

# TerraSAR-X Applications Guide

**Extract: Digital Elevation Models**

April 2015

## Digital Elevation Models

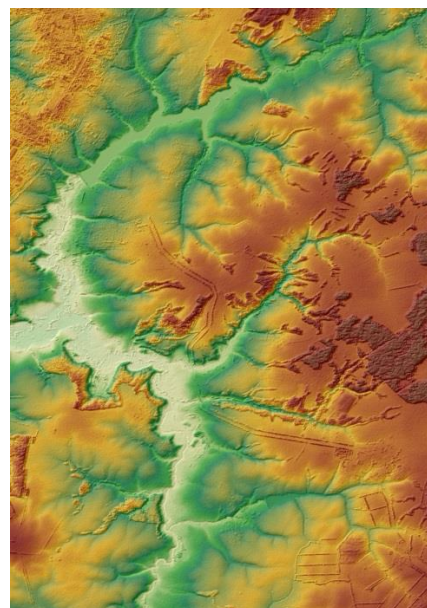
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### Issue

Digital Elevation Models (DEM) are used for high quality image calibration and ortho-rectification, multi-scale mapping, defence mission preparation and rehearsal, terrain knowledge for flight guidance, register intelligence and ease target identification, water body mapping, infrastructure and networks planning and for environmental modelling of static and dynamic processes.

### Markets

Defence, Oil/Gas and Minerals, Civil Engineering, Insurance and Aviation



### Achievements

Digital Surface Models can either be generated using a radargrammetric or an interferometric approach. The Digital Surface Model (DSM) includes “first surface” elevations (e.g. vegetation and man-made structures) and can be processed into Digital Terrain Models (DTM), that represent the bare earth elevation, i.e. vegetation and man-made objects are removed.

### Benefits of using TerraSAR-X

The main benefit of TerraSAR-X for generating Digital Elevation Models is that necessary input data (either for radargrammetric or for interferometric approaches) can be generated very quickly even for areas with frequent cloud coverages (e.g. tropical belts) or polar night. This is especially important for customers with stronger time constraints.

Furthermore, all TerraSAR-X derived products are offering a high geolocation and vertical accuracy.

Especially WorldDEM™ offers a very high level of detail of elevation information.

### Data Specifications

Recommended image specification depends on the foreseen processing approach.

Table 1: Recommended Image Specification for *radargrammetric* DEM generation

<b>Image Modes:</b>	StripMap, SpotLight, High Resolution SpotLight	
<b>Number of datasets:</b>	Two - one near range (steep), one far range (shallow)	
<b>Assumed Analysis Approach:</b>	<ul style="list-style-type: none"> <li>• Radargrammetric (Stereo) DEM generation</li> </ul>	
<b>System Settings:</b>	Polarization:	HH
	Incidence Angle [Degree]:	Angle difference (disparity angle) between the two images should be between 15° and 25° if possible
	Orbit	Ascending and Descending
<b>TerraSAR- Image Product</b>	Basic Image Product	MGD or SSC <sup>a</sup>
	Resolution Mode:	Radiometrically Enhanced (RE) or Spatially Enhanced (SE) <sup>a</sup>
	File Format:	GEOTIFF / COSAR
	Orbit Accuracy:	Scientific

Note: Recommended image specification is an indication only. It may vary depending on the software used. Airbus Defence and Space, Geo-Intelligence does not guarantee relevant capability.

Table 2: Recommended Image Specification for *interferometric* DEM generation

<b>Image Modes:</b>	StripMap, SpotLight, High Resolution SpotLight	
<b>Number of datasets:</b>	Two of same geometry (repeat pass)	
<b>Assumed Analysis Approach:</b>	<ul style="list-style-type: none"> <li>• Interferometric (InSAR) processing</li> </ul>	
<b>System Settings:</b>	Polarization:	HH
	Incidence Angle [Degree]:	35 - 45
	Orbit:	Ascending and Descending for steep terrain, otherwise ascending or descending

<sup>a</sup> depending on software

TerraSAR- Image Product	Basic Image Product:	SSC
	Resolution Mode:	-
File Format:		COSAR

*Note: Recommended image specification is an indication only. It may vary depending on the software used. Airbus Defence and Space, Geo-Intelligence does not guarantee relevant capability.*

## Relevant Products and Service available from Airbus Defence and Space, Geo-Intelligence

**Elevation10** provides reliable and customised elevation modelling independent of relief characteristics and weather conditions. The models are available tailored to the customer's area of interest starting at a minimum of 500 square kilometres, and up to full regional or even national coverage.

**WorldDEM** provides pole-to-pole coverage coupled with unrivalled accuracy and quality. The accuracy surpasses that of any global satellite-based elevation model available today and will define a new industry standard. WorldDEM™ provides a reliable and precise reference layer to enhance a wide range of applications.

## Related Publications

- Available on Request

## Related Sample Datasets

- Radargrammetric Processing
  - 5 x StripMap Marseille, France (MGD, SE, HH)
- Interferometric Processing
  - 2 x StripMap Grand Canyon, USA (SSC, HH)

## Suitable Software

Application	Company Name								
	BAE Systems	Exelis	GAMMA Remote Sensing AG	Hexagon Geospatial/ GEOSYSTEMS GmbH	Joanneum Research	PCI Geomatics	Racurs	Textron Geospatial Solutions	Trimble
	Provided Software								
	SOCET GXP	ENVI SARscape	GAMMA MSP ISP, DIFF&GE O, LAT, IPTA	ERDAS IMAGINE	RSG- Remote Sensing Software Package Graz	Geomatica and GXL	Photomod Radar	RemoteView, ELT5500, and Global ImageViewer	eCognition
<b>Digital Elevation Modelling</b>									
• Interferometric (InSAR) Processing		x	x	x	x		x		
• Radargrammetric (Stereo) DEM Generation	x	x		x	x	x	x		

*Note: Information provided by Software Providers, Airbus Defence and Space, Geo-Intelligence does not guarantee relevant capability.*

## List of Abbreviations

<b>ACD</b>	Amplitude Change Detection
<b>CCD</b>	Coherence Change Detection
<b>DEM</b>	Digital Elevation Model
<b>DInSAR</b>	Differential Interferometry
<b>DSM</b>	Digital Surface Model
<b>DTM</b>	Digital Terrain Model
<b>EEC</b>	Enhanced Ellipsoid Corrected (Basic Image Product)
<b>EGR</b>	Enhanced Gas Recovery
<b>EMSA</b>	European Maritime Safety Agency
<b>EOR</b>	Enhanced Oil Recovery
<b>EU</b>	European Union
<b>EEZ</b>	Exclusive Economic Zone
<b>GCP</b>	Ground Control Points
<b>GEC</b>	Geocoded Ellipsoid Corrected (Basic Image Product)
<b>GEO</b>	Airbus Defence & Space, Geo-Intelligence
<b>HS</b>	High Resolution SpotLight (imaging mode)
<b>IMINT</b>	Image Intelligence
<b>InSAR</b>	Interferometric SAR
<b>IWS</b>	Interferometric Wide Swath (Sentinel-1 imaging mode)
<b>MGD</b>	Multi Look Ground Range Detected (Basic Image Product)
<b>NRT</b>	Near-Real-Time
<b>PSI</b>	Persistent Scatterer Interferometry (PSI)
<b>RE</b>	Radiometrically Enhanced
<b>REED+</b>	Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
<b>SAR</b>	Synthetic Aperture Radar
<b>SBAS</b>	Small Baseline Subset Interferometry
<b>SC</b>	ScanSAR (imaging mode, 4-beam ScanSAR)
<b>SE</b>	Spatially Enhanced
<b>SL</b>	SpotLight (imaging mode)
<b>SM</b>	StripMap (imaging mode)
<b>SSC</b>	Single Look Slant Range Complex (Basic Image Product)
<b>SRTM</b>	Shuttle Radar Topography Mission



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<b>ST</b>	Staring SpotLight (imaging mode)
<b>WS</b>	Wide ScanSAR (imaging mode, 6-beam Scan SAR)

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## Contact

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For feedback or further inquiry please contact the Airbus Defence and Space Customer Service Centre via telephone at +49 7545 8 4344 / eMail: [terrasar@astrium-geo.com](mailto:terrasar@astrium-geo.com) or visit <http://www.geo-airbusds.com/terrasar-x/>