TerraSAR-X
Products, Services, and Applications

UN-OOSA, 5th Industry Symposium

Vienna, 20 February 2006

Joerg F. Herrmann, Infoterra GmbH
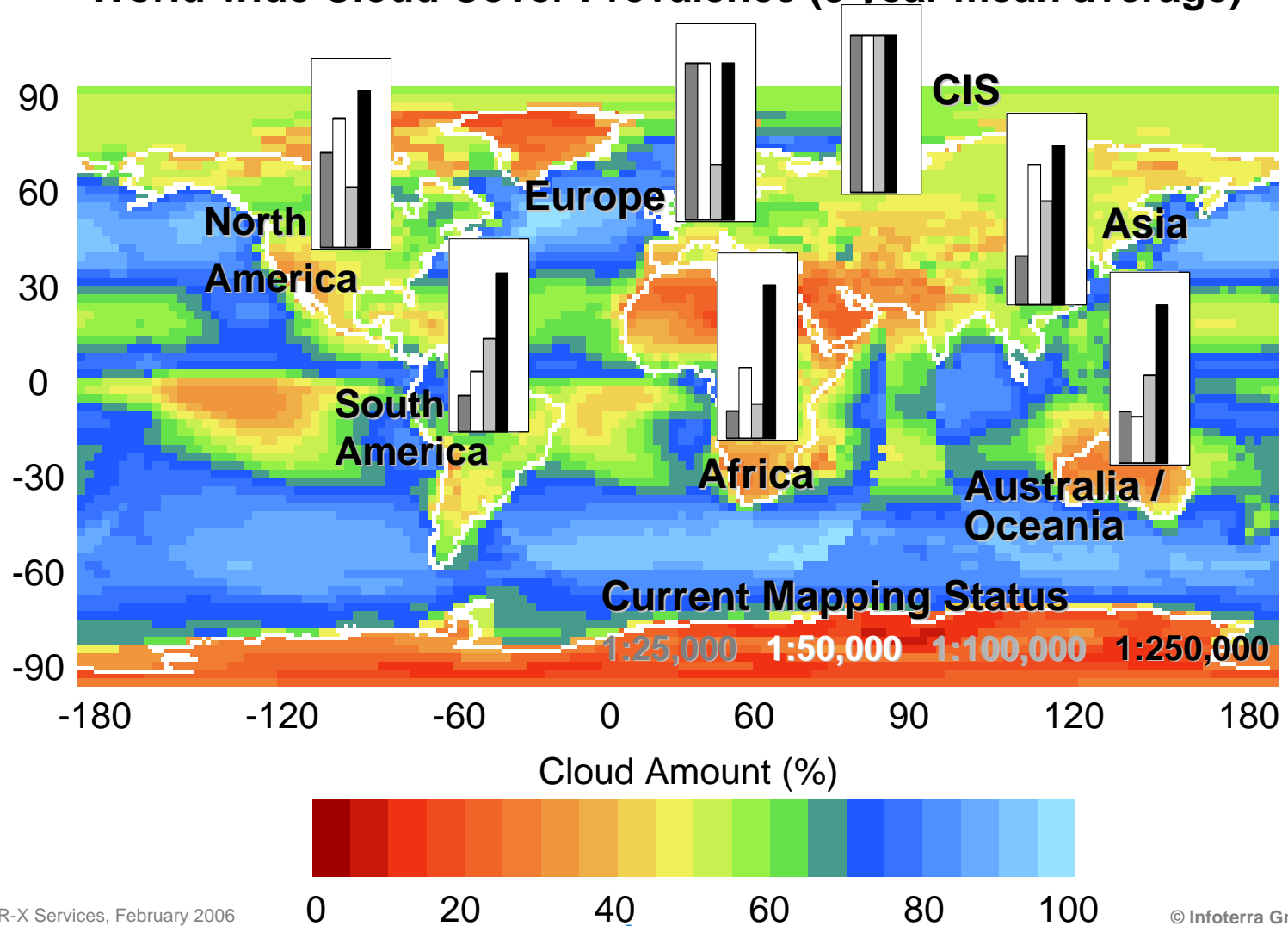
Issue: Cloud Cover, Complentarity

Regional Advantage of Radar

World-wide Cloud Cover Prevalence (8 year mean average)

Current Mapping Status

1:25,000   1:50,000   1:100,000   1:250,000

Cloud Amount (%)

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Commercial Services

- ❏ **TerraSAR-X Program**
  - implemented by a German public private partnership (PPP, 2002)
  - Parties: EADS Astrium GmbH and German Aerospace Centre (DLR)

- ❏ **Infoterra GmbH**
  - created in 2000 to structure and market TerraSAR
  - 100% subsidiary of EADS Astrium GmbH
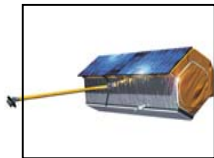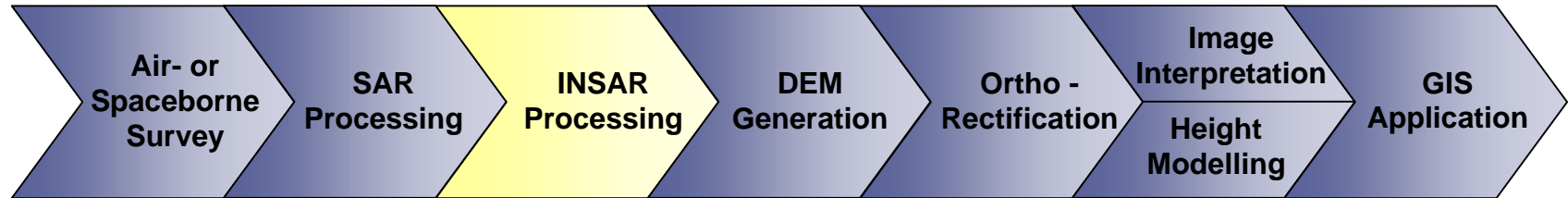 - exclusive world-wide commercial tasking / data rights for TerraSAR-X

- ❏ **Commercial data will be available Dec 2006, for > 10 years**

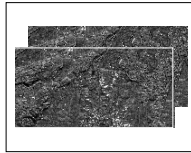- ❏ **1st Subscription Contract signed for Japan (February 2005)**

Global Monitoring of Environment and Security (EU, ESA)
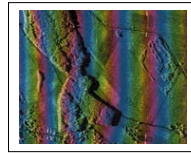
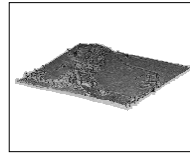**We are addressing the "E" and the "S" in GMES**

Production Experience

Air- or Spaceborne Survey	SAR Processing	INSAR Processing	DEM Generation	Ortho - Rectification	Image Interpretation / Height Modelling	GIS Application

Source Data Acquisition

Radar Images

Interfero-gram

DEM

Ortho-rectified Image Map

Thematic Map

Vector Map

• Repeat Pass (2007)
• TanDEM-X (2009)

Contour Map

• Ground Survey
• DEM Data Base
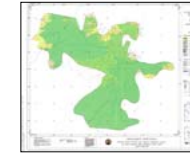
Heritage in Airborne SAR Mapping
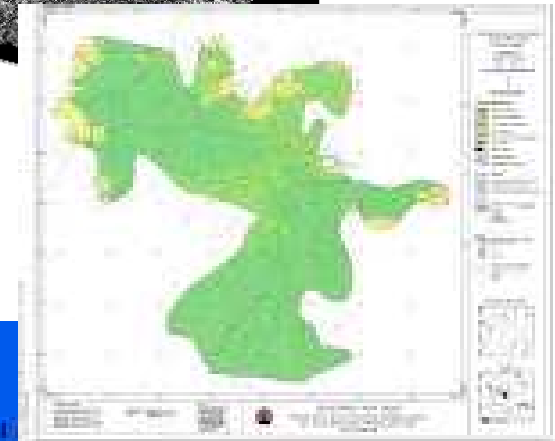
Protected Forest Indonesia

☐ Airborne single-pass SAR interferometry 1996 (DoSAR, X-band)

☐ Resolution

  ● Imaging up to 0.8 m

  ● Height up to 0.1 m

☐ 300,000 km² with 20,000 km² per week

☐ Near real-time digital processing up to final map printouts

Heritage in SAR Application: Topo Mapping

- 260.000 km² airborne INSAR mapping in Venezuela

- Radar-orthoimages and topographic maps 1:50,000

- In-country production 05/2003 – 12/2003, 520 map sheets

- P&X-Band survey:

P-Band DTM   **X-Band DEM**

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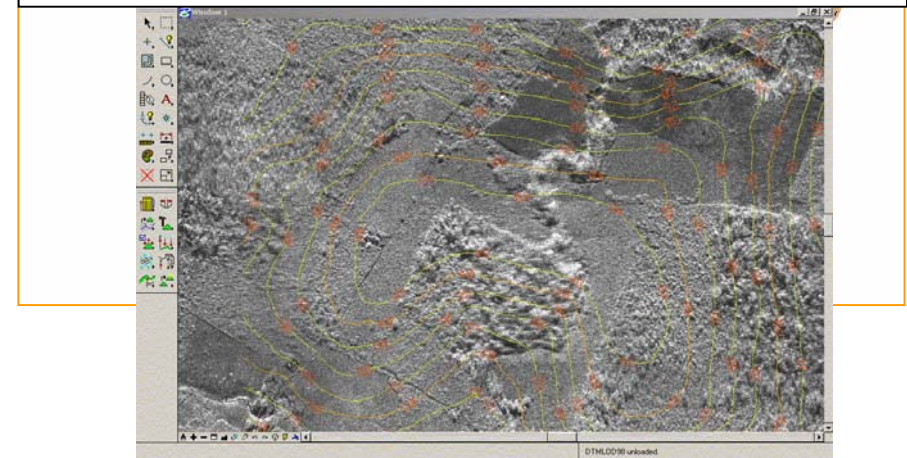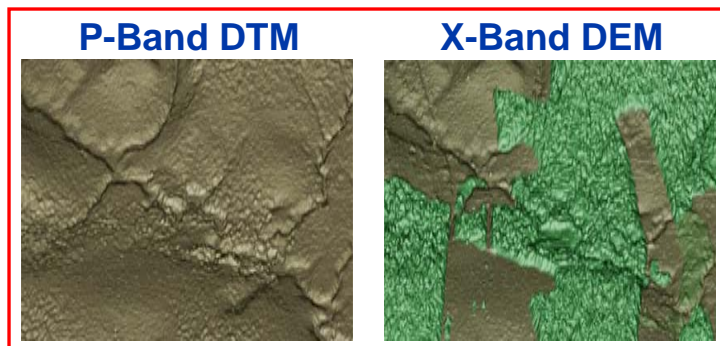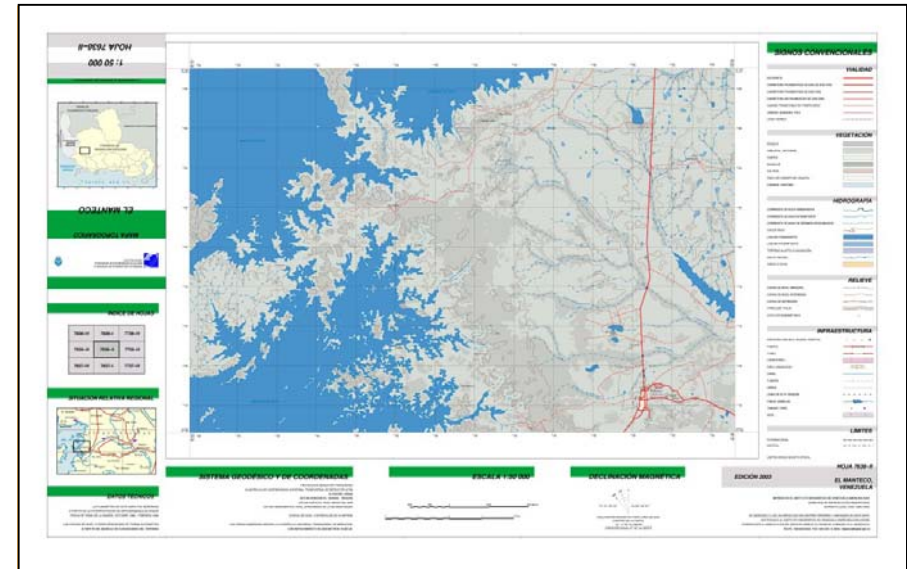
TerraSAR-X Radar-Modes

SpotLight mode
- **5/10 km x 10 km**
- **1 m resolution**

StripMap mode
- **30 km swath**
- **3 m resolution**

ScanSAR mode
- **100 km swath**
- **16 m resolution**
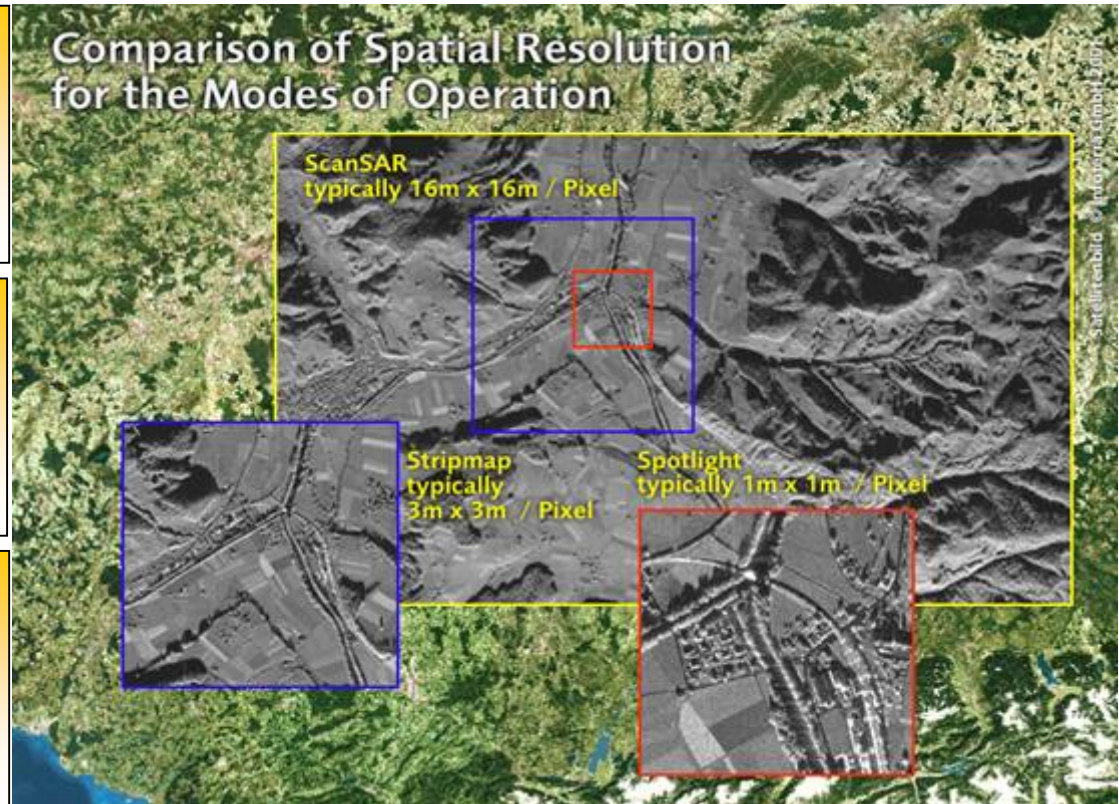
Dual receive antenna mode
- **along-track interferometry**
- **Moving Target Identification**

Comparison of Spatial Resolution for the Modes of Operation

ScanSAR typically 16m x 16m / Pixel

Stripmap typically 3m x 3m / Pixel

Spotlight typically 1m x 1m / Pixel

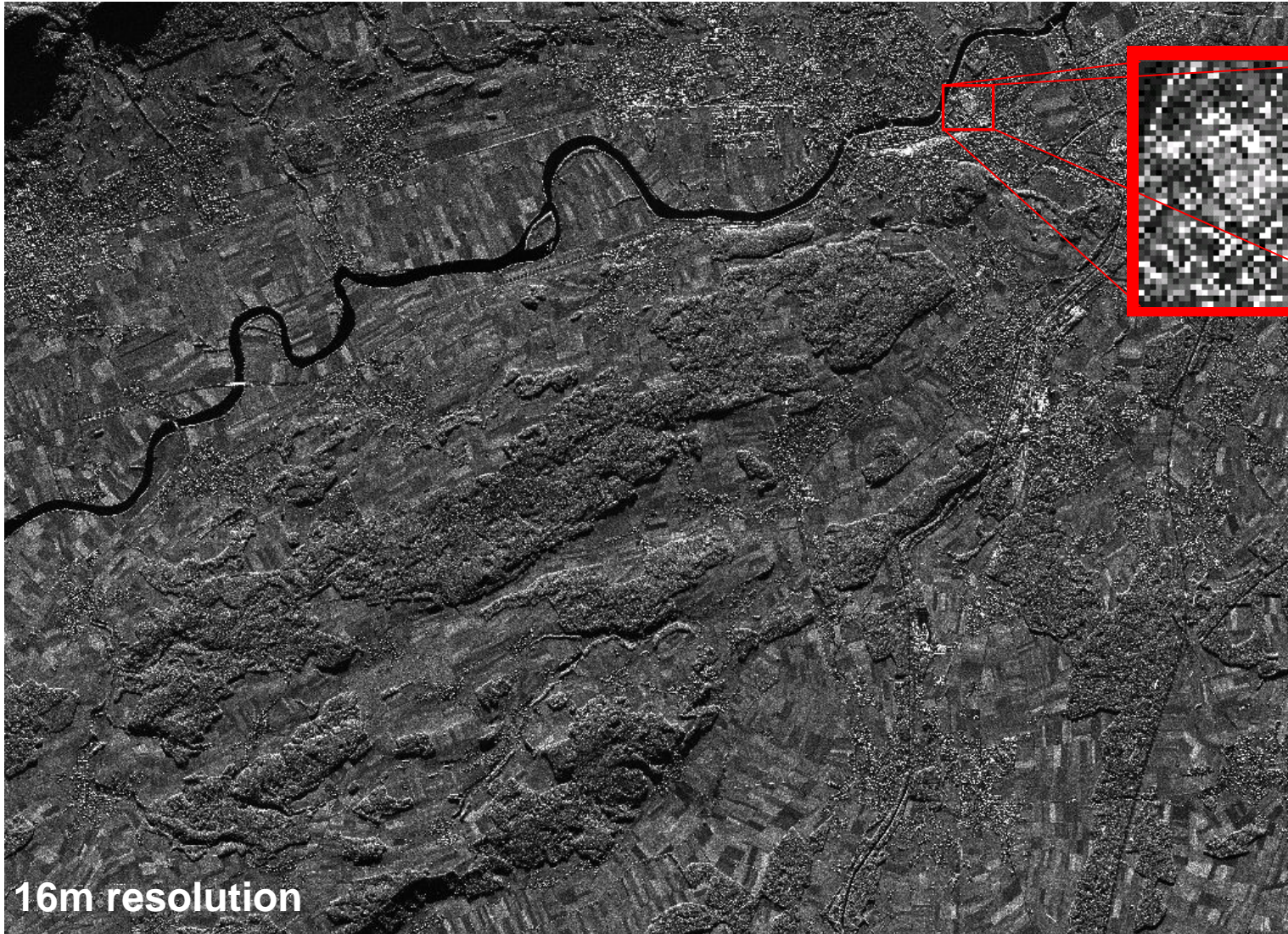# TerraSAR-X Operational Flexibility

TerraSAR-X Image Simulation

1m resolution

**Autobahn bridge
Bad Neuenahr/Ahrweiler
XHH**

**Man made targets
can be identified
(bridge pillars, railway,
industry, housing)**

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TerraSAR-X Image Simulation (Solothurn)

ScanSAR

16m resolution

Possible
interpretation:
• rivers
• forest/non-f.
• cities
• major roads
• coast lines

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TerraSAR-X Image Simulation (Solothurn)

1 m resolution

Railway Station, Bridges, Landcover

© Infoterra GmbH

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SpotLight Mode vs. Aerial Photo

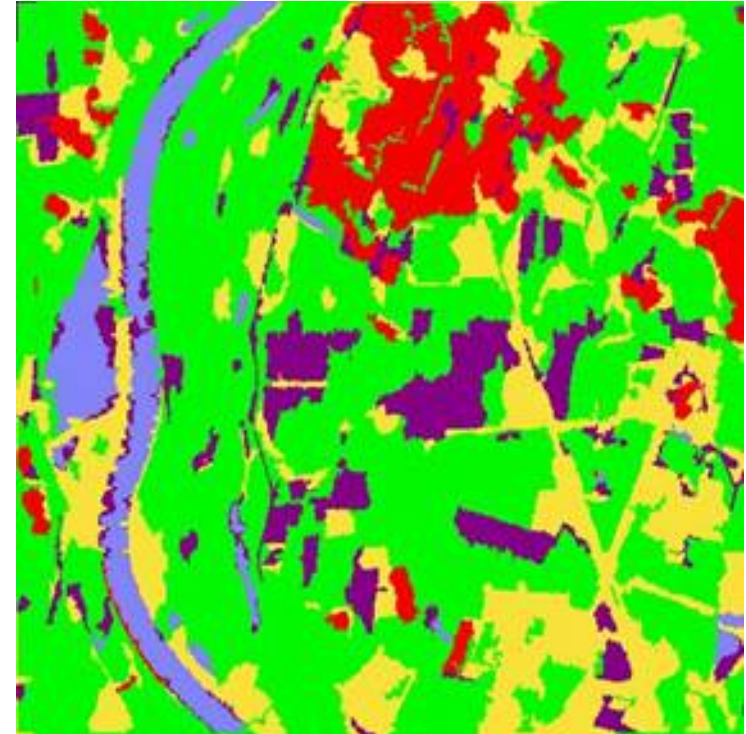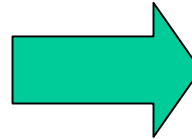**Solothurn, CH**

Urban mapping application.

Comparison to aerial image data.

Metal roofs and structures along the railway tracks clearly stand out.

Polarimetric Products

Full polarimetric Image
(RGB: HH/HV/VV)

Automated Classification
water: blue
grass: green
forest: yellow
bare soil: purple
urban: red

TerraSAR-X Products and Services

❑ **Basic Products (Level 1B)**
- Spotlight (up to 1 m resolution)
- Stripmap (up to 3 m resolution)
- Scansar (up to 16 m resolution)

❑ **Enhanced Image and Geoinformation Products**
- Orthorectified Images
- Mosaic, Oriented Images
- Orthomap
- Coherent Change Detection (CCD), Subsidence Map (mm vertical accuracy)

❑ **Basic Applications *)**
- DEM, GCP
- Regional monitoring
- Land Use/Land Cover Maps
- Topographic Base Maps
- Ship Detection, etc.

❑ **Services (Direct Access, Training)**

Oberpfaffenhofen (1.5 m Resolution)

*) direct or thru/with partners

Direct Access Service

- ❑ **Most direct means to receive TerraSAR-X**

- ❑ **Certified processor and equipment in terminal ensures best performance**

- ❑ **TerraSAR-X terminal operator training**

- ❑ **Multimission station upgrade, or Station setup support**

- ❑ **Service and terminal maintenance**

- ❑ **Upgrade and enhancement packages**

Data Security Policy

❑ **German data security policy for EO satellite data is being established as a federal law**

❑ **Objectives:**

- Avoid any threats or hazards for national security and security of other nations

- Support commercialization by defining reliable and transparent policies

- Guarantee positive control over "high quality" satellites

❑ **Implementation by Infoterra GmbH through sensitivity check**

- Customer

- Observation Area

- Delivery Time

- Technical Product Parameters

❑ **Final Judgement by German governmental body (sensitivity case)**
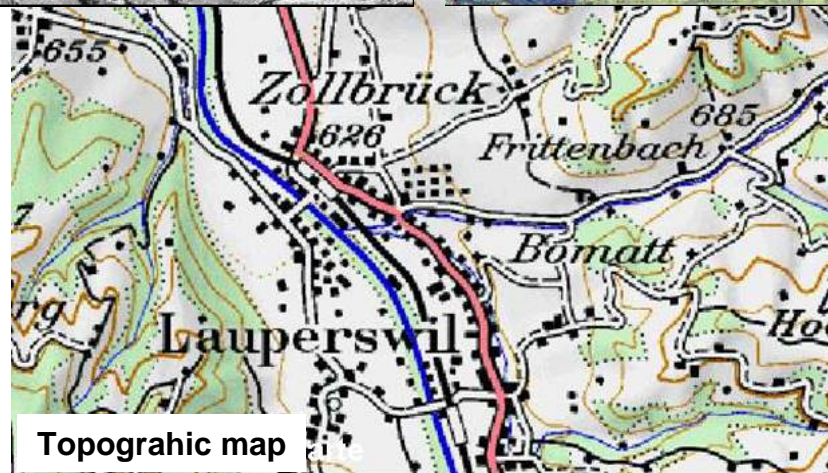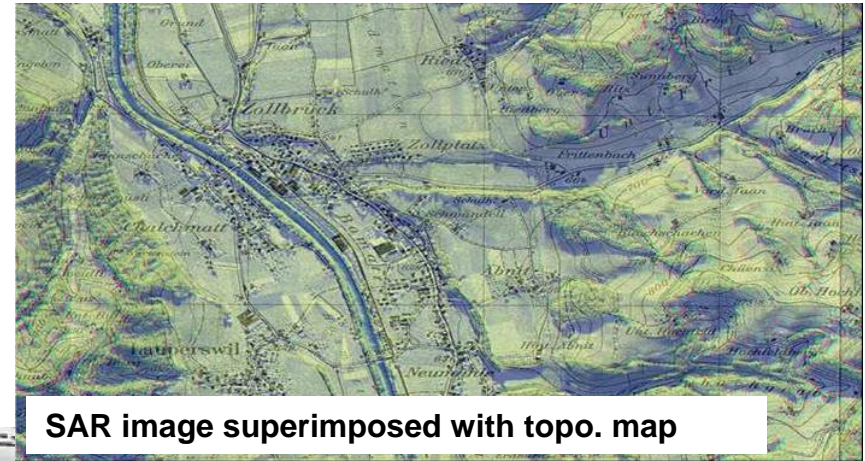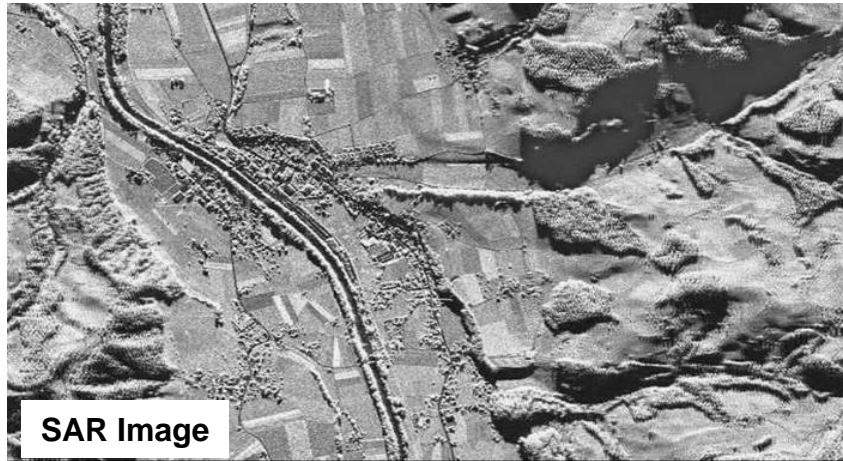
TerraSAR-X Commerial Applications
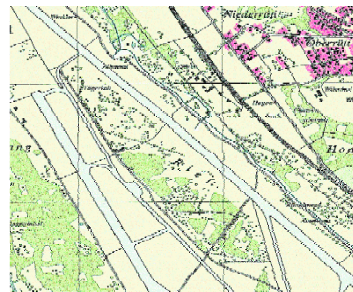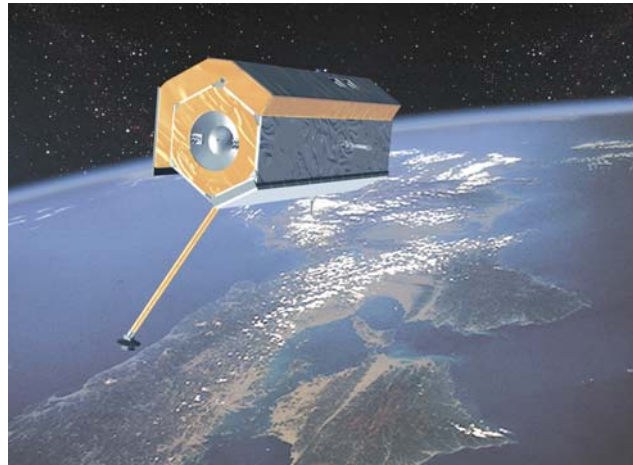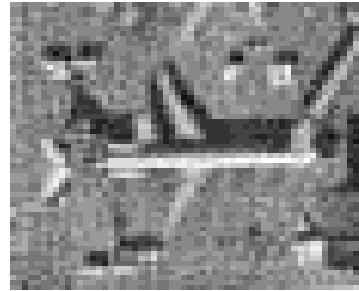
Example: Very High Resolution Imagery

Test Site: Oberpfaffenhofen (1,5 m resolution)

⇨ Security Applications

Example: Topographic Mapping

SAR Image

SAR image superimposed with topo. map

Topographic Maps © Bundesamt für Landestopographie (Schwitzerland)

Topograhic map

⇨ Survey Authorities

Example: Land Cover Change

Customer specific change detection:

Change probability map
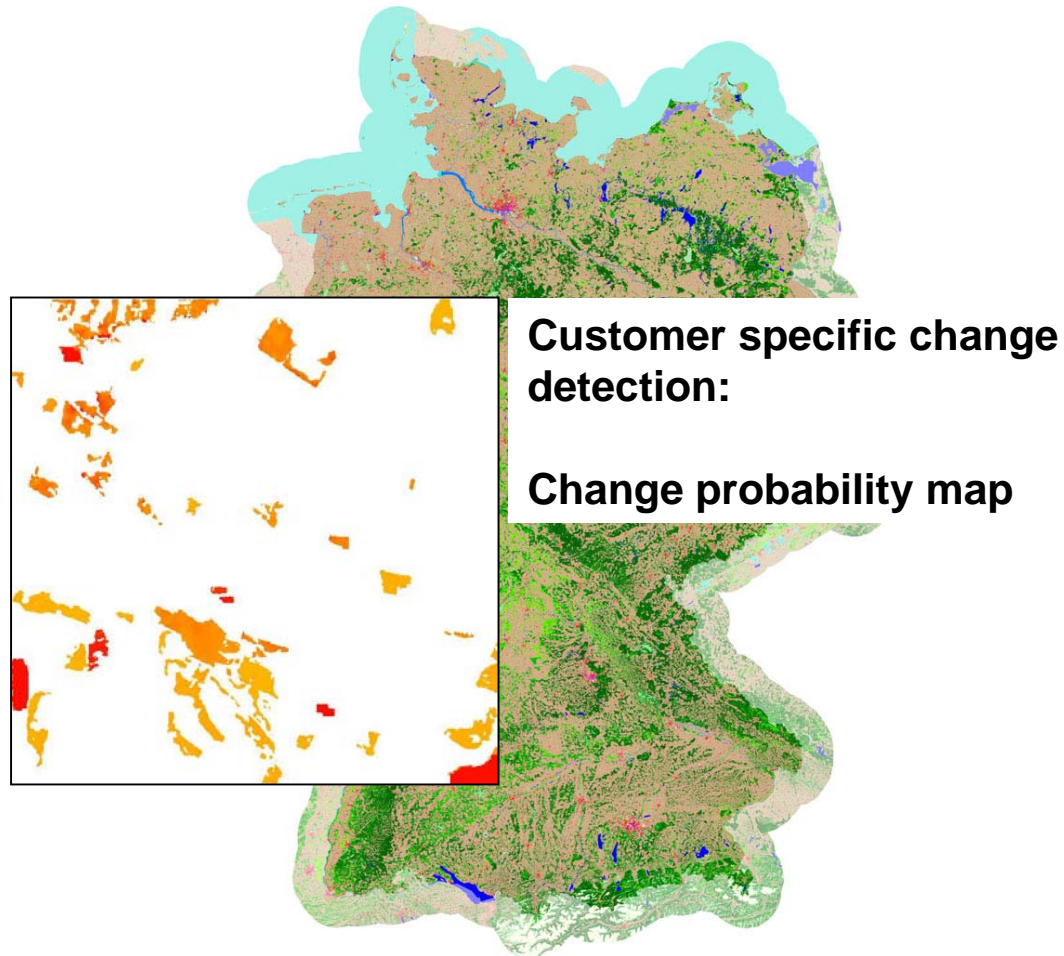
⇨ Environmetal Control Reporting

Example: Urban and Regional Planning

Legende

- Durchgängig städtische Prägung (112)
- Infrastruktur (122)
- Industrie- und Gewerbeflächen (121)
- Städtische Grünflächen (Schrebergärten, 414)
- Städtische Grünflächen (Parks, Sportplätze, 414)
- Landwirtschaftliche Nutzung (211)
- Landwirtschaftliche Nutzung (211)
- Wald (incl. innerstädtische Parks, 311)
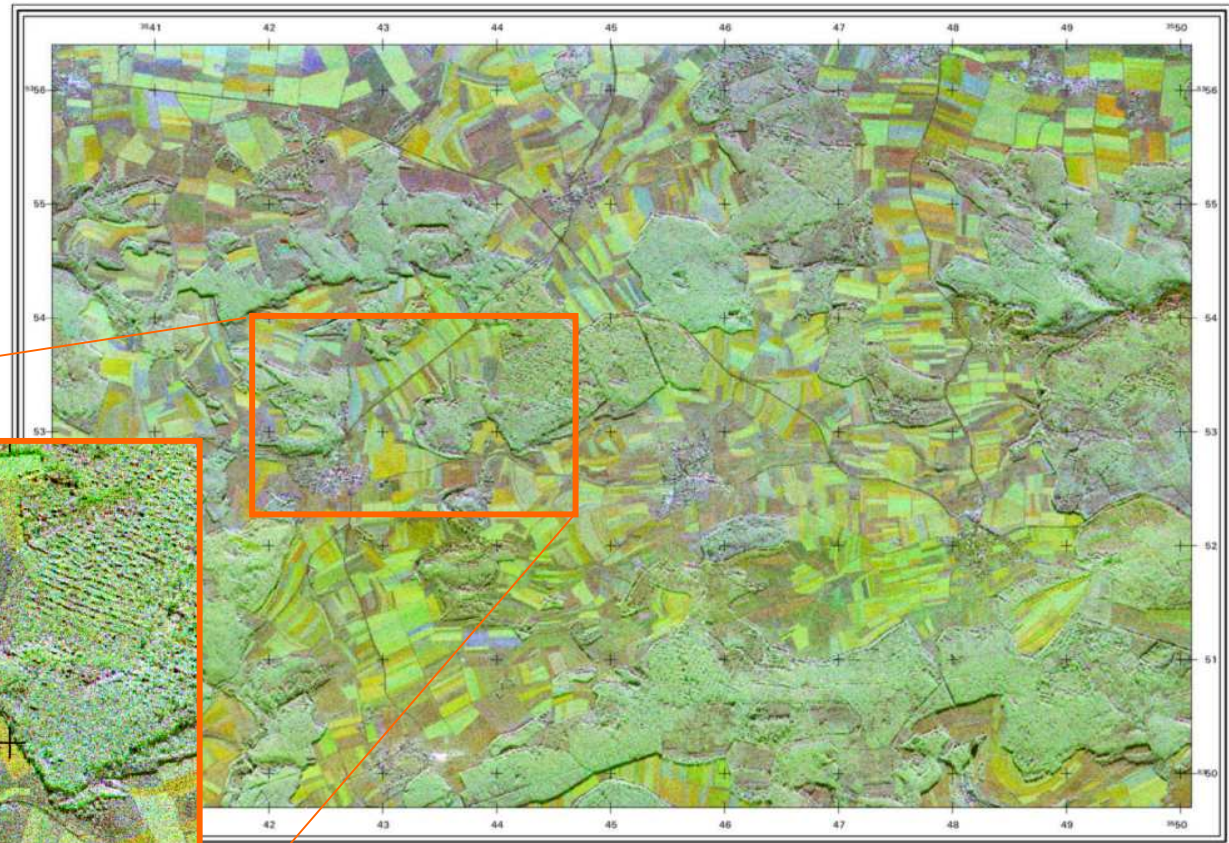- Stehendes Gewässer (512)
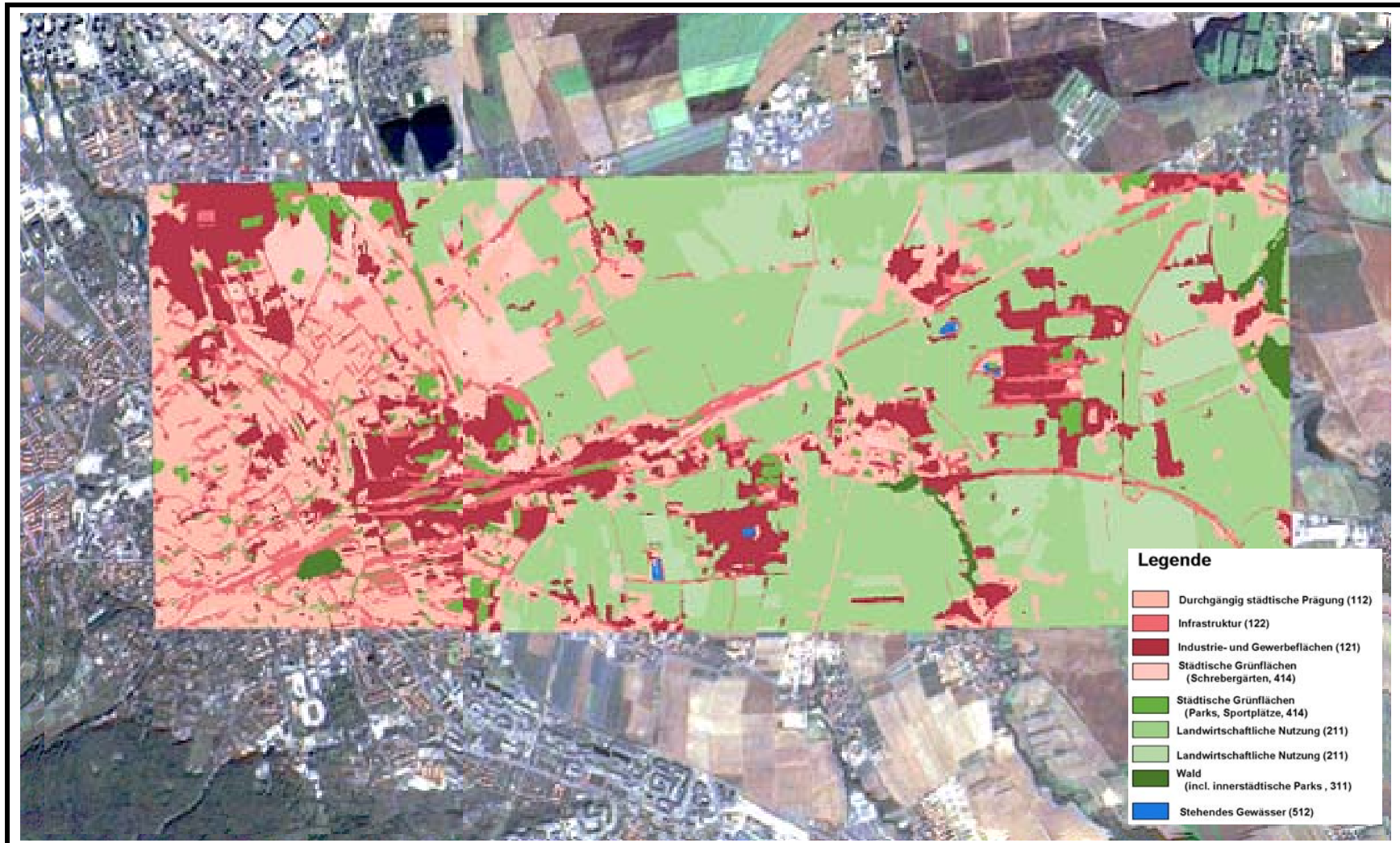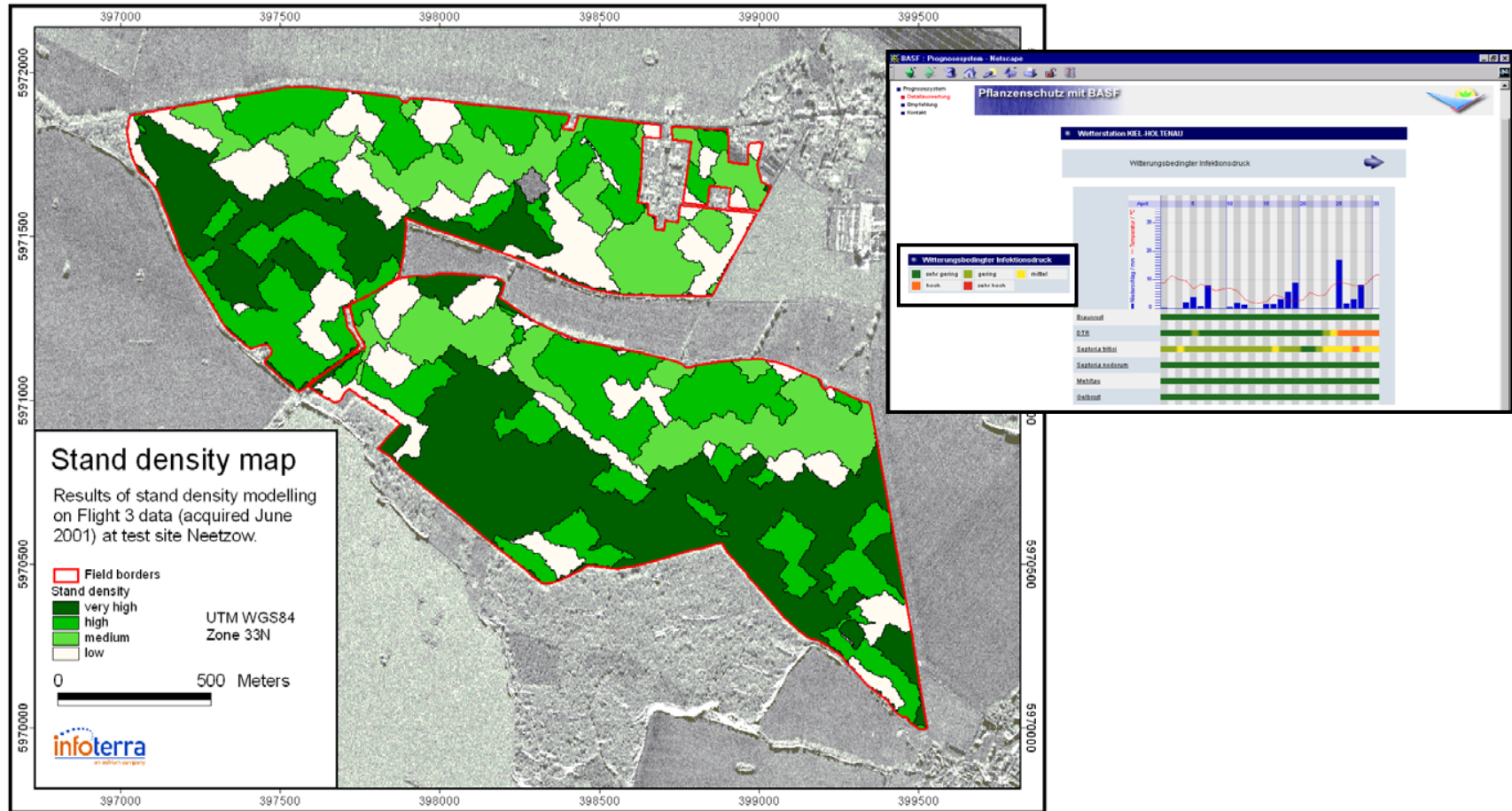
Example: Base Mapping of Rural Areas

TerraSAR-X

Multitemporal images
- Sept.00 (red)
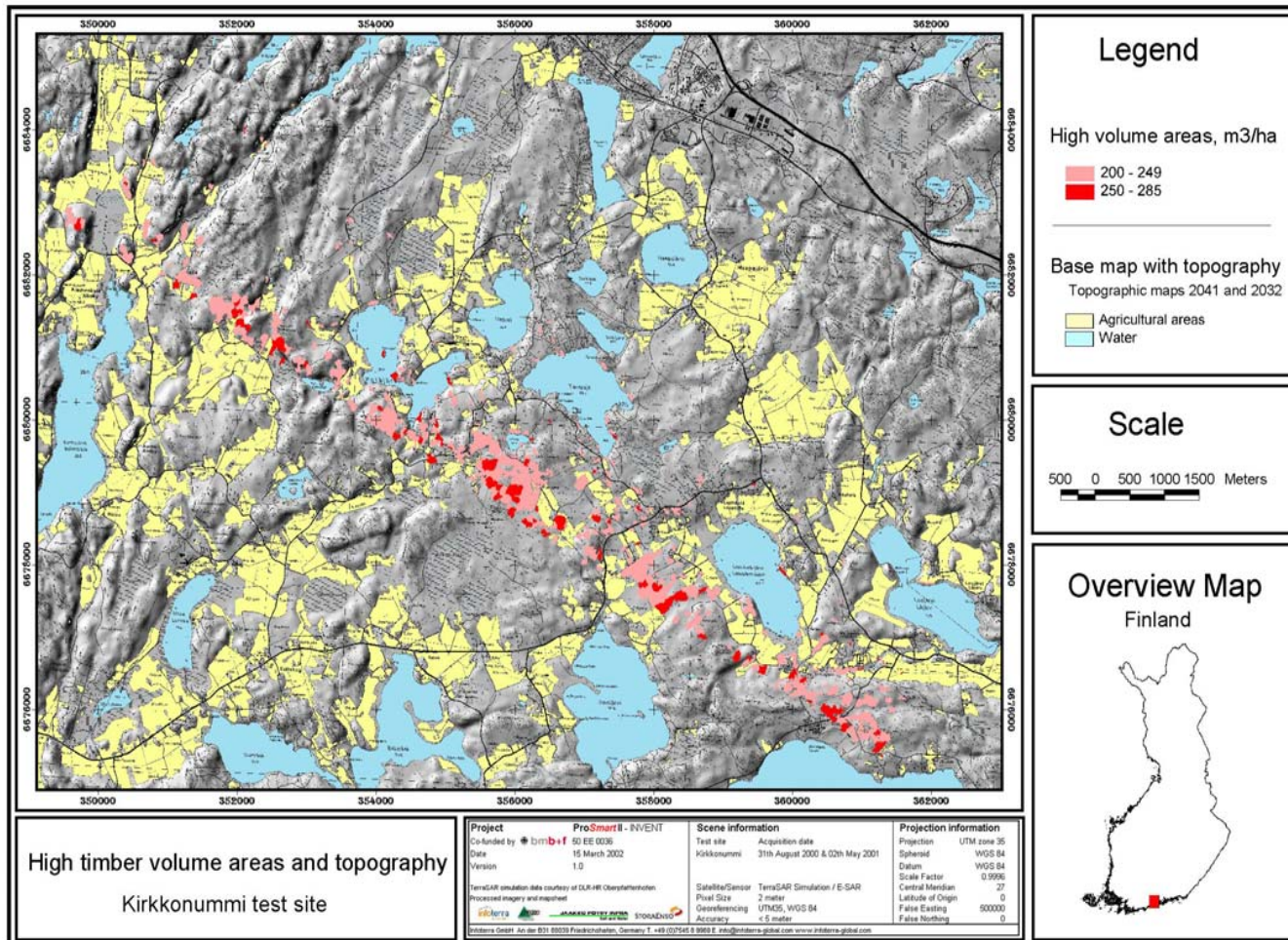- March01 (green)
- May01(blue)

Simulationsdaten, X-Band, HH Polarisation, Multitemporal
blau: Mai 2001, grün: März 2001, rot: September 2000
Maßstab 1 : 25.000

Example: Agri/Environmental Application
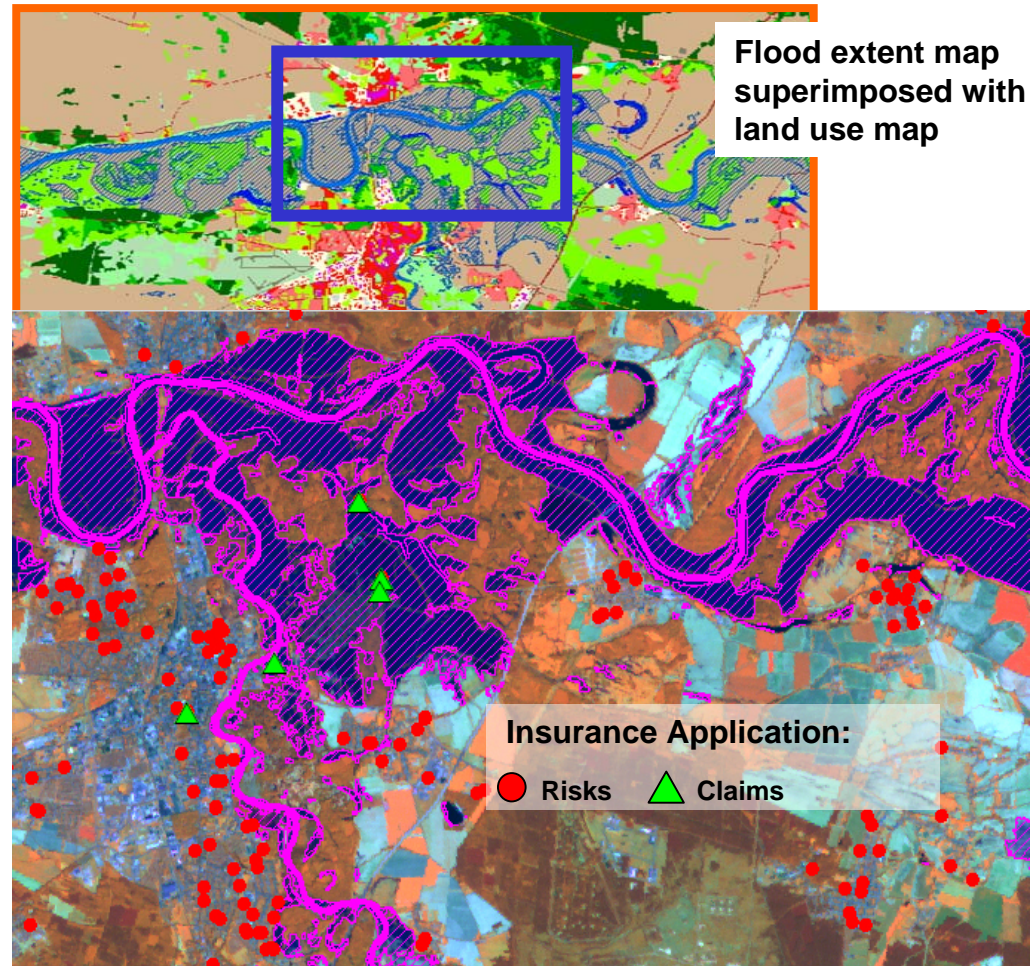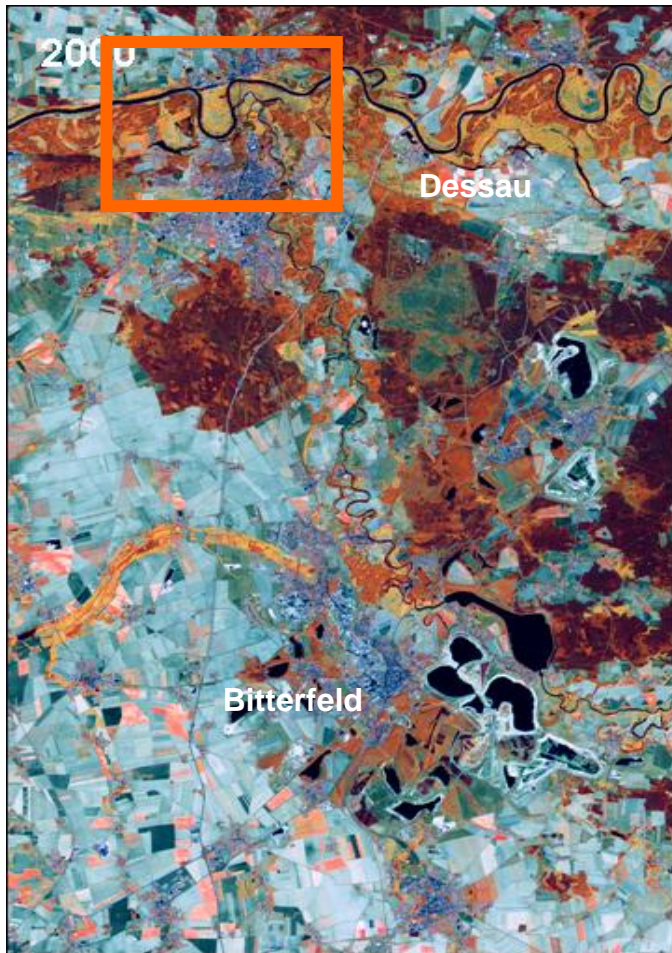

⇨ Fungicide Application

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Example: Timber Volume Map

⇨ Forest Harvesting

Example: Flood Mapping

Flood extent map superimposed with land use map

Insurance Application:
🔴 Risks   🔺 Claims

⇨ Mission Planning / Claims Management

Example: Fire Damages

Pre-fire situation

Post-fire situation

Damage extent

Sensor:	SIR-C/X-SAR
Images:	X-SAR, VV-polarisation
Acquisition:	April, 14 1994
	May, 05 1994
Location:	Catalunya/Spain
Material:	© DLR
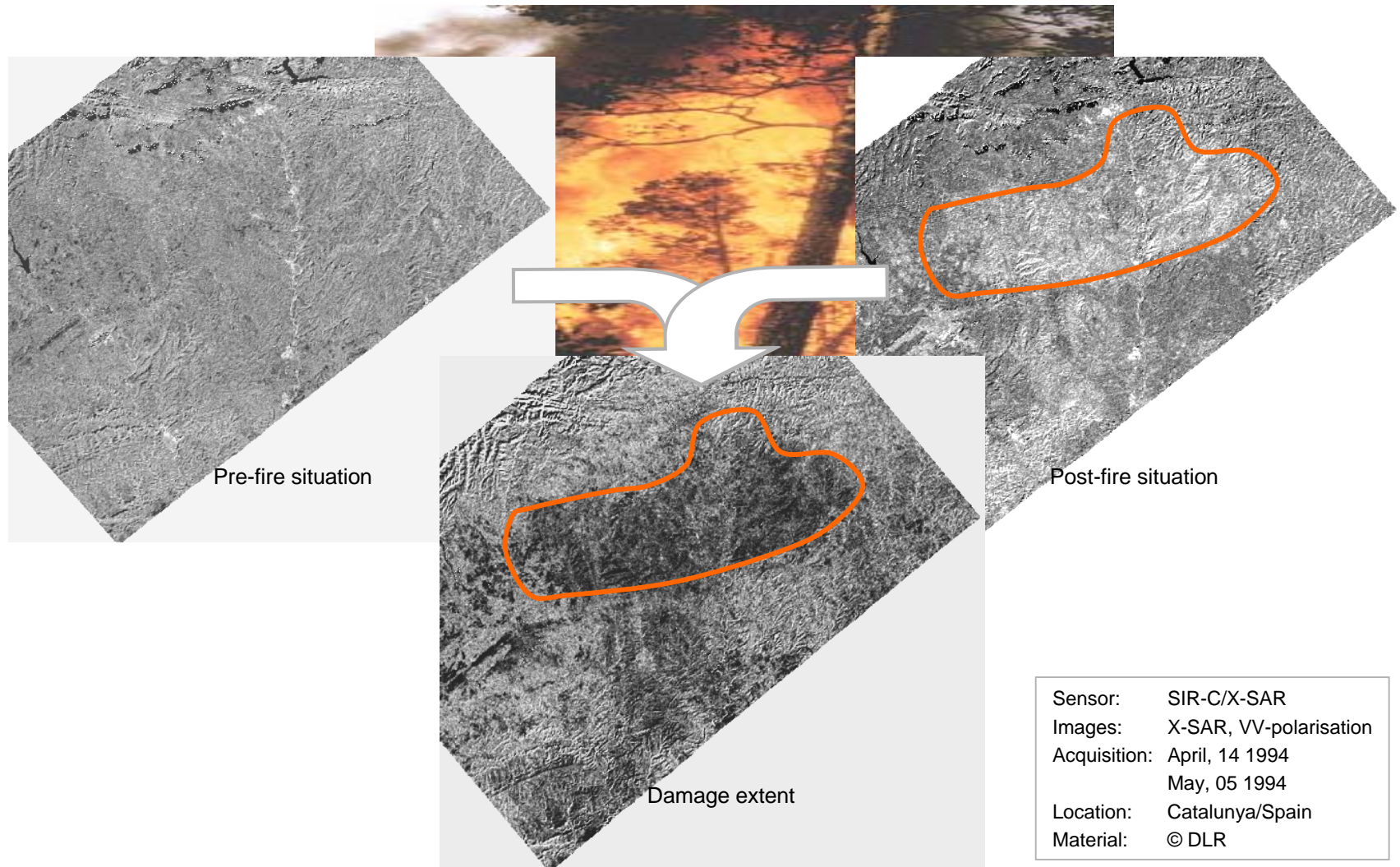
Example: Marine Applications

Natural Oil Seeps

Drift

Ship Pollution

Ship

Pollution trail

Rig Pollution

Wind

Rig

Pollution slick

Conclusion

infoterra
an EADS Astrium company
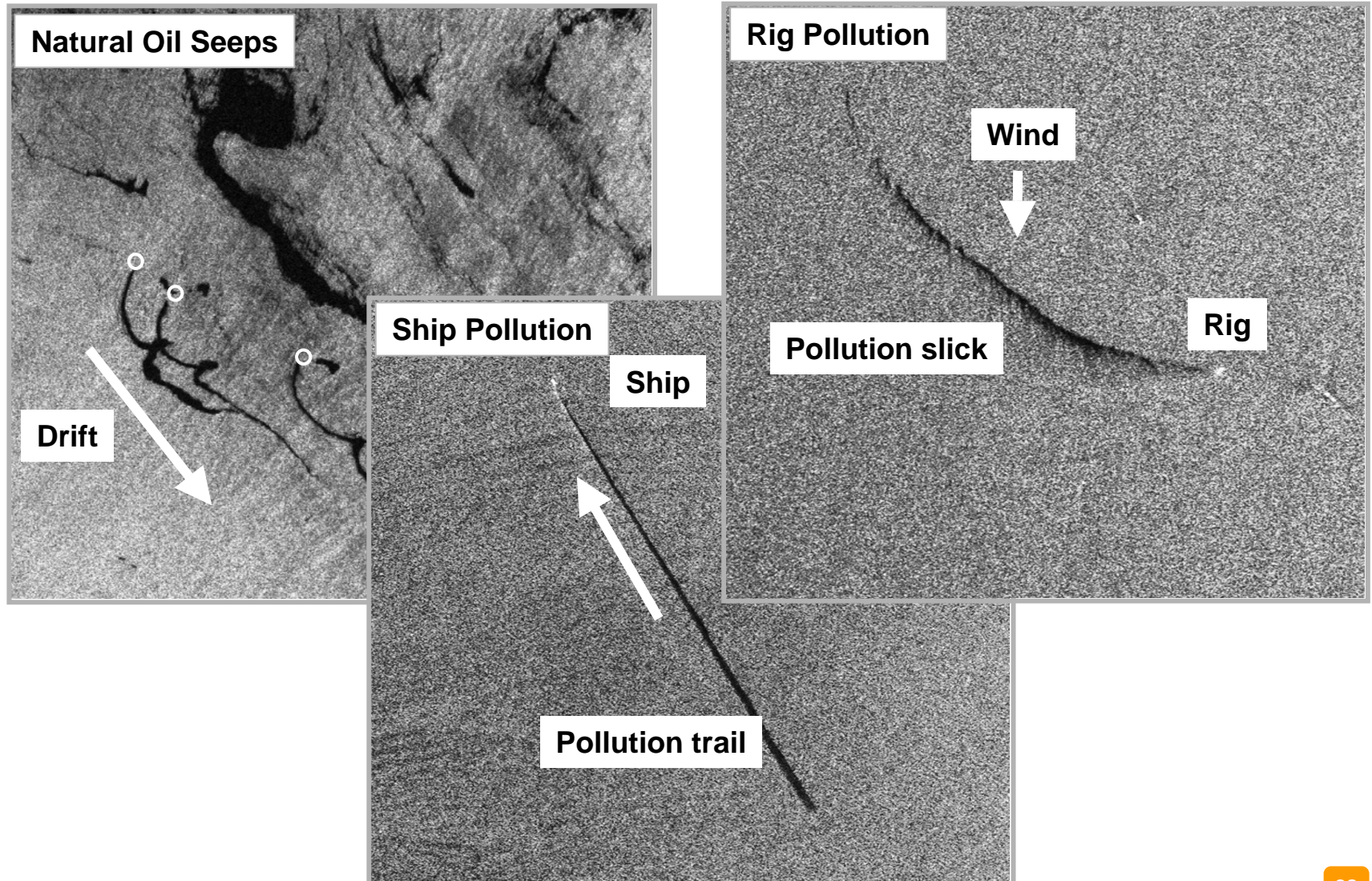
- ❑ **Weather independence, complementary timing**

- ❑ **1 meter resolution**

- ❑ **Multi modes**

- ❑ **Acquisition flexibility**

- ❑ **Quick global access**

- ❑ **High productivity**

- ❑ **Sustainability**

- ❑ **Secrecy**

TerraSAR-X provides unique space imagery from 2006

www.terrasar.de