Course and Workshop Lecturers

The course is certified by the University of Belgrade as one of the regular courses of the MS Program of the Department of Hydrogeology. Its value is 6 ECTS (European Credit Transfer and Accumulation System). All attendants who complete the course receive a Certificate of Attendance and those that pass the exam receive an additional Certificate with final grade and obtained credits issued by the University of Belgrade.

Lectures, laboratory and field demonstrations, and tutorials will be conducted by university professors and leading experts from the industry and research organizations from around the World. These include the University of Belgrade and other prominent institutions and organizations as well as experts from the Karst Commission of IAH. The lists from previous years are available at web site: www.karst.edu.rs, while the new one regularly creates and announce in the Springtime of the calendar year.

The course takes place in spring -early summer months (May, June) in period of nice climate in the region.

The Course Partners

Organizers:

- Department of Hydrogeology and Centre for Karst Hydrogeology of the University of Belgrade - The Faculty of Mining & Geology (http://www.karst.edu.rs)

- The Geological Survey of the Republic of Srpska, Zvornik (Bosnia & Herzegovina) (http://www.geozavodrs.com)

in cooperation with:

- HET (Hydro-Electro System on Trebisnjica River), Trebinje, Bosnia & Herzegovina (http://www.het.ba)

- Northern Arizona University, Flagstaff, AZ, USA (https://www.nau.edu)

- The Public Enterprise Regional Waterworks for Montenegrin Coast (http://www.regionalnivodovod.me/)

- Karst Commission of the IAH (International Association of Hydrogeologists (http://www.iah.org/karst)

- IGRAC (International Groundwater Resources Assessment Centre), Delft, The Netherlands (http://www.un-igrac.org)

- Edwards Aquifer Authority, San Antonio, Texas, USA (www.edwardsaquifer.org)

- The Faculty of Civil Engineering, University of Montenegro, Podgorica, Montenegro (http://www.ucg.ac.me/gf) and The Geological Survey of Montenegro (www.geozavod.co.me)

The main CEKA sponsor

UNESCO International Hydrological Programme /
the Section Groundwater Systems and Settlements

United Nations Educational, Scientific and Cultural Organization — International Hydrological Programme

Course fee

The attendants are responsible for covering travel and accommodation cost which is very affordable in comparison with nearby tourist centers (e.g. accommodation and food costs in Trebinje are on the order of 40-50 USD/day). Although the course is not commercially based for university students, the participants might be charged to cover operating cost (field trips, refreshments, tutorials preparation and copying, and similar). Working professionals will be charged a modest fee in addition.

Additional information:

Prof. Dr Zoran Stevanovic, accredited full professor responsible for the course implementation and Head of the Centre for Karst Hydrogeology
e-mail: zstev_2000@yahoo.co.uk

Veljko Marinović, MS, the course secretary
e-mail: veljko.marinovic@yahoo.com

University of Belgrade
School of Mining and Geology
Djusina 7, Belgrade 11000, Serbia

info : www.karst.edu.rs

CEKA

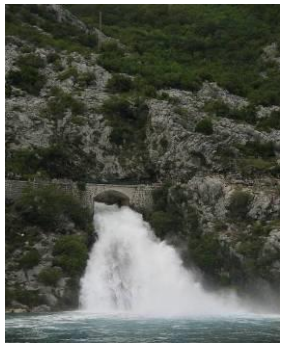
CEKA

United Nations Educational, Scientific and Cultural Organization — International Hydrological Programme

Centre for Karst Hydrogeology
Department of Hydrogeology
of the University of Belgrade –
The Faculty of Mining & Geology
&
The Geological Survey of the
Republic of Srpska, Zvornik

Under **UNESCO-IHP** *sponsorship*
announce the course and field seminar

Characterization and Engineering of Karst Aquifers – C E K A



HET

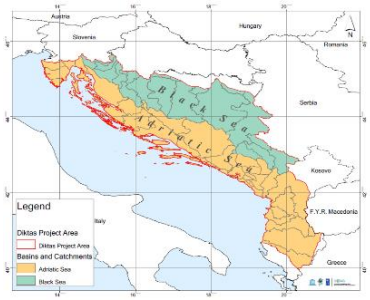
NORTHERN ARIZONA UNIVERSITY

Why this Course?

Groundwater in karst environments has intrigued scientists, engineers, and ordinary people alike for millennia due to its many fascinating facets. It feeds the world's largest springs, many of which enabled the establishment of the first urban centers in human history and continue to serve as reliable sources of water supply to the present day; it creates mysterious underground world of caves; it behaves unpredictably as it can sometimes rise hundreds of feet after heavy rains in the matter of hours giving life to numerous temporary springs, increasing the flow of permanent springs 1000-fold, and often causing serious floods; and it is extremely vulnerable to both natural and anthropogenic contamination thus seriously limiting its unrestricted use in many parts of the world. The aim of this course is to prepare both the academic students and the working professionals for the challenges of working on karst water resources.

About Dinaric Karst

Term Dinaric Karst is a synonym for fully developed, classic, mature karst. The term *karst* itself was born in the Dinaric region and, along with many other local terms (doline, polje, uvala, ponor) is now widely used internationally. The Dinaric region has exemplary karst landforms including numerous geo-heritage sites, abundant groundwater resources, and engineering structures. It is also the birthplace of karstology - a scientific discipline whose foundations were laid by Jovan Cvijić and his peers at the end of the 19th century.



The Dinaric system (Dinarides) is a long, NW-SE oriented orogenic belt, parallel to the Adriatic Sea, with numerous inter-mountain depressions, large karst poljes, and valleys created by perennial and sinking streams. Its NW fringe is the Carso area around Trieste in Italy while the SW part continues deep into Albania. In between, it extends over the territories of six countries of former Yugoslavia: Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, and FYR of Macedonia.

Course Location

The course will take place in the two Dinaric countries – Bosnia & Herzegovina (B&H) and Montenegro (MNE). Trebinje is the largest town of eastern B&H, located on the northern rim of one of the spectacular karst poljes of the Dinarides – Popovo polje in the Trebisnjica river basin, just 30km from the Adriatic coastline. Home of the historic Karst Institute, since the 1960s Trebinje also serves as the headquarters of one of the World's largest water resources engineering projects in karst. With karst poljes, dams, artificial reservoirs, water supply intakes and tunnels, caves, specific karst features, underground endemic species, countless project documentation, and experience and knowledge of local experts, Trebinje is an ideal place to learn about karst and its specific character. Nikšić polje the largest in MNE, is also place where large hydrotechnical project had included construction of 3 reservoirs and where battle for keeping water in them is continual process and engineering challenge. Once completed, the Bolje sestre intake on one of sublacustrian springs in Skadar basin (MNE) represents a real engineering masterpiece which today ensures water supply of entire MNE coastal area. The Skadar Lake (MNE) is included in the Ramsar list of protected wetlands and belonging habitats. All these sites, and many others will be visited during the field seminars. The Adriatic Sea, and historic towns from the UNESCO world heritage list – Dubrovnik, Mostar, and Kotor, as well as their famous karst springs, can also be visited during or after the course field trips.

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Course Organizer

The University of Belgrade, a state-owned institution with a long tradition, is home to 72,000 students enrolled in 31 colleges and schools. It offers academic and professional studies based on accredited higher education programmes which are fully adapted to common European high-education standards. Diplomas granted by the University of Belgrade are recognized worldwide. The Department of Hydrogeology at the Faculty of Mining & Geology is one of the four accredited geology programmes at three levels: undergraduate a four-year program; masters studies as a one-year program; and doctorate studies, a three-year program (www.rgf.bg.ac.rs/dhg). Since the Department's beginning in 1971, some 800 students earned the title Engineer of Geology for Hydrogeology.

Content and History of the Course

The academic course CEKA is developed primarily for graduate students and students in senior years of undergraduate studies in geology, environmental sciences, and engineering that are interested in the research of karst environments and in the development and engineering of karst water resources. The professionals and decision makers involved in engineering and management of karst waters or environments also benefit from the course by improving their understanding of karst processes and sensitivity.

The starting year of the course was 2014. During the past four years and same number of courses 80 participants from 21 countries were join the lectures and field seminars. They were lectured every year by 10 professors from different countries, half of them rotated every year. Since 2016 professors and students from Northern Arizona University, USA are actively participating in CEKA activities. All reports from previous courses are available at www.karst.edu.rs.

The course consists of intensive 6 to 7-day lectures and laboratory, followed by the field work, and one- and half-day field trips, and the final exam. The goal of the course is to enhance knowledge of basic hydrogeology in fractured rock and karst aquifers, introduce applicable investigation methods, and provide framework for monitoring, engineering and management of water in karst. Design and execution of field investigations, design and optimization of groundwater extraction, aquifer protection and restoration, artificial groundwater control, and prevention of leakage from reservoirs constructed in karst are some of the specific topics that attendants are studying.

The results of previously conducted inquiries indicate high accomplishments and satisfaction of attendants with the course. However, some modifications of the programme are introduced and will take place from 2018. Firstly, the course will be organized in the two countries instead in B&H, only. More practical works in the field is also planned. Depending on availability of equipment and technicians will include pumping and/or pressure tests, tracing test at one of the ponors or boreholes, water quality testing, cavities exploring and similar. Detail programme will be defined and announced prior the course. More practical calculations and designs, as well as examinations of the students during the course are also envisaged.