Water Resources

Objective

To support Member States in using isotope hydrology for assessment and management of their water resources, including characterization of climate change impacts on water availability.

Renewing the Global Network of Isotopes in Precipitation

As climate change becomes a reality, the Global Network of Isotopes in Precipitation (GNIP) has been increasingly used by Member States to track changes in precipitation source regions, interpret palaeoclimatic archives and animal migration pathways, and provide a baseline for forensic verification of crop production. In 2021, the Agency and the World Meteorological Organization (WMO), as host partners of GNIP, signed a renewed Memorandum of Understanding (MoU) at COP26. The MoU will facilitate improved outcomes for the GNIP platform by expanding the network and incorporating advanced data processing and evaluation approaches, particularly in adaptation to and mitigation of climate change. GNIP data were used to construct the Agency's Regionalized Cluster-based Water Isotope Prediction model. This model was expanded in 2021 to globally map naturally occurring tritium in precipitation. The resulting maps depict the spatial distribution of present-day tritium in precipitation and are open access (Fig. 8). They serve as input in addressing the baseline precipitation tritium input function to surface and groundwater systems.

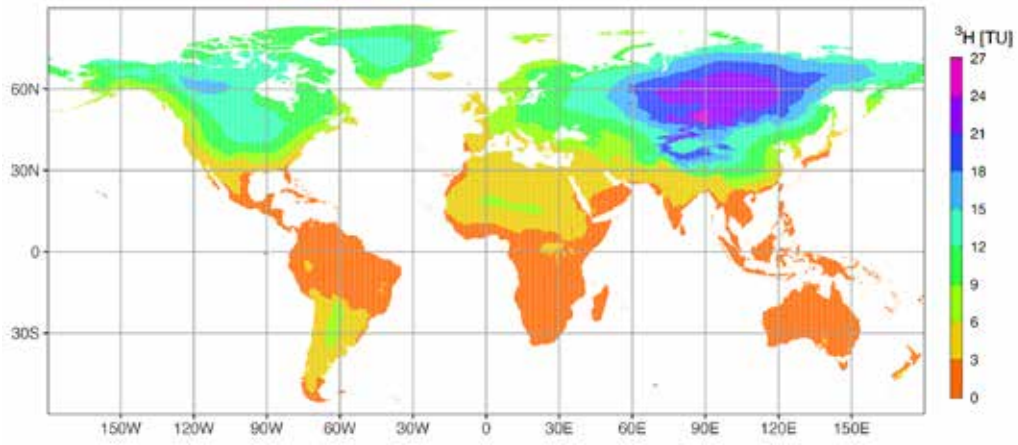

FIG. 8. Contemporary tritium levels in precipitation. TU stands for tritium activity expressed in tritium units.

The Fukushima Prefecture Initiative Project for Improvements in Tritium Analysis

Since the accident at the Fukushima Daiichi nuclear power plant in 2011, there has been continued public interest in better understanding the distribution and environmental dynamics of radionuclides released as a result of the accident. In response to this, the Fukushima Prefecture Initiative Projects (FIP) were established via Practical Arrangements between Fukushima Prefecture and the Agency. In 2016, a new sub-project, the FIP7, was established to improve the analytical capacity of the Prefecture with assistance provided by the Isotope Hydrology Laboratory. During the four years of the FIP7 sub-project, the Agency assisted the Prefecture with installation of a tritium enrichment unit in the Fukushima Prefectural Centre for Environmental Creation as well as comprehensive training on the principles and operation of the tritium enrichment unit, and the Prefecture's scientists are now able to confidently process natural water samples for their tritium analysis (Fig. 9). The project was concluded successfully in March 2021. These activities are essential for the Prefecture to be able to promptly provide independent analytical results to its residents.

FIG. 9. Technical staff from Fukushima Prefecture working on the tritium enrichment system. (Photograph courtesy of the Fukushima Prefectural Centre for Environmental Creation.)

Source Tracking of Water Pollution with Nitrate Isotopes

The integration of nitrate isotope tools with other methods for water quality assessment generates several practical benefits for Member States. Among these are the determination of nitrate sources and the temporal and spatial variability of nitrate in atmospheric, surface and groundwater, as well as the identification of processes controlling nitrate concentrations. In 2021, a new coordinated research project was initiated to examine the relationship between nitrate isotopes and contaminants of emerging concern (CECs). Preliminary work on the Danube River conducted in conjunction with the International Commission for the Protection of the Danube River indicated clear relationships between different groupings of CECs and nitrate isotopes. Twelve projects on all continents will focus on developing guidelines to better understand nitrate source contamination and how nitrate pollution in surface water systems can be better managed.