EDITORIAL

Welcome to Issue 1, Volume 1 of *Ground Penetrating Radar*, the first peer-reviewed scientific journal dedicated to Ground Penetrating Radar (GPR) technology, methodology and applications! Founded in September 2017 as a follow-up initiative of COST (European Cooperation in Science and Technology) Action TU1208 "Civil engineering applications of Ground Penetrating Radar," this is an open-access open-science journal, published quarterly. Our website is www.GPRadar.eu/journal, where all papers are available for free download and an online submission form is waiting for your contributions to the forthcoming issues!

The scope of *Ground Penetrating Radar* spans all of the latest and emerging research in the GPR field. Thus, the journal topics cover:

- The development of novel instrumentation;
- The applications of GPR in earth and planetary sciences, environmental and civil engineering, archaeology and cultural heritage, forensics and security, and in any other areas;
- The advancement and use of electromagnetic modelling, imaging, inversion, and data-processing methods for GPR; and,
- The integration of GPR with complementary non-destructive testing techniques.

Ground Penetrating Radar publishes regular research papers, review papers, tutorials, software and data papers, communications, and comments. We also accept manuscripts presenting the outcomes of training, dissemination and outreach activities, as well as papers aiming at communicating to a broader audience with regard to research projects financed with international, European or national funds.

We foster openness, reproducibility and re-use of research. We therefore encourage scientists to publish theoretical, computational and experimental methods and results in as much detail as possible, so that Readers can thoroughly understand and further develop the methods and/or easily reproduce the results. For this reason, there is no restriction on the paper length and supplementary material is most welcome (e.g., data, software, and any other useful electronic file).

GPR is a relatively new inspection technique with a bright future, which started being used in the field of geoscience in the 1950s and rapidly found applications in several other areas. In the last decades, new developments have occurred at an increasing pace and, although the technique has now reached a level of maturity, there still are vast opportunities for further advancements and innovation. The number of GPR-related scientific papers is growing significantly (see Figure 1); over recent years, special issues and books on GPR are published more and more often by

renowned journals and publishing houses. As is well known, GPR has two longstanding dedicated biennial events (the International Conference on Ground Penetrating Radar, held since 1986, and the International Workshop on Advanced Ground Penetrating Radar, held since 2001); additionally, GPR-related sessions are organized in the framework of many international and national conferences. In this landscape, the time is ripe for a GPR journal to start and I am confident that, with the cooperation and support of you all, this challenging but promising project will be a success. *Ground Penetrating Radar* is our journal, created to support and promote the GPR scientific community: all together we can gradually make it a high-quality, innovative, impactful and influential periodical publication.

Our first issue is a humble first step, to kick off this ambitious editorial venture. It includes six papers stemming from recent short-term scientific missions and training schools funded by COST Action TU1208. The second issue is expected for April 2018. *Ground Penetrating Radar* papers are currently processed and published free of charge, thanks to the generous support of the non-profit TU1208 GPR Association.

We welcome your ideas, suggestions, comments, questions, and special-issue proposals! We are looking forward to extending the editorial board and to receiving many interesting manuscripts.

The Editor-in-Chief
Lara Pajewski

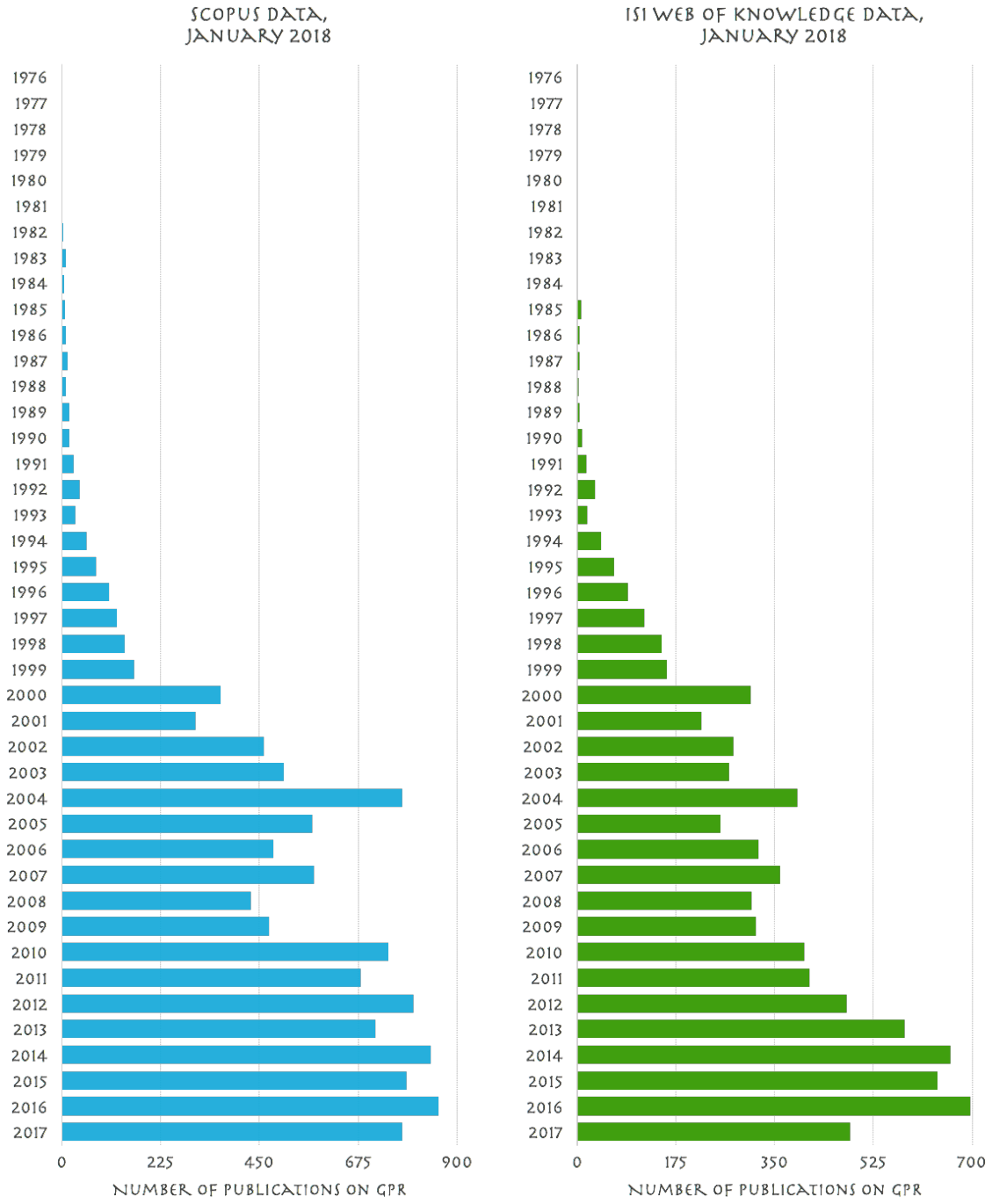

Fig. 1 – Evolution of the number of GPR-related scientific publications over the years. The histogram on the left is obtained from January-2018 Scopus data, whereas the histogram on the right presents January-2018 data taken from ISI Web of Knowledge. Though these data are obviously not exhaustive, they nonetheless give an idea about the increasing trend.

PREFACE

We are delighted and honoured to present the first issue of the first volume of *Ground Penetrating Radar*, which includes six papers stemming from short-term scientific missions and training schools recently funded by COST (European Cooperation in Science and Technology) Action TU1208 "Civil engineering applications of Ground Penetrating Radar" (www.GPRadar.eu). The papers are authored by scientists from eight institutes in five countries (Germany, Italy, Malta, Portugal, Spain).

As is well known, COST (www.cost.eu) is the longest-running European framework supporting trans-national cooperation among researchers, engineers and scholars across Europe. COST Actions are bottom-up science and technology networks where scientists, professionals and stakeholders can jointly develop their own ideas. They are active through a range of networking tools, such as workshops, conferences, training schools, short-term scientific missions, and dissemination activities.

COST Action TU1208 (www.GPRadar.eu) was running from 4 April 2013 to 3 October 2017. Its main objective was to exchange and increase scientific-technical knowledge and experience of Ground Penetrating Radar (GPR) techniques in civil engineering, whilst promoting a wider and more effective use of this safe and non-destructive method in the monitoring of structures. The research activities carried out in the Action included all aspects of the GPR technology and methodology: development and testing of radar systems and antennas; design and application of surveying procedures for the inspection of natural and manmade structures, in civil and environmental engineering, cultural heritage, and beyond; integration of GPR with complementary non-destructive testing methods; development of advanced electromagnetic modelling, inversion and data-processing techniques for radargram analysis and interpretation.

Short-term scientific missions are among the most effective COST networking tools. They are institutional visits aimed at supporting individual mobility across Europe and at fostering collaboration between researchers from different countries; their minimum and maximum duration is 5 and 180 calendar days, respectively. In the framework of TU1208, we have seen very positive results stemming from such missions: several Action Members exploited this networking tool, carried out research together, and were able to achieve impressive results in a short period of time.

The first three papers of this journal issue report and discuss the results of cutting-edge experimental activities carried out in Malta in 2015 and 2016, during two short-term scientific missions and a training school funded by TU1208. Overall, a wide and variegated range of interesting case studies is presented in these three contributions.

The first research paper of the Malta series, entitled "Use of Ground Penetrating Radar and standard geophysical methods to explore the subsurface" and authored by Raffaele Persico and Sebastiano D'Amico, deals with GPR and passive seismic measurements performed in 2015 in several sites of historical and geological interest. Namely, the prospected sites included: an area of the Golden Bay, in the vicinity of Għajn Tuffieħa Tower; an area close to La Ferla Cross church; Madliena tower, in Pembroke; an area outside Santa Maria church, in Birkikara; and, the co-cathedral of St John, in Valletta, a UNESCO World Heritage Site. The used radar system was an innovative reconfigurable stepped-frequency GPR prototype and the investigations carried out in Malta represented a valuable opportunity to test the prototype on various real scenarios.

In the second research paper, entitled "Ground Penetrating Radar investigations in sites of cultural interest in Malta," Raffaele Persico, Sebastiano D'amico, Enzo Rizzo, Luigi Capozzoli, and Aaron Micallef present the results of further GPR measurements performed in Malta in 2016. The reconfigurable stepped-frequency GPR prototype was used to inspect the Argotti Garden in Floriana, where the Authors looked for ancient buried cisterns, and the floor of a Nymphaeum inside the garden, to assess its conditions prior to restoration works. A commercial pulsed GPR system was then employed to assess the walls of the co-cathedral of St. John and of a building of the University of Malta, in Msida.

In the third research paper, entitled "Electrical Resistivity Tomography investigations in Mgarr (Malta)," Raffaele Persico, Sebastiano D'amico, Enzo Rizzo, Luigi Capozzoli, and Aaron Micallef present the results of electrical resistivity tomography (ERT) measurements carried out in 2016 near the village of Mgarr, on the western coast of Malta, in an area of naturalistic and cultural interest. The main objective of the experimental campaign was to perform a hydrogeological study of carbonate rocks close the sea. As is known, ERT allows a deeper penetration than GPR (with a worse resolution) and is often used in combination with GPR.

The journal issue continues with the research paper entitled "Non-destructive tests for railway evaluation: detection of fouling and joint interpretation of GPR data and track geometric parameters." Here, Mercedes Solla and Simona Fontul present the results of a short-term scientific mission funded by TU1208 and carried out in Lisbon, Portugal, in 2015. In particular, the paper deals with the assessment of railways by using GPR, Falling Weight Deflectometer and Light Falling Weight Deflectometer. The Authors investigated how to detect track defects at railway infrastructure level, how to measure the ballast layer thickness, and how to evaluate the fouling level of ballast.

The subsequent contribution is entitled "A practical guide on using SPOT-GPR, a freeware tool implementing a SAP-DoA technique" and is authored by Simone Meschino and Lara Pajewski. This is a software paper, which main objective is to provide practical information on how to use SPOT-GPR release 1.0, a MATLAB®-based software for the analysis of GPR profiles. This tool allows detecting targets and estimating their position in a two-dimensional scenario, it has a graphical user interface and implements an innovative sub-array processing method. SPOT-GPR was developed during three short-term scientific missions funded by TU1208 and carried out in Rome in 2015, 2016, and 2017.

The journal issue is concluded with a tutorial entitled "Thermography: principles and applications," authored by Mercedes Solla and Susana Lagüela. This contribution resumes a lecture given by the first Author during a TU1208 training school on non-destructive testing techniques applied to civil engineering, held in Barcelona, Spain, in 2016. The tutorial presents the main principles of the thermography technique and its civil-engineering applications. Several examples are given and two case studies are described, where thermography and GPR are jointly used to assess a radiant heating floor installed in a building, and to detect moisture in a masonry arch bridge.

The works included in this issue were reviewed by Isabel Rodríguez-Abad, Andreas Loizos, Marian Marciniak, Loredana Matera, Lara Pajewski, and Santo Prontera.

We would like to warmly thank the Authors of the papers and the Reviewers for their efforts. We are grateful to COST for funding and supporting the Action TU1208.

Isabel Rodríguez-Abad (Guest Editor)

Marian Marciniak (Guest Editor)

Lara Pajewski (Editor-in-Chief)