

Protection and Sustainable Use of Dinaric Karst Aquifer System

Content of the presentation

- Introduction to IGRAC
- Introduction to DIKTAS Project
- (Internationally) Shared Groundwater Resources
 - Introduction to TBA
 - Hydrogeological Characterisation
 - Information Management
- Concluding remarks



"You're not allowed to use the sprinkler system to keep your audience awake."

What is IGRAC?

- A non-profit centre that facilitates and promotes global sharing of information and knowledge required for sustainable groundwater resources development and management.
- Launched at WWF3 in Kyoto in Spring 2003
- Works under auspices of UNESCO and WMO
- Receives financial support from the government of The Netherlands
- Hosted by the DELTARES in Utrecht, The Netherlands.



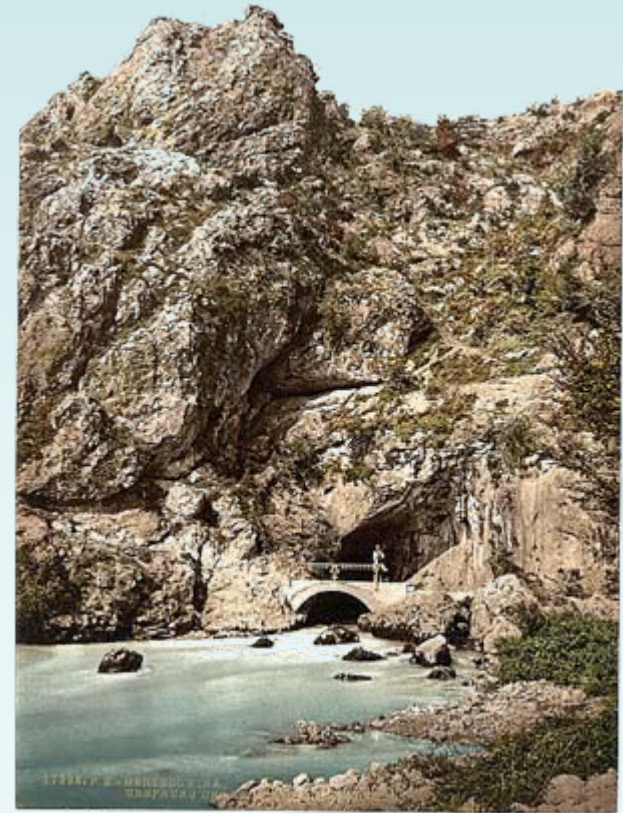
What is DIKTAS?

- A project proposal ‘Protection and Sustainable Use of the Dinaric Karst Aquifer System’
- Initiative of GEF and UNESCO at the Petersberg Roundtable (Berlin 2005), Expert meeting (Belgrade 2006), Ljubljana Roundtable (2007)
- Proposal submitted to GEF (Global Environment Facility) at the end of February 2008
- Project partners: Croatia, Bosnia & Herzegovina, Montenegro, Albania (and Italy, Slovenia and Greece as non GEF recipient countries)
- Project duration: four years (2009-2013), 2008-preparation
- Proposed budget: circa 7M\$ (GEF 3M\$)



DIKTAS Objectives

- At the **global level** the project aims to **increase attention** of the international community on the huge but **vulnerable water resources** contained in karst aquifers, which are widespread globally, but **poorly understood**.
- At the **regional level** the project's objectives are to:
 - **facilitate the equitable and sustainable utilization** of the transboundary water resources of the **Dinaric Karst Aquifer System**, and
 - **protect the unique groundwater dependent ecosystems** that characterize the **Dinaric Karst region** of the **Balkan peninsula**.



DIKTAS Activities

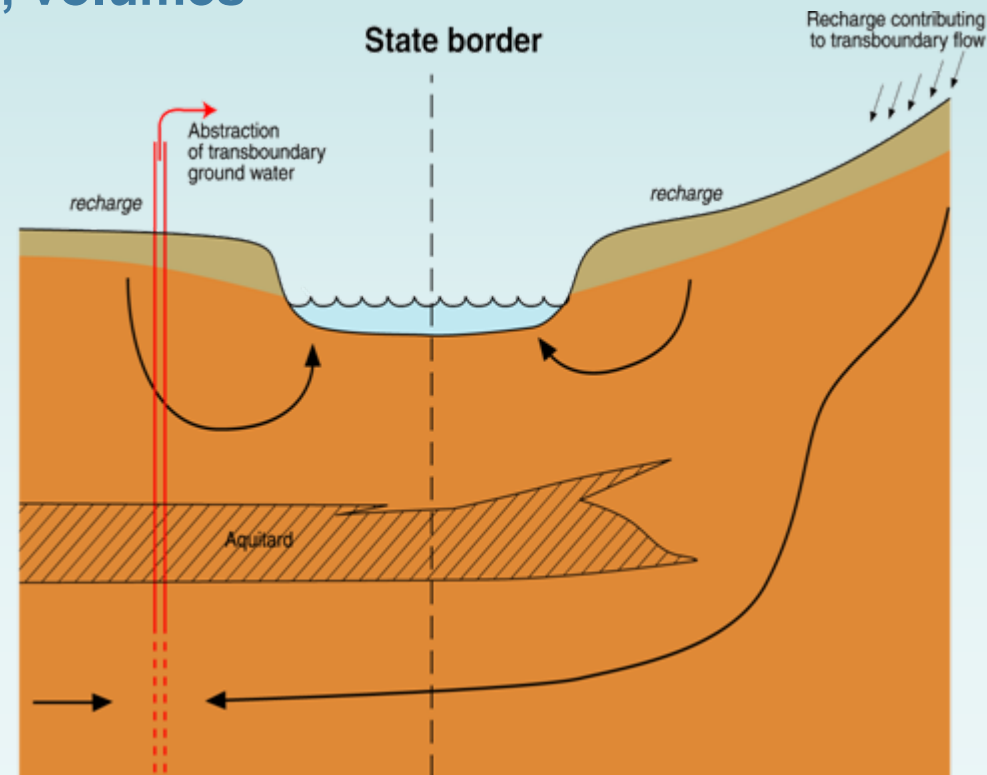
Objectives are expected to be achieved through a concerted international effort involving:

- improvement in understanding of the Resource and its environmental status
- building of political consensus and facilitating harmonisation around key reforms and new policies,
- enhanced and sustainable coordination among countries, donors, projects and agencies,



Introduction to TBA

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



ISARM Programme

- UNESCO and IAH global initiative for the identification, assessment and sound management of internationally shared groundwater resources.
- Hydrogeological aspect
- Legal aspect
- Socio-economic aspect
- Institutional aspect
- Environmental aspect



ISARM Portal: www.isarm.net

Address <http://www.isarm.net/> Go

UNESCO IAH AIIH I FAO OSS INWEB IWLRI Water law - Water for all

Welcome to

- Initiative
- Programme
- Regional Activities
- People
- Documents
- Collaborative Environment

ISARM
International Shared Aquifer Resource Management

what is a transboundary aquifer?
how widespread are transboundary aquifers?
read the ISARM news

ISARM contact

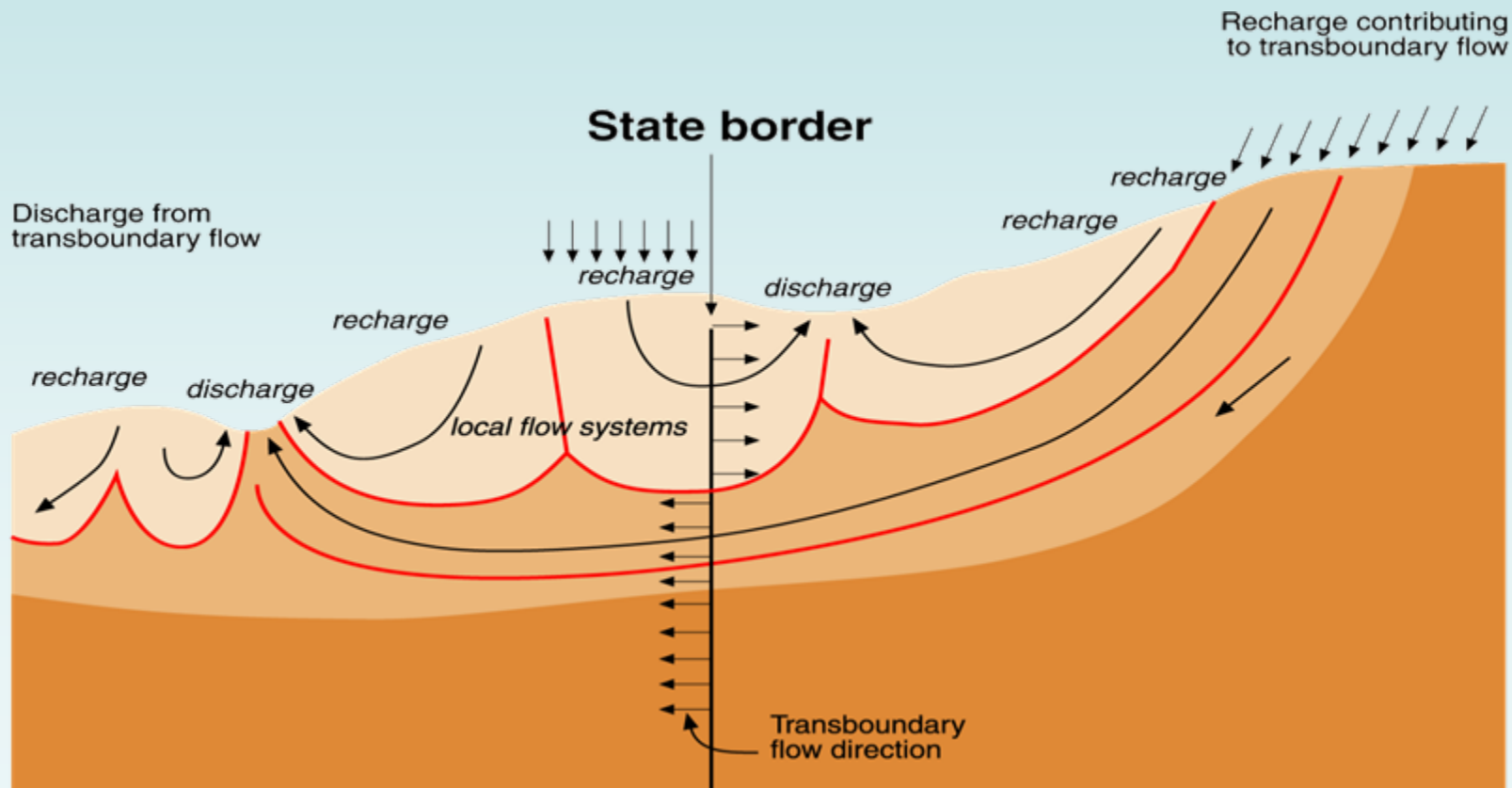
a global initiative for identification, assessment and sound management of transboundary aquifers

© ISARM 2004

Internet

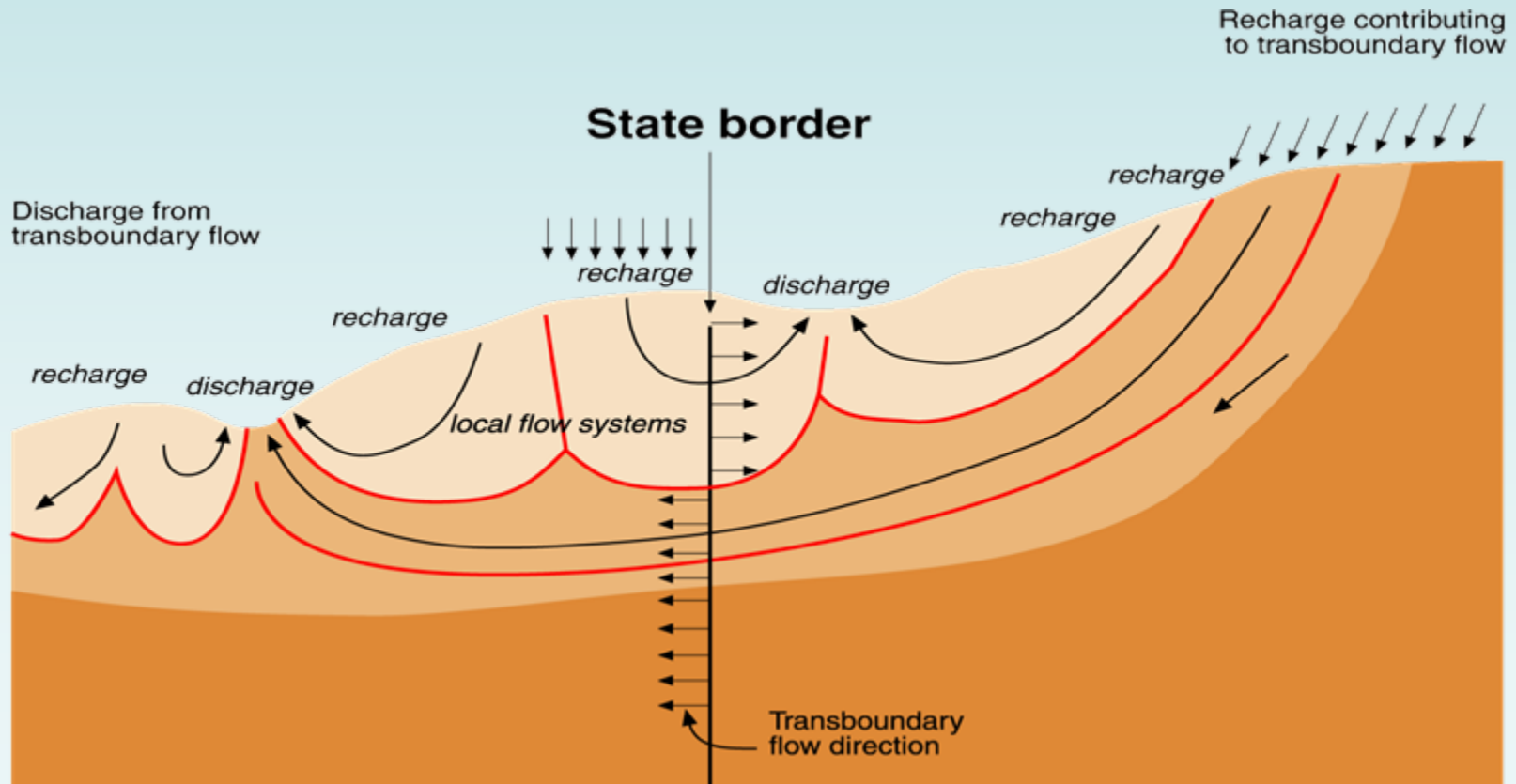
Introduction to TBA

- **Aquifer** means a permeable water-bearing underground geological formation underlain by a less permeable layer and the water contained in the saturated zone of the formation;



Introduction to TBA

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

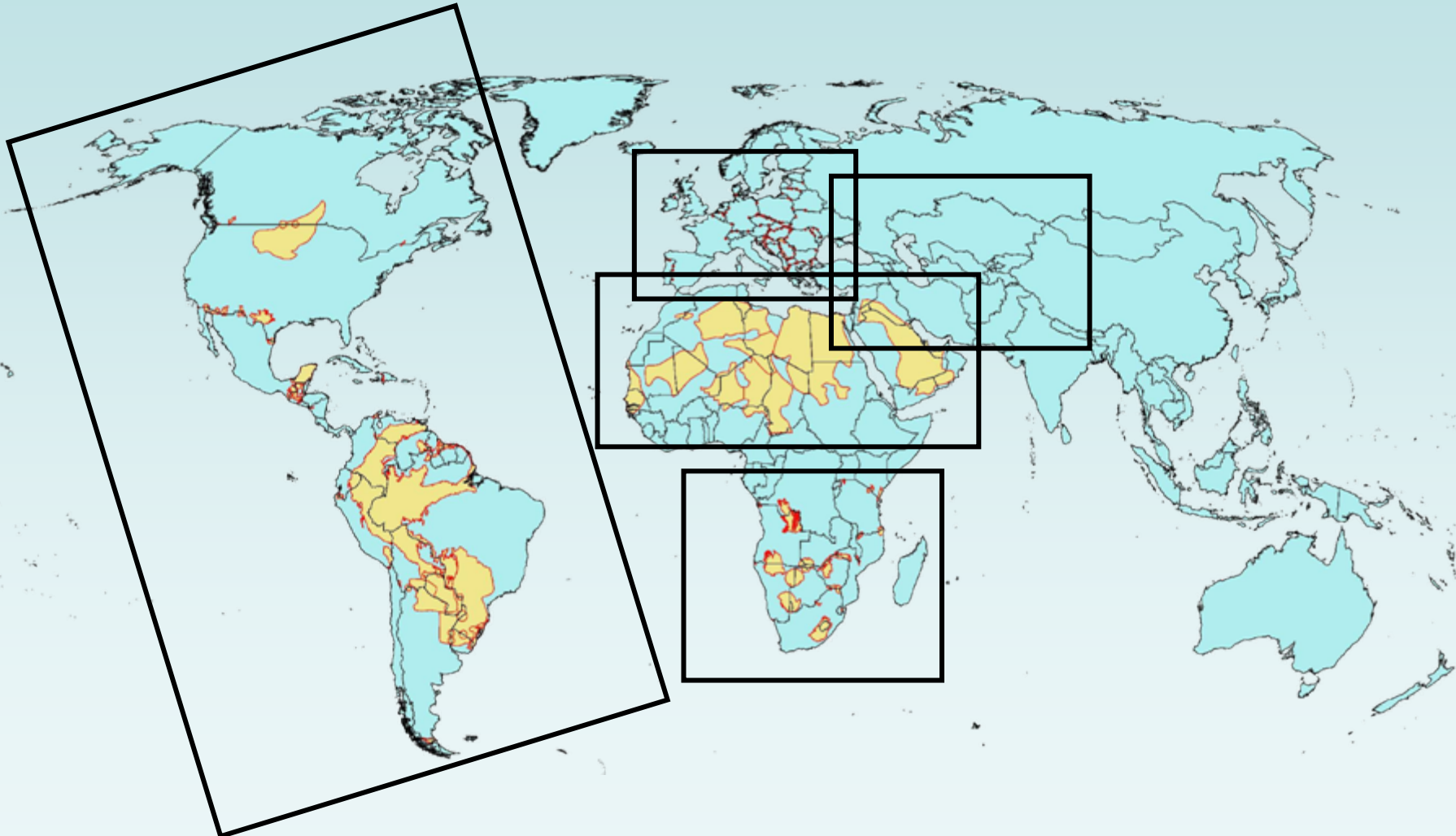


TBA Activities at IGRAC

- ISARM Core Group participation (development of the new strategic plan)
- ISARM Portal development & maintenance (www.isarm.net)
- UN ILC assistance in development of an International Legal Agreement on groundwater
- WHYMAP assistance in development of Transboundary Aquifer Systems map
- ISARM transboundary aquifers Course Material
- GEF IW-LEARN: Lesson Learned from TBA projects
- ISARM Regional Activities (Americas, Africa, Europe, Asia..)



Global Overview of TBA activities



- TBA characterisation and improvement of info accessibility

Content of the presentation

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- Introduction to DIKTAS Project
- (Internationally) Shared Groundwater Resources
 - Introduction to TBA
 - Hydrogeological Characterisation
 - Information Management
- Concluding remarks



Standardised TBA Delineation

(TBA Activities Americas)



LEYENDA

Alturas (meters)

- 4000 - 6000
- 3000 - 4000
- 2000 - 3000
- 1500 - 2000
- 1000 - 1500
- 400 - 1000
- 200 - 400
- 0 - 200

mar / agua superficial

extensión de acuífero

- ▲ Límite de acuífero transfronterizo, confiable
- ▲ Límite de acuífero transfronterizo, aproximado
- ▲ Límite de acuífero transfronterizo, inferido
- ▲ Límite de cuenca hidrológica transfronteriza, con acuífero(s) incluido(s), confiable
- ▲ Límite de cuenca hidrológica transfronteriza, con acuífero(s) incluido(s), aproximado
- ▲ Límite de cuenca hidrológica transfronteriza, con acuífero(s) incluido(s), inferido
- ▲ Límite de formación u otra unidad geológica transfronteriza, con acuífero(s) incluido(s), confiable
- ▲ Límite de formación u otra unidad geológica transfronteriza, con acuífero(s) incluido(s), aproximado
- ▲ Límite de formación u otra unidad geológica transfronteriza, con acuífero(s) incluido(s), inferido
- ▲ Límite de sistema hídrico transfronterizo no clasificado, confiable
- ▲ Límite de sistema hídrico transfronterizo no clasificado, aproximado
- ▲ Límite de sistema hídrico transfronterizo no clasificado, inferido
- ▲ río
- ▲ frontera internacional
- ▲ ubicación de la sección
- ciudad

Standardised TBA Description

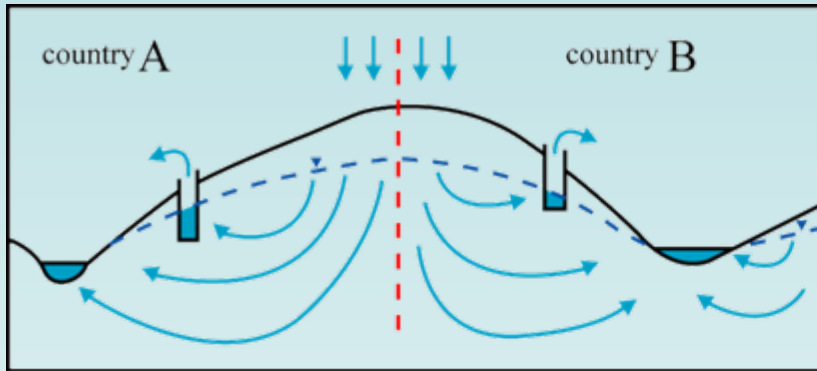
5.16. ARGENTINA – BRASIL – PARAGUAY - URUGUAY

SISTEMA ACUIFERO TRANSFRONTERIZO GUARANI - SAG ARGENTINA-BRASIL-PARAGUAY-URUGUAY
<p>El Sistema Acuífero Transfronterizo Guaraní está localizado en el subsuelo de la Cuenca Hidrográfica del Plata y se extiende desde la cuenca sedimentada del Paraná hasta la Cuenca del Chaco-Paraná. Con una extensión aproximada a los 1,2 millones de km² esta subyacente a cuatro países: Argentina, Brasil, Paraguay y Uruguay. El clima se caracteriza como húmedo o subhúmedo con precipitaciones entre 1200 a 1500 mm. Cerca de 20 millones de habitantes se encuentran en esta área. El agua es utilizada principalmente para abastecimiento humano, lazer e industria.</p> <p>El acuífero Guaraní está conformado por capas arenosas que se encuentran depositadas en la cuenca sedimentaria del Paraná desde el Mesozoico (periodos triásico, jurásico y cretáceo inferior) entre 200 y 132 millones de años, que constituyen las formaciones geológicas Pirambóia y Betucata en Brasil (las primeras formaciones se encuentran con el nombre Buena Vista en Uruguay y las segundas con el nombre Misiones en Paraguay, Tacuarembó en Uruguay y en Argentina).</p> <p>Las áreas de afloramiento ocurren en dos fajas situadas al este y al oeste del área de ocurrencia y corresponden al 10% de la extensión total del acuífero, mientras el restante 90% del acuífero es confinado. El potencial explotable estimado es de 40 km³/año. Los caudales de pozos varían entre 60 a 200 m³/h en las áreas adyacentes a los afloramientos y de 200 a 400 m³/h en las áreas de mayor confinamiento. Su espesor medio es de 250 m. Las aguas son bicarbonatadas calcicas y magnésicas en las áreas próximas al afloramiento y son sodicas en las áreas más profundas. El pH es alcalino y los valores de residuos secos varían de 200 a 600 mg/l. La temperatura varía de 25 a 63°C.</p> <p>Hay vacíos de conocimiento ligado a dos aspectos en particular a la delimitación de las áreas de descarga y la ocurrencia de anomalías hidroquímicas como exceso de fluor en algunos pozos. Importancia regional por la magnitud de la reserva.</p> <p>El sistema acuífero reviste mucha importancia a nivel regional y para cada país como elemento básico para el desarrollo socio-económico.</p> <p>El área de recarga del acuífero, que tiene una importante función en el mantenimiento del equilibrio hidrológico, es el área más vulnerable y necesita específicas medidas de protección.</p> <p>Los cuatro países están trabajando juntos en un proyecto empezado en el año 2002, sobre la gestión sostenible y protección del acuífero con cooperación del GEF/Banco Mundial/OEA.</p> <p>Referencias</p> <ul style="list-style-type: none"> • Mapa Hidrológico do Aquífero Guaraní, 1999, Campos, H.C. • Mapa Hidrológico da América do Sul (papel, 1996, Escala 1:3.600.000, UNESCO, CIPRM, DNP/M) <p>Autores: Argentina: Ofelia Tujchneider, con la colaboración de Marta Paris, Mario Hernández. Brasil: Julio Thadeu Kettelhut, Colaboradores: Uriel Duarte-ABAS, Gerencio Rocha-DAEE/SP, Mara Akie Britani, IG/SP, Adriana Ferreira, Fabricio Cardoso, Hélio Oliveira, Claudia Lima- SRH/MMA. Paraguay: Celso Velásquez con la colaboración de Wilfrido Castro, Ana Maria Castillo, Uruguay: Juan Ledesma con la colaboración de DINAMIGE OSE.</p>

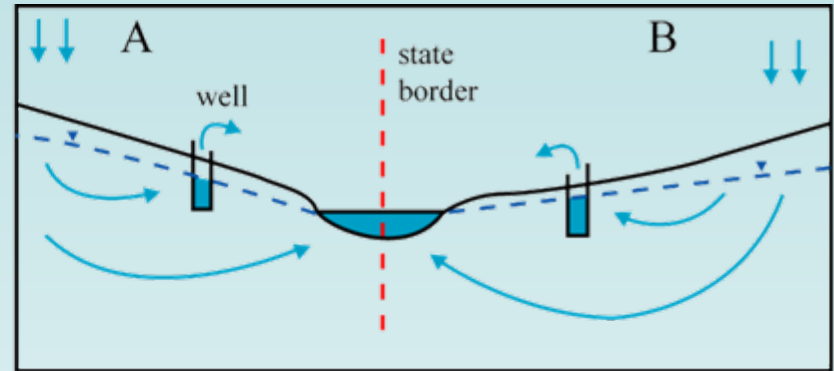
(TBA Activities Americas)

- ◀ Physiography, Demography & Water Use
- ◀ Geological Setting of Aquifer
- ◀ Water Quantity & Quality
- ◀ Importance and need for TBA
- ◀ TBA cooperation
- ◀ References
- ◀ Authors

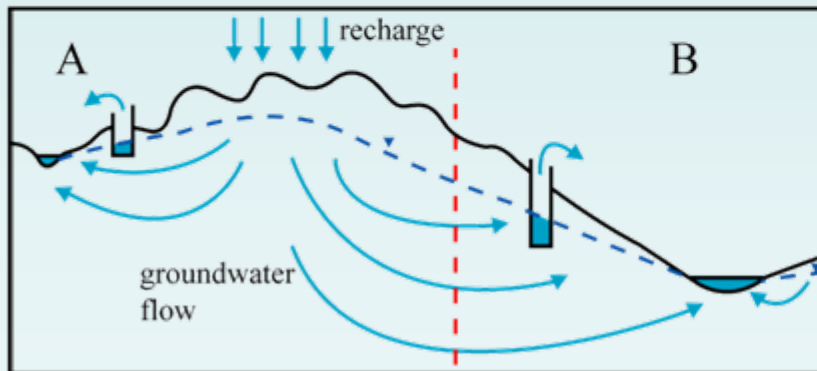
TBA Classification and Prioritisation



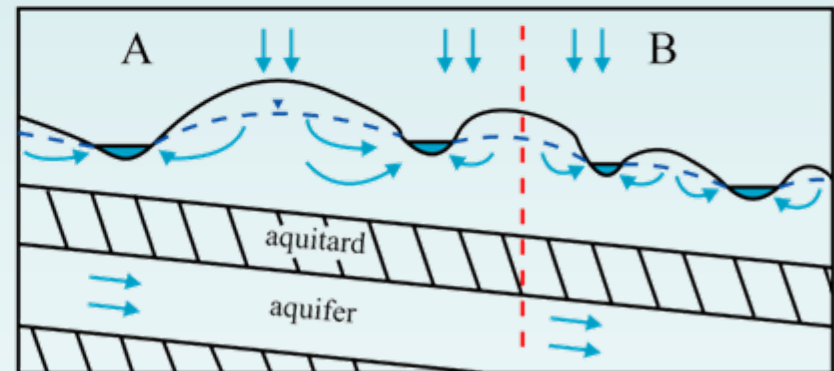
(1) state border follows surface water catchment and groundwater divide, little transboundary groundwater flow.



(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.

Global Groundwater Informa

Zoom to: Choose transboundary aquifer ...
Only Southern Africa

By transboundary aquifer

Aquifer Characteristics

- Aquifer type (Intergranular/fissured/combi
- Reservoir sytem (Single layer/multi layered)
- Dominant lithology (sand and gravel/sandstone/carbonate rock/carbonate rock and sandstone/volcanic rock/intrusive and metamorp
- Groundwater flow system (Phreatic/confined/semi-confined)
- Predominat groundwater flow (S-N; N-S; E-W; W-E; no predominace)
- Minimum depth to lower aqu boundary (system base) (m)
- Maximum depth to lower aqu boundary (system base) (m)
- Minimum depth to upper aqu boundary (system top) (m)
- Maximum depth to upper aquifer boundary (system top) (m)
- Minimum hydraulic conducti (m/s)
- Maximum hydraulic conductivity (m/s)

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0 320km

Query - Microsoft Internet Explorer

Query by transboundary aquifer

Attribute

Dominant lithology

Estimated volume is storage

Extent of arid land (P/ET<0.2) as a % of total land

Extent of humid land (P/ET>0.65) as a % of total land

Forseen total water demand in next 10 years

Frequency of water-level monitoring

= > >= And Not Between

<< < <= Or () In()

Unique values

'Sand and gravel'

'carbonate rock'

'sandstone'

'volcanic rock'

Retrieve

Query

Dominant lithology = 'Sand and gravel'

Clear Check Ok Close

To overview and compare...by browsing & searching

attribute values

Attribute	Value
Countries (-)	Brazil
ISO-3 alpha code (-)	BRA
Mean annual groundwater recharge (mm)	220
Annual groundwater recharge per capita (cubic meter per capita)	10295
Annual groundwater abstraction per capita (cubic meter per capita)	43
Year of abstraction estimate (-)	1987
Presence of large springs (none/few/many)	
Extent of highly productive intergranular aquifers (percentage of total area)	11
Extent of highly productive fissured aquifers (percentage of total area)	12
Extent of zones without groundwater (percentage of total area)	11

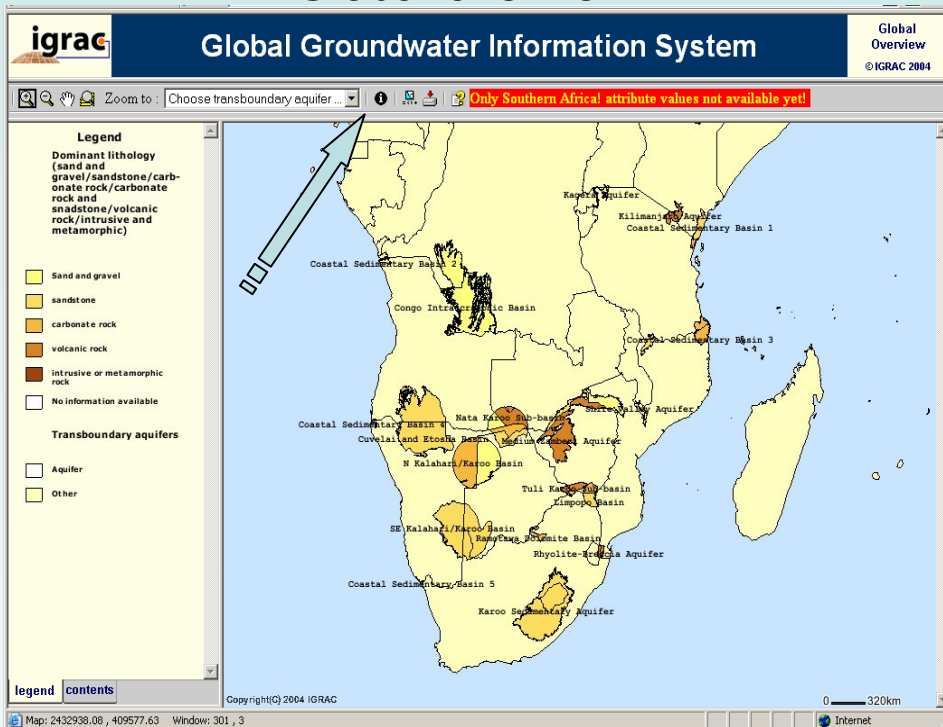
document info

Field	Value
Author's name	FAO
Author's surname	FAO
Title	Aquastat 2003
Publisher	FAO
Year	2003
Theme reference	Climate (and groundwater) Surface Water (and groundwater) Groundwater Recharge Groundwater Abstraction Pollution Chloride Aquifer Depletion Land Subsidence Saline Intrusion Other GW Problems GW Resource Management Institutional Setting
	Afghanistan Angola Albania

link to info source

The screenshot shows the AQUASTAT website interface. A red circle highlights the URL in the address bar: <http://www.fao.org/aquastat/landwater.htm>. A blue arrow points from the 'link to info source' header to this URL.

Global overview



Meta Information Module

The figure shows the 'Meta Information Module' search results page. A red circle highlights the 'Documents' tab in the search filters. A blue arrow points from the 'link to info source' header to the search results. The results list 15 documents, including 'Administración del agua en América Latina y el Caribe en el umbral del siglo XXI' (2001), 'Aquastat 2003' (2003), 'Climatic data from the IPCC Data Distribution Centre' (2004), 'Countries or areas, codes and abbreviations' (2003), 'Endemic Fluorosis in Developing Countries. Causes, effects and possible solutions.' (1992), 'Geo Brazil 2002. Brazil Environment Outlook' (2002), 'Geo-3 data compendium' (2002), and 'Gestion des ressources en eau au Brésil' (1998).



organisation info

Organisation card - Microsoft Internet Explorer

name Food and Agriculture Organization of the United Nations
acronym FAO
head organisation
address Viale delle Terme di Caracalla
pobox
city 00100 Rome
country Italy
telephone (+39) 06 57051
fax (+39) 06 570 53152
email FAO-HQ@fao.org
website http://www.fao.org

brief introduction
type of organisation
experience abroad
experience in projects

Employees

[Burchi](#) stefano.burchi@fao.org
[Mechlem](#) kerstin.mechlem@fao.org
[Burke](#) jacob.burke@fao.org 9821 662945/668365

people info

Person card - Microsoft Internet Explorer

prefix Dr
name Jacob J.
surname Burke
address (see organisation)
pobox (see organisation)
city (see organisation)
country
jobtitle hydrogeologist
telephone 9821 662945/668365
email jacob.burke@fao.org
organisation [Food and Agriculture Organization of the United Nations](#)
brief introduction
languages

Global overview

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Zoom to: Choose transboundary aquifer ... Only Southern Africa! attribute values not available yet!

Legend

Dominant lithology (sand and gravel/sandstone/carbonate rock and sandstone/volcanic rock/intrusive and metamorphic)

- Sand and gravel
- sandstone
- carbonate rock
- volcanic rock
- intrusive or metamorphic rock
- No information available

Transboundary aquifers

- Aquifer
- Other

Map: 2432938.08, 409577.63 Window: 301, 3

Meta Information Module

igrac IGRAC Home Sitemap Contact Search Links Your Opinion WMO UNESCO

IGRAC in Brief Global Groundwater Information System Guidelines & Protocols Downloads News WMO

Home > GGIS > MIM > Organisations

Search for:

[Organisations](#) [People](#) [Projects](#) [Documents](#) [Tools](#)

Found in total: 15 documents

Administración del agua en América Latina y el Caribe en el umbral del siglo XXI	Jouravlev, A.	2001
Aquastat 2003	FAO	2003
Climatic data from the IPCC Data Distribution Centre	Climatic Research Unit (CRU)	2004
Countries or areas, codes and abbreviations	United Nations	2003
Endemic Fluorosis in Developing Countries. Causes, effects and possible solutions.	Frænken, J.E. (editor)	1992
Geo Brazil 2002. Brazil Environment Outlook.	UNEP	2002
Geo-3 data compendium	World Resources Institute	2002
Gestion des ressources en eau au Brésil	Raymundo GARRIDO	1998

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Multimedia facility

Conference: Moderate Present Help

Attendees: Invite Materials

brochure-photo.jpg
milet-apps.doc
feeder-video.ppt
feeder-pricing.xls
feeder-blurpnc.html

3 Videos

Chat

Edwin: OK, tell me about this new design
Gary (Local): Well, we want to keep the birds DRY this time
Gary (Local): Seriously, look at the overhang
Gary (Local): Is it too long?
Edwin: No, I don't think so, as long as loading the feeder is not impaired
Gary (Local): There's a hinge now
Edwin: Great! I've had that feature request in for a while now!

Public

Global overview

igrac Global Groundwater Information System Global Overview © IGRAC 2004

Zoom to: Choose transboundary aquifer ... Only Southern Africa! attribute values not available yet!

Legend

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Transboundary aquifers

- Aquifer
- Other

Map: 2432938.08, 409577.63 Window: 301, 3

Collaborative environment

File Edit View Options GoTo Help

Home Public Clipboard Trash Addr Calend Bkms

Your location: .kukuric / IGRAC Digital Project Environment / ISARM Collaborative Environment file upload

catch up send copy link cut delete archive

ISARM Collaborative Environment					5 entries
Name	Size	Share Owner	Last Modified	Events	Action
ISARM Africa Managing Shared Aquifer Resources in Africa	1	kukuric	2004-12-03		
ISARM Americas Acuíferos Transfronterizos de las Américas Transboundary aquifers of the Americas	3	kukuric	2004-12-09		
ISARM Commission Collaborative place for the members of the IAH ISARM Commission	0	kukuric	2004-12-03		
ISARM General Documents These general documents are also accessible for the general public	4	kukuric	2004-12-03		
Transboundary Aquifers MED/SEE	6	buzaszs	2005-10-05 10:02		

Meta Information Module

igrac IGRAC Home Sitemap Contact Search Links Your Opinion WMO

IGRAC in Brief Global Groundwater Information System Guidelines & Protocols Downloads News WMO

Home > GGIS > MIM > Organisations

Search for:

Organisations People Projects Documents Tools

Found in total: 15 documents

Administración del agua en América Latina y el Caribe en el umbral del siglo XXI	Jouravlev, A.	2001
Aquastat 2003	FAO	2003
Climatic data from the IPCC Data Distribution Centre	Climatic Research Unit (CRU)	2004
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Endemic Fluorosis in Developing Countries. Causes, effects and possible solutions.	Frænken, J.E. (editor)	1992
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Geo-3 data compendium	World Resources Institute	2002
Gestion des ressources en eau au Brésil	Raymundo GARRIDO	1998

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TBA Information Management

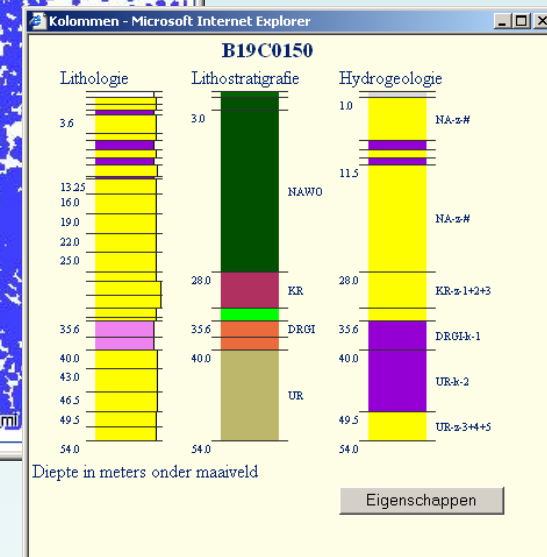
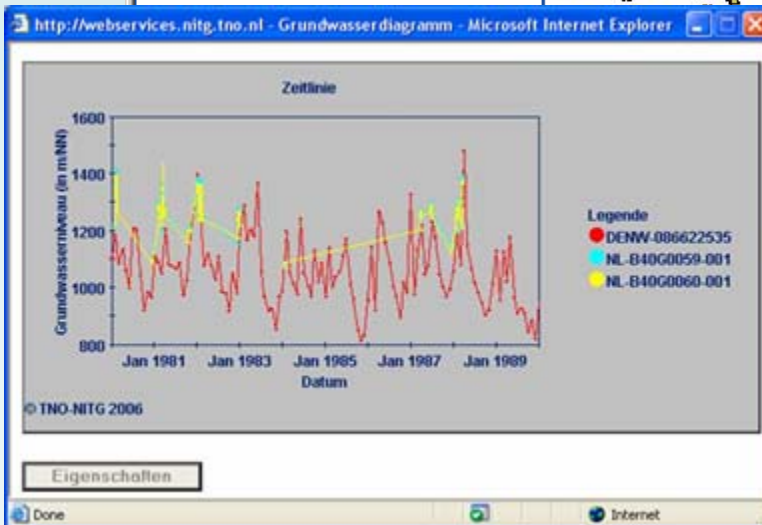
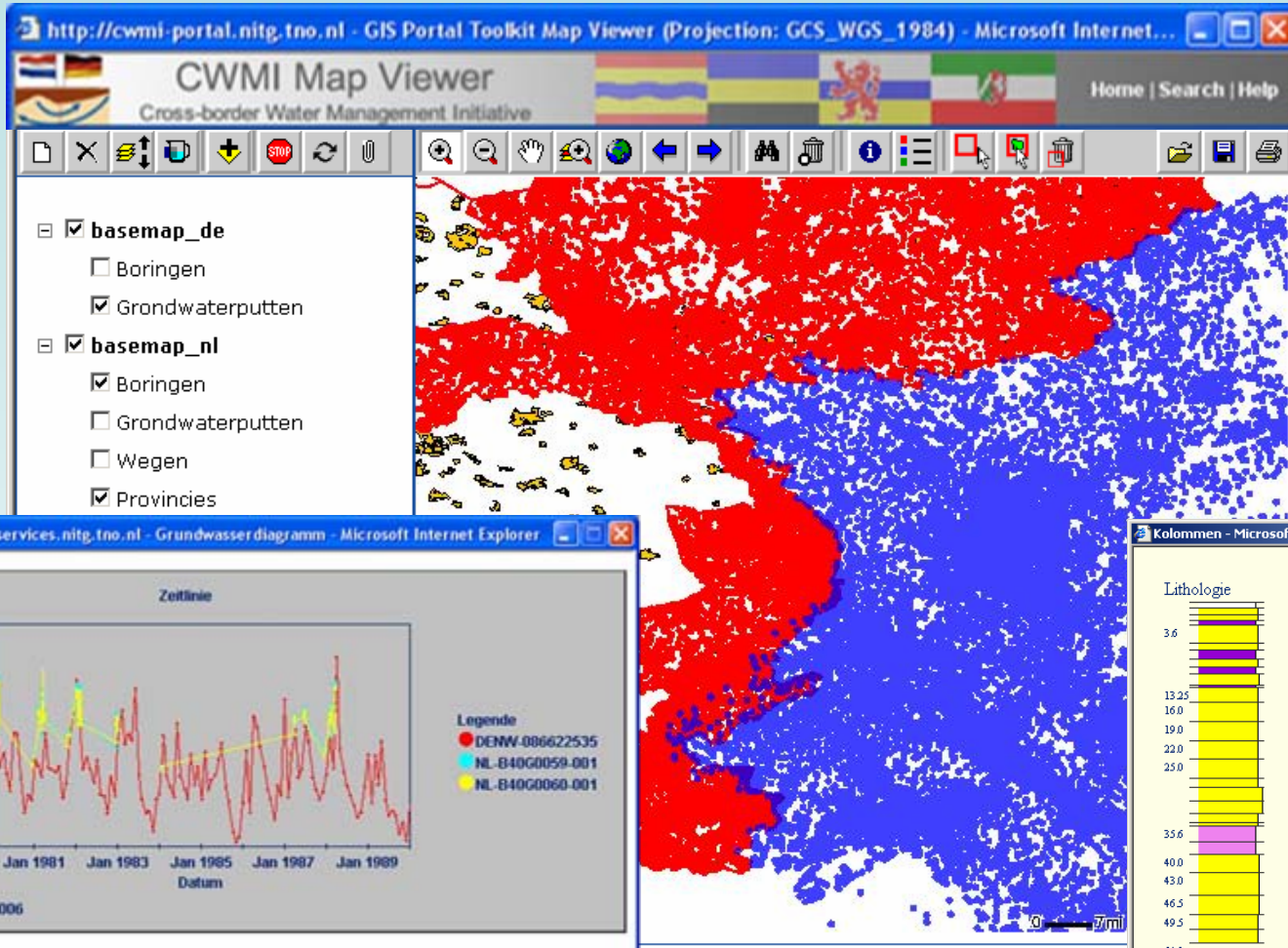
EU Water Framework Directive

- **Characterisation:**
 - **Groundwater bodies as managerial units** (quite loose guidelines provided)
 - **A set of basic groundwater variables** (quite low density and frequency of monitoring)
- **Information management**
 - **WISE (Water Information System Europe)** – currently a reporting mechanism



The screenshot shows the homepage of the Water Information System for Europe (WISE). The page features a navigation menu at the top with links for POLICY, THEMES AND DATA, PROJECTS, and LINKS. Below the navigation is a banner image with the text "Water Information System for Europe". The main content area includes a welcome message: "Welcome to the Water Information System for Europe". There are four main navigation buttons: ABOUT WISE, PARTNERS, FEEDBACK, and LANGUAGE (set to English). Below these are four image-based navigation buttons: POLICY, THEMES AND DATA, PROJECTS, and LINKS. The footer contains copyright information for WISE and the European Commission.

TBA Information Management



Concluding remarks

- Importance of **karst groundwaters** (more than 25% of the world's population either lives on or obtains its water from karst aquifers)
- Importance of **cooperation** regarding shared groundwaters (also regional and intersectoral)
- We have to be aware of:
 - **externalities** (side effects on a third party)
 - **voiceless groundwater users** (ecosystems and future generations)
 - **interdependencies** (socio-economical, political)
 - Perceptions, scales, etc.
- How to **trigger TBA management action**: awareness, motivation, institutional framework and operation means (therefore **DIKTAS**)



www.igrac.nl

- Thank you for your attention



United Nations Educational,
Scientific and Cultural Organization



World Meteorological
Organization

