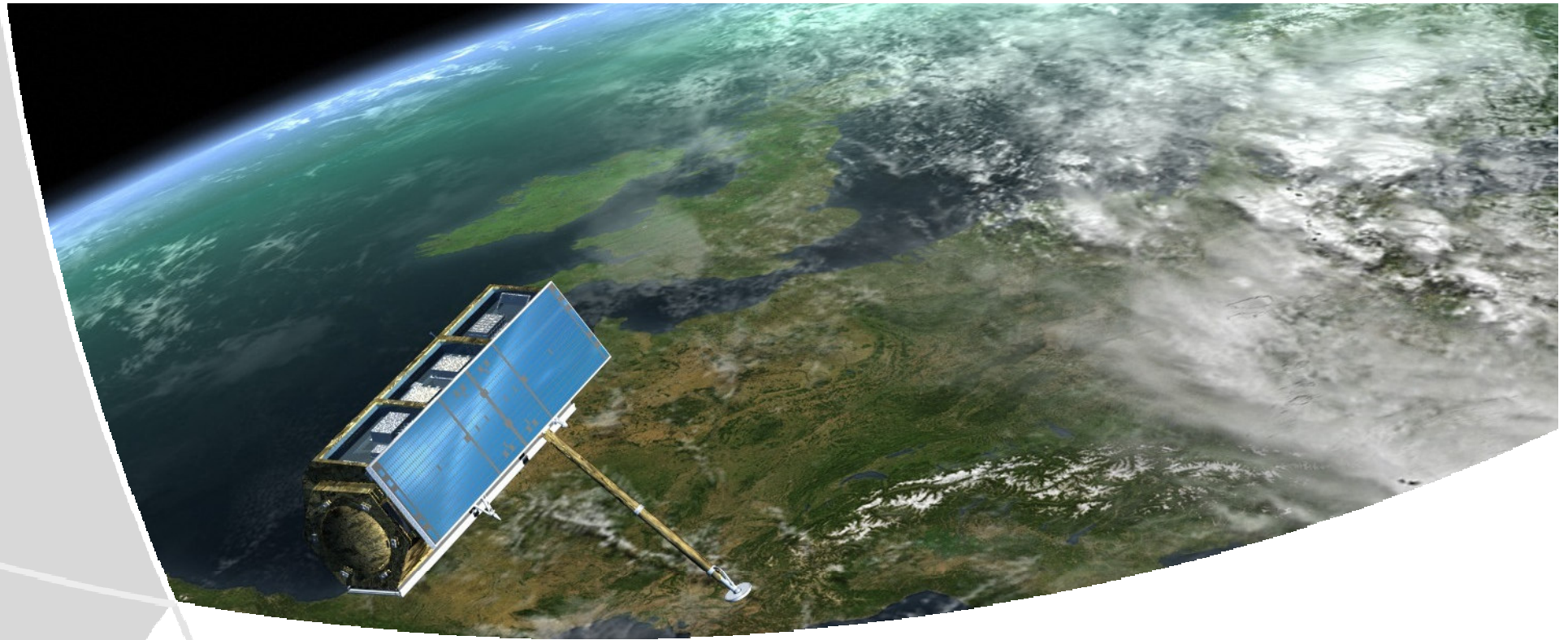




TerraSAR-X: Scientific Use

Achim Roth

Science Coordinator TerraSAR-X

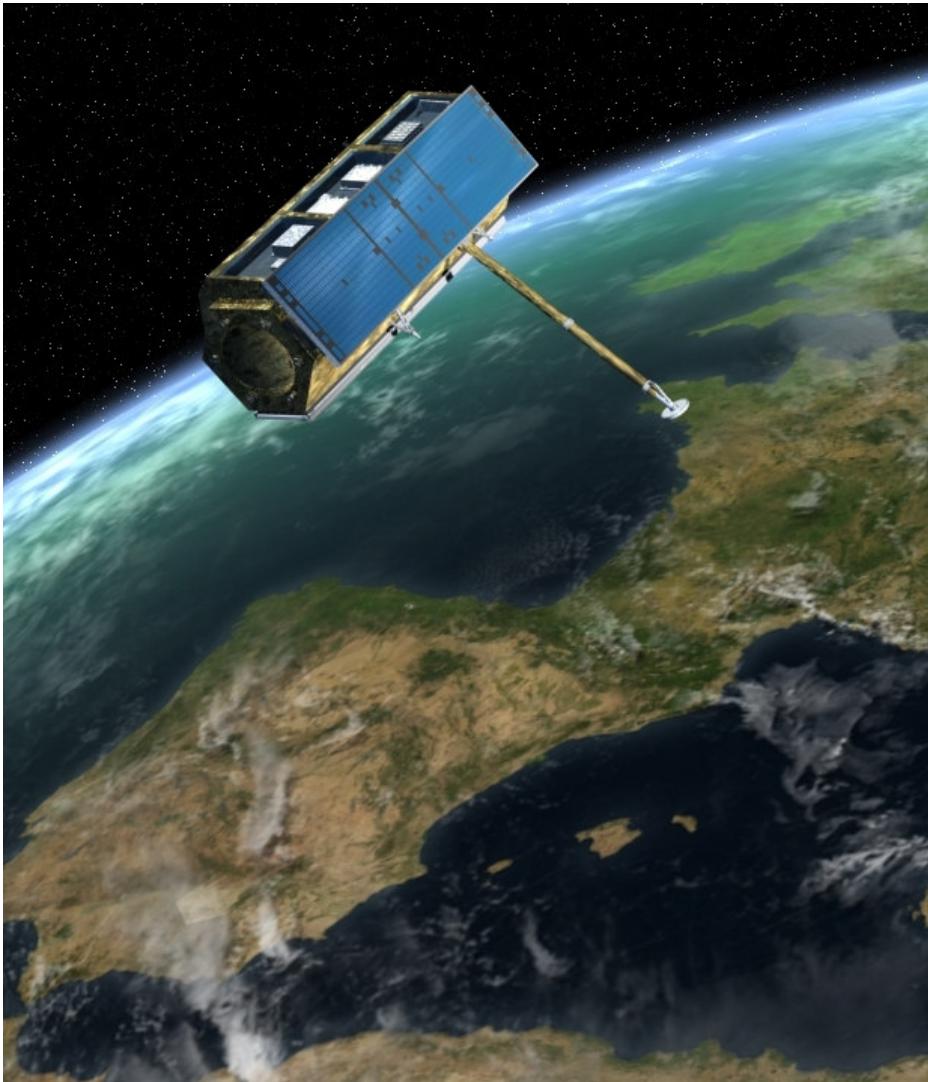
DLR – German Remote Sensing Data Center



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft



Introduction



- High-resolution radar mission
- National Implementation
- Scientific and commercial applications
- Public / private co-funding
 - ***Public Private Partnership (PPP)***
- Launch: June 15th, 2007
- Service started on January 7, 2008



“TerraSAR-X, a National Science Mission with Commercial Potential”

Public Private Partnership

DLR



- Project Management
- G/S Development & Ops
- Science Coordination
- System Engineering Support

EADS Astrium



- Platform Development
- Instrument Development
- Launch on Dnepr-1

Infoterra



- Service Infrastructure
- Information Products
- Commercial Exploitation

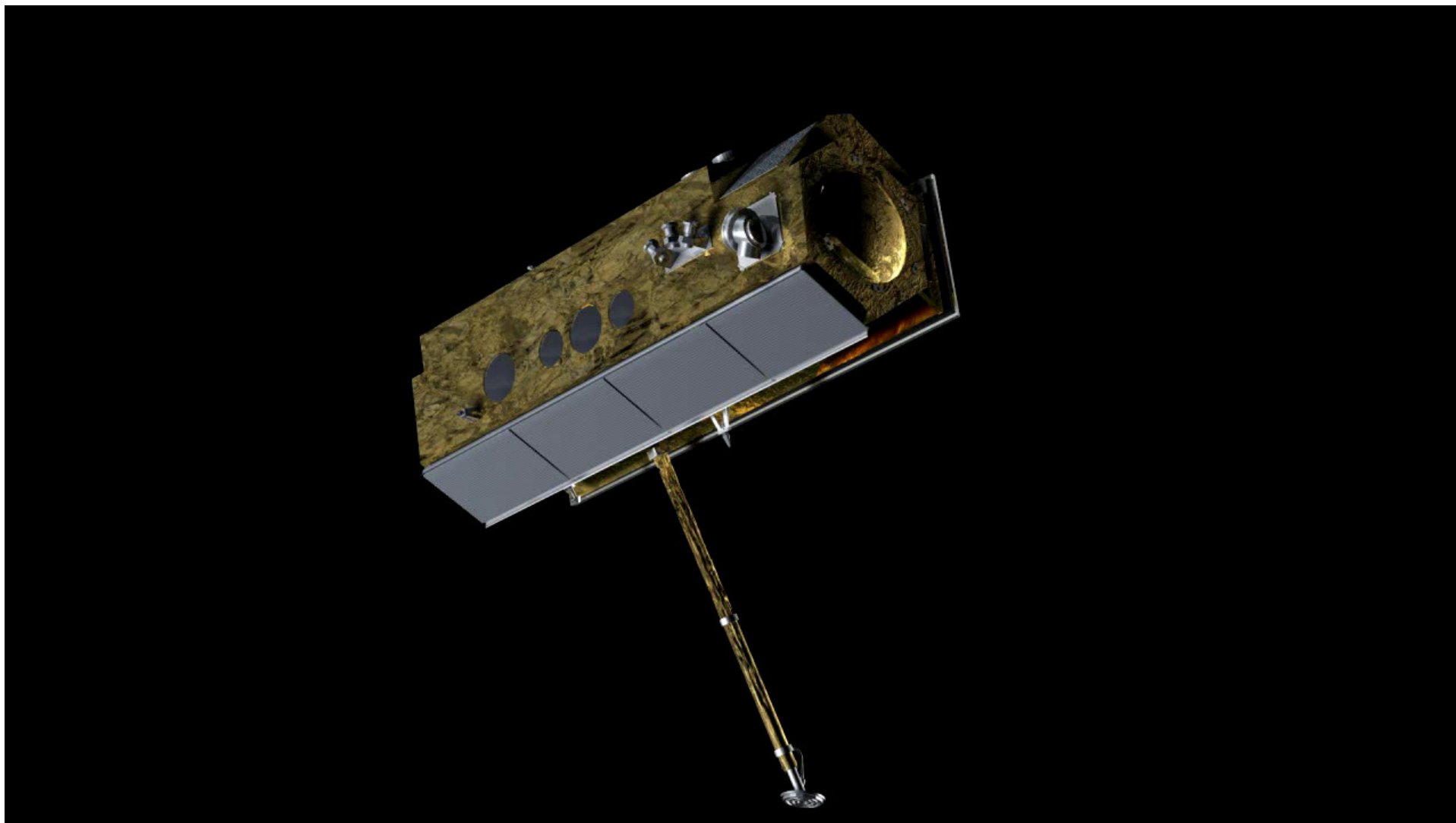
Main Mission Goals:

- Provision of TerraSAR-X data and products for **scientific applications** → **public interest**
- **Commercial exploitation** of remote sensing data → **by industry**



TerraSAR-X Satellite





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TerraSAR-X Ground Segment – Mission Operations



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TerraSAR-X Ground Segment – Mission Operations



*DLR Ground Station
Neustrelitz*



*DLR Payload
Ground Segment
Oberpfaffenhofen*

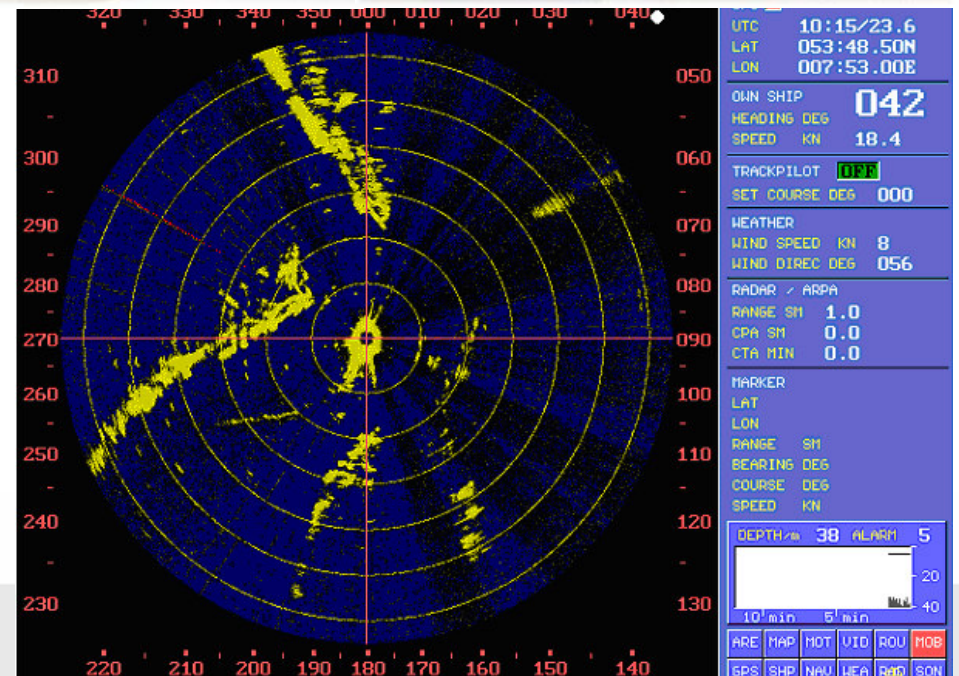


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Radar characteristics



- Radio detection and ranging (active system)
- Transmits signals
- Receives echoes
- Visualization of radar echoes
- All weather & day, night observation capability



What does the radar measure?

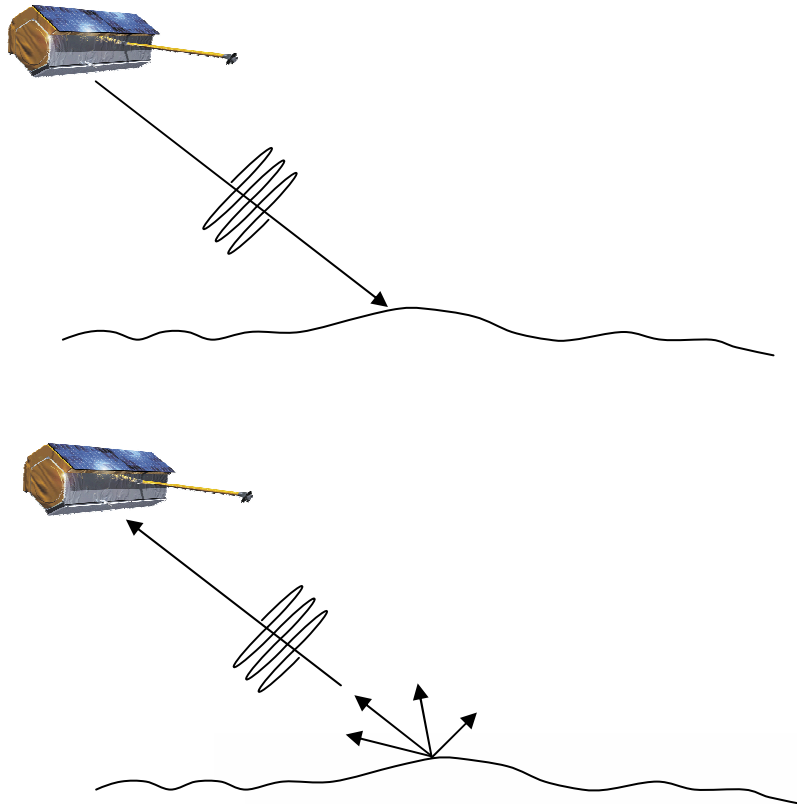
Brightness of features in radar imagery depends on portion of energy that is backscattered to the SAR system

Radar transmits a pulse (traveling velocity is equal to speed of light)

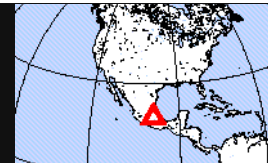
Some of the energy is reflected back to the sensor. The radar measures the radar backscatter σ_0 (sigma naught or sigma zero)

Backscatter properties

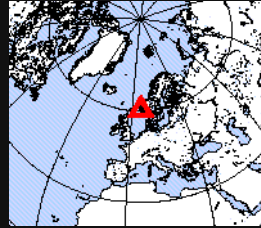
- **Surface roughness**
- **Dielectric properties**
- **Imaging and surface geometry**



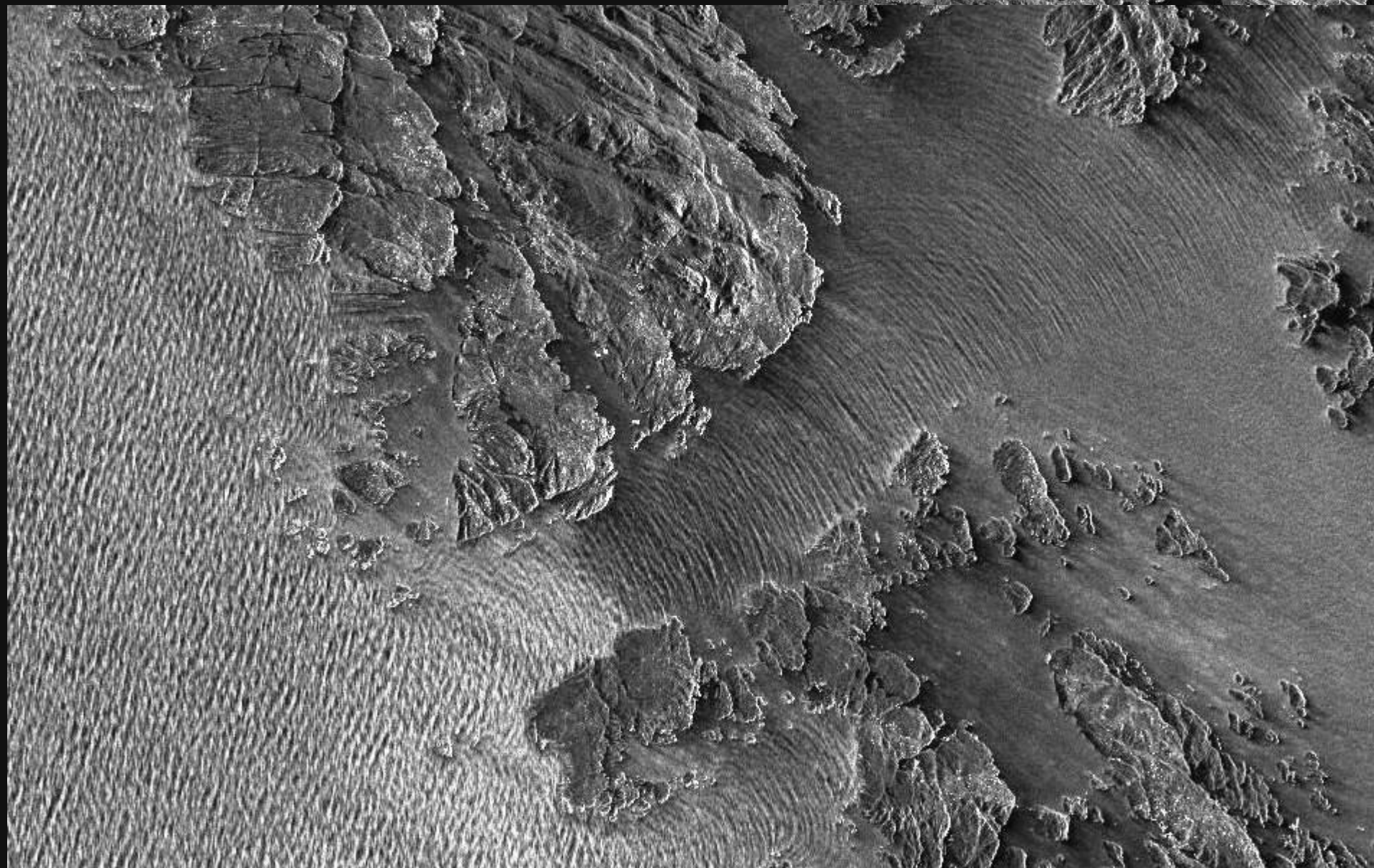
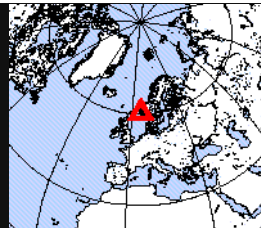
Spotlight Image: Teotihuacán



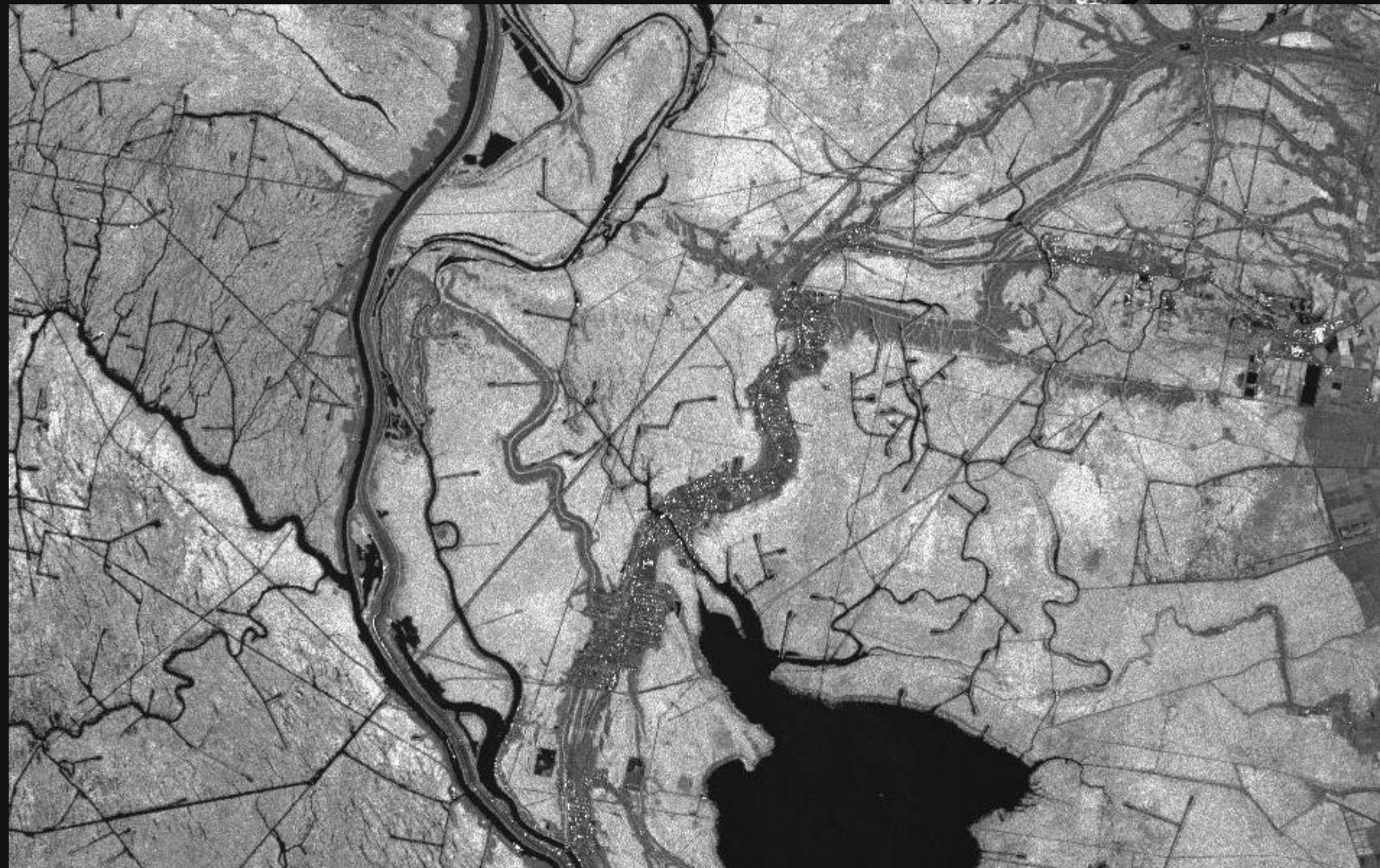
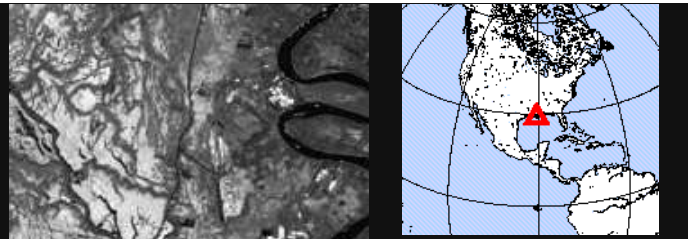
**TSX-StripMap:
Bergen, Norway
March 13, 2008**



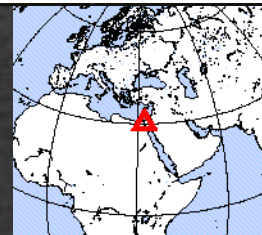
TSX-StripMap: Bergen, Norway



TSX-StripMap: Mississippi Delta February 1st, 2008

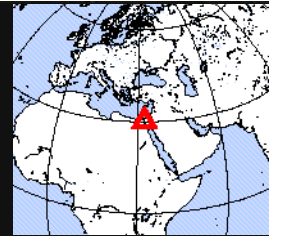


TSX-Sc
Suez-Ca



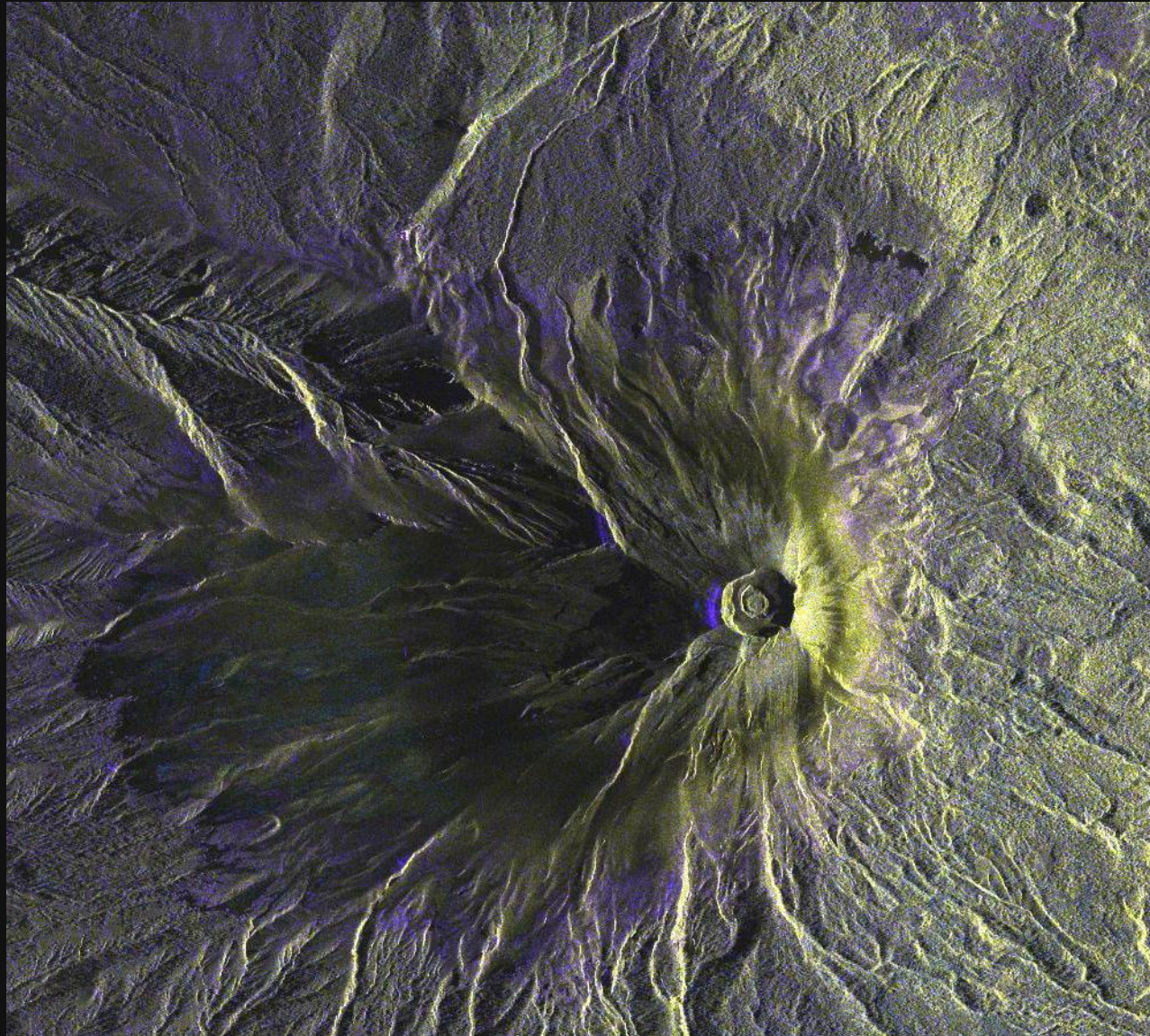
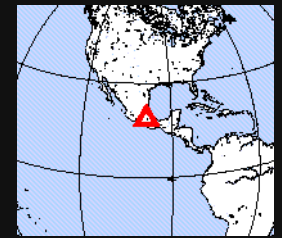
TSX-Spotlight: Suez-Canal

February 11, 2008



TSX-Spotlight: Popocatepetl Volcano

March 14, 2008 - Dual Pol (HH/VV)





Access to TerraSAR-X data for scientific use

➤ Data policy issues

- Commercial exploitation: EADS-Astrium
- Scientific utilization: DLR
- Both parties equally share the satellite resources

=> proposal

➤ National security regulations:

- Satellitendatensicherheitsgesetz (Sat DSiG)
- Resolution and phase information
 - Urgency of the product provision (<5 days)
 - Users / people having access to the data



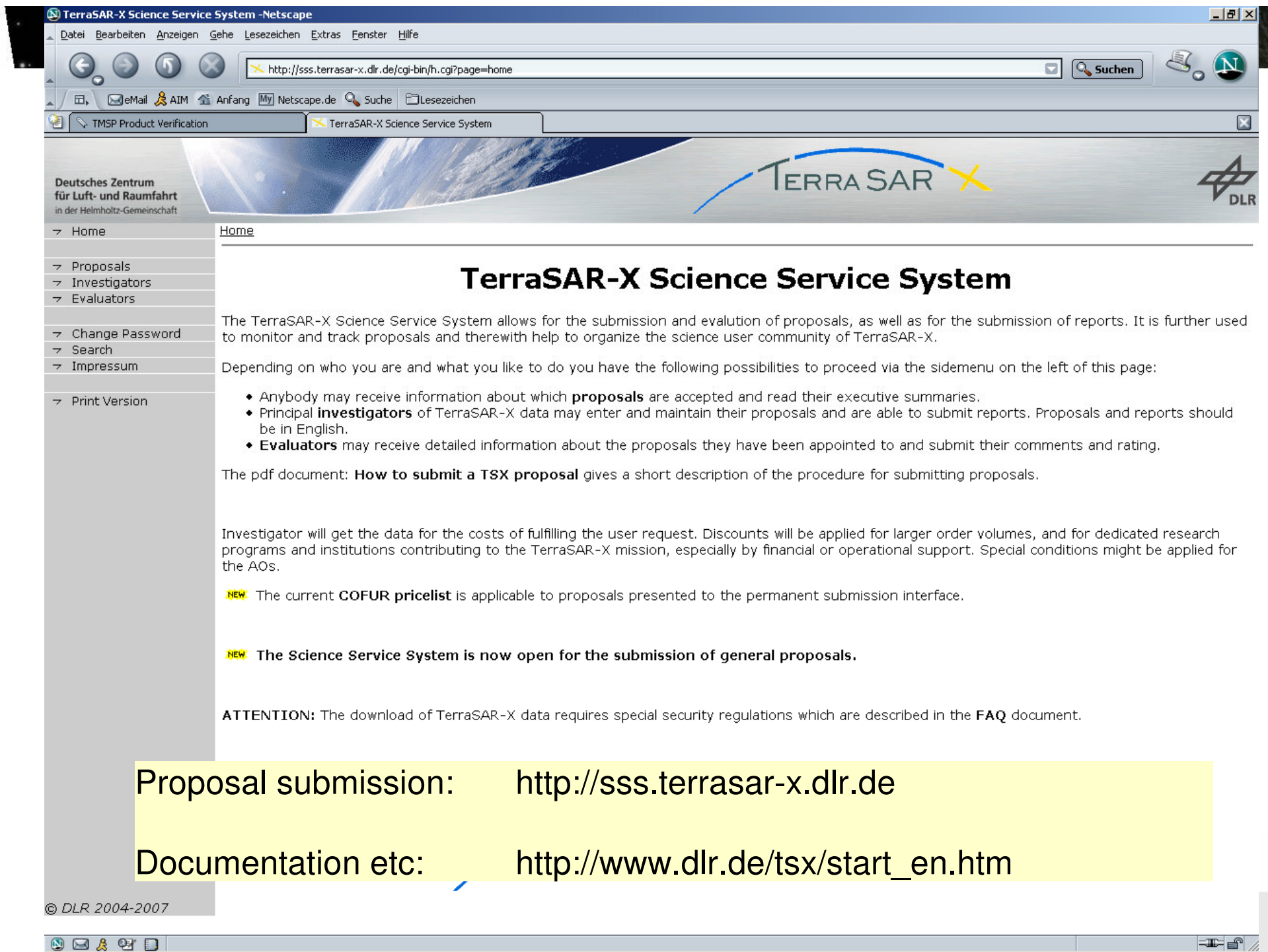
Access to TerraSAR-X data for scientific use

- The status is gained via a selection process
 - proposal submission
 - evaluation (mission objectives, data requirements, scientific use criteria)
- General proposal submission (since October 2007):
 - Submission at any time
 - Data are provided for the costs of fulfilling the user request
- Announcement of Opportunity
 - Related to specific topics
 - Special conditions
 - Next AOs planned for
 - Experimental modes
 - synergistic use with Rapid Eye
 - other SAR frequencies



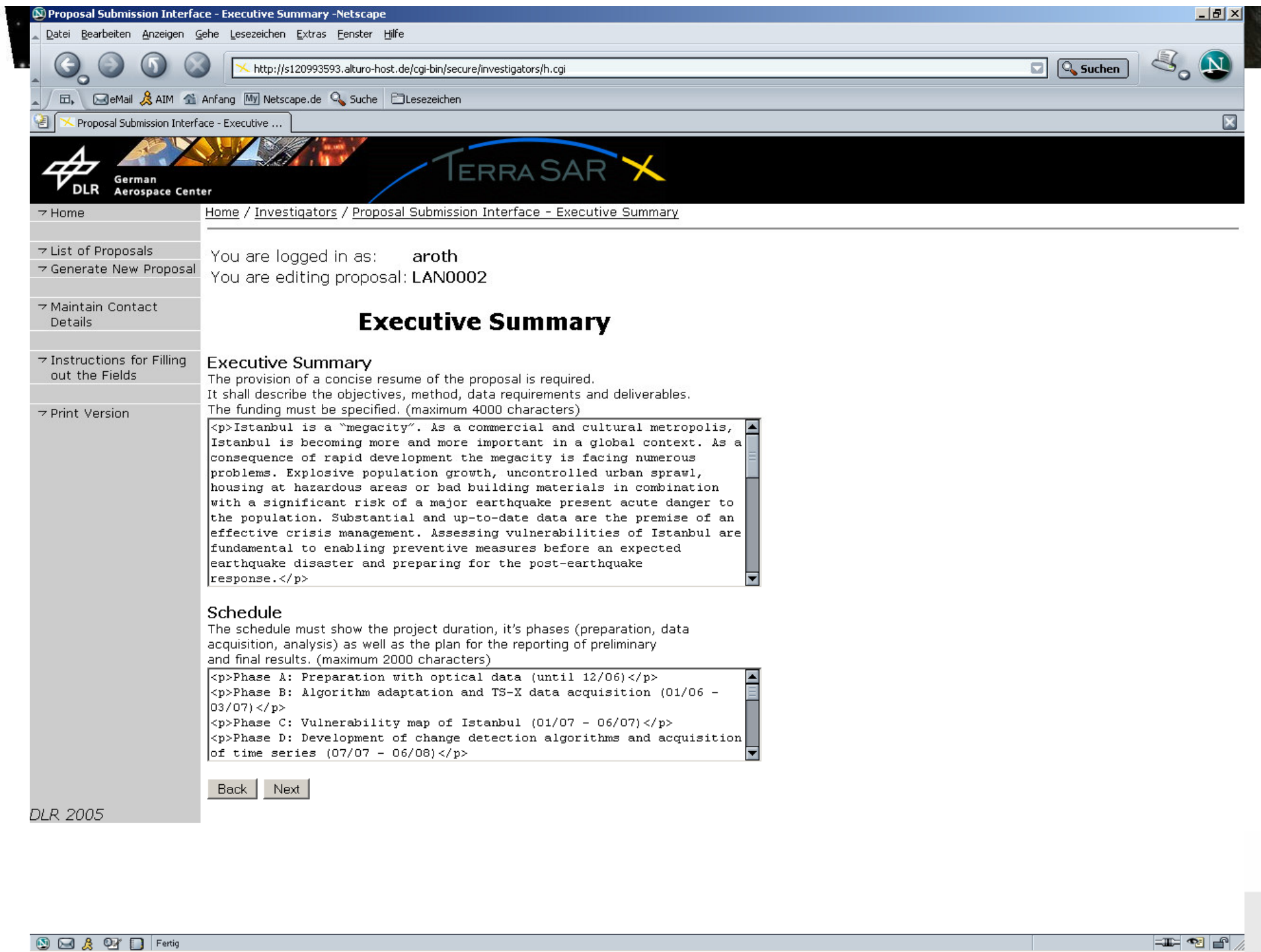
Access to TerraSAR-X data for scientific use

- Accepted proposals:
 - Creation of a proposal specific user account
 - quota of products for the agreed purpose.
 - priority
- The provision of data requires
 - the signature of the user license agreement
 - the list of people having access to the TerraSAR-X data
 - the confirmation of the corresponding funding



Proposal submission: <http://sss.terrasar-x.dlr.de>

Documentation etc: http://www.dlr.de/tsx/start_en.htm



Proposals - Netscape

Datei Bearbeiten Anzeigen Gehe Lesezeichen Extras Fenster Hilfe

http://sss.terrasar-x.dlr.de/cgi-bin/secure/none/h.cgi?page=proposals

Suchen

eMail AIM Anfang My Netscape.de Suche Lesezeichen

Proposals

Deutsches Zentrum für Luft- und Raumfahrt in der Helmholtz-Gemeinschaft

TERRA SAR X DLR

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List of accepted Proposals

The following table gives a complete overview about all accepted proposals. The proposal id links to the proposal's executive summary (only for 'non-confidential' proposals)

Proposal Id	Title	Investigator
CAL0107	FLUX-X Winds, waves and air-sea fluxes in the Southern Ocean - a study of extreme conditions - with a surface mooring and TerraSAR-X	Drennan, William - University of Miami, RSMAS, Applied Marine Physics
CAL0109	Validation of TerraSAR-X Mapping Precision for Land Cover and Disaster Monitoring	Suga, Yuzo - Hiroshima Institute of Technology, Dept. of Environmental Information Studies
CAL0137	Interferometric Calibration and Verification	Eineder, Michael - DLR, IMF
CAL0138	Calibration and Validation of TerraSAR-X in Mongolia	Sato, Motoyuki - Tohoku Univesrity, Center for Northeast Asian Studies
CAL0163	Geometric Validation of TerraSAR-X High-Resolution Products	Meier, Erich - Remote Sensing Laboratories (RSL), Geography
CAL0166	Validation of spectral and individual ocean Wave parameters at offshore platforms VW-X	Lehner, Susanne - German Aerospace Center, MF
CAL0196	Validation of the TerraSAR performances by using airborne SAR (Pi-SAR) and ground experiments	Uratsuka, Seiho - National Institute of Information and Communications Technology, Applied Research and Standards Department
CAL0264	TerraSAR-X products geometrical calibration and validation	Arnaud, Alain - ALTAMIRA NFORMATION, Research and Development
COA0025	Investigations of meso-scale dynamics associated with marine sand waves in the tidal channel of the Lister Tief in the German Bight of the North Sea by using TerraSAR-X data (MESODYNTSX)	Hennings, Ingo - Leibniz-Institut fuer Meereswissenschaften an der Universitaet Kiel IFM-GEOMAR, Ozeanzirkulation und Klimadynamik
COA0047	Investigation of intertidal zone using TerraSAR-X	Won, Joong-Sun - Yonsei University, Earth System Sciences
COA0061	Coastal zone mapping and monitoring using SAR	Yang, Chan-Su - KORDI (Korea Ocean Research & Development Institute), Ocean Satellite Research Group
COA0065	Ocean Winds from Terra SAR X	Horstmann, Jochen - GKSS Research Center, Institute for Coastal Reserach

Home Proposals

Proposals

Investigators

Evaluators

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Impressum

Print Version

EOWEB User Interface (TerraSAR-X)

Cluster AF Earth Observation Data - Windows Internet Explorer bereitgestellt von T-Systems S/R

http://centaurus.caf.dlr.de:8080/

EOWEB® - Earth Observation ... Cluster AF Earth Observ...

EOWEB®

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DLR Home
Cluster AF Home
EOWEB®-Next Generation
EOWEB®
WDC-RSAT
EOS Data Gateway

EOWEB®
Earth Observation on the WEB

<http://centaurus.caf.dlr.de:8080>

DLR EOWEB® - Next Generation (EOWEB-NG)
The user interface Earth Observation on the WEB provides access to the earth observation data available at the DFD. You can search for catalogue data, view browse images, order catalogue data, specify and order future acquisitions. The following products are available via EOWEB-NG:
• TerraSAR-X products (Access is restricted to privileged users only!)
→ Access

DLR EOWEB®
The user interface Earth Observation on the WEB provides access to the earth observation data available at the DFD. You can search for data, view browse images, order data and retrieve data on-line.
→ Access

Announcement of NOAA-18 AVHRR data reception by DFD
On January 1st, 2007, DLR - DFD has started on an operational basis the reception of NOAA-18 AVHRR data replacing NOAA-17 AVHRR. The performance of our reception of NOAA-17 AVHRR data degraded in the last months. On April 1st, 2007, DLR - DFD also started the operational processing of NOAA-18 AVHRR data to generate daily, weekly or monthly NOAA18-AVHRR products as NDVI, LST or SST maps. In order to test the performance of our processing chains, we processed simultaneously all NOAA-17 and NOAA-18 data from January 1st, 2007 till March 29th, 2007. All products will be available via EOWEB. Please remember that NOAA-18 is a PM sensor which passes central Europe about 1.5 hours later than NOAA-17 (about 11:30 UTC instead of 10:00 UTC for NOAA17). LST will be increased in general.

Other Data Services

World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT)
The WDC-RSAT provides measurements and derived data products from a wide range of atmospheric sensors.
→ Access

EOS Data Gateway
The Earth Observing System Data Gateway provides access to worldwide distributed data. You can find and order data from multiple participating archives.
→ Access

EARTH OBSERVATION DATA

EOWEB User Interface (login)

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You are logged in as anonymous user.

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[Shop Cart](#) | [Order Monitoring](#)

[Catalogue](#) | [Future Products / Acquisitions](#) | [User Set](#)

Collections :
☐ Deselect all ☐ Expand/collapse 0 Collections selected

Anonymous user has no access rights for this collections! Please login

Query Mode: Standard

Date:

From: 2008-03-17 00:00:00
To: 2008-03-17 23:59:59

Area:

Center Lat/Lon

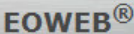
Extension Lat/Lon





[Results](#) |  |  | ☐ Display |  |  |  | 

EOWEB User Interface (Catalogue search)

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[Catalogue](#) | [Future Products / Acquisitions](#) | [User Set](#)

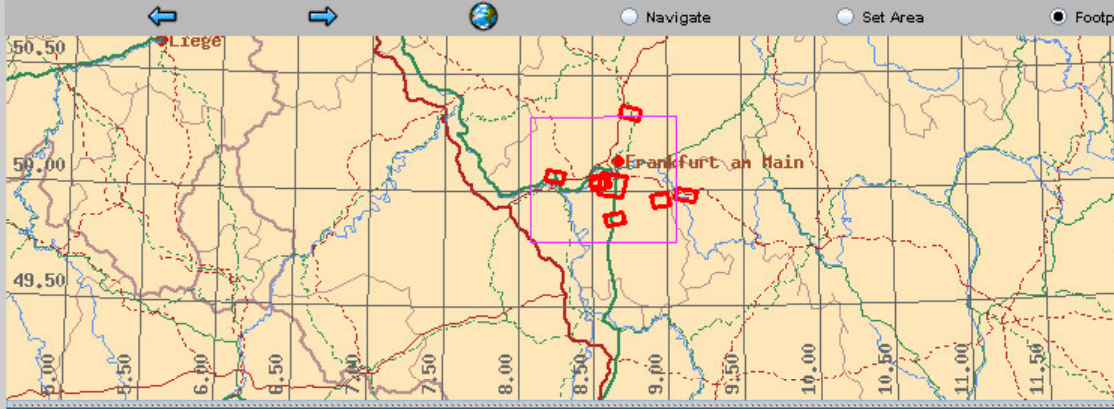
Collections :
☐ Deselect all ☐ Expand/collapse 2 Collections selected
☒ TSX-1

- ☐ TSX-1.SAR.L1b-ScanSAR
- ☐ TSX-1.SAR.L1b-Stripmap
- ☒ TSX-1.SAR.L1b-High-Resolution-Spotlight
- ☒ TSX-1.SAR.L1b-Spotlight

Query Mode: Standard

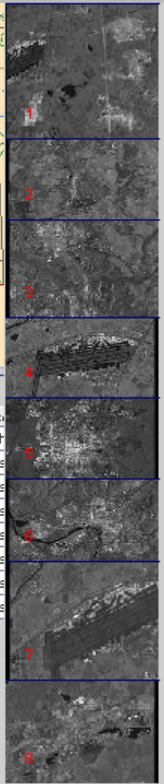
Date:
Choose a Date
From: 2007-12-01 00:00:00
To: 2008-03-17 23:59:59

Area:
Rectangle
Center Lat/Lon
50.051 8.579
Extension Lat/Lon
0.539 0.975
[Step by range](#)



8 out of 8 items returned

Id	Abstract	Item Type	Mission	Sensor	Start Date	End Date	Sensi
1	TSX-1.SAR.L1b-Spotlight	CatalogueSce...	TSX-1	SAR	2007-12-02T05:34:29,5...	2007-12-02T05:34:31,0...	Spotlight
2	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-07T05:42:58,2...	2007-12-07T05:42:58,9...	HighRes
3	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-07T05:43:03,4...	2007-12-07T05:43:04,1...	HighRes
4	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-10T17:08:58,8...	2007-12-10T17:08:59,5...	HighRes
5	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-21T17:08:57,0...	2007-12-21T17:08:57,7...	HighRes
6	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-29T05:43:02,9...	2007-12-29T05:43:03,6...	HighRes
7	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2007-12-30T05:25:54,9...	2007-12-30T05:25:55,6...	HighRes
8	TSX-1.SAR.L1b-High-Resolution-Spotli...	CatalogueSce...	TSX-1	SAR	2008-01-01T17:08:56,2...	2008-01-01T17:08:57,0...	HighRes



[Start Search](#)

[Results](#) |  |  |  Display |  |  |  | 

EOWEB User Interface (Acquisition)

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Shop Cart | **Order Monitoring**

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: 2008-03-21 00:00:00,000 ▼

To: 2008-04-01 23:59:59,999 ▼

Step by range ▼

Region of Interest:

Polygon ▼

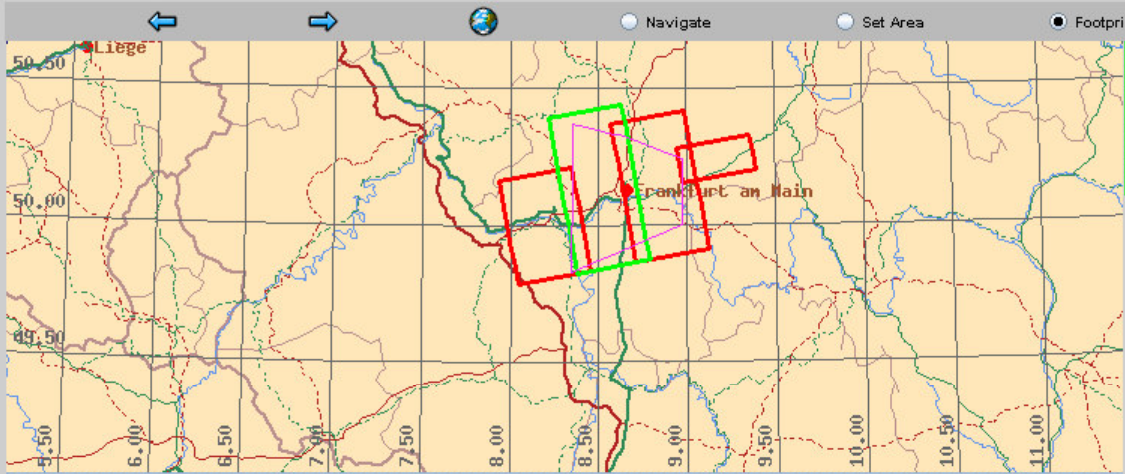
Import | Export

Nr.	Latitude	Longitude
1	50.366	8.366
2	49.829	8.345
3	50.002	8.969
4	50.242	8.973
5	50.327	8.619

Acquisition Criteria:

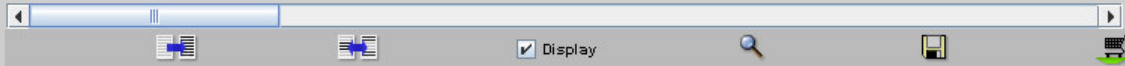
Incidence Angle [degree]	30.00 - 40.00
Min. Incidence Angle [degree]	30.00
Max. Incidence Angle [degree]	40.00
Pass Direction	Ascending
Looking Direction	Right
Polarization Mode	Single

Submit Query



1 record selected

Id	Abstract	Item Type	Start Date	End Date	Sensor Mode	Polarization Mode	SI
1	PID_TSX-1.SAR.Stripmap...	FutureScene	2008-03-29T17:08:54.7...	2008-03-29T17:09:00.7...	Stripmap	Single	40
2	PID_TSX-1.SAR.Stripmap...	FutureScene	2008-03-29T17:08:54.7...	2008-03-29T17:09:03.7...	Stripmap	Single	40
3	PID_TSX-1.SAR.Stripmap...	FutureScene	2008-03-29T17:08:54.7...	2008-03-29T17:09:02.7...	Stripmap	Single	40
4	PID_TSX-1.SAR.Stripmap...	FutureScene	2008-03-29T17:08:58.7...	2008-03-29T17:09:00.7...	Stripmap	Single	40



Preview not available
1234

Display

TSX-Spotlight:

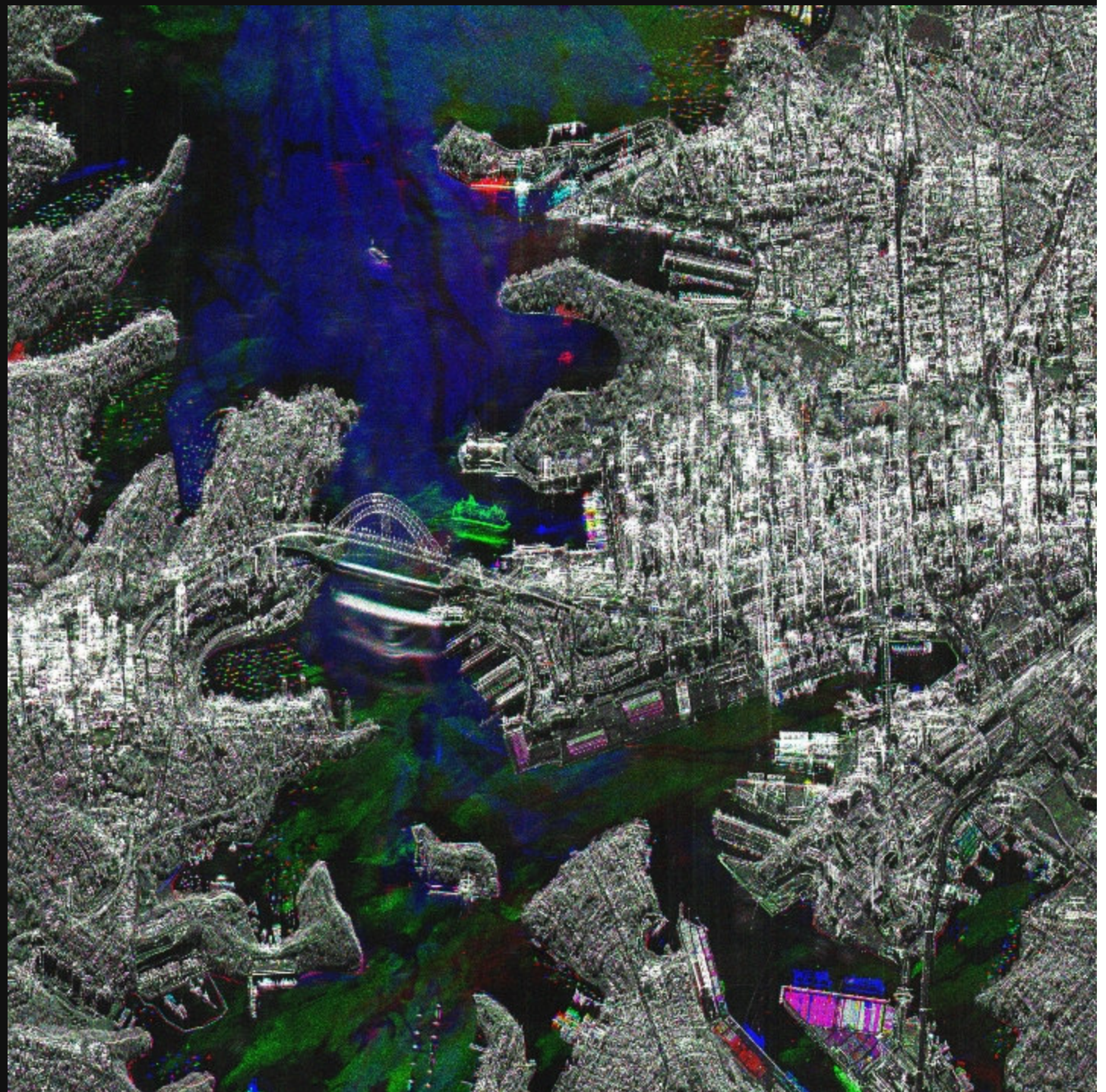
Sydney, Australia

r-g-b:

January 12, 2008

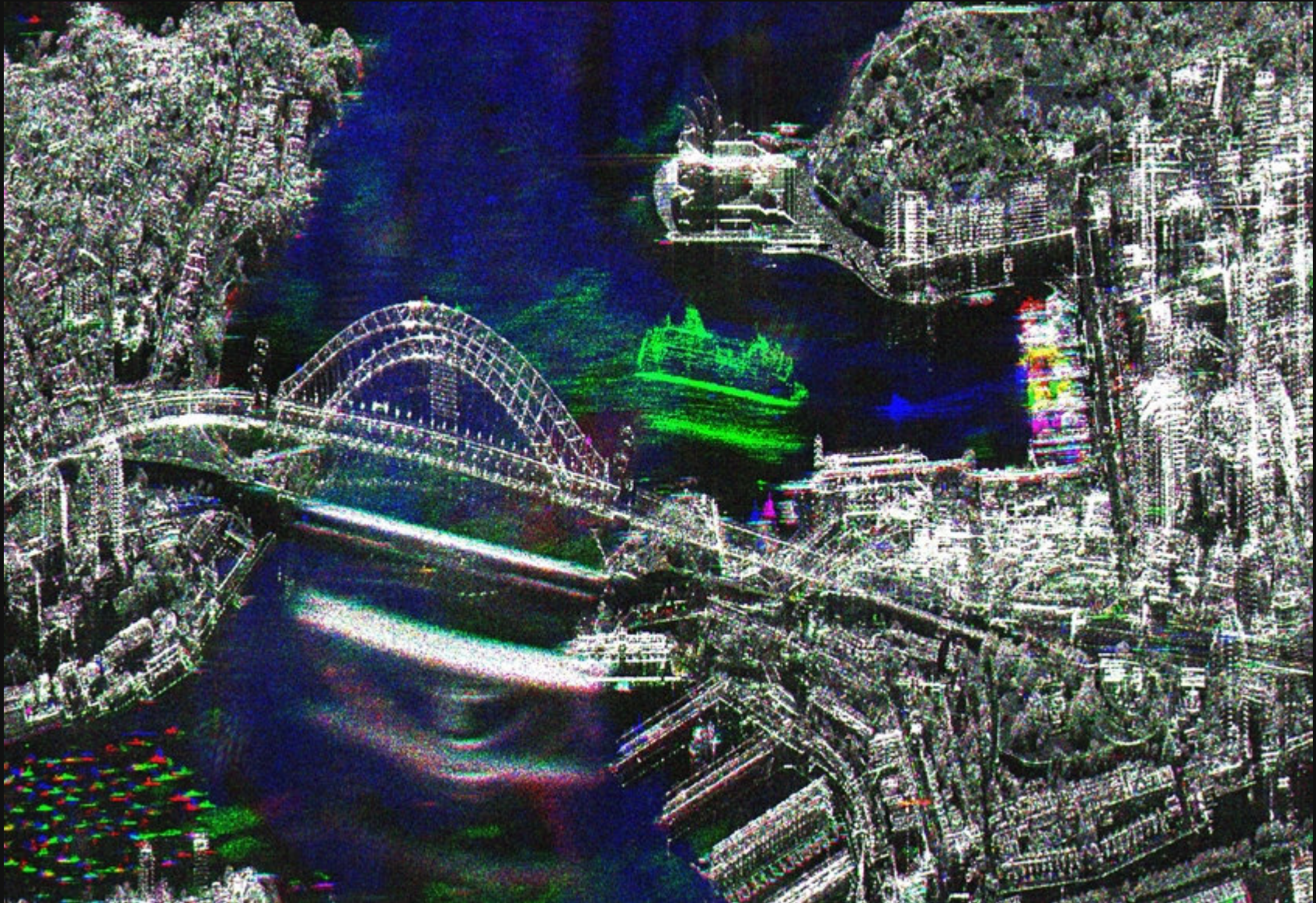
December 21, 2007

January 1, 2008



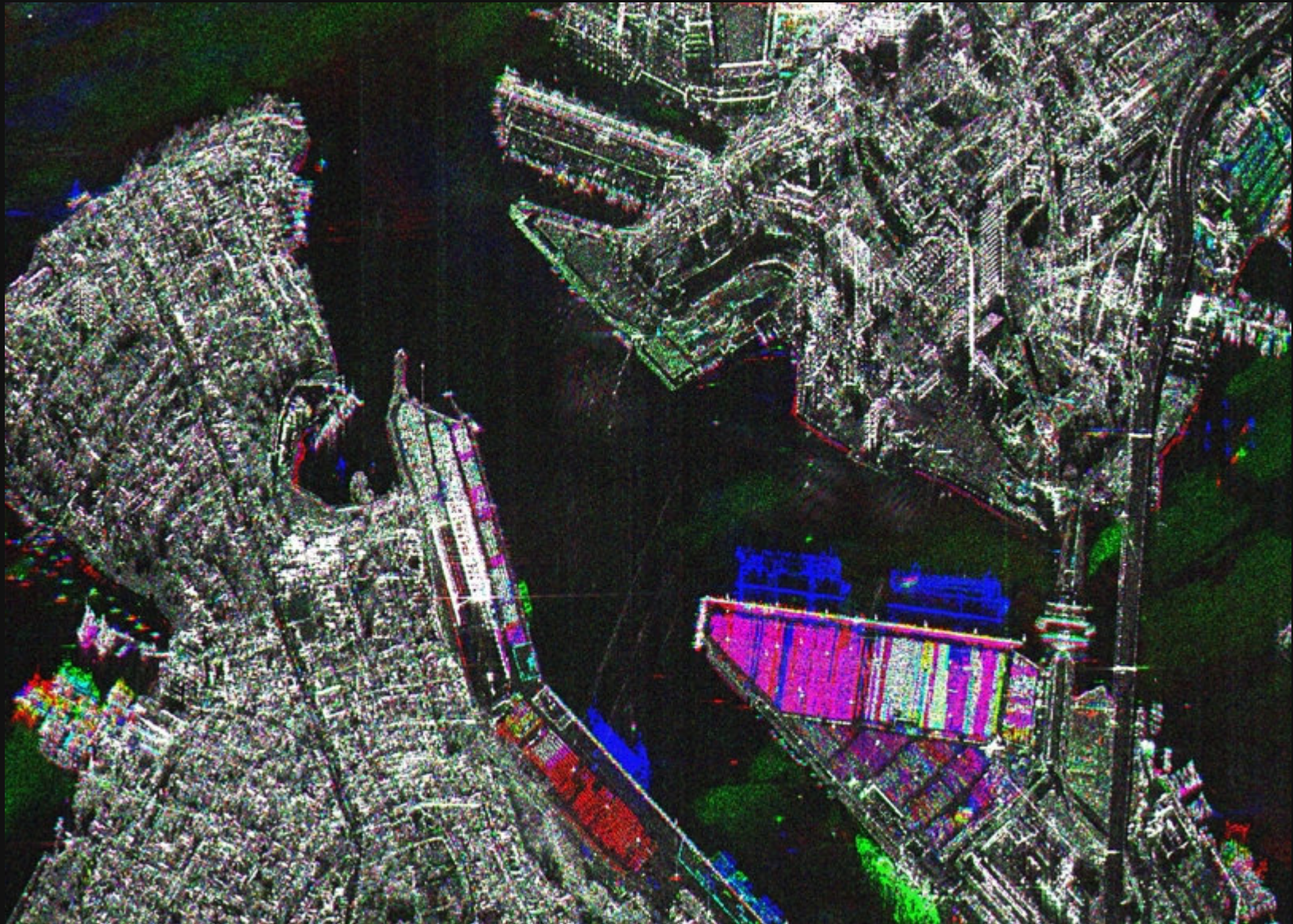
TSX-Spotlight: Sydney, Australia

r: January 12, 2008 – g: December 21, 2007 – b: January 1, 2008



TSX-Spotlight: Sydney, Australia

r: January 12, 2008 – g: December 21, 2007 – b: January 1, 2008



EOWEB User Interface (Shop cart)

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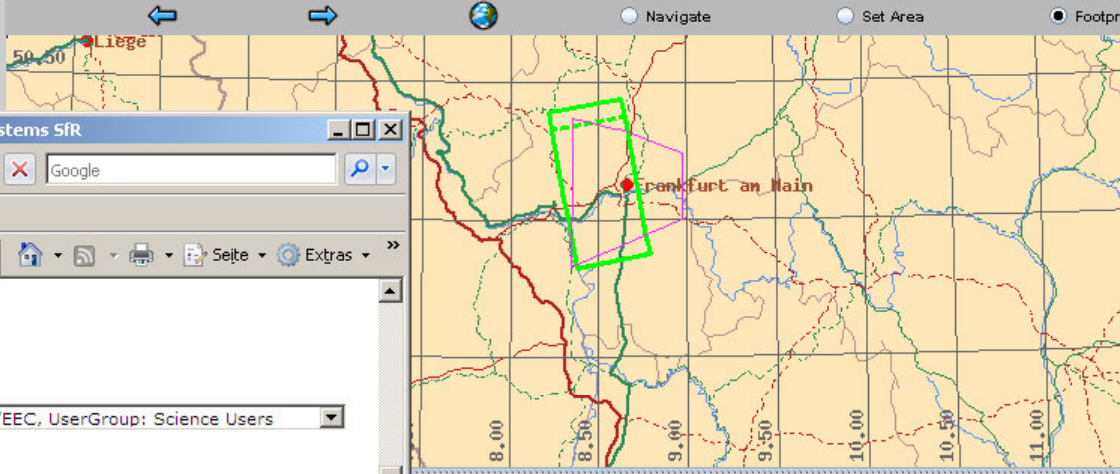
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OrderOptions - Windows Internet Explorer bereitgestellt von T-Systems SFR
https://centaurus.caf.dlr.de:8443/eoweb-nc
Google

Order Options

Order Service: DLR-DFD

Order Option: ProductType: L1b-MGD/GEC/EEC, UserGroup: Science Users

Acquisition Options
Polarization Channels: HH
Extension of acquisition time window: 0 / + 0 cycle(s) (1 cycle = 11 days)

Processing Options
Processing Level: L1B
Processor Gain Attenuation [dB]: 0
Orbit Precision: RAPID
Resolution Variant: Spatially Enhanced (SE)
GIM (EEC only): No
Product Type: Multi Look Ground Range (MGD)
Projection (if applicable): Auto

Delivery Options
Delivery Method: ftps
Product Medium: File
Product Format: --
Access Constraints: Product price per medium Euro TBD

Scene Selection
Scene Type: L1b-subscene

1 record selected

Item Type	Mission	Sensor	Orbit	Start Date	End Date
tureScene	TSX-1	SAR	40	2008-03-29T17:08:54.7...	2008-03-29T17:09:03.7...

lay | Vertrauenswürdige Sites | 100%

EOWEB User Interface (Order monitoring)

EOWEB®



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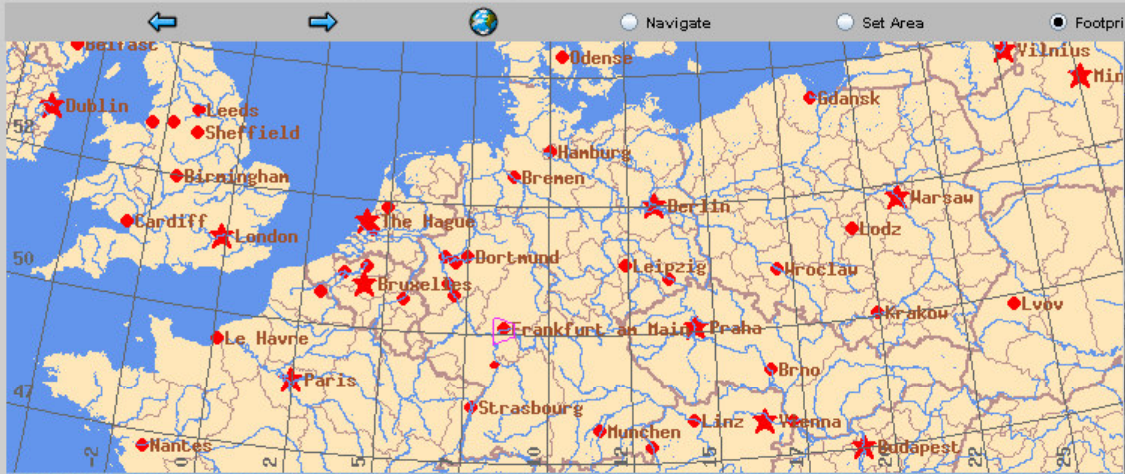
Mon, 17 Mar 2008

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[Save Query Parameters](#) | [Load Query Parameters](#) | [Durchsuchen...](#)

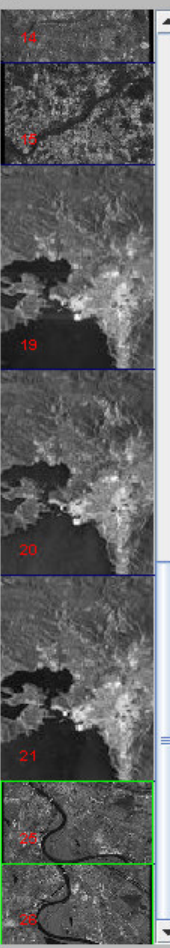
[Shop Cart](#) | **Order Monitoring** | [Catalogue](#) | [Future Products / Acquisitions](#) | [User Set](#)

Order Criteria
Order Id: *
Order Name: *
Order Status: All
Order Date: From: 2008-01-01 00:00:00 To: 2008-03-17 23:59:59



1 record selected

Id	Order Id	Order Name	Status	Status Details	Item
* 1	arothe_LAN0002_2008-02-20-08:09:48,2...	arothe_LAN0002_mexicocity_2_m...	orderCompleted	PROCESSED	
* 3	arothe_LAN0002_2008-02-14-08:42:09,8...	arothe_LAN0002_mexicocity1	orderCompleted	PROCESSED	
* 6	arothe_LAN0002_2008-03-10-14:14:42,8...	arothe_LAN0002	orderBeingProcess...	IN_PROCESSING	
* 9	arothe_LAN0002_2008-02-28-08:18:51,8...	arothe_LAN0002_belo_horizonte	orderCompleted	PROCESSED	
* 11	arothe_LAN0002_2008-02-14-21:27:50,2...	arothe_LAN0002-aircraft	orderCompleted	PROCESSED	
* 13	arothe_LAN0002_2008-01-10-07:23:17,7...	arothe_LAN0002_hyderabad	orderCompleted	PROCESSED	
* 16	arothe_LAN0002_2008-02-18-12:20:41,8...	arothe_LAN0002_mexicocity_2	orderCompleted	PROCESSED	
* 18	arothe_LAN0002_2008-01-21-11:20:02,9...	arothe_LAN0002_athen_mgd	orderCompleted	PROCESSED	
* 22	arothe_LAN0002_2008-02-29-09:33:11,1...	arothe_LAN0002	orderCompleted	PROCESSED	
* 24	arothe_LAN0002_2008-03-13-15:40:26,3...	arothe_LAN0002_monnem	orderBeingProcess...	IN_PROCESSING	





  ☒ Display  

EOWEB User Interface (TerraSAR-X)



Cluster
Angewandte Fernerkundung

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EOWEB
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You are logged in as anonymous user.

UserSet | ShopCart | Orders

Catalogue | FutureProducts/Acquisitions

Collections :

☐ Deselect all
 ☐ Expand/collapse
 1 Collection selected

- ☐ TSX-1 PN Gating Products
- ☐ TSX-1 System Products
- ☐ TSX-1 SAR L0 Spotlights future products
- ☐ TSX-1 SAR L0 High Resolution Spotlights 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

Query Mode: Advanced

Acquisition Window:

Choose a Date

From: 2006-11-11 00:00:00

To: 2006-11-13 23:59:59

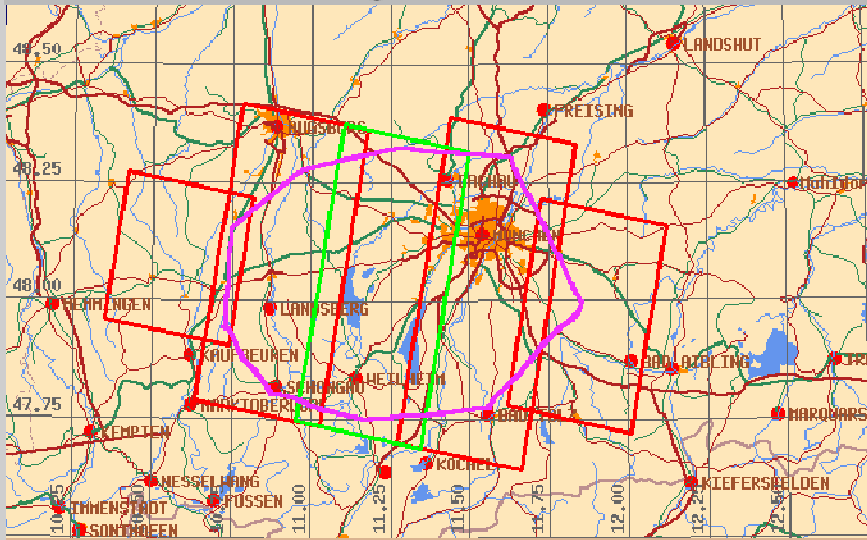
Acquisition Criteria:

☒ Incidence Angle (degree)	20.0 - 60.0
☐ Pass Direction	Ascending/Descending
☐ Looking Direction	Right
☐ Polarization Mode	Single

Submit Query

← → 🌐

☐ Navigate
 ☐ Set Area
 ☒ Footprints



1 record selected

Id	Abstract	Product Type	Start Date	End Date
1	TSX-1 SAR L0 Stripmap future scenes- sin...	singleScene-single-Stripm...	2005-11-13 05:26:...	2005-11-13 05:26:...
2	TSX-1 SAR L0 Stripmap future scenes- sin...	singleScene-single-Stripm...	2005-11-13 05:26:...	2005-11-13 05:26:...
3	TSX-1 SAR L0 Stripmap future scenes- sin...	singleScene-single-Stripm...	2005-11-13 05:26:...	2005-11-13 05:26:...
4	TSX-1 SAR L0 Stripmap future scenes- sin...	singleScene-single-Stripm...	2005-11-13 05:26:...	2005-11-13 05:26:...
5	TSX-1 SAR L0 Stripmap future scenes- sin...	singleScene-single-Stripm...	2005-11-13 05:26:...	2005-11-13 05:26:...

☒ Display

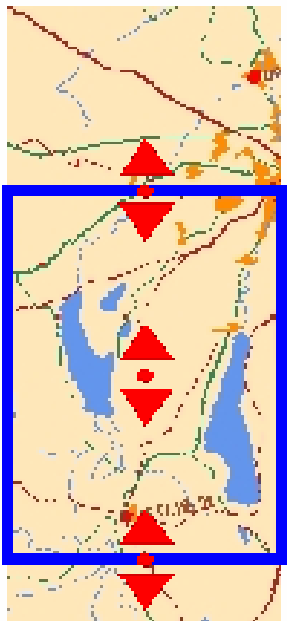
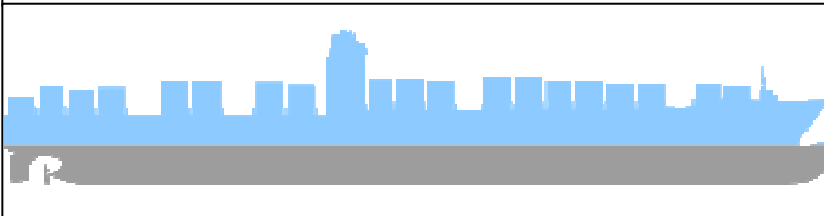


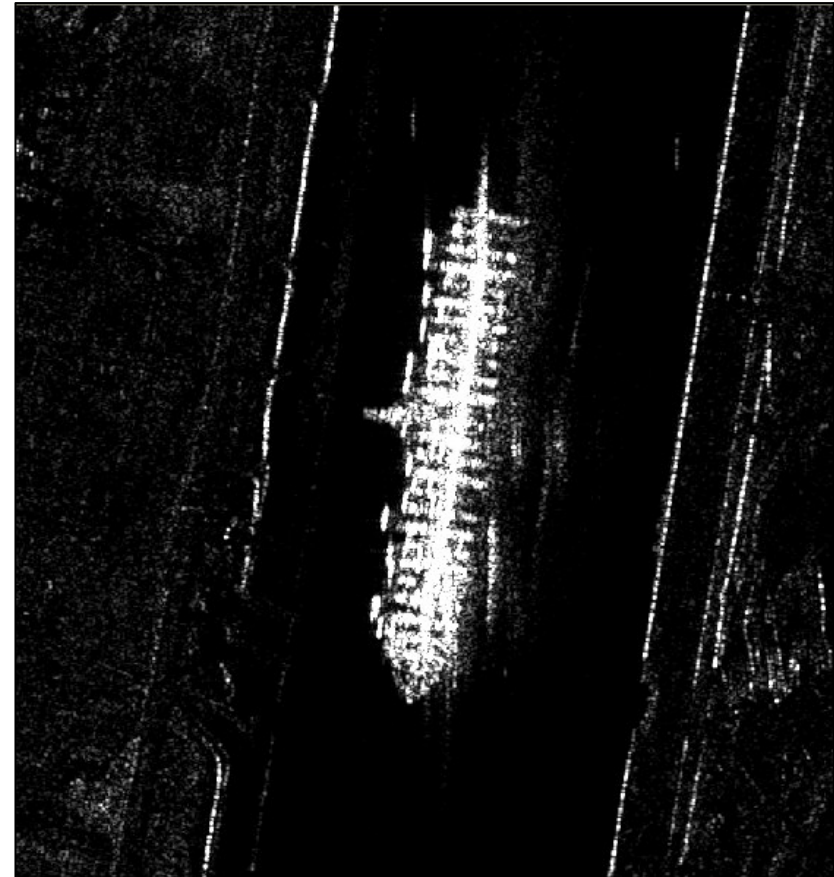
Image enhancement: Radiometric (Example “Ship”)



- Container ship
- Bridge almost in central position
- Length : ~ 400m (397m)
- Width: ~ 55m (56m)
- ~ 24 rows of containers (11 back, 13 front) (23, 10/13)



Container ship “Emma Mærsk”



Container ship captured by TerraSAR-X

