

Report on the RCA Technical Cooperation Project_46th RCA NRM

Improving Water Resources Management Practices by Enhancing the Regional Collaboration in Environmental Isotope Analysis and Applications RAS7040

- Project Duration: 2022 – 2025
- LC: Viet Nam
- 18 participating Government Parties



PROJECT DESCRIPTION

- **Project Title:** Improving Water Resources Management Practices by Enhancing the Regional Collaboration in Environmental Isotope Analysis and Applications (RCA)
- **Project Number:** RAS 7040
- **Thematic Area:** Water Resources Management
- **Lead Country:** Viet Nam
- **Phase Implementation:** 3rd year
- **Date of Presentation:** May 2024
- **Budget Allocation:** 630.775 Euros
- **Sustainable Development Goal project aims to achieve:** *Ensure availability and Sustainable Management of water and sanitation for all.*

■ Project Objective and Outcome

➤ Overall objective

To enhance the regional capability in **quality** and **quantity** of water resource monitoring for effective development and management of ground - and surface water through the use of isotopic techniques.

➤ Specific Objectives

- Organize regional trainings in water and environmental isotope analysis, data treatment, and modelling for young researchers;
- Standardize monitoring protocols and analytical programmes adapted to regional conditions;
- Help Member States (governmental agencies and stakeholders) to set up national monitoring networks and calibrate water resource models based on isotopic data.

➤ Outcome

Capacity of participating countries enhanced in the use of isotopic techniques for water quality improvement and water resource management

PROJECT ACTIVITIES

➤ In 2023: 02 RTCs and 01 Workshop were held

- RTC on "Enhancing water resources management in the Asian and Pacific region through isotopic techniques: concepts and approaches ", PINSTECH, Pakistan, 7-11 August, 2023: *11 participants from 8 GPs*
- RTC on "Mixing models and complementary approaches to apportion sources of contaminants in a water source", Jakarta, Indonesia, Aug 28-Sept 01, 2023: *16 participants from 10 GPs*



- Workshop on "Current studies on improving water resources management with the use of environment isotopes tracers within the countries in the Asian and Pacific region". Ha Noi, 20-23 Nov, 2023: *27 participants from 15 GPs*

➤ In 2024: 02 RTCs to be held

- RTC on "Groundwater flow and solute transport modelling", Kuala Lumpur, Malaysia, 15-19 July, 2024
- RTC on "Dating groundwater using noble gases and ^{14}C -techniques", Bangkok, Thailand, 5-9 August 2024

Surveys

- National Working Teams have been formed and the study areas have been identified in all participating GPs;
- First groundwater and surface water sampling campaign in dry/rain season was conducted for chemistry and isotopic composition analyses;
- The data obtained are being processed;
- One paper (Viet Nam) was published in the Journal of Hydro-Environmental Research, 2024.

PROJECT EFFECTIVENESS

Output	Indicator and baseline	Targets	Status of achievement
1. Project implementation and monitoring structure established and managed	National project teams identified for each GP	Listed key components in place by end of Q2 2022	Completed

PROJECT EFFECTIVENESS

Output	Indicator and baseline	Targets	Status of achievement
2. Improved skills in isotopic analysis of dissolved nitrogen species in water (NH ₄ , NO ₃), in groundwater dating analysis, and in carbon isotope analysis	<p>Indicators: Numbers of technical staffs trained and skilled of isotopic analysis (competent in using laser N₂O isotope analyser) improved by 2023. Numbers from ILGPs and BLGPs trained on dual stable isotope analysis of NO_x by 2023.</p> <p>Baseline: No research institution from ILGPs and BLGPs is capable of performing dual in stable isotope analysis of NO_x.</p>	<ul style="list-style-type: none"> - 9 technical staffs from ILGPs in the region trained and their skills of isotopic analysis (competent in using laser N₂O isotope analyser) improved by 2023. - 15 researchers from ILGPs and BLGPs trained on dual stable isotope analysis of NO_x by 2023. 	<p>On schedule</p> <ul style="list-style-type: none"> - Progress toward target: 30% - No achievement for isotopic composition of nitrogen in ammonium and nitrate as not many labs in the region are currently equipped with appropriate facilities - 02 TCs held in 2023; The RTC on GW dating using ¹⁴C- and noble gases and carbon analysis to be held in Aug 2024, Bangkok, Thailand.

PROJECT EFFECTIVENESS

Output	Indicator and baseline	Targets	Status of achievement
3. Improved models/development of scenarios for surface water and groundwater management for socioeconomic benefits.	<p>Indicator: - Numbers of researchers from ILGPs and BLGPs trained in water modelling. - Names of numerical models available in GPs by the end of 2025</p> <p>Baseline: Water isotopic calibrated and validated hydrological models are not popular in GPs"</p>	<ul style="list-style-type: none"> - 15 researchers from ILGPs and BLGPs trained in water modelling. - Surface and/or ground water models available in GPs by the end of 2025 	<p>On schedule</p> <p>- Progress toward target: to be completed by the end of 2024. A RTC is scheduled in June 2024 in Kuala Lumpur, Malaysia.</p>

PROJECT EFFECTIVENESS

Output	Indicator and baseline	Targets	Status of achievement
4. Isotope, chemical, and hydrogeological database established.	<p>Indicators: - Number of database developed by 2024 - Numbers of GIS maps in some GPs available by 2025.</p> <p>Baseline: Most GPs do not have integrated isotopic, chemical and hydrogeological database.</p>	<p>- 15 researchers from ILGPs and BLGPs trained in water modelling.</p> <p>- Surface and/or ground water models available in GPs by the end of 2025</p>	<p>On schedule</p> <p>- Progress toward target: 50%. All the Labs in the region are collecting the database.</p>
5. Water isotopic monitoring networks integrated for the region.	<p>Indicators: Guideline to set up water isotopic monitoring networks by 2025</p> <p>Baseline: No regional network of water isotope monitoring has been established in APR</p>	<p>- Water isotopic monitoring networks (RNIP and RNIR) supported/considered by the GPs authorities</p> <p>- To have some protocols and agreements among GPs in setting monitoring networks and sharing</p>	<p>Progress toward target: 0%. This output is scheduled to be completed by the end of the Project.</p>

Overview of Effectiveness

- The outputs and outcomes of the Project are basically achieved as planned;
- The output of establishment of a monitoring network for isotopic compositions and chemistry in precipitation and main rivers water in the region will be discussed at the Mid-term Review Meeting early next year;
- The targets of the Project are expected to be met by the end of the Project Implementation

PROJECT EFFICIENCY

- **Technical Staffs:** Appropriate NPCs, sufficient & qualified researchers and technical staffs of GPs, including high skill experts in the field of isotope hydrology and young scientists → *Opportunity to train young generation with the use of nuclear and isotopic techniques in water resources management.*
- **Well organized project activities** in consideration of resources: *mix of virtual coordination meeting and physical regional activities including WS, TCs and expert missions.*
- **Budget management:** More resources are needed to assist LDC and the SIDS, in purchase tools, consumables for the isotopic analysis in the Lab and the field pre-treatment of water samples.

GENDER EQUALITY

The lists of National Working Teams from GPs have almost half of female team members → ***the Gender Equality Target is achieved***. Female participants and team members have actively participating in the pre-treatment of water samples in the field and conducting analyses in the Labs.

RISK MANAGEMENT

- **The facility for isotopic analysis**, e.g. Laser Spectrometer, Liquid Scintillation Counter, in a number of Labs in the region sometimes is damaged and needs repairing that makes delays in the analyses activities or requires assistance from other Labs → ***In time assistance from the IAEA, LC and GPs***
- **Progress Report:** Some GPs did not submit project progress reports → ***more interaction between NPCs and LCCs in consultation of NRs***

Notable project achievements during the past 2 years

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Stream analysis for a sub-catchment of Red River (Vietnam) using isotopic technique and recursive digital filter method

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ABSTRACT

River streams, in general, comprise of two flows: quick flow and baseflow. The baseflow is closely related to geological catchment properties, and understanding the baseflow contribution to stream flow is very important in the planning of water resources management. The baseflow in a sub-catchment of the Red River in Vietnam was quantified using the isotopic technique, and results were compared with Eckhardt's recursive digital filter (RDF) method. Results of the isotopic approach showed that groundwater is recharged from regions at 300 to 800 m above mean sea level. The upstream baseflow gains from Holocene and Pleistocene aquifers throughout the year, contributing to 65 ± 4 % of the river discharge. On the contrary, the midstream baseflow contributes 44.6 ± 6.5 % of the river's annual discharge to both Holocene and Pleistocene aquifers. The downstream is more complicated, where the baseflow loses to the Pleistocene aquifer and gains 73 ± 17 % of the river's annual discharge from the Holocene aquifer. The loss of baseflow was attributed to the high rate of groundwater mining.

Maintaining the vegetative cover over the recharge areas is recommended to reduce runoff and increase groundwater potential so that the baseflow could sustain the river stream.

Results of a study within the Project have been published in early 2024

It was shown that isotopic techniques using the values of $d2H$ and $d18O$ in water samples can be used to validate the models describing the contribution of runoff flow/base flow to main stream flow of a river. This means that water isotopes are good tracers for the quantification of water resources in a certain region.

RECOMMENDATIONS

- The Agency is recommended to offer a fund for purchasing standards/consumables for the isotopes analytical Labs of less developed GPs.
- Advanced GPs are recommended to be more active contributing to the Project through hosting RTCs to demonstrate current advance techniques/equipment being currently used in the study of quantity and quality of water resources.
- Less developed GPs are recommended to request the Agency to provide expert missions for the explanation of results obtained to address the enhancing water resources management based on the isotopic and chemistry data of water samples collected.

Thank you for your attention



**Vietnamese experts assisted Lao PDR
colleagues in sampling groundwater, Jan 2024**



Comments and Questions