	<b>Peng Huang (2019 – 2022)</b>
	Towards a general framework for assessing the vulnerability of reservoir water management under global change - Application to Lac de l'Oule (French Pyrenees)
	Encadrants : E. Sauquet et J.P. Vidal (Irstea RiverLy HyBV )
	Ecole Doctorale: ED105, terre-Univers-Environnement, Université de Grenoble Alpes

**Le travail se base sur l'analyse détaillée la gestion du Lac de l'Oule (vallée de l'Aure, Pyrénées), pris comme exemple d'ouvrage de gestion de la ressource en eau.**

**On souhaite en construire une représentation fonctionnelle, valorisable dans les modèles hydrologiques distribués à visée de connaissance et de gestion des ressources en eau.**

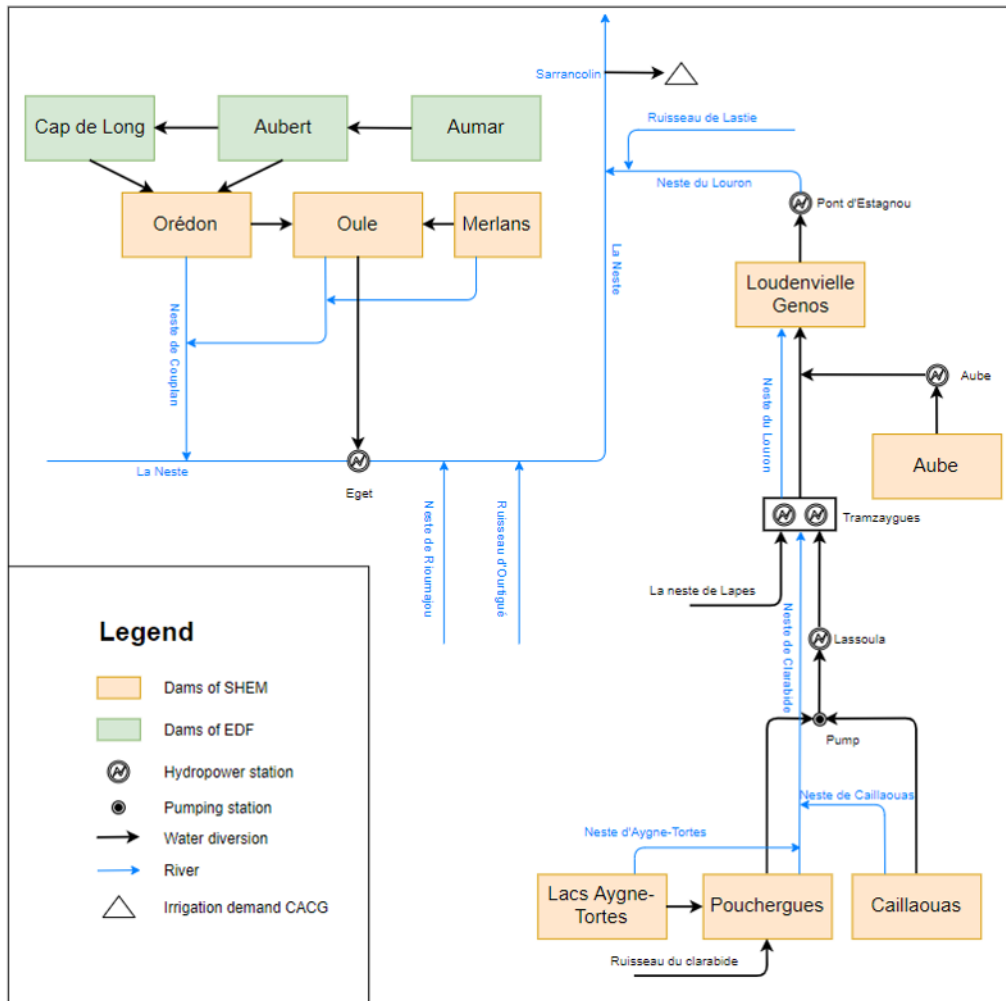
**La visée scientifique est de disposer d'outils efficaces pour décrire fonctionnement (et dysfonctionnements) tant des milieux naturels que des modes de gestion usuels de la ressource en eau dans les conditions de l'anthropocène, et cerner leur fragilité devant le changement climatique et global.**

This thesis is a scientific contribution to the Interreg PIRAGUA project (2018-2020) and new developments will be illustrated on the Lake Oule, a reservoir located in the Aure Valley in the French Pyrenees (lake elevation: 1819 m.a.s.l.). The sustainability of the current water management optimised for hydropower production and downstream irrigation will be investigated on this small mountain catchment. This work will be carried out in close collaboration with SHEM (Société Hydroélectrique du Midi, <http://www.shem.fr/fr/>) – a subsidiary of ENGIE – which manages this reservoir along many others in the Pyrenees.

The two main objectives of the thesis are:

- Developing and improving water use models as pieces of an integrated hydrological modelling framework: the thesis is an opportunity to implement models that may reproduce reservoir operations to produce hydroelectricity and to moderate low flows. An analysis will be carried out to identify drivers that control water releases and storages. The developed structure will be flexible enough to be combined with different hydrological models that simulate water resources, and to be transposable to a wide range of water management contexts. The regulatory aspects will also be included, in particular the compliance of environmental flows and the decision making process that leads to water restriction orders included in drought management plans.
- Characterizing the vulnerability of the management mode of reservoirs: there is a growing concern on the ability of reservoirs to cope with altered climates. The thesis will investigate their vulnerability based on the approach adopted by Sauquet et al. (2018). This method will require identifying the water management failures, particularly in terms of storage objectives, ability to meet high peak demands for energy, and correlating the respective intensity or frequency of failures to those of hydro-meteorological hazards (unanticipated flooding, severe low flow, etc.). These failures will be interpreted within a critical hydrological or climatic context and their likelihood under perturbed climate conditions will characterize the vulnerability of the system. The developed models will be forced by perturbed climates

to estimate the likelihood considering current management rules and adaptation strategies, in order to assess the efficiency of adapted rules able to reduce the vulnerability.



*Operating diagram of the Aure-Louron reservoir system*

**Financement :**

Projet Intereg Piragua

**Références :**

Montanari et al. (2013) "Panta Rhei—Everything Flows": Change in hydrology and society—The IAHS Scientific Decade 2013–2022. *Hydrological Sciences Journal*, 58(6): 1256-1275.

Sauquet et al. (2018). Water restrictions under climate change: a Rhone-Mediterranean perspective combining 'bottom up' and 'top- down' approaches. *Hydrol. Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/hess-2018-456>, in review