

**Development of a software tool to analyse
the effect of soil management scenarios on
soil erosion and sediment transport in
Flanders.**

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FLUVES  **Flow Monitoring**
Every meter, every minute

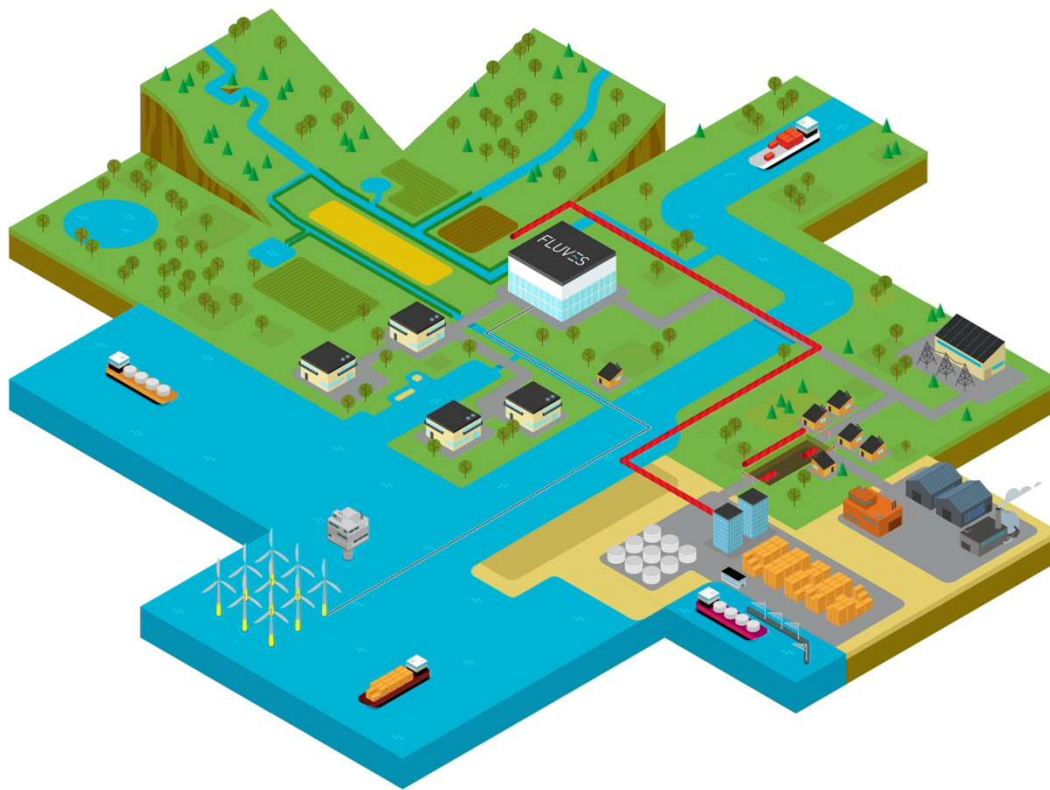
Erosion and sediment management in Flanders



Effect implementation
erosion control measures?

VLAAMSE
MILIEUMAATSCHAPPIJ

Innovations in monitoring technologies and data analytics



Modelling erosion and sediment transport with WaTEM/SEDEM

1. RUSLE: Yearly potential soil loss (def. Van Rompaey *et al.*, 2001)*

$$A = R.K.LS.C.P$$

2. Sediment transport

$$TC = kTC.E_{PR} = kTC.R.K.(LS - 4,12.S_g^{0,8})$$

3. Adapted multiple flow algorithm

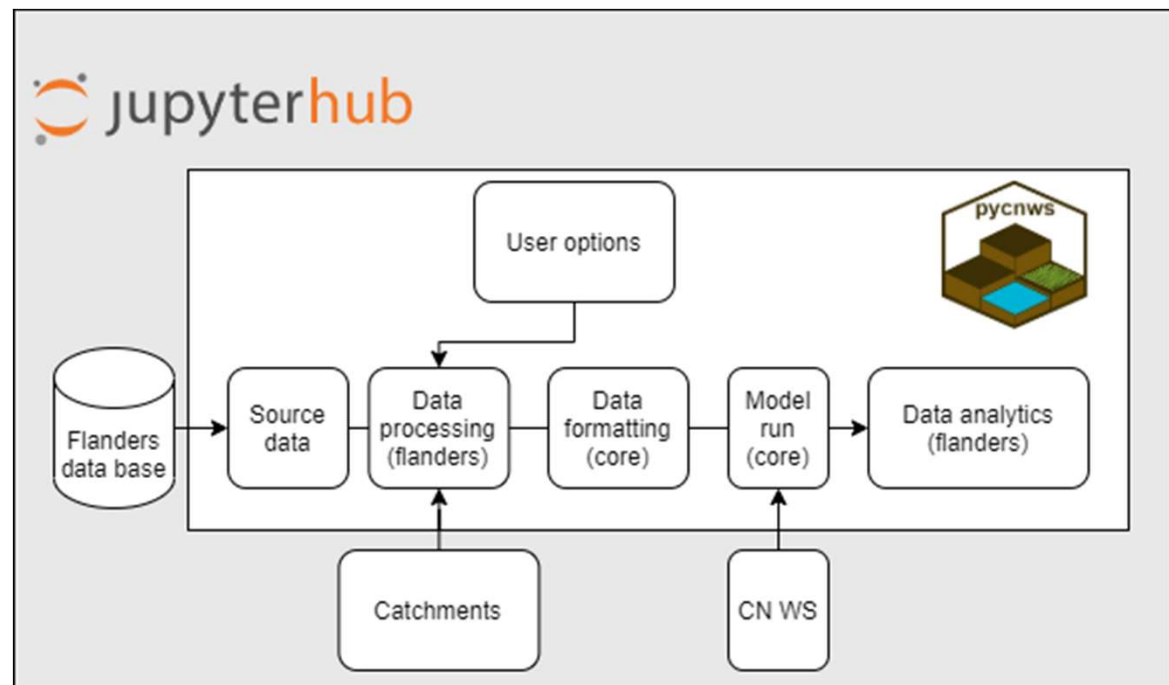
*For info on formula's, see extra slides at the end of the presentation



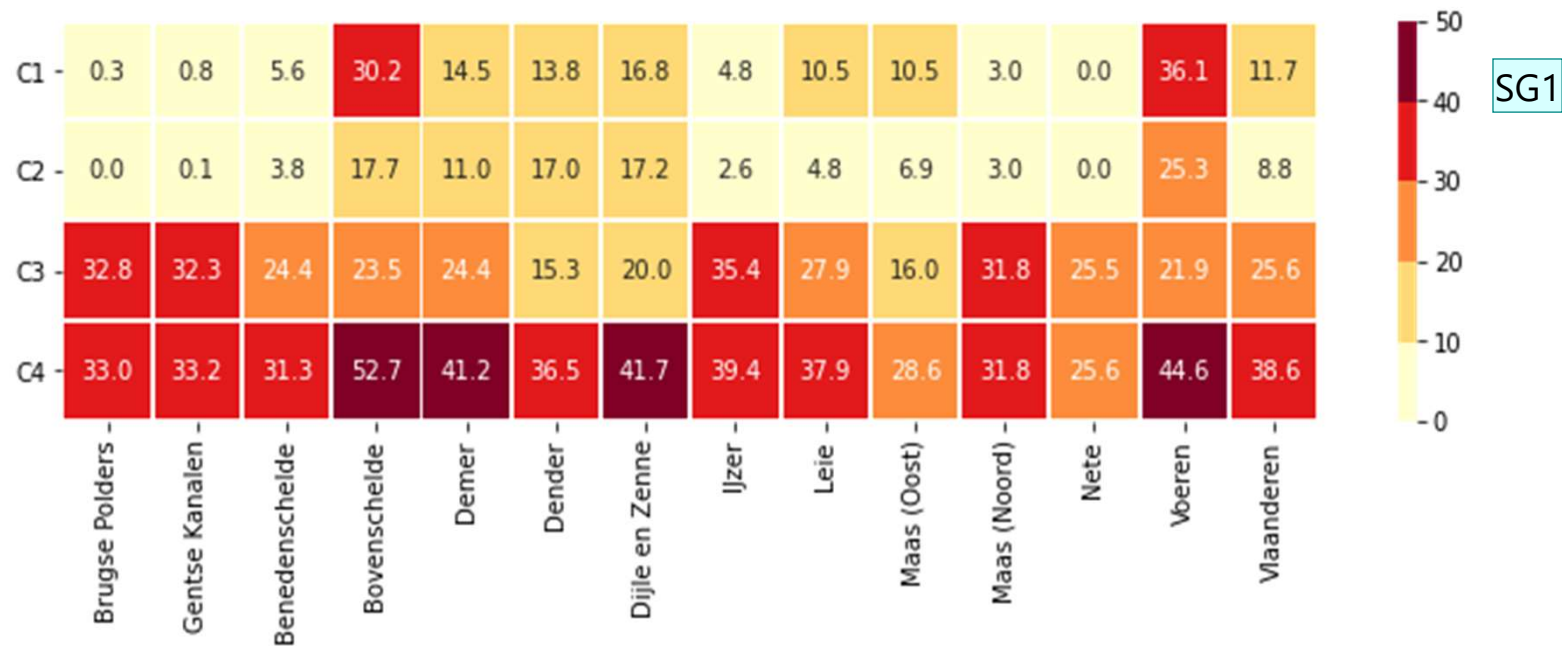
Modelling erosion and sediment transport with pycnws

CN-WS Applied to Flanders

- + Fast calculation engine
- Repetitive model development
- Standardisation
- Model analytics



Results



Percentual reduction (% , z-axis) in total sediment load for a number of hypothetical erosion control measure plans.

Slide 6

SG1

Sacha Gobeyn; 22-6-2021

Way forward: Open source

- + Higher quality software
- + Transparency
- + Sustainability
- Higher start-up cost

Documentation

The screenshot shows the documentation for the 'rfactor' package. The left sidebar contains a 'USER GUIDE' with links to 'R-factor', 'Installation', 'Tutorial', 'Module Reference', and 'Flanders', and a 'DEVELOPER GUIDE' with links to 'License', 'Authors', and 'Changelog'. The main content area is titled 'R-factor' and includes a DOI (10.5281/zenodo.4756759). It describes the R-factor as a measure used in erosion and (overland) sediment modelling to quantify the effect of rainfall on soil erosion. It is typically defined in the context of the RUSLE equation. A 'Get started' section explains that the package uses Python (with dependencies like Pandas and Numpy) and Matlab or Octave. A 'Note' box states that Octave is used as a free alternative if a license for Matlab cannot be acquired. The 'Data & application to Flanders' section mentions that input rainfall data is provided by the Flemish Environment Agency (VMM) and is also available via waterinfo.

Open source development

The screenshot shows the GitHub repository for 'cn-ws/rfactor'. The repository has 3 pulls, 1 unstar, and 0 forks. The 'Code' tab is selected, showing a list of files and their commit history. The files include .github/ISSUE_TEMPLATE, docs, src/rfactor, tests, .coveragerc, .drone.yml, .gitattributes, .gitignore, and .pre-commit-config. The commit history shows updates to documentation, pull requests, and restructuring of the package. The 'About' section on the right shows the repository is licensed under GPL-3.0 and has 3 releases, with the latest being v0.0.2 on 13 May.

Way forward: Monitoring

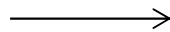
- IoT Network of pluviometers on dams
- RTK GPS measurements



Way forward: IoT



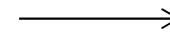
2010
10 000 €



2015
5000 €



2020
500 €



2021
< 500 €

FLUVES

Thank you



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Formula's (double-click to open document)

Erosion/sediment model: WaTEM/SEDEM — csws 4.1.0-488-gb387c66... <https://docs.fluv.es/csws-pascal/watem-seDEM.html>

🔗 » Model Description » Erosion/sediment model: WaTEM/SEDEM

Erosion/sediment model: WaTEM/SEDEM

Concept

WaTEM/SEDEM is a spatially distributed model that was created at the Laboratory for Experimental Geomorphology (KU Leuven, Belgium). WaTEM stands for Water and Tillage erosion model (Van Oost et al., 2000) and SEDEM is the abbreviation of Sediment Delivery Model (Van Rompaey et al., 2001).

In WaTEM/SEDEM, the mean annual soil erosion rate E and transport capacity TC are calculated for every pixel in the model domain. Next, the model iterates over all pixels according to the order determined by the routing algorithm. During the iteration, the outgoing sediment for every pixel is calculated by comparing the total available sediment in the cell S_A (incoming sediment, $S_i + E$) with the transport capacity.

Two cases exist:

- $S_A \leq TC$: the pixel can transport the total available sediment S_A , so erosion will occur at the mean annual soil erosion rate. The outgoing sediment S_o is set equal to the available sediment S_A .
- $S_A > TC$: the total available sediment S_A is higher than the amount of sediment that can be transported. The outgoing sediment (S_o) equals the transport capacity TC . The net erosion rate is lower than the mean annual erosion rate E and equals $TC - S_i$. If the incoming sediment S_i is higher than the transport capacity TC , net sediment deposition will occur and equals $S_i - TC$.

Or:

$$S_o = S_A \quad \text{if } S_A \leq TC$$
$$S_o = TC \quad \text{if } S_A > TC$$

The outgoing sediment of a cell is distributed to one or two target pixels. The target cells are determined by the routing algorithm. The outgoing sediment of pixel X to pixel Y is added to the incoming sediment of pixel Y. Pixel Y can receive sediment of multiple pixels.

This process is illustrated in figure (TO DO: create figure with pixel).

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