

**ESA SP-550**  
June 2004

Proceedings of  
**FRINGE 2003 Workshop**

1-5 December 2003  
ESA/ESRIN, Frascati, Italy

***European Space Agency***  
***Agence spatiale européenne***

## Scientific Committee

J. Askne	Chalmers University of Technology, Sweden
R. Bamler	DLR Aerospace Centre, Germany
A. Broquetas	Dpt. TSC, Universitat Politecnica de Catalunya, Spain
C. Carnec	BRGM, France
T. Cunha	IGM, Portugal
D. Deraw	Centre Spatial de Liège, Belgium
L. Gray	CCRS (Canada Centre for Remote sensing), Canada
R. Hanssen	Delft University of Technology, The Netherlands
J. Hyypä	FGI, Finland
K. Hoegda	NORUT Information Technology Ltd, Norway
P. Lundgren	Jet Propulsion Laboratory, California Institute of Technology, USA
E. Meier	RSL, University of Zurich-Irchel, Switzerland
J.J. Mohr	Technical University, Denmark
A. Monti Guarnieri	POLIMI, Italy
A. Moreira	DLR Aerospace Centre, Germany
G. Peltzer	Earth and Space Science Division, University of California, USA
F. Rocca	POLIMI, Italy
H. Rott	Institute for Meteorology & Geophysique, University of Innsbruck, Austria
M. Shimada	NASDA, Japan
A. Smith	Phoenix Systems, U.K.
J.C. Souryis	CNES, France
G. Wadge	ESSC, U.K.

## Workshop Local Organiser

Y.-L. Desnos & V. Arpaia (ESA/ESRIN)

<i>Publication</i>	Proceedings of FRINGE 2003 Workshop, 1 – 5 December 2003, ESA/ESRIN, Frascati, Italy, (ESA SP-550, June 2004)
<i>Compiled by:</i>	H. Lacoste
<i>Published and distributed by:</i>	ESA Publications Division ESTEC Postbus 299 2200 AG Noordwijk The Netherlands
<i>Printed in:</i>	The Netherlands
<i>Price:</i>	€ 50
<i>ISBN No:</i>	92-9092-861-1
<i>ISSN No:</i>	1609-042X
<i>Copyright:</i>	© 2004 European Space Agency

# Contents

## Tectonics

*Chairs: E. Fielding, A. Smith & F. Sarti*

Atmospheric Effects in SAR Interferometry, Implications on Interpretation and Modeling Surface Deformation: A Case Study of the 1999 (Mw=7.4) Izmit Earthquake, Turkey

*Z. Çakir, J.-B. De Chabalier, A. Rigo & R. Armijo*

## Land Motion

*Chairs: H. Rott, C. Delacourt & T. Pearson*

Small Baseline DIFSAR Techniques for Earth Surface Deformation Analysis

*P. Berardino, F. Casu, G. Fornaro, R. Lanari, M. Manunta, M. Manzo, A. Pepe & E. Sansosti*

Potential and Limitation of ERS-Differential SAR Interferometry for Landslides Studies in the French Alps and Pyrenees

*C. Delacourt, P. Allemand, C. Squarzoni, F. Picard, D. Raucoules & C. Carnec*

The 1998 Sarno (Italy) Landslide from SAR Interferometry

*A. Arturi, F. Del Frate, E. Latigano, G. Schiavon & S. Stramondo*

Support of Satellite Radar to Hazard Zone Mapping in the Italian Alps

*K. Belitz, A. Corsini, V. Mair, T. Strizzi, U. Wegmüller & J. Zilger*

## Methodology and Techniques

*Part 1 - Chairs: A. Monti Guarnieri, P. Durand & R. Cordey*

*Part 2 – Chairs: T. Wright, A. Arnaud & R. Cordey*

Modeling of Atmospheric Effects on InSAR Measurements with the Method of Stochastic Simulation

*Z.W. Li & L Ding*

Correcting InSAR Data for Tropospheric Path Effects over Volcanoes using Dynamic Atmospheric Models

*G. Wadge, P.W. Webley & N.F. Stevens*

InSAR-Based Hydrology of the Everglades, South Florida

*S. Wdowinski, F. Amelung, F. Miralles-Wilhelm, T. Dixon & R. Carande*

Generation of DEM with Sub-Metric Vertical Accuracy from 30' ERS-ENVISAT Pairs

*C. Colesanti, F. de Zan, A. Ferretti, C. Prati, & F. Rocca*

Radar Interferometry with Public Domain Tools

*B.M. Kampes, R.F. Hanssen & Z. Perski*

InSAR RADARGRAMMETRY: A Solution to the Phase Integer Ambiguity Problem for Single Interferograms  
*A. Sowter & J. Bennett*

Review of the Impact of ERS-2 Piloting Modes on the SAR Doppler Stability  
*N. Miranda, B. Rosich, C. Santella & M. Grion*

A Curvature Based Method for Combining Multi-Temporal SAR Differential Interferometric Measurements  
*M. Costantini, F. Minati & L. Pietranera*

Asar Wide-Swath Single-Look Complex Products: Processing and Exploitation Potential  
*R. Cordey, T. Pearson, Y.L Desnos & B. Rosich-Tell*

## DEMs

*Chairs: C. Prati, D. Derauw & F.M. Seifert*

A Comparative Study of Radar Stereo and Interferometry for DEM Generation  
*M. Gelautz, P. Paillou, C.W. Chen & H.A. Zebker*

ERS SAR Interferometry for Tidal Flat DEM  
*J.-S. Won & S.-W. Kim*

Baseline Combination for InSAR DEM Altimetric Resolution Enhancement  
*D. Derauw & A. Orban*

Problems and Solutions for InSAR Digital Elevation Model Generation of Mountainous Terrain  
*M. Eineder*

## Long-term Differential Interferometry

*Part 1 - Chairs: F. Rocca, B. Fruneau & M. Engdahl*  
*Part 2 – Chairs: R. Bamler, A. Broquetas & M. Engdahl*

Separation of Different Deformation Regimes using PS-InSAR Data  
*V.B.H. Ketelaar & R.F. Hanssen*

Differential Interferometric Applications in Alpine Regions  
*T. Strozzi, U. Wegmueller, A. Wiesmann, A. Käab, R. Frauenfelder, C. Werner, K. Graf, H. Rätzo & O. Lateltin*

Linear and Non-Linear Long-Term Terrain Deformation with DInSAR (CPT: Coherent Pixels Technique)  
*J.J. Mallorqui, O. Mora, P. Blanco & A. Broquetas*

Urban Deformation Monitoring in Bangkok Metropolitan (Thailand) using Permanent Scatterer and Differential Interferometry Techniques  
*J. Worawattanamateekul, J. Hoffmann, N. Adam, & B. Kampes*

Conventional and PS Differential SAR Interferometry for Monitoring Vertical Deformation due to Water Pumping: The Haussmann-St-Lazare Case Example (Paris, France)  
*B. Fruneau, B. Deffontaines, J.-P. Rudant, A.-M. Le Parmentier, C. Colesanti, S. Le Mouelic, C. Carnec & A. Ferretti*

Application of Permanent Scatterers on Mining-Induced Subsidence  
*M. Kircher, J. Hoffmann, A. Roth, B. Kampes, N. Adam & H.J. Neugebauer*

Long-Term Subsidence Monitoring of City Areas at Nordic Latitudes using ERS SAR Data  
*T.R. Lauknes, G. Engen, K.A.Høgda, I. Lauknes, T. Eltoft, D.J. Weydahl & K.Eldhuset*

Evaluating the Effect of the Observation Time on the Distribution of SAR Permanent Scatterers  
*A. Ferretti, C. Colesanti, D. Perissin, C. Prati & F. Rocca*

Integration of Permanent Scatterers Analysis and High Resolution Optical Images within Landslide Risk Analysis  
*P. Farina, D. Colombo, A. Fumagalli, E. Gontier & S. Moretti*

Identification of the Location Phase Screen of ERS-ENVISAT Permanent Scatterers  
*M. Arrigoni, C. Colesanti, A. Ferretti, D. Perissin C. Prati & F. Rocca*

## Thematic Mapping

*Chairs: J. Askne, J. Hoffmann & P. Bally*

Snow Mass Retrieval by Means of SAR Interferometry  
*H. Rott, T. Nagler & R. Scheiber*

Tree Height Estimation from Multi-temporal ERS SAR Interferometric phase  
*M. Santoro, J. Askne & P.B.G. Dammert*

Combining InSAR and Optical Data to Detect Earthquake Damages  
*S. Stramondo, C. Bignami & N. Pierdicca*

SAR Repeat-Pass Coherence in Winter for Boreal Forest Applications. A First Comparison between ASAR and JERS-1 SAR  
*L. Eriksson, T. Le Toan, A. Wiesmann, M. Grippa, U. Wegmüller & C. Schmullius*

ENVISAT Interferometry for Mapping and Monitoring: Preliminary Results  
*A. Monti Guarnieri, D. Daria, C. Cafforio, P. Guccione, P. Pasquali, D. Nüetsch, D. Small, E. Meier & Y.L. Desnos*

## Volcanoes

*Chairs: G. Wadge, P. Lundgren & F. Palazzo*

Measuring the Rate of Lava Effusion by InSAR  
*G. Wadge*

ERS InSAR Observations of Mt. Etna Volcano: Magma Inflation and Radial Spreading  
*P. Lundgren, F.Casu, M. Manzo, A. Pepe, P. Berardino, E. Sansosti, R. Lanari & P. Rosen*

Crustal Deformation of the Alban Hills Volcanic Complex (Central Italy) by Permanent Scatterers Analysis  
*C. Tolomei, S. Atzori, S. Salvi, J. Allievi, A. Ferretti, C. Prati, F. Rocca, S. Stramondo & N. Feuillet*

Remote Sensing for Ground Deformation Analysis during the Eruptive Event of July 2001 at Mt. Etna  
*A. Bonforte, C. Colesanti, A. Ferretti, F. Guglielmino, M. Palano, C. Prati, G. Puglisi & F. Rocca*

## Ice Motion

*Chairs: A. Shepherd, J.J. Mohr & M. Drinkwater*

SAR-Interferometric Flow Velocities of Two Tidewater Glaciers in NW Spitsbergen: Methods and Results  
*Z. Perski, J. Jania & M. Stober*

Full-Value Mapping of Glacier Rheology using Repeat Pass Sar Interferograms  
*A.I. Sharov & S. Etzold*

## TerraSAR-L

*Chairs: M. Zink & M. Werner*

The TerraSAR-L Interferometric Mission Objectives  
*M. Zink*

Achieving the EVINSAR Objectives with TerraSAR-L  
*G. Wadge, B.E. Parsons & the EVINSAR Science Team*

Interferometric Performance of a Cartwheel Constellation for TerraSAR-L  
*M. Zink, G. Krieger & T. Amiot*

L-band PS Analysis: JERS-1 results and TerraSAR-L predictions  
*K. Daito, A. Ferretti, S. Kuzuoka, F. Novali, P. Panzeri & F. Rocca*

## Poster Session

*Chairs: J-P. Muller & K. Hoegda*

Use of InSAR for Monitoring of Mining Deformations  
*A. Jarosz & D. Wanke*

SAR Interferometry with TerraSAR-X  
*M. Eineder, H. Runge, E. Boerner, R. Bamler, N. Adam, B. Schättler, H. Breit & S. Suchandt*

Comparison of Global and Local Approach to Phase Unwrapping for Rugged Terrain  
*L. Zakharova*

Differential InSAR Studies in the Boreal Forest Zone in Finland  
*K. Karila, M. Karjalainen & J. Hyypä*

Slow Deformation of Mt. Baekdu Stratovolcano Observed by Satellite Radar Interferometry  
*S.-W. Kim & J.-S. Won*

Test of the Applicability of a Multitemporal Differential Interferometry Analysis to Landslide Studies in Peri-Urban Areas  
*J. Wasowski, F. Bovenga, D. Casarano, R. Nutricato & A. Refice*

Detecting coal fires in China using Differential Interferometric Synthetic Aperture Radar (InSAR)  
*J. Hoffmann, A. Roth & S. Voigt*

Tropospheric Correction Techniques in Repeat-Pass SAR Interferometry  
*Z. Li, J.-P. Muller & P. Cross*

3D Motion Recovery with Multi-Angle and/or Left Right Interferometry  
*F. Rocca*

Test for Applying SAR Interferometry on the Nyiragongo Area: Preliminary Results

*F. Guglielmino, M. Coltelli & G. Puglisi*

Radar Backscatter and Coherence Information Supporting High Quality Urban Mapping

*P. Fischer, Z. Perski & S. Wannemacher*

Deformation Measuring using SAR Interferometry: Quantitative Aspects

*M. Crosetto, E. Biescas, I. Fernández, I. Torrobella & B. Crippa*

Optimised Mapping of Flood Extent and Floodplain Structures by Radar EO-Methods

*E. Stabel & E. Löffler*

IF Estimation based on Wavelet Transform

*Y. Zhang & V. Prinet*

Study of Artificial and Natural PSS in the Area of Bear Lakes Calibration Site

*A.I. Zakharov, P.A. Zherdev & C.G.M. van 't Klooster*

Sar Interferometric Data Inversion: A Study about Numerical Approaches

*G. Nunnari, G. Puglisi, F. Guglielmino & F. Accetta*

Detection of the Subsidence Affecting a Shopping Center in Marseilles (France) using Sar Interferometry

*D. Feurer, S. Le Mouelic, D. Raucoules, C. Carnec & J.-L. Nédellec*

MINERVA: An INSAR Monitoring Service for Volcanic Hazard

*M.L. Tampellini, E. Sansosti, S. Usai, R. Lanari, S. Borgstrom, M. Van Persie, G.P. Ricciardi, V. Maddalena, L. Cicero & A. Pepe*

ASAR Interferometry at Piton de la Fournaise, Preliminary Results

*J.-L. Froger, Y. Fukushima, P. Briole, T. Staudacher, T. Souriot, N. Villeneuve & J.-L. Cheminee*

Interferometric Processing of Envisat-1/Asar Image Mode and Alternating Polarisation Mode for Application in Land Cover and Crop Mapping

*M. Mroz, Z. Perski & M. Ciolkowska*

Stepwise Approach to InSAR Processing of Multitemporal Datasets

*A. Refice, F. Bovenga & R. Nutricato*

Integrated Radar Interferometry for Ground Subsidence Monitoring

*L. Ge, H.-C. Chang, J. Trinder & C. Rizos*

Identification of Landslides in La Reunion Island with JERS-1 and RADARSAT-1 Radar Interferometry

*D. Raucoules, C. Carnec, M. Cruchet, C. Delacourt, D. Feurer & S. Le Mouélic*

Development of a Procedure for Correcting and Reducing Unwrapping Artefacts using a Set of ERS SAR Interferograms. Case of the September 7, 1999 Athens Earthquake

*P. Elias, O. Sykioti, C. Kontoes, A. Avallone, S. Van Gorp, P. Briole & D. Paradissis*

Correction of Local and Global Tropospheric Effects of Differential SAR Interferograms for the Study of Earthquake Phenomena

*F. Chaabane, A. Avellone, F. Tupin, P. Briole & H. Maitre*

Operational Process Interferometric for the Generation of a Digital Model of Ground Applied to the Couple of Images ERS-1 ERS-2 to the Area of Algiers

*F. Hocine, M. Ouarzeddine, A. Belhadj-aissa, M. Belhadj-aissa & Y. Smara*

Storm Forest Damage Mapping Based On VHR InSAR Data

*C. Maire & H. Yesou*

Sar Interferometry as a Tool for the Detection of Active Tectonic Regions: Preliminary Results on the Algarve Region of the South Portugal

*T.A. Cunha & F. Sarti*

High Resolution Differential Interferometry using Time Series of ERS and ENVISAT SAR Data

*J. Duro, J. Inglada, J. Closa, N. Adam & A. Arnaud*

Slam, a Service for Landslide Monitoring Based on EO-Data

*P. Manunta, M. Brugioni, N. Casagli, D. Colombo, A.M. Deflorio, P. Farina, A. Ferretti, E. Gontier, K. Graf, J. Haeberle, O. Lateltin, E. Meloni, R. Mayoraz, G. Montini, S. Moretti, M. Paganini, F. Palazzo, D. Spina, L. Sulli & T. Strozzi*

Comparison of DEMs Derived from InSAR and Optical Stereo Techniques

*Y. S. Rao & K.S. Rao*

Space-Borne and Ground-Based Sar Interferometry for Landslide Activity Analysis and Monitoring in the Appennines of Emilia Romagna (Italy): Review of Methods and Preliminary Results

*M. Barbieri, A. Corsini, N. Casagli, P. Farina, F. Coren, P. Sterzai, D. Leva & D. Tarchi*

A New Method for Baseline Calibration in SAR Interferometry

*M. Costantini, F. Minati, A. Quagliarini & G. Schiavon*

Measuring Co-Seismic Deformation of the Fandoqa (14/03/98 – Mw 6.6) and Zirkuh (10/05/97 – Mw 7.1) Earthquakes, SE Iran

*M. Peyret, B. Cadoul & J. Chéry*

SAR Interferometry Monitoring of Landslides on the Stromboli Volcano

*G. Antonello, N. Casagli, P. Farina, L. Guerri, D. Leva, G. Nico & D. Tarchi*

Neural Networks to Retrieve Seismic Source Parameters by Sar Interferometry

*F. Del Frate, F. Rossi, G. Schiavon & S. Stramondo*

Application of Envisat/ASAR for Monitoring of Tropical Forest Plantation Biomass in Indonesia

*M.A. Raimadoya, B.H. Trisasongko, D.R. Panuju, D. Shiddiq & R. Maulida*

Summaries and Recommendations

List of Participants