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Hydrological budget of a peatland connected to a regional aquifer

C. Auterives (1), L. Aquilina (1), Bour, O. (1), M. Davranche (1), V. Paquereau (2)

(1) Géosciences Rennes, CAREN, UMR 6118 CNRS, Univ. Rennes 1, (2) Parc naturel régional des marais du Cotentin et du Bessin (chrystelle.auterives@univ-rennes1.fr / Fax : 033 223 236 090)

Usually, the substratum of wetlands is a clay-rich layer. This low permeability layer prevents interactions between wetlands and underlying geological formations. In North Western France, large areas of peatlands lie on a regional sandy Mio-Plioquaternary aquifer exploited for drinking water. A thin clay-rich layer, 1 to 3 meters thick, is included between the peat and the sand aquifer. The clay layer hydraulic conductivity is a key parameter in the wetland functionning since it may have a great influence on the flow structure in the wetland. The hydrologic budget of the peatland was constructed from field monitoring data (piezometric peat groundwater level, clay layer level and sand groundwater level). Over a 2-year period, the patterns of groundwater flow of two sites were described. One site is near the pumping station and the other is in downstream, outside of the influence of the pumping station, it allowed to have constrasting hydrogeological conditions.

The observed downward gradients between the peat groundwater and the sand groundwater are surprising considering that the wetland is located in a regional discharge area. The water balance at site scale and field slug-test results show that the clay hydraulic conductivity is estimated between 1E-08 to 7E-08 m/s, which does not constitute an efficient hydraulic barrier. The hydrological budget, from 01/03/03 to 29/02/04, shows that precipitations are the main input (774 mm). There are two main outflows (1) the actual evapotranspiration (516 mm) and (2) the flow from the peat groundwater to the sand groundwater throw the clay layer (around 300 mm) which represents more than 30% of the rainfall input. The exchanged flow between the stream and the peat groundwater are negligible (equivalent to less than 6 mm).

The sand groundwater and the peat groundwater are hydrogeologically connected, moreover the regional sand groundwater level controls the peat groundwater level. It implies a sensitivity of the peatland to the sand aquifer exploitation and a sensibility of the sand aquifer to the surface pollution.