Modelling long term Impact of hydro-electric reservoir creation on carbon accumulation in peatlands

Boreal peatlands play an important role in the global greenhouse gas budget. As for the forest ecosystems, peatlands absorb large amount of carbon dioxide through photosynthesis by the surface vegetation. While forest ecosystems also release carbon during fire episodes, every 125 years, peatlands accumulate carbon over thousands of years. This can be explained by the close to surface water table and generally low temperatures which both slow down the decomposition process and therefore, the return of carbon in to the atmosphere. To establish a the net greenhouse gas budget for the Eastmain-1 reservoir project, it is imperative to evaluate the long term amount of carbon that could be stored by the peatlands in the region and understand the impacts of the reservoir creation at the same time scale.

Carbon exchange can be measured using different methods such as static chambers and eddy covariance tower. However, these methods can only measure gas fluxes over several month or years. Modelling on the other side can provide long term information by simulating the peatland carbon dynamics over hundreds to thousands of years. In the Eastmain-1 project, this method can allow estimation in variation of carbon dynamics over the entire Eastmain-1 reservoir area and not be limited to punctual measurements obtained by using chamber or tower technique.

The models are created based on current knowledge of peatland dynamics. Information from peat cores (Figure 1) collected in the Eastmain-1 area are used to obtain information on carbon accumulation through time. Analyses provide knowledge on peatland dynamics and allow establishing relationships between the observed phenomena and better understand what are the controls the carbon accumulation. For example, plant remain of a certain species found in a peat core can be associated with a certain period of time or climatic regime. Similarly, it is possible to associate the amount of carbon accumulated with an event, such as the little ice age, or ecological factor. Once the major controls on peat accumulation are known, the relationships between these controls and carbon accumulation can be mathematize to reproduce peatland dynamics (Figure 2). This type of model allows simulating carbon dynamics in the peatland since the beginning of peat accumulation to today, and to simulate future variation in carbon accumulation.

Figure 1 : Peat core extracted from a peatland in the Eastmain-1 area

This approach will determine past variations in the carbon cycle of the peatlands in the Eastmain-1 region and estimate the future variation. Since some peatlands have been flooded following the creation of the Eastmain-1 reservoir, those ecosystems can no longer accumulate carbon. Therefore, the area has lost a potential carbon sink since reservoir creation and this deficit will be evaluated using modeling.

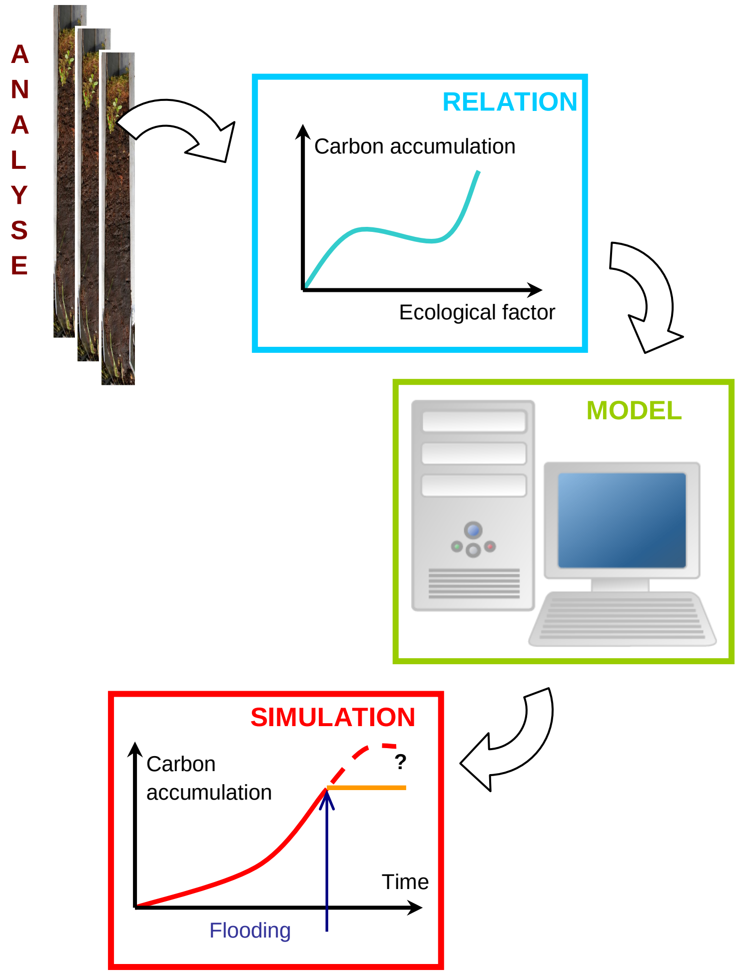

Figure 2 : Modelling carbon dynamics in peatlands