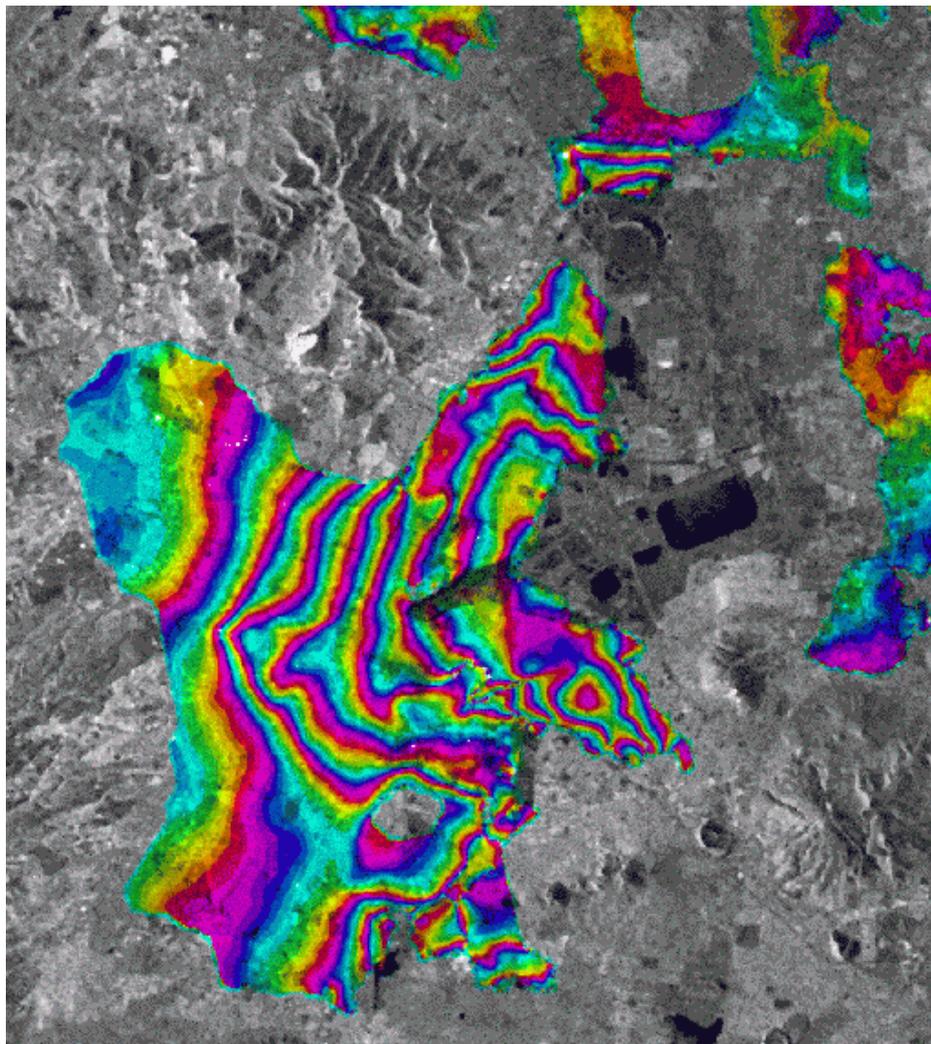


# Geophysical Displacement Mapping with SAR Interferometry

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## Overview

Earth surface displacements are the consequence of earthquakes, volcano eruptions, landslides and subsidence. In all these cases significant hazards can occur making the monitoring very important. GAMMA specialized on the mapping of geophysical displacements with differential SAR interferometry and has all the required processing tools and related experience. With this satellite based technique mm to cm accuracy can be achieved at low cost.



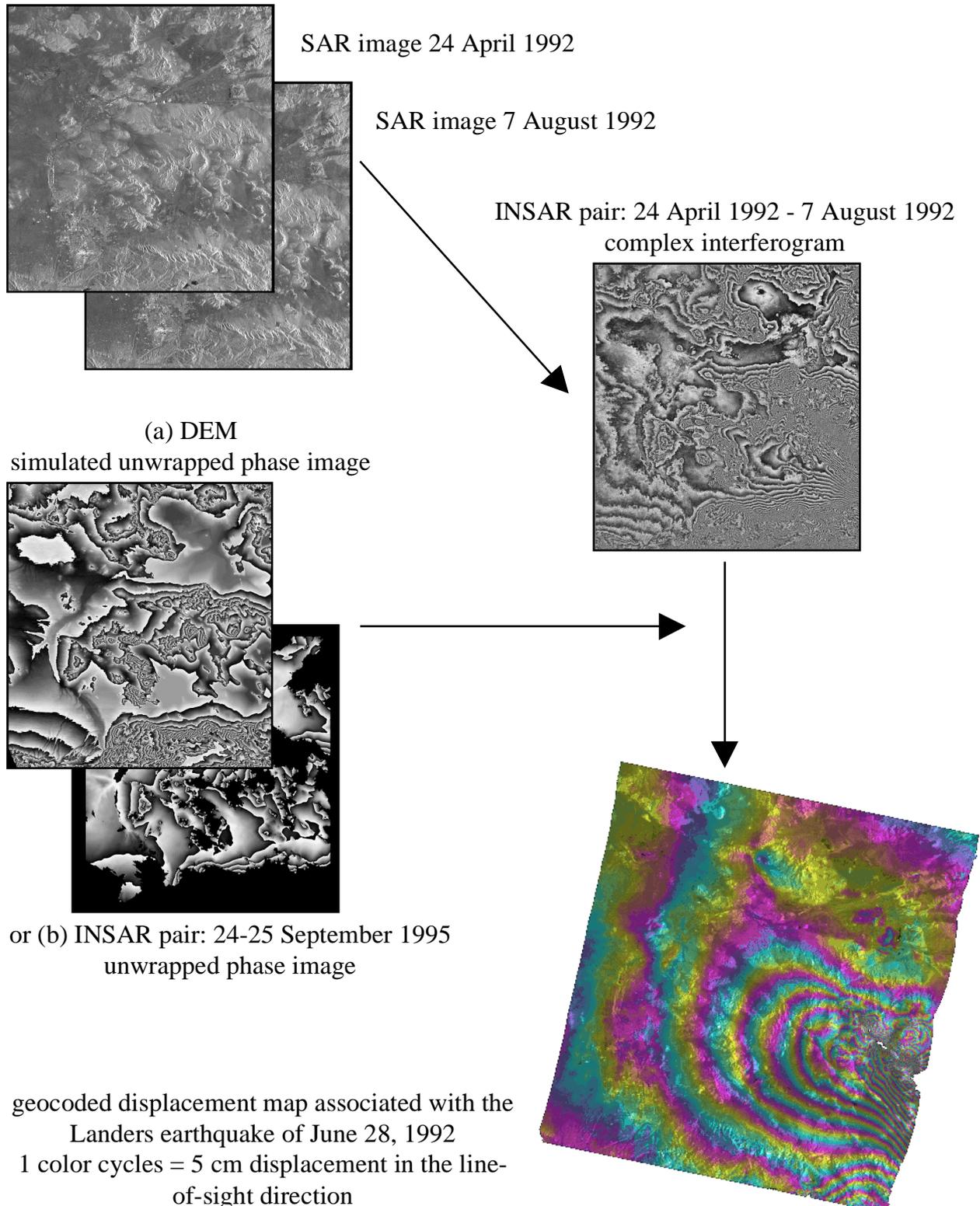
Surface displacement associated with the land subsidence of Mexico City between January 10 and May 28, 1996. One color cycle corresponds to a vertical displacement velocity of 5 cm/year. ERS raw data © ESA 1998 (processing by GAMMA)

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## Technique

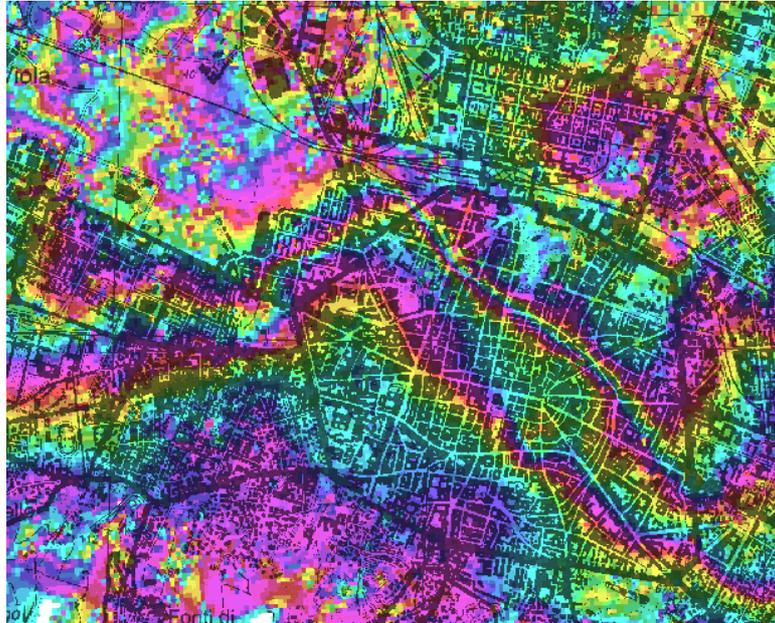
In the interferometric approach two complex SAR images are combined to exploit the phase of the signal. The interferometric phase is sensitive to both surface topography and coherent displacement along the look vector occurred between the acquisitions of the interferometric SAR (INSAR) image pair. The basic idea of differential SAR interferometry is to subtract the topography related phase from the interferogram leading to a displacement map. The topographic phase is estimated either from a Digital Elevation Model (DEM) or from an interferometric pair with negligible displacement.



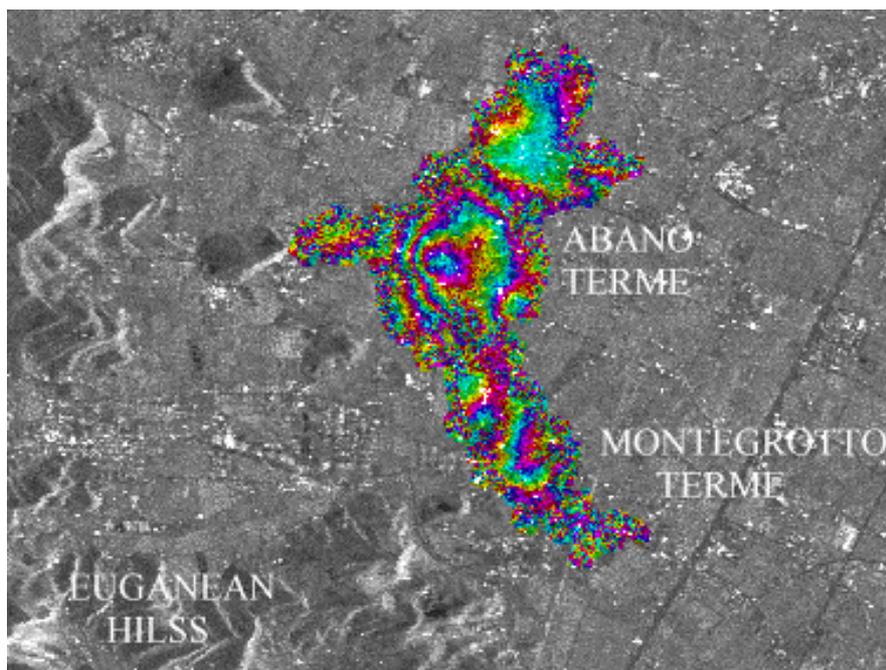
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## Results

The application of SAR interferometry to a specific case depends on the availability of a DEM, on the characteristics of the SAR data with respect to baseline, acquisition time interval and coherence, on the displacement rates, and on the land cover and topography. The main limitation factors are atmospheric disturbance (which can be reduced by stacking of multiple data) and loss of coherence.



Subsidence map of Bologna (Italy) superimposed to a topographic map of the region Emilia-Romagna. One color cycle corresponds to a subsidence velocity of 1 cm/year for the time period 1992-1996. ERS raw data © ESA 1998 (processing by GAMMA)



Subsidence map of the Euganean Geothermal Basin (Italy) superimposed to a backscattering image. One color cycle corresponds to a subsidence velocity of 1 mm/year for the time period 1992-1996. ERS raw data © ESA 1998 (processing by GAMMA)

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## Products and Services

GAMMA offers:

- deformation maps;
- processing services and support for the mapping of geophysical displacements associated with earthquakes, volcano eruptions, landslides and subsidence;
- licenses for GAMMA's SAR, interferometry and differential interferometry processing software.

For further information on services and products, please contact us at the addresses given below. Additional information may be found at our web site.

The required data are available from the SAR on ERS-1/2, JERS and RADARSAT and in the near future ENVISAT and ALOS.

## Acknowledgments

ERS SAR data partly provided under AO3 178 © ESA 1998. DEM's courtesy of USGS and INGS.

## Who is Gamma

GAMMA is a Swiss value adding company. It provides licenses for its SAR, interferometric and differential interferometric software packages, participates in research programs, and offers consulting and processing services in the field of microwave remote sensing.

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