Section Sciences et Ingénierie de l'environnement
Design Project 2020 (semestre de printemps)

Proposition n°19

Modelling basin-scale sediment dynamics for a Swiss catchment

Partenaire externe

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Deltares

Taille de l'entreprise (nbre de collaborateurs) : ~800

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Descriptif du projet

Sediment dynamics, from the mountains to the sea, play a key role in inland water systems both in the fields of morpho dynamics (river incision, retreating deltas…), management for water resources (especially for reservoir management) but also for water quality where having a good understanding and quantification of (fine) particle budgets on the catchment scale is of key importance for many pollutants (such as nutrients, carbon or heavy metals). As sediment data are rather sparse and rare, Deltares recently developed a model, wflow_sediment, to estimate catchment sediment dynamics and amounts at a fine time and space resolution. This model uses the results of the wflow_sbm hydrological model in order to estimate soil erosion, delivery to the river and river transport. It was first tested for the Rhine basin where results looked promising.

The role of this project would be to test and validate further the model for a catchment in the Swiss part of the Rhine. The first part of the project would consist in data collection (soil erosion and/or suspended sediment timeseries). From the calibrated hydrological model wflow_sbm, the results of the sediment model can be compared and adjusted with the collected data. Depending on the time remaining and the students' interests, the rest of the project could focus on implementing sediment management measures (soil erosion reduction, analysis of in-stream deposition/erosion hotspots…) or analyzing sediment retention in lakes.

The main domains of the project are hydrology, sediment and modelling (both models use the same Python framework).

wflow_sediment

Integrated basin-scale model for water quantity and sediment dynamics
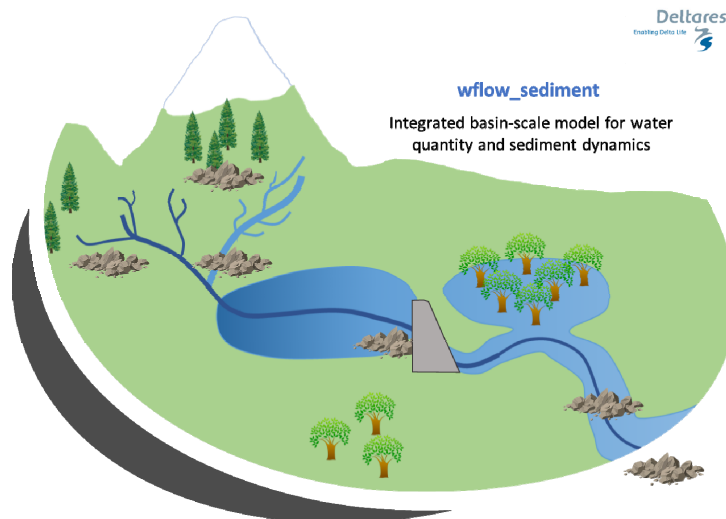
Objectif et buts

The general objective of the project is to set-up a sediment model for a Swiss catchment. Using collected data (land erosion or suspended sediment), the model results can then be compared, and model performance estimated.
Depending on the results, either sensitivity analysis of the model or more detailed calibration and validation can be performed.
If there is enough time, other goals can be to analyze the model to identify erosion and deposition hotspots and potential management measures.

Descriptif tâches

The different steps of the project are sediment/erosion data collection from the bibliography or federal agencies. Depending on data availability, a certain Swiss catchment will be selected for the study.
Then, a validated wflow_sbm hydrological model for the selected basin will be provided by Deltares. The supervisor will also provide advice, documentation and tutorials to help the students discover and start easily to run the hydrological model.
Results of the hydrological model will then be used by the students to prepare the wflow_sediment model using the outputs from the hydrology.
Model results will then be compared and analyzed with the data and a sensitivity analysis of the model will be performed.

Divers

All the required Deltares software for this project is completely open source and data will, if possible, come from global or more local available datasets.
Along the project, the Deltares supervisor will be available to assist and follow the work of the students via Skype meetings and emails. Supervision can either be in French or English, but the final report should be written in English.

More information on wflow: https://www.deltares.nl/en/software/wflow-hydrology/