Application Of Seismic Refraction Tomography To Karst Cavities

Basic Seismic Refraction Survey and Data Interpretation Techniques (Penerbit USM)Penerbit USM

Seismic measurements take many forms, and appear to have a universal role in the Earth Sciences. They are the means for most easily and economically interpreting what lies beneath the visible surface. There are huge economic rewards and losses to be made when interpreting the shallow crust or subsurface more, or less accurately, as the case may be.

The welcome accorded to the first two editions of this book has been most encouraging. The object of the third edition continues to be to give a brief but "fairly comprehensive survey of the methods of applied geophysics including some of the modern interpretation techniques. The general approach and plan of the previous editions are preserved, but in bringing the book up to date some changes have been made to which I would like to draw the reader's special attention. SI units are strictly adhered to except in six illustrative figures reproduced from older literature and left intact to save some extensive redraughting. Following the recommendation of the International Union of Geodesy and Geophysics, the

magnetic field measured in geophysical work is labelled here as flux density (tesla). Consequently, the symbols H, Z and T commonly used in geomagnetic work should stand for flux density. In the Max wellian theory of electromagnetism the symbol H stands, by convention, for a magnetizing force (A m -1) and a discerning reader will at once sense a source of confusion. This source of confusion is avoided in the present edition by B , B and B instead of H, Z and T. The employing the symbols b z t latter ~et is employed for the corresponding magnetizing forces of the earth's field. I hope this notation will gain general acceptance because it so easily dispenses with an ambiguity that otherwise tends to lead to unnecessary confusion of units and dimensions in geomagnetism.

Inverse problems in wave propagation occur in geophysics, ocean acoustics, civil and environmental engineering, ultrasonic non-destructive testing, biomedical ultrasonics, radar, astrophysics, as well as other areas of science and technology. The papers in this volume cover these scientific and technical topics, together with fundamental mathematical investigations of the relation between waves and scatterers.

The ongoing population growth is resulting in rapid urbanization, new infrastructure development and increasing demand for the Earth's natural resources (e.g., water, oil/gas, minerals). This, together with

the current climate change and increasing impact of natural hazards, imply that the engineering geology profession is called upon to respond to new challenges. It is recognized that these challenges are particularly relevant in the developing and newly industrialized regions. The idea beyond this volume is to highlight the role of engineering geology and geological engineering in fostering sustainable use of the Earth's resources, smart urbanization and infrastructure protection from geohazards. We selected 19 contributions from across the globe (16 countries, five continents), which cover a wide spectrum of applied interdisciplinary and multidisciplinary research, from geology to engineering. By illustrating a series of practical case studies, the volume offers a rather unique opportunity to share the experiences of engineering geologists and geological engineers who tackle complex problems working in different environmental and social settings. The specific topics addressed by the authors of chapters included in the volume are the following: pre-design site investigations; physical and mechanical properties of engineering soils; novel, affordable sensing technologies for long-term geotechnical monitoring of engineering structures; slope stability assessments and monitoring in active open-cast mines; control of environmental impacts and hazards posed by abandoned coal mines; assessment of and protection from geohazards

(landslides, ground fracturing, coastal erosion); applications of geophysical surveying to investigate active faults and ground instability; numerical modeling of seabed deformations related to active faulting; deep geological repositories and waste disposal; aquifer assessment based on the integrated hydrogeological and geophysical investigation; use of remote sensing and GIS tools for the detection of environmental hazards and mapping of surface geology. This volume is part of the proceedings of the 1st GeoMEast International Congress and Exhibition on Sustainable Civil Infrastructures, Egypt 2017.

Basic Seismic Refraction Survey and Data Interpretation Techniques This book is written to impart knowledge on seismic refraction method, which covers data acquisition, processing and interpretation techniques. The discussion in this book is about seismic waves and their characteristics, theory of seismic refraction and field procedures. Examples of seismic refraction data and simple calculation are also provided to enable readers to better visualize and aid their understanding on the seismic refraction method. Rosli Saad is currently a lecturer at School of Physics, Universiti Sains Malaysia, Pulau Pinang with 30 years of experience in geophysics. His expertises is in the areas of Ground Penetrating Radar (GPR), gravity, magnetic, seismic and

electrical methods. His main research is in engineering and environmental studies. He has published three research book chapters, four research books and more than 250 journal papers. Recently, he was appointed as head of geophysics section at the Centre of Tropical Geoengineering (GEOTROPIK), Universiti Teknologi Malaysia.

This book provides a systematic review of tomographic applications in seismology and the future directions. Theories and case histories are discussed by the international authors, drawing on their own practical experiences with global and local case histories.

As a result the FDOT is interested in methods of early detection. The capabilities of three commercially available seismic refraction tomography (SRT) programs, specifically Rayfract, SeisImager, and SeisOpt Pro, to image the subsurface were evaluated. The resulting tomograms were then compared to traditional, intrusive geotechnical test methods such as: CPT soundings, SPT soundings, and rock coring data. The results of these comparisons suggest that SRT is capable of accurately imaging the laterally-variable top of bedrock typical of karst terrain.

The aim of the present work is to develop an approach for detecting and mapping different types of subsurface anomalous zones using tomographic processing techniques. Tomography is applied to process seismic refraction and Ground Penetrating Radar (GPR) data. We developed a new tomography technique depending on acquiring the GPR or seismic data from surface

survey, where both sources and receivers are located on the earth s surface. Three synthetic seismic models and two sets of field data are discussed to test the proposed seismic refraction tomography technique. Due to the similarities between GPR and seismic data, the adopted tomography technique is applied to GPR data. Three GPR tomography laboratory experiments are acquired in the laboratory of Kiel University, Germany. The inversion of GPR data using the adopted technique give satisfactory results on the lateral extension of the anomalies as well as GPR velocity. One GPR tomography field test is acquired in the botanic garden of Kiel University, Kiel, Germany. In this data the root system of a tree and zone of high water content, due to previous excavation processes could be marked on the inverted tomogram map.

"The research presented here consists of two case studies: the first from a study site in Illinois and the second from a site in Arkansas. In both instances, geophysical investigations were conducted to characterize the subsurface. At the Illinois site, borehole control, downhole seismic (DHS), seismic refraction tomography (SRT) and multichannel analysis of surface waves (MASW) data were acquired for the purpose of seismic site characterization. Shear wave and compressional wave velocities were used to estimate depth to bedrock and to generate 1-D plots depicting variations in Poisson's Ratio, elastic moduli and density. The average shear wave velocity in the upper 100 ft was calculated and the national earthquake hazards reduction program (NEHRP) class D was assigned to the

site based on MASW and DHS data results. At the Arkansas site, borehole control, electrical resistivity tomography (ERT), seismic refraction tomography (SRT), and multichannel analysis of surface waves (MASW) data were acquired with the objective of verifying and mapping a postulated fault. A comparative evaluation of the overall usefulness of the ERT, SRT and MASW techniques was also performed. The comparison showed that ERT and SRT tools generated remarkably similar images of the fault. The MASW tool generated a slightly different image of the fault. The research demonstrates that integrated use of seismic (seismic refraction tomography, multichannel analysis of surface waves and downhole seismic) and electrical (electrical resistivity tomography) methods is an effective approach in terms of assessing soil and rock in the New Madrid Seismic Zone"--Abstract, page iii.

"The critical zone is defined as the upper most portion of the crust extending from the top of unweathered bedrock to the top of the vegetation canopy. It is the zone in which inorganic rock is transformed into biologically useful soils and saprolites in a process termed weathering. Because the critical zone is the connection between the subsurface and surface it plays a role in a wide variety of biological, hydrologic, and climatic processes. Understanding the critical zone though is inherently difficult because its scale and heterogeneity often means direct sampling methods, e.g. soil pits and cores, under represent the heterogeneous critical zone process. Geophysical methods are increasingly applied to study the near-surface processes at a variety of

spatial and temporal scales. This paper presents two geophysical experiments that capture two different hydrologic processes and two different scales: the first is the study of the influence of aspect, elevation, and snow accumulation on weathering depths at the catchment scales using seismic refraction tomography and second is the application of electrical resistivity tomography to observe the heterogeneous seasonal change of soil moisture and its connectivity at the plot scale."--Boise State University ScholarWorks.

Many scientific studies have been conducted on the Cretaceous-Paleogene boundary (KTB) in the Gulf coast region and, in particular, the Brazos River section in Falls County, Texas. Despite this, there remains much to be learned about the KTB and its depositional environment. Study of the KTB has been multidisciplinary, primarily in the fields of sedimentology and paleontology. Some researchers in these disciplines have questioned the consensus view of the placement of the KTB and subsequent interpretation of the timing of depositional events and mass extinction events. Geophysical methods have potential to provide additional understanding of the physical properties of the KTB. To date, study of the KTB has relied on point data and borehole information to create cross sections of the complex. Seismic refraction surveys can provide spatially continuous information on susburface horizons located adjacent to the KTB. In this study, seismic first-arrival traveltimes are processed with a tomographic modeling program to map the top of the hummocky cross-bedded sandstone (HCS), which is a key indicator of the

deposition environment at the time of KTB boundary complex placement. The survey area is located at Cottonmouth Creek, a tributary of the Brazos River. Three seismic lines were surveyed, one across Cottonmouth Creek, and two parallel to the creek on either side. The data from the two parallel lines were processed using the 2-D seismic refraction tomography algorithm of Zelt and Smith. The reconstructed depth to the HCS in the survey area is approximately 6 m, with layer seismic velocities of 364, 1800, and 2200 m/s, respectively. Seismic tomography successfully mapped the HCS layer and reveals approximately 1 m amplitude undulations vertically and undulations on the order of several m horizontally. These variations are consistent with exposed surfaces of the HCS in the creek bed. Seismic refraction has been utilized successfully herein to map a key buried indicator, namely the top of the HCS layer, associated with the KTB complex. A detailed 3-D seismic refraction survey at this site is recommended to generate a high-resolution 2-D terrain map of the top of the HCS layer.

This book aims to inform policy-makers, engineers and earth scientists about the current and emerging role of geophysics in addressing environmental processes, assessments, and policy directions related to new and existing dams and levees. Until now geophysics has concentrated on characterization and remediation of dams and levees, but now the field is changing our understanding on the influence of natural processes (e.g., floods, dissolution) and human activities in the design, and management of these structures. This

monograph includes advances in the following fields of Dams and Levees studies: · New insights from small and mid-sized laboratory experiments· Integrated methods electromagnetic, seismic, potential methods· Inverse modeling approaches· Statistical considerations· Monitoring of processes attending aging structures · Hazard monitoring· Risk Analysis

The field of slope engineering encompasses slope stability analysis and design, movement monitoring, and slope safety management and maintenance. Engineers in this field are concerned with landslides and other gravity-stimulated mass movements. Their job is to frequently evaluate existing and proposed slopes to assess their stability. As such, this book provides information on remote sensing in landslide detection, tunnel face stability, stability analysis and maintenance of cut slopes, design techniques in rock and soil engineering, statistical models for landslide risk mapping, slope stability analysis in open-pit mines, ecological engineering for slope stabilization, and asphalt-stabilized strengthening in open-pit coal mining.

Consisting of more than 150 articles written by leading experts, this authoritative reference encompasses the entire field of solid-earth geophysics. It describes in detail the state of current knowledge, including advanced instrumentation and techniques, and focuses on important areas of exploration geophysics. It also offers clear and complete coverage of seismology, geodesy, gravimetry, magnetotellurics and related areas in the adjacent disciplines of physics, geology, oceanography and space science.

The Encyclopedia of Earthquake Engineering is designed to be the authoritative and comprehensive reference covering all major aspects of the science of earthquake engineering, specifically focusing on the interaction between earthquakes and infrastructure. The encyclopedia comprises approximately 300 contributions. Since earthquake engineering deals with the interaction between earthquake disturbances and the built infrastructure, the emphasis is on basic design processes important to both non-specialists and engineers so that readers become suitably well informed without needing to deal with the details of specialist understanding. The encyclopedia's content provides technically-inclined and informed readers about the ways in which earthquakes can affect our infrastructure and how engineers would go about designing against, mitigating and remediating these effects. The coverage ranges from buildings, foundations, underground construction, lifelines and bridges, roads, embankments and slopes. The encyclopedia also aims to provide cross-disciplinary and cross-domain information to domain-experts. This is the first single reference encyclopedia of this breadth and scope that brings together the science, engineering and technological aspects of earthquakes and structures.

This edited volume is based on the best papers accepted for presentation during the 1st Springer Conference of the Arabian Journal of Geosciences (CAJG-1), Tunisia 2018. This special volume is of interest to all researchers practicing geosphysicists/seismologists, students of PG and UG in the fields of multifaceted Geoscience. Major

applications with relevant illustrations presented in the volume are from Middle East. And therefore, this book no doubt would serve as a reference guide to all geoscientists and students in the broad field of Earth Science. This volume covers significant applications of gravity and magnetic methods, electrical and electromagnetic methods, refraction and reflection seismic methods besides a large number of study on earthquakes, tectonics and geological settings etc. The salient features of this volume are the interpretation and modeling of geophysical data of different nature. Main topics include: 1. Applications of gravity and magnetic methods.2. Electrical and Electromagnetic methods in mineral and groundwater exploration.3. Case studies on refraction and reflection seismic methods.4. Integrated geoscience applications in the exploration of subsurface resources.5. Hydrocarbon and petrophysical studies6. Earthquakes and seismic hazard assessment.7. Tectonics

Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions contains invited, keynote and theme lectures and regular papers presented at the 7th International Conference on Earthquake Geotechnical Engineering (Rome, Italy, 17-20 June 2019. The contributions deal with recent developments and advancements as well as case histories, field monitoring, experimental characterization, physical and analytical modelling, and applications related to the variety of environmental phenomena induced by earthquakes in soils and their effects on engineered systems interacting with them. The book is

divided in the sections below: Invited papers Keynote papers Theme lectures Special Session on Large Scale Testing Special Session on Liquefact Projects Special Session on Lessons learned from recent earthquakes Special Session on the Central Italy earthquake Regular papers Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions provides a significant up-to-date collection of recent experiences and developments, and aims at engineers, geologists and seismologists, consultants, public and private contractors, local national and international authorities, and to all those involved in research and practice related to Earthquake Geotechnical Engineering.

A practical handbook for the petroleum geophysicist. Fundamental concepts are explained using heuristic descriptions of seismic modeling, deconvolution, depth migration, and tomography. Pitfalls in processing and contouring are described briefly. Applications include petroleum exploration of carbonate reefs, salt intrusions, and overthrust faults. The book includes past, present, and possible future developments in time-lapse seismology, borehole geophysics, multicomponent seismology, and integrated reservoir characterization.

Covers the basic ideas and methods used in seismic processing, concentrating on the fundamentals of seismic imaging and deconvolution. Many of the seismic methods in popular use today go back to the work of some of the great scientists of past centuries. The ideas are developed from the ground up. Most chapters in the book are followed by problem sets. Some exercises are designed to supplement the material presented in the text; others are meant to

stimulate classroom discussions. There are few industrial-grade illustrations. Instead, both the text and the exercises deal mostly with simple examples that often can be solved with nothing more than a pencil and paper. Each chapter is as self-contained as possible to make it easier for a reader to concentrate on topics of particular interest. The book covers such basic topics as wave motion; digital imaging; digital filtering; various visualization aspects of the seismic reflection method; sampling theory; the frequency spectrum; synthetic seismograms; wavelets and wavelet processing; deconvolution; the need for continuing interaction between the seismic interpreter and the computer; seismic attributes; phase rotation; and seismic attenuation. The last of the 15 chapters gives a detailed mathematical overview. Digital Imaging and Deconvolution, nominated for the Association of Earth Science Editors award for the best geoscience publication of 2008-2009, will be of interest to professional geophysicists as well as graduate students and upper-level undergraduates in geophysics. The book also will be helpful to scientists and engineers in other disciplines who use digital signal processing to analyze and image wave-motion data in remote-detection applications. In particular, the methods described in this book are important in optical imaging, video imaging, medical and biological imaging, acoustical analysis, radar, and sonar.

The importance of seismic wave research lies not only in our ability to understand and predict earthquakes and tsunamis, but it also reveals information on the Earth's composition and features in much the same way as it led to the discovery of Mohorovicic's discontinuity. As our theoretical understanding of the physics behind seismic waves has grown, physical and numerical modeling have greatly advanced and now augment applied seismology for better prediction and engineering practices. This book demonstrates the latest techniques and

advances in seismic wave analysis from a theoretical approach, data acquisition and interpretation, to analyses and numerical simulations, as well as research applications. The major topics in this book cover aspects on seismic wave propagation, characteristics of their velocities and attenuation, deformation process of the Earth's medium, seismic source process and tectonic dynamics with relating observations, as well as propagation modeling of seismic waves.

Treatise on Geophysics, Second Edition, is a comprehensive and in-depth study of the physics of the Earth beyond what any geophysics text has provided previously. Thoroughly revised and updated, it provides fundamental and state-of-the-art discussion of all aspects of geophysics. A highlight of the second edition is a new volume on Near Surface Geophysics that discusses the role of geophysics in the exploitation and conservation of natural resources and the assessment of degradation of natural systems by pollution. Additional features include new material in the Planets and Moon, Mantle Dynamics, Core Dynamics, Crustal and Lithosphere Dynamics, Evolution of the Earth, and Geodesy volumes. New material is also presented on the uses of Earth gravity measurements. This title is essential for professionals, researchers, professors, and advanced undergraduate and graduate students in the fields of Geophysics and Earth system science. Comprehensive and detailed coverage of all aspects of geophysics Fundamental and state-of-the-art discussions of all research topics Integration of topics into a coherent whole

This book provides a general introduction to the most important methods of applied geophysics with a variety of case studies. These methods represent a primary tool for investigation of the subsurface and are applicable to a very wide range of problems. Applied geophysics is based on

physics principles that collect and interpret data on subsurface conditions for practical purposes, including oil and gas exploration, mineral prospecting, geothermal exploration, groundwater exploration, engineering applications, archeological interests, and environmental concerns. The depth of investigation into applied geophysics is shallow, typically from the ground surface to several kilometers deep, where economic, cultural, engineering, or environmental concerns often arise. Applied geophysics uses almost all of the current geophysical methods, including electrical, magnetic, electromagnetic, gravimetric, geothermal, seismic, seismoelectric, magnetotelluric, nuclear, and radioactive methods. In applied geophysics, geophysicists are usually required to have a good understanding of math and physics principles, knowledge of geology and computer skills, and hands-on experience of electronic instruments. A geophysicist's routine job includes survey designs, data acquisition, data processing, and data interpretation with detailed explanation of the study. Applied geophysics consists of three main subject and interest areas, which are exploration geophysics, engineering geophysics, and environmental geophysics.

This book reviews and assesses the various methodologies for site characterization and site effect estimation to carry out seismic zonation at micro and macro levels. Readers will learn about the suitability of these methodologies for each level of zoning that needs to be assessed in order to optimize the resources for carrying out seismic zonation. The Indian sub-continent is highly vulnerable to earthquake hazards, and past studies have focused primarily on the Himalayan region (inter-plate zone) and the northeast region (subduction zone). The book improves understanding of the Peninsular India that also has significantly high seismicity and is prone to earthquakes of sizeable magnitude. Particular attention is

given to the various methodologies for assessing seismic hazards, the scales at which site characterizations are carried out, and optimal methods for zonation practices using site data and hazard indexes. Aimed at students, this book will be of use to post-graduates and doctoral students researching seismic zonation, hazard assessment and mitigation, and spatial data in earth sciences.

The use of geophysical techniques has become an important tool in many geomorphological studies. However, the correct handling of geophysical instruments and the subsequent processing of the data they yield, on the one hand, and the description and interpretation of geomorphological settings to which they are applied, on the other hand, are difficult tasks. Without close cooperation of geophysicists and geomorphologists, the accurate and effective use of geophysical techniques and their geophysical and geomorphological interpretation is often limited. There are many text books in both disciplines, but no single book addresses the interdisciplinary aspects of combining geophysics and geomorphology. In addition to these papers, we include a CD-ROM by Karl-Josef Sandmeier which contains (i) a test version of the software package REFLEXW (programme for 2D and 3D processing and interpretation of GPR and seismic refraction/reflection data, incl. Demo-data and handbook); (ii) an introduction to the interpretation of seismic refraction data; (iii) an introduction to modelling and tomography tools, and (iv) a technical note on the use of wavefront inversion, forward modelling and tomographic interpretation tools for seismic refraction

data

Transportation Tunnels, 2nd Edition provides a comprehensive text on tunneling and tunnel engineering applicable in general to all types of tunnels, with more detailed information on highway and railway tunnels. While the First Edition of the book was confined to deal with railway and highway tunnels, the Second Edition is also extensively considering the latest trends in use of tunnels in different other fields. The book has been revised to provide coverage of water conveyance, navigation and material conveyance tunnels also and deals with these subjects in more detail. It covers all aspects of investigation, design, construction, monitoring and maintenance of tunnels. Special emphasis has been laid on the geotechnical investigations, interpretation of findings and relating the same to the design as well as the construction of tunnels. The book reflects the advancements in the knowledge of ground behaviour and rock mechanics and also in construction technology, including use of TBM in the last two decades. It covers in sufficient detail the basic requirements of tunnel profile, the geometric parameters, clearance requirements, aerodynamics, and cost economics in fixing alignments with different design parameters like curvature, gradient and operational requirements. It discusses in detail alternative forms of the cross section / profile and illustrates design methodology with examples. The different methodologies that have been used in the past using timber or steel supports by stage wise expansion of cross sections and modern methodologies used for boring full profile using new tunneling methods and

Tunnel Boring Machines are also comprehensively discussed. Requirements of tunnels in respect of ventilation, lighting and drainage are adequately covered. Separate chapters have been included on 'Instrumentation' and 'Tunnel Inspection and Maintenance'. The expanded text on the use and advantages of methodologies and equipment for dealing with various aspects of construction of tunnels is based on observations through site visits, discussions with, and experiences of people as recorded on large number of tunneling works which have been taken up recently for railways, highways and urban transport subway projects. The book can serve as a textbook for undergraduate and graduate students and as a reference book for practicing engineers.

This volume is a compilation of the newer techniques of refraction seismic surveying. It contains a series of articles written principally by members of SEG who are specialist in refraction techniques. The volume contains only new materials with a bibliography of references to other refraction materials available. The majority of the papers are of a "technique type" which describe some particular interpretation technique that may be used for better interpretation of special refraction data.

This new edition of the well-established Kearey and Brooks text is fully updated to reflect the important developments in geophysical methods since the production of the previous edition. The broad scope of previous editions is maintained, with even greater clarity of explanations from the revised text and extensively revised figures. Each of the major geophysical methods

is treated systematically developing the theory behind the method and detailing the instrumentation, field data acquisition techniques, data processing and interpretation methods. The practical application of each method to such diverse exploration applications as petroleum, groundwater, engineering, environmental and forensic is shown by case histories. The mathematics required in order to understand the text is purposely kept to a minimum, so the book is suitable for courses taken in geophysics by all undergraduate students. It will also be of use to postgraduate students who might wish to include geophysics in their studies and to all professional geologists who wish to discover the breadth of the subject in connection with their own work.