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## Dynamic Coupling of SWAT+ with System Dynamics Models using Tinamit and a Socket Based Protocol

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Effective and sustainable decision making in water resources management often requires modelling techniques that are able to account for the inherent complexity of coupled human-water systems. One approach that is used to model coupled human-water systems is to couple physically based models and system dynamics models. However, in many cases, this type of model coupling is labour-intensive and time-consuming, which can hinder its routine use in modeling and decision making.

Tinamit, a Python package, is an application programming interface (API) that provides definitions of functions and objects that simplify, in this case, coupled model building. Tinamit supports automatic SD model wrapping and coupling to specialized physically-based models, which makes it particularly useful for coupled human-water systems modelling. In this research, a connection between SWAT+ (a FORTRAN-based hydrological model) and the Tinamit API is established through model wrapping. This wrapping approach takes advantage of both the agility of sockets and the wide applicability of JavaScript Object Notation (JSON) to transmit data between FORTRAN and Python routines at runtime. Any model that runs in SWAT+ can now be automatically coupled to SD models through the Tinamit API, without the need for extensive programming, therefore facilitating wider application of coupled modelling techniques for integrated policy development and decision making in the field of coupled human-water systems.