



WP 3 – Integrative tools

## **Release of open source code for mature QGIS plug-ins**

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**The entire WATExR consortium has contributed to the material of this report.**

## **Table of Contents**

1. Introduction.....	3
2. Overview of software repositories in WATExR.....	4

# 1. Introduction

In WATExR, two main objectives are to 1) integrate cutting-edge seasonal climate prediction and ecosystem impact models in co-developed advanced tools; and to 2) implement these tools in a standardized, user-friendly GIS environment. The original plan was to develop site specific QGIS plugins, which deal with the workflow needed to complete a seasonal prediction simulation through an impact model. Each site partner has been responsible for designing a software workflow in collaboration with the site end-user (also called co-developer in the context of WATExR) thus ensuring that the solution meets end-user needs as far as possible. In some cases, the end-user needs turned out not to include a QGIS-based solution, in which cases WATExR partners have tried their best to adapt an alternative solution. This report (Deliverable 3.2) provide a brief overview of the code repositories used and developed for each site, where end-users and other interested parties can now access and download the tools used in WATExR. We emphasize that the tools will continue to undergo development during the remainder of the WATExR project, and hopefully also beyond the project, where the tools may be further adapted to meet new end-user or research needs, and thus continue to be “state-of-the-art”. The actual software workflows, which the tools enable, are described in Deliverable 3.1 (Report on the new QGIS plug-ins, with examples of impact models being executed with seasonal climate prediction through the plug-in).

## 2. Overview of software repositories in WATExR

The software repositories used and in some cases developed specifically in WATExR are listed in tables below (one for each WATExR site partner).

Table 1. Overview of software used and developed for Lake Arreskov (Denmark) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
Lake Arreskov (Denmark)	climate4R	R	Downloading, bias-correcting and formatting reanalysis climate data and <b>seasonal climate predictions</b> .	<a href="https://github.com/SantanderMetGroup/climate4R">https://github.com/SantanderMetGroup/climate4R</a>	Open source	Fully functional
	QSWAT	QGIS plugin	Setting up a SWAT <b>watershed model</b> , adapting model to local case, and running simulations.	<a href="https://swat.tamu.edu/software/qswat/">https://swat.tamu.edu/software/qswat/</a> new SWAT+ version: <a href="https://bitbucket.org/ChrisWGeorge/qswatplus3/src/master/">https://bitbucket.org/ChrisWGeorge/qswatplus3/src/master/</a>	Open source	Fully functional
	WET	QGIS plugin	Setting up a WET <b>lake/reservoir model</b> , adapting model to local case, coupling to SWAT model output, and running simulations.	<a href="https://gitlab.com/WET">https://gitlab.com/WET</a>	Open source	Fully functional
	Python post-processing	Python	A series of scripts to produce <b>ensemble plots</b> (as presented in example in Deliverable 3.1)	Contact person, Anders Nielsen, <a href="mailto:an@bios.au.dk">an@bios.au.dk</a>	Open source	Fully functional

## Deliverable 3.2

Table 2. Overview of software used and developed for Lake Erken (Sweden) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
Lake Erken (Sweden)	WET <sup>1</sup>	QGIS plugin	Setting up a WET <b>lake/reservoir model</b> , adapting model to local case, coupling to SWAT model output, and running simulations.	<a href="https://gitlab.com/WET">https://gitlab.com/WET</a>	Open source	Functional, minor adaptation needed to build in ISIMIP scenarios.

<sup>1</sup>Lake Erken is a special case of WATExR, which be used mainly as a dissemination and teaching site. In WATExR, this means adapting WET to allow visualization of ISIMIP climate scenarios for a range of lakes.

## Deliverable 3.2

Table 3. Overview of software used and developed for the Sau Reservoir (Spain) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
Sau Reservoir (Spain)	climate4R	R	Downloading, bias-correcting and formatting reanalysis climate data and <b>seasonal climate predictions</b> .	<a href="https://github.com/icra/WATExR/tree/master/Sau-Reservoir">https://github.com/icra/WATExR/tree/master/Sau-Reservoir</a>	Open source	Fully functional
	Sau QGIS plugin	Python and R	App developed for the stakeholders to show results and reports from the seasonal climate predictions.	<a href="https://github.com/icra/WATExR/tree/master/Sau-Reservoir">https://github.com/icra/WATExR/tree/master/Sau-Reservoir</a>	Open source	In development

## Deliverable 3.2

Table 4. Overview of software used and developed for the Burrishoole catchment (Ireland) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
Burrishoole (Ireland)	climate4R	R	Downloading, bias-correcting and formatting reanalysis climate data and <b>seasonal climate predictions</b> .	<a href="https://github.com/SantanderMetGroup/climate4R">https://github.com/SantanderMetGroup/climate4R</a>	Open source	Fully functional
	EcoCountR	R	Preprocessing downloaded climate data. Quantifying migration phenology anomalies. Calibrating ecological (statistical count) models relating seasonal climate anomalies with phenology anomalies. Generating seasonal forecasts.	Will be available on gitlab upon completion. Contact person: Andrew French, <a href="mailto:Andrew.French@Marine.ie">Andrew.French@Marine.ie</a> .	Open Source	Under development

## Deliverable 3.2

Table 5. Overview of software used and developed for Lake Vansjø (Norway) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
<b>Lake Vansjø (Norway)</b>	<b>climate4R</b>	R	Downloading, bias-correcting and formatting reanalysis climate data and <b>seasonal climate predictions</b> .	<a href="https://github.com/SantanderMetGroup/climate4R">https://github.com/SantanderMetGroup/climate4R</a>	Open source	Completed
	<b>Seasonal lake ecological forecaster</b>	Python/R/QGIS	Postprocessing downloaded climate data. Updating Bayesian Belief Network linking climate, historic lake observations and future state of the lake. Generating seasonal forecasts, plots and producing pdf output reports.	<a href="https://github.com/icra/WATExR/tree/master/Norway_Morsa">https://github.com/icra/WATExR/tree/master/Norway_Morsa</a>	Open Source	Under development



## Deliverable 3.2

Table 6. Overview of software used and developed for Wupper reservoir (Germany) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
<b>Wupper reservoir (Germany)</b>	<b>climate4R</b>	R	Downloading, bias-correcting and formatting reanalysis climate data and seasonal climate predictions.	<a href="https://github.com/SantanderMetGroup/climate4R">https://github.com/SantanderMetGroup/climate4R</a>	Open source	Fully functional
	<b>Water Quantity Delft-FEWS adapter</b>	Python	Adapter developed from the stakeholders to compute drought indexes (SPI) with the seasonal climate predictions within Delft-FEWS and show the results compared to water quantity parameters.	Will be available on github upon completion. Contact person, Eleni Teneketzi, <a href="mailto:eti@wupperverband.de">eti@wupperverband.de</a>	Open source	In development
	<b>Water Quality Delft-FEWS adapter</b>	R	Adapter developed for the stakeholders to run the CE-QUAL-W2 model with the seasonal climate predictions within Delft-FEWS and show the results on water quality parameters.	Will be available on github upon completion. Contact persons, Eleni Teneketzi, <a href="mailto:eti@wupperverband.de">eti@wupperverband.de</a> and Chenxi Mi, <a href="mailto:chenxi.mi@ufz.de">chenxi.mi@ufz.de</a>	Open source	In development
	<b>TALSIM Delft-FEWS adapter</b>		Adapter developed from SYDRO Consult and configured by Hydrotec Ingenieurgesellschaft für Wasser und Umwelt mbH for the stakeholders to run the TALSIM catchment within Delft-FEWS.	Software TALSIM-NG available upon request only for research projects ( <a href="mailto:info@sydro.de">info@sydro.de</a> )	Closed source	Fully functional
	<b>CE-QUAL-W2</b>	Fortran	Reservoir model for reservoir hydrodynamics and ecosystem dynamics.	<a href="http://cee.pdx.edu/w2/">http://cee.pdx.edu/w2/</a>	Open source	Fully functional

## Deliverable 3.2

Table 7. Overview of software used and developed for Mt. Bold reservoir (Australia) in WATExR and its accessibility.

Site	Software name	Code type	Key features	Availability	Open or closed software	Status
<b>Mt. Bold Reservoir (Australia)</b>	<b>climate4R</b>	R	Downloading, bias-correcting and formatting reanalysis climate data and <b>seasonal climate predictions</b> .	<a href="https://github.com/SantanderMetGroup/climate4R">https://github.com/SantanderMetGroup/climate4R</a>	Open source	Fully functional
	<b>GR4J</b>	R (or excel)	Watershed model for simulating the water discharge entering Mt. Bold.	<a href="https://webgr.irstea.fr/en/modeles/journalier-gr4j-2/fonctionnement_gr4j/">https://webgr.irstea.fr/en/modeles/journalier-gr4j-2/fonctionnement_gr4j/</a>	Open source	Fully functional
	<b>GOTM</b> and <b>FABM</b>	Fortran	Reservoir model for reservoir hydrodynamics and water quality.	<a href="https://github.com/gotm-model">https://github.com/gotm-model</a> <a href="https://github.com/fabm-model/fabm">https://github.com/fabm-model/fabm</a>	Open source	Fully functional
	<b>R</b>	R	A series of scripts to produce <b>ensemble plots</b> (as presented in example in Deliverable 3.1)	Available upon request, contact person: Tadhg Moore, <a href="mailto:tadhg.moore@dkit.ie">tadhg.moore@dkit.ie</a>	Open source	Fully functional