

Environmental Protection Agency is planning the procurement of services for the updating and enhancing surface inland water modeling capabilities. Please provide comments and suggestions for the Terms of Reference as well as the approximate estimation of value for such services until 1st of December.

Terms of Reference

Introduction

In the end of 2015 Lithuanian Environmental Protection Agency (further - Agency) has prepared surface water modeling system (further - modeling system) based on the open source Soil and Water Assessment Tool (further - SWAT model, all model related information could be found on <http://swat.tamu.edu/>) in order to increase its capabilities in the environmental assessments connected to the inland surface water questions. Project documents and detailed description of modeling system could be found on <https://www.dropbox.com/sh/s0pmfxemuaja992/AABk2buj9JDISPnu3Xh5HBAmA?dl=0> (please read Document 0). This system was used in the preparation of River Basin Management Plans, reporting for HELCOM, Nitrate directive, WISE-SOE and other needs. However, an update and expansion of additional capabilities is required to satisfy further Agency needs and to ensure greater reliability of the modeling system results. Additionally to this, it is important to guarantee the operational support during initial phases of expanded application of modeling system. This project is designed to fulfill these needs.

Purpose

The main aim of the project is to update and enhance the capabilities of Agency's surface water modeling system and provide operational support during initial phases of application of updated system.

Objectives and requirements

1. Update river network data in the places, which lacks connectivity information.
 - a. River network data (river edges with connectivity information and basin areas) were developed during the project of modeling system preparation. Yet, for 76 internal small river patches left without connectivity information, such information should be gathered with field survey or other means in order to have full network connectivity.
 - b. Geometric network and catchment data prepared during project should be updated to adjust for the updated information gathered for the first point.
2. Enhance Agency's modeling system to be able to model small river water bodies.

- a. Updated river network data prepared for the first objective should be used to define small river water bodies.
 - b. Python script/s should be prepared for the automatic preparation of model setup for small water bodies.
 - c. Prepared script/s should allow automatic integration of small water body setup within the rest of modeling system.
 - d. Prepared script/s should allow user to select any small river water body and preparing, running model and providing output should be done automatically with possibility to define required output and time step.
 - e. Prepared script/s should automatically update PAIC SWAT input files what would allow opening and seeing output with PAIC SWAT without the need for additional adjustments.
 - f. Small water bodies, which have a part of their in the neighboring countries should be included into enhancement providing their catchment information by using neighboring country DEM or directly catchment boundaries if they are available.
 - g. Small water bodies, which have lakes on their reaches, should be included into enhancement by automatically providing necessary information into .res files to enable lake or reservoirs modeling.
3. Incorporate rainfall radar data as input data into modeling system.
 - a. Python script/s should be prepared for the automatic integration of rainfall radar data into model .pcp input files from meteorological data format.
 - b. Prepared script/s should sum rainfall data within SWAT subbasin for daily time step.
 - c. Prepared script/s should allow also partial updating of .pcp files with rainfall radar data.
 - d. The quality of precipitation data generated from radar data should be assessed in the relation to the precipitation measurements as well as to the water discharge results from modeling comparing them with results obtained with inputs from the precipitation measurements.
 4. Renew modeling system input databases with the newest data and the newest model revision.
 - a. Time series data of point sources, water quality and quantity measurements, meteorological data should be updated for 2017.
 - b. Renew relevant water use data up to 2017.
 - c. The latest available atmospheric deposition data from EMEP should be used in the renewal of modeling system.
 - d. Fertilization data should be updated based on information delivered by the Agency.
 - e. The latest versions of GIS databases used in preparation of modeling systems should be obtained on land use (forest cadastre, crop declaration data, GDR10LT, Mel_DB10LT, SŽNS_DR10LT), soil (Dirv_DB10LT) and used in renewal of modeling system.
 - f. Based on previously and newly gathered GIS data update .lup files to include land use change processes in the renewal of modeling system.

5. Update and recalibrate modeling system prepared with new, updated data and new model revision.
 - a. Model setups should be prepared with updated data and new model revision.
 - b. Extensive comparison should be done to compare existing monitoring data (water quality, water quantity) with updated modeling system output data.
 - c. Results of SWAT Check for updated modeling system should be examined as well as model seasonal performance comparing to monitoring data.
 - d. Problems list should be prepared on all actual and potential problems, which could be solved with calibration of updated system.
 - e. Consultation with agreed external experts should be used to gain more insights how to deal with existing problems during recalibration efforts.
 - f. Recalibration plan and its aims should be agreed before recalibration with Agency.
 - g. Recalibration should be done in the accordance of agreed recalibration plan and any deviations could be applied only after approval from Agency.
6. Develop comprehensive library of scenario scripts for the automatic preparation of modeling system for the modeling application of pollution abatement measures or introduction of new pollution sources and automatic extraction of modeling results.
 - a. Python script/s should be prepared for the automatic setup preparation with adjustable settings for the following measures:
 - i. Introduction of new point sources or updating values (flow, nutrient, sediment, BOD, pesticide, heavy metal) of existing once.
 - ii. Conversion of one type land uses with given ratio setting to the other types on all country territory or only specific regions.
 - iii. Introduction of vegetative cover in autumn and winter through catch crops.
 - iv. Application of reduced or no tillage technology, alteration of tillage timing.
 - v. Adapting amounts of chemical or/and organic fertilizers on a regional or crop basis by setting percentage of fertilization reduction or maximum amounts allowed for fertilization.
 - vi. Adapting available timing for the applications of chemical or/and organic fertilizers.
 - vii. Application of advanced fertilization techniques (like combi-drilling, incorporation of fertilizers) to decrease nutrient leakage and to raise nutrient absorption efficiency.
 - viii. Introduction or enlarging grassed waterways and buffer zones along water and erosion sensitive areas.
 - ix. Introduction of managed drainage into fields (if feasible within current SWAT version capabilities).
 - x. Introduction of sedimentation ponds and wetlands within subbasin areas (not on the modeled river network).

- xi. Application of pesticides on selected crops on all country territory or only specific regions.
 - b. The script/s should also automatically extract relevant data from prepared scenario and compare it with baseline scenario in order to make easy examination of impacts, which are connected with applied measures.
- 7. Develop script/s for HELCOM PLC data extraction from modeling system.
 - a. Python script/s should be prepared for the automatic extraction of relevant data into following HELCOM PLC reporting sheets:
 - i. TRANSBOUNDARY_FLOW_LOAD
 - ii. MON_DIFFUSE_SOURCE
 - iii. UNMON_DIFFUSE_SOURCE
 - iv. TRANS_DIFFUSE_SOURCE
 - v. MON_RETENTION
 - vi. UNMON_RETENTION
 - vii. TRANS_RETENTION
 - viii. MON_LOAD ORIENTATED
 - ix. UNMON_LOAD_ORIENTATED
 - x. TRANS_LOAD_ORIENTATED
 - b. The script/s should allow data extraction to fulfill annual and periodic reporting requirements (information about HELCOM requirements could be found in HELCOM PLC-Water Guidelines published in the year 2016 <http://www.helcom.fi/Lists/Publications/PLC-Water%20Guidelines.pdf>).
 - c. Extracted data should be automatically filled into HELCOM given annual and periodic reporting templates. Templates could be found here: <https://www.dropbox.com/sh/qy8fgdh40gbzzai/AAAg8hBvDxMTbOFVcDWslxla?dl=0>.
- 8. Prepare automatic backup system for the modeling system.
 - a. Tool/s should be prepared for the automatic backing up of the modeling system, which would be integrated with cloud service.
 - b. Cloud service with space of at least 2TB should be guaranteed for the backing up of modeling system for a period of at least 5 years.
- 9. Provide operational support.
 - a. Operational support required for the Agency activities involving modeling system should be provided during the project and for minimum of at least 2 years counting from the start of the this project.
 - b. Solutions on technical problems, which don't involve redesigning or complicated corrections of modeling system, should be provided within three working days.
- 10. Assess changes required for modeling system to be able to run SWAT+ model.
 - a. Detailed list should be prepared of necessary technical changes, which would be needed to run SWAT+ model with modeling system.