GMES – Terrafirma
Stassfurt Case Study
- Preliminary Results -

Contact Terrafirma I and II:
Dr. Friedrich Kuehn
Federal Institute for Geosciences
and Natural Resources (BGR)
Stilleweg 2,
30655 Hannover, Germany
Email: Friedrich.Kuehn@bgr.de
Phone: +49-511-643-3007
Fax: +49-511-643-2304

Contact Terrafirma III:
Dr. Kai Hahne
Federal Institute for Geosciences
and Natural Resources (BGR)
Stilleweg 2,
30655 Hannover, Germany
Email: Kai.Hahne@bgr.de
Phone: +49-511-643-3003
Fax: +49-511-643-2304

PSI-Processing by DLR Oberpfaffenhofen/Germany

Reference: http://www.terrafirma.eu.com/atlas.htm
Project Summary

Terrafirma is one of ten services being supported by the European Space Agency's (ESA) GMES Service Element Programme. Terrafirma aims at providing a ground motion hazard information service, distributed throughout Europe via national geological surveys and institutions, and through utilizing the technique of Persistent Scatterer Interferometry (PSI) (www.terrafirma.eu.com).

The technique of Persistent Scatterer Interferometry (PSI) analyses series of 20 to 100 satellite SAR data (SAR: Synthetic Aperture Radar). Phase shifts detectable for persistently backscattering points over the complete series of SAR data are highly sensitive to vertical motion of the ground even if annual displacement rates amount to millimeters only.

BGR is Terrafirma project partner. BGR’s contribution was the geological evaluation of PSI-ground motion data for Berlin, Hamburg and Stassfurt (Terrafirma stages I and II). A summary of the Stassfurt results is presented. Further processing results are presented in the Terrafirma Atlas (www.terrafirma.eu.com).

Stassfurt is the site of several abandoned potash mines. The mines have been flooded causing collapse sink holes and land subsidence. The city centre is now below the groundwater table due to subsidence. The PSI-derived land subsidence features strictly follow the surface projection of mined potash horizons. The PSI data complement the levelling data collected for a few benchmark points very effectively. The PSI-derived motion rates fully agree with motion rates from levelling.

Terrafirma stage III, launched in December 2009, focuses on testing and implementing a border-crossing "Wide Area Mapping Service".
**Stassfurt**: Simplified vertical section explaining formation of land subsidence and collapse sinkholes at the flanks of the rock salt diapir:

- **Land subsidence** marker (4.5 m level)
- Historic town center is ground water lake now.
- Abandoned mines – flooded and subject to convergence
- Buildings, severely damaged by land subsidence.
Enlarged section of Landsat 7 Pan image with classified PS-points, layout of former potash horizons at -325 m NN (blue) and mined subsurface space (yellow) according to geological map (above right).

PSI-derived ground motion rates coincide with mined subsurface space and former potash horizon and support results of ground-based observations.