

## **Preface to the volume ‘One small step to further our knowledge of the solid Earth’**

This is the twenty-second volume collecting a group of selected papers presented during the annual national conference of the Gruppo Nazionale di Geofisica della Terra Solida (NGGTS) published in the *Bollettino di Geofisica Teorica ed Applicata* (BGTA, now *Bulletin of Geophysics and Oceanography* BGO). It may be considered a sort of summary of the novelties arising during the congress.

NGGTS was established in 1978 as an offshoot of the Italian Consiglio Nazionale delle Ricerche to promote, develop, and coordinate research in the field of solid Earth geophysics. NGGTS comprised various sections: seismology, geodesy and gravimetry, geothermal research, crustal geophysics, mining and environmental geophysics, near-surface applications, as well as seismic exploration. In the past years, in spite of its limited budget, NGGTS funded several research activities and sponsored multi-disciplinary projects, mainly devoted to the study of the Earth’s crust. About 500 researchers refer to the NGGTS and meet every autumn for a national assembly: a point of reference in the life of the Italian geophysics. Although the institution NGGTS was closed in December 2000, the annual conference NGGTS, sponsored by the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, continued to be held and reached its silver anniversary in 2006.

The NGGTS annual conference, which has been taking place for almost 40 years now, is the meeting point for all researchers who work, even with different roles, in geophysics, seismology, geology, and volcanology, as well as all the scientific branches that collaborate to improve our knowledge of the solid Earth. It is a spontaneous gathering that had a remarkably high number of participants in its last session at the CNR in Rome. The conference returned to be held in Rome after several years following an itinerant edition in other Italian towns. Rome is a focal point for participants and certainly favours logistics and participation. It is in fact, an aspect that the Scientific Committee of the NGGTS has very well understood and which suggests Rome as the privileged location in which to organise the next conferences. However, the pandemic situation of the last two years leads us to elaborate future projects with great caution. Holding the next conference is certainly an objective of the NGGTS itself and for all its researchers and those wishing to attend in person, but unfortunately at the moment we are not sure when this will be possible.

It is important not to forget the fundamental role of NGGTS in its function as a ‘training ground for young researchers’ and the NGGTS Scientific Committee encourages the participation of young people in every way. Often, it is precisely at the NGGTS that the young or aspiring researchers present their first work. The traditional and anomalous free participation means that the conference is also open to all young doctoral students, fellows, contract and aspiring

researchers, who can participate in the conference by attending a scientific forum for the first time. Similarly, there is a great deal of attention to the participation of the university component of both teachers and students and for this reason, the GNGTS is looking for dates that are compatible with the teaching activities of the universities.

Peer-reviewed proceedings of the national conferences have been published since 1997 in special volumes and on CD-Roms, mainly in Italian. These documents are also available at the GNGTS website [gngts.inogs.it](http://gngts.inogs.it). Since the year 2000, with the exceptions of 2012 to 2015, when the volumes of the proceedings of the conference were printed, it was decided to publish selected papers from the GNGTS conferences in an international geophysical journal, also in order to achieve a better dissemination of the GNGTS activities for an international audience.

Over the years, multidisciplinary and single-theme volumes have been issued. The multidisciplinary volumes, which make up the vast majority of the published volumes, generally presented one paper from each of the sessions of the GNGTS conference. In this case, all three broad themes, i.e. geodynamics, seismic characterisation of the territory, and applied geophysics, have been documented by a suite of papers. Conversely, the five thematic issues published up to now, have presented papers from a single GNGTS session that was of particular interest in the year of presentation. In this way, one BGTA volume was devoted to the 2009 L'Aquila earthquake (Amato *et al.*, 2011), another to the GNGTS session concerning earthquake forecasting and hazard assessment (Albarelli and Meletti, 2012), a third to the international session on the seismic hazard of the critical facilities (Grimaz and Slejko, 2014), a fourth referred to the session about science, technology, and communication to support seismic prevention (Dolce and Martelli, 2019), and a fifth focused on energy, related risks and cascade effects (Martelli and Masi, 2021). A summary of the structure and activities of the GNGTS is described in a recent paper by Slejko (2020).

The present volume consists of 6 out of the 271 papers presented orally or as posters during the 38th GNGTS national conference, held in Rome in November 2019. The topics treated in this volume cover several themes of solid Earth geophysics, such as exploration geophysics, volcanology, and engineering seismology. They present specific studies conducted in the Italian territory that give important highlights on the subsurface geological/geophysical structure which provide fundamental elements for the scientific community and all the potential stakeholders interested in the sustainable use of the subsurface.

The work by Gasperini *et al.* (2021) presents a case study dealing with the application of 3D techniques to a set of 2D shallow-water data, where the effect of lateral reflections and diffractions can be neglected. The authors show how such techniques can be effective in highlighting geological properties and features of the seafloor and sub-seafloor.

A two-dimensional, time-dependent, numerical study of natural convection in porous media is presented in the paper by Gola (2021). The author uses finite element models based on an idealised crustal section, including the main structural features characterising many hydrothermal systems, and the onset of the thermal convection is investigated by exploring different thermal boundary conditions.

On the basis that both elastic and poroelastic phenomena are observable and measurable by continuous GNSS monitoring of ground deformations and that both can be triggered by periodical atmospheric processes but also by extreme events, like heavy rainfalls, the study by Riguzzi *et al.* (2021) shows a few case studies, observed in the Italian area, that demonstrate

how deformation patterns, at different repeating periods, clearly correlate with groundwater circulation in different environmental conditions.

Valentini (2021) has used a publicly available tool (SUNFiSH) to obtain multi-fault earthquake occurrences in central Italy, by defining a fault model and assigning to each subsection a slip rate value through a geologic deformation model. The author goes on to compare the long-term time-independent earthquake rates of all possible ruptures computed by this approach with the time-independent activity rates obtained by using individual seismogenic sources, and with the observed historical rates. Results highlight the necessity to consider a model that relaxes segmentation and considers the multi-fault events similarly to what has been done, for example, in the western U.S.A.

The paper by Scalise *et al.* (2021) illustrates a 2-year seismic re-processing program intended to assess the residual gas potential in the still productive hydrocarbon area of the Adriatic Sea by drawing on integrated geological and geophysical workflows, modern processing techniques, and high-performance parallel computing capabilities.

As the method of Electrical Resistivity Tomography has boosted its potential since the development of new-concept resistivity-meters, the multi-source resistivity-meter system, which is a modular system based on stand-alone units remotely controlled via radio signals, was successfully tested by Bocchia *et al.* (2021) in the Vajont valley, in north-eastern Italy, with the purpose of imaging the deep sliding surface of the catastrophic landslide occurring in 1963.

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