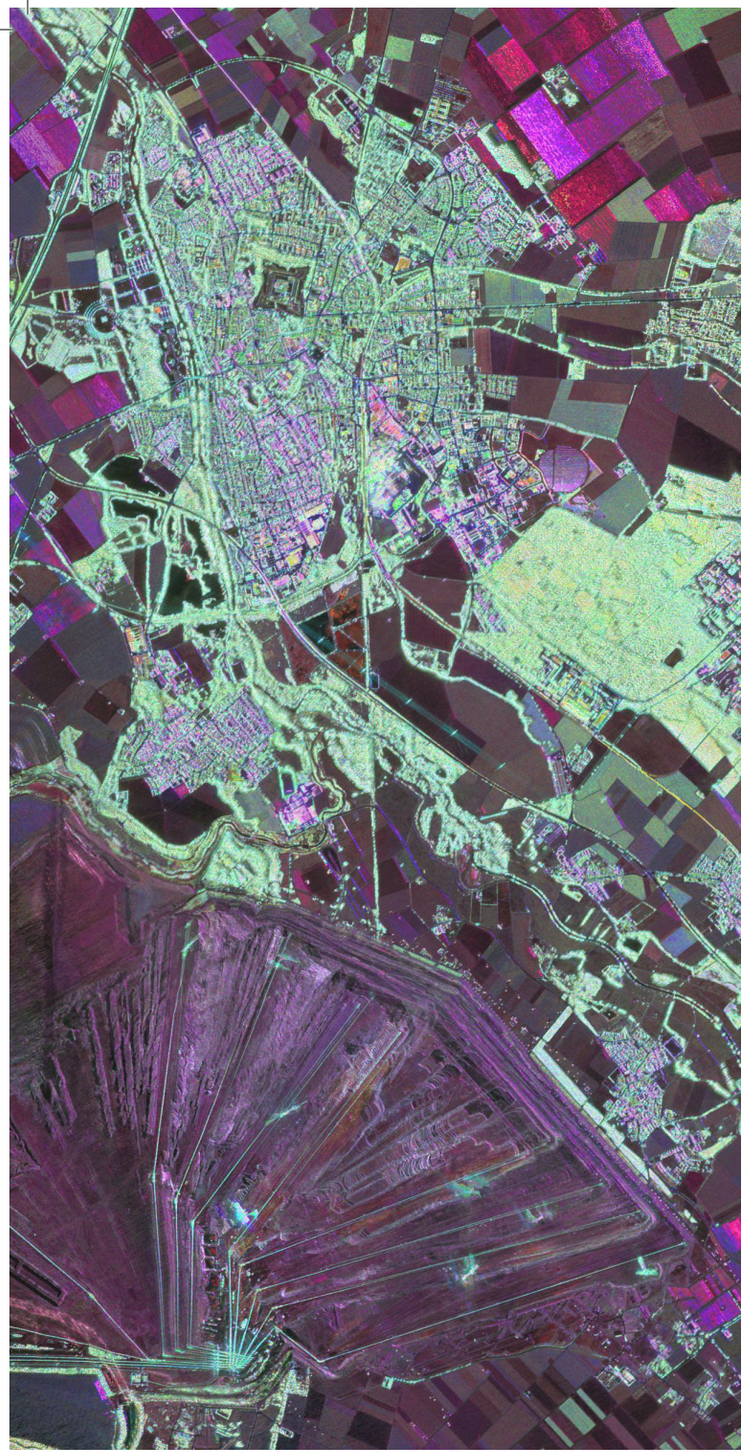
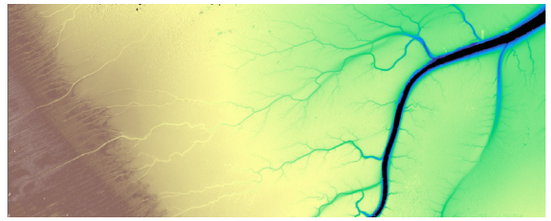


Subset of a mosaic of ten fully polarimetric L-band data strips near the town of Juelich, Germany, including an open brown coal pit.

Applications range from high-resolution imaging at different frequencies and analyses of polarimetric and interferometric properties to the derivation of high-level data products. Latter products, derived from interferometric and polarimetric processing, support numerous applications and include digital elevation models, topographic change maps, glacier flow velocity maps, vehicle speed measurements on roads, forest height, biomass and soil moisture maps among others. New tomographic SAR approaches are studied for extremely high resolutions and 3D information retrieval.



A Digital Elevation Model created from F-SAR X-band repeat pass data over dry fallen mudflats in the German Jade Bight. The ground elevates towards the coastline on the left. To the right some tidal creeks cut through the mudflats area. The height difference to a reference LIDAR DEM is 12 cm rms.


**Deutsches Zentrum für Luft- und Raumfahrt**
German Aerospace Center

Microwaves and Radar Institute
Münchener Str. 20
D-82234 Wessling
Germany

**Contact:**

Ralf Horn
Phone: +49 (0)8153 28-2384
Fax: +49 (0)8153 28-1449
E-Mail: ralf.horn@dlr.de

Dr. Andreas Reigber
Phone: +49 (0)8153 28-2360
Fax: +49 (0)8153 28-1449
E-Mail: andreas.reigber@dlr.de

www.DLR.de/HR/en




Information

# F-SAR

Airborne SAR
Remote Sensing

# Airborne SAR Remote Sensing at DLR

The Microwaves and Radar Institute of the German Aerospace Center (DLR) is one of the world's leading institutions in airborne synthetic aperture radar (SAR) technology and applications.
State of the art airborne SAR instruments, like F-SAR, the Institute's latest development, are capable of delivering high-quality SAR data with decimetre resolution, combined with polarimetric, interferometric, as well as multi-spectral imaging modes. They are the basis for the development of innovative approaches in environmental research and support the design of future Earth observation satellite missions.


## The F-SAR Instrument

In recent years, the Microwaves and Radar Institute has constructed one of the world's most advanced airborne SAR instruments, the F-SAR. Its main design feature is the fully polarimetric operation in up to five frequency bands (X-, C-, S-, L- and P-band) with the ability to acquire data in different bands and/or polarisations simultaneously. Furthermore, the system features two single-pass polarimetric interferometers at X-band (across and along-track) as well as one at S-band (across-track). The F-SAR also provides a very high spatial resolution of up to 25 cm at X-band. The primary technical parameters are summarised below:

| | X | C | S | L | P |
|---|---|---|---|---|---|
| Frequency [MHz] | 9600 | 5300 | 3250 | 1325 | 350 / 435 |
| Polarisation | all bands are fully polarimetric | | | | |
| Bandwidth [MHz] | 760 | 384 | 300 | 150 | 100 / 50 |
| Peak power [W] | 2500 | 1000 | 1250 | 750 | 750 |
| PRF [kHz] | 5 | 5 | 5 | 10 | 10 |
| Sampling | 8 bit real at 1000 Msamples/s | | | | |
| Resolution [m] | 0.25 | 0.5 | 0.6 | 1.0 | 2 / 4 |
| Swath width [km] | 1 to 5 (depending on altitude) | | | | |

## The Instrument Platform

The F-SAR is operated on-board a DLR Do 228-212 aircraft. The Do 228 is a twin-engine short take-off and landing turboprop aircraft without pressurised cabin. Special modifications, like 28 VDC and 220 VAC instrumentation power supply, hard points, bubble windows, circular mounts in the roof, and a floor hatch with a roller door, make it ideal for scientific payloads. With F-SAR installed, the maximum operating altitude is about 6100 m above sea level. During SAR data acquisition, the average ground speed is 175 kt (or 90 m/s). The endurance is configuration dependent and ranges between 2.5 and 5 hours.

The F-SAR instrument installed in the cabin of the Do 228 aircraft. Standard instrumentation racks hold the radar's electronics units.

## Operation & Applications

The development of the F-SAR instrument was driven by the demand for high quality SAR data products that cannot be provided by current SAR satellites. Best possible aircraft positioning in the centimetre range and skilled pilots, able to keep the aircraft in a 2 m envelope around the planned track, are essential to ensure high precision SAR data.
Since its completion, F-SAR is in heavy use for various SAR experiments and measurement campaigns, both for external customers and internal research purposes. About half of the campaigns are dedicated to establishing new imaging techniques, while the other half is carried out to provide standard SAR data products. Additionally, calibration test flights are performed every time the SAR system is installed on board the aircraft, as well as following modifications to the SAR hardware.