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THE IWAVE METHODOLOGY APPLIED TO IMPROVE THE STATE OF KNOWLEDGE OF WATER RESOURCES IN LATIN AMERICA

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Abstract: This paper presents the first results of the RLA/7/018 Project 'Improving Knowledge of Groundwater Resources to Contribute to their Protection, Integrated Management and Governance' which through the application of the IWAVE methodology (IAEA Water Availability Enhancement Project) proposes strengthening of national capacity to conduct comprehensive assessments of water resources. Four Latin American countries (Argentina, Brazil, Ecuador and Nicaragua) began the identification of national gaps in hydrological understanding, data and information and prepared a work plan to address them. It is expected that the IWAVE approach will help countries become more efficient and effective to meet the different and specific problems related to the management of water resources.

1. INTRODUCTION

Latin America concentrates about one third of the world's renewable water resources, which should ideally meet the demand of its population, which represents about 9% of the world's population. Latin American countries are located over tropical and subtropical ecosystems in which a significant volume of water is produced, thus large river flows are utilized for the purpose of domestic and industrial supply, power generation, transportation, aquifer recharge and as a resource for food, through products obtained from these rivers and tributaries. The sources of groundwater rely on rainfall, which varies from very high values in the forests during the rainy season, with more than 1000 mm in a month, to negligible in arid areas [1]. Groundwater resources in many parts of Latin America are the main or only source of water, providing services for urban supply, development of productive activities and maintenance of ecosystems.

Water demand has increased by 76% (150-265 km^3/year between 1990 and 2004) as a result of population growth (especially urban), the expansion of industrial activity and high demand for irrigation [2]. Water consumption in agriculture accounts for over 70% of total extraction [3].

The paradigms of water resources management in the region have evolved to become major challenges: a) water development through projects aimed at increasing the supply of water, in which each project seeks to maximize its own profit, b) development of separate water sectors, such as irrigation, energy, water and sanitation, tourism, etc., which can create conflicts among users, including environmental issues, and c) integrated water resources management defined by [4] as a process which promotes the coordinated development and management of water, land and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

This integrated management requires water governance, which involves the ability of society to mobilize energies consistently for sustainable development of water resources. That ability to generate adequate policies and implement them requires consensus building, development of consistent management systems (institutions, laws, culture, knowledge, practices and traditions) and the proper administration of the system (participation and social acceptance, and skills development).

The International Atomic Energy Agency (IAEA) is implementing since 2012 a project called the Water Availability Enhancement Project (IWAVE), which aims to enhance the availability and sustainability of freshwater (with emphasis on groundwater) through science-based, comprehensive assessments of national water resources [5]. The project was initially implemented in the Philippines, Oman and Costa Rica, in the form of Pilot Projects, working in close cooperation with national experts and international partners. The experience gained and the achievements of the IWAVE Project in the strengthening of national capacities and in the assessing and managing of water resources in these countries, led to the decision to apply the IWAVE methodology at regional level.

The project IAEA RLA/7/018 Project 'Improving Knowledge of Groundwater Resources to Contribute to their Protection, Integrated Management and Governance' was launched in early 2014 under the auspices of ARCAL, a cooperative agreement to promote nuclear science and technology in the region. Fourteen countries are participating in the regional project, namely: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Mexico, Nicaragua, Paraguay, Uruguay and Venezuela.

The aim of the paper is to present the diagnosis of the state of knowledge regarding the management of water resources in four countries in Latin America, as first results of the implementation of the RLA/7/018 Project in the region.

2. METHODOLOGY

The IWAVE methodology proposes: a) identify national gaps in hydrological data e information, b) determine the expertise, technology and infrastructure support required to fill identified gaps, c) formulate and implement the optimum methodology for utilizing isotope techniques and d) develop an approach for collaborating with other multilateral and bilateral organizations to address the identified gaps.

The RLA/7/018 Project began to develop in four pilot study cases: Argentina, Brazil, Ecuador and Nicaragua. The first task undertaken in the framework of the project was the identification of key institutions should be involved in the project, through conducting workshops with the supervision of a regional expert in each country. The second step was the identification of national or provincial gaps in hydrological understanding, data, and information, and the preparation of the Preliminary Work plan. These tasks were held in a coordination meeting at the IAEA Headquarters in Vienna, which was attended by high level officials of institutions involved in water management from each country.

The remaining countries participating in the project will be trained on the IWAVE methodology from the experience gained in the pilot study cases.

3. RESULTS

Water Authorities, service companies, academic institutions and agencies generating hydrological information were identified in each country. Other institutions able to provide relevant information such as Geological Surveys, Meteorological Surveys, users associations, universities, etc. were also involved in the project in order to carry out joint activities.

Argentina and Brazil focused on capacity building in isotope hydrology at national level. However, considering its geographical extent, identifying and filling gaps in hydrological data and information is performed at a lower level, the province of Buenos Aires (307571 km^2) and the Urucuia aquifer (states of Bahia, Maranhão, Piauí, Tocantins and Minas Gerais, 325954 km^2) respectively. Ecuador (283560 km^2) and Nicaragua (129494 km^2) implement the nation-wide project.

The main gaps identified in the countries can be characterized in general form:

a. Gaps in the hydro-meteorological knowledge: deficiencies in the capturing of existing data (including isotopic data) in different water bodies, insufficient training (with emphasis on isotopic tools) of sampling network operators, few certified laboratories, deficiencies in hydrological and hydrogeological conceptual models, limited use of numerical models and lack of unified hydrogeological maps.

b. Gaps in knowledge of uses of water resources: deficiencies in the capture and validation of data.

c. Gaps in the planning and management of water resources: institutional weaknesses, insufficient development of a conceptual framework linked to integrated management of water resources and lack of predictive models involving global change.

The main actions proposed by countries to fill the gaps in hydrological knowledge and water resource management are shown in Table 1. In general, countries propose similar actions to address the challenge of improving hydrological knowledge; some differences in measures to improve the institutional aspects are appreciated. With regard to capacity building, training of human resources in isotope hydrology and mass balance assessment through the application of isotope tools is expected.

4. CONCLUSIONS

The fact that in some Latin American countries such as Ecuador and Nicaragua, surface water resources are primarily used to meet urban, agricultural and industrial demand, causing shortages in many places and deterioration of water quality, raises awareness in the institutions of the need to develop groundwater resources. Other countries such as Argentina and Brazil, have large territories where intensive use of groundwater is common to meet demand. In all cases, high level officials of the institutions responsible for research and water management, recognize the existence of gaps in hydrological understanding, both institutional and technical, and expressed their commitment to work with the RLA/7/018 Project to improve knowledge of groundwater as part of the strategic planning of the country.

It is expected that the application of IWAVE allows the strengthening of national capacities for the collection, management and interpretation of data on water resources, and help countries become more efficient and effective to meet the different and specific problems related to water resources. In this regard, a significant contribution of the project will be the development of a "roadmap" nationwide for water resource management.

Table 1. Summary of work plan proposed by countries under the IWAVE methodology

ACTIONS	ARGENTINA Buenos Aires Province	BRAZIL Urucuia Aquifer	ECUADOR	NICARAGUA
Interagency survey on existing hydrological information	•	•	•	•
Identification of gaps in hydrological information	•	•	•	•
Filling gaps in hydrochemical and isotopic information	•	•	•	•
Interagency survey on water use information	•	•	•	•
Generating a hydrological database	•	•	•	•
Installing isotope monitoring networks (*)	•	•	•	•
Hydrogeological map / Land use map			•	•
Development of hydrogeological conceptual model	•	•	•	•
Development of numerical model of flow and transport	•	•		
Quantification of the water footprint	•			
Predictive modeling involving global change	•	•		•
Network of certified laboratories		•	•	
Training in isotope hydrology (*)	•	•	•	•
Training on water balances with application of isotope tools (*)	•	•		
Training data management systems (*)	•			
Creation / Implementation of the Water Agenda			•	•
Training of Postgraduate Human Resources in Hydrogeology			•	•

(*) Activity undertaken at national level

REFERENCES

[1] OCTA. Perfil Estratégico Regional para América Latina y el Caribe 2016 – 2021. XV Reunión del Órgano de Coordinación Técnica de ARCAL (2014). http://www.arcal-lac.org/index.php/es/documentos

[2] PROGRAMA DE NACIONES UNIDAS PARA EL MEDIO AMBIENTE, GEO ALC 3. Perspectivas del Medio Ambiente: América Latina y el Caribe. PNUMA (2011). http://www.pnuma.org/geo/geoalc3/

[3] IICA. Promoting competitive and sustainable agriculture in the Americas. Forty-fourth Regular Session of the General Assembly of the Organization of American States (OAS) (2014). http://scm.oas.org/pdfs/2014/CP32384E.pdf

[4] BGWP. Integrated Water Resources Management.Global Water Partnership.Technical Advisory Committee, Background Paper N° 4. (2000)

[5] DUNNING C. Water Availability to be Enhanced through Focus on National Water Resources Assessments. IAEA. Water & Environment News. N° 27 (2010) http://www-naweb.iaea.org/napc/ih/IHS_projects_iwave.html