ECV T03

GLOBAL TERRESTRIAL NETWORK FOR GROUNDWATER (GTN-GW)

by Jay Famiglietti

Groundwater accounts for nearly 30 percent of global fresh water resources. Today, some 2 billion people rely on groundwater as a primary source of drinking water and for other uses, such as agriculture. However, in many regions of the world, available groundwater resources are under stress due to a number of factors, including groundwater depletion (when withdrawal rates exceed recharge rates), salinization and contamination. When coupled with the pressures of changing climate (including the potential for redistribution of the amounts and locations of groundwater recharge) and population growth (which will result in increased water demand) the stresses on groundwater supplies will only increase in the decades to come.

LACK OF GROUNDWATER DATA

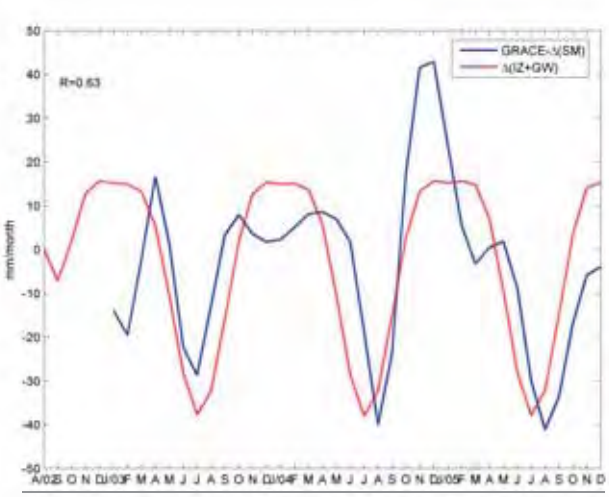
In spite of its importance to the world's fresh water supply, groundwater remains poorly monitored on a global basis. In developing countries, where groundwater often accounts for the bulk of the fresh water supply, monitoring is not well established. Moreover, in developed countries, many groundwater monitoring programmes are being downscaled. In short, no comprehensive, global framework for monitoring groundwater storage and quality currently exists.

MONITORING SYSTEM CONCEPT

A concept for a global groundwater monitoring system includes *in situ* well observations as a foundation, supplemented by satellite observations of groundwater storage changes (e.g. from GRACE and InSAR) and by outputs from regional groundwater models for the world's major aquifer systems and from global hydrologic models. The synergistic use of these information types can yield a consistent picture of the current state of global groundwater storage and its variations, and will help improve predictive model forecasts of groundwater availability in future decades.

COORDINATED EFFORT

Such an ambitious effort will require significant international cooperation and coordination of ongoing efforts. Recently, a critical step towards a global terrestrial network on ground water (GTN-GW) was taken in the form of a Global Groundwater Monitoring System (GGMS). A first workshop on Global Monitoring of Groundwater Resources, jointly sponsored by IGWCO, GARS and UNESCO, was held 18–19 October 2007, at the International Groundwater Resources Assessment Centre (IGRAC) in Utrecht, the Netherlands. An important outcome of the meeting was support for IGRAC as the lead institution for the development of the GGMS as a network of networks. At present, IGRAC plans that GGMS will archive monthly data using 1º global grids. Data will be



Remote sensing of groundwater in Illinois, USA, using GRACE; the blue line shows a GRACE-based estimate; the red line is from observed groundwater well levels; the time series are shown as seasonal cycles (*Source*: P. Yeh, S. C. Swenson, J. S. Famiglietti and M. Rodell)

Nearly one third of the world's population relies on groundwater for its major source for drinking water, yet globally the amount of available groundwater, and how it is changing, remains highly uncertain

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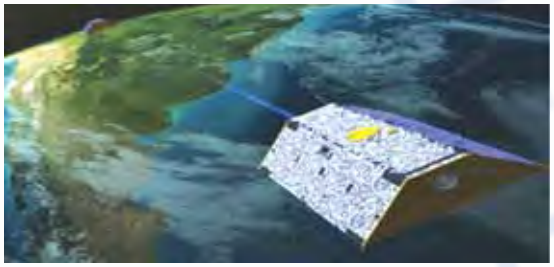
provided on a by-country basis, and will be uploaded by national experts via a user-friendly Web interface. Candidate groundwater variables and hydrogeologic parameters for inclusion in the GGMS were discussed, and include: groundwater level, groundwater abstraction, salinity and other indicators of water quality, storage coefficients, well head elevation, screen depth, and local aquifer characteristics, including aquifer type, thickness and whether measurements are for confined or unconfined units.

INTERNATIONAL PARTICIPANTS AND PARTNERS

The success of any GTN-GW will depend on coordination among several existing agencies, universities and ongoing activities. These include, but are not limited to: ESA, GARS, GEMS/Water, GRAPHIC, GRDC, GTN-(H,L,P,R), IAEA, IGRAC, IGWCO NASA/Goddard Space Flight Center, TU Delft, UNESCO, USGS, University of California (Berkeley, Irvine, USA), University of New Hampshire (USA), VU Amsterdam (the Netherlands) and WHYMAP.



The Gravity Recovery and Climate Experiment (GRACE) twin satellites

NEAR-TERM PRIORITIES

In order for IGRAC/GGMS to mature into the role of a full GTN-GW, several near-term priorities were identified at the Utrecht meeting. First, the broader groundwater hydrologic community will have an opportunity to provide feedback to the workshop group regarding its recommendations, after publication of the workshop report. Second, GGMS capabilities should be demonstrated using readily available data from existing monitoring efforts, modelling and remote sensing products, with a focus on regional hotspots where groundwater resources are under stress. Finally, as GGMS evolves, potential users from around the world must learn of its existence via user workshops in conjunction with upcoming international conferences, such as the UNESCO groundwater conferences in Kampala, Uganda, and in Irvine, California, USA, in June and December of 2008, respectively.

CRITICAL VARIABLES FOR A GROUNDWATER MONITORING STRATEGY

- **Groundwater level**
- **Groundwater abstraction**
- **Salinity and other water quality variables**
- **Well head elevation**
- **Screen depth**
- **Aquifer (hydrogeologic) unit**
- **Aquifer type**
- **Aquifer thickness**
- **Specific yield/specific storage**
- **Transmissivity**