

The 11<sup>th</sup> International Conference

**ENVIRONMENTAL LEGISLATION, SAFETY ENGINEERING AND DISASTER  
MANAGEMENT**

**ELSEDIMIA 2016**

**26 – 28 MAY 2016, CLUJ-NAPOCA, ROMANIA**

**BUILDING DISASTER RESILIENCE IN A CHANGING WORLD**

**- SELECTED PAPERS –**

**Organizers**

“Babe -Bolyai” University of Cluj-Napoca - Faculty of Environmental Sciences and Engineering

General Inspectorate for Emergency Situations – Ministry of Internal Affairs

S.C. ICPE Bistrița S.A.

Academy of Technical Sciences of Romania

National Society of Environmental Science and Engineering

**Partners**

National University of Public Services, Hungary

University of the Free State, Disaster Management Training and Education Centre for Africa, South Africa

## President of the Conference

Ozunu Alexandru, Prof. Eng. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania

## Co-Chairman

Gavrilescu Maria, Prof. Eng. Ph.D., “Gheorghe Asachi” Technical University of Iasi  
B Iteanu Dan, Acad. Prof. Ph.D., Institute of Geography of the Romanian Academy

## International members

Antonioni Giacomo, Prof. Ph.D., Università di Bologna, Italy  
Burny Philippe, Prof. Eng. Ph.D., University of Liege, Gembloux, Belgium  
Critto Andreea, Ph.D. Università Ca' Foscari di Venezia, Italy  
Etiopie Giuseppe, Ph.D., Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy  
Jordaan Andries, Ph.D., Disaster Management Training and Education Centre for Africa (DiMTEC), University of the Free State, South Africa  
Mahalov Alex, Prof. Ph.D., Arizona State University, USA  
Orlich Ileana, Ph.D., Arizona State University, USA  
Redey Akos, Prof. Ph.D., University Pannonia Veszprem, Hungary  
Sole Aurelia, Prof. Ph.D., University of Basilicata, Potenza, Italy

## National members

Ajtai Nicolae, Assist. Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Arafat Raed MD, Ministry of Internal Affairs  
Baciu C lin, Prof. Ph.D., Babes-Bolyai University of Cluj-Napoca  
B Iteanu Dan, Acad. Prof. Ph.D., Institute of Geography of the Romanian Academy  
Benedek Jozsef, Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Botezan Camelia, Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Bri an Nicoleta, Assoc. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca  
Chiribuc Dan, Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Constantinescu Dan, Prof. Eng. Ph.D., Politehnica University of Bucharest  
Copolovici Lucian, Prof. PhD., “Aurel Vlaicu” University of Arad  
Dan Viorel, Assoc. Prof. Eng. Ph.D., Technical University of Cluj-Napoca  
Damian Gheorghe, Prof. Ph. D., North University Centre of Baia Mare  
Dâncu Vasile, Prof. Ph.D., University of Bucharest, Cluj-Napoca  
Feodorov Valentin, Prof. Eng. Ph.D., University of Agronomic Science and Veterinary Medicine, Bucharest  
Gavrilescu Maria, Prof. Eng. Ph.D., “Gheorghe Asachi” Technical University of Iasi  
Gurlui Silviu, Assoc. Prof. Ph.D., “Alexandru Ioan Cuza” University, Iasi  
Gurz u Eugen Associate Professor, MD, Ph.D., Environmental Health Centre, Cluj-Napoca  
Hosu Ioan, Assoc. Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Ionescu Constantin, Eng. Ph.D., National Institute of Research and Development for Earth Physics  
Jinescu Gheorghe a, Prof. Eng. Ph.D., Politehnica University of Bucharest  
Jinescu Cosmin, Assoc. Prof. Eng. Ph.D., Politehnica University of Bucharest  
Laz r Gabriel, Prof. Ph.D., “Vasile Alecsandri” University of Bac u  
Literat Liviu, Prof. Eng. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Manea Florica, Assoc. Prof. Eng. Ph.D., Politehnica University, Timi oara  
Maria Gheorghe, Prof. PhD. Eng., Politehnica University of Bucharest  
Micle Valer, Prof. Eng. Ph.D., Technical University of Cluj-Napoca  
Mih iescu Radu, Assoc. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca  
Modoi Oana Cristina, Assist. Prof. Eng. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Muntean Liviu, Assoc. Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Nedeff Valentin, Prof. Eng. Ph.D., “Vasile Alecsandri” University of Bac u  
Nicolae Doina, Ph.D., National Institute of R&D for Optoelectronics, Bucharest  
Niculescu Virginia, Assoc. Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Onu u Ion, Prof. Eng. Ph.D., Petroleum – Gas University of Ploie ti

Oros Vasile, Prof. Ph.D., Tehnical University of Cluj-Napoca - University Centre of Baia-Mare, Romania  
P un Nicolae, Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Petrea D nu , Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Petrescu Valentin, Prof. Eng. Ph.D., “Lucian Blaga” University, Sibiu  
Petrescu - Mag Malina – Ruxandra, Assist. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Petrescu-Mag Ioan Valentin, Assist. Prof. Ph.D., University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca  
Petru el Adrian, Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Pop Ciprian-Marcel, Prof. Ph.D., Babes-Bolyai University, Cluj-Napoca  
Popa Maria, Prof. Eng. Ph.D., “1 Decembrie 1918” University of Alba Iulia  
Popa Mihaela, PhD., National Institute of Research and Development for Earth Physics  
Prunariu Dumitru-Dorin, Eng. Ph.D., Honorary Member of the Romanian Academy  
Reti Kinga, Assist. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Roman Cecilia, Eng. Ph.D., INCDO-INOE 2000 Research Institute of Analytical Instrumentation, Cluj-Napoca  
Ro u Cristina, Prof. Eng. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Rusu Tiberiu, Prof. Ph.D., Technical University of Cluj-Napoca  
Silaghi Gheorghe Cosmin, Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Sima Mihaela, Ph.D., Institute of Geography of the Romanian Academy  
Sluser Brîndu a, Assoc. Prof. Ph.D., “Gheorghe Asachi” Technical University of Iasi  
Sofronie Ramiro, Prof. Ph.D., University of Agronomic Science and Veterinary Medicine, Bucharest  
Soporan Vasile Filip, Prof. Ph.D., Technical University of Cluj-Napoca  
Stanov Mugurel-Ioan, General Inspectorate for Emergency Situations, Ministry of Internal Affairs  
tef nescu Lucrina, Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Teodosiu Carmen, Prof. Eng. Ph.D., “Gheorghe Asachi” Technical University of Iasi  
Török Zoltán, Assist. Prof. Eng. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Vlad Grigore, Eng. Ph.D., SC ICPE SA Bistrita

### **Organizing Committee:**

Ajtai Nicolae, Assist. Prof. Ph.D., “Babes-Bolyai” University, Cluj-Napoca  
Arghiu Viorel, Assist. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Bizo Maria, Eng. Ph.D. student, “Babes-Bolyai” University of Cluj-Napoca, Romania  
Botezan Camelia, Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Cr ciun Iulia, Ph.D. student, “Babes-Bolyai” University of Cluj-Napoca, Romania  
Dogeanu Marius, General Inspectorate for Emergency Situations, Ministry of Internal Affairs  
Gavriloaie Ionel-Claudiu, Ph.D., Bioflux SRL, Cluj-Napoca, Romania  
Kovacs Alexandra, Ph.D. student, “Babes-Bolyai” University of Cluj-Napoca, Romania  
Martono Ildiko, Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
M cic an Vlad, Assist. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Meltzer Monika, Ph.D. student, “Babes-Bolyai” University of Cluj-Napoca, Romania  
Pi tea Ioana, Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Roba Carmen, Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Roman Emil, Ph.D. student, “Babes-Bolyai” University of Cluj-Napoca, Romania  
Ro ian Gheorghe, Assist. Prof. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Senzacani Francisc, General Inspectorate for Emergency Situations, Ministry of Internal Affairs  
Socalici Ana Virginia, Assoc. Prof. Eng. Ph.D., Politehnica University, Timi oara, Romania  
tef nescu Lucrina, Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
tef nie Hora iu, Eng. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Török Zoltán, Assist. Prof. Eng. Ph.D., “Babes-Bolyai” University of Cluj-Napoca, Romania  
Varvara Simona, Assoc. Prof. Ph.D., “1 Decembrie 1918” University of Alba Iulia