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Isotopic tracing of water cycle in river basins: recent IAEA programmes

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This paper presents the recent IAEA efforts in coordination of studies on monitoring isotopic content in rivers. They address worldwide about 100 river basins of different scale, climate, hydrogeological settings, landuse and human development The objectives are twofold: firstly, to trace the large-scale climate controls on the isotopic content of water cycle components, and secondly, to trace the age and origin of water fluxes between rivers and shallow aquifers for purposes of river basin management. Several methods and case studies are addressed, such as long-term monitoring of stable water isotopes and tritium in streams with respect to the IAEA/WMO Global Network of Isotopes in Precipitations (GNIP), isotopic validation of large-scale water balance and climate models, partitioning of evaporation and transpiration in the basin integrate runoff from cold areas, quantification of storage effects in lakes and water loss by evaporation in arid areas, estimation of amount, age and origin of shallow groundwater contributing to streams via baseflow (using $^{3}He/^{3}H$, among others), and tracing the interaction of tributaries with the main river course from headwater to mouth. There are several isotopic studies at the scale of small homogeneous basins or hillslopes, but applications in more heterogeneous large basins remains a scientific frontier. Presented IAEA activities are contributing to a better assessment of the water cycle at the river basin scale, and also demonstrate the unique value, needs and limitations of isotope techniques in large-scale river basin studies.