57:22.7...	2008-05-05T16:58:35.7...	Stripmap	Single	100	100	strip_014L	43.69155784430174	45.6
2008-05-05T18:32:10.7...	2008-05-05T18:33:25.7...	Stripmap	Single	101	101	strip_014L	43.69252350956009	45.6
2008-05-05T20:06:59.7...	2008-05-05T20:08:22.7...	Stripmap	Single	102	102	strip_014L	43.69341612880892	45.6
2008-05-05T21:41:54.7...	2008-05-05T21:43:09.7...	Stripmap	Single	103	103	strip_014L	43.692414923298585	45.6
2008-05-05T23:16:46.7...	2008-05-05T23:17:58.7...	Stripmap	Single	104	104	strip_014L	43.691680859161494	45.6
2008-05-05T01:08:46.7...	2008-05-05T01:10:12.7...	Stripmap	Single	90	90	strip_015L	45.35218810713823	47.2
2008-05-05T02:43:37.7...	2008-05-05T02:45:00.7...	Stripmap	Single	91	91	strip_015L	45.354156989216136	47.2
2008-05-05T04:18:28.7...	2008-05-05T04:19:52.7...	Stripmap	Single	92	92	strip_015L	45.347753049273685	47.2
2008-05-05T05:53:21.7...	2008-05-05T05:54:46.7...	Stripmap	Single	93	93	strip_015L	45.315168797708836	47.2
2008-05-05T07:28:10.7...	2008-05-05T07:29:35.7...	Stripmap	Single	94	94	strip_015L	45.29877410560743	47.2
2008-05-05T09:02:59.7...	2008-05-05T09:04:27.7...	Stripmap	Single	95	95	strip_015L	45.340357376846606	47.2

Submit Query

Display

Left looking EOWEB Request simulation (3):

1 day (05.5.2008), one beam/orbit (no conflicts), 44° inc. angle

Region of interest : South of **85.0°S**

Result: 15 scenes, length 2 min.

85.0°S

87.1S

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Shop Cart **Order Monitoring**

Catalogue **Future Products / Acquisitions** **User Set**

Collections :

Deselect all Expand/collapse 1 Collection selected

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 - TSX-1 SAR L0 Stripmap future products**
 - TSX-1 SAR L0 Stripmap future coverages
 - TSX-1 SAR L0 Stripmap future scenes**
 - TSX-1 SAR L0 ScanSAR future products

Acquisition Window: **Region of Interest:**

Choose a Date:

From: 2008-05-05 00:00:00,000 To: 2008-05-05 23:59:59,999

Step by range:

Start Date	End Date	Sensor Mode	Polarization Mode	Start Orbit	Stop Orbit	Beam	Full Perf.	Min. Inc. Angle	Full
2008-05-05T13:47:17.7...	2008-05-05T13:49:13.7...	Stripmap	Single	98	98	strip_013L	41.94266329344672	44.024	44.024
2008-05-05T13:47:15.7...	2008-05-05T13:49:17.7...	Stripmap	Single	98	98	strip_014L	43.66275365800236	45.679	45.679
2008-05-05T13:47:12.7...	2008-05-05T13:49:22.7...	Stripmap	Single	98	98	strip_015L	45.32370261906691	47.261	47.261
2008-05-05T15:22:08.7...	2008-05-05T15:24:03.7...	Stripmap	Single	99	99	strip_013L	41.955367044285	44.024	44.024
2008-05-05T15:22:05.7...	2008-05-05T15:24:06.7...	Stripmap	Single	99	99	strip_014L	43.67836189806704	45.659	45.659
2008-05-05T15:22:02.7...	2008-05-05T15:24:09.7...	Stripmap	Single	99	99	strip_015L	45.34321522572964	47.221	47.221
2008-05-05T16:56:59.7...	2008-05-05T16:58:57.7...	Stripmap	Single	100	100	strip_013L	41.95773732218552	44.006	44.006
2008-05-05T16:56:56.7...	2008-05-05T16:58:59.7...	Stripmap	Single	100	100	strip_014L	43.6893618182368	45.647	45.647
2008-05-05T16:56:53.7...	2008-05-05T16:59:00.7...	Stripmap	Single	100	100	strip_015L	45.344933803368085	47.216	47.216
2008-05-05T18:31:52.7...	2008-05-05T18:33:43.7...	Stripmap	Single	101	101	strip_013L	41.96095961938563	44.006	44.006
2008-05-05T18:31:49.7...	2008-05-05T18:33:47.7...	Stripmap	Single	101	101	strip_014L	43.69252350956009	45.644	45.644
2008-05-05T18:31:47.7...	2008-05-05T18:33:51.7...	Stripmap	Single	101	101	strip_015L	45.348022717660534	47.214	47.214
2008-05-05T20:06:42.7...	2008-05-05T20:08:38.7...	Stripmap	Single	102	102	strip_013L	41.96134116819437	44.007	44.007
2008-05-05T20:06:39.7...	2008-05-05T20:08:40.7...	Stripmap	Single	102	102	strip_014L	43.69313004258623	45.648	45.648
2008-05-05T20:06:37.7...	2008-05-05T20:08:43.7...	Stripmap	Single	102	102	strip_015L	45.34824746401208	47.216	47.216
2008-05-05T21:41:35.7...	2008-05-05T21:43:31.7...	Stripmap	Single	103	103	strip_013L	41.959104786673294	44.008	44.008
2008-05-05T21:41:30.7...	2008-05-05T21:43:33.7...	Stripmap	Single	103	103	strip_014L	43.690545618674314	45.648	45.648
2008-05-05T21:41:26.7...	2008-05-05T21:43:34.7...	Stripmap	Single	103	103	strip_015L	45.345723602565506	47.216	47.216
2008-05-05T23:16:22.7...	2008-05-05T23:18:15.7...	Stripmap	Single	104	104	strip_013L	41.957429023826116	44.010	44.010
2008-05-05T23:16:20.7...	2008-05-05T23:18:18.7...	Stripmap	Single	104	104	strip_014L	43.68851653135575	45.651	45.651
2008-05-05T23:16:18.7...	2008-05-05T23:18:21.7...	Stripmap	Single	104	104	strip_015L	45.34368788392467	47.222	47.222

Acquisition Criteria:

- Incidence Angle [degree]: 43 - 46
- Pass Direction: Ascending/Descending
- Looking Direction: Left
- Polarization Mode: Single

Submit Query

15 records selected

TerraSAR-X left looking (LL) mode:

Successfully tested for single scenes but not for large areas:

- impact on mission operations (solar antenna, SAR antenna orientations)
- products have degraded performance

Scientific community: should give a detailed planning of the acquisitions (areas, incidence angle, polarization, priorities, period of the acq.). 4 successive cycles (11 day repeat pass) or with longer interval?

DLR:

- looks which Antarctic regions desired by the IPY - community can be acquired in one 11-days cycle
- consultancy of EADS - Astrium (constructor) for larger acquisitions in LL mode
- checks other restrictions for the proposed dates (orbit usage, maintenance phases, eclipse)

Theme 3. Multi-frequency (C-, L-, X) and fully polarimetric data acquisitions over common supersites

Dual receive antenna (DRA) configuration – experimental mode of TerraSAR-X:

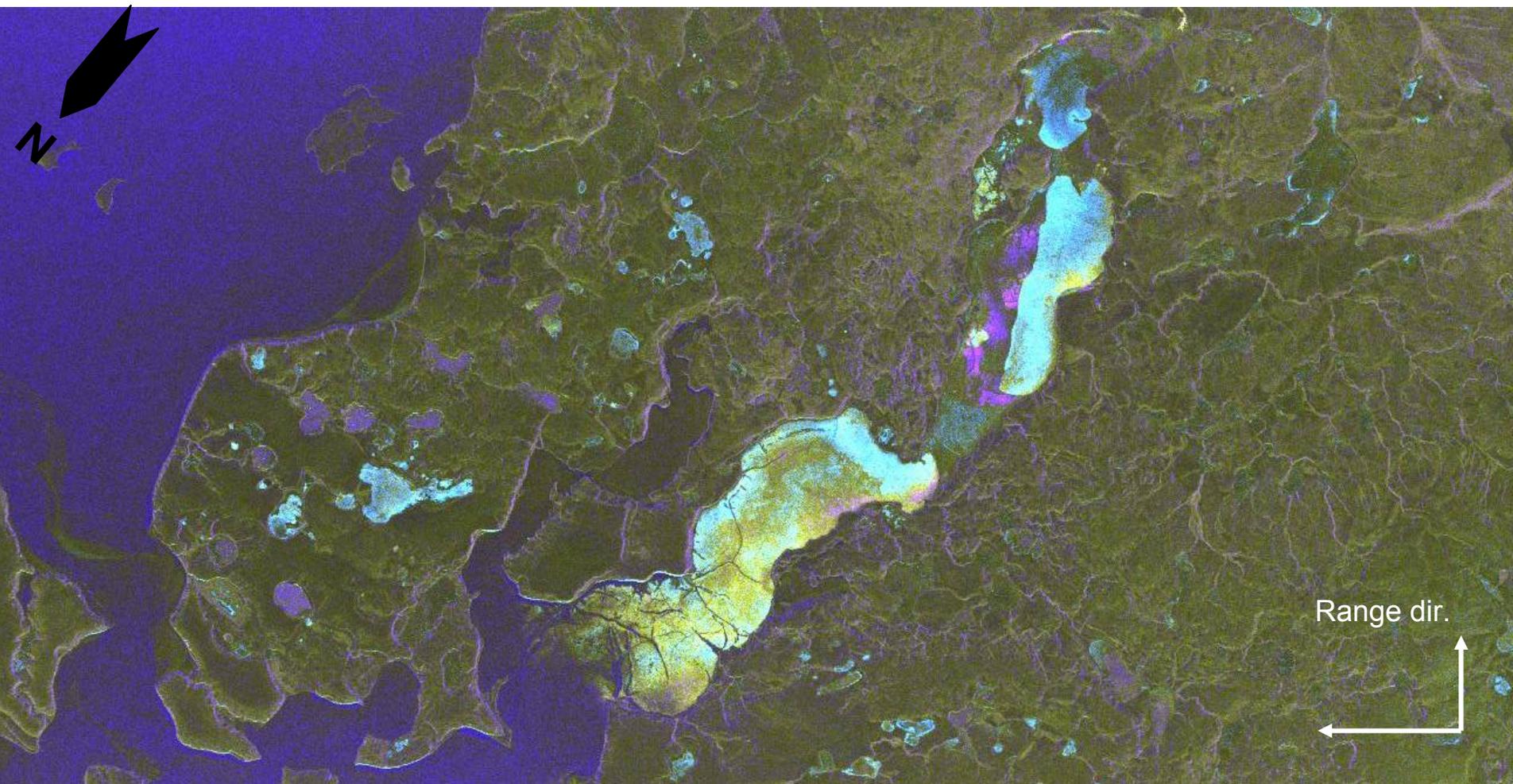
- DRA tests are planned for summer 2008, for fully polarimetric and along track interferometry imaging.
- Test sites for fully polarimetric acquisitions can be proposed (through D. Floricioiu). **IPY - supersites** selected by the scientific community are welcome (applications: sea ice, permafrost, glacier facies, SWE). **Deadline 10 June 2008.**
- Quad pol TerraSAR-X acquisitions: in **August 2008**

Recent TSX acquisitions for the IPY project on state and fate of the Canadian cryosphere: region Inuvik; mode stripmap, dual pol VV/VH, 6 test sites

Husky Lake 68.8N 133.1W; 6 April 2008

41 deg inc. angle

VH, VV, VH-VV

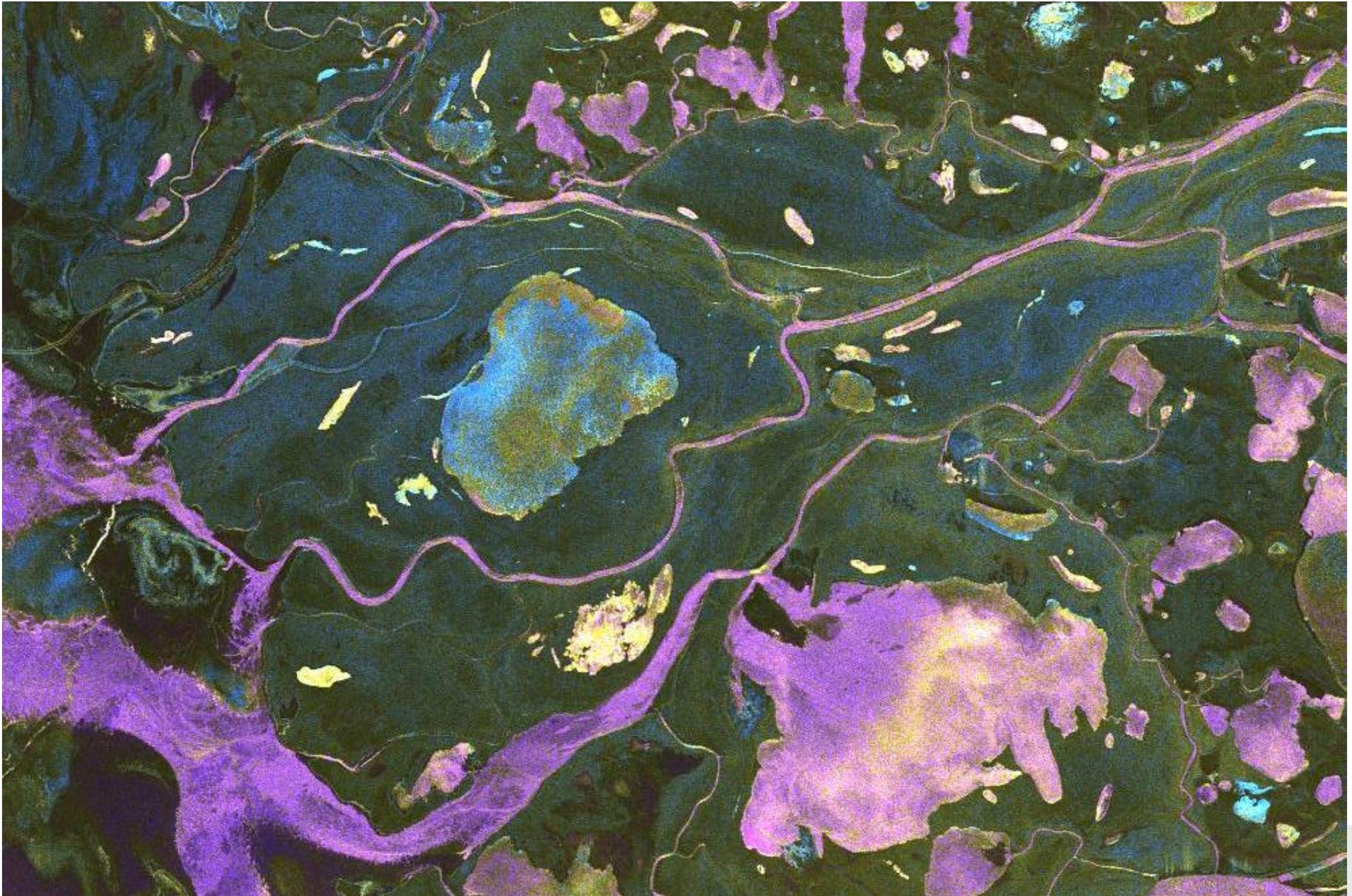


Inuvik Campaign – Site: Delta 69.4N 135.2W; 25 April 2008

VH, VV, VH-VV

23 deg inc. angle

DT 5073



Access to TerraSAR-X data for scientific use in IPY

- Pre-launch accepted proposals (status 29.04.2008):
 - ▶ ☺ COA0195 Ronald Saper (Vantage Point International) *active*
 - ▶ ☺ HYD0270 Alexander Braun (University of Calgary) *active*
 - ▶ LAN0066 Kenneth Jezek (Ohio State University) *not active*
 - ▶ ☺ LAN0013 Mathias Braun (University of Bonn) *active*
 - ▶ ☺ MTH0123 Wolfgang Dierking (AWI) *active*
 - ▶ ☺ MTH0176 Kjell Arild Hogda (Norut IT) *active*
 - ▶ ☺ OCE0116 Detlev Stammer (University of Hamburg) *active*

New IPY related science proposals for TerraSAR-X submitted since March 2008

Ice velocity:

- ▶ 😊 HYD0377 Ian Joughin (Univ of Washington) - accepted

Greenland glaciers and Antarctica, if LL possible: Whillans and Kamb ice streams

Should we gather/acquire all LL sites for IPY in the common DLR - IPY proposal?

- ▶ HYD0396 Dana Floricioiu (DLR)

Antarctic peninsula – outlet glaciers around Larsen A and B



Stripmap, single polarization

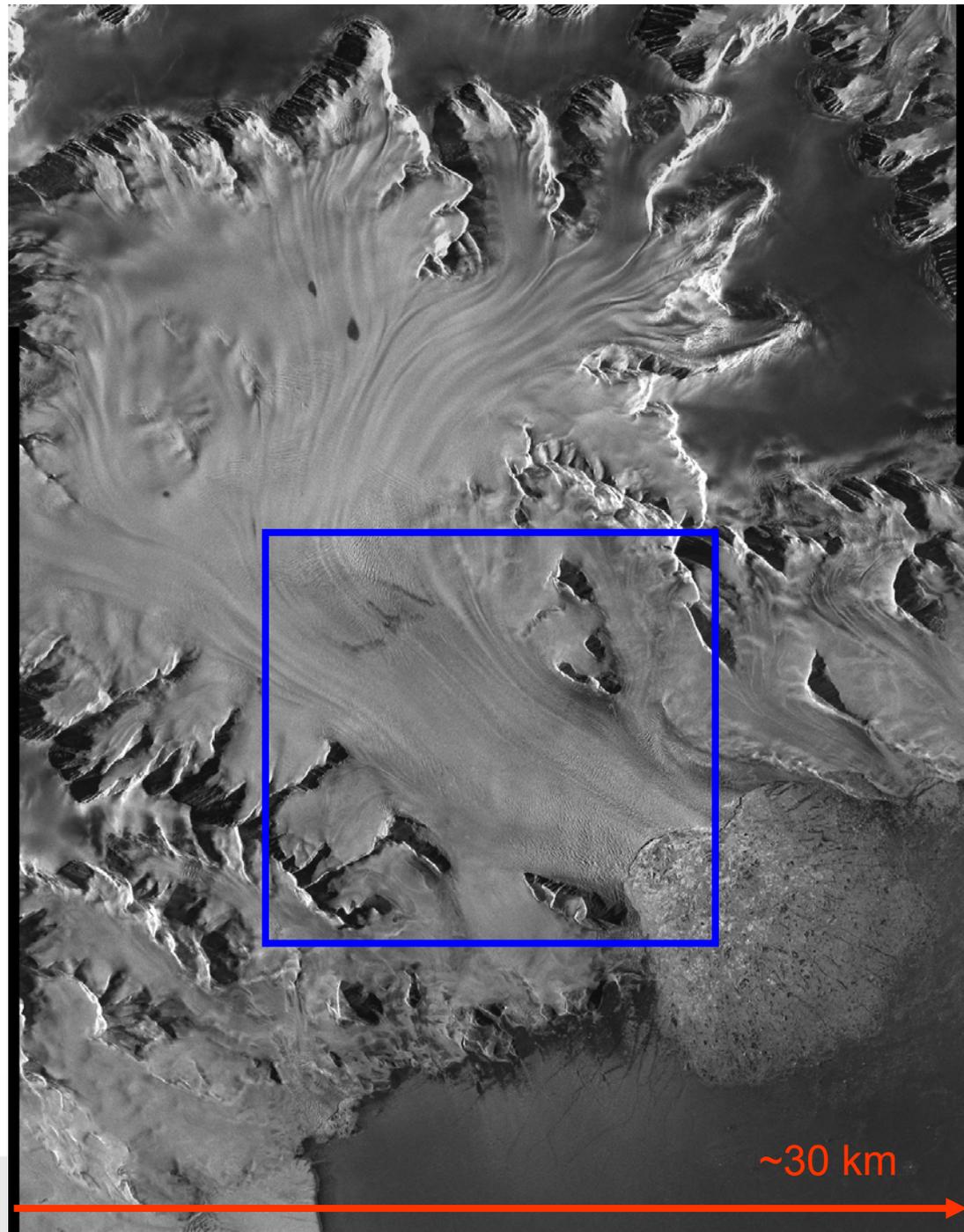
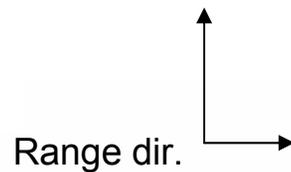
Drygalski glacier, Antarctic peninsula, 08.10.2007

Polarisation: HH

Incidence Angle: 37 deg
(beam:strip_010 R)



Flight dir (Asc)



TerraSAR-X stripmap mode

8.10.07

**Envisat ASAR image
mode (30 m res.)**

