IWRA 2020 - Addressing Groundwater Resilience under Climate Change
(Online Conference: 28-30 October 2020)

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Improving Needs Assessment and Project Formulation with IWAVE

-

The IAEA Water Availability Enhancement Approach

O. Kracht [1], L. Ortega [1], S. Terzer-Wassmuth [1], K. Zouari [2] & L. J. Araguas [1]

[1] International Atomic Energy Agency (IAEA), Vienna, Austria

[2] Ecole Nationale Ingenieurs de Sfax (ENIS), Tunisia

IAEA

International Atomic Energy Agency

Atoms for Peace and Development

IAEA | Water Resources Programme

IWAVE The IAEA Water Availability Enhancement Approach

ISOTOPE HYDROLOGY can provide critical insights into the water cycle permitting assessments of changes over time impacting **WATER AVAILABILITY**, thereby **PROVIDING FOREKNOWLEDGE** and **ENABLING SOLUTIONS** for addressing groundwater issues under climate change.

IWAVE helps scientists and policy-makers **IDENTIFY KNOWLEDGE GAPS** in their national hydrological assessments, and to strengthen capacities to conduct comprehensive **WATER RESOURCES ASSESSMENTS** using **ISOTOPES** and **NUCLEAR DATA**.

Why IWAVE?

- The **IWAVE** approach stems from different **OBSERVATIONS** in the past:
- Few IAEA isotope hydrology **TECHNICAL COOPERATION PROJECTS** utilized systematic water assessment approaches.
- Many TC projects focused on applying isotopes to **LOCAL OR SITE-SPECIFIC PROBLEMS**, often completely **DETACHED FROM CONVENTIONAL HYDROLOGY**.
- Such way often **LITTLE BENEFICIAL INFORMATION** is gained.

The IWAVE Approach

The **IWAVE** approach comprises several key steps:

1) **IDENTIFY** knowledge **GAPS** in national hydrological data and information.
2) **DISTINGUISH** the expertise, **TECHNOLOGY**, and infrastructure support required to address the issues.
3) **PROPOSE** appropriate **ISOTOPE** and nuclear **TECHNIQUES** to address identified knowledge gaps.
4) **PROMOTE COLLABORATIONS** with other national or international organizations to address identified gaps.
5) **ASSIST** water agencies in obtaining **SCIENTIFIC SUPPORT** and **TECHNICAL ISOTOPE SERVICES** from the **IAEA**.

Stakeholders Consultation during IWAVE Nigeria

IWAVE Experience

IWAVE Pilot Countries (IAEA/Peaceful Uses Initiative Project 2012/13):

- **Costa Rica, Oman, Philippines**

RLA 7018 (year 2018 ff): "Improving knowledge of groundwater resources to contribute to its protection, integrated management and governance"

- **Argentina, Brazil, Ecuador, Nicaragua**

RAF7019 (year 2018 ff): "Adding the Groundwater Dimension to the Understanding and Management of Shared Water Resources in the Sahel Region."

- **Benin, Cameroon, Ghana, Niger, Nigeria**

IWAVE National Project

- **Kenya** (since 2020)

RER7013 (2020 ff): "Evaluating Groundwater Resources and Groundwater-Surface-Water Interactions in the Context of Adapting to Climate Change "

- **IWAVE pre-Evaluation with 38 institutions from 27 Countries**

The core of the **IWAVE** Methodology comprises **FOUR STAGES**.

IDEALLY these stages are:

- The **PREPARATORY STUDY** identifies national-level gaps in hydrological understanding. It is presented and discussed at the **NATIONAL IWAVE WORKSHOP**.
- It follows a process to prepare the **HYDROLOGICAL GAP ANALYSIS** that is reviewed at the national level and correlated with national plans and programs, institutional roles and responsibilities.
- The third stage is a continuous process of **CONSULTATION** and **CONSENSUS BUILDING**. Follow-up meetings may be required to clarify, articulate and build consensus.
- Finally, the **NATIONAL HYDROLOGICAL PLAN** or the **ACTION PLAN** reflects a program to realize desired end-states. It captures the roles and responsibilities of all stakeholders in pursuit of national water resource goals, and the implementation strategy.

ELEMENTS OF AN IWAVE ASSESSMENT

Hydrological data and information

Natural water system

Surface water

- Hydrographic maps and models – hydrography, storage volume and flux
- Streamflow hydrographs, maps and models – discharge, channel geography, rating curves
- Flood risk and drought risk maps and models – recurrance intervals, trends
- Surface water quality maps and models – water chemistry, common and emerging pollutants, trends

Groundwater

- Hydrogeological setting maps – surface and subsurface geology, aquifer thickness and extent, resisitve layer thickness and extent
- Aquifer characteristics maps – porosity, hydraulic conductivity, transmissivity, anisotropy, storativity
- Groundwater storage and flow maps and models – saturated thickness, water levels, vertical/horizontal gradients
- Groundwater quality maps and models – water chemistry, common and emerging pollutants, trends

Water budget

- Precipitation maps and models – point precipitation, areal/regional precipitation, extreme events
- Runoff and recharge to groundwater maps – runoff coefficients, infiltration and recharge rates
- Evapotranspiration maps and models – temperature, point evaporation, meteorological data
- Surface and groundwater interaction maps and models – hydraulic gradient, groundwater discharge to surface water, surface water seepage to groundwater

Engineered water system

- Withdrawal rate and location maps and models – withdrawal by category, rates, trends
- Conveyance rate and losses maps and models – conveyance by category, rates, trends
- Consumptive use maps and models – consumptive use by category, rates, trends
- Reclaimed wastewater maps and models – rates, volumes, trends

MORE INFORMATION AT

https://www.iaea.org/topics/water

Isotope Hydrology Section

Department of Nuclear Sciences and Applications

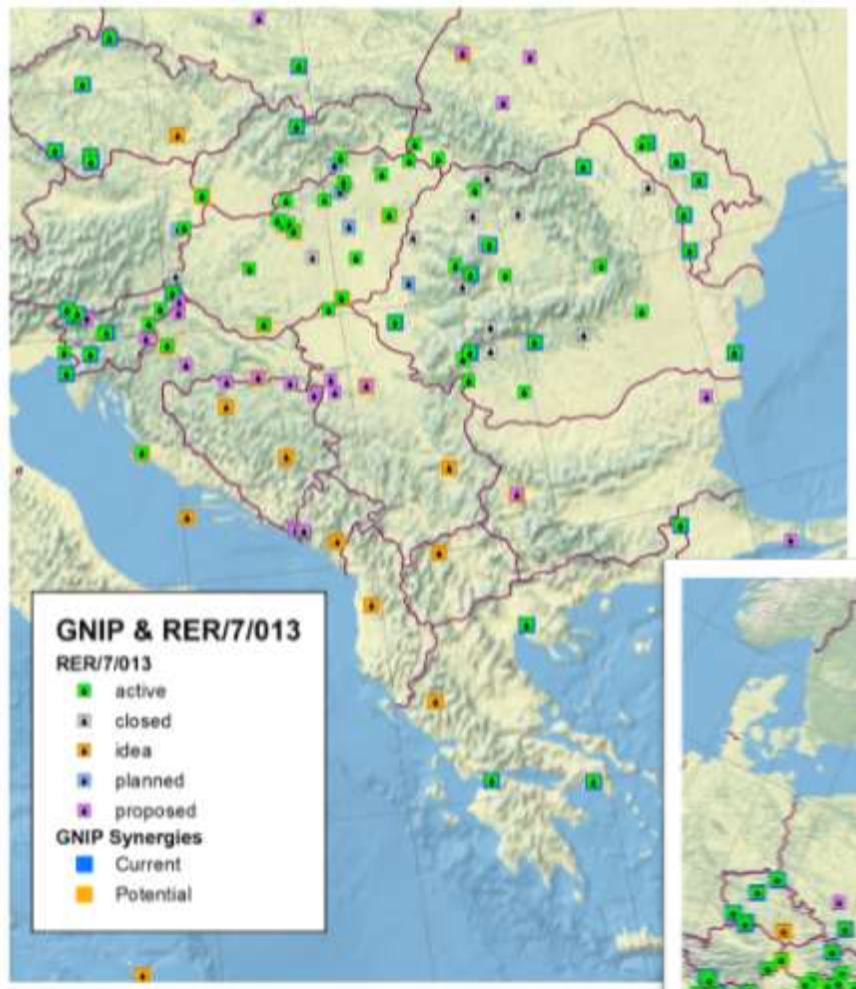
International Atomic Energy Agency

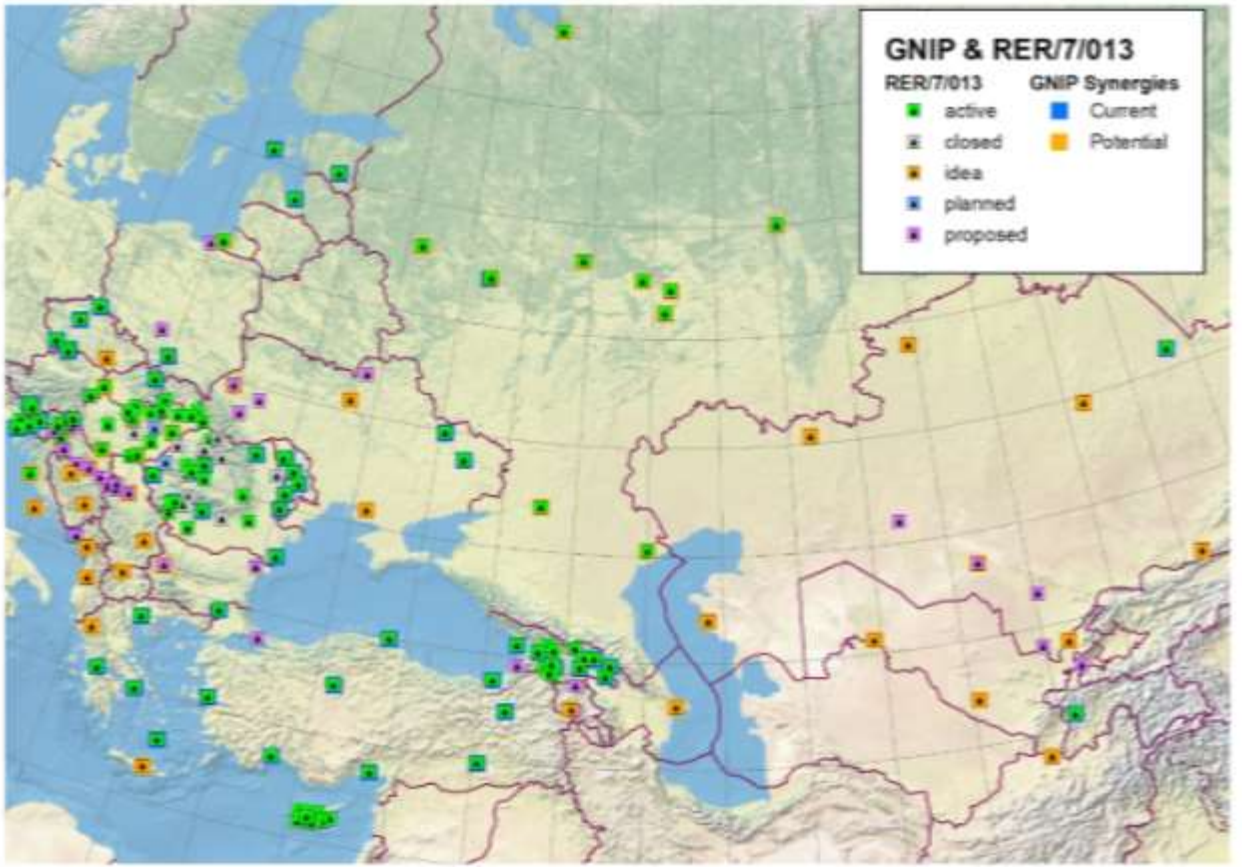
IAEA

Practical Example:

- Evaluating the potentials for the **EXPANSION of GNIP** in Regional Project RER7013.
- **SUSTAINABILITY** of a collaborative effort.

(27 Member States)





Global Network of Isotopes in Precipitation

Some Caveats

EACH national **IWAVE** is **DIFFERENT**.

Always requires **TAILOR-MADE ADJUSTMENTS** to consider the particular requirements of the water sector in the respective Member State.

Important to reach **ALL RELEVANT ACTORS** of the national water sector and professional community.

Need for a comprehensive and holistic approach, but **KEEP AN EYE ON** our **CORE BUSINESS**:

- How can **ISOTOPES** and **NUCLEAR METHODS** help to close important knowledge gaps, thereby improving water availability?

Find the **RIGHT SCOPE** and find the **RIGHT SIZE** of an **IWAVE** action:

- **NATIONAL HYDROLOGICAL PLAN** vs. **ISOPTOPE HYDROLOGY ACTION PLAN** (define realistic goals)

Thank You for your kind attention!