GGIS

GLOBAL GROUNDWATER INFORMATION SYSTEM

igrac
International Groundwater Resources Assessment Centre

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GLOBAL EXCHANGE OF KNOWLEDGE AND INFORMATION

The International Groundwater Resources Assessment Centre (IGRAC) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide. IGRAC's mission is to contribute to the world-wide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries. IGRAC's goals are to support the sustainable utilisation and management of groundwater resources, to promote the role of groundwater in integrated water resources planning and to elucidate the impact of groundwater on ecosystems.

Under this general objective of "promoting sustainable groundwater resources utilisation and management by means of global exchange of knowledge", IGRAC has developed the Global Groundwater Information System.

GLOBAL GROUNDWATER INFORMATION SYSTEM

The Global Groundwater Information System (GGIS) is an interactive, web-based portal to groundwater-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on groundwater resources and the sharing of this information among water experts, decision makers and the public.

The GGIS consists of several modules structured around 6 themes. Each module has its own map-based viewer with underlying database to allow storing and visualizing geospatial data in a systematic way.

GGIS PORTAL CAPABILITIES:

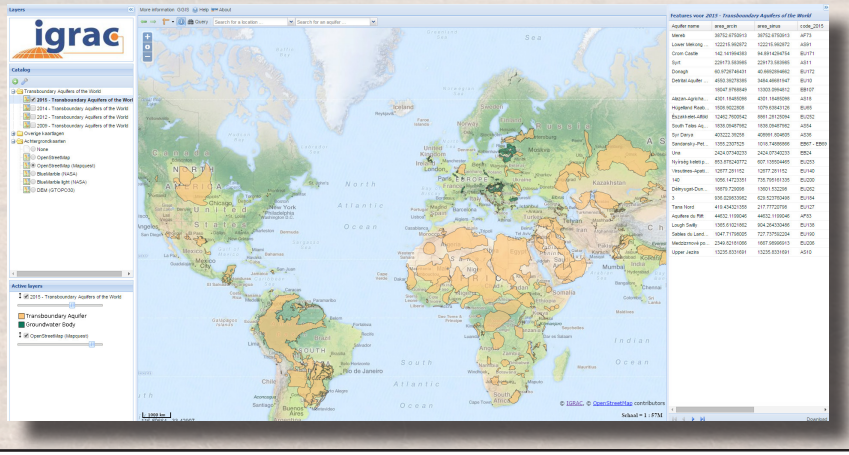
1. Store variables, thematic maps and documents.
2. Visualise geospatial data and information in a map viewer.
3. Share and analyse results in a protected environment before making it publically available.
4. Add map layers from external sources via web map services (WMS).
5. Generate new pieces of information by creating overlays of thematic maps.

META INFORMATION MODULE

Maps are an excellent tool to communicate spatial data and information, but metadata related to the map layers is of equal importance. Therefore the GGIS also contains a meta-information module (MIM) which allows uploading, storing and searching of additional information linked to the data presented in the system, like documents or references. It is also possible for groundwater specialists, and other interested professionals to create a personal and/or organisation profile in MIM and to upload documents that they wish to share with the global groundwater community.

OPEN WEB SERVICES

The GGIS is using open and extendable state of the art technology enabling to connect to external data sources and information systems online. The GGIS is developed based on OGC's (Open Geospatial Consortium) international standards for geospatial data. Information uploaded to the GGIS can be shared and easily integrated with external Geographic Information Systems (GIS) using web services.

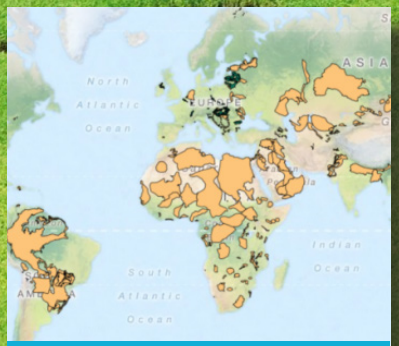


THEMES

In 2004, IGRAC launched the first version of the GGIS and its main feature was the Global Overview module, which contained a country view with about 70 thematic maps showing aggregated groundwater-related attributes for the countries of the world.

Since then IGRAC has developed several new modules, particularly related to transboundary groundwater. To provide GGIS users a clear overview of the type of information that can be found, six overarching groundwater themes have been defined:

- Transboundary Groundwater
- Global Country Data
- Managed Aquifer Recharge
- Small Islands
- Groundwater Monitoring
- Project-related Modules

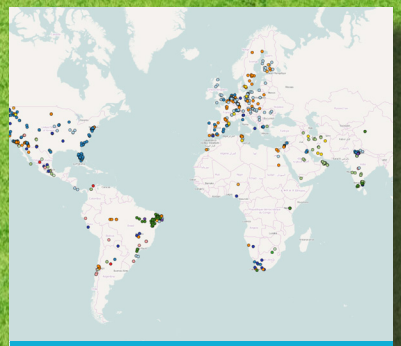


TRANSBOUNDARY GROUNDWATER

Political, institutional, socio-economic, cultural and other differences between neighbouring countries complicate the assessment and management of internationally shared aquifers. As a United Nations centre, IGRAC provides independent content and process support for the assessment of transboundary aquifers (TBAs).

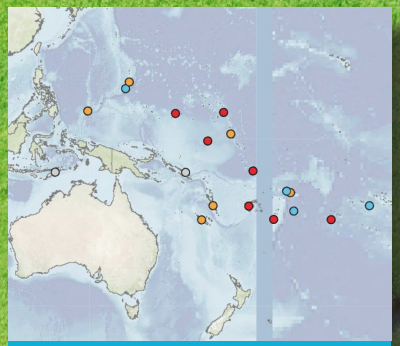
GLOBAL COUNTRY DATA

Under the theme of global country data IGRAC provides groundwater related data and information per country, rather than at aquifer level. The Global Overview provides a map based review of the groundwater conditions per country through aggregated groundwater-related data, while Country Briefs provide clear overviews of information per country.



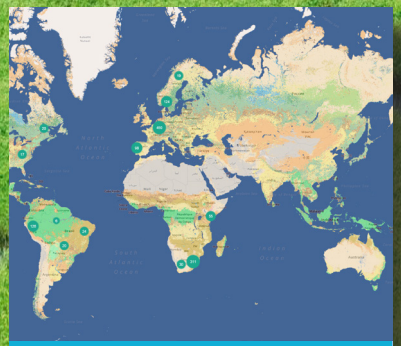
MANAGED AQUIFER RECHARGE

Managed Aquifer Recharge (MAR) offers viable solutions for sustainable water management. Many existing MAR schemes offer excellent best-practice examples which can be useful for planning and implementation of new projects. The MAR module contains detailed information on MAR sites around the world and regional maps on MAR suitability.



SMALL ISLANDS

The geophysical and socio-economic setting of many Small Island Developing States (SIDS) makes them vulnerable not only to extreme climatological and seismic events but also to periods of low recharge and adverse environmental impacts, including pollution, saline intrusion and soil erosion. The SIDS module presents aggregated information on various hydrogeological, environmental and socio-economic aspects of these islands.



GROUNDWATER MONITORING

The state of groundwater resources needs to be monitored regularly to provide a basis for quantitative and qualitative resource assessment, which forms the basis for informed management actions, development and evaluation of policies, etc. Recognizing the need for a systematic collection of groundwater data, IGRAC took the initiative to establish the Global Groundwater Monitoring Network (GGMN).

PROJECT RELATED MODULES

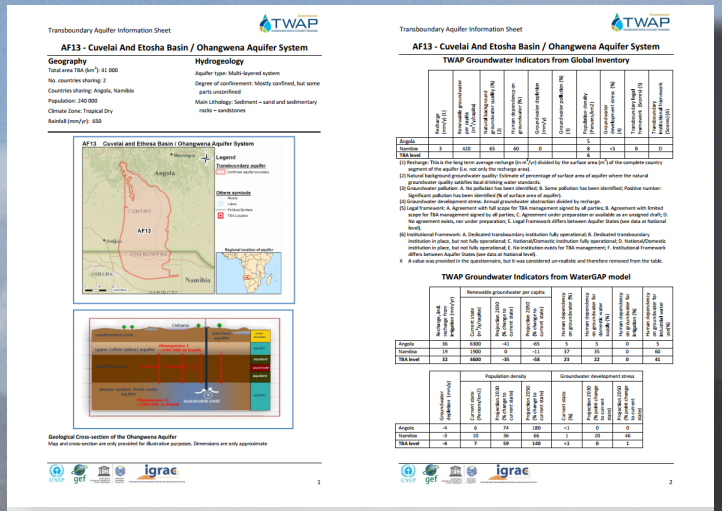
Within several projects, IGRAC has provided a project Information Management System (IMS). These project IMS's are independent modules of the GGIS and provide stakeholders with an online platform to consistently collect, organise, analyse and disseminate project-related information.

TRANSBOUNDARY GROUNDWATER

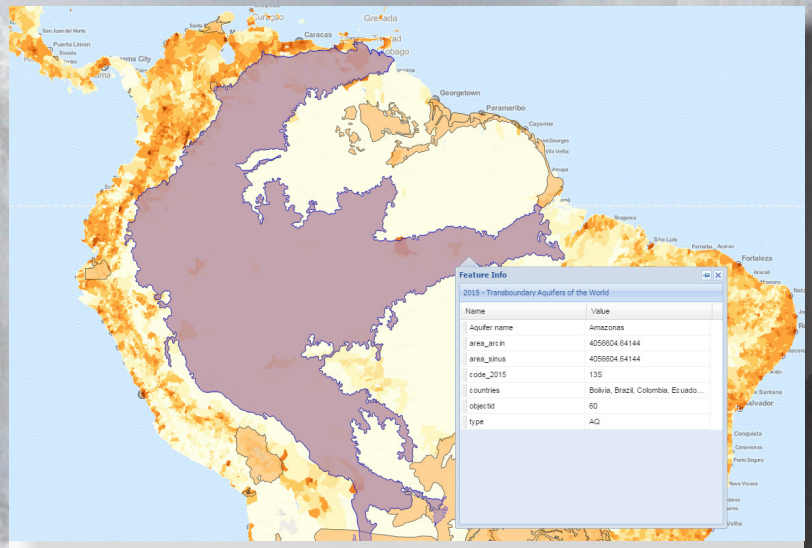
Political, institutional, socio-economic, cultural and other differences between neighbouring countries complicate the assessment and management of internationally shared aquifers. As a United Nations centre, IGRAC provides independent content and process support for the assessment of transboundary aquifers.

The GGIS provides access to the online versions of the Transboundary Aquifers of the World Map. The TBA map (2015) is based on the most recent results of an inventory of many projects carried out around the world. It contains information on the occurrence and extent of transboundary aquifers.

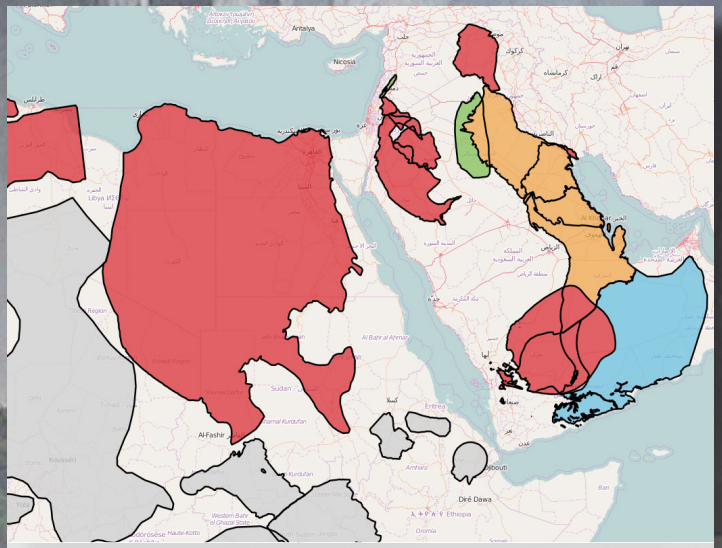
This GGIS provides access to the map based results from the Groundwater component of the Transboundary Waters Assessment Programme. It contains aggregated information on parameters and indicators for 199 selected aquifers. The project results are envisioned to assist the GEF and other international organizations in setting priorities for supporting the conservation of transboundary groundwater systems. The data shown in this portal have been made available by national experts from countries involved in the TWAP Groundwater project. It also includes the results from scenario analyses using the global WaterGAP model (University of Frankfurt, Germany).



Aquifer briefs give more information about aquifer type, degree of confinement and the main lithology



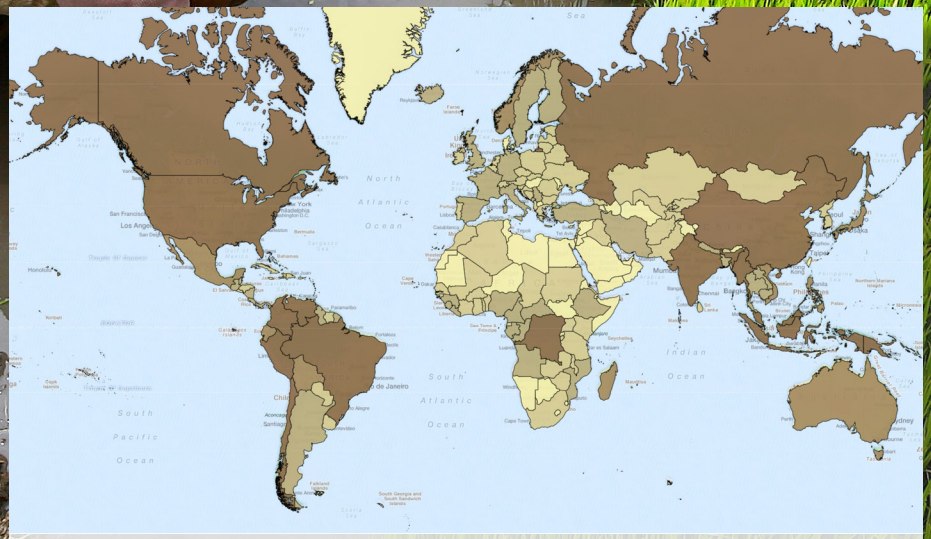
GGIS allows users to make overlays and gives information on aquifer level



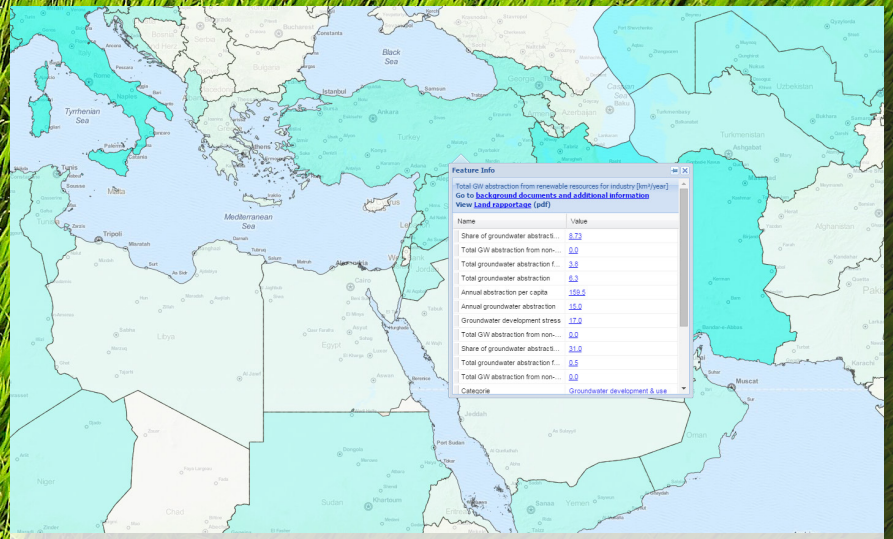
GGIS shows several current state indicators

GLOBAL COUNTRY DATA

The Global Overview (GO) provides a general review of the groundwater conditions per country. It contains a set of aggregated groundwater-related attributes for each country and enables comparison of groundwater characteristics between countries and identification of global patterns. The database contains more than 70 attributes, divided into various categories (groundwater development, management, agriculture and economics, etc.). To compile these data sets, IGRAC made use of publicly available information found on the internet, in publications, reports and maps.



Global Overview enables users to compare groundwater characteristics between countries



Global Overview shows aggregated groundwater information on country level

MANAGED AQUIFER RECHARGE

Managed aquifer recharge (MAR) represents a viable method for sustainable (ground)water management, by increasing the available amount of fresh water. Many existing MAR schemes offer excellent best-practice examples that can be useful for planning and implementation of new projects. The MAR Portal contains detailed information on MAR sites around the world as well as a regional maps on MAR suitability. By facilitating access and promoting international sharing of information and knowledge on MAR, the MAR portal encourages stakeholders to consider MAR as a viable solution for sustainable groundwater resources development and management.

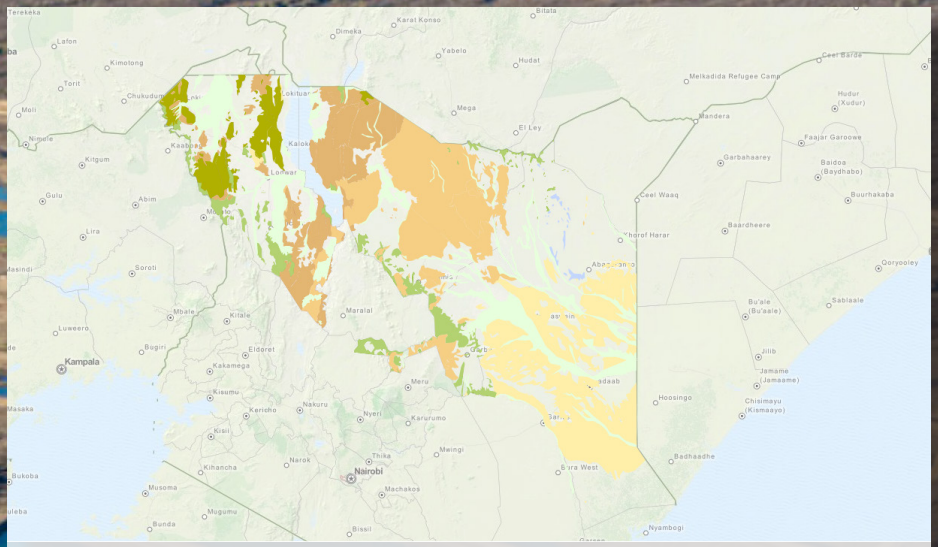
GLOBAL INVENTORY OF MAR SCHEMES

About 1200 case studies from over 50 countries from around the whole world were collected, analysed and compiled in the first global inventory of MAR schemes. The inventory contains information such as site name, location, MAR type, year of scheme deployment, the source of infiltration water, the final use of abstracted water, as well as the main objectives of the project. New information will be collected and uploaded to the portal as it comes available.

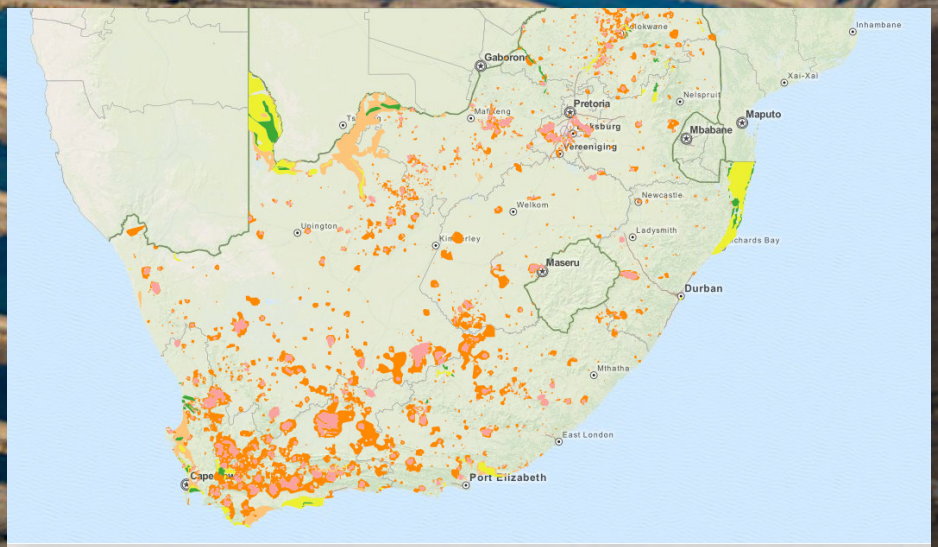
The global MAR inventory is the result of work by a team of researchers from the INOWAS research group from TU Dresden, a consortium of researchers collaborating within the framework of the EU-funded project DEMEAU, IGRAC and the IAH MAR Commission.

MAR SUITABILITY MAPS

MAR can be used to improve water security and resilience to droughts. The selection of suitable locations may however not be a simple task as there are many aspects which need to be considered. These include landscape characteristics, soil and aquifer properties, and the availability of excess surface water. Regional MAR suitability maps are collected and shared within the portal. Specialists are encouraged to share regional maps indicating MAR suitability to improve accessibility to this information and provide guidance for MAR suitability.



MAR potential map for North Kenya



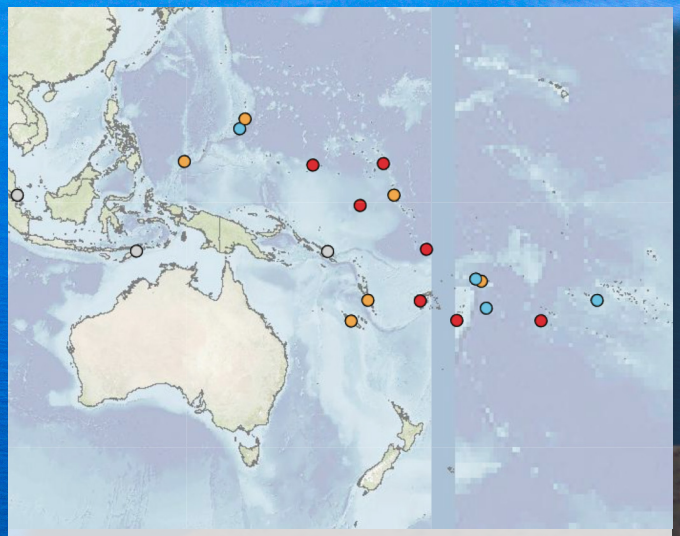
MAR potential map for South Africa

SMALL ISLANDS

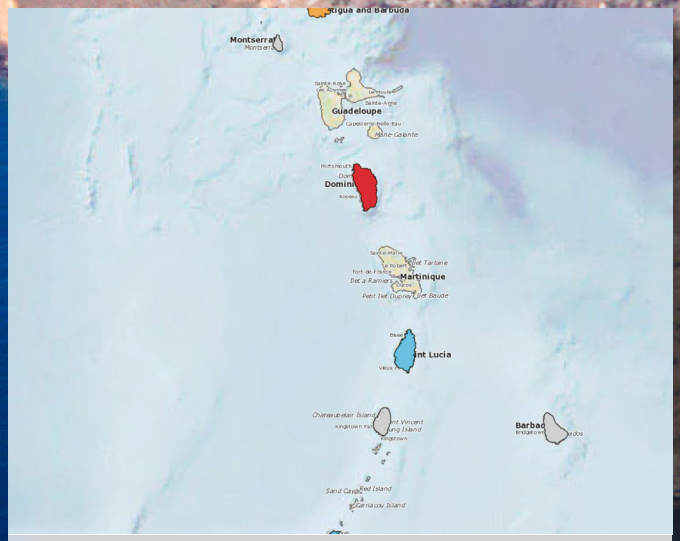
Small Island Developing States (SIDS) have special physical and socio-economic features. Their often very small surface area, shortage of natural resources (arable land, freshwater, minerals and conventional energy sources), geological and orogenic complexity, isolation and widespread nature of their territories, and exposure to natural disasters (typhoons, hurricanes, cyclones, earthquakes, volcanic eruptions and tsunamis) complicate the assessment, development and management of the available freshwater resources. The geophysical and socio-economic setting of many SIDS makes them vulnerable not only to extreme climatological and seismic events but also to periods of low recharge and adverse environmental impacts, including pollution, saline intrusion and soil erosion.

SIDS VIEWER

The SIDS viewer provides groundwater related information on Small Island Developing States. At present the system contains mainly information derived from the Transboundary Waters Assessment Program (see next page) on 43 SIDS. The data include indicators describing the hydrogeological, environmental, socio-economic and governance dimensions of the SIDS groundwater systems. The data have been derived from questionnaire surveys and an extensive desk-top study executed by the Simon Frasier University (Canada) and coordinated by UNESCO-IHP. Data in the system can be explored and analysed using a map based viewer, which is particularly useful to make comparative analyses of multiple SIDS. Additionally SIDS information sheets are also available providing clear overviews per SIDS. Further data on SIDS will be collected and uploaded into the SIDS viewer as they become available.



SIDS viewer showing the indicators for Pacific SIDS



SIDS viewer showing the indicators for Caribbean SIDS

GROUNDWATER MONITORING

The Global Groundwater Monitoring Network (GGMN) is a participative, network of networks, set up to improve quality and accessibility of groundwater monitoring information and subsequently improve knowledge on the state of groundwater resources. The GGMN aims at bringing groundwater professionals together to share groundwater monitoring information. The web-based portal, also under the name of GGMN, is a tool to upload, share and analyse groundwater monitoring information at a global, regional or national scale. GGMN is a UNESCO programme, implemented by IGRAC and supported by many global and regional partners.

THE GGMN PORTAL

The GGMN portal provides insight on the availability of groundwater monitoring data in space and time. Groundwater level data and changes in groundwater levels can be displayed on a regional scale. Additional data layers and information are available to analyse the monitoring data in a broader water-related context.

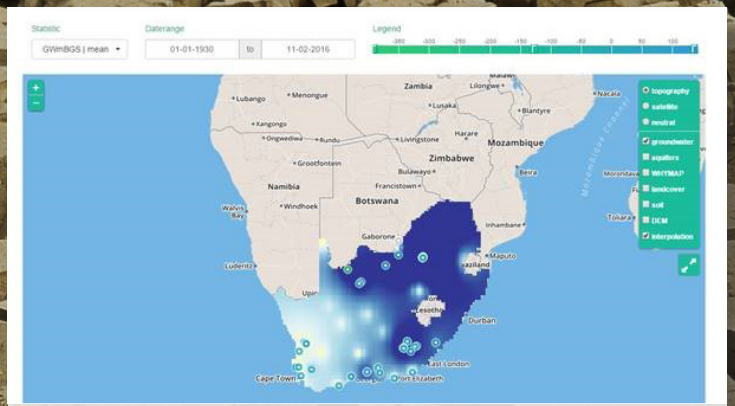
The web-based software application assists users in the spatial and temporal analysis of monitoring data. The system is integrated with QGIS to process data offline. QGIS is an open source and freeware Geographic Information System with a variety of functionalities to analyse data and create spatially interpolated groundwater level maps.

YOUR GGMN PORTAL

Member states which are interested in making use of the GGMN are provided with a password protected environment within the GGMN application. This allows users to upload, interpolate and analyse the groundwater data using the following options:

1. Representative groundwater point measurements can be uploaded to the protected environment. Alternatively, measurements can be transferred from a national system via web services.
2. Data can be displayed showing the mean, range or change in groundwater level for a selected time period.
3. The GGMN is integrated with QGIS to process data offline. Point measurements can be combined with proxy information and personal expertise to create groundwater level maps. Produced groundwater maps can be shared via the online GGMN Portal.
4. Time series analysis can be performed for each point measurement location to better understand temporal changes of groundwater levels. The time series analysis is a step-by-step procedure to identify trends, periodic fluctuations and autoregressive model. Time series analysis helps defining optimal monitoring frequencies, one of the key components of groundwater monitoring network design.

The recently launched GGMN Portal 2.0



The new GGMN Portal enables user to interpolate groundwater data

THE GGMN PEOPLE NETWORK

The GGMN relies on the participation of groundwater specialists with knowledge of regional hydrogeology. Regional (spatial) interpolation of groundwater point measurements is much more than a numerical interpolation and averaging process. It needs to be carried out by regional experts with a clear understanding of local hydrogeological conditions, existing monitoring practices, historic developments, socio-economic changes and other relevant factors. Therefore, establishing a network of regional groundwater specialists is the key task of the GGMN.

The GGMN operates according to principles of the World Meteorological Organization (WMO) and UNESCO with the aim of encouraging the widespread use of hydrological data for national, regional and global studies. Members and other data providers are encouraged to contribute to the GGMN, quality controlled groundwater data.

The long-term ambition of the GGMN is to provide an online overview of global groundwater changes. If you would like to make use of the GGMN application, or to simply contribute with groundwater data, please contact us for more information.

PROJECT RELATED MODULES

IGRAC provides Information Management Systems (IMS) to a variety of projects, like the TWAP, GGRETA and RAMOTSWA project. Those IMSs are designed to store interpreted and processed data from the assessment of the groundwater resources in order to be used as a tool to support decision makers and to create transparency between the (international) stakeholders. The project IMSs can be set up in such a way that they facilitate sharing of data between project partners only, and/or with the general public.

PROTECTED AND PUBLIC WORKSPACE

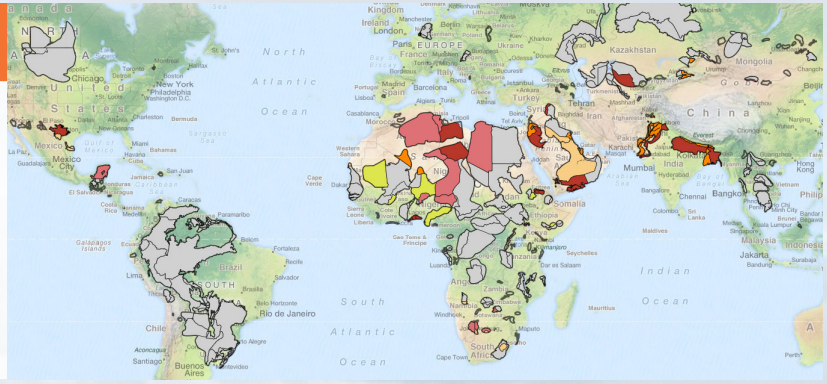
A project-IMS consists of a public viewer, freely accessible to anyone with internet access, and a password-protected environment, exclusively available to registered and authorised project partners. This additional functionality allows project partners to share, visualise, analyse and discuss results before making the data publicly available. This can facilitate processes such as harmonization of maps, sharing of draft maps during the course of the project or even sharing of sensitive information with a group of people. The project coordinator(s) can decide for each individual thematic map if this should be shared publically or only with authorised users.

SYSTEM SUPPORT

IGRAC provides technical support to GGIS users. Information stored in the GGIS is maintained by IGRAC and therefore the long-term online availability of data and of the assessment results - also after completion of the project - is guaranteed.

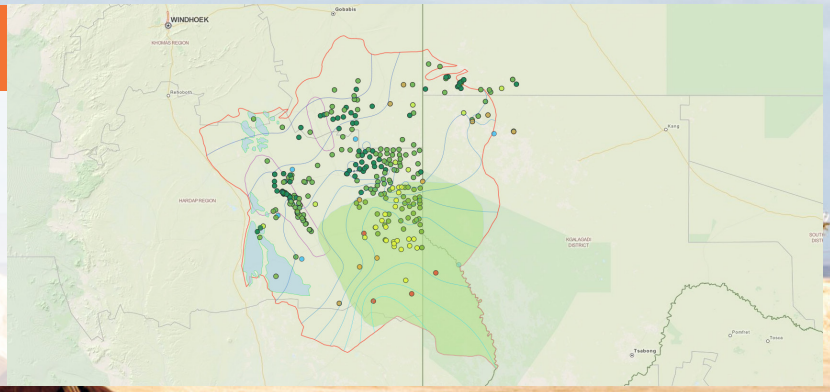
TWAP IMS

The IMS of the groundwater component of the Transboundary Waters Assessment Programme (TWAP) provides aggregated information for 199 selected transboundary aquifers (mainly aquifers larger than 5000 km2) and for 43 Small Island Developing States (SIDS). The data include indicators describing the hydrogeological, environmental, socio-economic and governance dimensions of the transboundary aquifers.



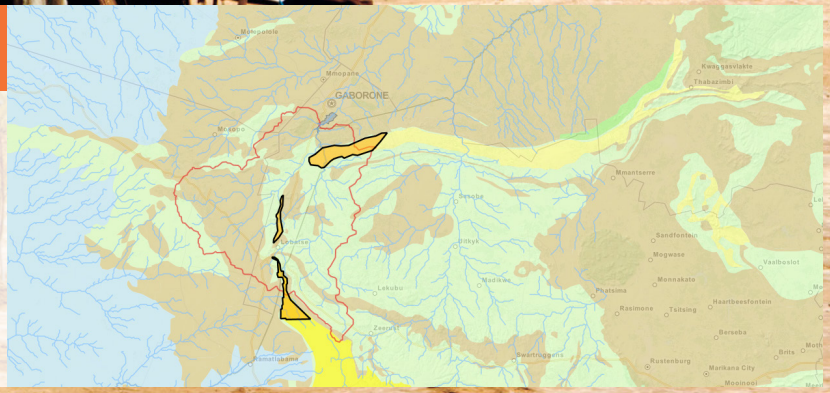
GGRETA IMS

The main objective of the Governance of Groundwater Resources in Transboundary Aquifers Information Management System (GGRETA IMS) is to provide stakeholders with an online platform to consistently collect, organise, analyse and disseminate the information collected for the TBA assessment. This IMS operates as a data and information sharing platform between the countries for the assessment and governance of the transboundary aquifer.



RAMOTSWA IMS

The RAMOTSWA Information Management System (IMS) is a platform developed for the 'Potential Role of the Transboundary Ramotswa Aquifer' (RAMOTSWA) project, focussing on one of the most important shared aquifers in the Limpopo Basin: The Ramotswa Aquifer, shared between Botswana and South Africa.



YOUR PROJECT IMS

The modular set-up of the system allows for an easy development of a dedicated IMS for new projects. A new IMS can be developed as a stand-alone application or, if preferred, further integrated with existing modules available in the GGIS. In the last years, the GGIS has demonstrated its capacity in transboundary aquifer assessment projects. Shared information systems among countries have facilitated joint management and better groundwater governance focused on coordination, scientific knowledge, social redress and environmental sustainability.

The GGIS is designed, implemented and maintained by the International Groundwater Resources Assessment Centre (IGRAC), and is accessible via: https://ggis.un-igrac.org.

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