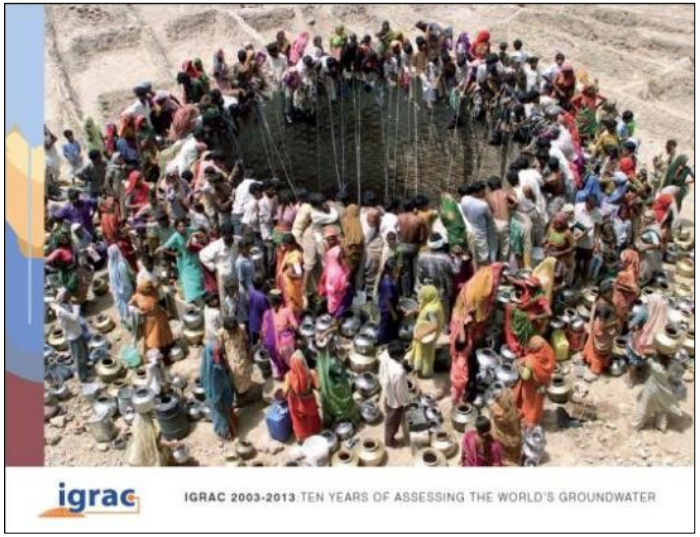
Assessment of Transboundary Aquifers in Europe
(and the rest of the world)

igrac
International Groundwater Resources Assessment Centre

Dr Neno Kukurić

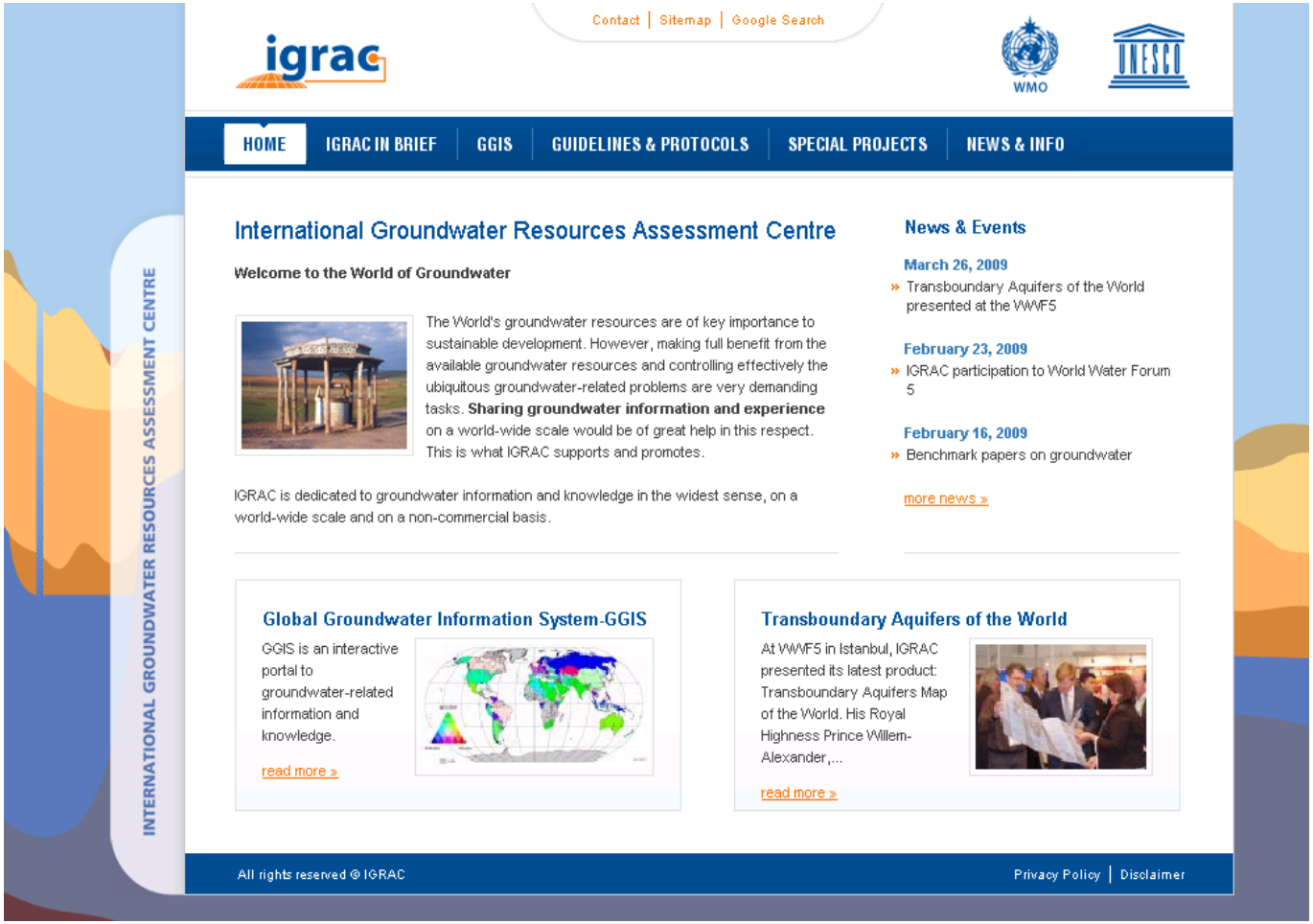
Groundwater from Global Perspective

- IGRAC - International Groundwater Resource Assessment Centre is (since 2003) UNESCO and WMO groundwater centre
- IGRAC facilitates and promotes global sharing of information and knowledge required for sustainable groundwater resources development and management
- Focused on information and knowledge management, transboundary aquifer assessment and groundwater monitoring
- Receives financial support from the Government of The Netherlands



- In-house partner of UNESCO-IHE in Delft, The Netherlands

IGRAC Portal



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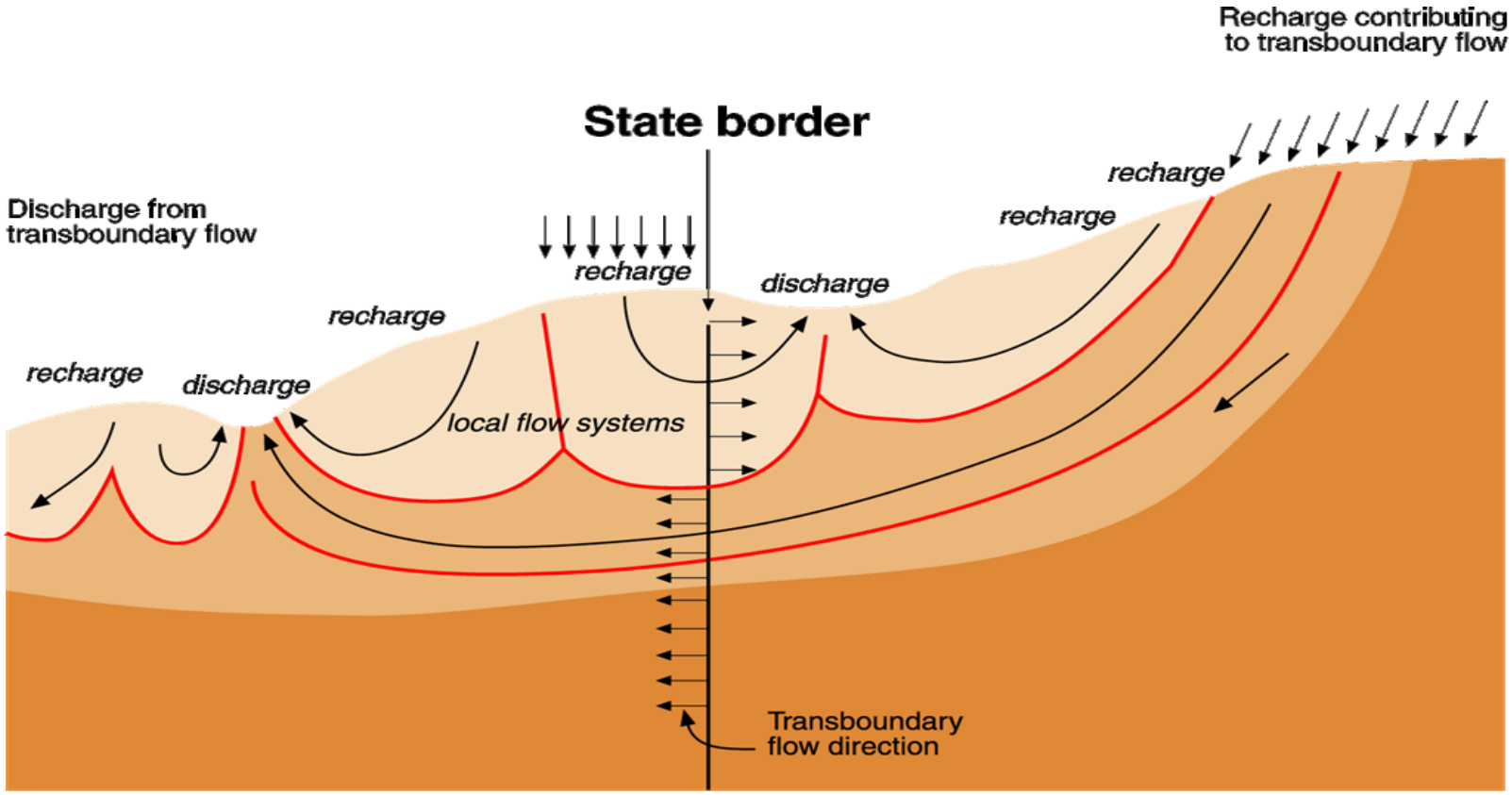
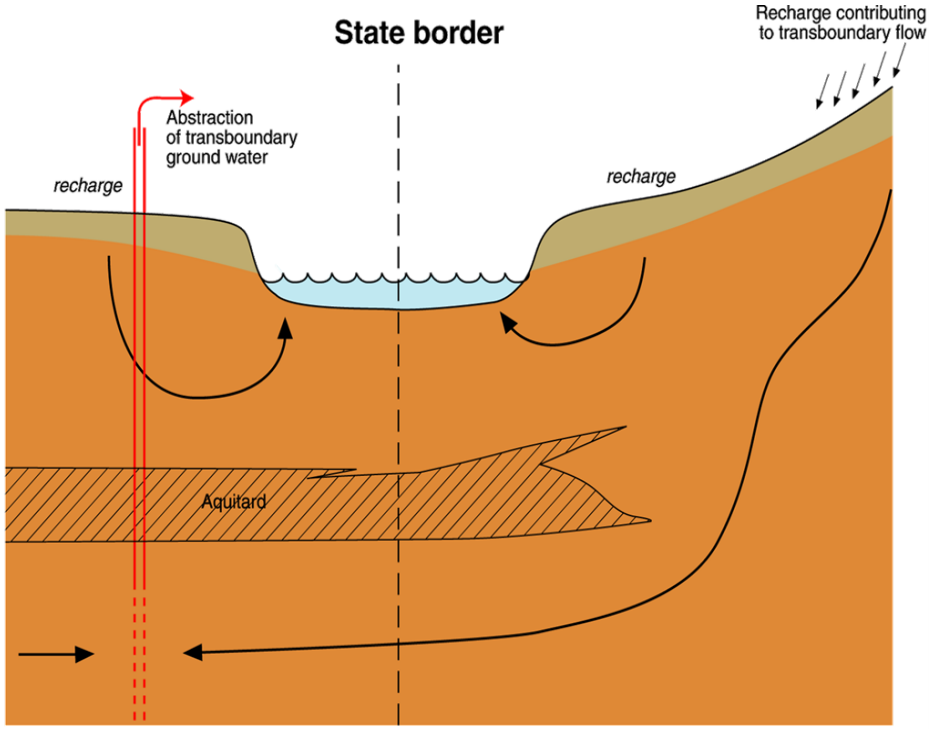
What is a Transboundary Aquifer?

- **Transboundary aquifer or transboundary aquifer system means, respectively, an aquifer or aquifer system, parts of which are situated in different States;**



Why do we need a TBA assessment?

- **The fact**: many aquifers cross the political borders
- **Potential cross-boundary problems**: changes in groundwater flow, levels, volumes (quantity) and dissolved substances (quality).
- **Actions**: TBA assessment, monitoring and appropriate management.
- **Benefits**: eliminating potential sources of conflict and improving the overall benefit from groundwater.



Internationally Shared Aquifers

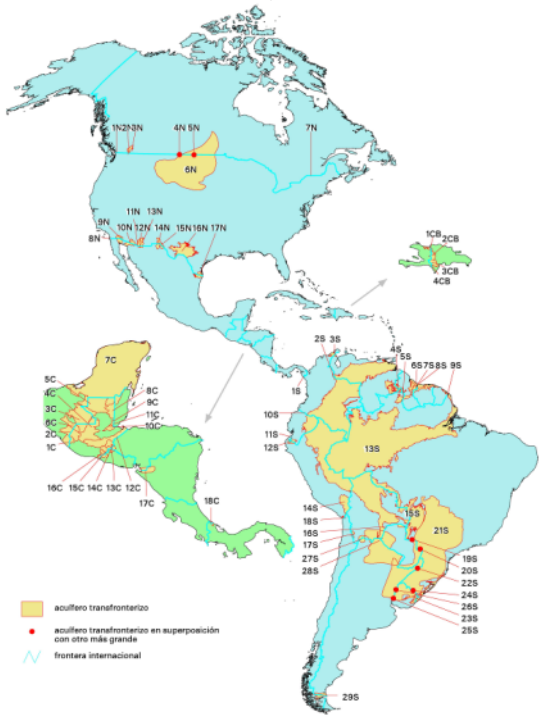
- ISARM Regional Activities, Core group, portal..

- UNECE Assessments in Europe and Asia

- Participation in GEF (Global Environment Facility) projects

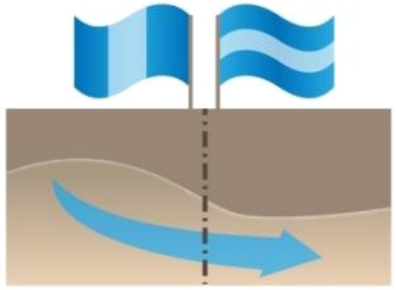
- Development of a TBA Methodology and a TBA Course, contribution to UNILC, WW

- Transboundary Aquifers of the World Map



ISARM Programme

- The worldwide **ISARM** (Internationally Shared Aquifer Resources Management) Initiative is an **UNESCO** led multi-agency effort aimed at improving the understanding of hydrogeological, socio-economic, legal, institutional and environmental issues related to the **management of transboundary aquifers**.

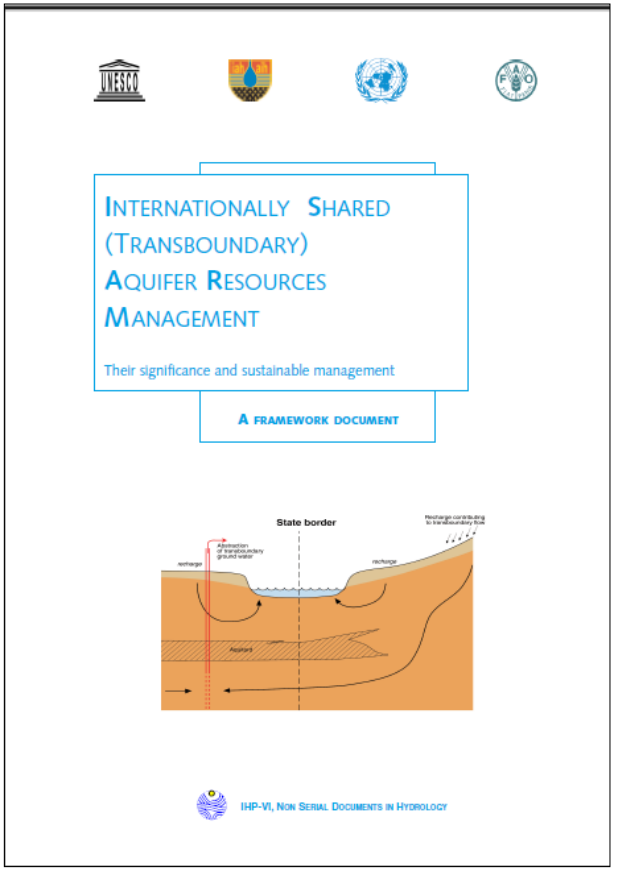


isarm

- ISARM operates as an **umbrella programme**, (co)organising various TBA-related activities around the world.

ISARM Background

- June **2000**: in recognition of the importance of transboundary aquifer systems as a source of freshwater in certain regions of the world, **UNESCO IHP Council** decided to **launch** an ISARM initiative to promote studies on transboundary aquifers.
- A cooperation was established with **IAH** (**TARM** commission), UNECE, FAO and other regional and international institutions.
- A **framework document** in **2001**, describing the main aspects of the internationally shared aquifers and setting up the basis for the TBA assessment

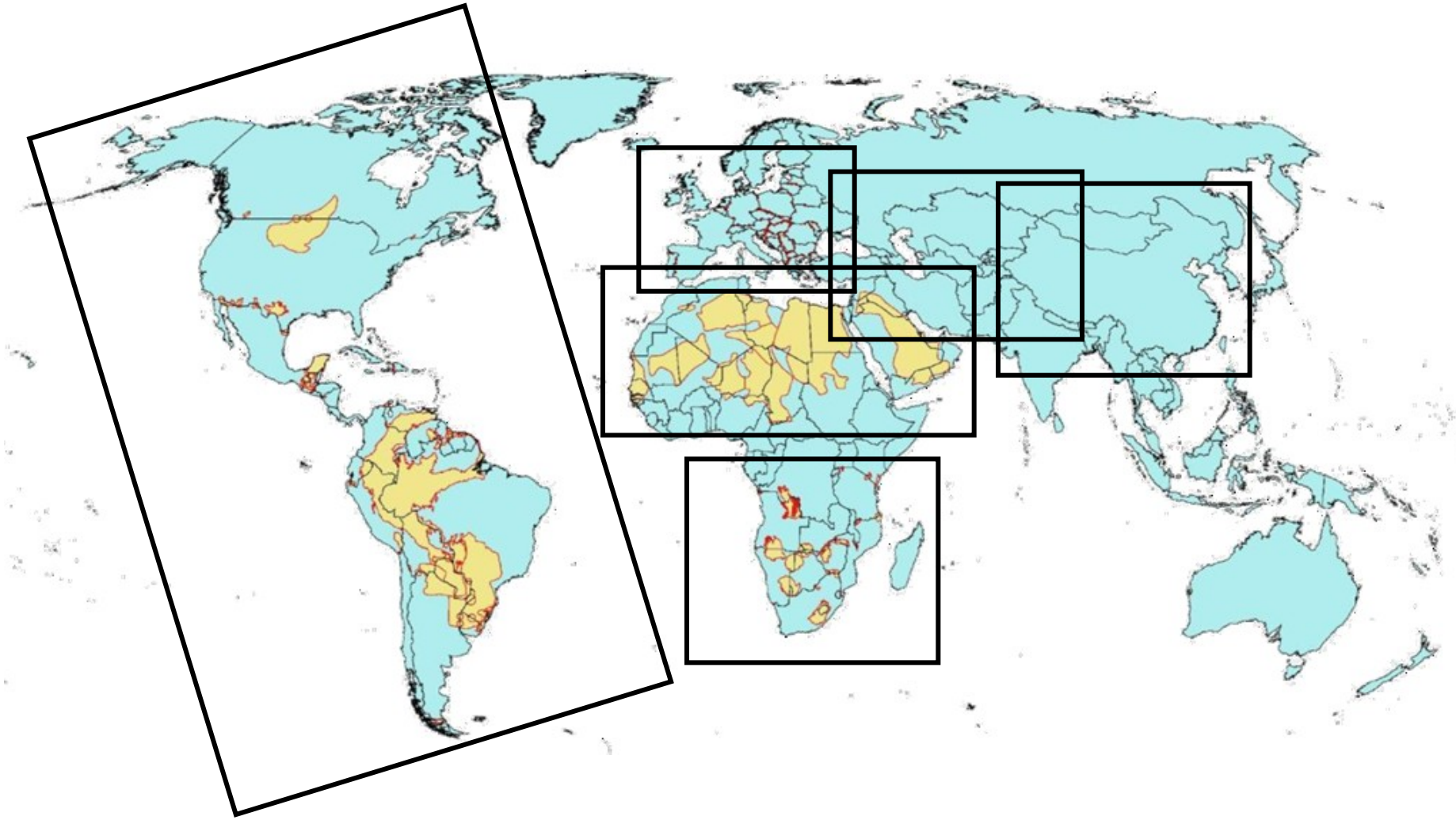


TBA Assessment Methodology

- **Hydrogeological Aspect**
  - Delineation and description
  - Classification, diagnostic analysis and zoning
  - Data harmonisation and information management

- **Environmental issues**
- **Socio-economic framework**
- **Institutional settings**
- **International legal framework**

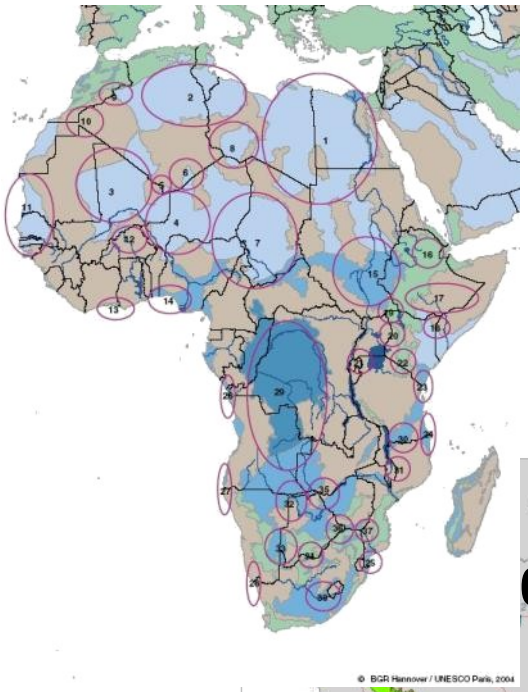
Global Overview of ISARM activities



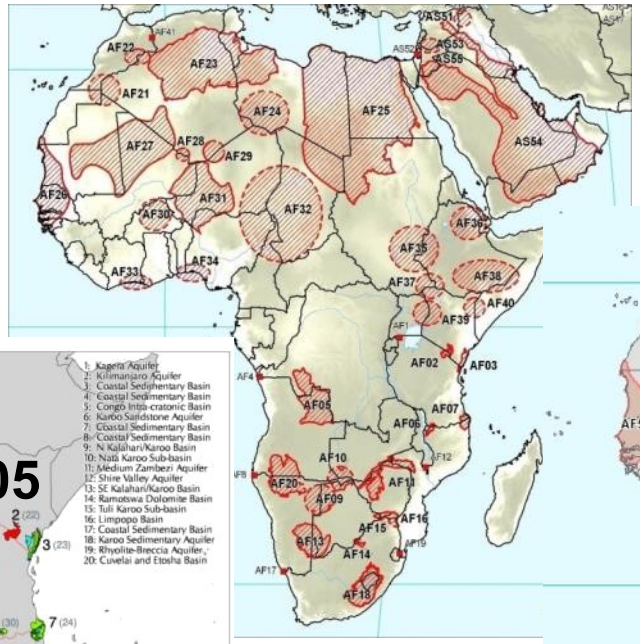
ISARM Regional Activities

- Since its start in 2000, ISARM launched a number of regional initiatives designed to assess transboundary aquifer systems and to encourage aquifer sharing states to work cooperatively toward mutually beneficial and sustainable aquifer development.
- Cooperation with regional organisations is crucial for success of ISARM activities.
- The most numerous initiatives carried out in Africa (Tripoli 2002 , Cape Town 2005, 2007, Tripoli 2008, Nairobi 2010, 2011, Duala 2011, 2012…)
- The most advanced assessment so far is of ISARM Americas (hydrogeology, legal and institutional frameworks, socio-economic framework...)
- South East Europe Caucasus and Central Asia in cooperation with UNECE
- ISARM Western Asia in cooperation with Geological Survey of China

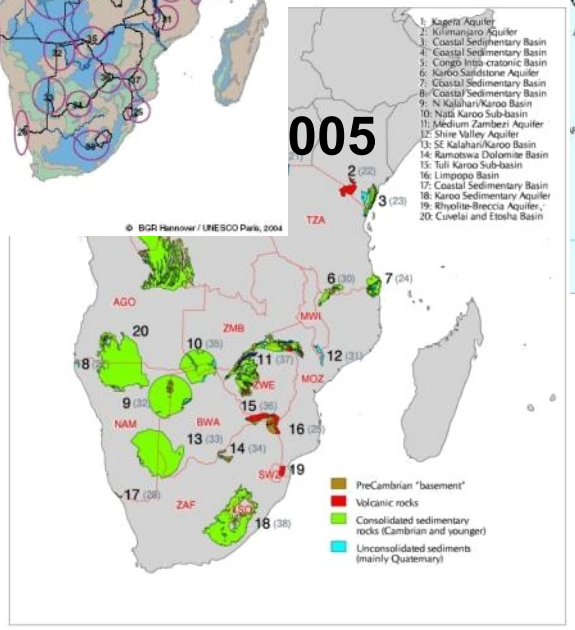
TBA assessment in Africa



2009

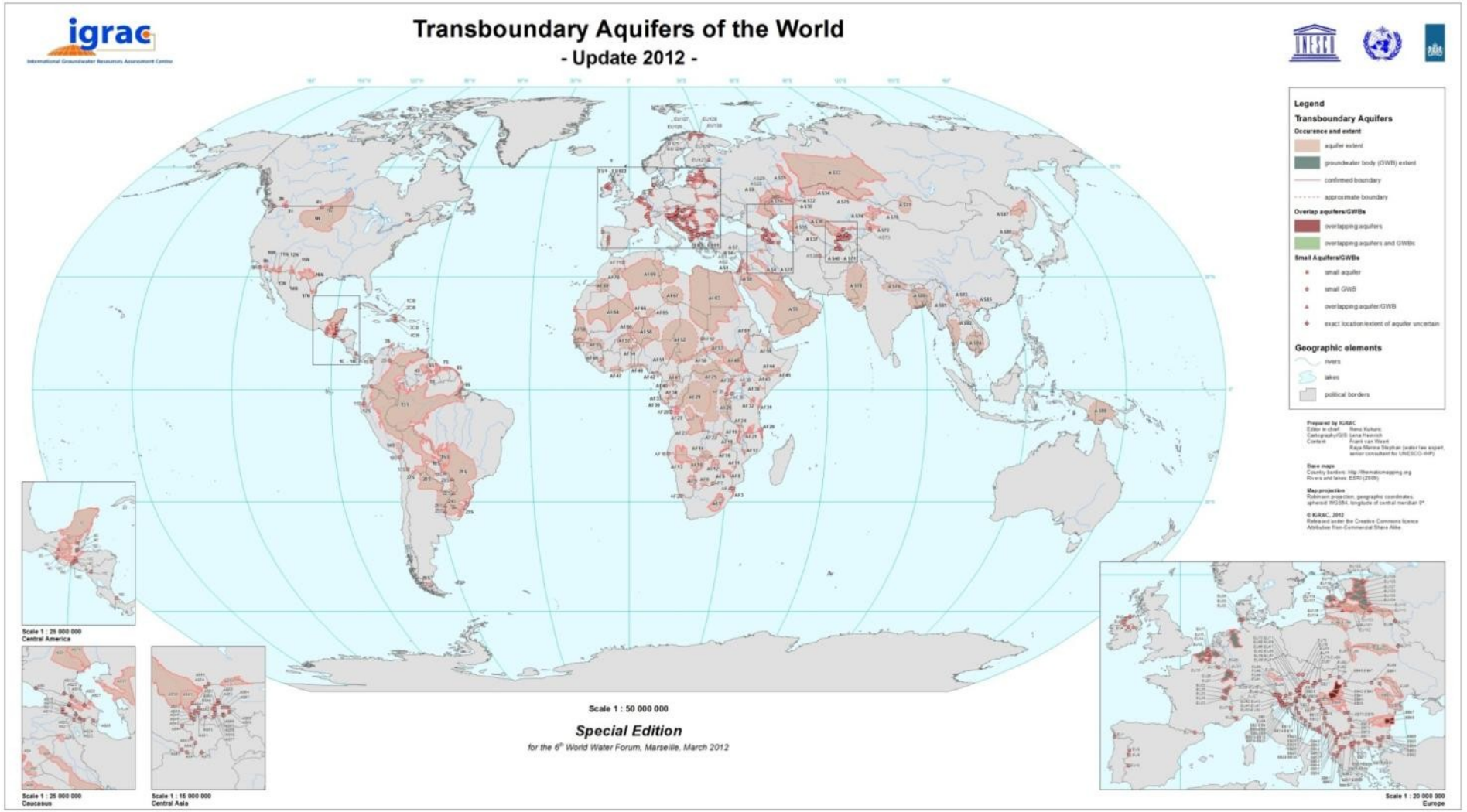


2005



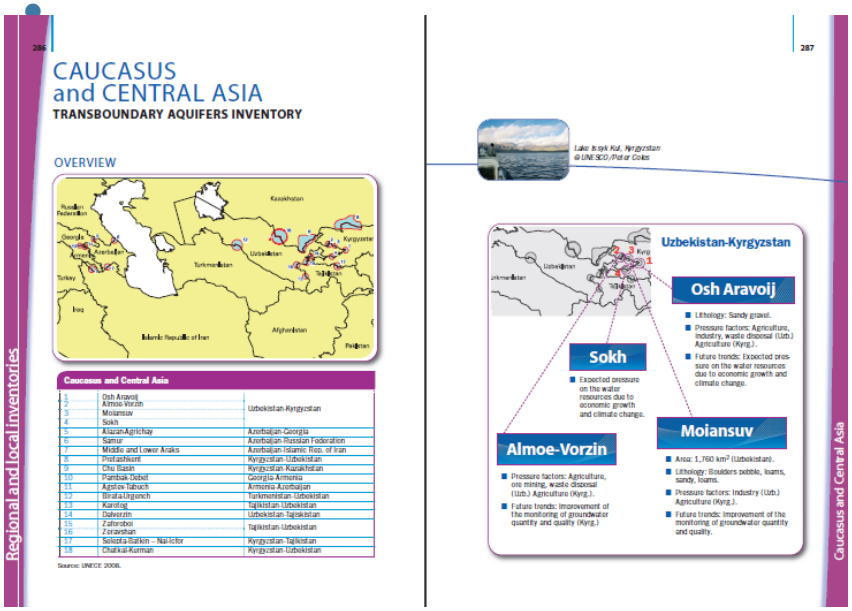
2012

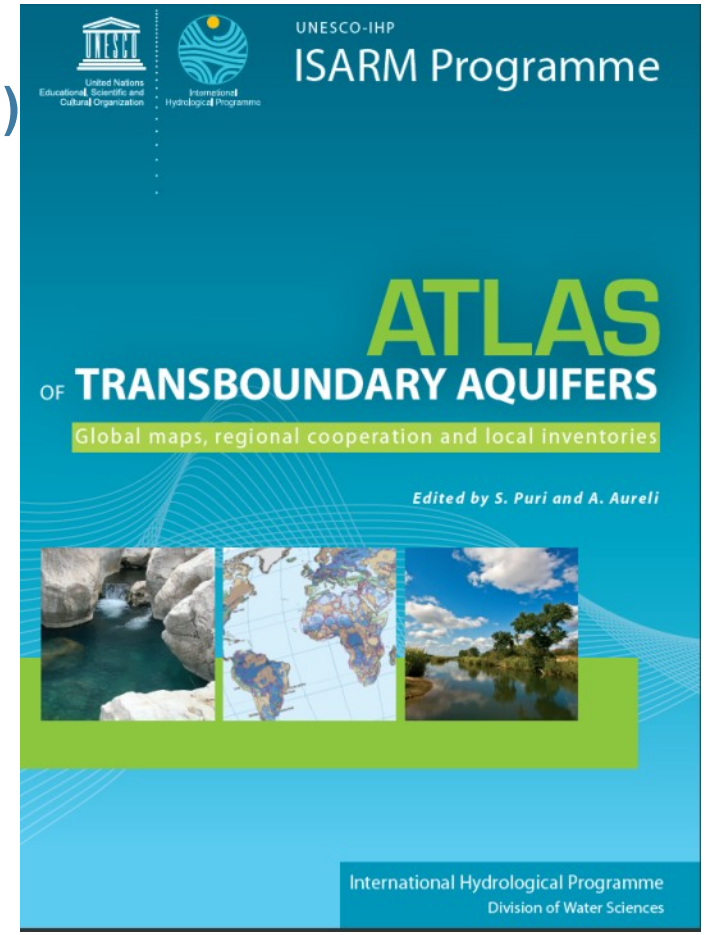
TBAs of the World - 2012



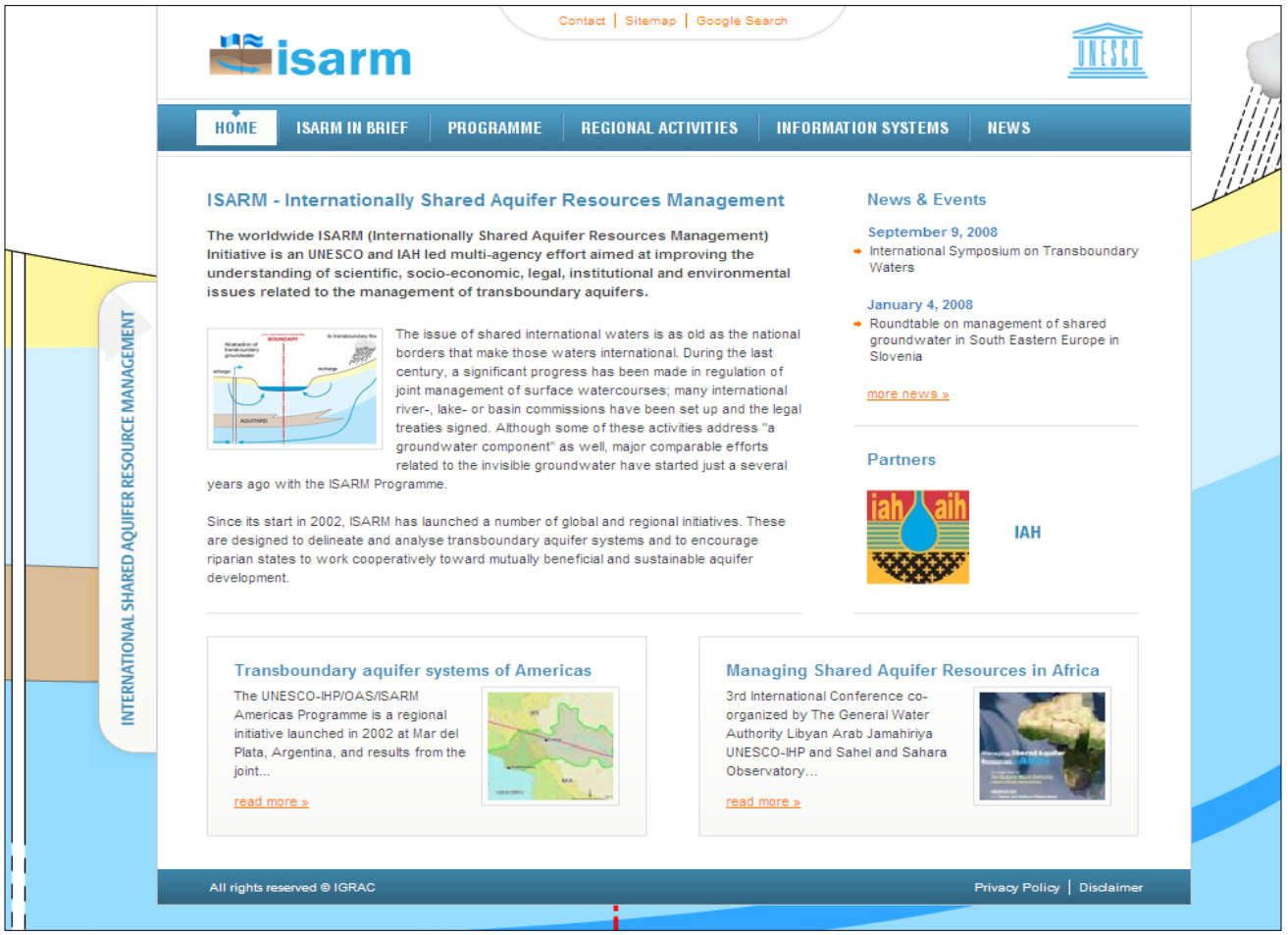
Atlas of Transboundary Aquifers

- Includes basic info about aquifers, regional cooperation and references
- The first global publication (other than a map – delineation process)
- Very limited info/no analysis





ISARM Portal



www.isarm.org

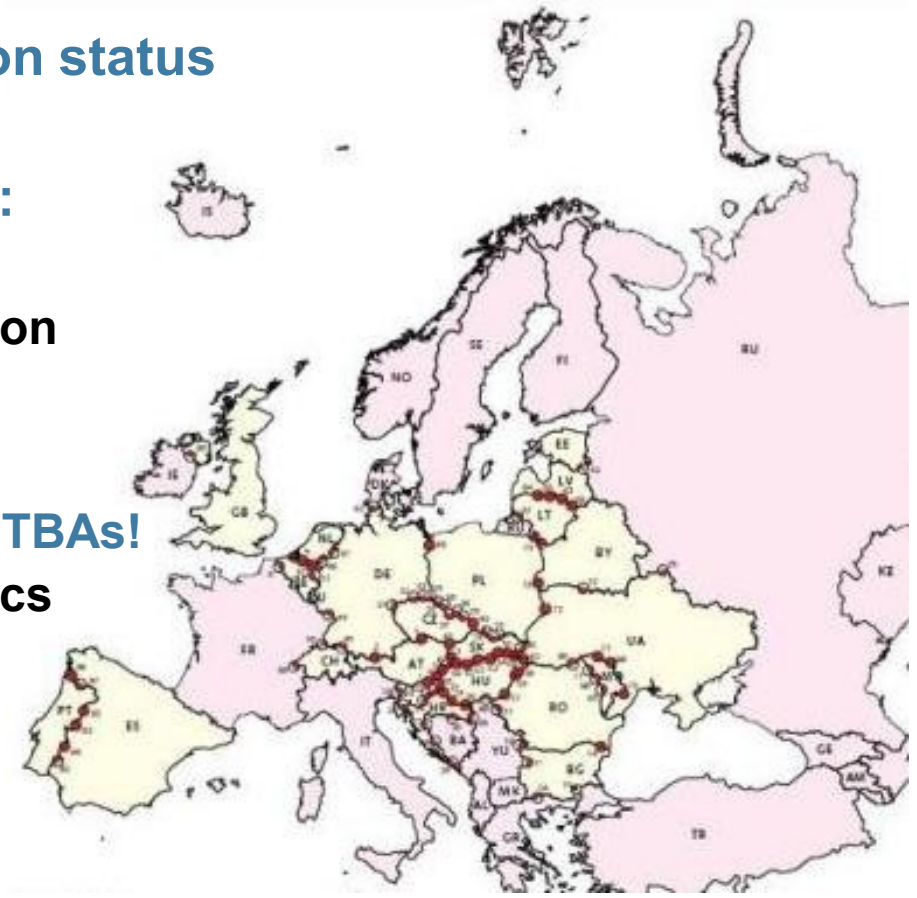
Global TBA Information System

Overview of Global Transboundary Aquifer Assessment Activities

Inventory of TB Groundwaters 1999

The UNECE Task Force on Monitoring & Assessment

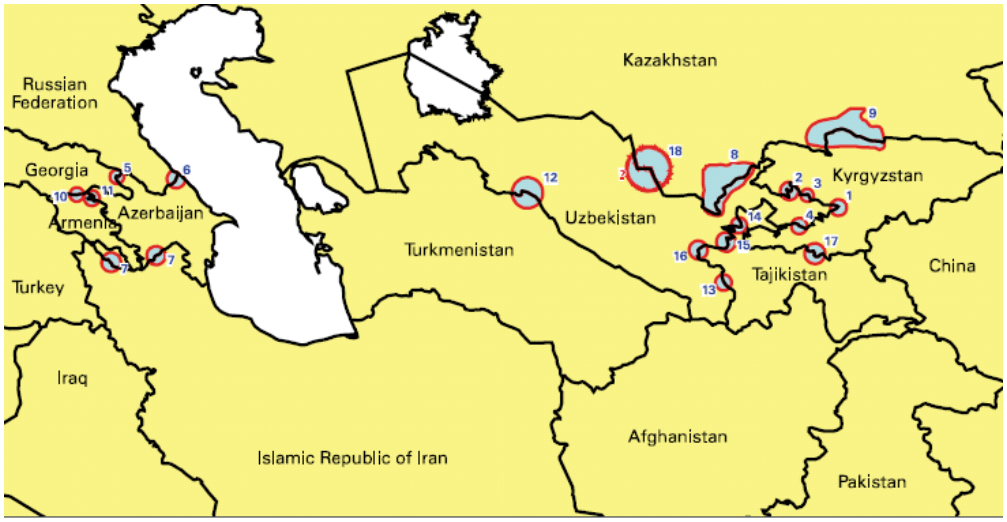
- Only locations and a recognition status
- Lesson learned - challenges of:
  - TB groundwater assessment
  - international data harmonisation
- Added value:
  - Pioneering role in addressing TBAs!
  - Formulating TBA characteristics
  - Pan European overview

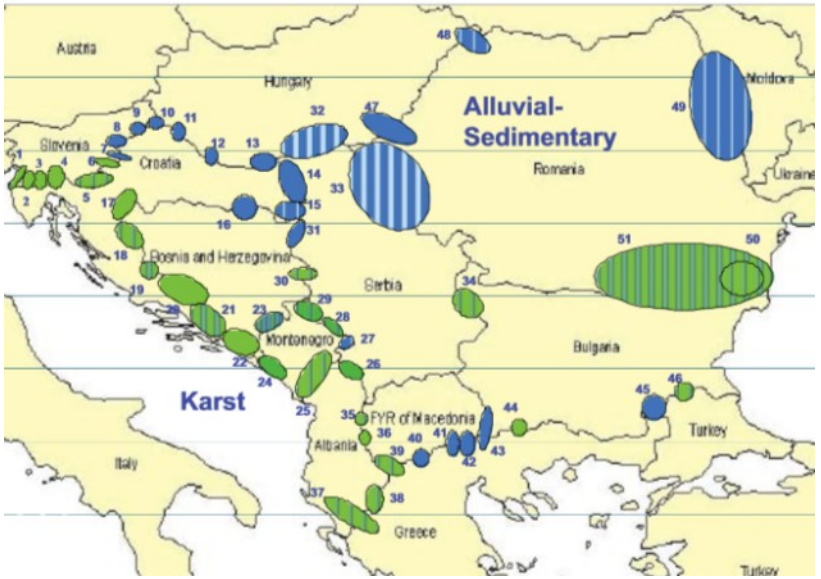


The First UNECE Assessment 2007

First Assessment of Transboundary Rivers, Lakes and Groundwaters

- Only South-Eastern Europe and Caucasus & Central Asia
- Approximate delineation (circles & ovals)





The First UNECE Assessment 2007

First Assessment of Transboundary Rivers, Lakes and Groundwaters

- followed the Driving Forces-Pressures-State-Impact-Responses (DPSIR) framework also adopted by the EEA
- a clear regional overview of current groundwater status (including the transboundary impact and management measures), of pressures and of future trends and prospects.
- Facts and Figures for each aquifer

No. 5 Groundwater: Cerknica/Kupa[4]	Shared by: Slovenia and Croatia	
Type 5, Triassic and Cretaceous limestones and dolomites with some alluvium in the river valley, weak to medium links to surface water systems, groundwater flow from Croatia to Slovenia and Slovenia to Croatia		Black Sea basin Border length (km): 32
	Slovenia	Croatia
Area (km²)	238	137
Water uses and functions	Local drinking water supply, first karst spring of the Ljubljanica River (a karstic river with 7 surface and 6 underground stretches)	Drinking water supply
Pressure factors	None, sparsely populated, forested with some extensive agriculture and pasture	None, very scattered population
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	None, good chemical status	Occasional bacteriological pollution
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	None	Existing protection zones
Trends and prospects		
GWB identification	GWS ID 11823	HR 343 and HR 344
Status and what is most needed	Not at risk. It is unclear which groundwater systems in the two countries correspond to each other; delineation of transboundary groundwaters needs common research and bilateral decision to propose a transboundary groundwater, if appropriate	

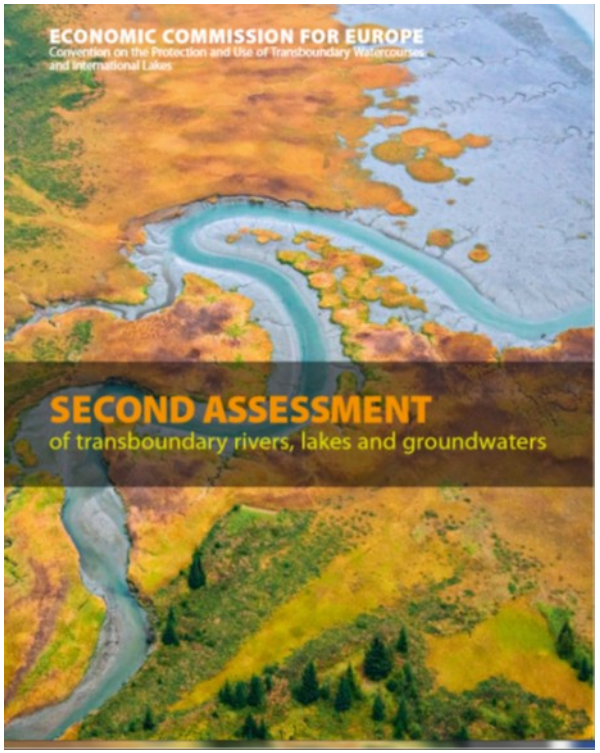
The Second UNECE Assessment 2011

Second Assessment of Transboundary Rivers, Lakes and Groundwaters

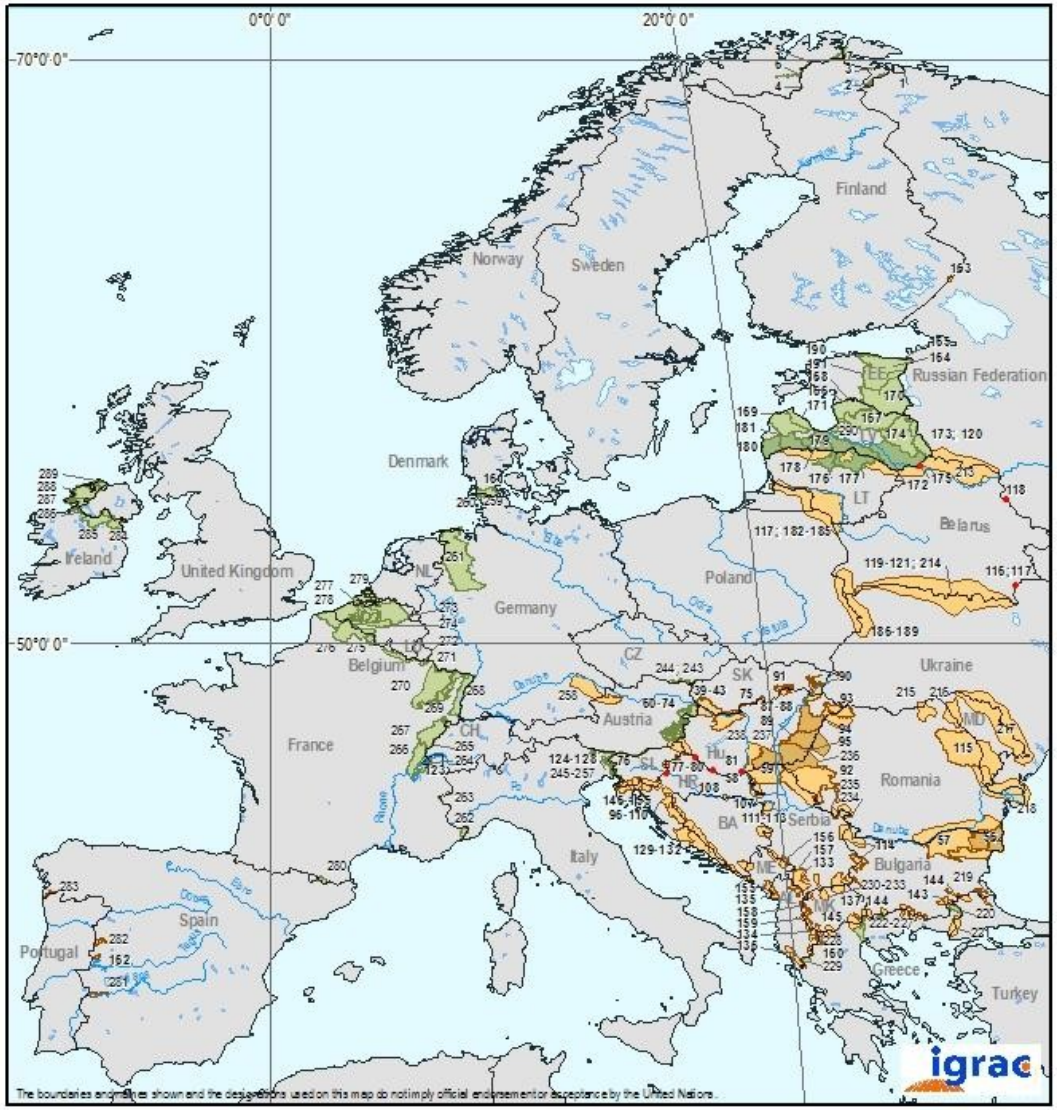
- A river catchment approach – no separate descriptions of aquifers
- It is difficult to implement a balanced (IWRM) assessment, especially in areas with large rivers (groundwater easily remains insufficiently addressed).

- EU WFD defines groundwater bodies (GWBs) rather than aquifers, causing the harmonisation difficulty at the borders of the EU.

- Country-based questionnaires contain still unprocessed information that is potentially useful for further TBA assessment



The Second UNECE Assessment 2011



Second Assessment of Transboundary Rivers, Lakes and Groundwaters

Legend

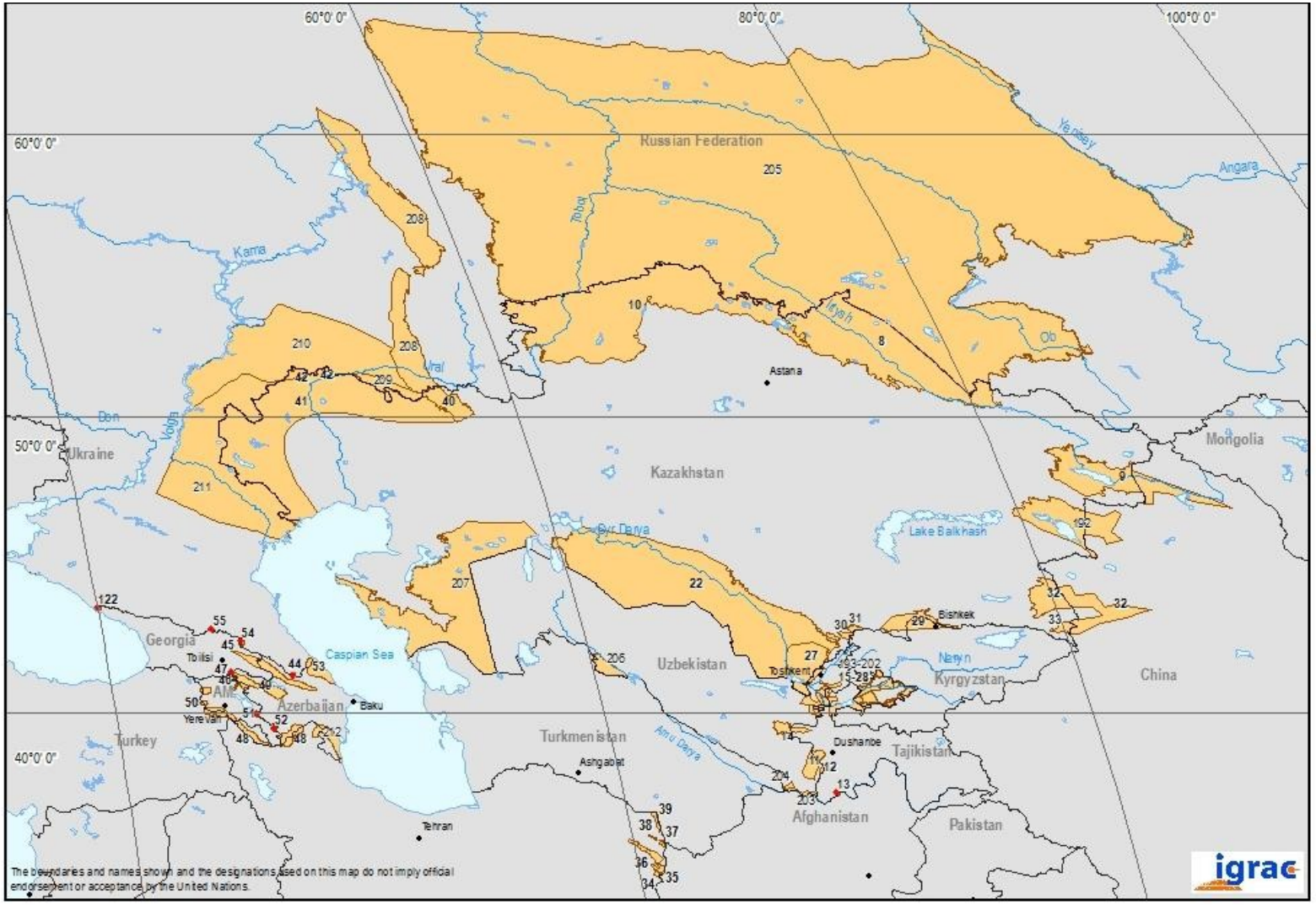
Transboundary groundwater

- WFD groundwater body (GWB)/ set of GWBs
- GWB (partially) overlapping with aquifer
- Aquifer
- (Partially) overlapping aquifers
- Exact location/extent of aquifer uncertain
- 143 In the Assessment
- 246 Not in the Assessment

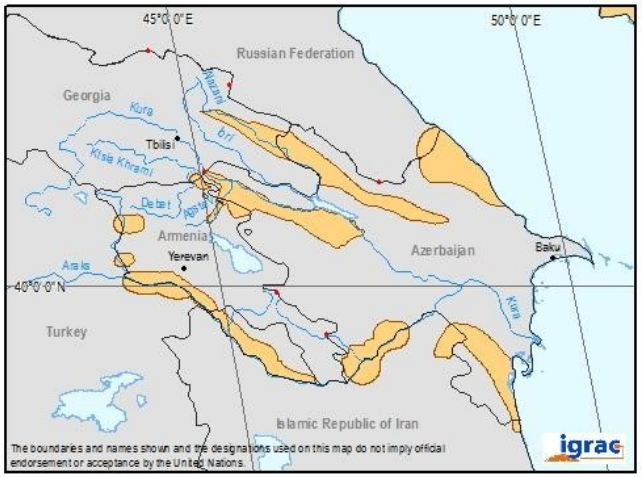
Geographic features

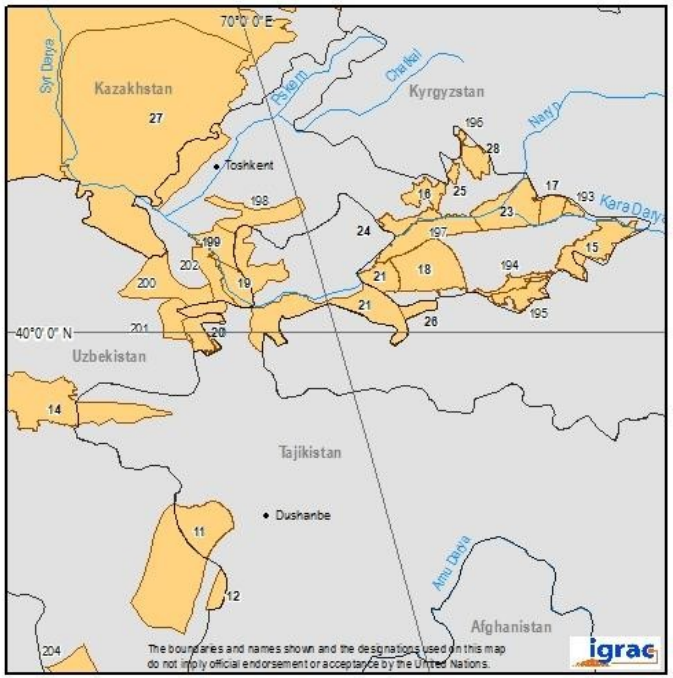
- National capital
- River
- Surface water
- Political border

The Second UNECE Assessment 2011



The Second UNECE Assessment 2011





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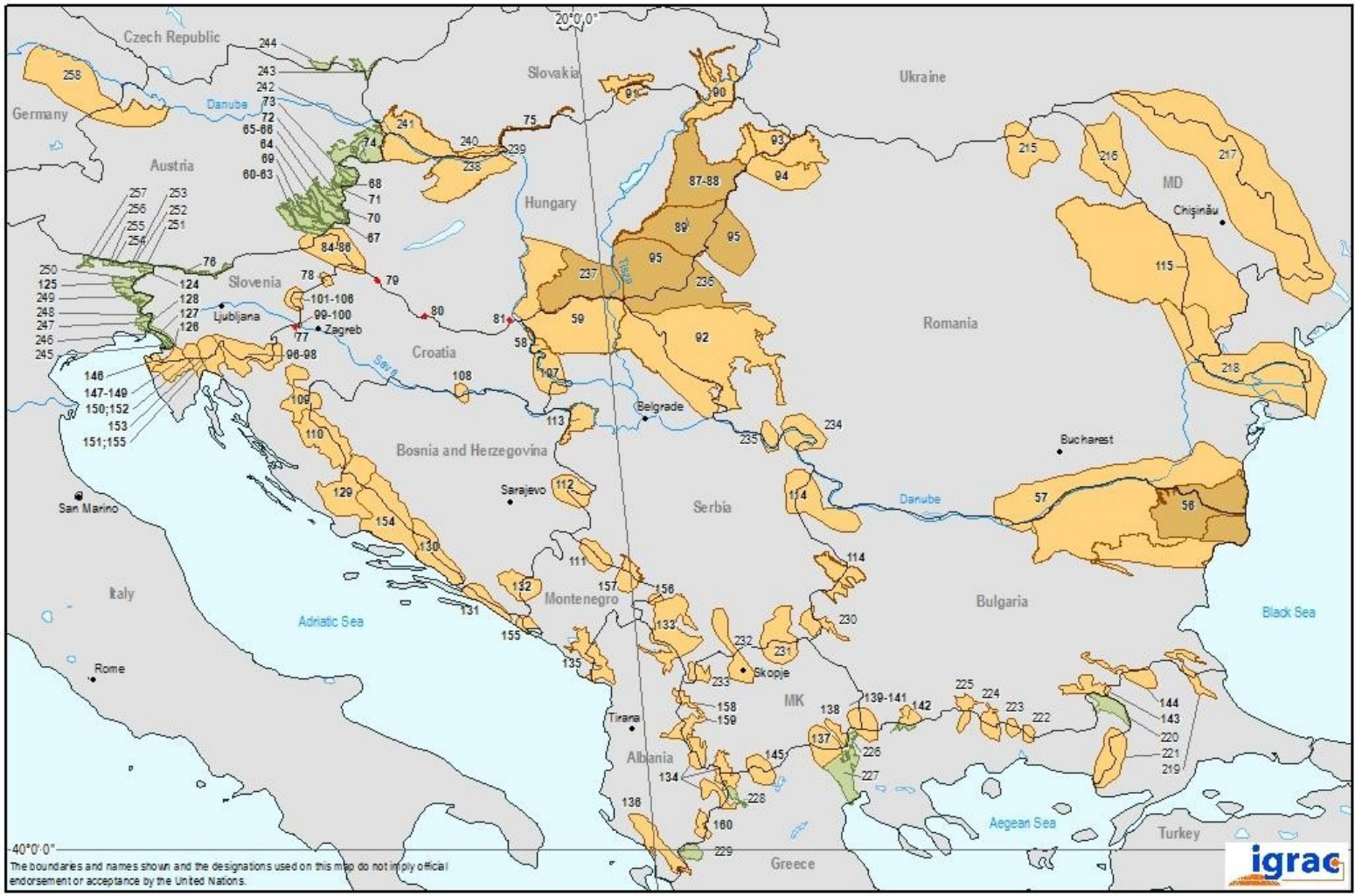
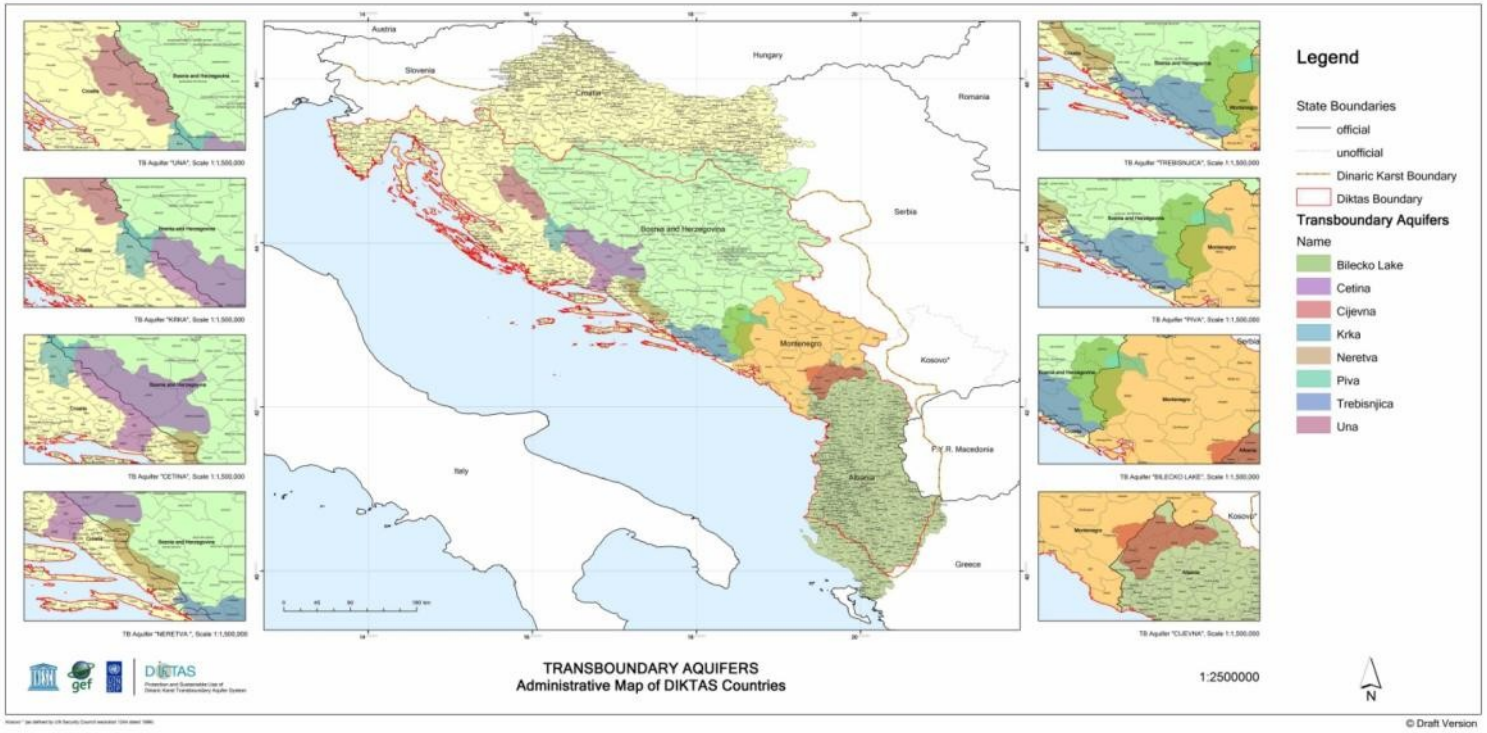


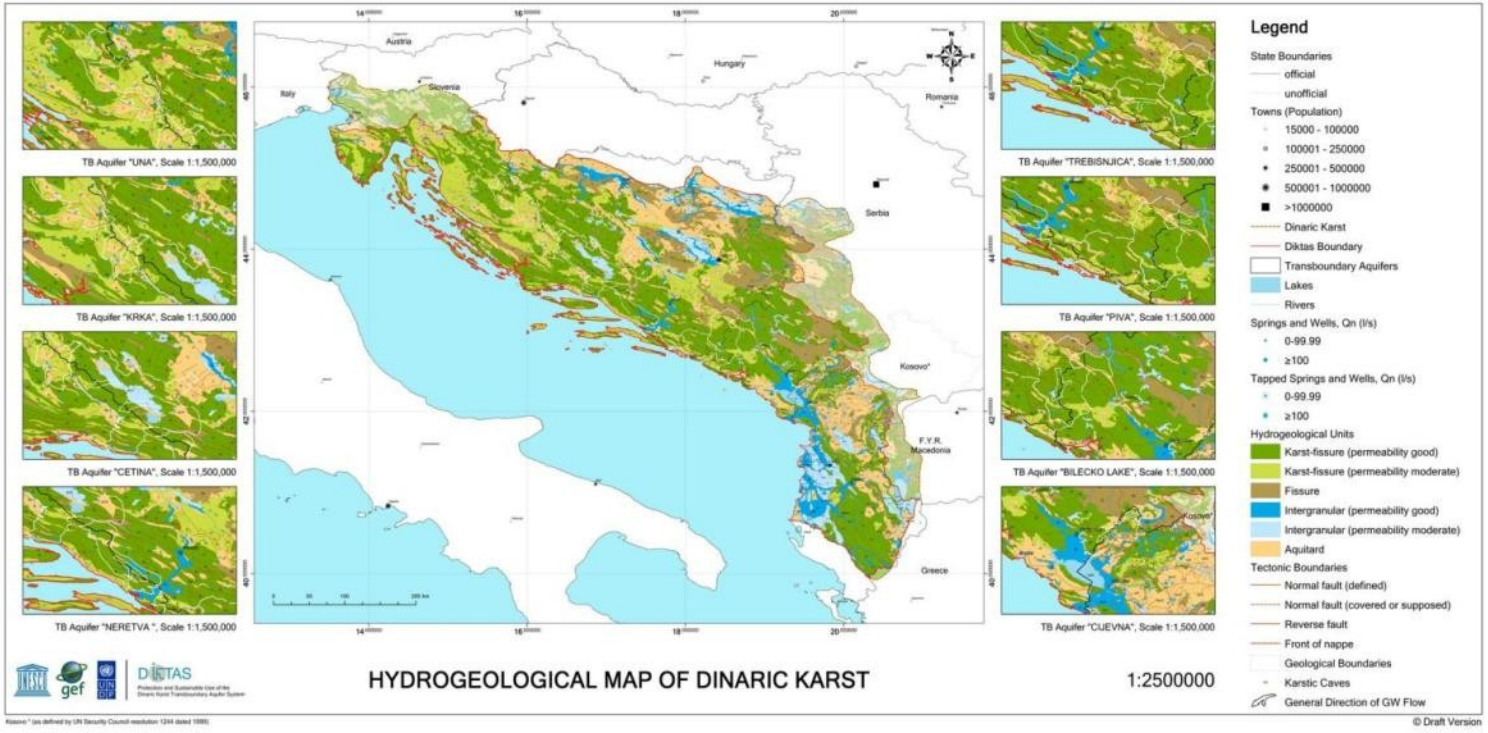
GEF DIKTAS Project in SEE

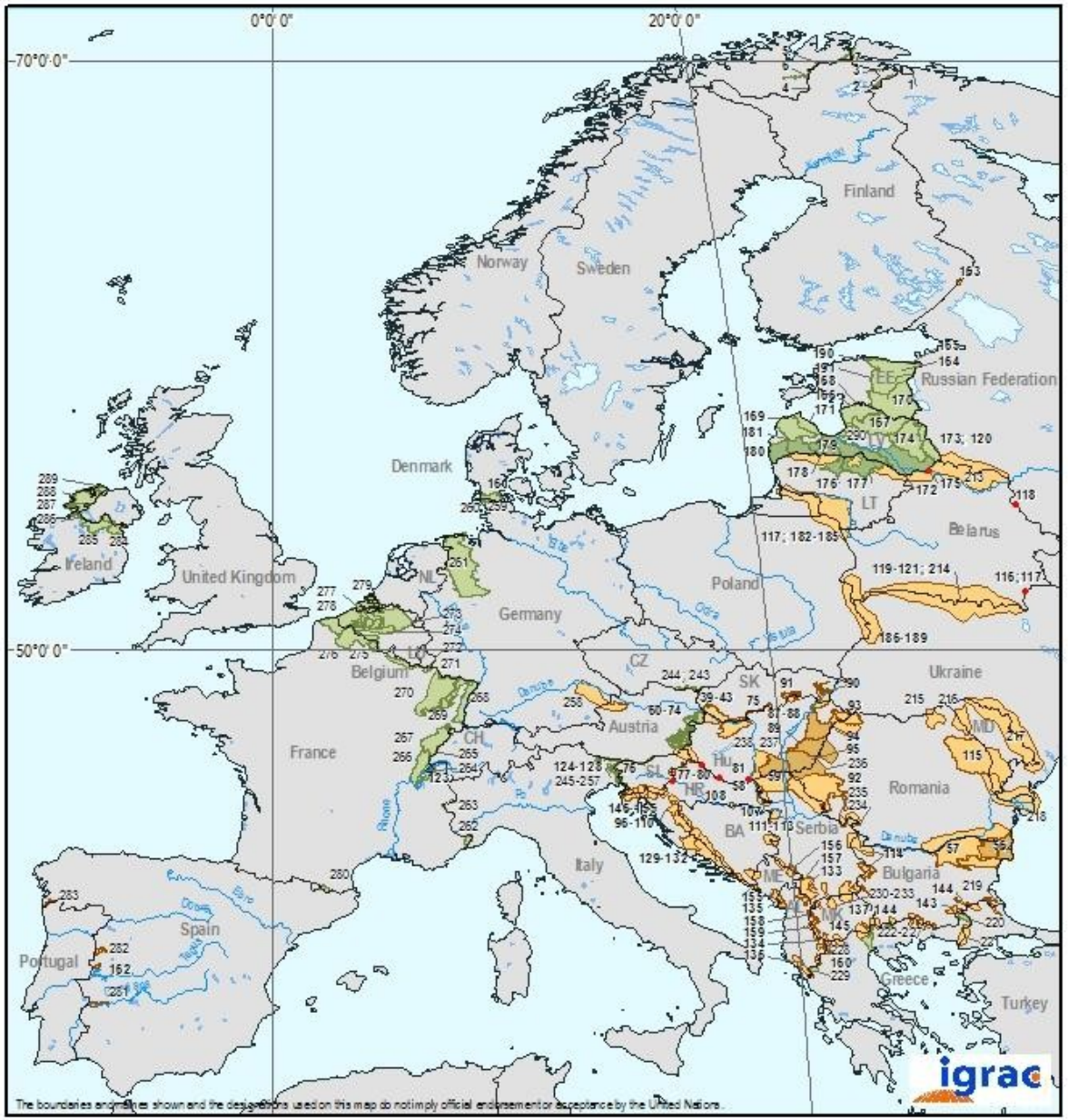
- In the last decade, **Global Environment Facility** co- funded several **large TBA assessment projects**
- Comparing with ISARM and UNECE, GEF projects concentrate often on one aquifer (system) allowing **in depth analysis.**
- **TDA - Transboundary Diagnostic Analysis**



GEF DIKTAS Project in SEE

- **Transboundary specifics** are usually found in (hydro)geological classifications, data and information management, legislation, organisational structure, etc.
- Further than an assessment: **consultation/cooperation mechanisms** and agreeing on **joint strategic actions** (SAP)

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Finland
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Romania
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Italy
Bulgaria
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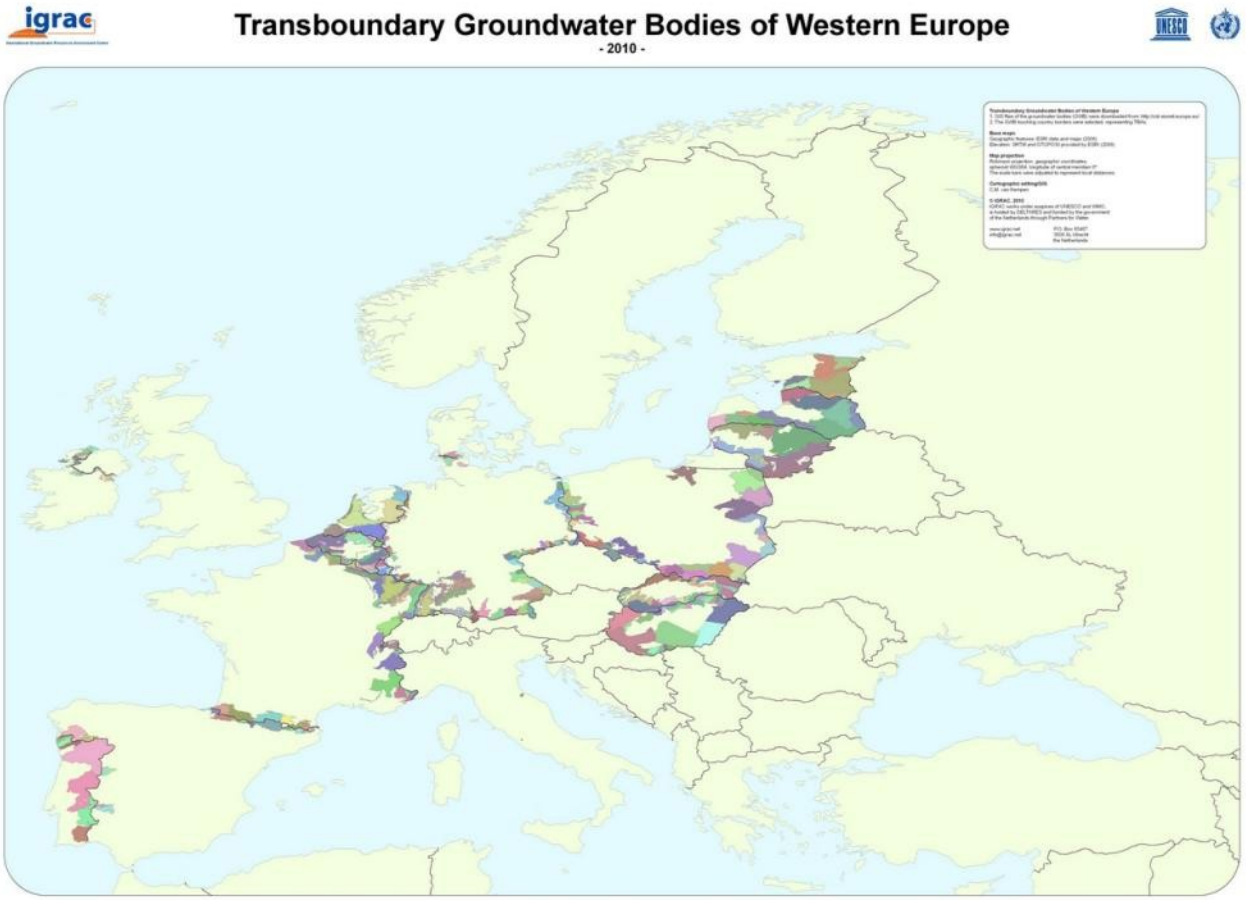
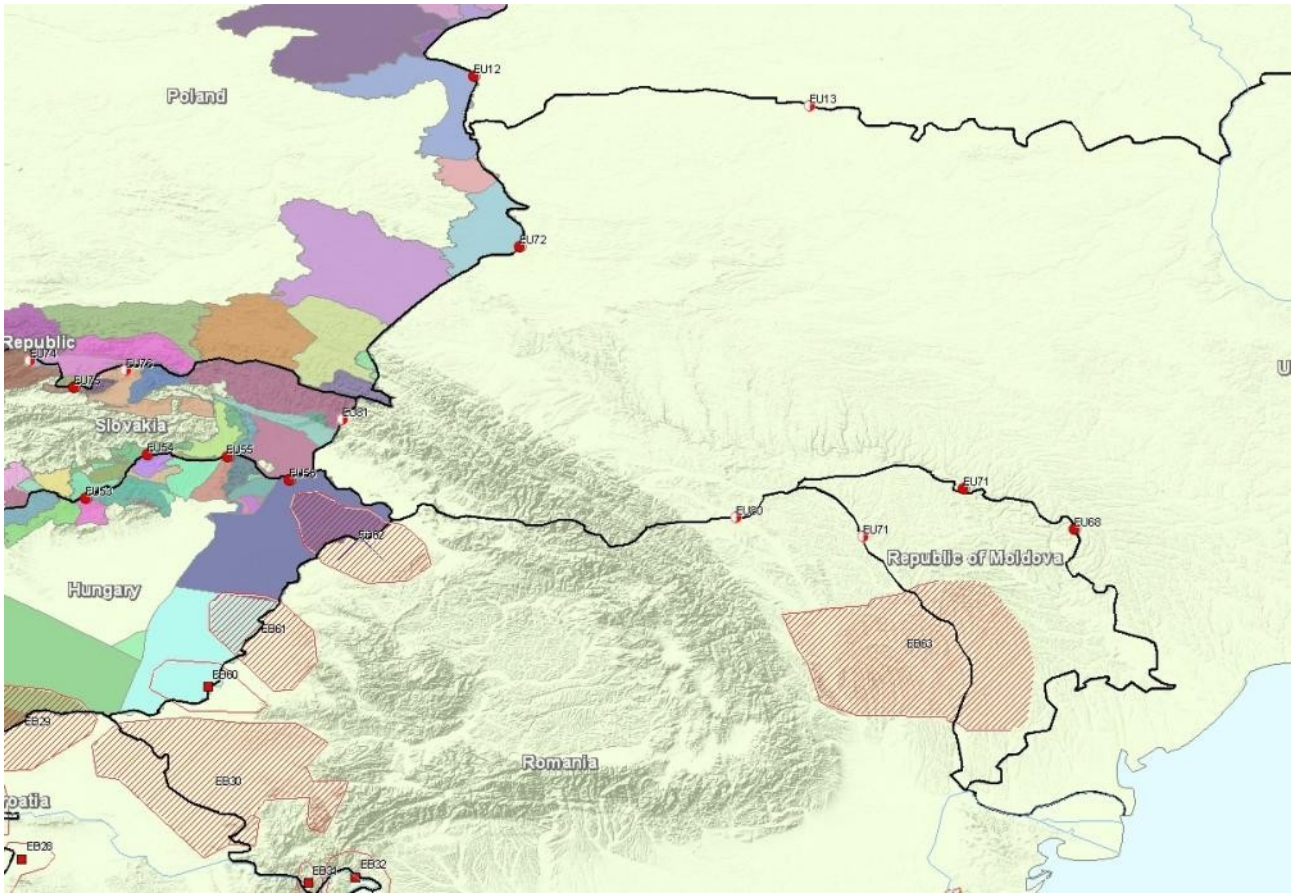
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Transboundary GWB 2011



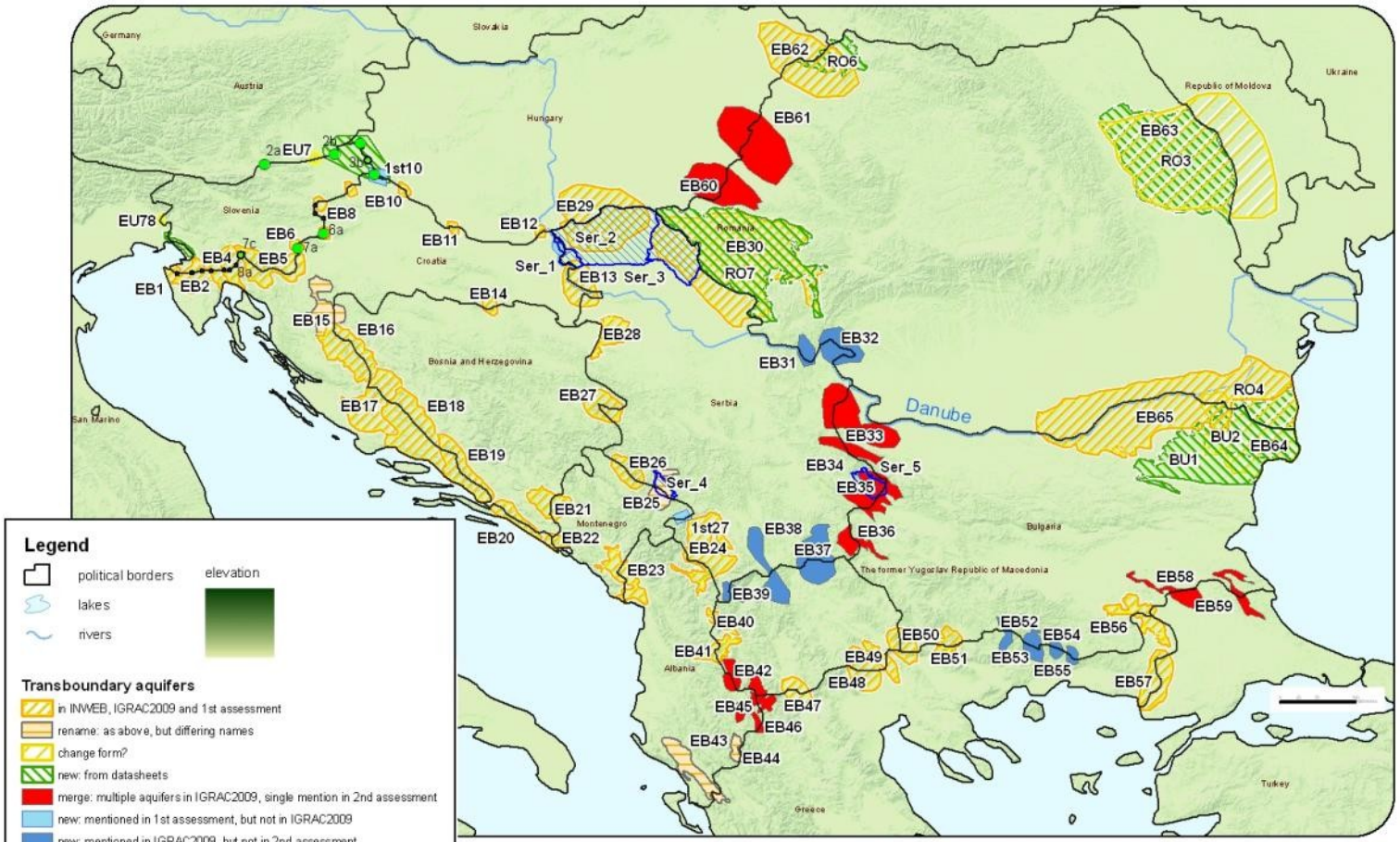
Out of 7019 GWBs in total holding specifications related to TBA attribute, only 124 transnational GWBs have been reported . In case of 4588 datasets the column is left empty.

Transboundary GWB vs Aquifers



Transboundary Aquifers of South East Europe

- Update 2010 - DRAFT



Base maps
Geographic features: ESRI data and maps (2006)
Elevation: GRTM and GTOPO30 provided by ESRI (2006)
TBAs of Uzbekistan: provided by Uzbekistan (2009)
Country borders and TBAs of Kazakhstan: Provided by Dr.O. Fedotov (2009)

Map projection
Polyconic projection, geographic coordinates,
datum WGS84, longitude of central meridian 0°.
The scale bars were adjusted to represent local distances.

Cartographic editing/GIS
C.M. da Campos

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is hosted by DELTARES and funded by the government
of the Netherlands through Partners for Water.

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The Netherlands

Closing remarks

- TBAs: hydrogeological maps vs aquifer maps
- TBA representation in 2D (multilayer, inclination, depth, etc)
- Aquifers vs Ground Water Bodies
  - Aquifers: hydrogeological units; no vertical delineation (inclination of layers or presence of aquifer systems not taken in account)
  - GWBs: managerial units ('distinct volume of water within an aquifer or aquifers'); distinction of GWB layers (horizons).
- Transboundary aquifers and transboundary GWBs at the (current) borders of the European Union
- Transboundary aquifers within the European Union
- Mapping is just a first step!
- Main obstacles: invisible groundwater – lack of knowledge, 'strategic information', insufficient cooperation among countries and among international organisations

Assessment of Transboundary Aquifers

- It's all about people….

Thank you for your attention

International Groundwater Resources Assessment Centre

Government of
The Netherlands

United Nations Educational,
Scientific and Cultural Organization

World Meteorological
Organization