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INTAMAP

Interoperability and Automated Mapping

**SIXTH FRAMEWORK PROGRAMME
PRIORITY IST-2005-2.5.12
ICT for Environmental Risk Management**

Deliverable 6.8

“GeoInformatics for Environmental Surveillance”

Organization of a Workshop

Title of Deliverable	GeoInformatics for Environmental Surveillance
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Executive Summary

The purpose of Deliverable 6.8. was, in addition to papers presented at conferences and published in journals, to present the theoretical developments as well as the operational software and web services. Through an INTAMAP dedicated workshop, users could test the developed applications by themselves. This workshop was organized on the 19th of June in combination with StatGIS (17 & 18 June), a conference traditionally organized every three years by the University of Klagenfurt, a project partner of INTAMAP.

The topic of StatGIS 2009 was “*GeoInformatics for Environmental Surveillance*” and was organized by JRC with mainly the support of the Technical University of Crete, a project partner of INTAMAP, on the island of Milos (Greece). 45 peer reviewed papers (each paper was reviewed by at least two members of the Scientific Committee) were accepted for publication and around 15 posters were presented. The web site of the conference can be found at <http://milos.conferences.gr/statgis2009> while the peer reviewed proceedings have been distributed on USB sticks and are available online at <http://www.math.uni-klu.ac.at/stat/Tagungen/statgis/2009/>.

Around 70 participants coming from 4 continents participated with enthusiasm to the conference and the INTAMAP exercises and demonstrations made during the workshop were running smoothly. The conference clearly showed the increasing interest of the scientific community in distributed services for environmental applications, especially for solving issues that require a multidisciplinary approach. Web services are not new, but only a few have demonstrated so far their potential in a Shared Environmental Information System (SEIS) and a Single Information Space in Europe (SISE), in particular when dealing with processing chains. We believe that INTAMAP has not only fully demonstrated the potential of an automatic mapping web service for SEIS, but it also has underlined its use for benchmarking exercises and for handling the increasing availability of information coming from a large variety of environmental sensors.

The following two invited keynote lectures further addressed latest developments: Prof. Hans Wackernagel, Ecole des Mines de Paris: « *Data assimilation for epidemiological surveillance*» and Prof. Stefano Nativi, CNR-IMAA, University of Florence: «*Multidisciplinary interoperability architectures, some GEOSS and GMES experiences*».

Computers & Geosciences (Elsevier) will publish a special issue based on selected papers that will have to be further developed. The special issue is in preparation and will be edited by G. Dubois, E. Pebesma, D. Cornford, J. Pilz and D. Hristopulos

Although originally organized on a 3 year basis, Andreas Papritz from the Soil and Terrestrial Environmental Physics research group of the ETH Zurich proposed to organize the next StatGIS conference in 2011, in Ascona, Switzerland.

1. INTRODUCTION

StatGIS is addressed to researchers in academia and research institutes, as well as practitioners and industry professionals who want to learn about recent developments in spatial statistics and their applications, and to share their experiences in these areas. Application fields of interest for this conference will include, but not be limited, to: spatial environmental modelling, early warning monitoring systems for the environment, geostatistics in natural hazards prediction, optimum spatial design, space-time analysis and renewable energy resources, remote sensing applications in land reclamation after mining exploitation, spatial metrics for biodiversity assessment and monitoring, etc.

The conference will provide an opportunity for researchers and industry to meet and exchange the latest in spatial statistics and geoinformatics with an emphasis on the main steps involved in environmental monitoring and surveillance. We will start with the collection of data from environmental sensors and monitoring networks and further discuss their use by the web services and systems involved in the processing of the information. The automated analysis of the data and the detection of anomalies and changes will also be covered before finally addressing the visualization and communication of the generated information for efficient decision making.

The international character of the conference will be an opportunity to focus on GMES (Global Monitoring for Environment and Security) and GEOSS (Global Earth Observation System of Systems) related issues, in particular on the need for cost-effective sustainable services. StatGIS 2009 will therefore focus on generic solutions, re-usable software solutions, in particular Open Source technology, and interoperability of systems. Cross-border issues that affect the homogeneity of geographic information (INSPIRE) and of global environmental monitoring networks as well as the interoperability of the systems will also be covered.

Those used to the tradition of StatGIS being an important meeting to learn about the latest developments in geostatistics and spatial statistics will not be disappointed by the challenges that will be discussed in Milos. Statistical issues that will be covered range from the analysis of data provided by heterogeneous networks, the automatic detection of anomalies for early warning, to the real-time interpolation of data collected by mobile devices or the fast processing of environmental data for reducing computing times. The monitoring of environmental risks using spatial statistics and geoinformatics covers a large number of applications. These cover issues as different as environmental radioactivity, global change, biodiversity, pests, floods, droughts, fires or earthquakes but also health risks associated with the spreading of viruses or any health threats.

Key papers will be published in a special issue of Computers & Geosciences.

2. COMMITTEES

Organizing Committee

Cornford, Dan (Aston University, UK)
Dubois, Gregoire (JRC, European Commission)
Hristopulos, Dionisis (Technical University of Crete, Greece)
Pebesma, Edzer (University of Münster, Germany)
Pilz, Juergen (University of Klagenfurt, Austria)

Scientific Committee

Allard, Denis (INRA, France)
Atkinson, Peter (University of Southampton, UK)
Bogaert, Patrick (Université Catholique de Louvain, Belgium)
Brenning, Alexander (University of Waterloo, Canada)
Brus, Dick (Wageningen University and Research Centre, The Netherlands)
Christakos, George (San Diego State University, USA)
Cornford, Dan (Aston University, UK)
Diggle, Peter (Lancaster University and Johns Hopkins University School of Public Health, UK and US)
Dubois, Gregoire (JRC, European Commission)
Fortin, Marie-Josée (University of Toronto, Canada)
Ghosh, Sujit K. (North Carolina State University, USA)
Goodchild, Michael F. (University of California Santa Barbara, USA)
Goovaerts Pierre (BioMedware, USA)
Griffith, Daniel A. (University of Texas at Dallas, USA)
Havlik, Denis (Austrian Research Centres GmbH - ARC, Austria)
Heuvelink, Gerard (Wageningen University, The Netherlands)
Hristopulos, Dionisis (Technical University of Crete, Greece)
Kyriakidis, Phaedon (University of California Santa Barbara, USA)
Lark, Murray (Rothamsted Research, UK)
Myers, Wayne (The Pennsylvania State University, USA)
Neteler, Markus (Fondazione Mach - Centre for Alpine Ecology, Italy)
Nativi, Stefano (CNR-IMAA, University of Firenze, Italy)
Papritz, Andreas (ETH Zurich, Switzerland)
Patil, Ganapati P. (The Pennsylvania State University, USA)
Pebesma, Edzer (University of Münster, Germany)
Pilz, Jürgen (University of Klagenfurt, Austria)
Saura, Santiago (Polytechnic University of Madrid, Spain)
Schaepman, Michael (Wageningen University, The Netherlands)
Schoupe, Michel (DG INFSO, European Commission)
Stein, Alfred (ITC, The Netherlands)
Stöhlker, Ulrich (BFS, Germany)
Switzer, Paul (Stanford University, USA)
van den Boogaart, Gerald (TU Bergakademie Freiberg, Germany)
Wackernagel, Hans (Ecole des Mines de Paris, France)

3. CONFERENCE TOPICS

Suggested topics for oral presentations or posters were:

Topic A. **Monitoring networks and SensorWebs**

- Mobile and ad-hoc networks
- Network Optimization problems
- Data harmonization and uncertainties
- Data fusion and heterogeneous networks
- Spatial support: integrating remote sensing and ground based networks

Topic B. **Service Oriented Architectures for Environmental Monitoring**

- Web Services for environmental monitoring
- Sensor Observation Services
- Interoperability & semantic Interoperability
- Communication schemata: GML, SWE, UncertML, O&M,- limitations and extensions
- Architecture for real time environmental monitoring solutions

Topic C. **Statistics and spatial metrics for Environmental Monitoring**

- Detecting changes in spatial, temporal and spatio-temporal processes
- Anomaly and hot-spot detection for early-warning
- Spatio-temporal geostatistics for continuous prediction
- Bayesian frameworks
- Data assimilation
- Graph-theory and landscape pattern metrics

Topic D. **Open Source tools for Environmental Web Services**

- Recent developments in Open Source Geoinformatics
- Spatial and spatio-temporal data analysis in R
- Tool integration: Python and R, RSOAP, plugins

Topic E. **Applications and Case Studies**

- Environmental hazards: floods, droughts, fires, nano-technologies, virus
- Environmental releases: radioactivity, chemicals, oil spills
- Natural resources and biodiversity

- Global change

Topic F. **Visualisation and Decision-Making**

- Information analysis in a distributed environment
- Coping with qualitative information and uncertainties
- Handling information in real-time
- 3D models

Topic G. **Socio-economical benefits of Service Oriented Architectures for Environmental Monitoring**

- Methodologies and socio-economical indicators
- Case studies
- Future directions and perspectives

4. KEYNOTE LECTURES

Stefano Nativi, CNR-IMAA, University of Florence, Italy

Talk: *Multidisciplinary interoperability architectures, some GEOSS and GMES experiences*

Biography



Stefano Nativi received a 1st and 2nd (Laurea) degree and a Ph.D from the University of Florence (IT). He had a PDRA grant from the University of Bristol (UK). He is President of the Earth and Space Sciences Informatics (ESSI) division of the European Geosciences Union (EGU). He is co-leader of GEOSS IP3 (Interoperability Process Pilot Project), chair of the Climate Change & Biodiversity WG of GEOSS AIP-2 (Architecture Implementation Pilot – phase 2), and member of the GEOSS Standards and Interoperability Forum (SIF). He is member of the “Metadata Core Drafting Team” for the Implementing Rules of the INSPIRE initiative. He is coordinator of the ESSI Laboratory - Institute of Methodologies Environmental Analysis of the Italian National Research Council (CNR - IMAA). He is member of the National Inter-university Consortium for Telecommunications (CNIT) Scientific Committee. He is professor of “Web services management” (University of Florence - Faculty of Electronic and Telecommunications Engineering, Information Engineering 1st degree). He is professor of “Systems for land management” (University of Padua -Faculty of Mathematics, Informatics 2nd degree). He is Co-PI of the OGC GALEON (Geo-interface to Atmosphere, Land, Earth, Ocean netCDF) IE.

Hans Wackernagel, Ecole des Mines de Paris, France

Talk: *Data assimilation for epidemiological surveillance*

Biography



Hans Wackernagel is a Senior Research Scientist within the Geostatistics Group of the Geoscience Center of Ecole des Mines de Paris (MINES-ParisTech). He received his Doctoral degree in geostatistics from Ecole des Mines de Paris in 1985 and he obtained a Habilitation à Diriger des Recherches diploma in 2004 from Université Pierre et Marie Curie, Paris. Dr Wackernagel, well-known by his book on Multivariate Geostatistics (3 editions, Japanese translation), has been involved in several multidisciplinary national and inter-national projects on data assimilation and statistical modelling in such different fields like oceanography, climate, air pollution, radio-electric exposure estimation, epidemiology (non-contagious, contagious and vector-borne diseases), to mention but a few.

5. CONFERENCE VENUE

The Conference venue is the "Milos Conference Center - George Eliopoulos" on Milos island, Greece.



Milos Conference Center - George Eliopoulos

[Heliotopos Conferences](#)

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ANNEXES

- Program
- List of Participants

StatGIS 09

**“Geoinformatics for
Environmental Surveillance”**

Milos Island, Greece, 17-19 June 2009

PROGRAM

Program of Wednesday 17 June	
08h30-09h00	Registration
08h50-09h00	WELCOME: DAY 1
09h00-10h00	<p>KEYNOTE Talk 1: Hans Wackernagel</p> <p><i>"Data assimilation for epidemiological surveillance"</i></p> <p>Chair: G. Heuvelink</p>
Topic A. Monitoring networks and SensorWebs Chair: G. Heuvelink	
10h00-10h20	Prediction of PM10 Concentrations using a Modular Neural Network System and Integration with an Online Air Quality Management System [Kapageridis]
10h20-10h40	Spatial monitoring of soil phosphorus in the Florida Everglades [Marchant]
10h40-11h00	Network optimization algorithms and scenarios in the context of automatic mapping [Baume]
11h00-11h20	Coffee break
11h20-11h40	Optimization for the design of environmental monitoring networks in routine and emergency settings [Melles]
11h40-12h00	Anomalies of spatial variables [Bossew]
12h00-12h20	INTAMAP: an interoperable automated interpolation web service [Pebesma]
12h20-12h40	An OGC web service architecture for near real-time interpolation of air quality over Europe [Henneböhl]
12h40-13h00	A Web Processing Service for the Validation of Interpolation [Mendes de Jesus]
13h00-14h00	LUNCH

14h00-15h20	<p style="text-align: center;">Poster Session 1</p> <ol style="list-style-type: none"> 1. Effects of Climate on Malaria in Burundi [Nkurunziza] 2. Radiological Monitoring Network Design Using a Multi-Objective Genetic Algorithm [Fraley] 3. KARTOTRAK: a GIS platform for real-time characterization of radiological contaminations [Attigbe] 4. Hierarchical Bayesian Interpolation for Precipitation of Pakistan [Hussain] 5. Modeling and Interpolation of Non-Gaussian Spatial Data: A Comparative Study [Spöck] 6. Quantitative interdependency between landscape and agricultural land price dynamics [Grandgirard] 7. Estimating and modeling variograms of compositional data with occasional missing variables in R. [Tolosana-Delgado] 8. Integrated use of GIS, GPS and Sensor Technology for managing water losses in the water distribution network of the Paphos Municipality in Cyprus [Achilleos] 9. Estimating the space-time distribution of radioactivity levels by combining monitoring network data and atmospheric transport models [Hiemstra]
Topic A. (cont'd). Monitoring networks and SensorWebs Chair: D. Cornford	
15h20-15h40	Automatic processing, quality assurance and serving of real-time weather data over lightweight protocols [Williams]
15h40-16h00	Real-time mapping for environmental surveillance: a decision-maker's perspective [Stöhlker]
16h00-16h20	Beyond Service Oriented Architecture [Havlik]
16h20-16h40	Coffee break

<u>Parallel Session 1</u> Topic B. GeoInformatics for Environmental application Chair: G. Dubois	
16h40-17h00	Climate-based dengue predictions for Brazil [Lowe]
17h00-17h20	Spatial upscaling of process-based vegetation models: An overview of common methods and a case-study for the U.K. [van Oijen]
17h20-17h40	Automatic Classification of Landsat Timeseries using Geostatistics and Discriminant Analysis [Goovaerts]
17h40-18h00	Geostatistical Estimation of Contaminated Sediment Volumes: Review of Common Challenges and Solutions [Goovaerts]
18h00-18h20	Fault interactions and patterns of short-term fault growth due to micro-earthquakes [Mouslopoulou]
<u>Parallel Session 2</u> Topic C. Spatio Temporal Developments Chair: E. Pebesma	
16h40-17h00	A framework for comparing spatio-temporal interpolators [Bisier]
17h00-17h20	Deriving space-time variograms from space-time autoregressive (STAR) model specification [Griffith]
17h20-17h40	Spatiotemporal Analysis of Solar Radiation for Sustainable Research in the Presence of Uncertain Measurements [Kolovos]
17h40-18h00	An application of spatiotemporal BME analysis to the estimation of rainfall in northwestern Greece [Modis]
18h00-18h20	An automatic approach to the mean and covariance estimations of spatiotemporal non stationary processes [Yu]
18h20-	Welcome Reception
	End of Day 1

Program of Thursday 18 June	
08h50-09h00	WELCOME: DAY 2
09h00-10h00	<p>KEYNOTE Talk 2: Stefano Nativi</p> <p><i>"Multidisciplinary interoperability architectures, some GEOSS and GMES experiences"</i></p> <p>Chair: D. Cornford</p>
<p><u>Parallel Session 1.</u></p> <p>Topic B (cont'd). Geoinformatics for Environmental application</p> <p>Chair: D. Cornford</p>	
10h00-10h20	Wildfire Prevention and Management in a 3D Virtual Environment [Sanchez Perez]
10h20-10h40	Spatio-temporal analysis of NDFF records: generating dynamic distribution maps of flora and fauna species [Heng]
10h40-11h00	Geoinformatics for the Environmental Surveillance of Protected Areas in Africa [Dubois]
<p><u>Parallel Session 2</u></p> <p>Topic D. Spatial patterns</p> <p>Chair: D. Hristopulos</p>	
10h00-10h20	Ocean eddy tracking with circlets [Wackernagel]
10h20-10h40	Testing Spatial Isotropy by Using a Non Parametric Bootstrap Approach [Miranda]
10h40-11h00	Conditional Simulations of Anisotropic Spatial Data with Global Gradient-Curvature Constraints [Zukovic]
11h00-11h20	Coffee break
<p>Topic A. Estimations & Predictions</p> <p>Chair: J. Pilz</p>	
11h20-11h40	The Codispersion Coefficient: An Application in the Evaluation of the Performance of Different Spatial Interpolators [Vallejos]
11h40-12h00	Limitations of Indicator Kriging for Predicting Data with Trend [Papritz]
12h00-12h20	Bayesian spatial modeling and interpolation using copulas [Kazianka]
12h20-12h40	Bayesian locally stationary trans-Gaussian Kriging using generalized Voronoi tessellations [Spöck]
12h40-13h00	Projected Sequential Gaussian Processes: Flexible Interpolation for Large Data Sets [Cornford]
13h00-14h00	LUNCH

	Poster Session 2
14h00-15h20	<ol style="list-style-type: none"> 1. Spatial structure of monthly and annual maximum daily precipitation totals from the area of Poland [Stach] 2. Measurement frequency optimization at the environmental monitoring networks [Orlov] 3. Conception and implementation of a monitoring network at a former base metal mining and ore processing site (Kirki Mines, Greece) [Lemiere] 4. rtop - an R package for interpolation of data with a non-point support [Skøien] 5. Use of wavelet-transform for analysis of urbanized groundwater regime [Batrak] 6. A preliminary analysis of GIS-based Decision Support System to monitor climate aridity and drought in a Mediterranean country [Salvati] 7. Saharan dust over France [Métivier] 8. The Integrated Information System on Water Resources: The Italian Experience from Official Statistics [Tersigni] 9. Landslide monitoring and mechanical-mathematical modeling for sediment movement. [Svalova] 10. Analyzing the effect of different aggregation approaches on classified remotely sensed images [Raj]
	Topic A. (cont'd). Estimations & Predictions
	Chair: E. Pedesma
15h20-15h40	Extending Minimum Curvature Estimators Using Spartan Spatial Random Fields [Hristopulos]
15h40-16h00	Spatio-temporal predictions of agricultural land prices. Application to France [Carre]
16h00-16h20	Higher Order Co-occurrences in Point Pattern Analysis and Decision Tree Clustering [Leibovici]
16h20-16h40	Coffee break
16h40-17h00	Wave data assimilation using non-stationary kriging [Tolosana-Delgado]
17h00-17h20	Non-parametric estimation of geometric anisotropy in scattered data from environmental sensor network measurements [Petrakis]
17h20-17h40	Monte Carlo and spatial sampling effects in regional uncertainty propagation analyses [Heuvelink]
	10 min break
17h50-18h50	KEYNOTE Talk 3: Håvard Rue <i>"Bayesian Geostatistics with Gaussian Markov random fields: models and inference"</i> Chair: E. Pebesma
21h00	Conference Dinner, Alevromilos Restaurant
	End of Day 2

Program of Friday 19 June	
	WELCOME: DAY 3
	WORKSHOPS
09h00-11h00	<p><i>INTAMAP: a Web Service for Automatic Interpolation</i></p> <p>Universities of Utrecht and Aston, the Joint Research Centre of the European Commission and the German Federal office for Radioprotection</p> <p>Workshop 1 will present INTAMAP, a web service for the real time mapping of environmental data. The main objective of INTAMAP was to develop an interoperable framework for real time automatic mapping of critical environmental variables by extending spatial statistical methods and employing open, web-based, data exchange and visualisation tools. To illustrate the potential of the framework at the European scale, the framework was applied to produce a system for automatic mapping of radiation levels reported by 29 European countries that participate in the European radiological data exchange platform (EURDEP).</p>
11h00-11h20	Coffee break
11h20-13h00	<p style="text-align: center;">Parallel Workshop 1</p> <p><i>UncertML and WPS in practice</i></p> <p>Aston University</p> <p>This workshop will introduce the concept and usage of UncertML using a variety of examples from domains including meteorology, radioactivity monitoring, epidemiology and user contributed data. We'll show you can use UncertML to encode uncertainty in a range of scenarios. If you want to bring your own problems we will be happy to discuss how UncertML might be used in your scenarios. We'll also show how to use this in practice in the INTAMAP setting and describe what might come next with web processing services and the model web, and where UncertML might fit.</p>
11h20-13h00	<p style="text-align: center;">Parallel Workshop 2</p> <p><i>An introduction to Anisotropy detection and estimation methods</i></p> <p>Technical University of Crete</p> <p>This workshop will introduce the concept of anisotropy in its various manifestations. Then, we will briefly review existing methods for the estimation of anisotropy from 2D scattered data. We will show how the anisotropy can be estimated using the method of covariance tensor identity (CTI). We will explain how the CTI is used in the frame of Intamap. We will also demonstrate the application of CTI in various data sets generated in the framework of Intamap; in relation to these case studies we will highlight advantages of the method as well as remaining issues for further development.</p>
13h00-14h00	LUNCH

14h00-16h00	<p><i>Bayesian geostatistics: tools and methods for detecting and handling extreme event</i></p> <p>University of Klagenfurt</p> <p>This workshop will present the main concepts, tools and methods of Bayesian geostatistics.</p> <p>We will start with classical Bayes ordinary Kriging, extend the ideas to include uncertainty with respect to variogram parameters and then present the main ideas of modern model-based Bayesian geostatistics. Finally, we introduce the new concept of copula-based geostatistics, which is particularly well suited to deal with extreme observations. The use of this concept is demonstrated by analyzing real data with the copula R-package that has been developed within the INTAMAP project.</p>
16h00-16h20	<p>Coffee break</p>
16h20-18h00	<p><i>Monitoring networks: optimization of sampling designs</i></p> <p>Wageningen University</p> <p>Optimization of spatial sampling designs is concerned with the choice of the number and spatial configuration of observation locations. These must be chosen such that a pre-defined criterion is optimized. In this workshop you will learn about the various criteria that may be used and the many numerical algorithms that have been developed to seek the optimal design. You will design a sampling design by hand for two simplified case studies, see whether these designs can be improved using a numerical optimization algorithm and reflect on the spatial pattern of the resulting designs.</p>

List of Registered Participants

Participant	Address	Country
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BLEHER Martin	Bundesamt fur Strahlenschutz	GERMANY
BOSSEW Peter	Georg Sigl-Gasse 13/11	AUSTRIA
BURBEK Sven	Bundesamt fur Strahlenschutz	GERMANY
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