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Impact of the Alex storm on the exchanges between the Roya River and its alluvial aquifer

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The alluvial aquifer of the transnational Roya watershed is exploited for drinking water to supply both French and Italian coastal cities. The Interreg project CONCERT-EAUX (2017-2020) aimed to improve the understanding of the functioning of this hydrosystem. Several wells were equipped in order to measure water level, temperature and conductivity temporal and spatial distribution within the aquifer. Two surface and groundwater sampling campaigns were also carried out to perform chemical and isotopic water analysis.

Near the Porra wellfield, vertical distribution of parameters proved the homogeneity of the alluvial formation in the first layer, and very different properties in the underlying less permeable alluvions. In the upper layer, temperature shows seasonal variations, whereas it is very stable in the underlying aquitard. The existence of advective transfers between the Roya River and the alluvial aquifer was proved both by the thermal transfer analysis and modelling, and by the isotope study. The CFCs and SF₆ concentrations in groundwater confirmed that the aquifer is recharged with recent water. Thanks to meteorological and water level daily data, the aquifer recharge was estimated applying two different approaches. The results proved that for an annual average rainfall, the infiltration of the effective precipitation represents only 15 to 20% of the total aquifer recharge. The main part of the aquifer recharge comes directly from the Roya River.

A hydrogeological numerical model including the exchanges between the river and the aquifer has been developed using the finite difference model MARTHE[®]. Run in steady-state conditions, it allowed completing the water budget. It also highlighted the sections of the river which most contribute to the aquifer recharge.

All these elements helped us to understand the behaviour of the hydrosystem following the Alex storm in October 2020. An important volume of sediment has been transported by the river from the upper valley to the downstream reach. This led to the clogging of the riverbed, which strongly reduced the aquifer recharge. Today, although trenches have been excavated immediately upstream of the wellfield to promote the artificial recharge of the aquifer by the Roya River, groundwater level still decreases due to pumping.



Evolution of the piezometric level at the Porra wellfield (Roya alluvial aquifer)