**Stream A - Conveners:** Ann van Griesven, Tatiana Filatova, Martin Volk.

**A1: Environmental Fluid Mechanics - Theoretical, Modeling and Experimental Approaches**

**Organizers:** Carlo Gualtieri, Dragutin Mihailovic, Sarah Wakes.

Environmental Fluid Mechanics (EFM) is the scientific study of transport, dispersion and transformation processes in natural fluid flows on our planet Earth, from the microscale to the planetary scale. The processes studied by EFM are of paramount importance for the environmental quality of the natural air and water systems as well of the urban systems interacting with the hydrosphere and the atmosphere. For this session papers reporting observational, experimental, numerical and theoretical investigations would be welcome. So the Session will be organized in two parts: Theoretical and Numerical aspects (Part 1) and Applicative, Software and Experimental issues (Part 2).

**A2: Interoperability, Reusability, and Integrated Systems**

**Organizers:** Gene Whelan, Rajbir Parmar, Kurt Wolfe, Bert Jagers, Andrew Hughes, Jon Goodall, Jeff Horsburgh, Pat Deliman, Patrick N. Deliman, Billy Johnson, Billy E. Johnson, S. Tom Purucker, Amber Ignatius.

This session aims to address the growing importance of software interoperability both for systems integration and component reuse. Interoperability is the ability of two or more software components to transfer data and to subsequently make use of the data. Software reuse is the use of existing environmental software, in whole or in part, to develop new software. The need for greater interoperability is motivated by a need to build integrated systems spanning multiple science disciplines. Reuse is an important factor in developing software in a more efficient fashion. This session will discuss scientifically consistent and coherent environmental software systems and approaches for multi-disciplinary data integration, decision and policy support, and modeling. This includes discovery, access, and integration of components developed world-wide, and a means to standardize science-based information, codifying technology standards to enable automated discovery, access, and integration.

**A3: Integrated Assessment Modeling for Air Quality Improvement: Methodologies and Applications At Regional/Local Scale**

**Organizers:** Enrico Pisoni, Giorgio Guariso, Marialuisa Volta, Philippe Thunis.

Regional/local decision makers have to design air quality plans, trying to reduce short-term and long-term exposure to air pollutants, taking into account at the same time environmental, social and economic aspects. Broadly speaking, various approaches classified under the “Integrated Assessment Modeling” concept can be applied, varying from more simple “scenario analysis” to more complex “optimization procedures”. In this session we welcome contributions related to air quality management at regional/local scale, focusing both on methodologies/tools and on “real world” applications. A key aim of the session is to compare experiences and research projects/applications running in various part of Europe.

**A4: Modeling for Low Carbon Economies**

**Organizers:** Dimitry V. Kovalevsky, Klaus Hasselmann, Nicolaus Tideman, Alexey Voinov.

The science of complex systems distinguishes linear from non-linear dynamics. Simpler systems can often be satisfactory described by linear models, but complex systems require non-linear models that can capture more of the characteristics of such systems, such as thresholds, feedback loops, avalanche effects, and irreversibility. Linear systems can be validated by aligning models to the past and using the model to predict the future. Non-linear systems, however, are often time- asymmetric-they can be explained with the wisdom of hindsight, but are not always predictable. Most current models of climate change and carbon emission assume the immediate past is a reasonable guide to the future. They struggle to represent the complex causal structures and time- asymmetries of many socio-natural systems. There is need to integrate the classic models of meso-scale processes with our best understanding of multi-scale space-time patterns and the transitions that are likely to occur between now and 2050.

**A5: Environmental Modeling of Human and Ecosystem Health Effects From Global to Local Scale**

**Organizers:** Stefan Reis, Tim Oxley.

Processing power has grown rapidly, enabling models to cover increasingly large spatial and temporal scales in ever higher spatiotemporal model resolution. Models often run at resolutions of meters to 100s of meters (local), km (regional) and up to 100s of km (global), with various approaches being utilized to connect these scales. At the same time, environmental sensors are generating unprecedented data volumes, from earth observation using satellites to local, smart sensor networks (e.g. personal sensors and other low-cost monitoring). While these developments lead to a context in which models at all scales can draw upon a rich landscape of data products, modelers are still frequently faced with challenges related to up- or down-scaling, nesting and boundary conditions, uncertainties and sensitivity to data and process understanding. These challenges occur in different contexts and different research questions, but are inherent to all modelling approaches applied across scales.

**A6: Integrated Modelling for Ecosystems Services Valuation**

**Organizer:** Michael Bruen

This session is suggested to explore approaches to link ecosystems modelling with policy formulation using a multi-criteria formulation to map ecological model outputs with the valuations and criteria required by policy makers and environmental managers. There already are a multitude of ecosystems models designed to simulate individual aspects of the environment but their outputs (and states) don't map readily with the type of information, mainly about impact on ecosystems services, required by decision makers. Too readily, a cost benefit approach is adopted in an attempt to simplify to a single criterion (monetary equivalences). However, a large variety of multi-criteria decision support systems, capable of handling qualitative as well as quantitative criteria, have been developed in many other contexts and its seems appropriate that they can be used to ensure that ecosystems services considerations are

included in policy/management decisions. This session is aimed at bringing together scientists interested in ecosystems services and impacts with multi-criteria decision support experts in the expectation that very useful synergies will be developed that will facilitate the use of ecosystems modelling in environmental decision making based on MCDA.

**Stream B - Convenors:** James Ascough, Ioannis Athanasiadis, Georgii Alexandrov.

**B1: Data Assimilation Techniques for Uncertainty Reduction**

**Organizers:** Sophie Ricci, Goutal

Natural hazards and its impacts are crucial societal and financial stakes that require a solid capacity of anticipating systems changes often limited by uncertainties in numerical models. Data Assimilation (DA) algorithms and Uncertainty Quantification (UQ) aim at quantifying and reducing model uncertainties making the most of various observation types. DA and UQ are now being applied with increasing frequency to environmental topics in order to optimize model parameters and forecast. Major challenges for environmental modeling lie in

- the development of algorithmic tools,
- the computationally efficient implementation of ensemble based method
- the development of advanced minimization techniques,
- the use of remote sensing data,
- the proper treatment of non linearities.

This session aims at bringing environmental modelers together with applied mathematics experts to demonstrate the merits of UQ and DA methods.

**B2: Advances in Agricultural Modelling**

**Organizer:** Ioannis Athana

Global food security, climate change and extreme events are raising new challenges for modelling and decision support in agricultural systems. Recent developments aim to incorporate advances in data science, as those of open, linked and big data technologies with agricultural modelling. Agricultural models need to be improved to accommodate new needs, and their software implementations also need to facilitate massively parallel computations, inter-comparison in ensemble modelling, and integration into larger frameworks.

**B3: Methods for Visualization and Analysis of High-Dimensional Simulation Model Outputs**

**Organizers:** Dawn Parker, Tatiana Filatova, Gary Polhill, Ju-Sung Lee.

Simulation models developed to analyze the dynamics of socio-ecological systems (SES) generally produce large quantities of output data, which represent sweeps across a large parameter space and multiple stochastic elements. This is especially true if decision-making of human actors and institutions is modeled in an adaptive and heterogeneous manner, as for example in agent-based models. Researchers are then tasked with the complex task of deriving hypotheses and drawing general conclusions through visualization and analysis of these output data. The development of appropriate and efficient visualization and statistical analysis methods to accomplish this task in social simulations, and consequently for much of SES modeling, remains in the adolescent stage, and communication between researchers across disciplines regarding novel approaches remains limited.

This session is designed as a follow-up to the 2014 IEMSS workshop "Analyzing and synthesizing results from complex socio-ecosystem models with high-dimensional input, parameter and output spaces" and the resulting synthesis paper (Lee et al, In Press), which examined methods currently in use by the socio-ecosystem simulation modeling community. The proposed session specifically targets application of novel visualization and analysis methods not historically used by this community, but potentially in use by other simulation modeling communities (e.g. ecological, engineering applications and social science). Presentations by simulation modelers from other communities are particularly welcomed. Potential topics may include but not be limited to linear and non-linear data dimension reduction strategies such as variants of multidimensional scaling (classical, non-metric, etc.), linear and non-linear principal component analysis, locally-linear embeddings, Isomap, self-organizing maps, various forms of clustering (e.g., stochastic neighbor embedding), kriging (for interpolation in the reduced or unreduced space), graph analytic analysis and visualizations, classification and regression trees, random forests, Bayesian networks, and Boolean modeling. We also welcome proposals using other novel metatmodeling, data visualization, and auralisation methods.

**B4: Environmental and Agricultural Modelling for Ecosystem Services**

**Organizer:** Roger Martin-Clouaire, Gary Polhill, Ju-Sung Lee

Although the body of scientific literature on ecosystem services (ES) is increasing rapidly, many challenges remain in the application of the concept to decision-making problems in environmental and agricultural management, especially regarding modelling. Numerous attempts have been reported on the quantification and spatial mapping, from empirical data, of the ES that are important for human wellbeing. However, the literature tells little about how such information together with ecosystem functioning knowledge and stakeholders' goals and preferences could be combined to inform decisions that will exploit or impact ES. This is the challenge to tackle if we want to understand the effects of management on the provisioning of ES and also to explore new management strategies for targeted ES or bundles of ES. The features that give rise to complex decisional problems include the need to consider many interactive, non-linear and some time irreversible biophysical processes operating at various temporal and spatial scales. Incorporating ES into decision systems also require considering the limited understanding and observability of these processes, the poor predictability of management action

effects on ES, the synergies and antagonisms between ES, and the key role played by the socio-economic context at different organizational levels.
This session will offer a forum to discuss about the progresses on the identification, formalisation, and computational aspects of modelling challenges raised by specific needs of management problems stated in terms of provision of bundles of ES. We encourage submissions tackling a broad range of decision-making problems (spatial configuration, planning of actions, production process control, coordination of actions, multi-attribute and multi-stakeholder decision-making...) and modelling approaches from mathematics, statistics and computer sciences disciplines (Bayesian influence diagrams, system dynamics, discrete-event systems, constraint-based models, agent-based models...). Aspects of interests, not necessarily exhaustive, include model design, data requirement, validation procedure, types of target users and types of interactions between them, quantitative-qualitative knowledge integration, interface between biophysical processes and anthropological aspects... Presentations of limits, research issues and open questions or results obtained so far in case studies are welcome.

**B5: Managing Uncertainty**

**Organizers:** Joseph Guillaume, Tony Jakeman, Holger Maier, Jiri Nossent, Evelina Trutnevyte.

Uncertainty is an intrinsic part of environmental modelling, and probabilities and statistics can only provide some of the solutions. Notably, environmental models generally have significant model structural error; lack of information about errors prevents the use of a formal likelihood function in parameter estimation; and models are often expected to provide information about future conditions for which no observed data exist and which may be significantly influenced by complex system interactions and past and future human actions. The legitimacy and utility of modelling is influenced by how these sources of uncertainty are addressed.
This session aims to share methods and case studies to promote explicit and reasoned consideration of uncertainty that cannot be adequately addressed by traditional probabilistic techniques. We welcome both quantitative and qualitative contributions, in both management and research settings, especially when there is no explicit decision to be supported. We also ask presenters to explicitly note why a non-probabilistic approach was deemed appropriate.

Examples of quantitative techniques include those associated with:
- deep uncertainty
- scenario analysis
- exploratory modelling
- expert elicitation
- use of multiple working hypotheses
- multi-model ensembles

Examples of qualitative techniques include:
- discussion and communication of limitations
- assessment of model pedigree
- identification of future research needs

**Stream C - Convenors:** Miquel Sànchez-Marrè, Karina Gibert, Marina Erechtchoukova.

**C1: VI Data Mining for Environmental Sciences Session**

**Organizers:** Karina Gibert, Miquel Sànchez-Marrè, Joaquín Izquierdo, Ignasi Rodríguez-Roda, Serena (Chen) Hamilton, Ioannis Athanasiadis, Antonio Ciampi, Geoff Holmes, Vanessa Kuentz-Simonet, Tina Rambonilaza.

This session is strongly linked with W-DMTES2016, sixth iEMSs DMTES workshop, and aims to approach and to promote the interaction between the Environmental Sciences community and the Data Mining community and related fields, such as Data Science, Artificial Intelligence, Statistics or other fields, all providing methodologies to exploit available data for decisional knowledge extraction in a wide sense. We invite submissions of papers and presentations about applications of data mining and related methodologies to environmental problems and sustainable development. New or improved techniques or methods are welcome, as well as innovative applications, including heterogeneous sources of information, like classical data, images, open text, semantic data, georeferenced data, incremental data among others. Particularly welcome in this edition, contributions including the impact of a Data Mining (and related fields) approach in decision-making processes, and the aggregation and weighting of multidimensional data.

**C2: Big Data and Geoscience: Concept, Theory and Algorithm**

**Organizers:** Amin Tayyebi, Hichem Omrani, Éva Bozsik.

Big data in geoscience becomes more common these days due to technology. Using conventional methods to analyze, visualize, interpret, and understand big data is very challenging. Thus, developing new algorithms to process big data and manage large data in order to simulate environmental phenomena at large scale is required. This session is seeking presentations which introduce new technologies or uses of computational, visualization innovations and computer-based analysis that foster a better understanding of ecosystem services, cutting-edge and innovative approaches in GIS and Remote Sensing not limited to: a) the airborne and terrestrial LiDAR (Light Detection And Ranging) remote sensing technologies in forestry practice, b) application and development of new data management approaches (e.g., database) and Non-conventional environmental databases (object-oriented, object-relational, NoSQL databases, etc.), c) new algorithms (e.g., statistical, data mining and machine learning), d) parallel algorithms (e.g., high performance computing) and software employing for novel applications on large Geoscience data.

**C3: Spatio-Temporal Modeling and Integration**

**Organizers:** Javier Martínez-López, Babak Naimi, Julia Martinez Fernandez, Man Qi.

Spatio-temporal modeling has become an important tool for environmental studies. When linked with remote sensing, spatio-temporal modeling can help in overcoming some typical limitations of ecological studies, such as the lack of historical data or the difficulty of studying species interactions and their relationships with environmental variables and pressures in space and time. In the last decades there have been important advances in spatio-temporal modeling, leading to a diversity of models and modeling environments. However, some key issues remain open, such as the compatibility between models, the lack of model reusability and transparency and the nature of the targeted end-users or developers communities. This session on spatio-temporal modeling and integration tries to address these challenges. Contributions with examples of the use of FOSS and online hosting repositories and platforms for collaborative model development, documentation and exchange, and modelling spatio- temporal ecosystem services are encouraged.

**C4: Application of Data-Driven Modelling and Intelligent Analysis to Water Resource Management**

**Organizers:** Marina Erechtchoukova, Peter Khaiter.

Sustainable water resource management requires informative decisions which heavily rely on the results of data analysis on aquatic environment, evaluation of water related management scenarios by predicting their consequences and developing mitigation measures, if such are necessary. The analysis can be implemented for any point of interest, e.g., observation site, section of a waterbody, watershed or at the global scale.

The session invites original contributions on application of advanced data-driven techniques to water resource assessment and management. The techniques include, but are not limited to, machine learning (both supervised and unsupervised) approaches, statistical data analysis and visualization, intelligent data analysis, and hybrid frameworks. Success stories of their application and lessons learned are welcome.

**C5: ICT for Energy and Water Demand Management**

**Organizers:** Matteo Giuliani, Andrea Rizzoli, Andrea Castelletti, Kaveh Madani, Manuel Pulido-Velazquez, David E. Rosenberg, Dragan Savic, Massimo Tavoni.

Developing suitable demand management strategies is becoming essential for meeting energy and water demands associated to the continuously growing human population. Yet, the potential of these options strongly relies on our level of understanding about consumers' behaviors. Recent applications showed that ICT could play a major role in supporting smart demand management solutions by closing the loop between consumption levels and desired targets and predicting how the consumers adapt their behavior to new regulations, pricing schemes, or awareness campaigns. This session aims to bring together scientists to discuss about existing and emerging ICT methods for energy and water demand management and to demonstrate their potential in real-world applications. Intelligent real-time metering, big-data analytics, end use disaggregation, consumers profiling, innovative demand management options will be covered in addition to a range of other topics.

**Stream D - Convenors:** Alexey Voinov, Suzanne Pierce, Olivier Barreteau.

**D1: Tools And Methods of Participatory Modeling**

**Organizers:** Nagesh Kolagani, Steven Gray, Alexey Voinov.

The popularity of participatory modeling (PM) has grown considerably in recent years with the acknowledgement that the inclusion of stakeholders and a variety of scientific perspectives are required to improve our understanding of social-ecological systems and current environmental problems. The proposed session (and the linked workshop) will focus on tools, methods, approaches and interfaces that can be used in participatory modeling and stakeholder interaction. We seek to attract academic experts, action researchers and practitioners to explore recent developments in modelling with stakeholders, and invite papers on such efforts and on visualization, interaction, documentation, recording, conceptualizing, etc. technologies that can help in these efforts. By bringing together diverse perspectives we hope to assess current trends in the field and define new questions that characterize future directions in PM.

**D2: Cognitive Mapping for Environmental Decision Making**

**Organizer:** Marta Olazabal

There are numerous advantages of using cognitive models to represent complex management contexts in which decisions need to be taken. These tools aim to model the system integrating the views of all affected actors. In the process of cognitive mapping, participants translate their experiences, values and knowledge into a map consisting of nodes and (weighted) interrelations. Scenarios can also be developed. In a final stage, models are validated and implemented in real decision-making processes. This session aims to attract novel scientific contributions that focus on: (i) new or improved methods and approaches for cognitive mapping, (ii) validation and implementation of the resulted models, (iii) constraints in the use of cognitive mapping for environmental decision-making. Contributions evidencing existing biases or propose new ways to manage them are especially welcome. Theoretical or practical approaches that combine cognitive mapping with other quantitative tools are also welcome.

**D3: Advances in Environmental -Decision Support- Software Systems**

**Organizers:** Gerald Schimak, Ralf Denzer.

Environmental Decision Support Systems are software systems which require a high degree of integration of different methodologies, tools and data sources when building user centered solutions. They have considerable modelling and technical requirements (e.g. human factors, usability, interoperability data integration, etc.). ISESS & IFIP-WG5.11 community aims at presenting recent advances in Environmental Software Systems, especially in decision support software for environmental applications and neighboring fields (safety, security, risk management, disaster management, climate change, and environmental resource management).

Papers shall demonstrate innovative approaches, advanced models and modern software architectures, new infrastructures and user friendly solutions using a variety of ICT methodologies including: models and data integration, robust architectures, spatial data platforms, advanced graphics and visualization, sensor networks as well as modern approaches taking into account new challenges like crowd-sourcing, -tasking and -management.

**D4: Water Resources Management and Planning – Modelling and Software for Improving Decisions and Engaging Stakeholders**

**Organizers:** Andrea Castelletti, Julien Harou, Stephane Binet, Amaury Tilmant, Joseph Kasprzyk, David Rosenberg, Patrick M. Reed, Holger Maier, Anne Johannet.

Growing global water scarcity and expectations of effective stakeholder engagement continue to challenge analysts to create more sophisticated tools to support decision-making in the water domain. Regionally-specific water management issues almost invariably require customization of existing tools. In this session, we look at a range of water management tools that have been customized for particular contexts considering both surface water and groundwater. We focus on unique institutional, economic and political contexts, in addition to hydrological considerations. Hydro-economic models, trans-national and cross-sectoral resource management, integrated models that consider human or institutional agents, modeling changes will be covered in addition to other topics. Presenters will emphasize what features made their tools ideal to study a particular context. Are they flexible and adaptable? Can they be ported to different contexts? Do they cope with nonstationary futures?

**D5: Advancing in Environmental Decision Making Under Deep Uncertainty: Emerging Tools and Challenges**

**Organizers:** Jan Kwakkel, Patrick Reed, Rob Lempert.

Current challenges associated with planning environmental systems under deep uncertainty have led to rapidly expanding body of research. Emerging approaches include multi objective robust-decision making, adaptation pathways, and decision scaling. These methods represent exploratory modelling strategies for discovering highly adaptive and robust management actions and key signposts. In the presence of deep uncertainty, planners are urged to develop robust plans, which can encompass a complex mixture of performance requirements. Eliciting and understanding satisficing performance in a wide range of futures remains an outstanding challenge. In confronting this challenge, model-informed robustness frameworks must provide a high level of additivity across key decisions. The aim of this session is to bring together researchers working on the development and application of model-based approaches for supporting the development of robust plans in the face of deep uncertainty.

**D6: The Importance of Human Decision Making in Agent-Based Models of Natural Resource Use**

**Organizers:** Gunnar Dressler, Jule Schulze.

Models of natural resource often put great emphasis on a detailed representation of the biophysical processes, whereas human decision making is only poorly addressed. Many ABMs assume a purely rational decision maker but resource users often don’t have the capabilities to calculate the optimal decision, relying on simple heuristics, habits or other strategies such as social learning. Only rarely do ABMs apply existing theories of human decision making.

However, the success of resource use policies depends on the decisions of local resource users, to avoid negative effects such as environmental spillover

or resource degradation. Therefore, an adequate representation of human decision making in models of natural resource use is needed.
For this session we invite papers that present ABMs that explicitly address human decision making as well as papers that propose new approaches on how human decisions can be adequately represented in models or reviews about this topic.

**D7: Model Management in Public-Sector Organizations**

**Organizers:** Thorsten Arnold, Steve Holysh.

Numerical modelling increasingly becomes a standard tool for decision support, especially in the realms of groundwater and water quantity management. Modelling increasingly is imposed on public-sector organizations through legislation and recommendations by academia and engineering consultants. At the same time, a gap remains between what is academically possible and what can be done within the limited budget and capacity constraints of public sector organizations.

The objective of this session is to enhance awareness for the institutional constraints in which public sector agencies must operate, while making decisions derived from numerical models. The session goal is to gather approaches that can improve the cost/benefit ratio of numerical modelling in such agencies.

With academic communication that focuses on "the possible", public expectations have quickly risen to demand 21st century methodologies. At the same time, the available cyberinfrastructure for data/model integration, data processing routine management, and tools for managing quality control and knowledge are lagging behind these expectations. Numerical modelling has specific demands on organizational structures, which mostly remain trapped in 20th century approaches. As a result, public-sector organizations face increasingly expensive modelling needs in a quicker-changing world with less public funding available. How can smart IT and organizational approaches reduce the cost of modelling, in order to better use these tools for decision making?

We invite organizations that deal with numerical models for public decision making to share approaches for cost-effectively managing numerical modelling projects (archiving, maintenance, updating, sharing). Examples include proven methods for procurement guidelines, approaches to handle consultant contracts, knowledge management tools, documentation in metadata, high-level policies that deal with cascading responsibilities and agreements, and multi-organizational data management. We expect speakers from national modelling agencies (e.g. a weather service) and multi-organizational networks on strategies that increase the efficiency of public sector investments into environmental modelling.

We hope this session will create a discussion between public agencies and academics, in order to foster sustainable approaches to anchor modelling in the lower-tier public-sector.

**D8: Innovative, Participatory and Integrated Modelling for Climate Change Assessments and Management**

**Organizers:** Oz Sahin, Russell Richards.

There is a growing realisation that models developed and used for local- and regional-scale climate change impact (and vulnerability) assessments must integrate key drivers, processes and responses that interact within, and have an influence on, the system that is being investigated. Often, this integrative approach requires participation and collaboration of researchers from diverse domains, decision-makers and (other) stakeholders.
Advanced innovative technologies such as smart phones and touch-screen tablets are emerging as an effective mechanism for participatory engagement with researchers, decision makers and stakeholders (e.g. 'citizen science'). Use of this advanced innovative technology has been facilitated in part by research that is motivated by undertaking a more 'participatory approach', where the objectives include enhancing stakeholder and community engagement and the elicitation of information from the 'knowledge domain'.

In this session, we encourage the submission of research papers that:
• Highlight the development and use of integrated models for exploring and evaluating climate change impacts, resilience and vulnerability and for identifying and elaborating management responses for adaptation and adaptive capacity enhancement
• Employs the use of the smart/advanced technologies to facilitate research emphasizing on research that involves a strong stakeholder (including community) based component

**D9: Methods and Models to Assess Resiliency and Vulnerability in Environmental Systems**

**Organizers:** Amy Kakowa, Gautam Sethi.

Vulnerability and resiliency are multifaceted, multidimensional concepts. Increasing population is placing a multitude of stresses on environmental resources globally. Across all sectors in economies, such as, industrial, municipal, and agricultural, growing demands and competition are causing the need to adapt and shift priorities. Factors such as currently available resources, desired future conditions across stakeholders, clear constraints, and projected needs are among those considered by resource managers, however, the long term resiliency and inter-generational implications for these resources are rarely accounted for.

Understanding and planning to increase resiliency in environmental systems requires assessment and modeling of vulnerable factors. Yet the lack of standardization in the factors and indicators of sustainable use limits our ability to evaluate interconnected resource systems, such as water, energy, and food, in ways that allow for comparison and consistency. This session invites presentations on frameworks, models, and approaches that aid the identification, assessment, and implementation of resilient solutions. Reproducible approaches that enable conveying results of vulnerability and resiliency assessment in a manner that is comprehensible and relevant to policy makers and the public are welcome.

**D10: The Role of Modelling in Sustainable Development**

**Organizers:** Martin Volk, Peter Goethals.

Numerous studies on environmental modelling state that their simulations can be used to develop strategies for sustainable resources management, and / or to support stakeholders and policy-makers that are urged to assess the impact of their actions, strategies and policies in terms of sustainable development.

This fact supposes on the one hand a sound definition of sustainability but also necessitates the use of applied scientific models as tools for identifying and evaluating the likely environmental, economic and social impacts of alternative policies. The latter also means that the models are used in practice and the concept of sustainability is implemented into real world.

Hypothesizing that in - at least some cases - this is not the fact, this session seeks for studies that use indeed modelling approaches for developing and implementing sustainable development on different spatio-temporal. Although it would be great to have studies that show a clear relation to environmental management and present examples for implementation of their developed strategies of sustainable development in practice, we also welcome critical presentations that show the issues of such approaches and might give recommendations of solving the existing problems in the field.

**D11: Supporting Basin Planning in Developing Economies**

**Organizers:** Susan Cuddy, Carmel Pollino.

Building understanding of the nexus between water, food, energy and gender is key to informed and socially inclusive basin planning in all parts of the world. Nowhere is this more important than in countries that are experiencing significant increases in populations and resource demands. This session is intended to provide a forum for researchers/practitioners working in developing economies to present on their activities, with a focus on how their perspectives and approaches to basin planning have adapted to different cultures.