



# Isotope hydrology:

## Water resources assessment and management



**IAEA**

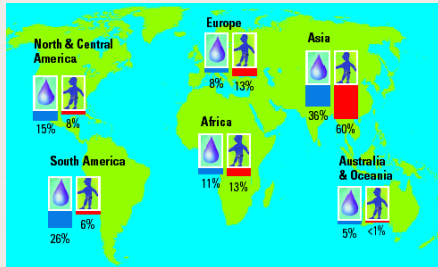
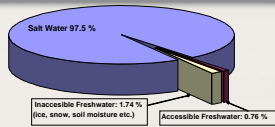
International Atomic Energy Agency

Luis Araguás

Isotope Hydrology Section



## Unequal distribution and stress on limited freshwater resources




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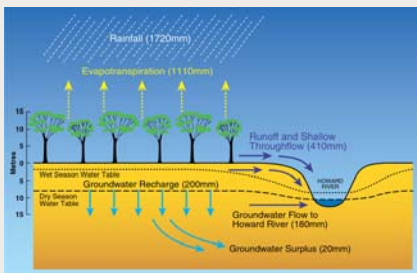
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## Water resources assessment



- Quantify resources
- Water balances
- Water quality
- Interactions
- Flow paths
- Recharge
- Age of water
- Vulnerability etc.




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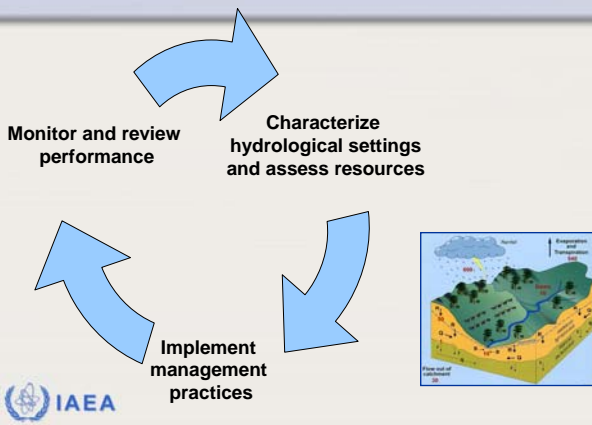
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## Water resources management




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## Programme vision

The Water Resources Programme assists Member States in assessing and managing their water resources in all aspects, with isotope hydrology as an integral part of their scientific and institutional strengths, and it is a premier programme within the UN system



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## Key features of the Programme

➤ Responds to scientific aspects of the Global Water Agenda arising out of international initiatives

- ↪ Improved understanding of the water cycle
- ↪ Sustainable exploitation of water resources
- ↪ Improved data and capacity for monitoring the quantity and quality of water resources



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## Collection and dissemination of global isotope data

The IAEA coordinated a research project during 2003-2006 entitled "Design criteria for a network to monitor isotopic composition of runoff in large rivers" as a preparatory activity for the creation of the GNIR. Isotopic data were collected from about 20 large rivers from headwaters to outlets, providing a reference for continuous monitoring in various sizes of rivers. The contribution and operation of GNIR is done on voluntary basis. Isotope and related data are compiled to the IAEA in a publicly available data repository (ISDR, accessible at [www.iaea.org/water](http://www.iaea.org/water)), which contains data from other IAEA monitoring networks and national hydrology projects. The IAEA will compile data contributions from established river isotope networks and will promote monitoring of rivers in areas with limited isotope data, dominantly in tropical and arid regions.



Global networks monitoring precipitation, river runoff, ice, water vapour, etc.

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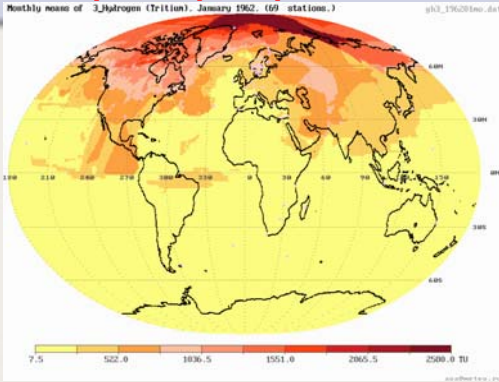
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### Map isotopes in precipitation



Long-term O-18 and monthly tritium concentrations in precipitation 1960-2008

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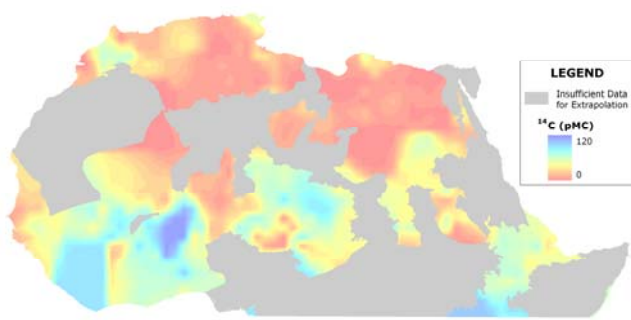
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### Mapping Northern Africa old groundwaters



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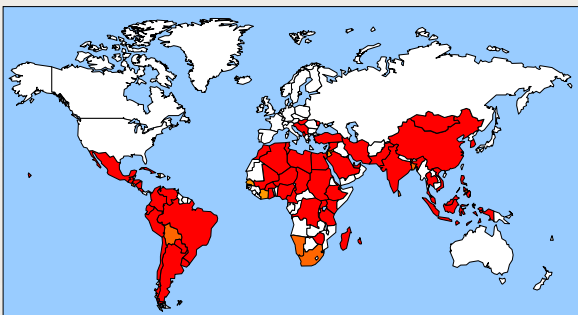
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### Direct support to Member States through Technical Cooperation



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### Mitigation of arsenic contamination of groundwater in Bangladesh

Millions exposed to arsenic in groundwater with serious health risks

Isotopes established natural, pre-irrigation origin of arsenic poisoning, and helped to locate arsenic-safe water

Influenced government's policy on protecting and managing clean, deep groundwater



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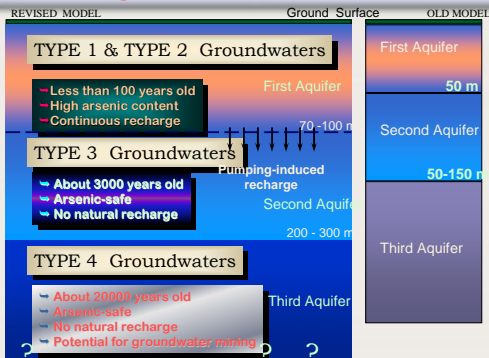
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### Isotope data provided a means to map arsenic-safe groundwater



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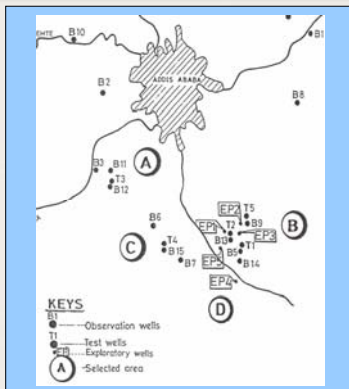
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### Expansion of drinking water supply for Addis Ababa, Ethiopia



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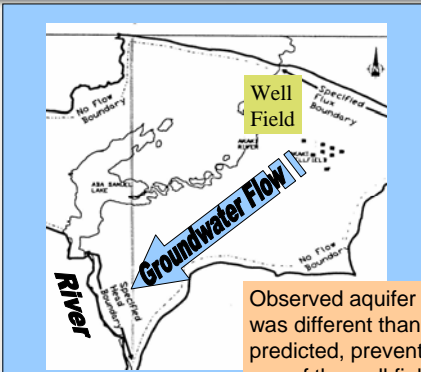
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**A groundwater well field was developed with a \$40 million investment**



Observed aquifer response was different than that predicted, preventing the use of the well field!

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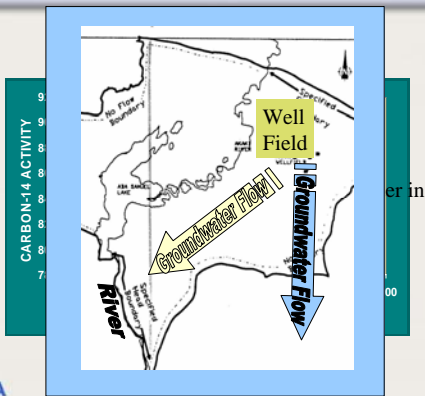
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**Groundwater mapping in Addis Ababa**



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**Guarani transboundary aquifer**

- Largest aquifer in the Americas
- Shared by Argentina, Brazil, Paraguay and Uruguay → 1,200,000 km<sup>2</sup>
- Goal: developing a common institutional framework for managing and preserving the Guarani Aquifer.



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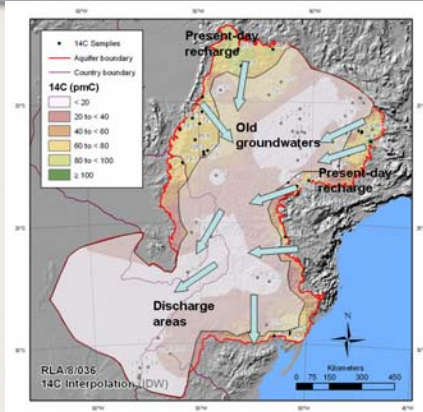
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## Groundwater types in the Guarani



Distribution of carbon-14 activities (pMC) showing main flow patterns, recharge and discharge areas

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## Education/Training in Isotope Hydrology

A collage of educational materials including: 'Isotope Hydrology' website content, a presentation slide titled 'Environmental isotopes in the hydrological cycle: Principles and applications', a slide titled 'Ciclo hidrológico ambiental', and a slide titled 'Programa hidrológico internacional'. A photograph shows two people in a field. The IAEA logo is visible at the bottom left.

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## Technical videos on field and lab methods

A collage of technical video thumbnails from the IAEA Water Resources Programme. Titles include 'Introduction to Water Sampling and Analysis for Isotope Hydrology' and 'INSTALLING, RUNNING, AND MAINTAINING THE LIQUID-WATER STABLE ISOTOPE ANALYSER'. The IAEA logo is at the bottom left.

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