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A European vision for hydrological observations and experimentation

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Upgrading standard weather station with cosmic ray neutron sensors in Italy: challenges, results, and opportunities.

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Over the last decades, several new observation systems have been developed, tested, and implemented in dedicated experimental sites by research groups in many countries all around the World. The data collected at these high-level test sites have boosted research and collaborations providing the basis for new hypothesis testing, better process understanding and model improvements. In contrast, national and more operational ground monitoring networks are still largely based on traditional instruments. Moreover, the different networks and the data are not always well integrated, even at the regional level. For these reasons, the capability to monitor the main components of the hydrological cycle over large areas is still limited and the observation systems to support the management of the water resources and for environmental protections can be improved. By using soil moisture and snow water equivalent monitoring as examples, in this contribution we present and discuss challenges, results and opportunities in upgrading national weather stations and improving the service provided by the public environmental agencies. Specifically, the difficulties of implementing ground monitoring networks are first discussed. The opportunities provided by the development of new non invasive sensors based on cosmic-ray neutrons detection are then presented. The activities and the results conducted during the last years to move this technology further from research to operation are shown. The current uptake from a number of Italian environmental agencies is reported. The key components and current challenges for a successful implementation are finally discussed.