INTERNATIONAL CONFERENCE

GROUNDWATER, KEY TO THE SUSTAINABLE DEVELOPMENT GOALS

PARIS - May 18 -20, 2022

ORGANIZED BY IAH-CFH, UNESCO-IHP, THE FRENCH WATER PARTNERSHIP, UNDER THE PATRONAGE OF THE FRENCH NATIONAL COMMISSION FOR UNESCO AND WITH THE SUPPORT OF THE MINISTRY FOR ENVIRONMENT, SEINE-NORMANDY WATER AGENCY, AND SORBONNE UNIVERSITY

Post conflict transboundary groundwater cooperation - West Balkans case study

Session 04c - Contribution of transboundary aquifers to the Sustainable Development Goals

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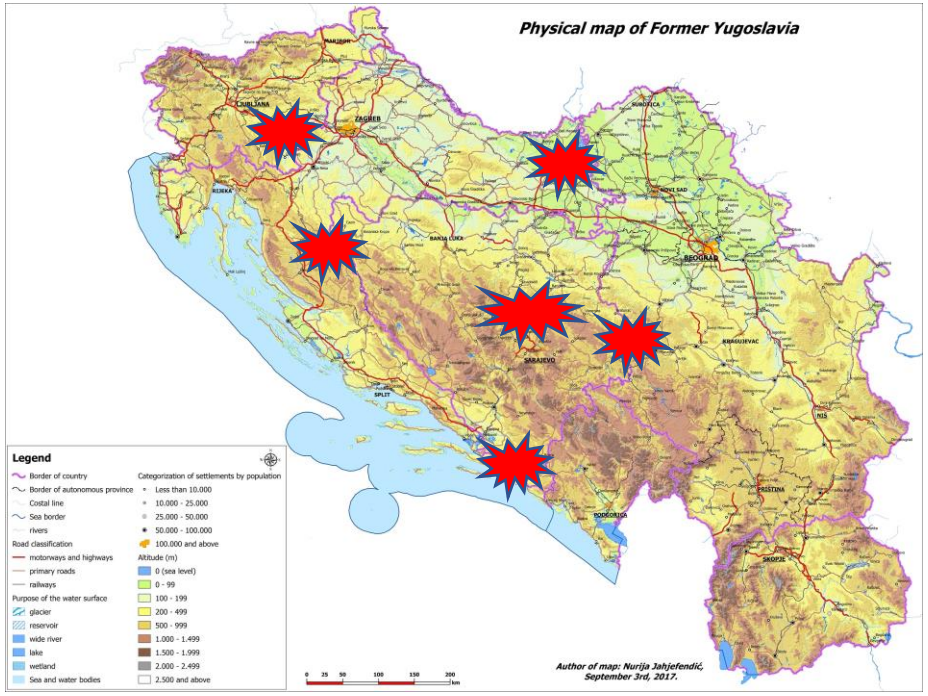
Centre for Karst Hydrogeology

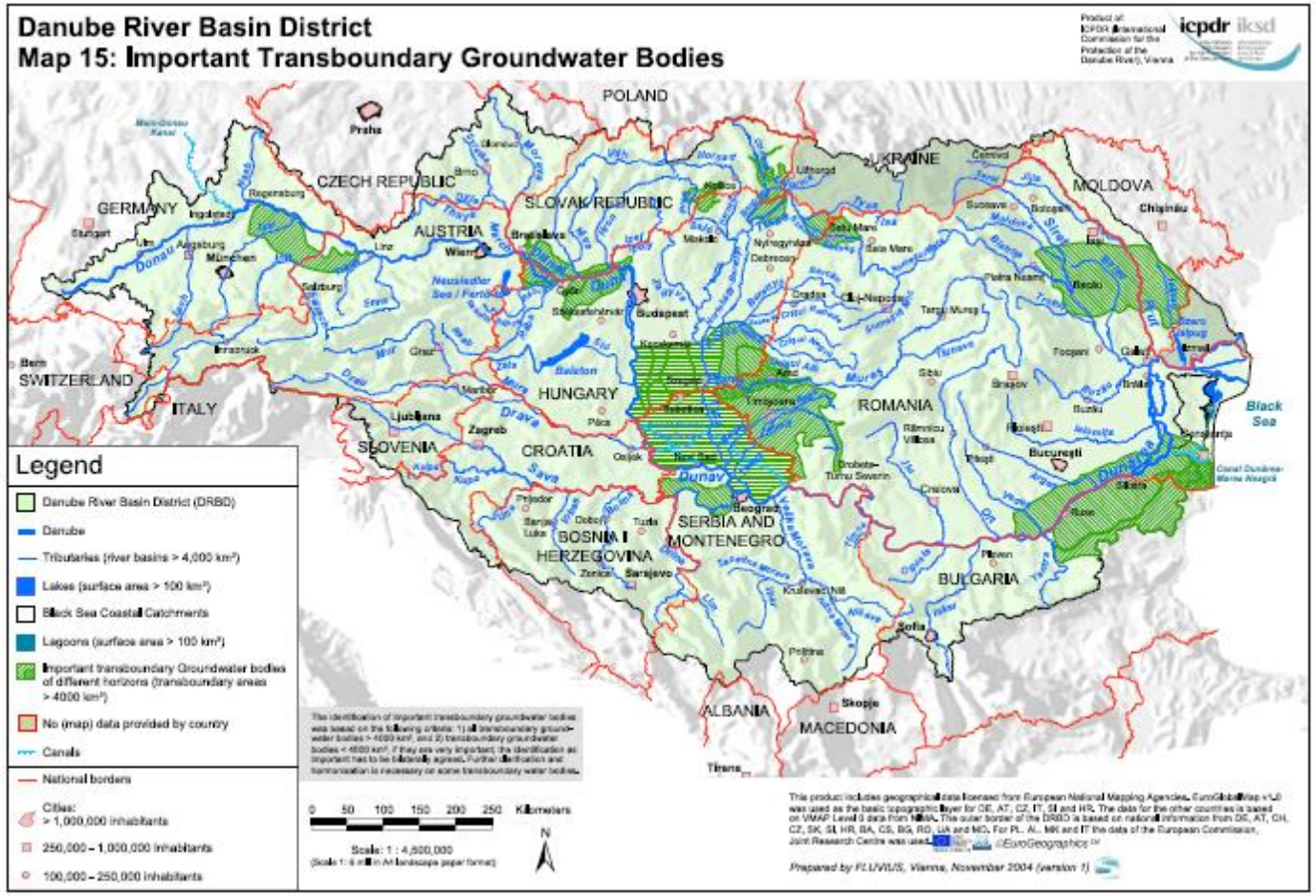
Paris, 18-20 May 2022

- Where? West Balkans, Former Yugoslavia, now 6 + 1*countries.
- What? The civil war in 1990s, new states and newly-created boundaries, at the centre of which is the former Yugoslavia, give rise to many questions regarding optimal water strategy in the region.
- And then? Since 1995 many initiatives, projects and concrete actions have been undertaken and provide a positive ambience for cooperation of specialists, water managers and decision makers.



Cooperation established firstly through:

ICPDR - The International Commission for the Protection of the Danube River as an International Organisation consisting of 14 cooperating states, and ISRBC - The International Sava River Basin Commission (Bosna and Herzegovina, Croatia, Slovenia and Serbia)



All countries from this large basin are actively engaged in the implementation of EU WFD targets. Thus, the characterization of groundwater bodies including delineation of transboundary aquifers has been done so far, while their monitoring has also improved.

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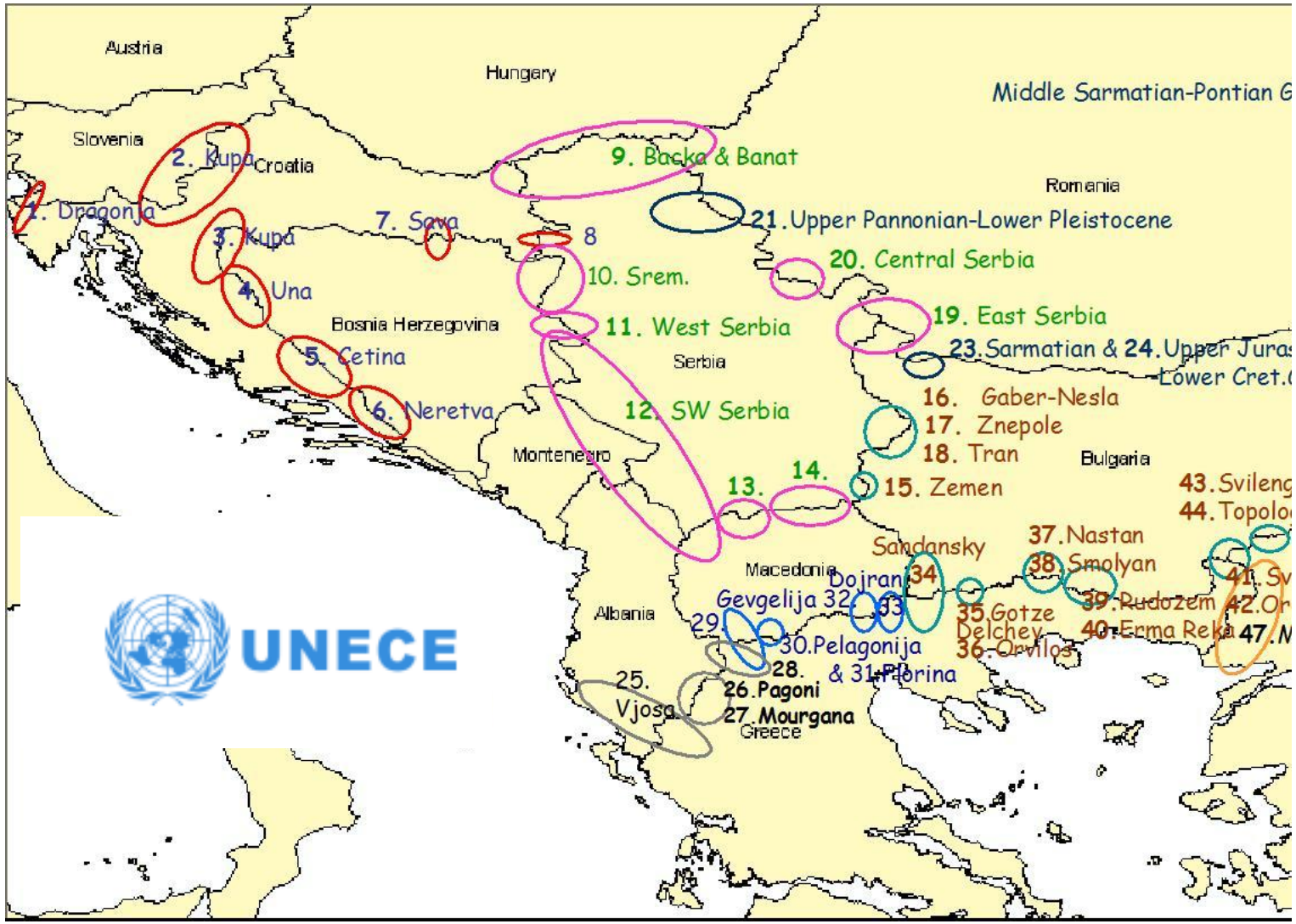
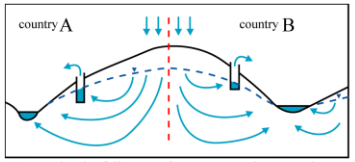
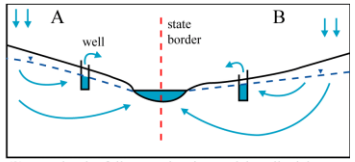
UNECE Transboundary aquifers inventory

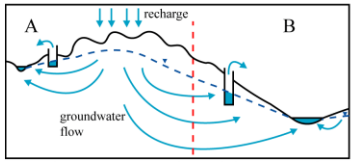




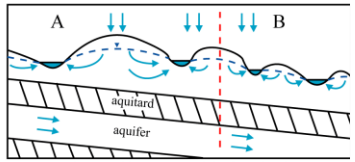
(1) state border follows surface water catchment and groundwater divide, little transboundary groundwater flow.



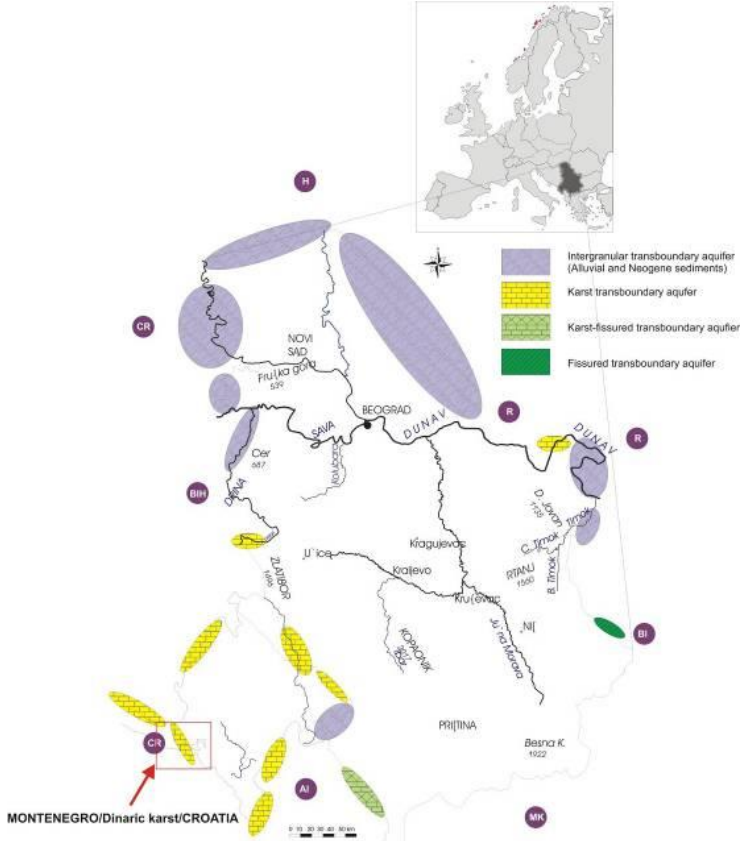
(3) state border follows major river or lake, alluvial aquifer connected to river, little transboundary flow.



(2) Surface water and groundwater divides separate from state border, recharge in one country, discharge in adjacent.



(4) Large deep aquifer, recharged far from border, not connected to local surface water and groundwater.



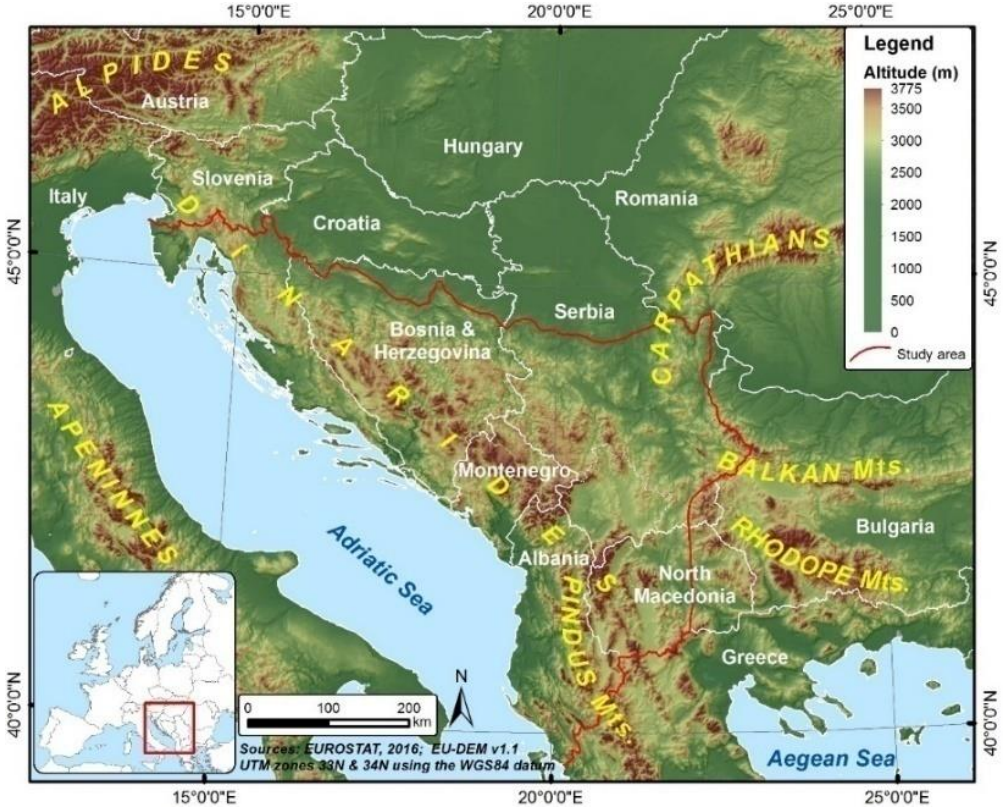
DIKTAS - Dinaric Karst Transboundary Aquifer System

„Classical“ karst region where science on karst – Karstology was born

Project aimed to improve the understanding of shared water resources and to facilitate their equitable and sustainable utilization, including the protection of dependent ecosystems in the four countries of Dinaric karst:

Albania, Bosnia & Herzegovina, Croatia and Montenegro.

Dinaric karst also includes parts of Italy, Slovenia, Serbia, FRY Macedonia.



DIKTAS – Funding & Implementation strategy

GEF project implemented by **UNDP** and **UNESCO's IHP**.

There are also many project partners. Implementation period: 2010-2015 (I Phase).
Budget ca M$5.2

Transboundary Diagnostic Analysis (TDA)

I - Improving the understanding of the resource and of its environmental status

II - Establishing cooperation mechanisms among countries sharing the aquifer

NOT ACHIEVED !

Strategic Action Program (SAP)

III - Facilitating harmonization of policies and priority reforms

IV - Stakeholder Participation, Consultation and Communication

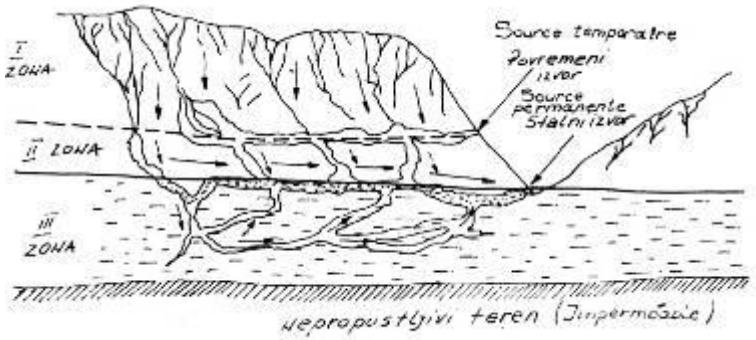
DIKTAS – TB AQUIFERS CHARACTERIZATION

Importance of karst aquifers in Alpine orogenic belt in SE Europe

The homeland of "classical karst". Mesozoic carbonates are spread out in the central part of the region arch and its terminal parts

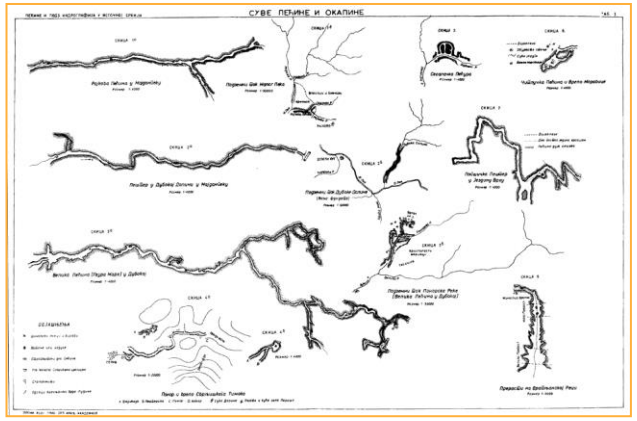
DIKTAS – TB AQUIFERS CHARACTERIZATION

Jovan Cvijić - founder of karstology and karst hydrogeology



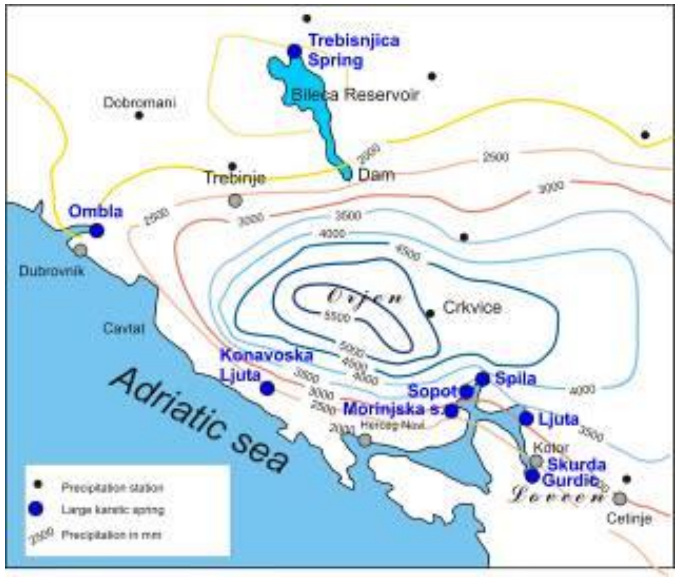
Gold medal of American geographical Society, New York, 1924

Das Karstphaenomen (1893)
– a new page in karst science



DIKTAS – TB AQUIFERS CHARACTERIZATION

Specific climate, hydrography, hydrology



DIKTAS – TB AQUIFERS CHARACTERIZATION

Polje in the Dinaric karst:

- Over 200 closed depressions in Dinarides, 130 of them are poljes in ex-Yugoslav part covering 1350 km^2
- Livanjsko Polje, considered the world's largest karst polje, has a surface area

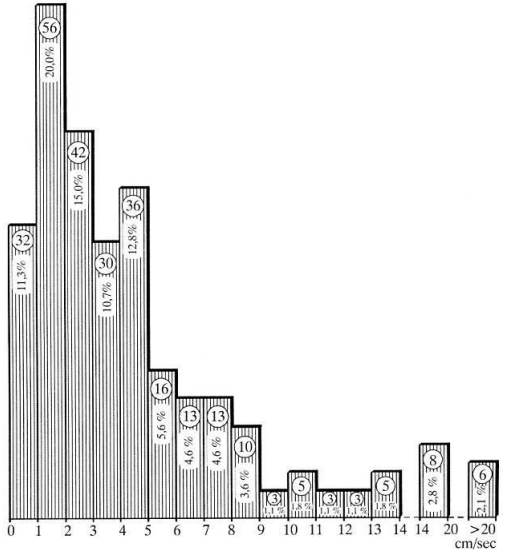
DIKTAS – TB AQUIFERS CHARACTERIZATION

Groundwater flow directions

- Milanović P. (1976) and A. Magdalenić (1971) found that based on 380 conducted experiments, the frequency of fictive groundwater velocities in Dinaric karst is as follows: in 70% of cases from 0 to 5 cm/s; in 20% of cases 5 to 10 cm/s; and in 10% of cases more than 10 cm/s.

Vf: In Eastern Herzegovina 0.002 to 55.2 cm/s. (Milanović, 2000); in Prespa Lake connected with Ohrid Lake the maximal values in the test in 2002 were 19 and 80 cm/s (Amataj 2005).

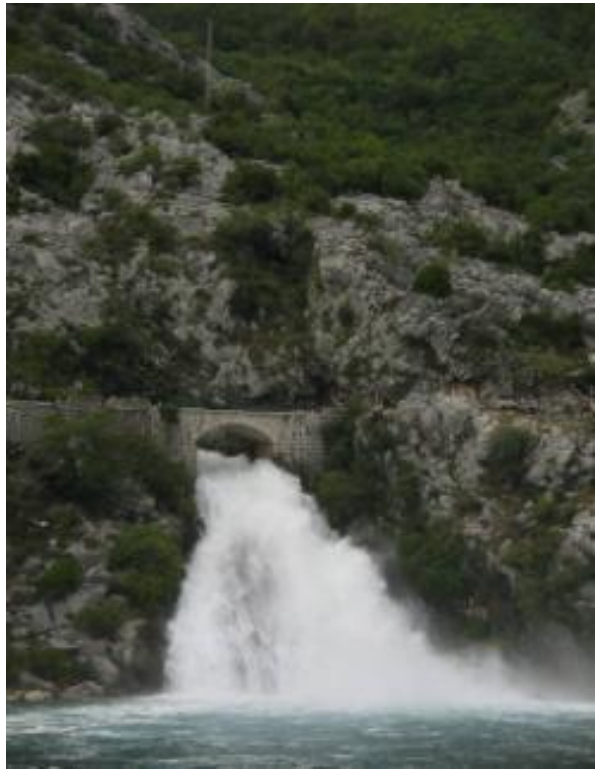
Difference in velocities: High / Low waters



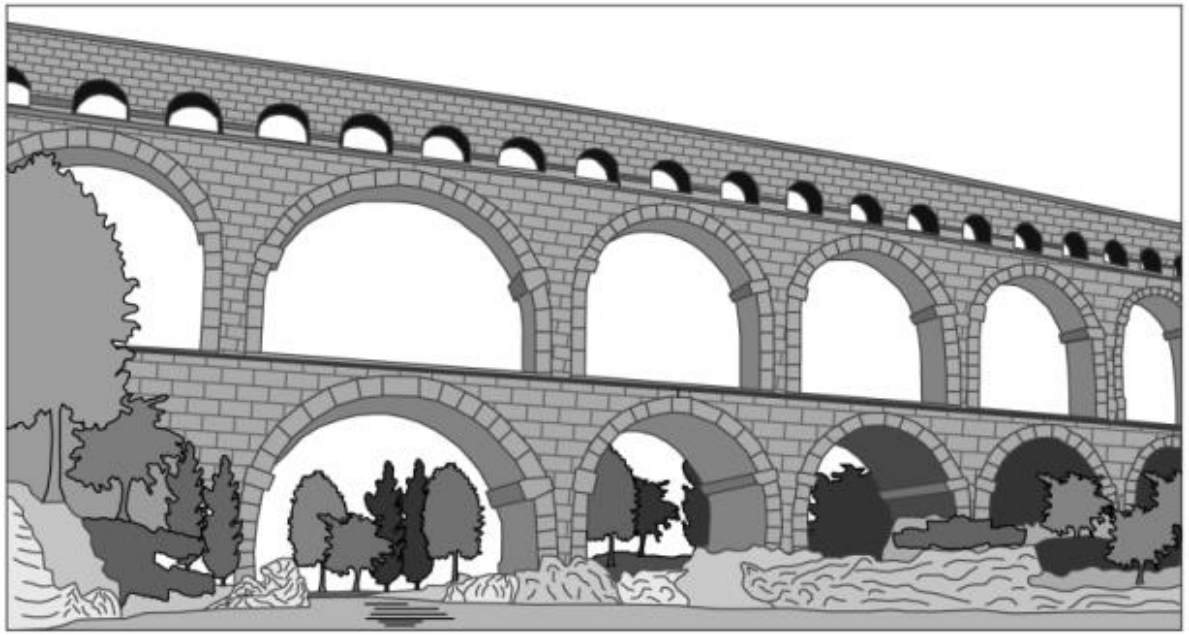
DIKTAS – TB AQUIFERS CHARACTERIZATION

Discharge of karst aquifer

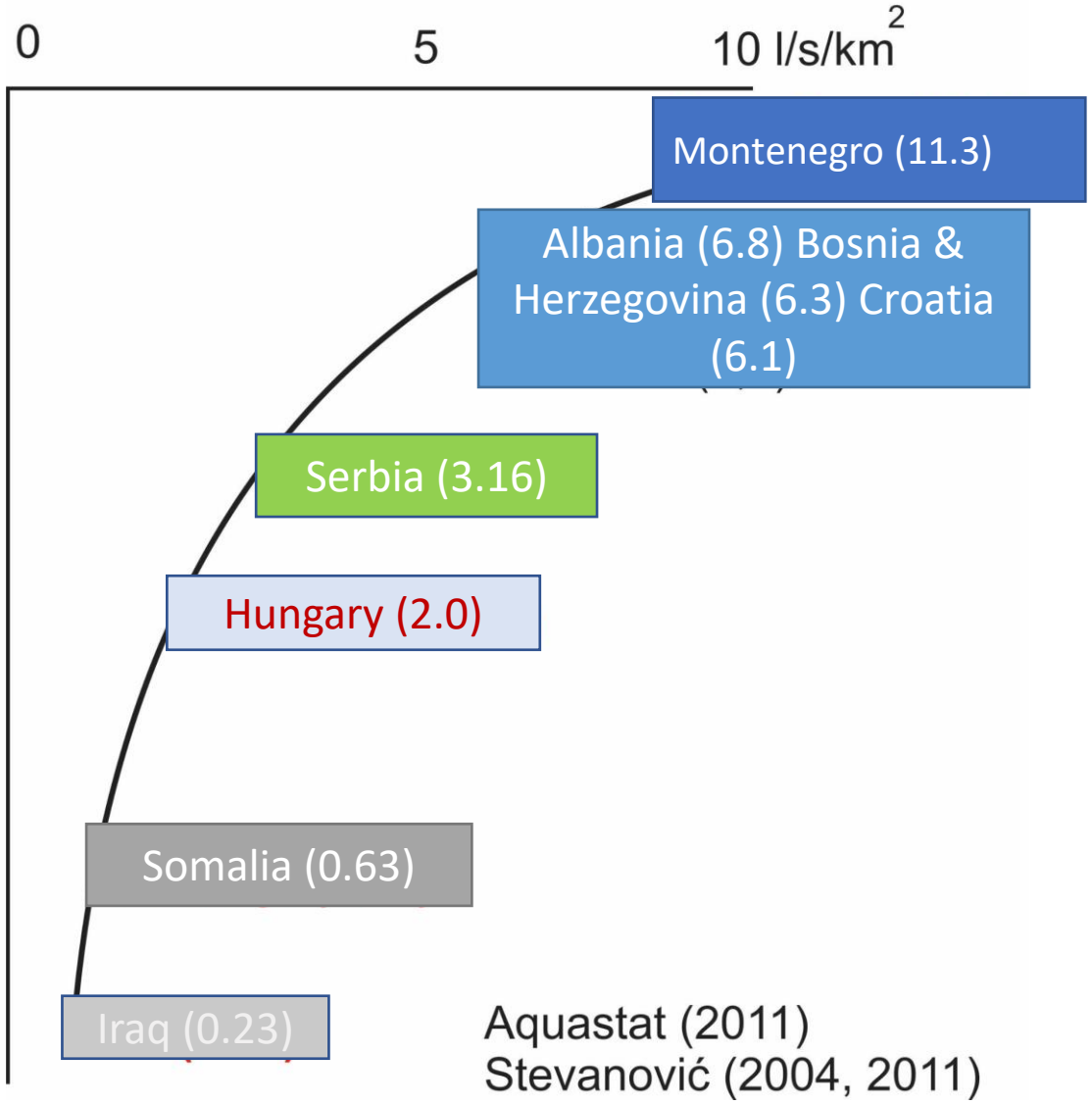
- Concerning karstic groundwater resources, the Dinaric region is by far the richest in all of Europe. Some areas, such as southern Montenegro, are characterized by a very intensive water balance: the average specific yield is over 40 l/s/km^2.
- Some authors stated that in the Dinaric region of ex-Yugoslavia there are 230 springs with a minimal discharge over 100 l/s, while about 100 springs have minimal discharge over 500 l/s.
- In Albanian karst there are roughly about 110 springs average discharge exceeding 100 l/s. Of these, 17 have discharges exceeding 1000 l/s (Eftimi, 2010).



Tapping karstic springs - Traditional way of water supply since Roman time

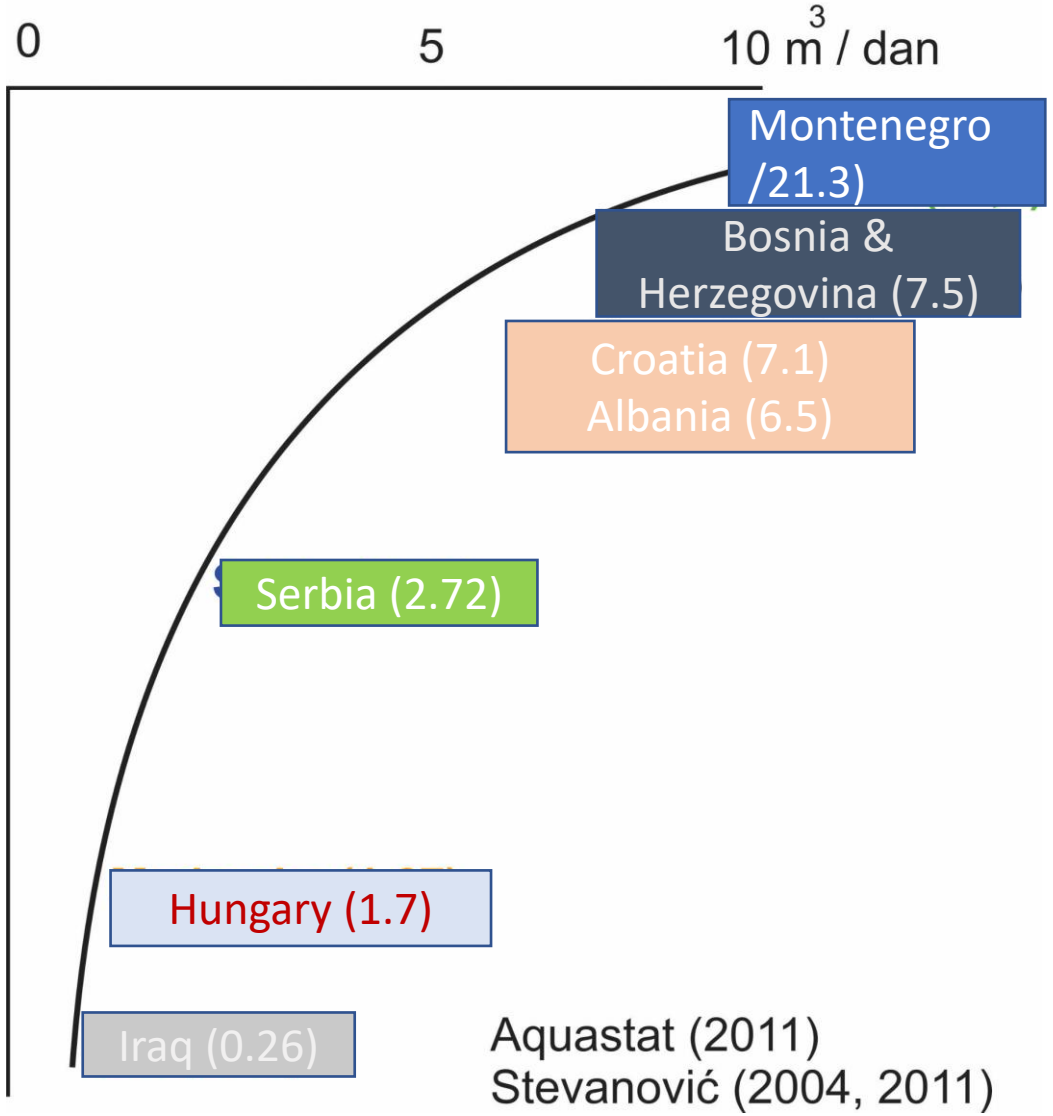


Specific groundwater discharge
(in l/s/km^2)



Aquastat (2011)
Stevanović (2004, 2011)

Available groundwater reserves per capita (in m^3/day)



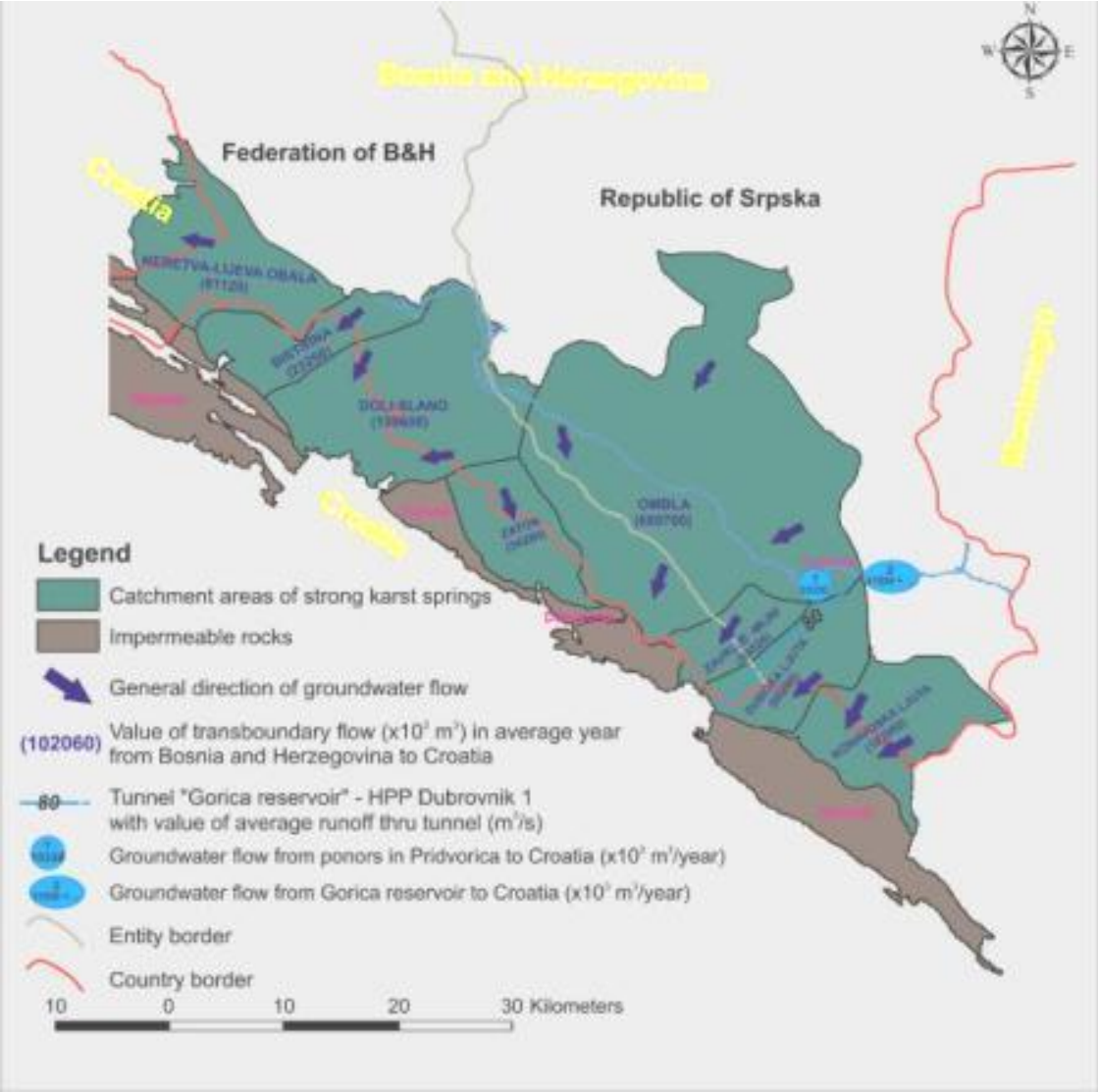
Aquastat (2011)
Stevanović (2004, 2011)

DIKTAS – TB AQUIFERS CHARACTERIZATION

Dinaric karst aquifer

A few critical points:

- SLO-CRO (Piran gulf)
- CRO-B&H (South Western Herzegovina)
- B&H-MNE-CRO (Eastern Herzegovina)
- MNE-AL (Skadar i.e. Skutari lake)
- AL-NMAC-GR (Prespa – Ohrid lakes)
- AL-GR (Saranda gulf)…



DIKTAS – Organizational setup & findings

- The Project Team was organised in four **Working Groups** (WGs), reflecting the main issues of regional analysis:
  - **WG1 - hydrogeological characterization**
  - WG2 - environmental and socio-economical assessment
  - WG3 - assessment of legal and institutional frameworks and policies
  - WG4 - stakeholder analysis

DIKTAS – Outcomes & Achievements

Legal and Institutional Framework and Policy

The DIKTAS countries have a wide **experience with international cooperation** on transboundary waters. The countries are party to a multilateral framework convention, and have bilateral and multilateral agreements at the inter-ministerial level covering transboundary water issues.

By **adoption of the Water Laws** in all four countries,
the key provisions of the EU Water Framework Directive (WFD) have been transposed into their legislation including designation of authorities for water management and identification of the river basin districts. The countries are making significant **efforts to develop a wide range of secondary legislation**, but these are not yet completed.

Environmental and Socio-Economic Analysis

The DIKTAS project countries showed a degree of similarity and **regional interconnectivities.**
The four countries represent very important **sources of clean water, protected and unprotected nature, specific local economies, habits, traditions** and future prospects. Each of the countries has many possibilities for development based on the wise exploitation of natural resources; tourism is and will most probably be one of the major sources of economic growth in the years to come.

The outcomes of TDA

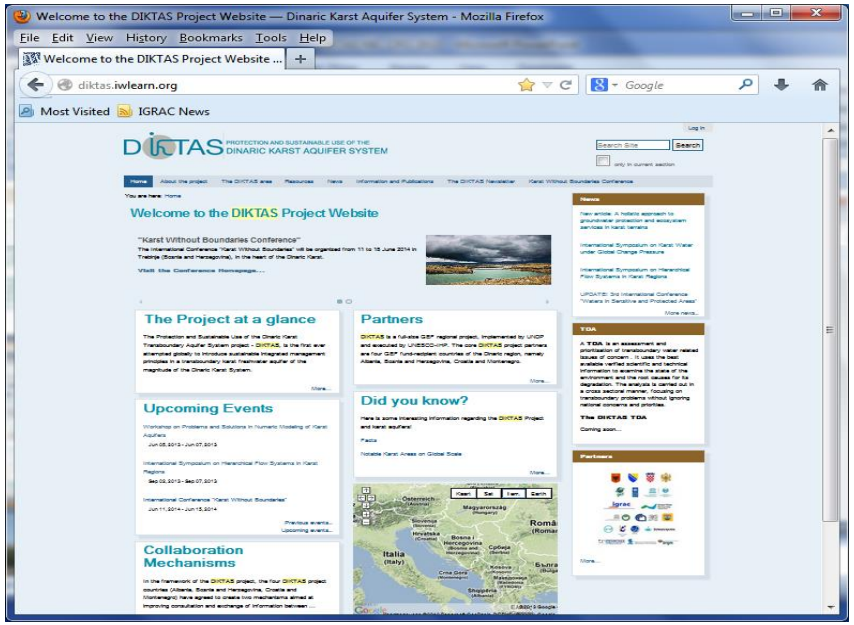
The state of groundwater in the DIKTAS project region is **in general good** with a few exceptions and with a number of **serious potential threats**.
The main threat to the groundwater quality in the DIKTAS region is **solid- and waste water disposal.**
Agriculture and **industry** also pollute groundwater and form a major threat but to a lesser degree that the waste.

Lack of Monitoring is one of major shortcomings.

Currently **no common legal and institutional framework** and no common criteria exist for **a) the delineation of water source sanitary protection zones,** and **b) setting cost-efficient measures for groundwater protection in the Dinaric Karst region.**

There is a **concern of some stakeholders about impact of hydrotechnical constructions in the region**, especially in Bosnia and Herzegovina

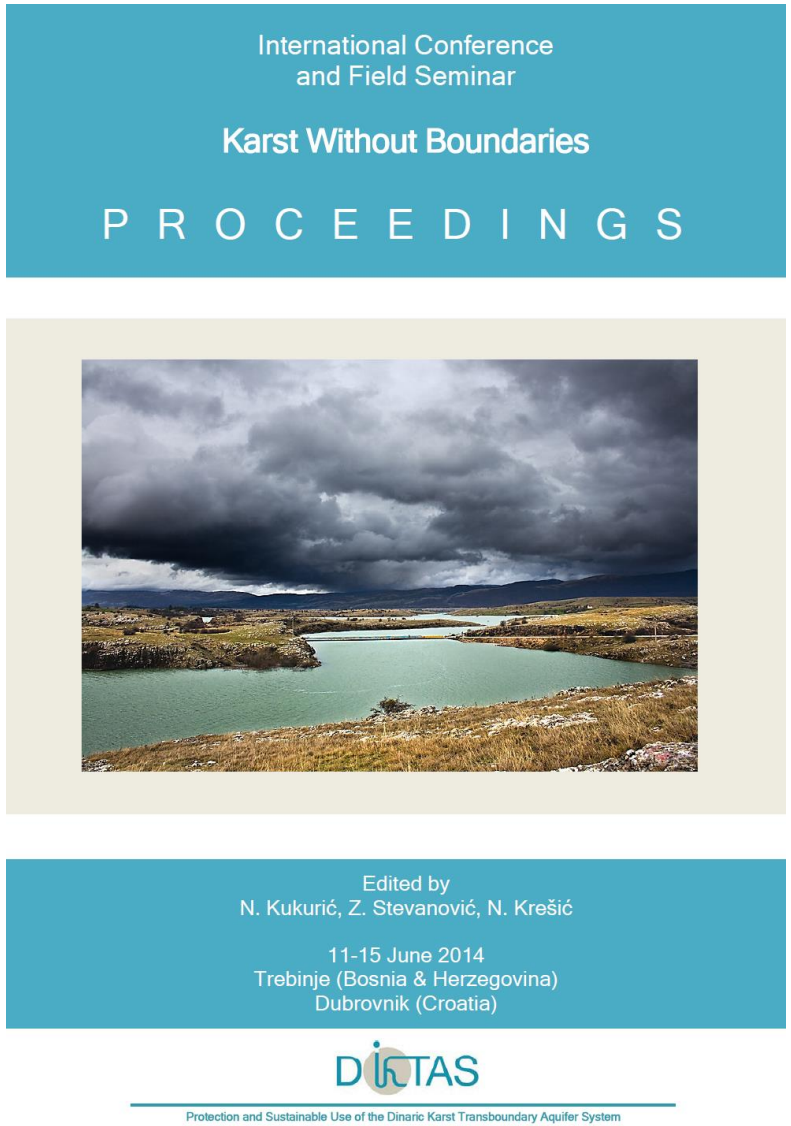
DIKTAS – Dissemination & Continuation

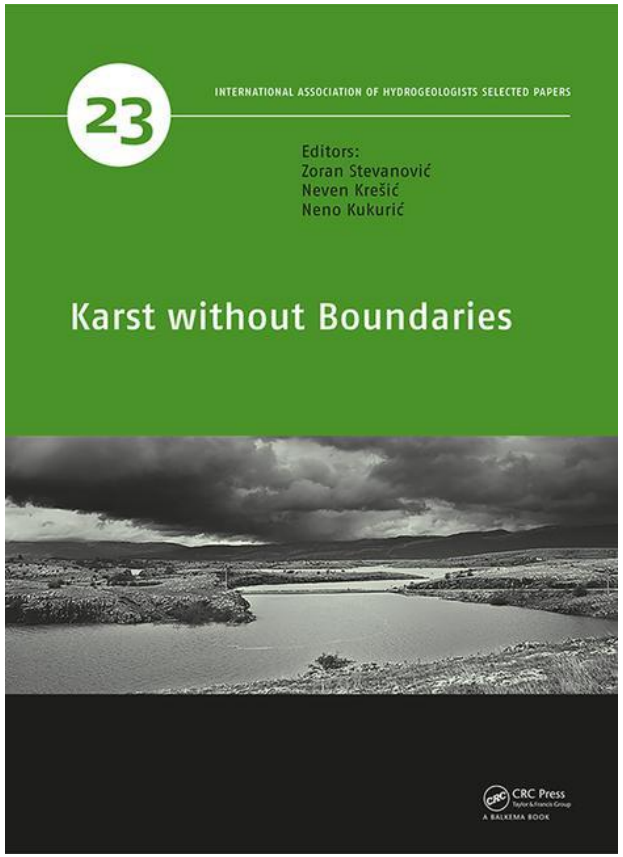


International Course

Characterization and Engineering of Karst Aquifers

Trebinje, Bosnia & Herzegovina,
June, 2014, 2015, 2016, 2017, 2018...





Dinaric karst – Place to learn on engineering achievements

Since 2014 the courses and field seminars were attended by more than 100 participants from 24 countries. They were lectured every year by 20 professors from different countries, half of them rotated every year.

SOUTH EAST EUROPE
Transnational Cooperation Programme

Programme co-funded by the
EUROPEAN UNION

Climate Changes and Water Supply

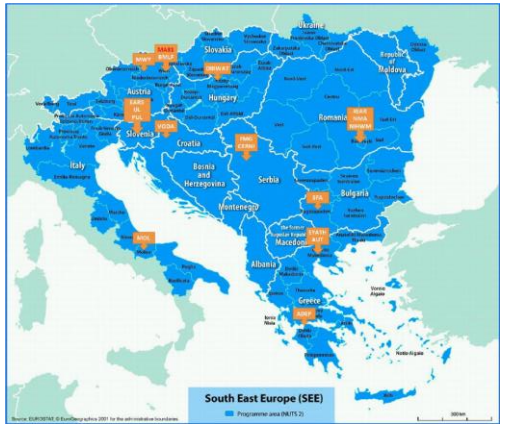
- CCWaterS -

2009-2012
www.ccwaters.eu

Jointly for our common future

- CCWaterS -

Climate changes – Pressure on aquifers will increase!



RCM resolution 25x25 km

Methods

RCM models from ENSEMBLES

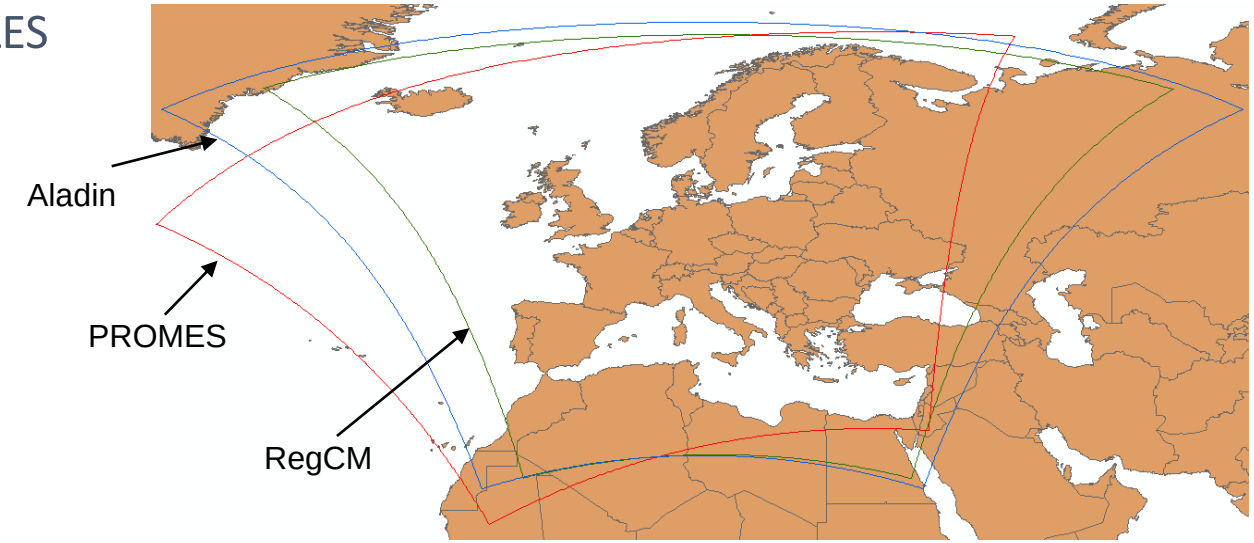
25x25km resolution

Selection criteria:

good performance in PRUDENCE,

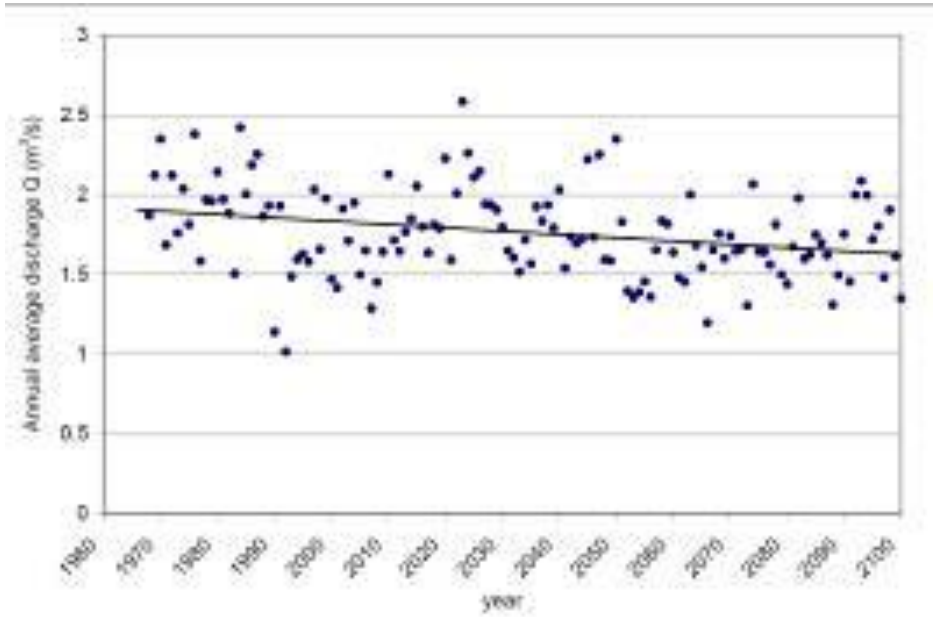
different driving GCM,

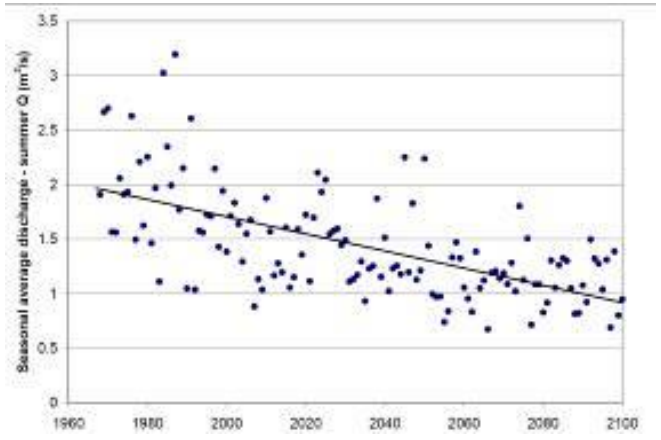
cover full project area.

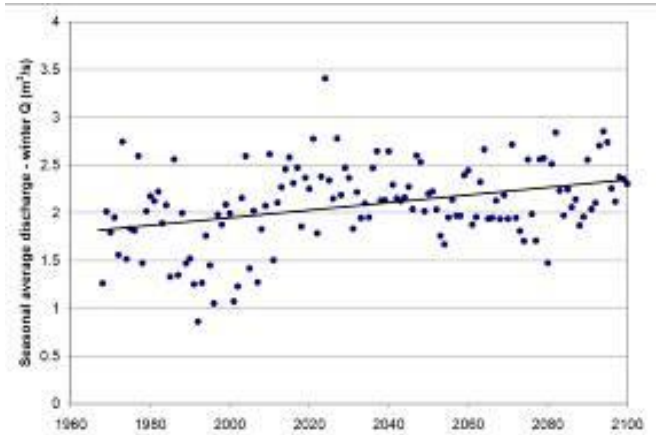


3 proposed RCMs

- Discharge of tested karstic springs in Eastern Serbia at the end of 21. Ct. will reduced 6-23% in average.
- Seasonal variations: summer-autumn variations result with reduction up to even -40% with probable winter increase of discharge of +25%.







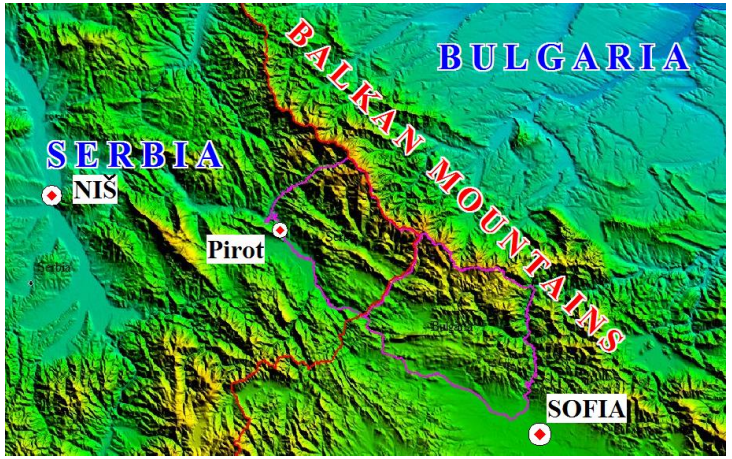
Several transboundary projects and initiatives

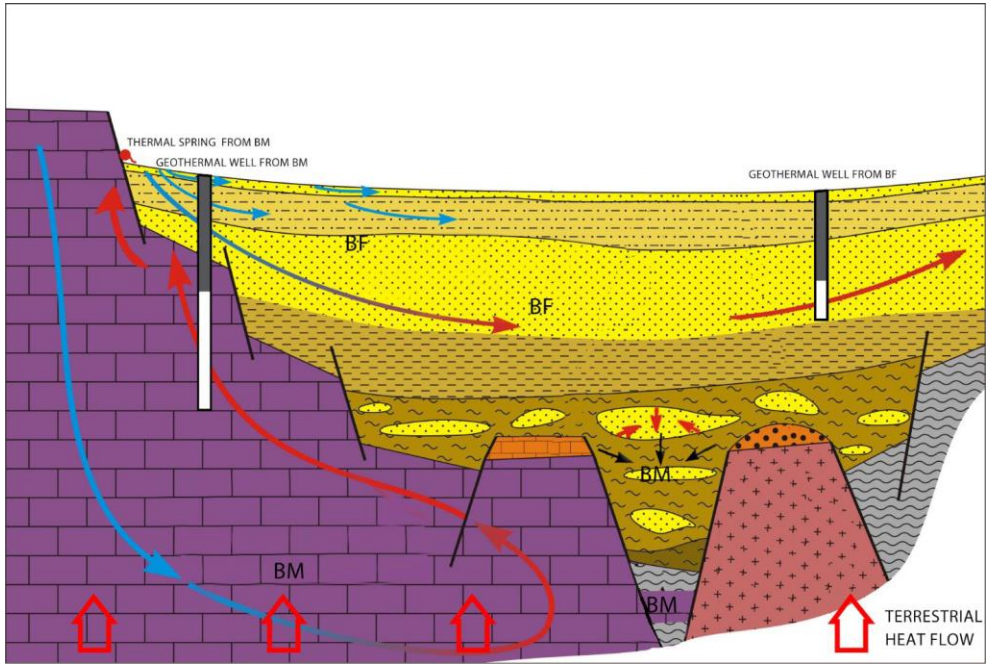
- TRANSENERGY (Austria, Hungary, Slovakia, Slovenia and Croatia),
- DARLINGe (Hungary, Croatia, Romania, Serbia and Bosnia & Herzegovina).

Interreg
EUROPEAN UNION
Danube Transnational Programme
DARLINGe

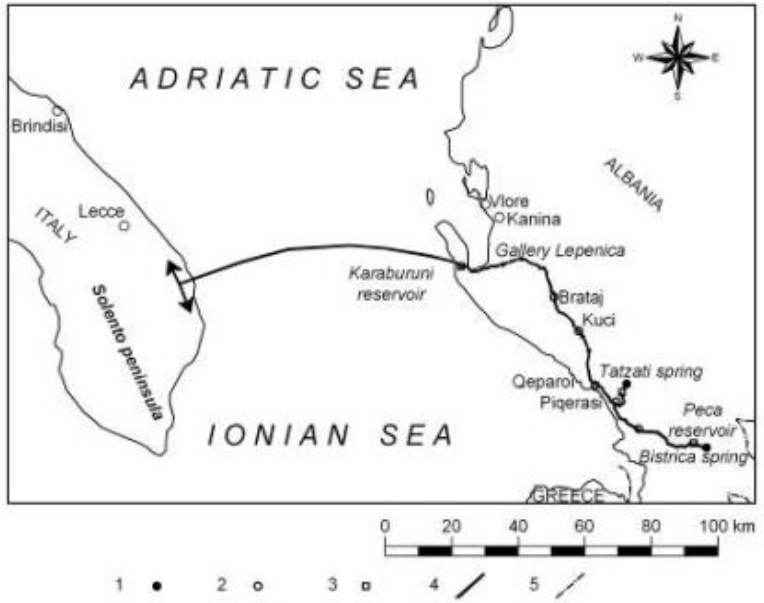
There are also several bilateral cooperation transboundary programs implemented. Among others:

- “Karawanke” (between Slovenia-Austria),
- “Pannonian basin” (Serbia-Hungary),
- “Stara Planina“ (Bulgaria-Serbia),
- “Skadar-Shkodra Lake” (Albania-Montenegro)...





Future:
Other Transboundary projects, such as Prespa-Ohrid…
Italy – Albania Transadriatic water transport project ?



Links to SDGs and WAD 2018-2028

Strategic Development Goals 2030

Water Action Decade 2018-2028

DIKTAS fully in line with:

1. Advance sustainable development
2. Energize existing programmes and projects
3. Inspire action to achieve the 2030 Agenda

DIKTAS Phase II

SAP/ Strategic Action 1:

Joint design and testing of a regional groundwater quantity and quality **monitoring network** and associated data exchange and analysis protocols.

SAP/ Strategic Action 2:

Harmonization of criteria for (content and extend) of **sanitary protection zones**.

SAP/ Strategic Action 3:

Application and promotion of joint principles of sustainable management and equitable use of transboundary Dinaric karst aquifers.

Int. Consult. and Inform. Exchange Body (CIE)
National Inter-ministerial Committees (NICs)

WATER ACTION DECADE 2018-2028

Continual Tasks of Hydrogeology:

- **Monitoring for GW Resources assessment**
- **Monitoring for GW Quality assessment**
- **Improving water supply**
- **Assessing aquifer vulnerability**
- **Ensuring adequate source sanitary protection**
- **Strengthening the institutions**
- **Increasing awareness of sustainable water use**
- **Adapting legislative concerning groundwater**
- **Promoting sustainable waste management**
- **Providing base for Water Master plans and National Development plans**

Thank you

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Google https://scholar.google.com/citations?user=t9WLy5IAAAAJ&hl=sr