

Water Resources

Objective

To enable Member States to sustainably use and manage their water resources through the use of isotope technology.

Raising Awareness of Water Issues and Improving Dissemination of Isotope Information

In 2008, the Agency made special efforts to disseminate the results of its work in the area of water resources to the public and experts in Member States. For example, it screened a film entitled *Search for Water* at the International Exposition on Water and Sustainable Development (EXPO 2008), held in Zaragoza, Spain. Also available at <http://www.iaea.org/NewsCenter/Multimedia/Videos/Isotopehydrology/index.html>, the film describes challenges in water resources management and introduces the topic of isotope hydrology in a manner that is understandable to both scientists and laypersons. More than 15 000 people visited the Agency's exhibit at Zaragoza, which included displays, posters and other information.

The Agency co-sponsored an international conference in Kampala, Uganda, on Groundwater and Climate in Africa. The Agency's contribution

helped elucidate the use of isotopes for understanding the impact of climate change on groundwater recharge. The conference was the first to discuss the role of groundwater in improving livelihoods in Africa under conditions of rapid development and climate change (Fig. 1). The main outcome of the conference was the creation of a roadmap for policy makers on how to adapt to the impacts of climate change on water resources. In addition, the conference emphasized the need for increased regional cooperation in water resources assessment.

The Agency published two technical documents containing the results of projects that were completed in 2008. The first highlights the results of individual country studies in

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Latin America conducted within the framework of regional technical cooperation projects and describes the application of isotope methods for characterizing hydrological systems and improved water management decisions. The second, on the characterization of submarine groundwater discharge (SGD) in coastal zones, describes the results of a CRP completed in 2008 jointly with IAEA-MEL. Among the major conclusions: isotope approaches are effective for identifying SGD and for quantifying the rates of discharge. Although SGD is not considered to be significant on a global scale, it



FIG. 1. Access to fresh water is expected to be affected by climate change in many areas. Isotope techniques can be used to map current water resources and assess their sustainability.

can be a large component on a regional scale and an important pathway for coastal pollution from land based activities.

The results of data analysis following an isotope survey (covering radon-222, tritium, stable oxygen, hydrogen and nitrogen isotopes) of the Danube River, conducted in collaboration with the International Commission for the Protection of the Danube River, were published in 2008 in the *Final Scientific Report of Joint Danube Survey 2*. In addition to serving as a baseline for monitoring the impact of climate change on river hydrology, the isotope data reveal that: (a) areas of groundwater input to the rivers can be identified; (b) nitrate pollution is mainly from natural organic matter in the soil and anthropogenic waste, rather than from atmospheric nitrogen and fertilizers; and (c) mixing of tributary waters in the main Danube channel may be relatively slow, occurring over a distance of several kilometres. These findings improved the understanding of river hydrology and nutrient sources, and contributed to more effective cooperation to meet the European Union's Water Framework Directive goals.

Strengthening Capacity and Advancing Isotope Hydrology Applications

The funds available for water resources projects in the Technical Cooperation Fund amounted to

over \$8.7 million in 2008. With this, the Agency supported over 80 active technical cooperation projects in Africa, Asia, Europe and Latin America to improve the management of groundwater and surface water and to address contamination issues. For instance, the Agency completed a technical cooperation project to characterize the hydrology of the Guarani Aquifer, shared by Argentina, Brazil, Paraguay and Uruguay, in cooperation with the Global Environmental Facility, the World Bank and the Organization of American States. The partners

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in this project collected new information on the source and movement of groundwater in this extensive aquifer system using isotope and geochemical data. This information led to the

construction of a better database for modelling the aquifer system so that appropriate shared resource management policies can be adopted.

An important component of the Agency's technical cooperation programme is providing training and building capacity in developing Member States. For example, in 2008 the Agency organized an isotope hydrology regional training course for counterparts from French speaking countries in Africa, in Rabat, Morocco. Another advanced regional course, held in Budapest, on the application of isotope techniques, in cooperation with the Environmental Protection and Water Management Research Institute and the Research Centre for Water Resources Development in



FIG. 2. The availability of isotope data is expected to improve through the routine use of laser based isotope analysers, which are cheaper and easier to use than conventional mass spectrometers.

Hungary, trained participants from south-eastern European countries in isotope hydrology and groundwater flow and transport modelling.

The Agency completed a CRP on the application of isotopes to understand water and carbon cycle dynamics in the atmosphere. Nine countries participated in the collection of over 10 000 samples of atmospheric moisture and plant water at 51 field sites. The results helped to improve the understanding of water and carbon cycle processes, particularly to quantify carbon and evaporation fluxes from land surfaces. Quantification of these fluxes provides a means to validate general circulation models used for simulating the impact of climate change on the water cycle.

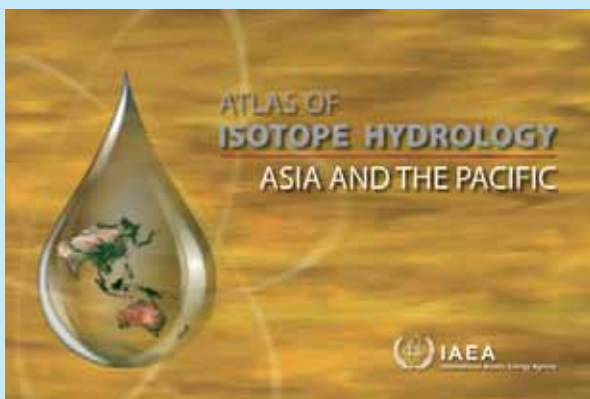
The Agency achieved a milestone in building Member State capacity for the isotope analysis of

water samples. Eleven Member States¹ received a laser instrument that was tested and adapted by the Agency in a technical cooperation project (Fig. 2). The instruments, which are now operational, were installed by counterparts who had earlier received hands-on training in their installation and operation.

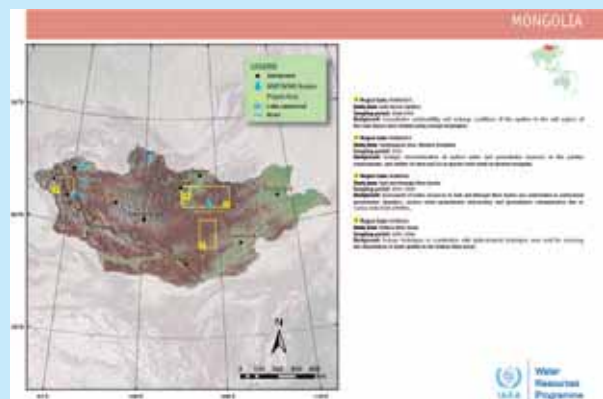
The IAEA Isotope Hydrology Analytical Network (IHAN) supporting the analytical needs of technical cooperation projects, CRPs and global isotope networks was expanded with new laboratories from Mexico and Vietnam.

¹ Albania, Argentina, Croatia, Ethiopia, Lebanon, Mexico, Thailand, Tunisia, Uganda, Venezuela and Vietnam.

New isotope hydrology atlas — Improving water management in Member States



Cover page of the atlas.



Example of a project page in the atlas.

Access to environmental isotope data is critical for expanding the application of isotope methods for improved water management. The release in 2008 of the *Atlas of Isotope Hydrology — Asia and the Pacific* followed the 2007 publication of an atlas covering Africa and is an important step in making existing isotope data available to Member States. These data were compiled from 105 Agency projects in 16 countries in Asia and the Pacific to produce the atlas. Nearly 16 000 isotope records were compiled from technical cooperation projects and CRPs conducted between 1973 and 2007. The atlas features a digital elevation map for each country in the region showing project areas, major water bodies and the locations of stations in the Agency's global network of isotopes in precipitation (GNIP). Summary pages for each project include a higher resolution map of the study area showing sample types and locations as well as isotope data tables and plots. The isotope information presented in the atlas is a valuable reference to scientists, practitioners and policy makers engaged in the field of hydrology. It can be downloaded from <http://www.iaea.org/water>.