

Global Monitoring of Groundwater Resources

Groundwater resources are vital for drinking water supply, irrigation, the sustainability of wetlands and rivers as well as many other important issues, including climate change adaptation. The state of groundwater resources needs to be monitored regularly to provide the basis for the assessment and prediction of their quantity and quality. Hence, water management decisions rely strongly on availability and quality of monitoring data.

Groundwater is monitored in many parts of the world by measuring groundwater levels, groundwater abstraction rates, spring discharge and groundwater quality. These point measurements are often interpolated and combined with other data (e.g. coming from remote sensing and modelling) to assess and predict the state of groundwater resources.

There is however, a lack of information on groundwater monitoring at regional and global scale, hampering assessment and informed water management internationally. Therefore IGRAC decided to

establish the

Global Groundwater Monitoring Network (GGMN).

The GGMN consists of two components: The GGMN People Network and the GGMN Portal (a web-based software application).

The GGMN People Network

The GGMN relies on the participation of groundwater specialists, with knowledge of regional hydrogeology. Regional (spatial) aggregation 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 challenge of the GGMN.

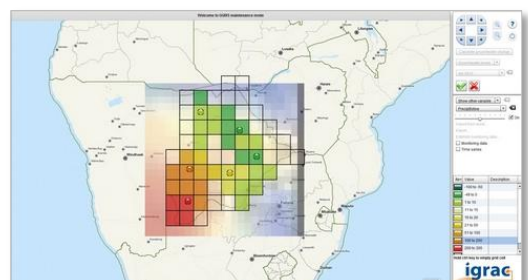
The GGMN Portal

A web-based software application assists in the analysis of monitoring data and provides insights into changes occurring in groundwater resources worldwide.

The GGMN portal has a public view mode where monitored and spatially aggregated data can be displayed and analysed at a national scale. Changes to groundwater over time also can be calculated and visualised at a regional and the global scale.

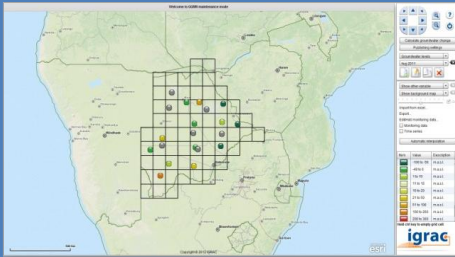
Groundwater specialists, who are members of the GGMN People Network, can access the country-dedicated workspace of the portal. This 'maintenance mode' allows users to upload, interpolate, aggregate and analyse the groundwater data from their country and to optimise the country monitoring network.

In practice, groundwater data are stored in many different formats, from paper forms to advanced online systems. Therefore, the GGMN portal allows data to be uploaded in various ways (directly on the screen, via simple spreadsheets, web-based services, etc).

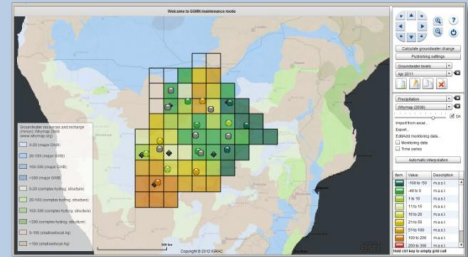


Data processing in 'maintenance mode'

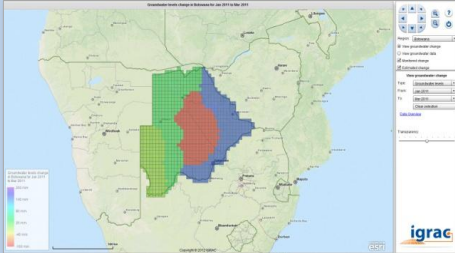
1. Representative groundwater point measurements and other relevant 'proxy' info (such as precipitation or demography maps) are uploaded. Alternatively, the measurements can be transferred from a national system via web services.



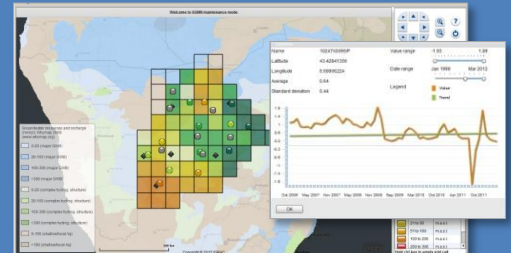
2. Point data are spatially aggregated per grid cell using customised grid overlays. Automatic interpolation can be used as a first step to interpolate available point data. However, final adjustments are made manually, using available proxy information and personal expertise.



3. The GGMN Portal enables users to periodically produce online maps showing groundwater changes over time on a regional scale.

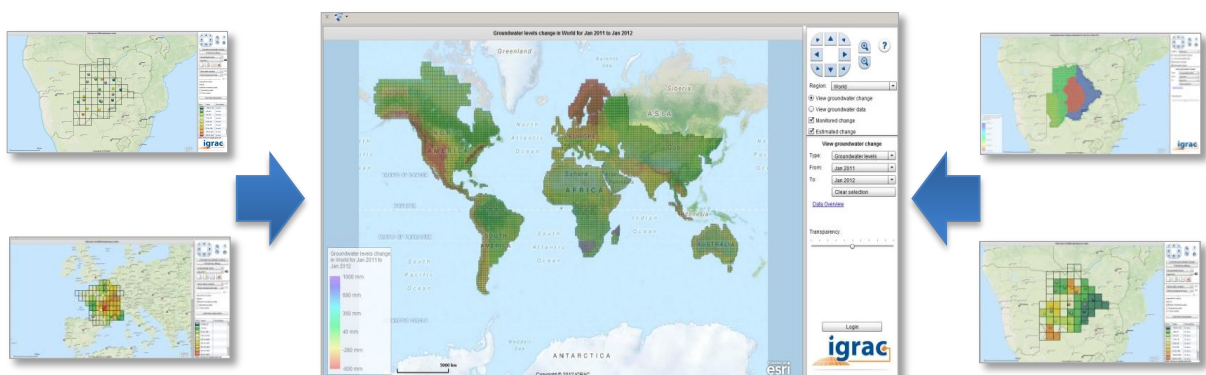


4. Timeseries analysis can be performed for each point measurement location. This functionality is currently being extended to also allow for the optimisation of monitoring frequency.



Using the 'public view mode'

This mode is meant for the general public, including researchers, consultants, teachers, policy makers and NGOs. It combines the resulting country-based aggregations in order to create a regional and global picture of the state and changes of groundwater resources. With permission from countries and data owners, the data sets can be used for calibration and verification of numerical models and remote sensing data.



1. PARTICIPATORY MONITORING

National online systems

Data & additional info

National archives

2. COUNTRY-BASED STORAGE & PROCESSING

Data entry

Back-ground maps

Estimation of spatial variability

Time series analysis

Regional Groundwater Knowledge

3. GLOBAL VISUALISATION AND ANALYSIS

Regional assessment

Global assessment

**RELIABLE ASSESSMENT AND PREDICTION
OF STATE OF GROUNDWATER RESOURCES**



The kick-off of the GGMN Programme Utrecht, The Netherlands, October 2007

Regional workshops

Regional workshops are organised to strengthen and expand the GGMN People Network in data sparse areas. Since these areas often lack an online monitoring database, the GGMN Portal can be fully employed. The workshops are designed for regional groundwater specialists to become familiar with the GGMN Programme and with the functionality of the GGMN portal.

The participants in the workshop have the opportunity to discuss the programme with their peers from neighbouring states, with whom they may share one or more aquifers. After the workshop, the country specialists continue to serve as GGMN focal points who will collect, process (via spatial aggregation and estimation) and analyse groundwater data on a regular (monthly) basis.

Providing an online database

Many countries already have online databases but currently a very few provide open-access to groundwater data. In collaboration with the countries championing international data sharing, IGRAC is establishing automated data flows between the national databases and the GGMN. Other countries are encouraged to follow these examples. In the meantime, they can join the People Network and upload measurements into the GGMN portal themselves. The countries (data owners) retain complete control over data supplied to the GGMN.



The GGMN Regional workshop for the Horn of Africa, Nairobi, Kenya, June 2012

Would you like to join the GGMN People Network and contribute to better monitoring, assessment and management of the World's groundwater resources?

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