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Using hydrological modeling, paleoecology and chronology to quantify the resilience of an aquifer-peatland ecohydrological system in southern Quebec (Canada)

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Superficial sedimentary aquifers play a significant role as potable water sources. These aquifers are often in direct connection with wetlands including peatlands over the regional landscape. To study the strong interconnections and feedbacks between aquifers and peatlands, geomorphology, vegetation and hydrological conditions must be field investigated and simulated. However, these conditions represent a limited array of possible interactions. Peatlands offer extremely rich archives of past vegetation and humidity which can be used to widen the array of known hydrological conditions. In the Quebec province (eastern Canada) peatlands cover 9-12% of the territory. In southern Quebec, it is estimated that 80% of peatlands have been impacted by anthropogenic activities. The Lanoraie peatland complex and its surrounding area (approximately 200 km2) located 40 km north-east from Montreal (Quebec, Canada) is used as a study site. The objective of the project is to determine the resilience of aquifer-peatland ecohydrological systems to hydrological stress brought by direct anthropogenic pressures and climate change. A 3D hydrostratigraphy model has been developed and includes peat thickness as well as hydraulic properties of peat deposits. Surface vegetation and hydrological conditions are monitored since 2006. A coupled surface and groundwater flow model including the peatland deposits is currently developed to simulate present time conditions. The temporal extension of the peatland complex since the last glaciation is reconstructed from paleoecological analyses (pollen and testate amoebae) and chronology (14C and 210Pb). The coupled model will be adapted to reproduce regional hydrology and aquifer-peatland interactions during selected past time periods. Results will provide insight into the resilience of aquifer-peatlands system in a variety of hydro-climatic conditions.