Proc. IAHS, 382, 1–4, 2020
https://doi.org/10.5194/piahs-382-1-2020

Preface: Subsidence and society

Peter A. Fokker[1,2] **and Gilles Erkens**[3,2]

[1]TNO Energy Transition, Utrecht, the Netherlands
[2]Utrecht University, Utrecht, the Netherlands
[3]Deltares Research Institute, Utrecht, the Netherlands

Correspondence: Peter A. Fokker (peter.fokker@tno.nl)

Published: 22 April 2020

The surface of the earth is constantly in motion. The lowering of the earth surface over time is called land subsidence. Land subsidence is a local phenomenon on a global scale and is often problematic in the context of human societies.

Much of the problematic land subsidence is human-induced, with major causes being the extraction or mining of resources and the drainage and loading of soft soils. This implies that human behavior also is often the key to mitigate the negative impact of land subsidence on society. Scientists contribute to this mitigation by quantifying subsidence, exploring its root causes, and identifying possible coping strategies.

Facilitating scientists in exchanging ideas and sharing research results and inspiring stories has always been the aim of the International Symposia on Land Subsidence. Organized by a local organizing committee under the auspices of the UNESCO International Hydrological Programme (IHP) and the UNESCO Land Subsidence International Initiative, already nine successful symposia have been held since the first in Tokyo (Japan) in 1969. Following symposia were held in Anaheim (USA) in 1976, Venice (Italy) in 1984, Houston (USA) in 1991, The Hague (the Netherlands) in 1995, Ravenna (Italy) in 2000, Shanghai (China) in 2005, Queretaro (Mexico) in 2010 and in Nagoya (Japan) in 2015. Contributions to each International Symposium were published as full papers by the International Association of Hydrological Sciences, thereby creating an impressive collection of papers on land subsidence, freely available and accessible. The Dutch land subsidence community feels honored and is excited to host the Tenth International Symposium on Land Subsidence (TISOLS) in the Netherlands.

The Nether-lands is the only country in the world to derive its name from its elevation (Nether means low-lying, i.e. the low-lying lands). It is also arguably the country with the longest history of human-induced land subsidence, which started already a 1000 years ago by the systematic large-scale cultivation of coastal marshlands. Land subsidence indeed made our country to what it is today: an even lower lying country with the characteristic Dutch windmill and polder landscape, as so often depicted in world famous paintings. Approximately 25 % of the area is below sea level and the country relies on continuous and careful water management. And subsidence in the Netherlands is still ongoing: caused by geological factors, but mostly by the loading and drainage of soft soils and the extraction of gas, salt and water. In the light of the predicted climate-induced sea level rise, continuously loosing elevation by land subsidence is particularly worrisome for an already low-lying and very densely populated country. The Netherlands in this sense is exemplar for other coastal regions around the world that are following a similar path.

The attention for land subsidence has steadily increased since the First International Symposium On Land Subsidence. New technologies have increased our abilities to establish the rates of subsidence over larger areas, and the predictive power of models and their spatial resolution have improved. At the same time, more attention was given to the economic aspects of land subsidence, and to the legal and governance framework required to implement measures. Ever more frequent news and media coverage on land subsidence have increased global awareness of land subsidence among the public. This is important, because subsidence remains an ongoing problem, which is exemplified by frequent discoveries of apparently new subsiding areas. There is a continuous and growing need to obtain science-based information and insights to understand the problem and propose effective, acceptable and feasible strategies.

Scientists play an important role in providing the data, information, knowledge and tools to allow for well-founded decision making. TISOLS will bring together international

experts from around the world to share the latest research and insights on natural and anthropogenically induced land-level lowering. A platform is provided to share our understanding of land subsidence, reliable data, and innovative techniques. Only an integrated effort will facilitate targeted strategies and solutions for long-term sustainable living conditions in subsiding areas. TISOLS takes on the challenge of linking geodetical, hydrological, geotechnical and geological knowledge to policy and socially acceptable solutions. To foster the link between the natural and social sciences and between science and society, five thematic sessions were created: (i) measuring and monitoring land subsidence, (ii) understanding land subsidence, (iii) modelling of land subsidence, (iv) impacts of land subsidence, (v) land subsidence coping strategies. The same themes have been used as chapters in the present Proceedings of the International Association of Hydrological Sciences.

In the winter of 2020, the world has witnessed the pandemic outbreak of COVID-19 or the coronavirus. Quickly it became clear that international travelling was considerably restricted and in the following weeks, large-scale meetings were completely banned. TISOLS 2020, to be held from 20–24 April 2020, had to be postponed to 2021. The new date for TISOLS is 17–21 May 2021, hoping that by then the situation has improved enough to be able to organize a great meeting. In the meantime, we wish all land subsidence researchers around the world all the best in getting through this corona pandemic.

While TISOLS was postponed just weeks before the original date, the Proceedings had almost been finished. It was decided to pursue the publication as planned to share the exciting research results and to do justice to all the work performed. We are very grateful to all the authors and reviewers for their contributions and we are delighted to introduce their work in this open access issue of the Proceedings of the International Association of Hydrological Sciences. The Proceedings contain a record of 136 papers of high quality from all over the world. The contribution to all five themes, including the themes focusing more on social sciences, is large. They are all essential to deal with land subsidence and we are grateful that we managed to link them here. We hope that this volume of papers will furnish inspiration for land subsidence research and policy formulation around the world, and we look forward to sharing the presented research results of these Proceedings in 2021!

Organizing committee

Gilles Erkens, Deltares Research Institute, Utrecht University, the Netherlands (Chair)

Jan van den Akker, Wageningen University/Wageningen Environmental Research, the Netherlands

Tommy Bolleboom, Ministry of Infrastructure and Water Management, the Netherlands

Gert Jan van den Born, Netherlands Environmental Assessment Agency, the Netherlands

Peter A. Fokker, TNO Energy Transition and Utrecht University, the Netherlands

Mariska van Gelderen, Deltares Research Institute, the Netherlands

Ramon Hanssen, Delft University of Technology, the Netherlands

Saskia Hommes, Deltares Research Institute, the Netherlands

John Lambert, Deltares Research Institute, the Netherlands

Ger de Lange, Deltares Research Institute, the Netherlands

Dominique Ngan-Tillard, Delft University of Technology, the Netherlands

Margriet Roukema, Deltares Research Institute, the Netherlands

Esther Stouthamer, Utrecht University, the Netherlands

Supportive working group

Mariska van Gelderen, Deltares Research Institute, the Netherlands

Saskia Hommes, Deltares Research Institute, the Netherlands

Margriet Roukema, Deltares Research Institute, the Netherlands

Ginny Ruiter, Event Solutions, the Netherlands

Natascha Voskuijl, Event Solutions, the Netherlands

Editors of issue

Peter A. Fokker, TNO Energy Transition and Utrecht University, the Netherlands

Gilles Erkens, Deltares Research Institute, Utrecht University, the Netherlands

Reviewers

Jan van den Akker, Wageningen University/Wageningen Environmental Research, the Netherlands

Mahmoud Bakr, Dar Al-Handasah Consultants, Egypt

Tom Burbey, Virginia Tech, USA

Enrique Cabral-Cano, UNAM, Mexico

Dora Carreón-Freyre, UNAM, Mexico

Kenji Daito, Daido University, Japan

Gilles Erkens, Deltares Research Institute, Utrecht University, the Netherlands

Peter A. Fokker, TNO Energy Transition and Utrecht University, the Netherlands

Devin Galloway, United States Geological Survey, USA

Ramon Hanssen, Delft University of Technology, the Netherlands

Gerardo Herrera, Instituto Geológico y Minero de España, Spain

Wei-Chia Hung, Green Environmental Engineering Co. LTD., Taiwan

Makan Karegar, University of Bonn, Germany

Kay Koster, Utrecht University, the Netherlands

John Lambert, Deltares Research Institute, the Netherlands

Ger de Lange, Deltares Research Institute, the Netherlands

Dominique Ngan-Tillard, Delft University of Technology, the Netherlands

Michelle Sneed, United States Geological Survey, USA

Esther Stouthamer, Utrecht University, the Netherlands

Pietro Teatini, University of Padova, Italy

Roberto Tomás-Jover, Universidad de Alicante, Spain

Luigi Tosi, University of Padova, Italy

Shujun Ye, Nanjing University, P.R. China

Acknowledgements. This issue of the Proceedings of the International Association of Hydrological Sciences was made possible thanks to the generous support of TNO-Geological Survey of the Netherlands, Deltares Research Institute, Rijkswaterstaat (Dutch Ministry of Infrastructure and Water Management), UNESCO Land Subsidence International Initiative (LASII), and UNESCO The Intergovernmental Hydrological Programme (IHP). All authors and reviewers of this special issue are sincerely thanked for their contributions. Copernicus publications is acknowledged for editing and helping with compiling this issue.