

## Demonstrator 6: **SEDMIX**

# Controlled fine sediment release through the power waterways by using a mixing device

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In cooperation with the CTI



**Energy**

Swiss Competence Centers for Energy Research



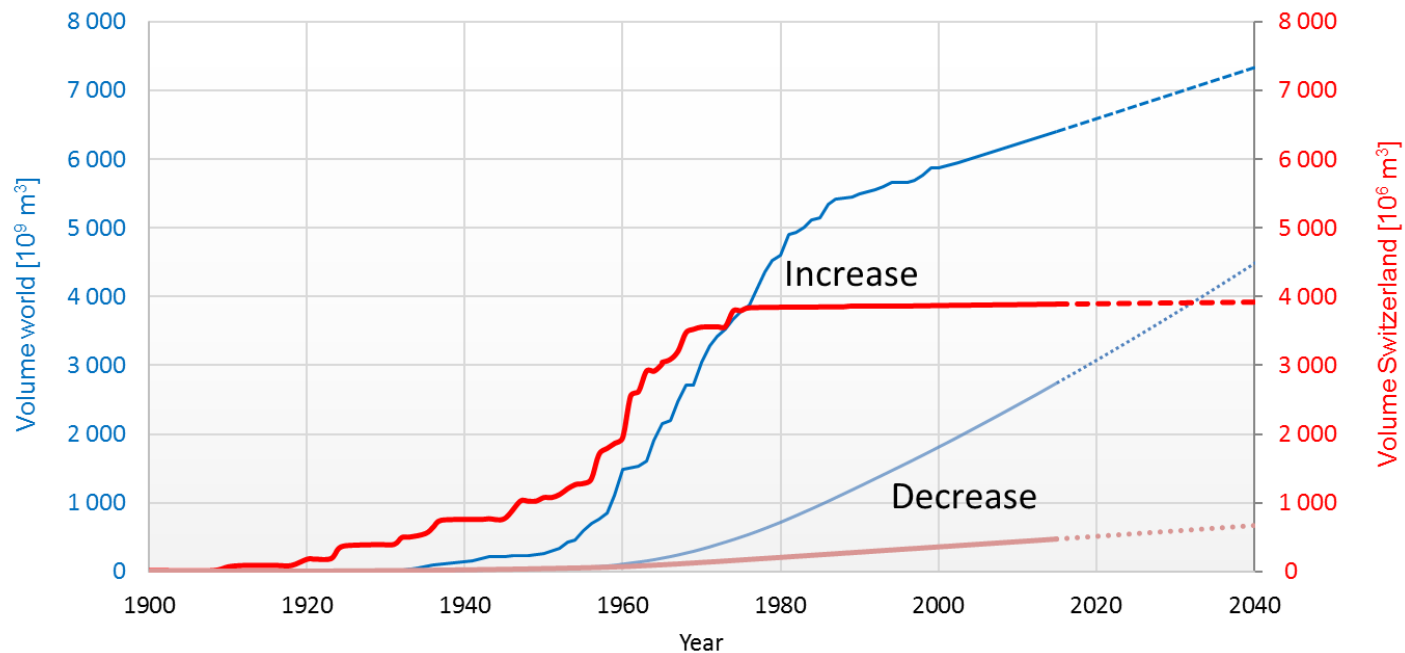
Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
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Swiss Confederation

Commission for Technology and Innovation CTI

# A worldwide problem: Reservoir sedimentation

Comparison of increase of reservoir volume due to construction and loss due to reservoir sedimentation

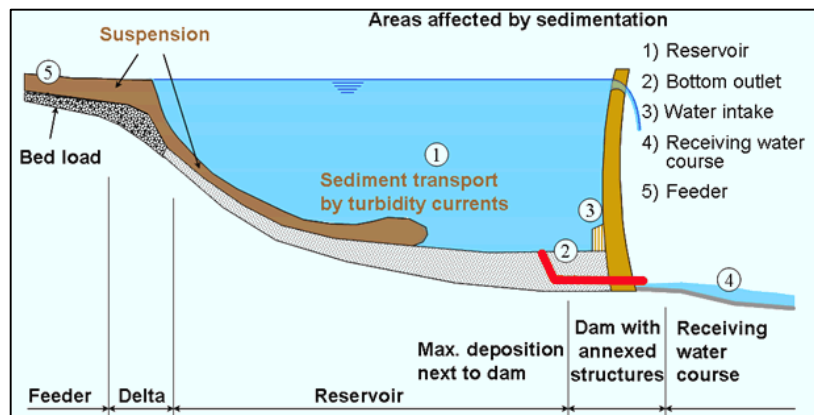


# Turbidity currents:

The main sedimentation process in deep reservoirs

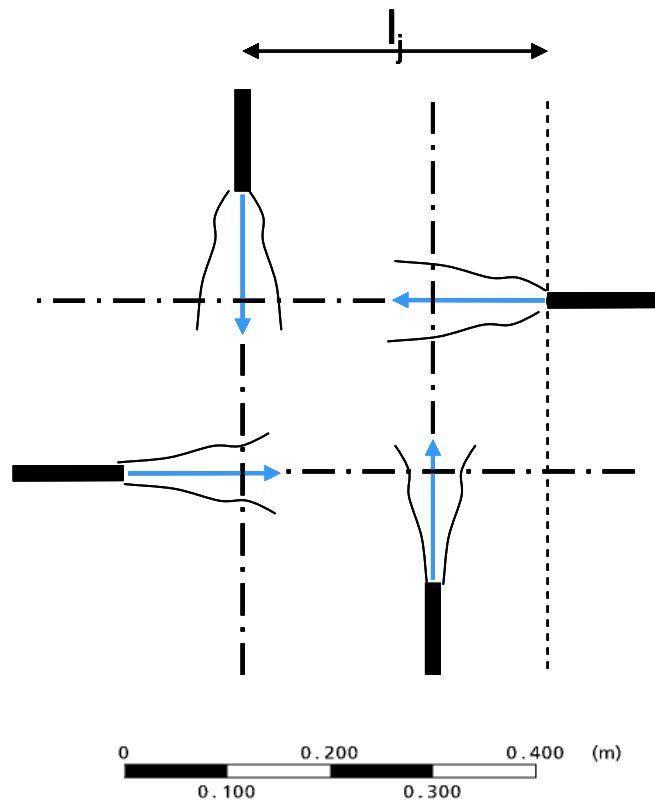
## Countermeasures:

- Venting  
(release through bottom outlets ev. intakes)
- Mixing  
(release through intakes)



# Demonstrator 6: SEDMIX

Circular jet arrangement creating mixer-like upflow  
PhD research project



- Jenzer Althaus, J.M.I., De Cesare, G, Schleiss, A. J (2015). Sediment Evacuation from Reservoirs through Intakes by Jet-Induced Flow. **Journal of Hydraulic Engineering**, 141(2).
- Jenzer Althaus J.M.I., De Cesare G. and Schleiss A. J. (2016). Release of suspension particles from a prismatic tank by multiple jet arrangements. **Chemical Engineering Science**, 144: 153–164.

# Trift new reservoir

Taking advantage of withdrawal of the glacier ...



1948



2008



202?



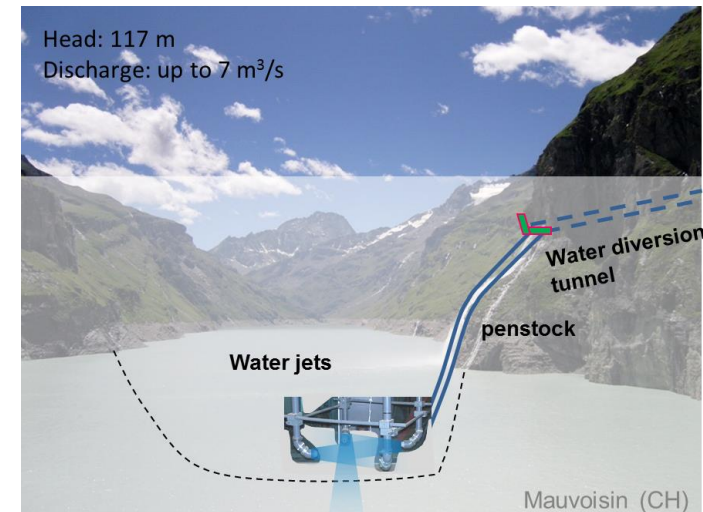
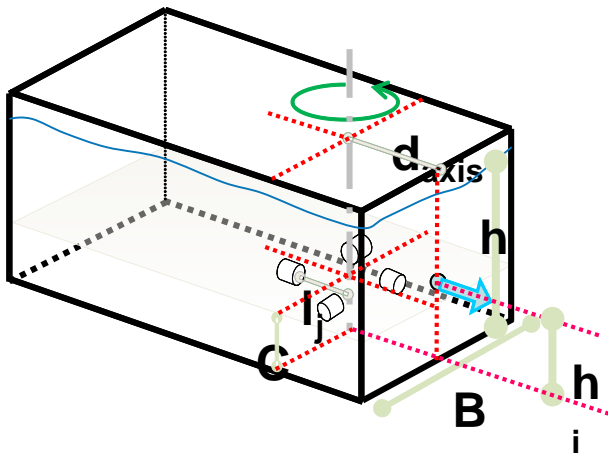
... an opportunity to foresee to implement **SEDMIX** at the very beginning!

# From experiments to prototype

Experiments



Prototype



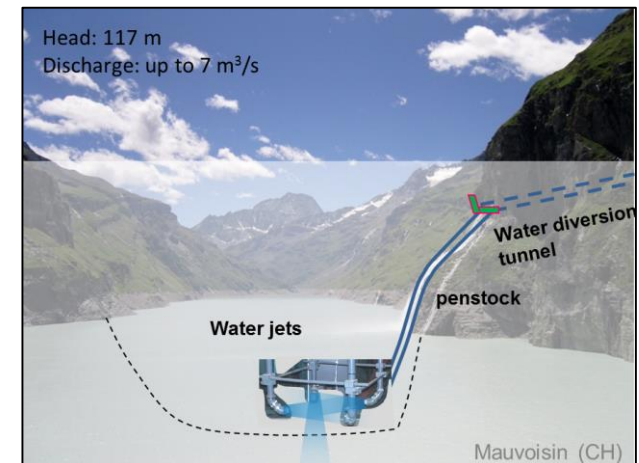
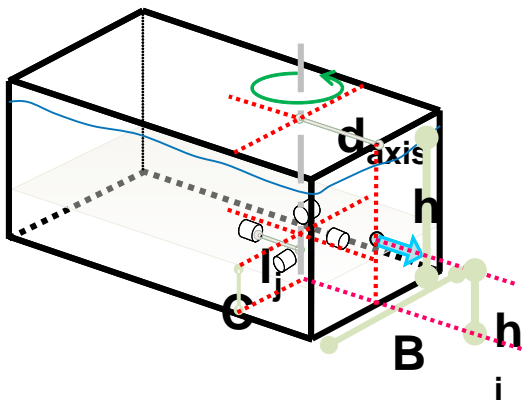
J. Jenzer-Althaus

# From experiments to prototype

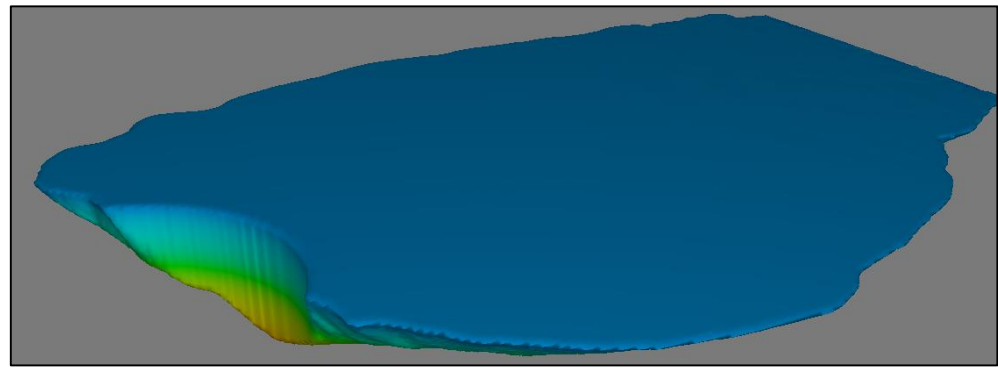
Experiments



Prototype



# From experiments to prototype



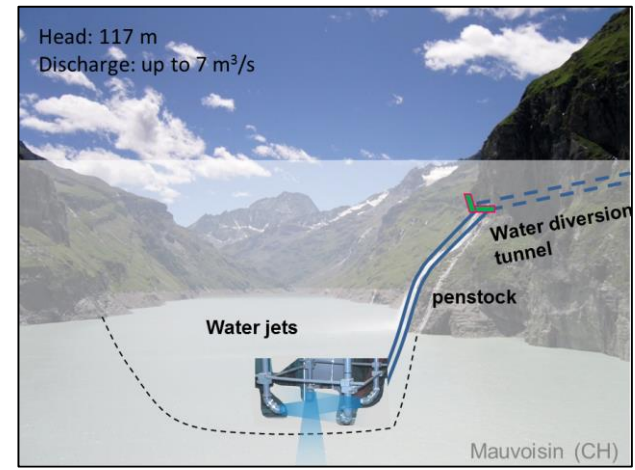
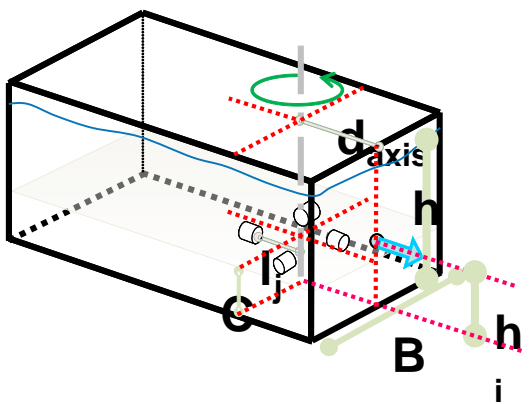
Experiments



Numerical simulations

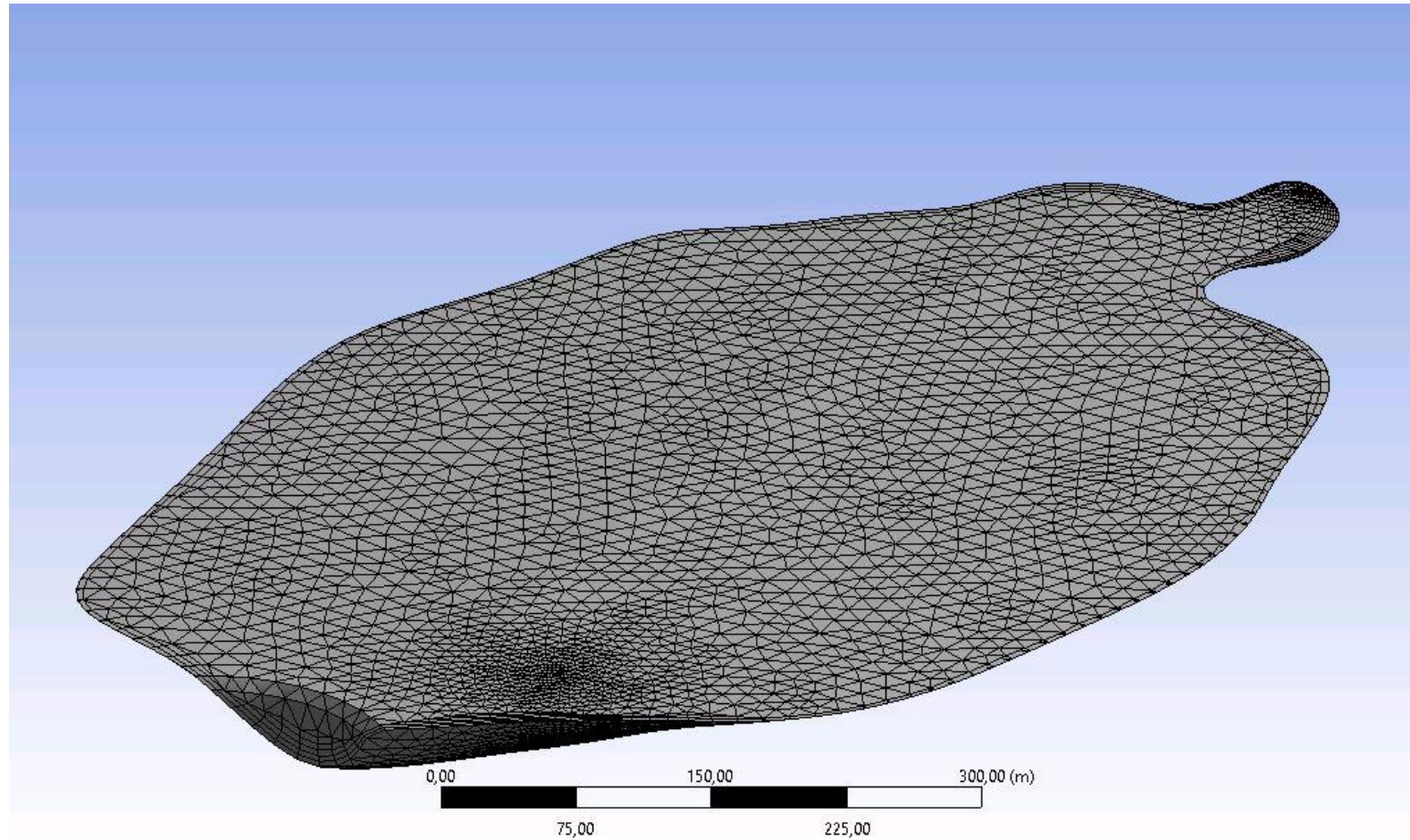


Prototype

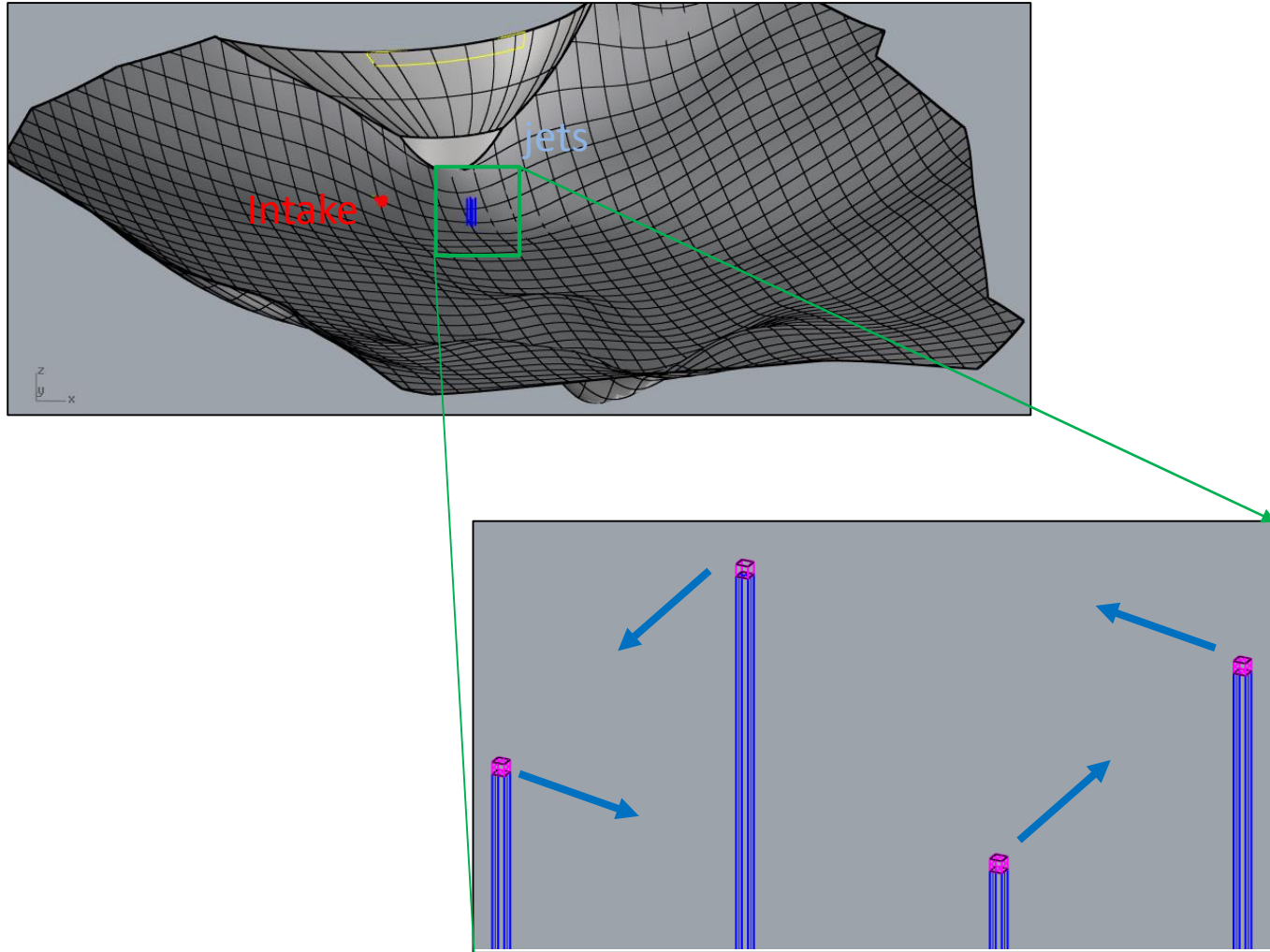




# ANSYS-CFX 3D model of Trift reservoir

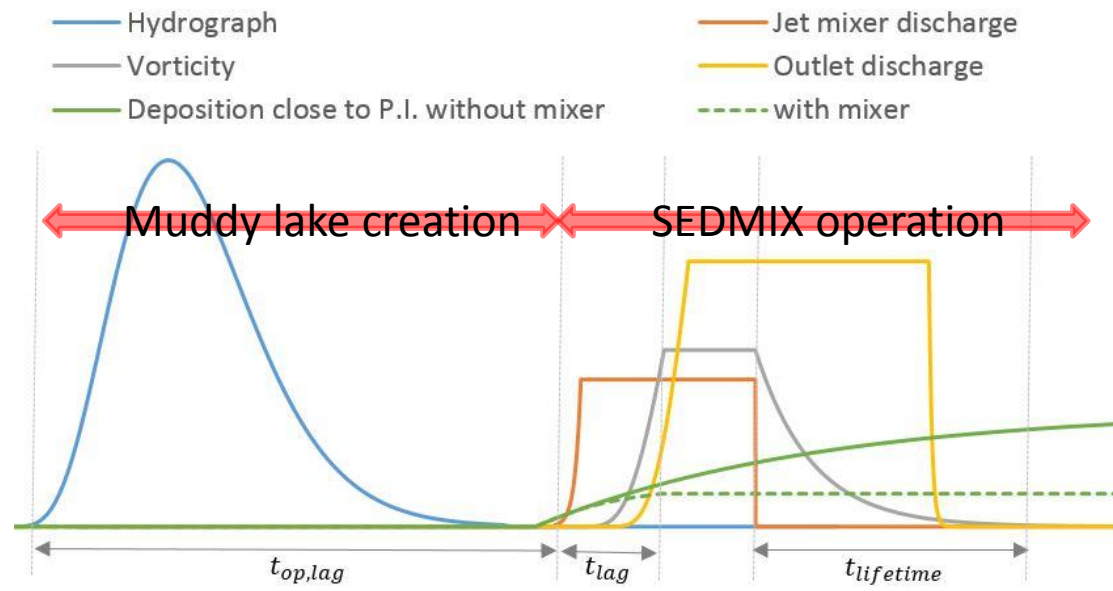


# Numerical model of Trift reservoir



# Simulation scenarios

- Water
- Water & sediments
- Water & jets
- Water & sediments & jets
- With/without initial concentration
- Different sediment characteristics
- Different jet positions/geometry/discharge

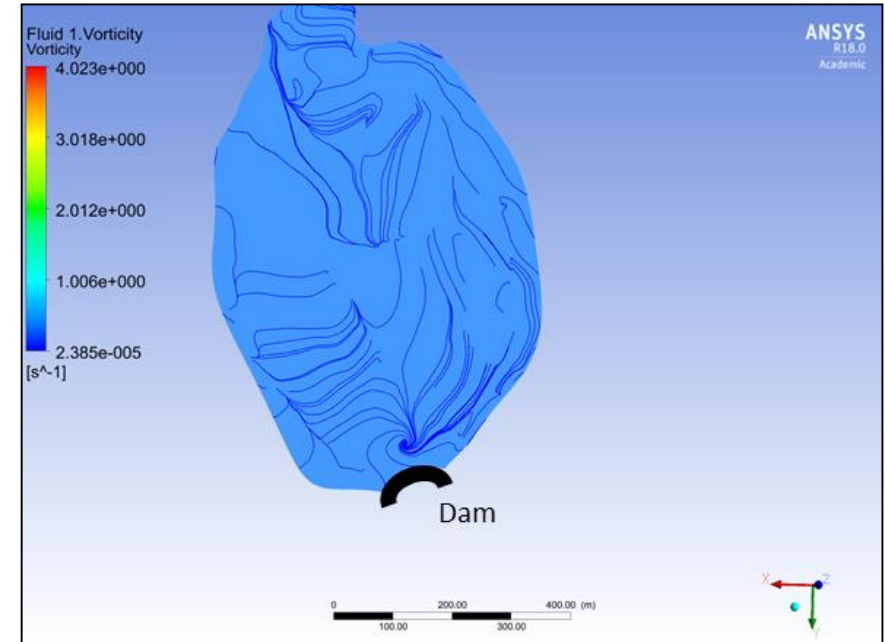


# Results: Jets + Sediments

## ESR: Evacuated Sediment Ratio

The evacuated sediment ratio, ratio between evacuated sediment and supplied sediment, ESR is equal to 0.14 and 0.70 respectively for without and with jets configurations.

Life time of reservoir 5 times higher than without jet mixing device (i.e. problems at the intake occur 5 times later)



# Outlook

- **Continue with numerical simulations for other potential reservoir sites (future project partners)**
- **Identify partners for a CTI project with the purpose to build a mobile prototype**
- **Test the prototype at the different reservoirs of the partners**

# Thank you for your attention!

Amini A., Manso P., Lindsey N.,  
Venuelo S. & Schleiss A. J. (submitted  
to Hydro 2017 conference, Sevilla,  
Spain). Computational hydraulic  
modelling of the sediment stirring  
and evacuation through the power  
waterways at the Trift reservoir.



Tourtemagne (Switzerland)