Session: Sediment assessment and management - concepts and policies

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

Vlaanderen is omgeving

VLAAMSE MILIEUMAATSCHAPPIJ

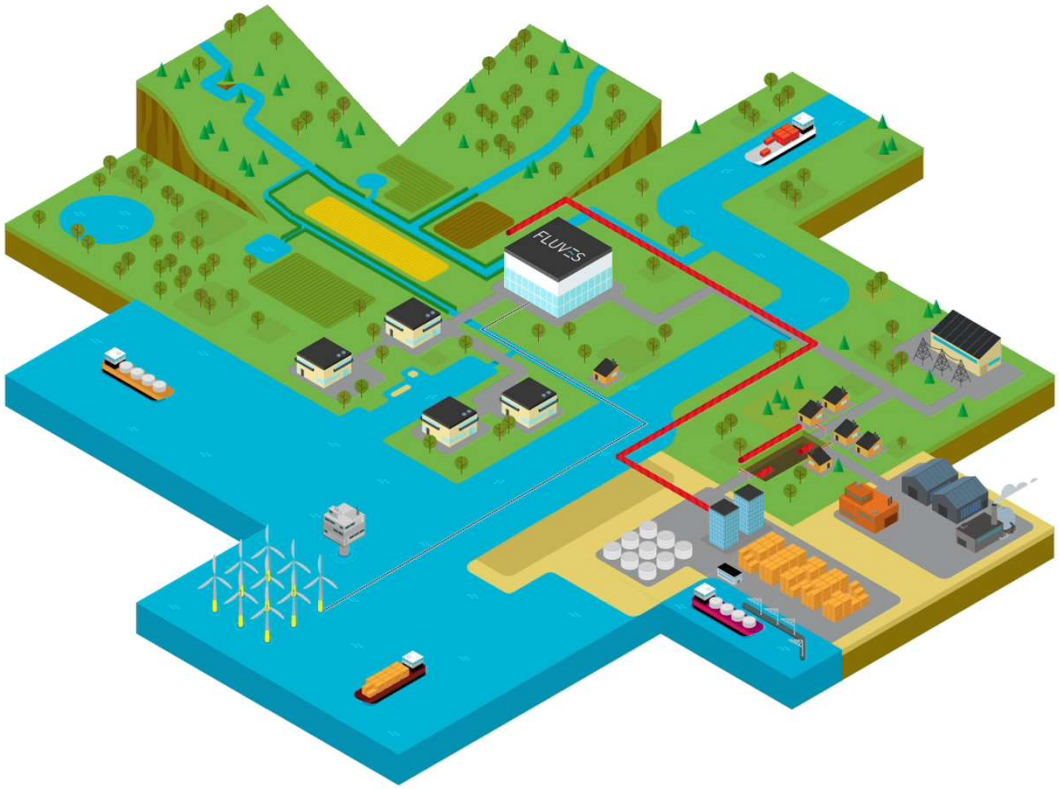
Erosion and sediment management in Flanders

Vlaanderen
is omgeving

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

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

3. Adapted multiple flow algorithm

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

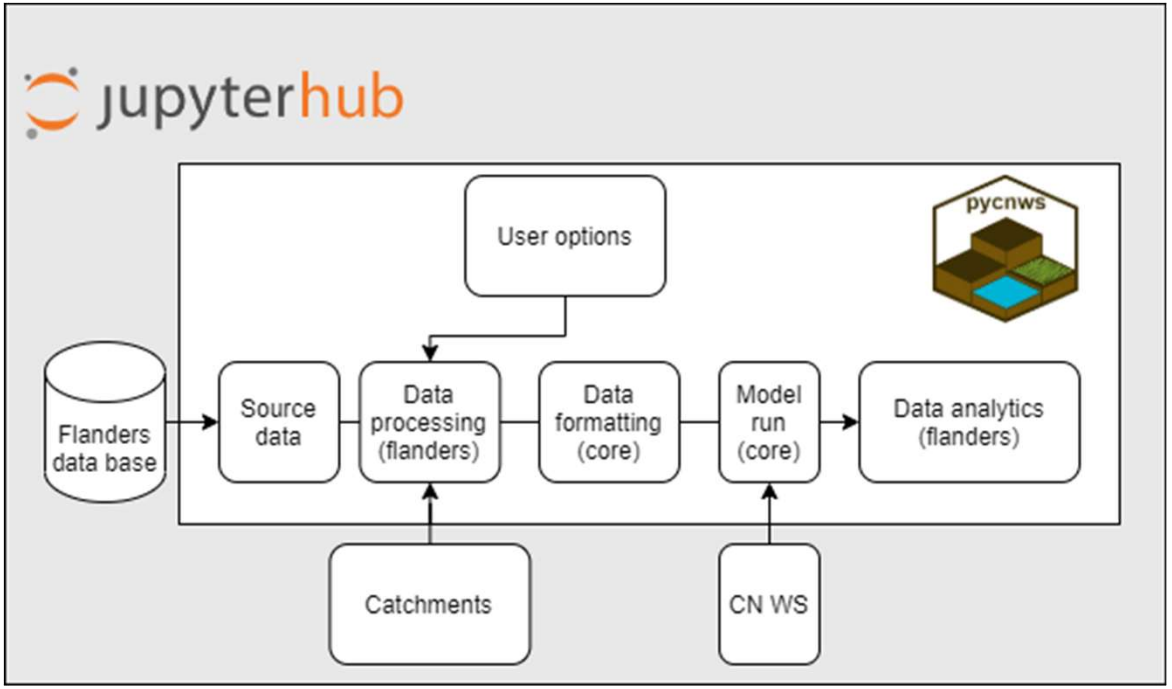
KU LEUVEN

Van Rompaey, A.J.J., Verstraeten, G., Van Oost, K., Govers, G., Poesen, J., 2001. Modelling mean annual sediment yield using a distributed approach. Earth Surf. Process. Landforms 26, 1221–1236. https://doi.org/10.1002/esp.275

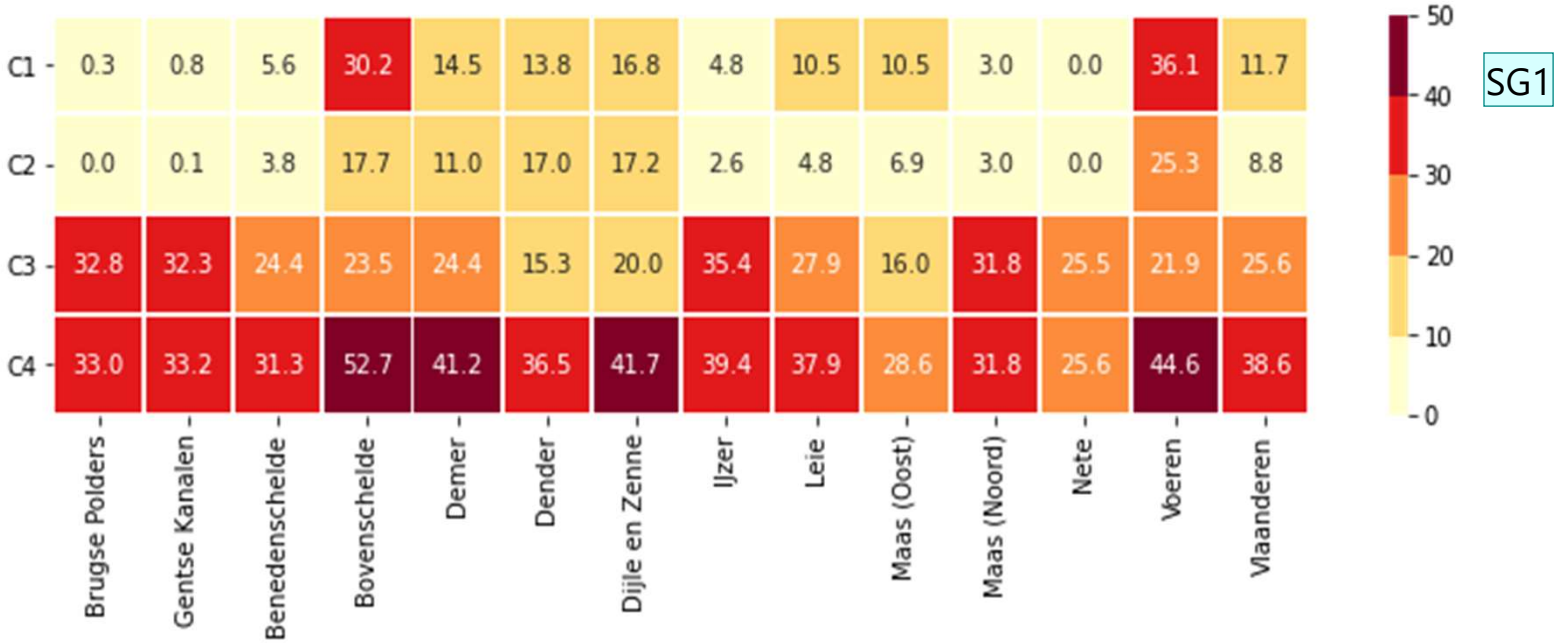
Modelling erosion and sediment transport with pycnws

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.

*these plots are for visualisation purposes only

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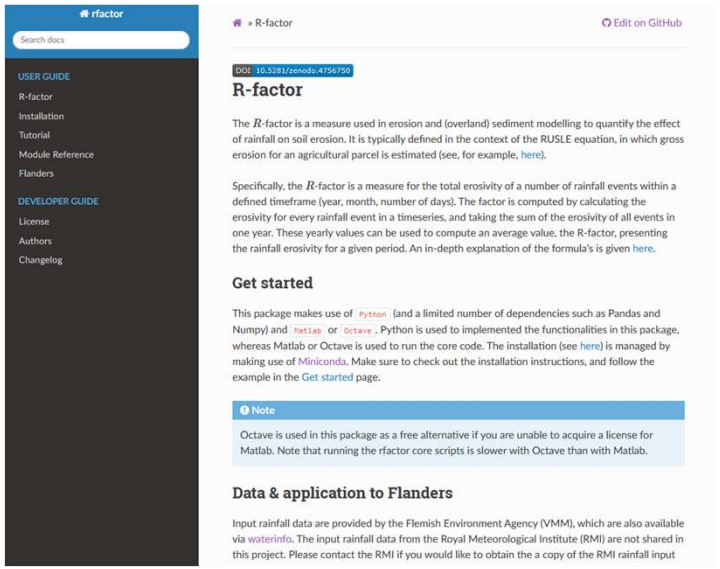
Slide 6

SG1 Sacha Gobeyn; 22-6-2021

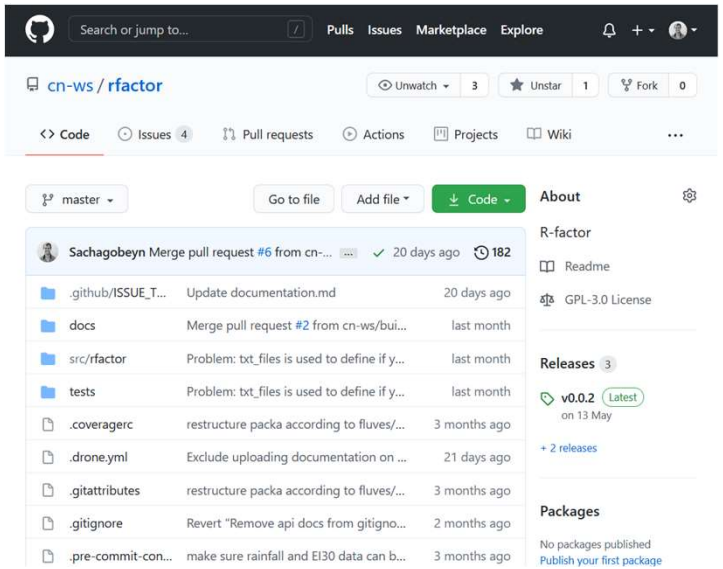
Way forward: Open source

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

Documentation



Open source development



https://cn-ws.github.io/

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Way forward: Monitoring

- IoT Network of pluviometers on dams
- RTK GPS measurements

FLUVES

Way forward: IoT

2010
10 000 €

2015
5000 €

2020
500 €

2021
< 500 €

FLUVES

Thank you

Vlaanderen
is omgeving

VLAAMSE
MILIEUMAATSCHAPPIJ

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Formula’s (double-click to open document)

Erosion/sediment model: WaTEM/SEDEM

Concept

WaTEM/SEDEM is a spatially distributed model that was created at the Laboratry 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 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).