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## **IFIP – The International Federation for Information Processing**

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is about information processing may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

Jiří Hřebíček Gerald Schimak  
Miroslav Kubásek Andrea E. Rizzoli (Eds.)

# Environmental Software Systems

Fostering Information Sharing

10th IFIP WG 5.11 International Symposium, ISESS 2013  
Neusiedl am See, Austria, October 9-11, 2013  
Proceedings



Springer

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# Preface

## 1 ISESS – The Conference

### 1.1 IFIP WG 5.11 and ISESS

The International Symposium on Environmental Software Systems (ISESS) is one of several overlapping forums discussing issues of Environmental Information Systems, Environmental Decision Support Systems, Environmental Software Systems, Environmental Informatics, Eco-Informatics or Enviromatics – whichever of the terms you prefer, at a certain time of day.

ISESS was founded by Gerald Schimak and Ralf Denzer in 1995, with great support from the German Informatics Society Working Group 4.6 “Computer Science for Environmental Protection” and the International Federation for Information Processing (IFIP) Working Group 5.11 “Computers and Environment”.

As with many things, ISESS started over a couple of drinks (how else, for a German), when a visiting friend, David Russell from Pennsylvania State University issued an invitation to organize some sort of workshop or conference at his campus. Ralf Denzer stated: “When we prepared for the first ISESS at Penn State, it was at best a shot in the dark, although I am prepared to swear every oath that neither the Pink Panther nor Inspector Clouseau had any part of the plot.”

The symposium has been held in a number of countries since: the United States, Canada, Austria, New Zealand, Switzerland, Portugal, the Czech Republic, Spain, Italy; in some years, joint sessions were held in conjunction with the biannual meeting of iEMSs (International Environmental Modelling and Software Society). ISESS is an official IFIP event which is directly supported by WG 5.11.

The WG itself was led by Giorgio Guariso (1991-1999), Ralf Denzer (1999-2005) and Dave Swayne (2005-2011). Since 2011 it has been in the hands of Gerald Schimak. Several individuals have served as vice-chairs respectively as secretaries of the WG and many members of the WG have been active supporters for a long time without holding an official position and whom we would like to express our thanks herewith.

### 1.2 The Why

As we can all feel in our personal and daily life the state of our environment is changing rapidly. Whatever we are going to invent, produce or market has effects or impacts on our environment or our physical health, positively or negatively. Sometimes it’s like a vicious circle.

For more than two decades ISESS has brought together researchers dealing with environmental challenges and tried to provide solutions using forward-

looking and leading-edge IT technology. Climate change has been in every mouth and the impacts can be seen again and most recently after the huge and unexpected flooding in Europe this summer. A flooding counted even more disastrous compared to the 100-years flooding in 2002 in Europe. This example stands as only one of the drivers to improve our knowledge on the content side as well as on the technology side to allow a better preparedness and mitigation of events.

As the challenges and problems are known ever since, the dynamics and impacts on each individual, the communication and information tools and the computational paradigms have changed more drastically than ever expected.

ISESS 2013 clues together researchers and users to overcome this manifold of technology changes and dynamics by using their best knowledge to improve for the society:

- the usage and understanding of environmental data and information;
- the openness of data: e.g. to open up data for third parties (starting up open data initiatives);
- the usability of new ICT technology: i.e. examine the usability of new technology for a broader communication of environmental, health, emergency or crises information (e.g. APPs for smartphones);
- monitoring leading edge technology for future internet applications
- obeying the outreach into other closely related domains like emergency or crises and disaster management;
- collaboration with decision makers in policy, legislation, authorities, emergency organizations.

Thus, the need for a conference like ISESS has been unbroken since 1995. We are looking forward to many follow-up workshops and conferences.

### 1.3 Fostering Sharing Environmental Information in EU - SEIS

The EU's Shared Environmental Information System (SEIS) sets out seven principles for better management of environmental data and information, which already guide the actions of the EU Member States, the European Commission (EC) and the European Environment Agency (EEA). The principles establish that shared environmental information should be:

- managed as close as possible to its source;
- collected once and shared with others for many purposes;
- readily available to easily fulfil reporting obligations;
- readily accessible to end-users at all levels for the design of new policies;
- accessible to enable comparisons of the environment at the appropriate geographic scale;
- fully available to the general public, to enable citizen participation;
- supported through common, free and open software standards.

The Digital Agenda for Europe (DAE)<sup>1</sup> initiative supports the SEIS principle aiming to generate information sharing through common, free, open source soft-

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<sup>1</sup> <http://ec.europa.eu/digital-agenda/>

ware. For example, an EU legal framework for licensing open source software now exists (ISA EUPL<sup>2</sup>) and governments are increasingly keen to develop its use. Actions under the DAE are creating a safer and better-performing digital environment, improving access conditions and interoperability and stimulating the growth of cross-border eGovernment services. The open source and open data movement offers significant opportunities for further developing the SEIS but more open-source empowered applications ensuring compatibility across EU member states will be needed for managing and sharing environmental information.

The EC outlines six priority areas (SWD(2013) 18 final) to bring the most value added to SEIS in the short to medium term:

1. Assessing the current capacities within the EU member states to meet the necessary information and data quality criteria required at the EU and international level with the full involvement of the EEA;
2. Streamlining EU reporting requirements towards fully on-line reporting;
3. Piloting the development of Structured Implementation and Information Frameworks (SIIFs)<sup>3</sup> for selected thematic areas, linking these location-based information systems to EU level eReporting systems in order to make reported information usable in various contexts and at different geographic scales;
4. Improving public access to environment information while contributing to – and benefitting from – the EU Open Data strategy (COM (2011)882). The recently adopted Commission report (COM (2012)774) on the implementation of the Public Access to Environmental Information Directive 2003/4/EC outlines the improvements and the challenges related to the public access to information;
5. Improving participation of the public in the collection and dissemination of environment data and information, through further improvements under the DAE and the EU eGovernment Action Plan (COM (2010)743) of eEnvironment services and flexible on-line communication and information systems;
6. Assessing, with the assistance of the EEA, the implementation of the Infrastructure for Spatial Information in Europe Directive (INSPIRE) provides the framework for a distributed network of databases, linked by common standards and protocols to ensure compatibility and inter-operability. It already sets out much of the core architecture for SEIS, i.e. by ensuring that electronic data content and services at national and regional levels are implemented in accordance with common standards, are easily accessible, and can be combined across administrative borders.

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<sup>2</sup> <http://joinup.ec.europa.eu/software/page/eupl/introduction-eupl-licence>

<sup>3</sup> A SIIF would aim, together with the range of SEIS initiatives, to help Member States set up transparent information systems that make this information accessible online. For example, one would be able to identify on a map abstraction points, source protection zones, treatment plants and distribution networks and have links to related information such as leakage reduction programmes.

From a longer-term point of view, we could foresee SEIS being the conduit towards a system of reporting / monitoring, (partly) driven by the reduction of administrative burden that modern ICT facilitates. It could be the structure around which the “knowledge-base” underpinning the environment is constructed. In addition, SEIS could finally provide a platform open to those beyond the policy domain – e.g. scientists, academicians, economists, researchers, and citizens – providing a neutral interface between environment policy-making and the fundamental information that should underpin it and vice versa.

#### 1.4 What the Future Might Behold?

ISESS also wants to be a privileged outpost to spot future trends in environmental software systems and to discuss such developments among the researchers and the institutions who could put the new developments at the service of the citizens and the community. In the past few years we have witnessed the amazing growth of social networks, as of today more than one seventh of the world population has some sort of social profile on the Internet. There is a growing interest in exploring how this information infrastructure can be exploited to provide useful outcomes, in the so called “social computation” research area. Examples range from digitising ancient textbooks to collaborative translation of texts, but the lowest common denominator are the distribution of complex tasks in smaller, much easier chunks, to a huge number of people, and rewarding their efforts thanks to different strategies, from simple monetary compensation to social rewards (reputation), to entertainment (the so-called “gamification” of social computation tasks).

As researchers in environmental software systems our antennae are raised and we are looking forward to new applications of social computing to the environmental domain. The most obvious applications are in the area of “crowdsensing” (people as sensors), where qualitative and quantitative environmental data can be collected at low cost by a large number of human sensors, and also in the area of “crowdsourcing”, where collective human behavior is driven by appropriate information channeled through the social networks.

We hope that ISESS will be a fertile ground for the development of innovative and effective software systems that will help us to close the loop: information from the people, and information to the people, for a better environment.

## 2 ISESS Framework

### 2.1 Predecessors of ISESS 2013

The first and second proceedings of the International Symposium on Environmental Software Systems (ISESS 1995 and ISESS 1997) were published and printed under official IFIP Chapman&Hall:

- R. Denzer, D. Russell, G. Schimak (eds.), *Environmental Software Systems*, Chapman & Hall, 1996, ISBN 0 412 73730 2.



- R. Denzer, D.A. Swayne, G. Schimak (eds.), Environmental Software Systems Vol. 2, Chapman & Hall, 1998, ISBN 0 412 81740 3.
- Then IFIP changed publisher and the third proceedings of ISESS 1999 was published and printed under official IFIP publisher Kluwer:
- R. Denzer, D.A. Swayne, M. Purvis, G. Schimak (eds.), Environmental Software Systems Vol. 3 - Environmental Information and Environmental Decision Support, Kluwer Academic Publishers, 2000, ISBN 0 7923 7832 6.
- The fourth and fifth proceedings of ISESS 2001 and ISESS 2003 were published and printed by organizers of symposium themselves under IFIP ISBN:
- D.A. Swayne, R. Denzer, G. Schimak (eds.), Environmental Software Systems Vol. 4 - Environmental Information and Indicators, International Federation for Information Processing, 2001, ISBN 3 901882 14 6.
- G. Schimak, D.A. Swayne, N.T. Quinn, R. Denzer (eds.), Environmental Software Systems Vol. 5 - Environmental Knowledge and Information Systems, International Federation for Information Processing, 2003, ISBN 3 901882 16 2.

In a similar way the sixth and seventh proceedings of ISESS 2005 and ISESS 2007 were published but this time on CD and USB-Stick under IFIP ISBN:

- D.A. Swayne, T. Jakeman (eds.), Environmental Software Systems, Vol. 6 - Environmental Risk Assessment Systems, International Federation for Information Processing, 2005, IFIP ISBN 3-901882-21-9.
- D.A. Swayne, J. Hřebíček (eds.), Environmental Software Systems, Vol. 7 - Dimensions of Environmental Informatics, International Federation for Information Processing, 2007, IFIP ISBN: 978-3-901882-22-7.

The eighth proceedings of ISESS 2009 were published again on USB-Stick, but not under IFIP ISBN:

- D.A. Swayne, R. Soncini-Sessa (eds.), Environmental Software Systems, Vol. 8, 2009, C.R.L.E University of Guelph ISBN: 978-3-901882-364.

Since 2011 we are following the IFIP Advances in Information and Communication Technology (AICT) publishing procedure which is done in conjunction with Springer. The proceedings of ISESS 2011 have been published:

- J. Hřebíček, G. Schimak, R. Denzer (eds.), Environmental Software Systems. Vol. 9 – Frameworks of eEnvironment. 2011; ISBN 978-3-642-22284-9; ISSN 1868-4238; IFIP AICT 359.

## 2.2 Collaboration with IFIP and Springer

Since 2011, the editors of these proceedings have decided to use the IFIP publishing channel which is Springer and to publish ISESS 2013 proceedings electronically (as a CD) in the IFIP Advances in Information and Communication Technology (AICT) series.

The IFIP AICT series publishes state-of-the-art results in science and of information and communication technologies. The scope of the series includes: foundations of computer science; software theory and practice; education; computer applications in technology; communication systems; systems modeling and optimization; information systems; computers and society; computer systems technology; security; artificial intelligence; and human-computer interaction.

The principal aim of the IFIP AICT series is to encourage education and the dissemination and exchange of information about all aspects of computing.

Merging knowledge and interests of members of WG 5.11 “Computers and Environment” and the ISESS 2013 conference dedicated to information exchange among scientists and businesses involved in the development and use of environmental informatics for the delivery of future oriented solutions and applied research results in Europe and worldwide.

Therefore the conference focuses specifically on the following topics:

- Environmental Application in the scope of the Future Internet
- Smart and mobile devices used for Environmental Applications
- Linked Open Data – fostering Environmental Services
- Information Tools for Global Environmental Assessment
- Environmental Applications in Risk & Crises Management
- SEIS as a part of the 7th Environment Action Programme of EU
- Human Interaction and Human factors driving future EIS/EDSS developments

The ISESS 2013 is the meeting place for experts on leading edge technologies, and it aims to foster the standardization and integration of environmental data and information flows, which are essential pre-requirements for managing our natural resources in a framework of sustainable development.

The ISESS 2013 is open to governmental institutions, international and intergovernmental organisations, environmental agencies and networks, scientists, academicians, politicians, businesses, public administration and decision makers in the field of environmental information, experts from ICT industry, specialists of theoretical and applied informatics, consultants, students, and the concerned public.

The editors hope that you experience new knowledge and ideas when reading the IFIP AICT proceedings of ISESS 2013 and its web, where you can meet reviewed contributions of authors and experts on leading edge ICT technologies for environment of the above mentioned topics.

### **3 Word of IFIP WG 5.11 Chairman**

ISESS 2013, which we all hope will be as fruitful as its predecessors, is organised under the umbrella of IFIP and represents itself the IFIP WG 5.11 “Computers and Environment”.

The vision and mission of the WG 5.11 was predominantly to foster the improved application of Information Technology in environmental research, moni-

toring, assessment, management, and policy. This is still valid but over the last years the picture has slightly changed and new challenges have popped up.

Challenges, stemming from requirements realizing a Single Information Space for Environment (SISE) and Shared Environmental Information System (SEIS) or when setting up the Strategies for the Digital Agenda for Europe, are asking for new services, new collaboration strategies in decision making and information exchange cross-border. This is not only valid for Europe but also applicable worldwide, if we consider the ICT needs in Copernicus (earlier GMES) or GEOSS in ICT and Future Internet development.

Beside that, within the last two years we recognized a tremendous technology jump in the usage of mobile devices in our domain. Mobile devices, sensitive in many directions are on the market; e.g. devices suitable to record or sense personal exposure information valuable for health protection, as well as to report environmental issues or deliver support in emergency or crises situations. The mass on information is increasing faster than ever.

Thus my personal vision and hopefully also the one of IFIP WG 5.11 for the future is, in order to achieve our mission mentioned above:

- To provide and broaden our platform / forum amongst and between ICT and Environmental professionals.
- Perform knowledge-centric conferences worldwide to exchange information about state-of-the-art technology and prepare the ground for the future.
- Provide expert advice to government, multinational organizations and industry.
- Provide strategy and policy makers with intuitive ICT concepts and solutions.

A permanent review and update of the ISESS membership list is a quality indication for allowing high level expertise in our domain and up-to-date knowledge provision to our audience.

### 3.1 Acknowledgements

The editors are grateful to all authors for their valuable contributions to the conference and the members of Program Committee for reviewing about one hundred submitted abstracts and selected papers. Special acknowledgements belong to representatives of International Federation for Information Processing, European Environment Agency, DG Environment and DG CONNECT of the European Commission as well as the Joint Research Centre for their kind support and useful advice with respect to the collaboration and organization of ISESS 2013.

We would like to thank the following institutions and partners:

- the AIT Austrian Institute of Technology, Department Safety & Security, which has organized this conference in Austria,
- the Masaryk University, its Institute of Biostatistics and Analyses,
- Austrian Environment Agency (Umweltbundesamt),

- the company Czech Software First and Mrs. Radka Novotná for their administrative support and Miroslav Kubásek, Jiří Kalina and Jakub Gregor - the conference web administration and editorial team for their enormous work in providing the ISESS web page.

Last but not the least we thank all partners involved in the preparation of this conference as well as all sponsors for their valuable cooperation and patience.

October 2013

Jiří Hřebíček  
Gerald Schimak  
Miroslav Kubásek  
Andrea Rizzoli

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# Table of Contents

## Environmental Application in the Scope of the Future Internet

The HABITATS Approach to Build the INSPIRE Infrastructure . . . . .	1
<i>Karel Charvát, Otakar Čerba, Štěpán Kafka, Tomáš Mildorf, and Přemysl Vohnout</i>	
Dynamic Data Driven Ensemble for Wildfire Behaviour Assessment: A Case Study . . . . .	11
<i>Margherita Di Leo, Daniele de Rigo, Dario Rodriguez-Aseretto, Claudio Bosco, Thomas Petroliaqkis, Andrea Camia, and Jesús San-Miguel-Ayanz</i>	
Automated Semantic Validation of Crowdsourced Local Information – The Case of the Web Application “Climate Twins” . . . . .	23
<i>Alexander Kaufmann, Jan Peters-Anders, Sinan Yurtsever, and Luca Petronzio</i>	
Information System Efficiency as an Attribute in Environmental Information Systems . . . . .	31
<i>Miloš Koch and Zuzana Chvátalová</i>	
PROMETHEE-GAIA Method as a Support of the Decision-Making Process in Evaluating Technical Facilities . . . . .	44
<i>Alena Kocmanová, Marie Dočekalová, and Jiří Luňáček</i>	
Incorporate Sensor Data and Dynamic Modeling for Real Time Control of Sewer Systems . . . . .	54
<i>Erik de Rooij and Klaas-Jan van Heeringen</i>	
Data Fusion in the Environmental Domain . . . . .	62
<i>Hylke van der Schaaf, Mike Kobernus, Markus Falgenhauer, Jasmin Pielorz, and Kym Watson</i>	
Approaching Cross-Domain Search in Environmental Applications – Towards Linked Data . . . . .	71
<i>Gerald Schimak, Luca Petronzio, and Tomas Pariente Lobo</i>	
ENVIROFI - Bringing Biodiversity to the Future Internet . . . . .	85
<i>Katharina Schleidt, Nina Laurenne, Andrea Giacomelli, and Denis Havlik</i>	

Acquisition and Representation of Knowledge for Atmospheric New Particle Formation ..... 98  
*Markus Stocker, Elham Baranizadeh, Amar Hamed, Mauno Rönkkö, Annele Virtanen, Ari Laaksonen, Harri Portin, Mika Komppula, and Mikko Kolehmainen*

The Future Internet Enablement of the Environment Information Space ..... 109  
*Thomas Usländer, Arne J. Berre, Carlos Granell, Denis Havlik, José Lorenzo, Zoheir Sabeur, and Stefano Modafferi*

**Smart and Mobile Devices Used for Environmental Applications**

A Model Integration Framework for Assessing Integrated Landscape Management Strategies ..... 121  
*Jared M. Abodeely, David J. Muth, Joshua B. Koch, and Kenneth M. Bryden*

E-SMART: Environmental Sensing for Monitoring and Advising in Real-Time ..... 129  
*Matthew Aitkenhead, David Donnelly, Malcolm Coull, and Helaina Black*

Identifying Smart Solutions for Fighting Illegal Logging and Timber Trade ..... 143  
*Ioannis N. Athanasiadis, Despina Anastasiadou, Kostas Koulinas, and Fotis Kiourtsis*

Using Smartphones to Profile Mobility Patterns in a Living Lab for the Transition to E-mobility ..... 154  
*Francesca Cellina, Anna Förster, Davide Rivola, Luca Pampuri, Roman Rudel, and Andrea Emilio Rizzoli*

Robust and Trusted Crowd-Sourcing and Crowd-Tasking in the Future Internet ..... 164  
*Denis Havlik, Maria Egly, Hermann Huber, Peter Kutschera, Markus Falgenhauer, and Markus Cizek*

Mapping of Illegal Dumps in the Czech Republic – Using a Crowd-Sourcing Approach ..... 177  
*Miroslav Kubásek*

A Mobile Application for Reporting Disease Incidents ..... 188  
*Hylke van der Schaaf, Ente Rood, and Kym Watson*



“My Environment” – A Dashboard for Environmental Information on Mobile Devices .....	196
<i>Thorsten Schlachter, Clemens Döpmeier, Rainer Weidemann, Wolfgang Schillinger, and Nina Bayer</i>	

## Information Tools for Global Environmental Assessment

Estimating Impacts of Environmental Interventions in Monitoring Programs Requires Conceptual Data Models and Robust Statistical Processing (Position Paper) .....	204
<i>Ladislav Dušek, Jana Klánová, Jiří Jarkovský, Jakub Gregor, Richard Hůlek, Ivan Holoubek, and Jiří Hřebíček</i>	

Tools for Collection, Analysis and Visualization of Data from the Stockholm Convention Global Monitoring Plan on Persistent Organic Pollutants .....	222
<i>Jakub Gregor, Richard Hůlek, Jiří Jarkovský, Jana Borůvková, Jiří Kalina, Kateřina Šebková, Daniel Schwarz, Jana Klánová, and Ladislav Dušek</i>	

GENASIS System Architecture: On the Way from Environmental Data Repository towards a Research Infrastructure .....	230
<i>Richard Hůlek, Jiří Jarkovský, Miroslav Kubásek, Jakub Gregor, Jiří Hřebíček, Ladislav Dušek, Jana Klánová, Kateřina Šebková, Jana Borůvková, and Ivan Holoubek</i>	

Integration of R Statistical Environment into ICT Infrastructure of GMP and GENASIS .....	240
<i>Richard Hůlek, Jiří Kalina, Ladislav Dušek, and Jiří Jarkovský</i>	

GENASIS: On-Line Data Browser for Environmental Monitoring and Associated Information Systems .....	253
<i>Jiří Jarkovský, Ladislav Dušek, Miroslav Kubásek, Richard Hůlek, Jakub Gregor, Jiří Hřebíček, Jana Klánová, Kateřina Šebková, Jana Borůvková, and Ivan Holoubek</i>	

Development of a Catchment Management Tool to Assess Environmental Risk from Nutrient Loadings Using Open Source GIS ...	262
<i>Ian Packham, Eva Mockler, and Michael Bruen</i>	

Continental-Scale Living Forest Biomass and Carbon Stock: A Robust Fuzzy Ensemble of IPCC Tier 1 Maps for Europe .....	271
<i>Daniele de Rigo, José I. Barredo, Lorenzo Busetto, Giovanni Caudullo, and Jesús San-Miguel-Ayanz</i>	

## Environmental Applications in Risk and Crises Management

Geo-analysis of Landscape Level Degradation and Natural Risk Formation under Uncertainty: A Case Study of Selected Czech Urban Watercourses . . . . .	285
<i>Radka Báčová, Petr Kubiček, Jiří Jakubínský, Eva Svobodová, and Vladimír Herber</i>	
The Use of Simulations for the Need of Environment Protection . . . . .	294
<i>Jiří Barta</i>	
Protection of Information and Communication Systems . . . . .	302
<i>Jiří Barta, Veronika Sadovská, Albert Srnák, and Jiří F. Urbánek</i>	
Crime Open Data Aggregation and Management for the Design of Safer Spaces in Urban Environments . . . . .	311
<i>Antonios Bonatsos, Lee Middleton, Panos Melas, and Zoheir Sabeur</i>	
Multi-scale Robust Modelling of Landslide Susceptibility: Regional Rapid Assessment and Catchment Robust Fuzzy Ensemble . . . . .	321
<i>Claudio Bosco, Daniele de Rigo, Tom Dijkstra, Graham Sander, and Janusz Wasowski</i>	
RainPortal – A Web Portal for Providing Climate Change Related Precipitation Data Using SUDPLAN Services . . . . .	336
<i>Peter Kutschera, Jonas Olsson, and Lars Gidhagen</i>	
Crowdtasking – A New Concept for Volunteer Management in Disaster Relief . . . . .	345
<i>Georg Neubauer, Andrea Nowak, Bettina Jager, Christian Kloyber, Christian Flachberger, Gerry Foitik, and Gerald Schimak</i>	
GIS-Based Route Planning for HAZMAT Transportation . . . . .	357
<i>Alexander Preda, Mauno Rönkkö, Stefan Pickl, and Mikko Kolehmainen</i>	
An Architecture for Adaptive Robust Modelling of Wildfire Behaviour under Deep Uncertainty . . . . .	367
<i>Daniele de Rigo, Dario Rodriguez-Aseretto, Claudio Bosco, Margherita Di Leo, and Jesús San-Miguel-Ayanz</i>	
TiTiMaKe: A Distributed Service Architecture for Security Applications . . . . .	381
<i>Mauno Rönkkö, Markus Stocker, Markku Huttunen, Ville Kotovirta, and Mikko Kolehmainen</i>	
Modelling of Environmental Risk Management under Information Asymmetry . . . . .	391
<i>Petr Šauer, Petr Fiala, and Antonín Dvořák</i>	

## SEIS as a Part of the 7th Environment Action Programme of EU

An Information System Supporting WFD Reporting . . . . .	403
<i>Thorsten Hell, Eckhard Kohlhas, Sascha Schlobinski, Ralf Denzer, and Reiner Güttler</i>	
Web 3D Visualization of Noise Mapping for Extended INSPIRE Buildings Model . . . . .	414
<i>Lukáš Herman and Tomáš Řezník</i>	
National INSPIRE Geoportal of the Czech Republic . . . . .	425
<i>Jan Prášek, Jiří Valta, and Jiří Hřebíček</i>	
INSPIREd Air Quality Reporting: European Air Quality e-Reporting Based on INSPIRE . . . . .	439
<i>Katharina Schleidt</i>	

## Human Interaction and Human Factors Driving Future EIS/EDSS Developments

Using the HOS Method for Evaluating the Efficiency of Environmental Information Systems . . . . .	451
<i>Zuzana Chvátalová and Miloš Koch</i>	
How to Build Integrated Climate Change Enabled EDSS . . . . .	464
<i>Ralf Denzer, Sascha Schlobinski, Lars Gidhagen, and Thorsten Hell</i>	
Qualified Safety Management Ensures Sustainable Human Life Quality . . . . .	472
<i>Dana Procházková</i>	
Novel Approaches for Web-Based Access to Climate Change Adaptation Information – MEDIATION Adaptation Platform and ci:grasp-2 . . . . .	489
<i>Markus Wrobel, Alexander Bisaro, Dominik Reusser, and Jürgen P. Kropp</i>	

## Environmental Management/-Accounting and -Statistics

Integration of Macro and Micro Sustainability Issues: The Need for ‘Engineering Accounting’ . . . . .	500
<i>Joanne L. Tingey-Holyoak, Roger L. Burritt, and John D. Pisaniello</i>	
Benefits of Environmental Management Systems in the Czech Republic . . . . .	508
<i>Jaroslava Hyršlová, Miroslav Hájek, and Gabriela Rajdlová</i>	

The Comparison of Selected Risk Management Methods for Project Management . . . . .	517
<i>Vladěna Obrová and Lenka Smolíková</i>	
A Framework for Monitoring and Evaluation of Learning Processes . . . . .	525
<i>Lucie Pekárková, Patrícia Eibenová, and Tomáš Pitner</i>	
Classifying Environmental Monitoring Systems . . . . .	533
<i>Mauno Rönkkö, Ville Kotovirta, and Mikko Kolehmainen</i>	
Waste Management Statistics in the Czech Republic . . . . .	543
<i>Egor Sidorov, Iva Ritschelová, and Jiří Hřebíček</i>	
Methodology and Information System for Evaluating Environmental Protection Expenditure Efficiency at the Local Level . . . . .	560
<i>Jana Soukopová and Eduard Bakoš</i>	
Modelling and Simulation Support of EMS Processes . . . . .	571
<i>Jan Ministr</i>	

## Information Systems and Applications

Green Computing Practices as a Part of the Way to the Sustainable Development . . . . .	579
<i>Zuzana Bezáková</i>	
The Plan4business Approach to Transfer Open Data into Real Estate Businesses . . . . .	588
<i>Jan Ježek, Tomáš Mildorf, Karel Charvát Jr., and Karel Charvát</i>	
SVOD – System for Visualizing of Oncological Data and Their Semantic Enhancement . . . . .	597
<i>Miroslav Kubásek, Jiří Hřebíček, Ladislav Dušek, Jan Mužík, and Jiří Kalina</i>	
Intelligent Facility Management for Sustainability and Risk Management . . . . .	608
<i>Adam Kučera and Tomáš Pitner</i>	
Visual Analytics in Environmental Research: A Survey on Challenges, Methods and Available Tools . . . . .	618
<i>Martin Komenda and Daniel Schwarz</i>	
Information System for Global Sustainability Reporting . . . . .	630
<i>Ondřej Popelka, Michal Hodinka, Jiří Hřebíček, and Oldřich Trenz</i>	
The Model of Territory Unit Evaluation for Allocation of Resources on Flood Protection . . . . .	641
<i>Jana Soukopová, Eduard Bakoš, Jan Šelešovský, and Lenka Furová</i>	

Decision Support of Waste Management Expenditures Efficiency Assessment . . . . .	651
<i>Jana Soukopová, Ivan Malý, Jiří Hřebíček, and Michal Struk</i>	
GeneDBase – Genetic Database of Selected Species of Mammals in the Czech Republic . . . . .	661
<i>Luděk Skočovský, Tomáš Šikula, Martin Ernst, and David Kouřil</i>	
Vattenwebb: A Transparent Service to Support Decision Makers in Achieving Improved Water Status . . . . .	669
<i>Lena Strömbäck, Niclas Hjerdt, Lena Eriksson Bram, and Per Lewau</i>	
Pedestrian Localization in Closed Environments: Android Prototype . . . .	679
<i>Jonáš Ševčík</i>	
 <b>Workshop ENVIP 2013, Environmental Information Systems and Services - Infrastructures and Platforms 2013</b>	
Environmental Infrastructures and Platforms with Citizens Observatories and Linked Open Data . . . . .	688
<i>Arne J. Berre, Sven Schade, and Dumitru Roman</i>	
<b>Author Index</b> . . . . .	697