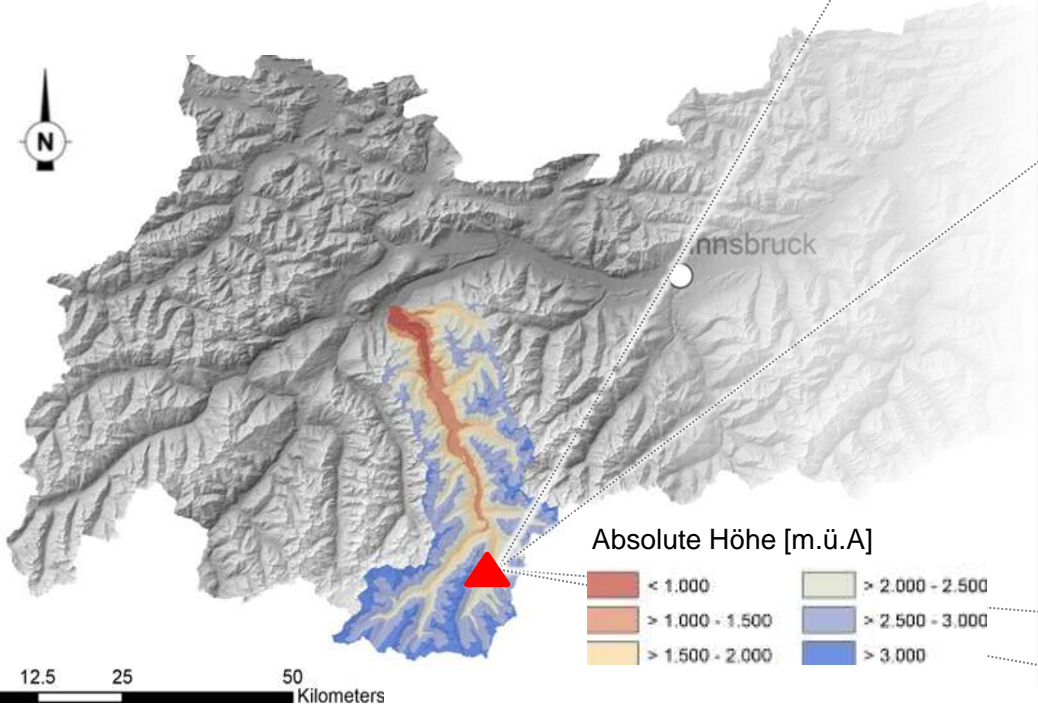


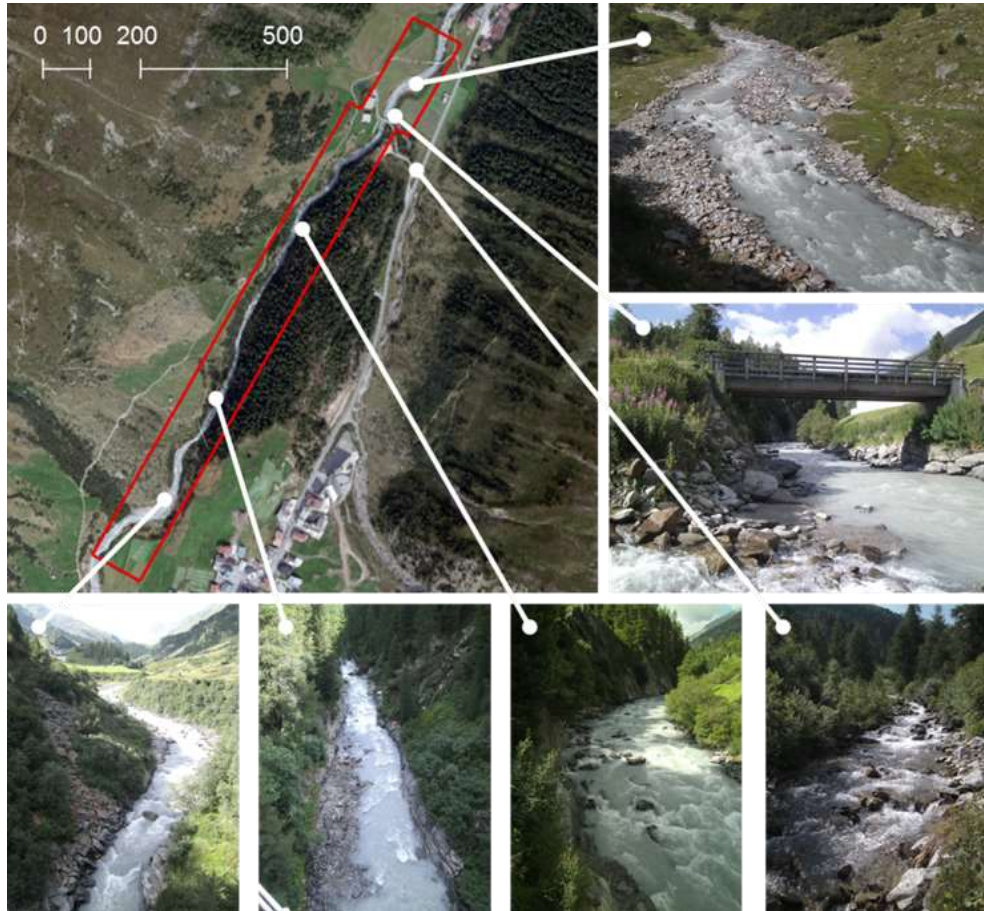


Untersuchung von Verlandungs- und Spülvorgänge an einer Wasserfassung mit Stauhaltung mit Hydro_AS-2D/Hydro_GS-2D

Manuel Plörer
Universität Innsbruck



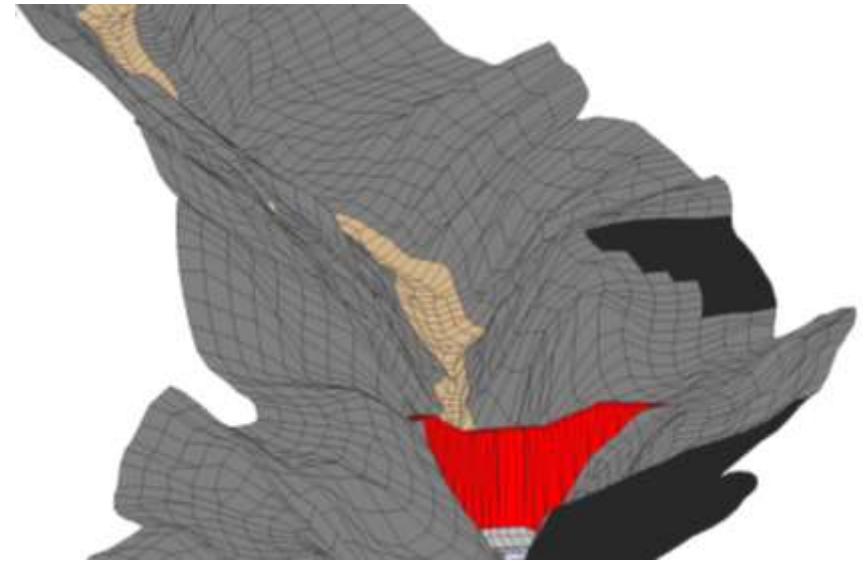






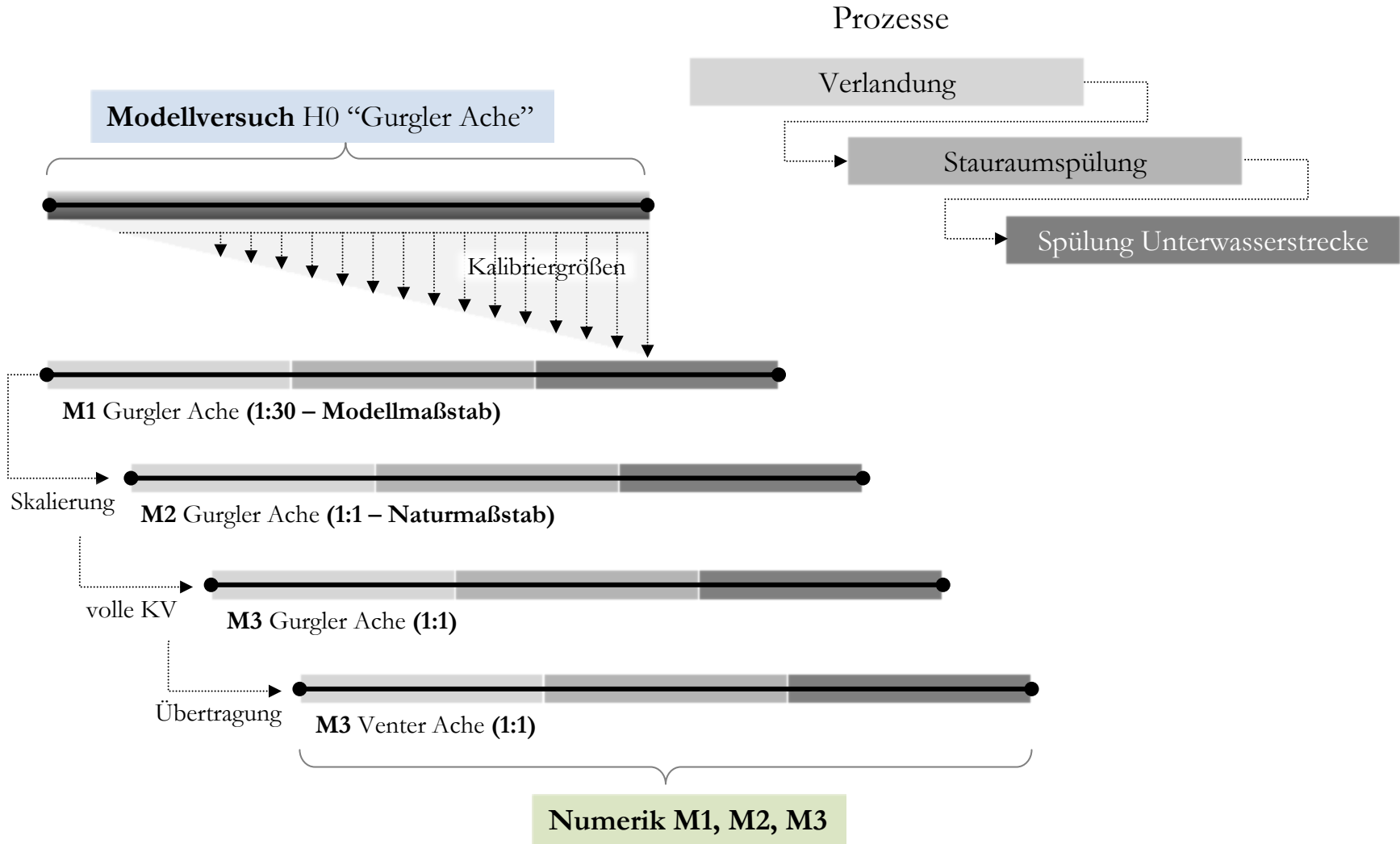
Modellversuch

- Froude'sches Modellgesetz
- Maßstab 1:30
- 900 m Oberwasser (Zulauf/Stauraum)/
460 m Unterwasserstrecke
- Wasserfassung
- Grundablass/Drucksegment
- Hochwasserentlastung (Überfall)

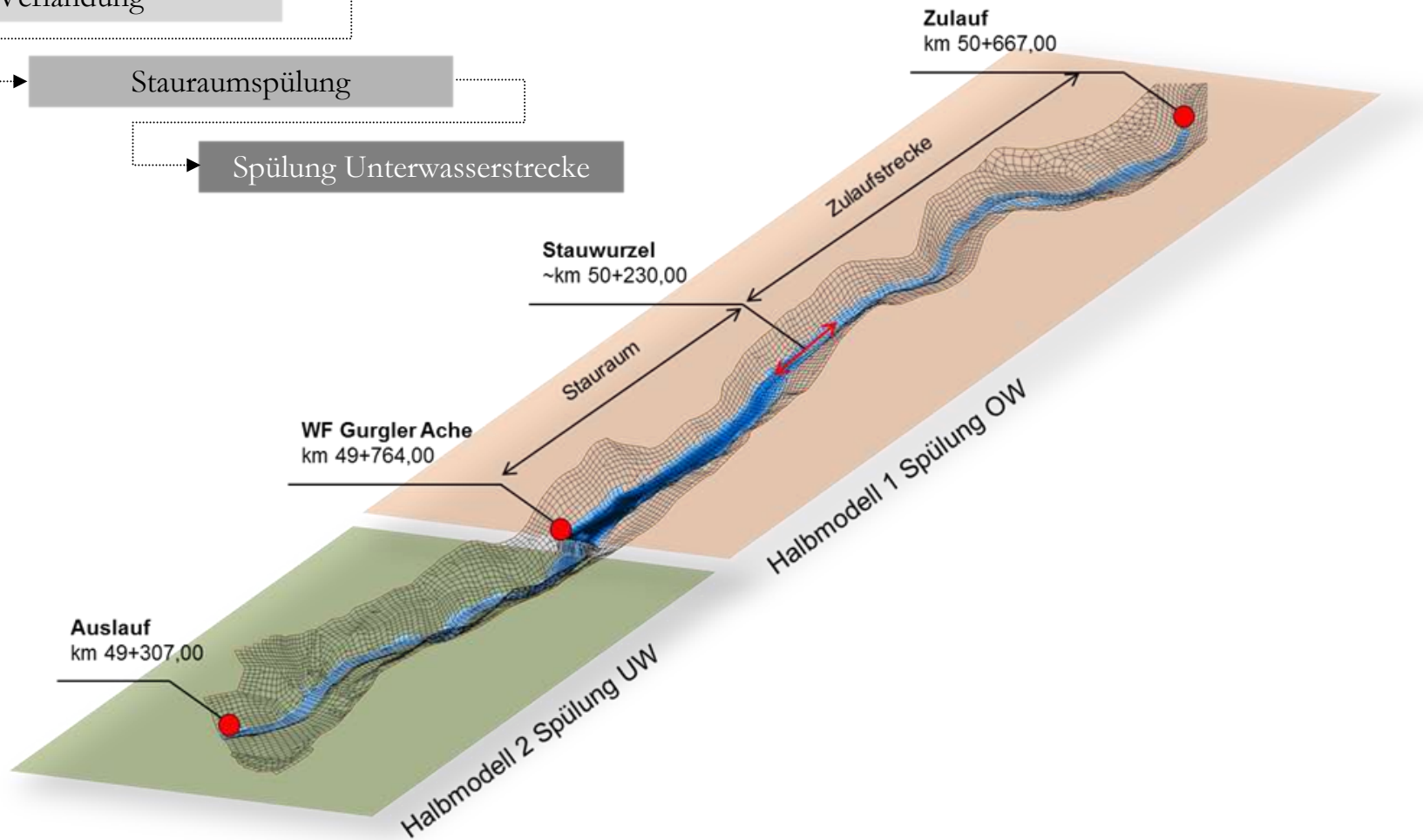
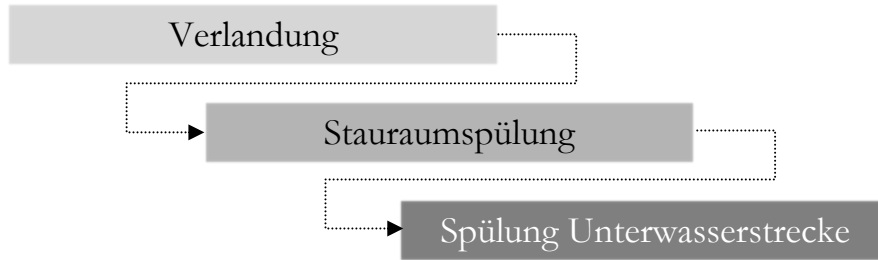


2D-numerische Simulation

- Hydro_AS-2D/Hydro_GS-2D
- Finite Volumen Methode
- Runge-Kutta Verfahren 2.Ordnung
- Reibungsterm $>$ Darcy-Weisbach-Gleichungen
- KV mit bis zu 12 Fraktionen



Prozesse

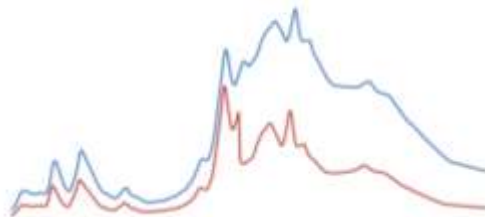


Mittlere jährliche Verlandung

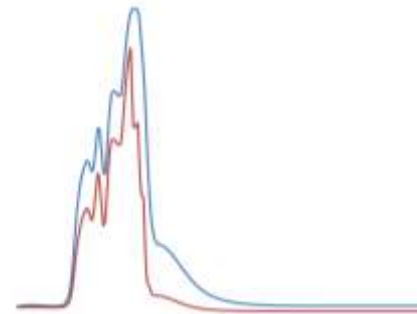
Halbe Jahresgeschiebefracht ($1/2$ JGF)
4 150 m³ (Feststoffvolumen)

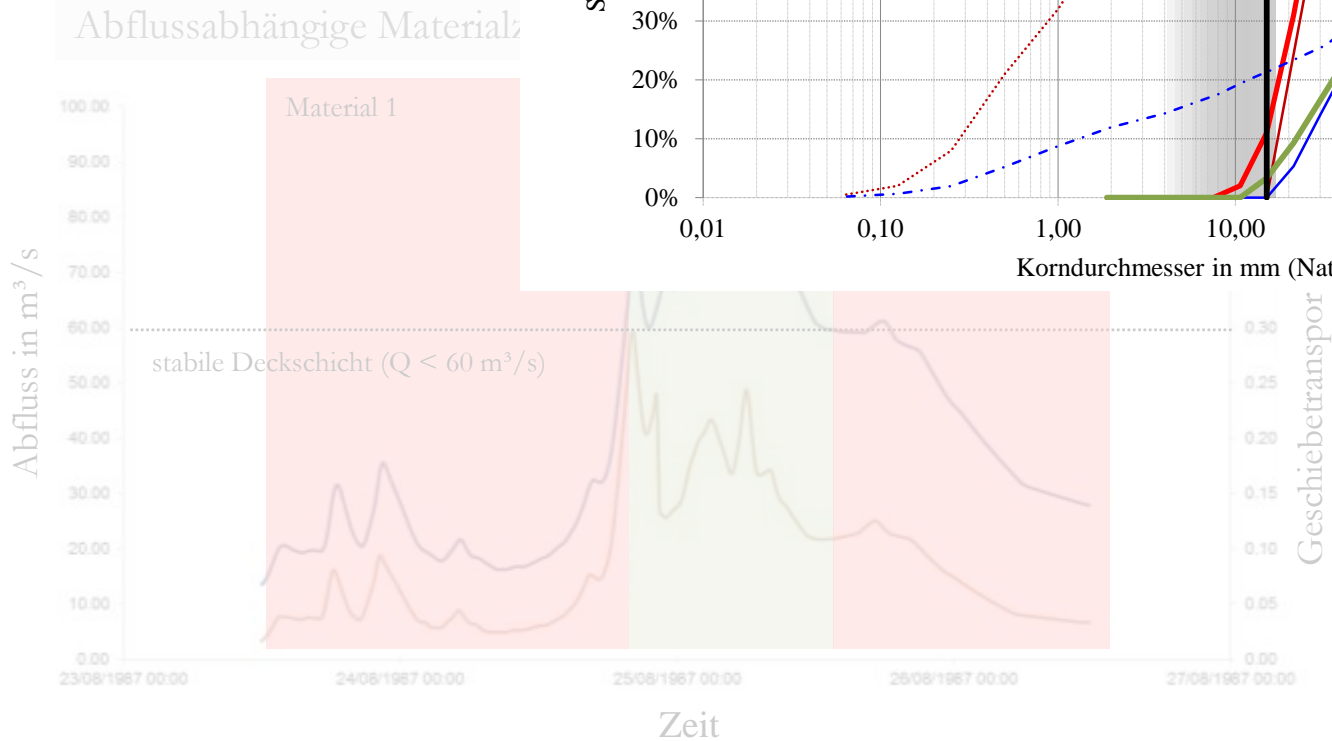
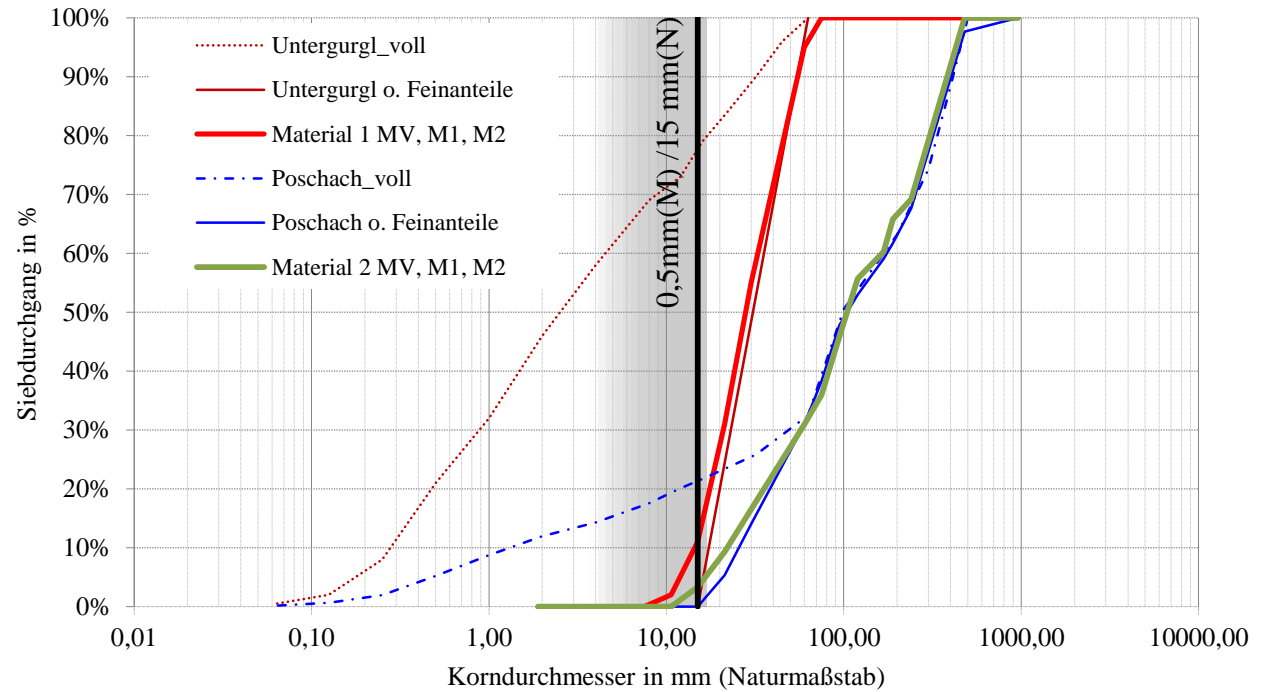
Hochwasserereignisse

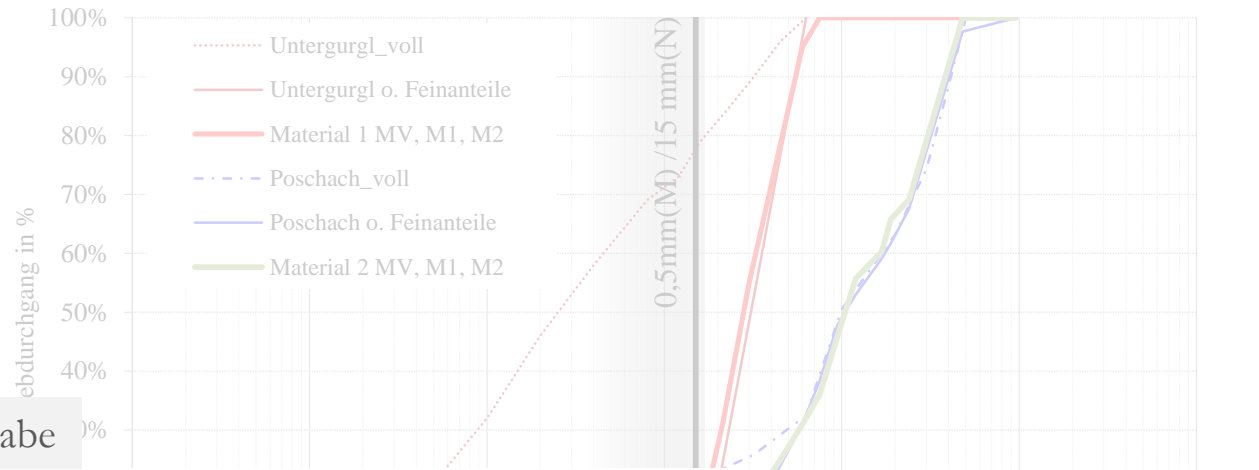
HW Aug 1987
~ HQ50 ($Q_{\text{peak}} = 87 \text{ m}^3/\text{s}$)
Ereignisfracht **22 600 m³**



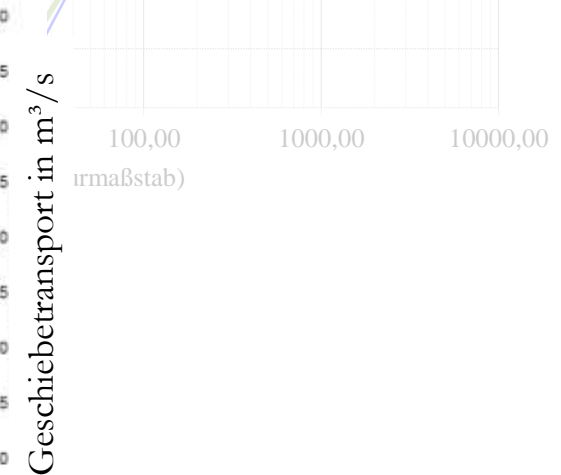
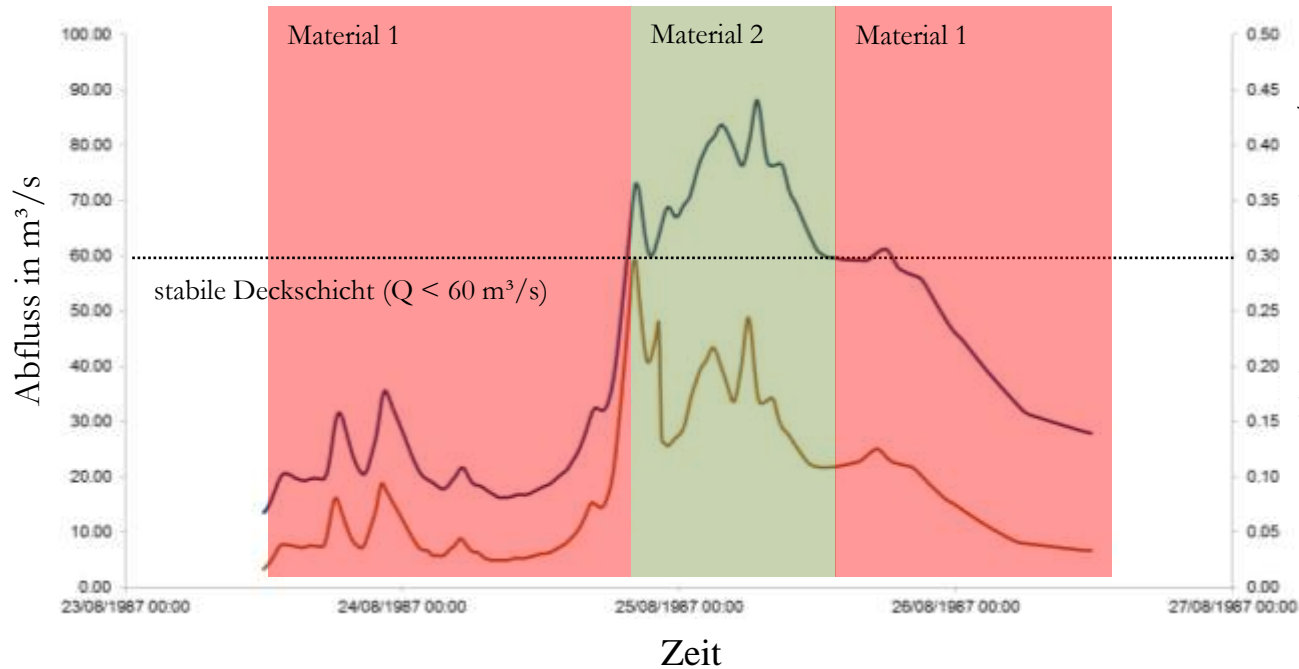
HW Sep 1999
~ HQ100 ($Q_{\text{peak}} = 115 \text{ m}^3/\text{s}$)
Ereignisfracht **16 300 m³**



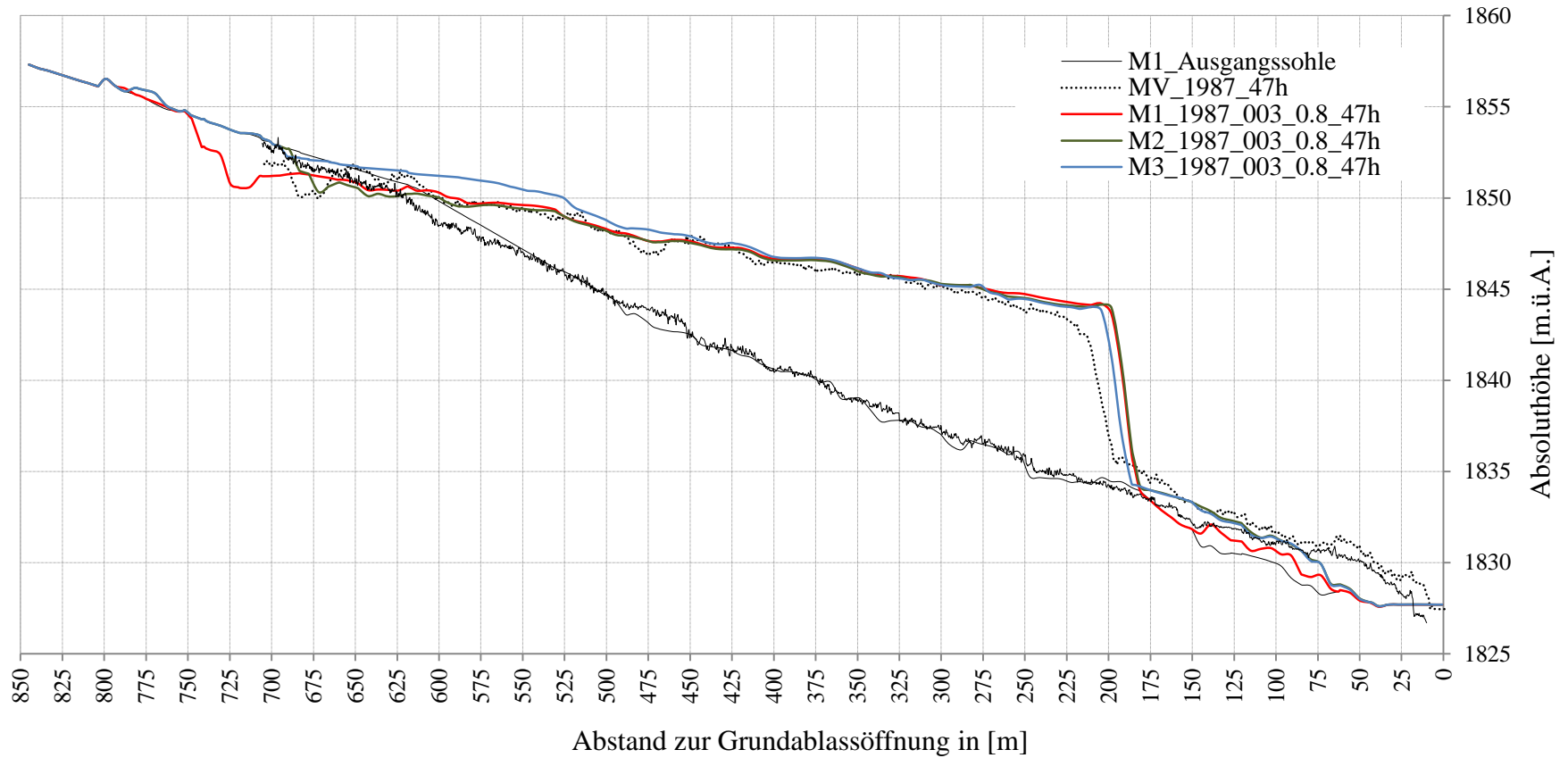




Abflussabhängige Materialzugabe

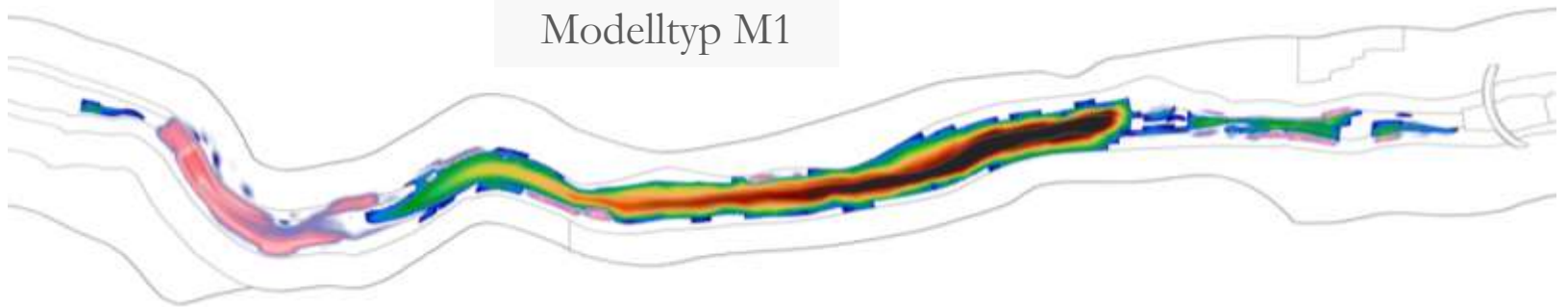


Verlandung HW 1987

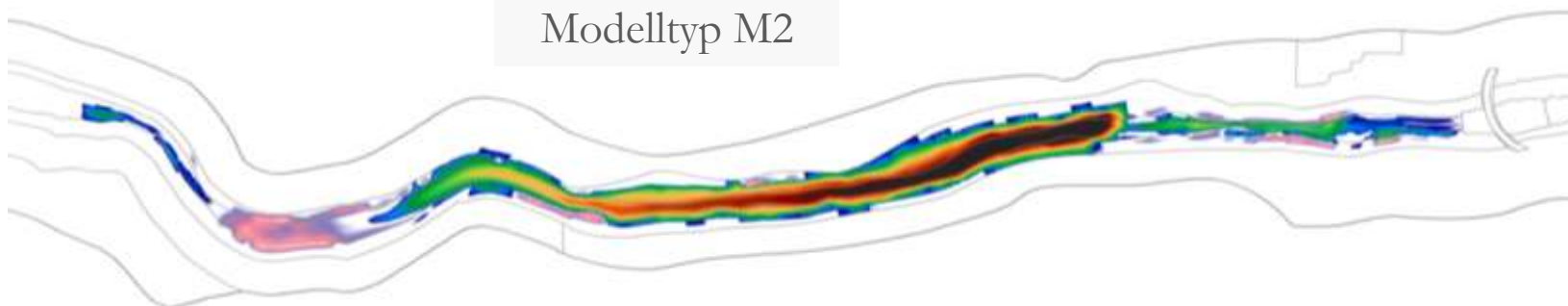


Verlandung HW 1987 nach 47h Ereignisdauer (Spülbeginn)

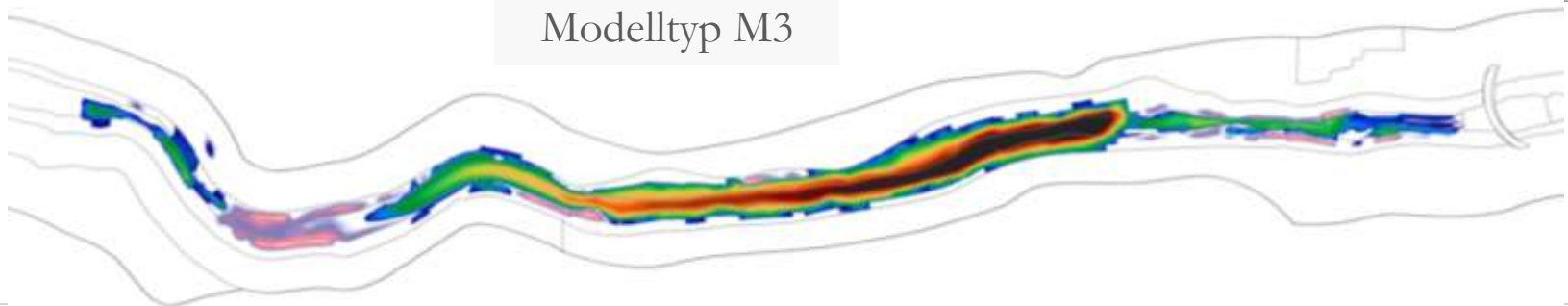
Modelltyp M1



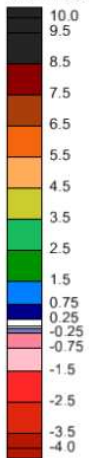
Modelltyp M2



Modelltyp M3



Mesh Module



Verlandungsvorgang

bei hohen Geschiebetransportraten

— Auflandungen Zulauf

+ Stoffeintrag verteilt auf mehrere nodestrings

lokal Erosionen durch hohe Abflüsse

— Beckenbildung

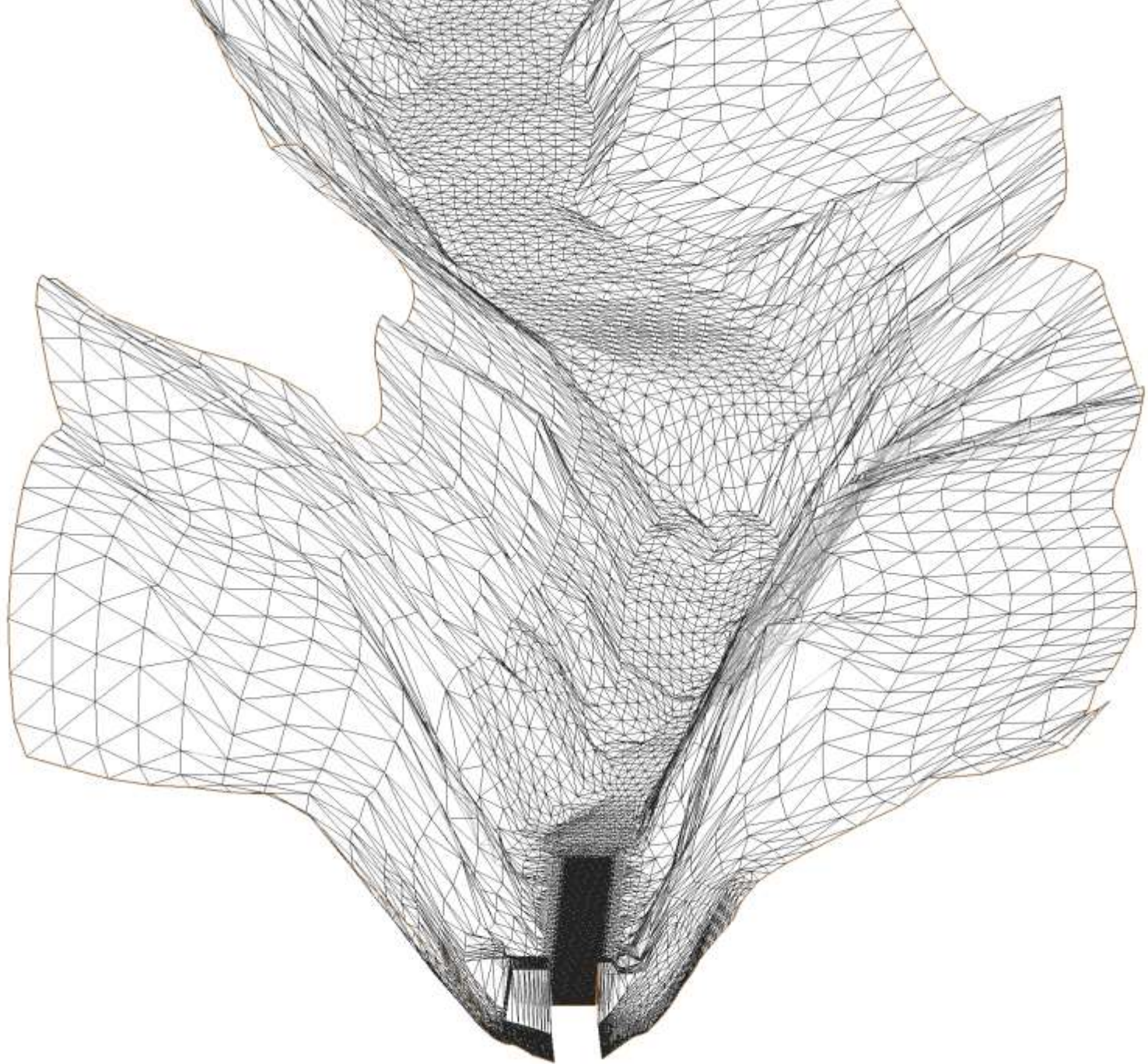
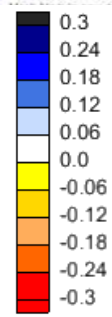
+ Sohlfixierung im Bereich der nodestrings

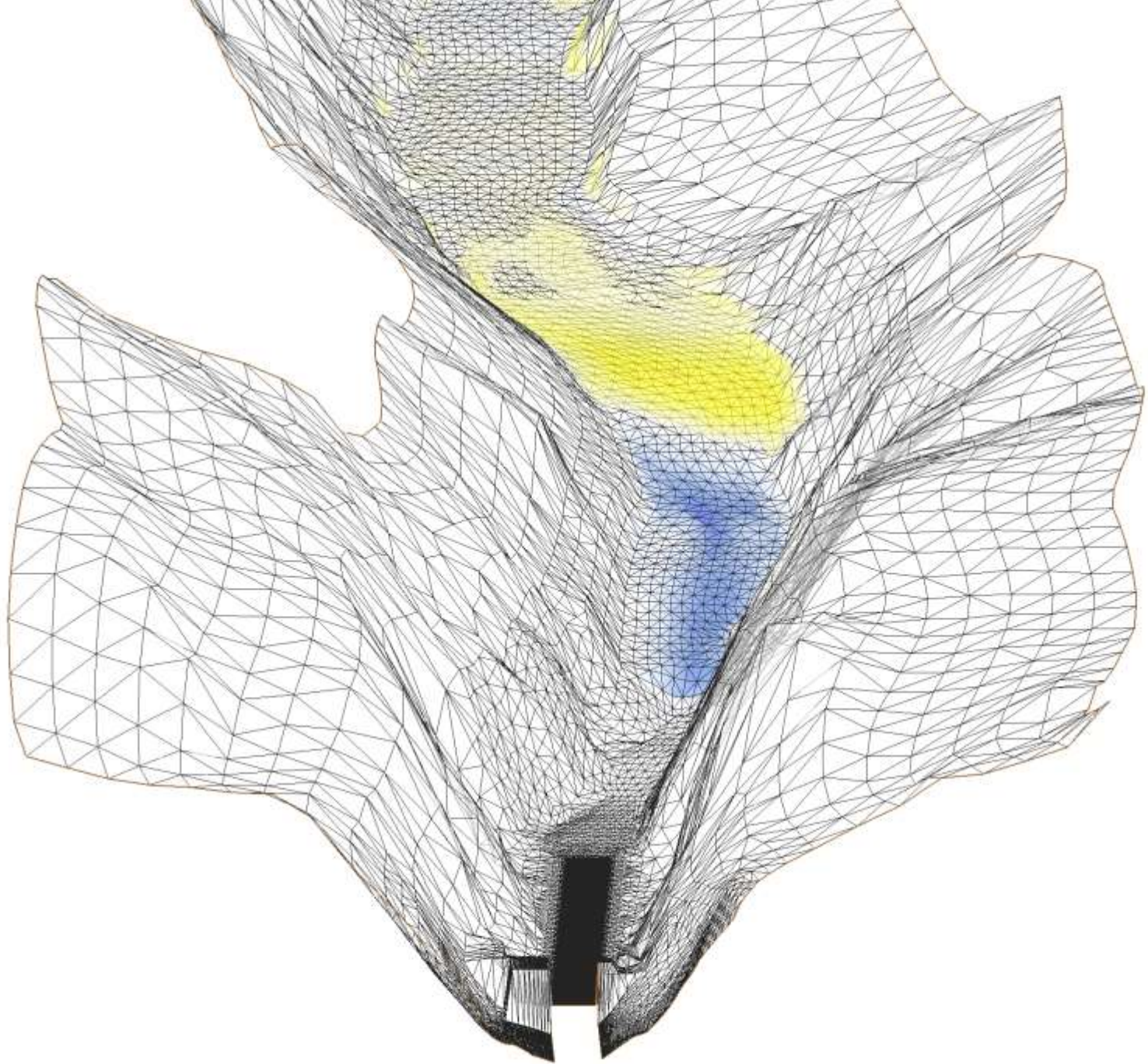
Steuerung des Vorgangs

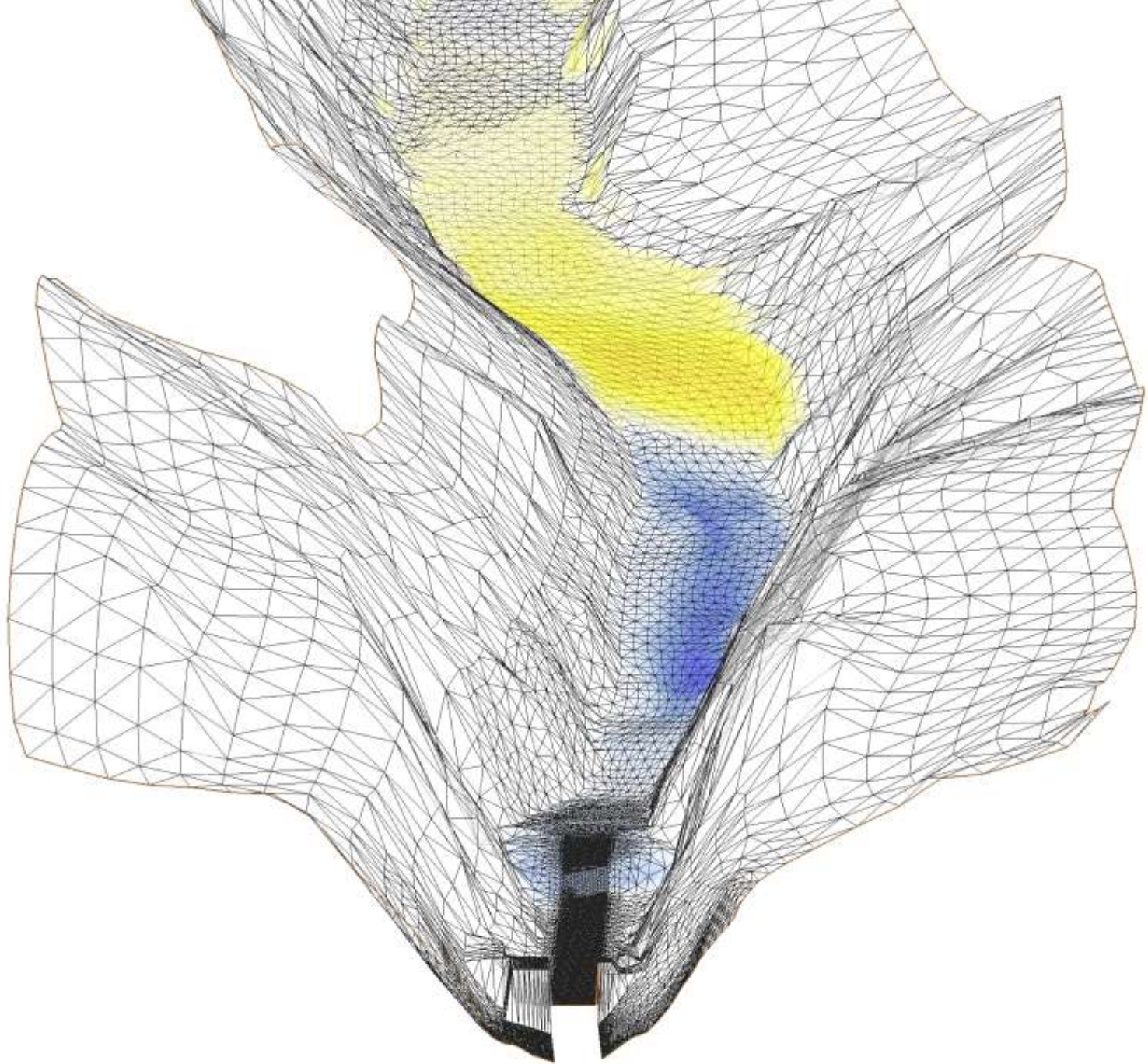
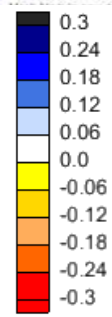
— Verlandungstiefe, Geschwindigkeit

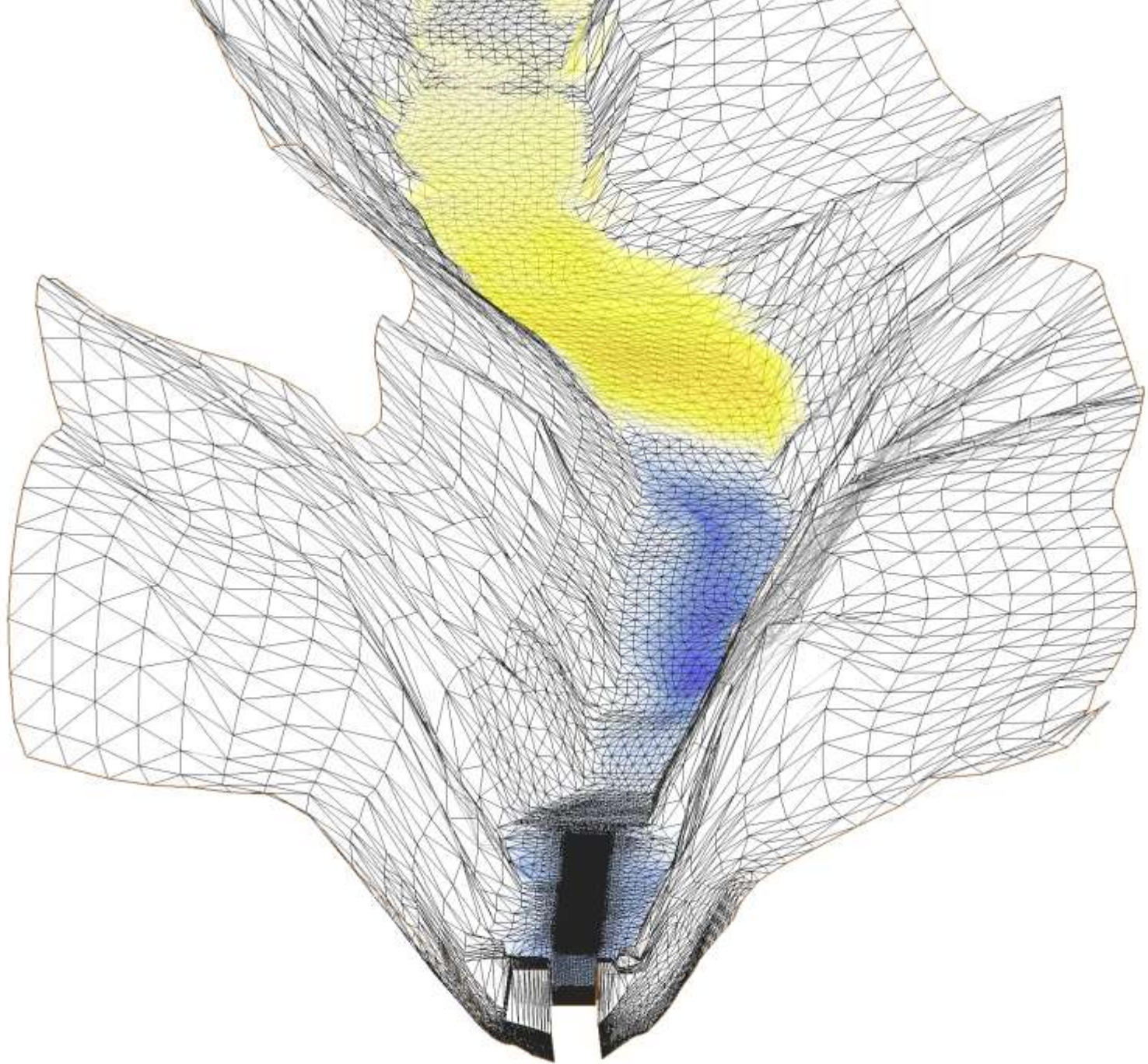
+ SCF-Formel Faktor

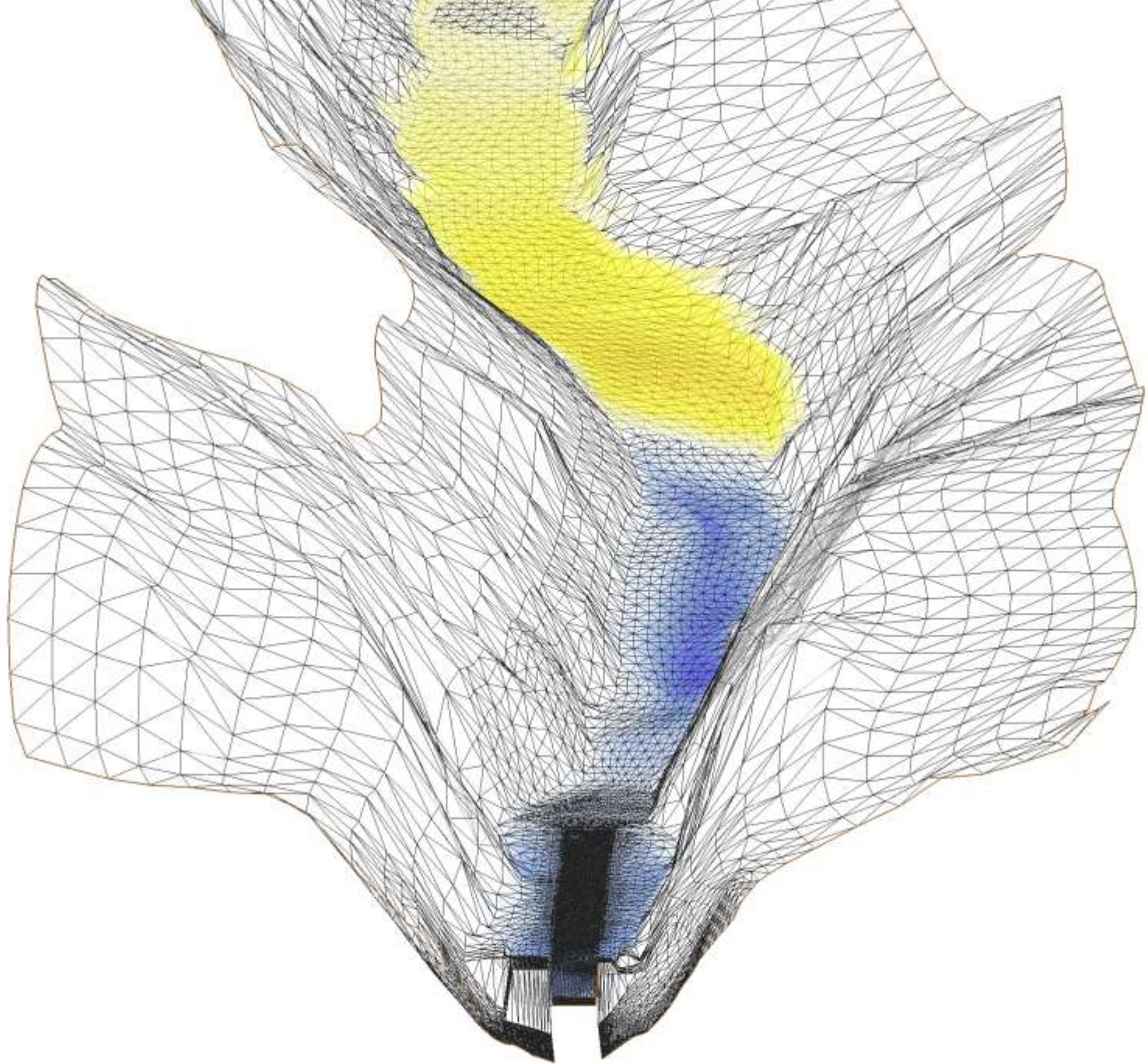
+ Θ_{cr} (τ_{crit})

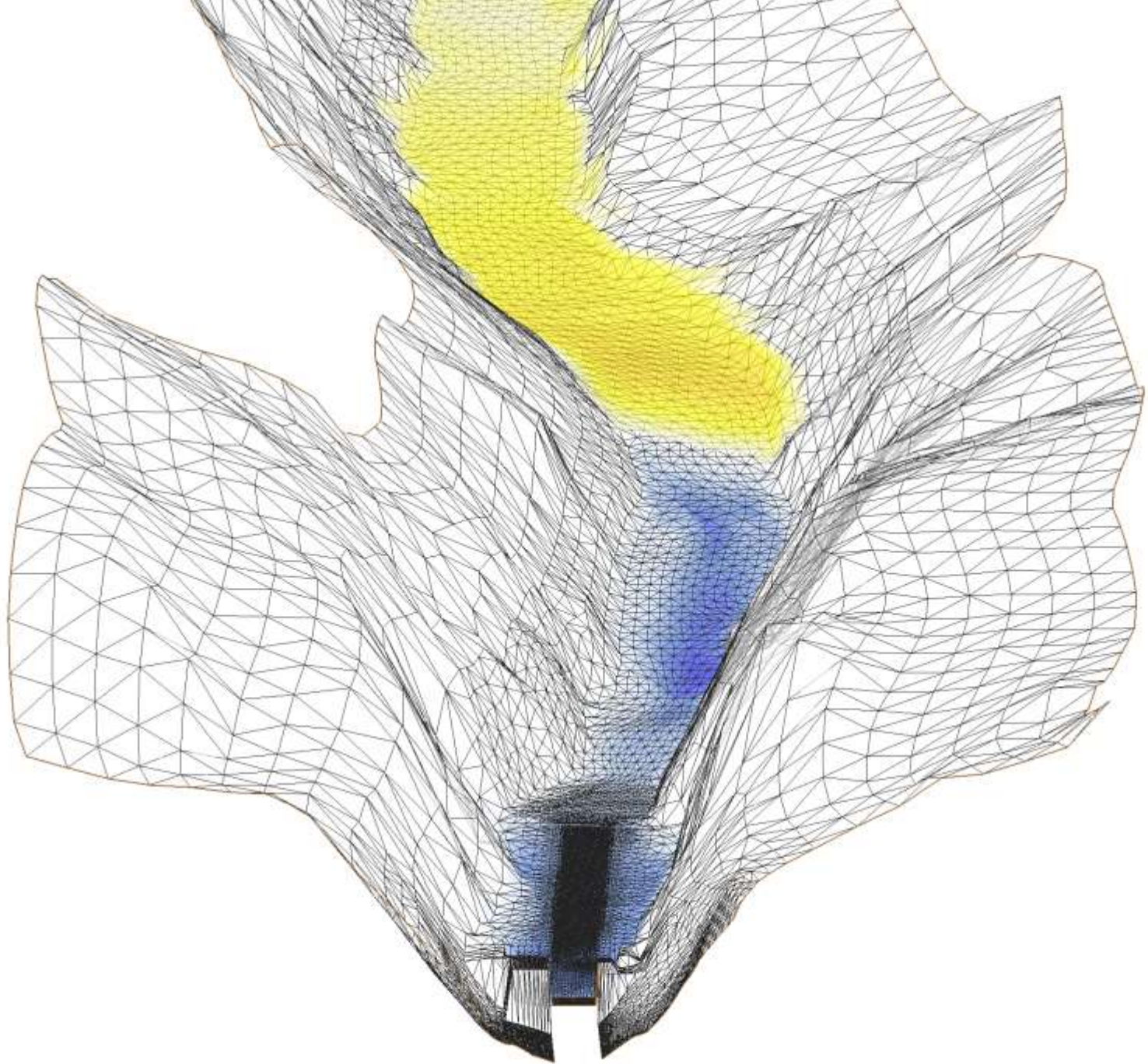
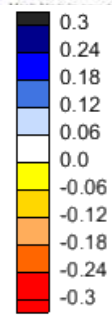


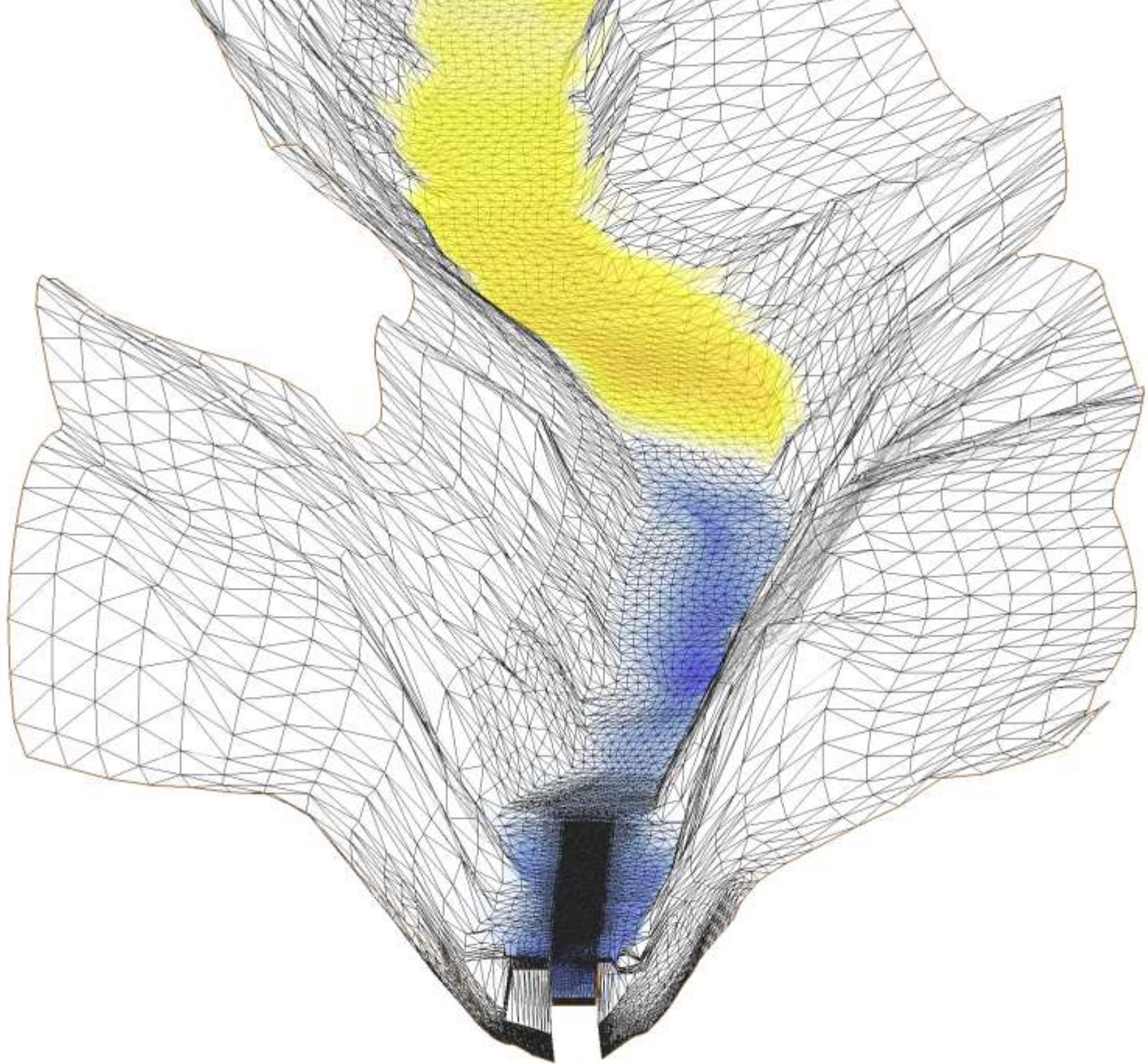


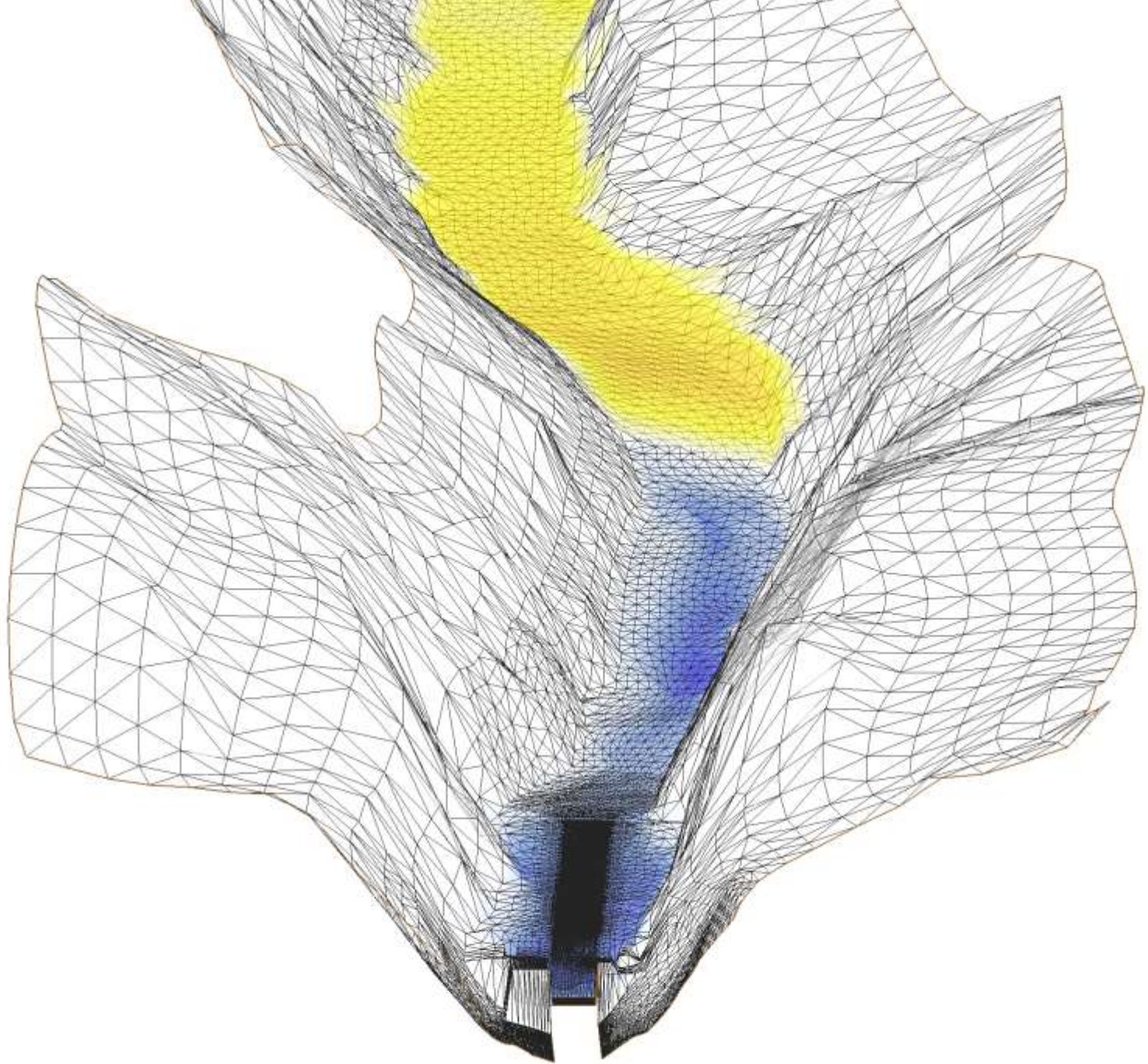


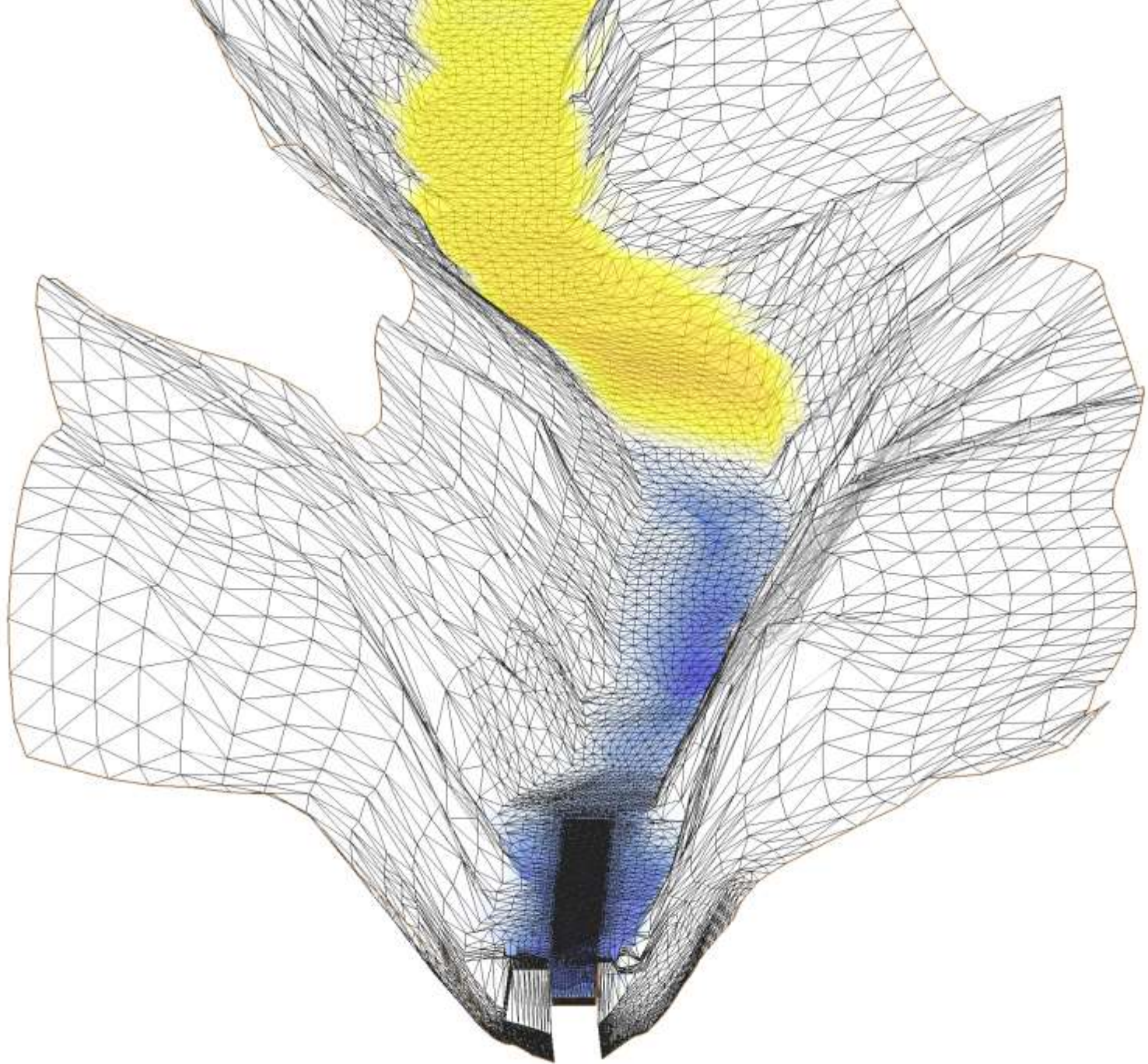


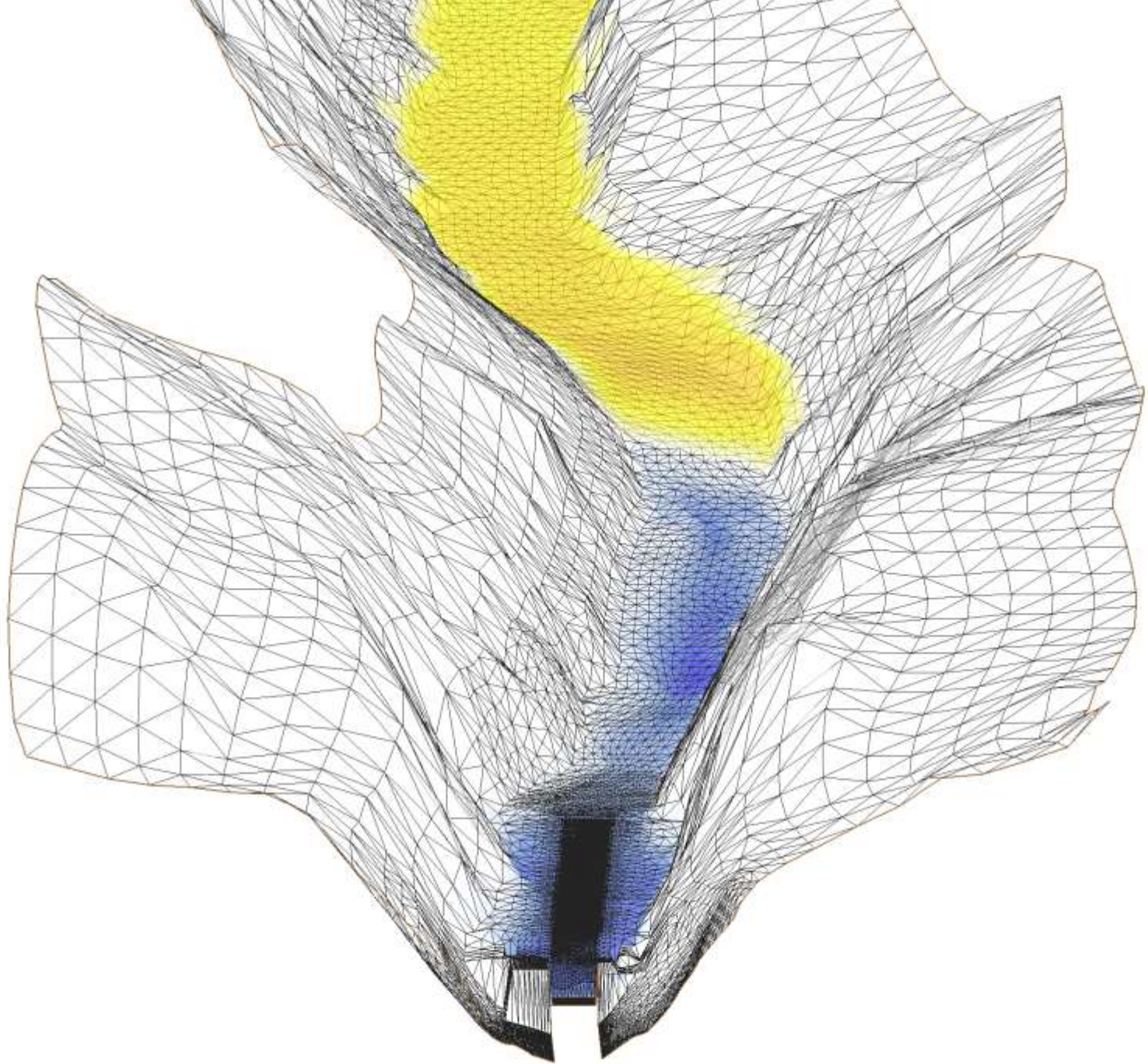


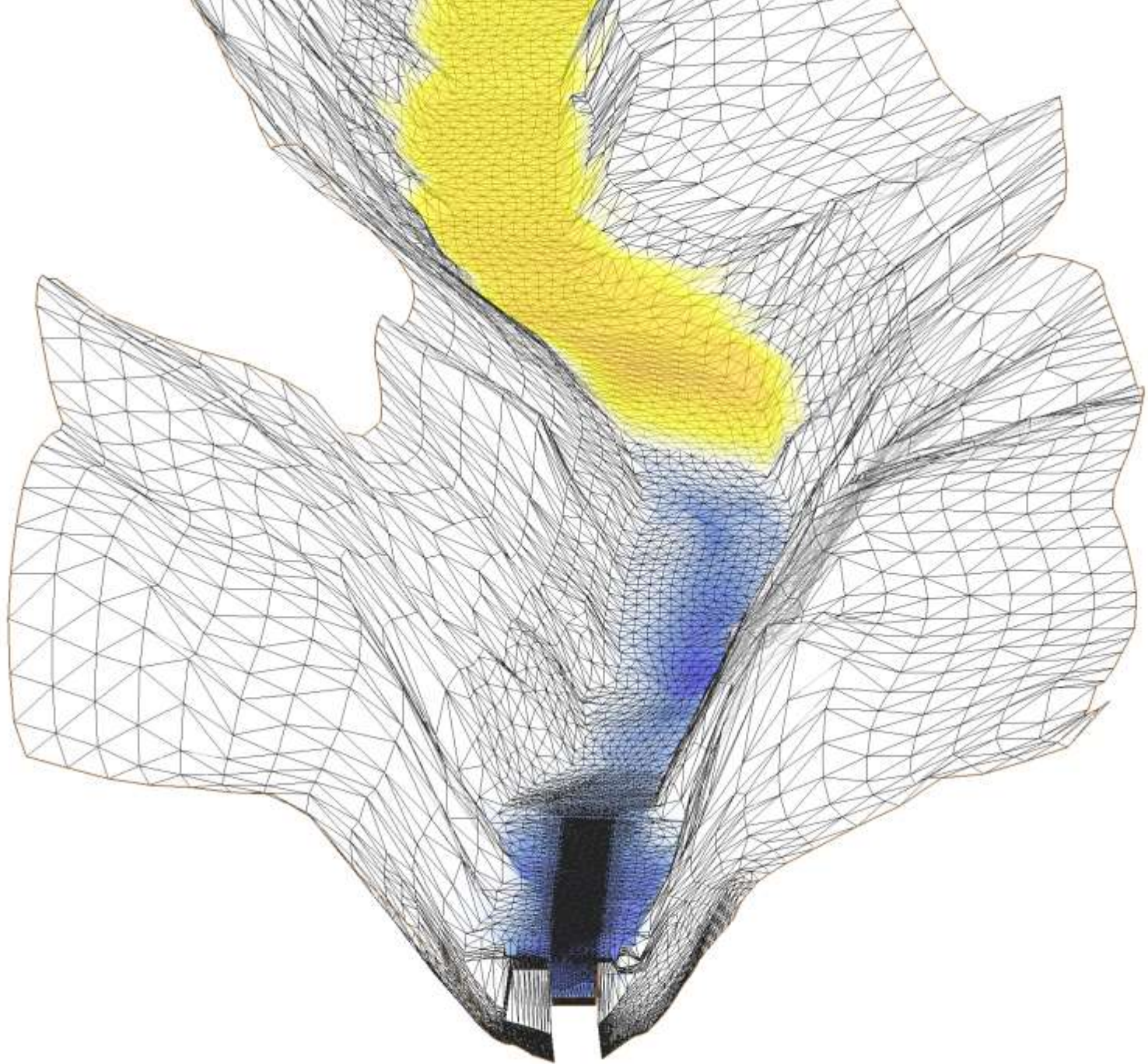
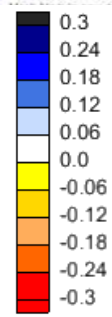


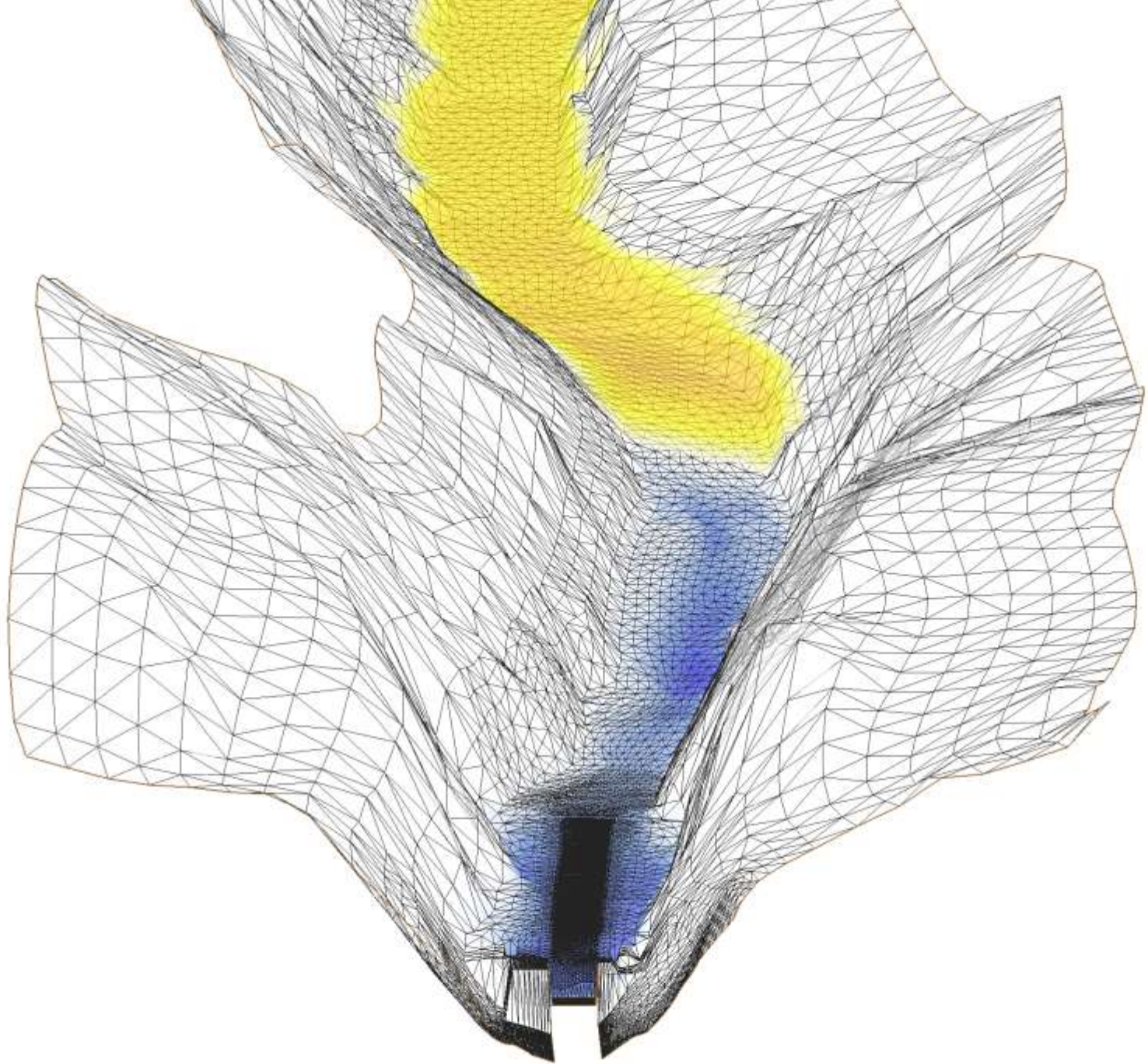


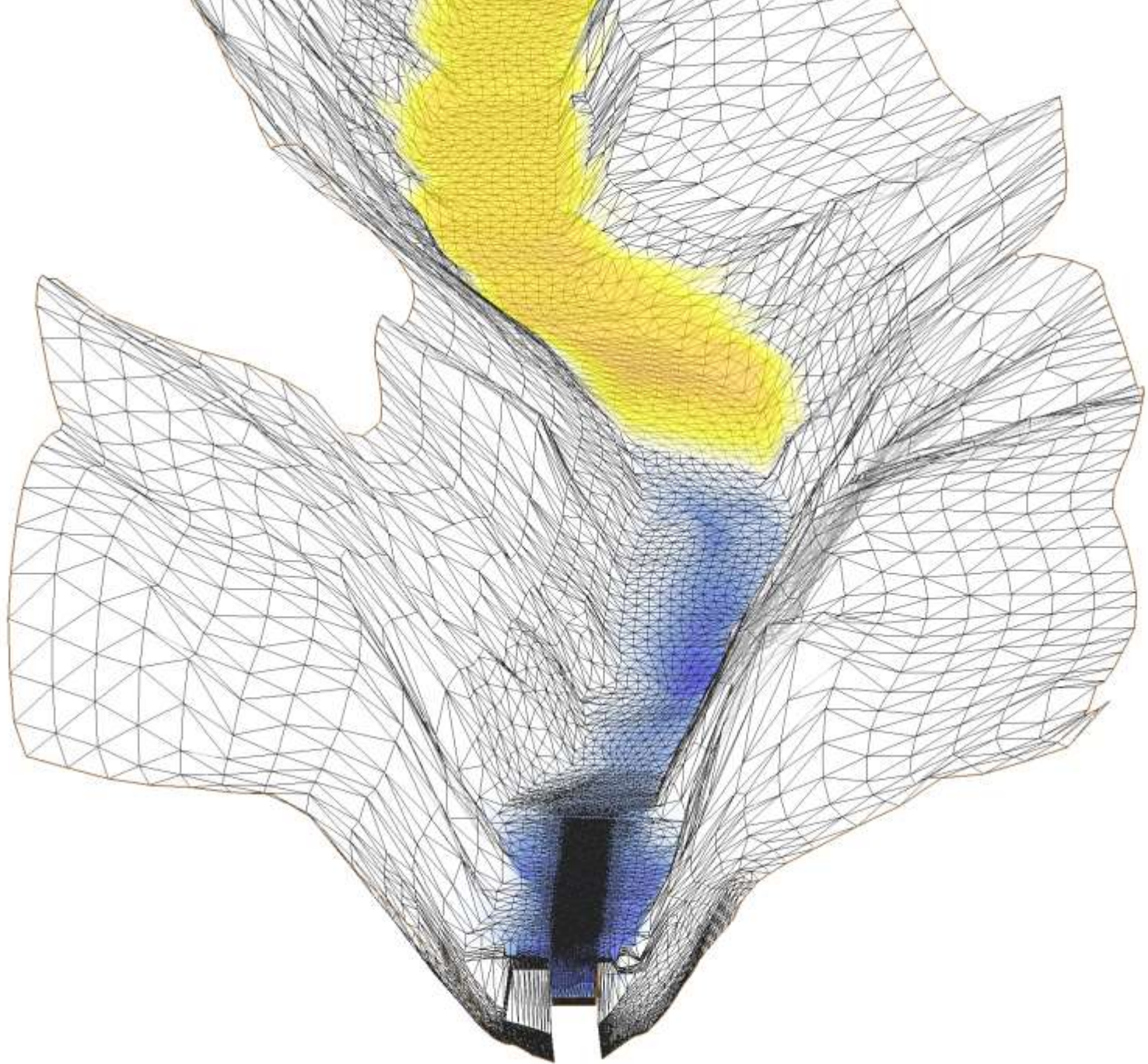


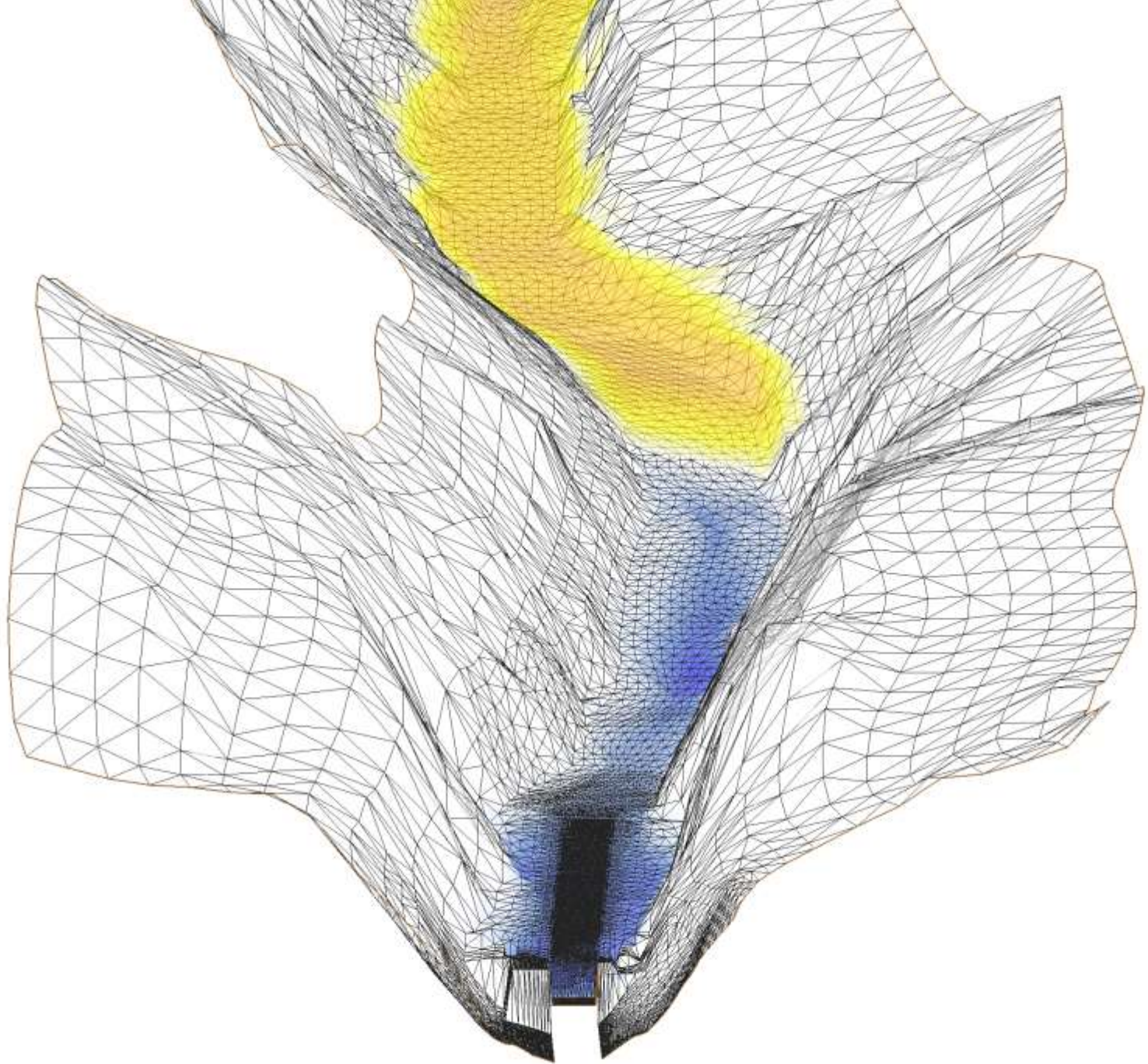


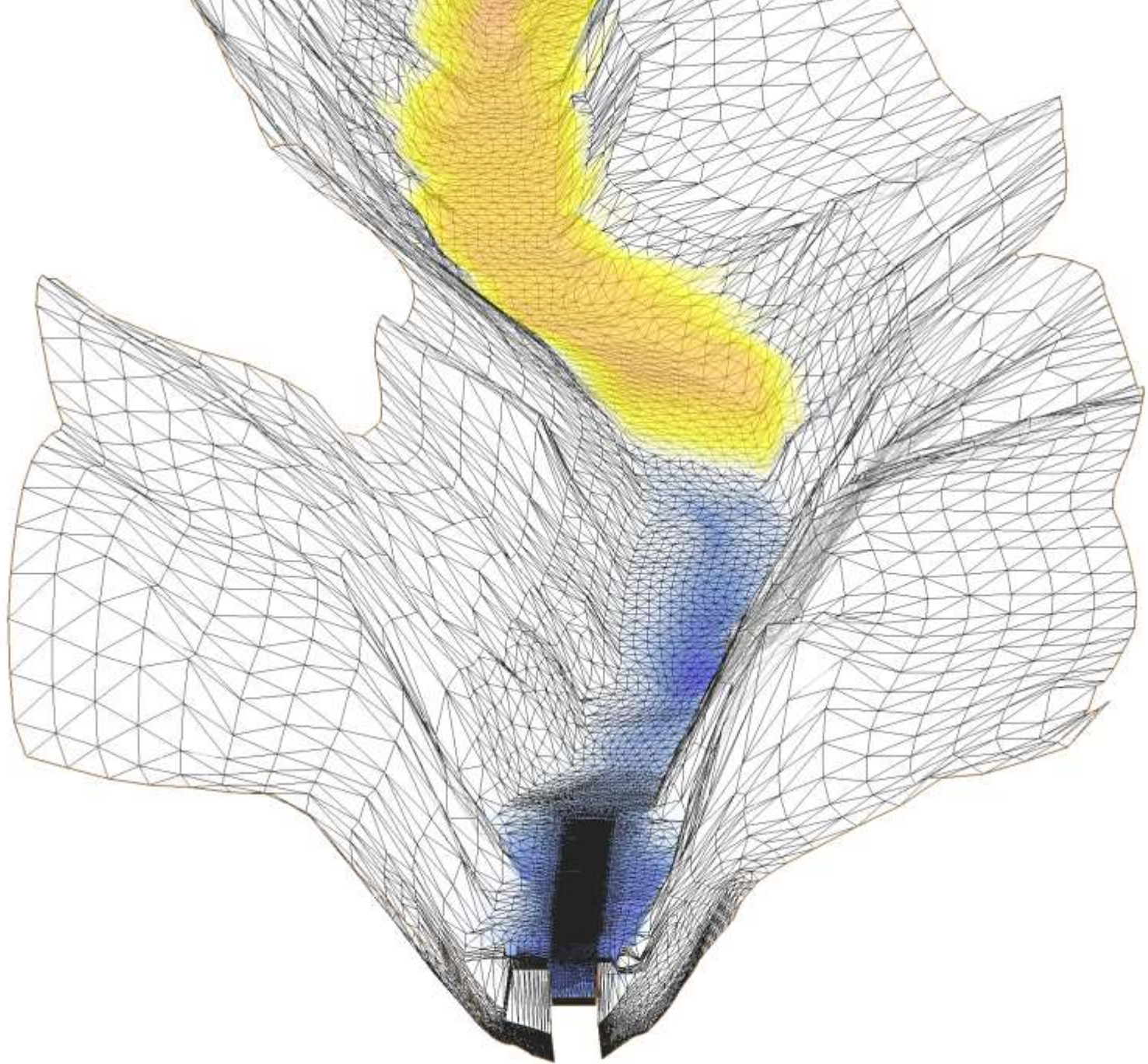
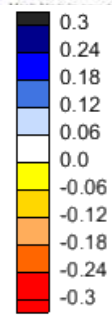


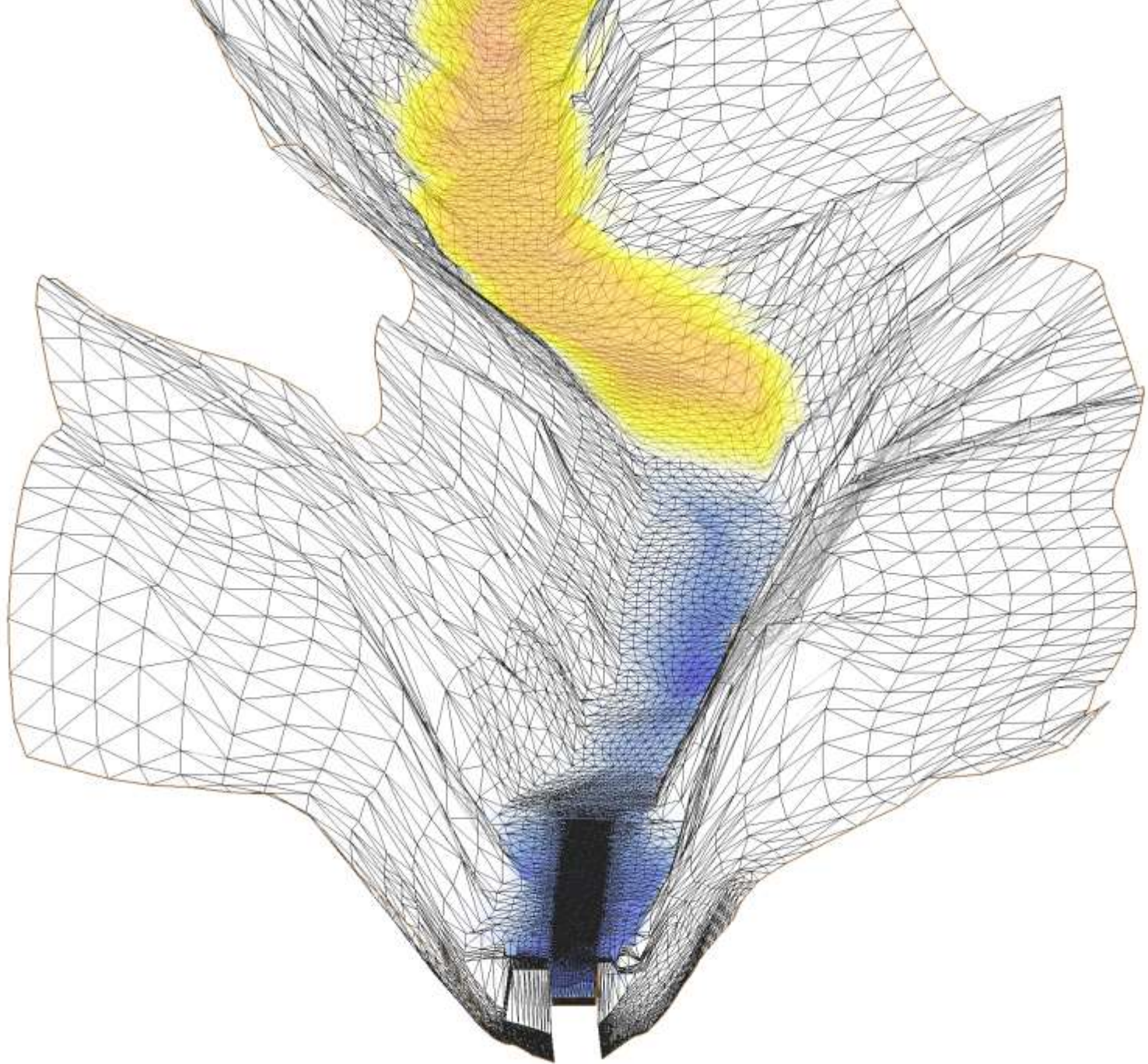


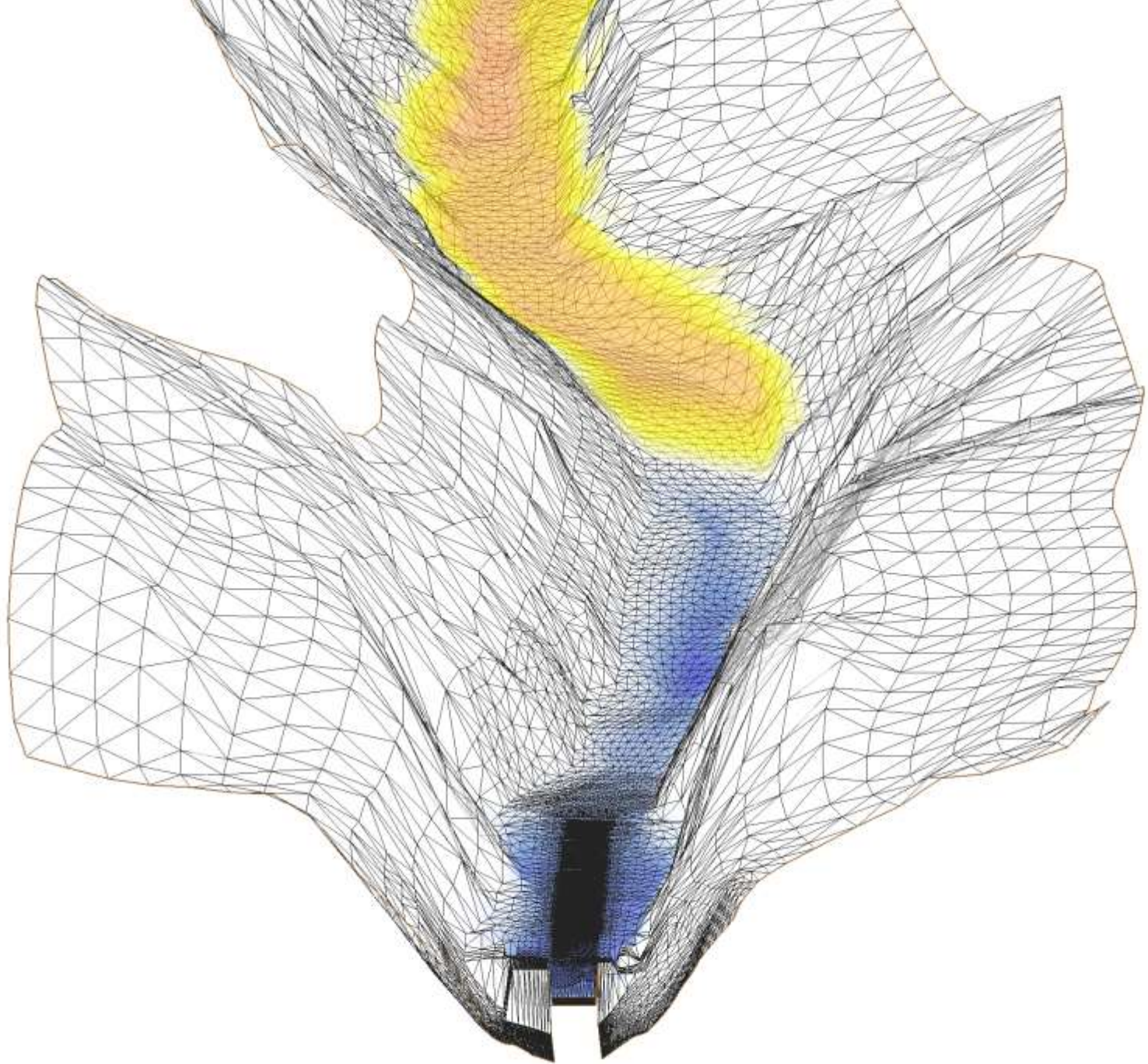


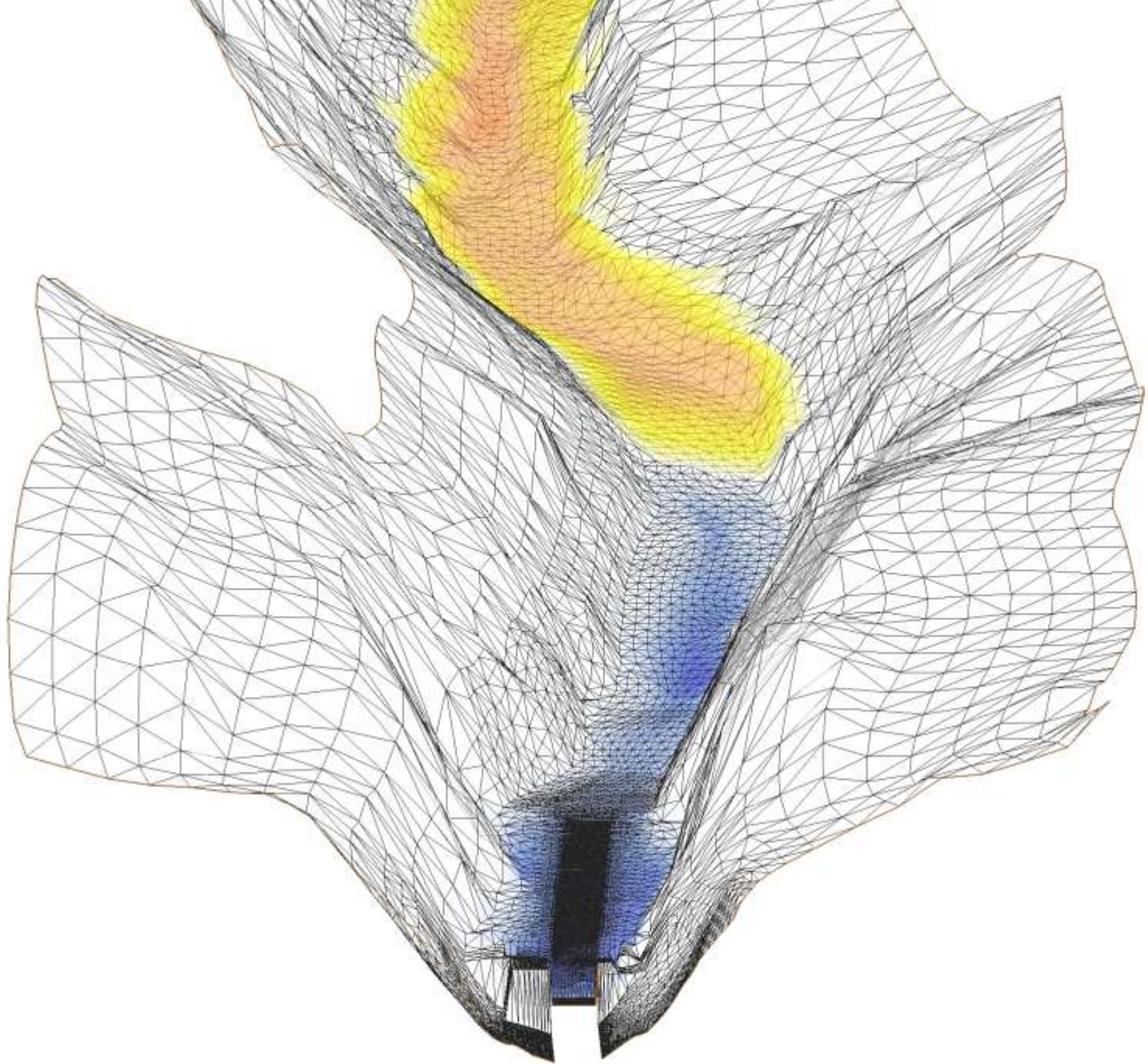


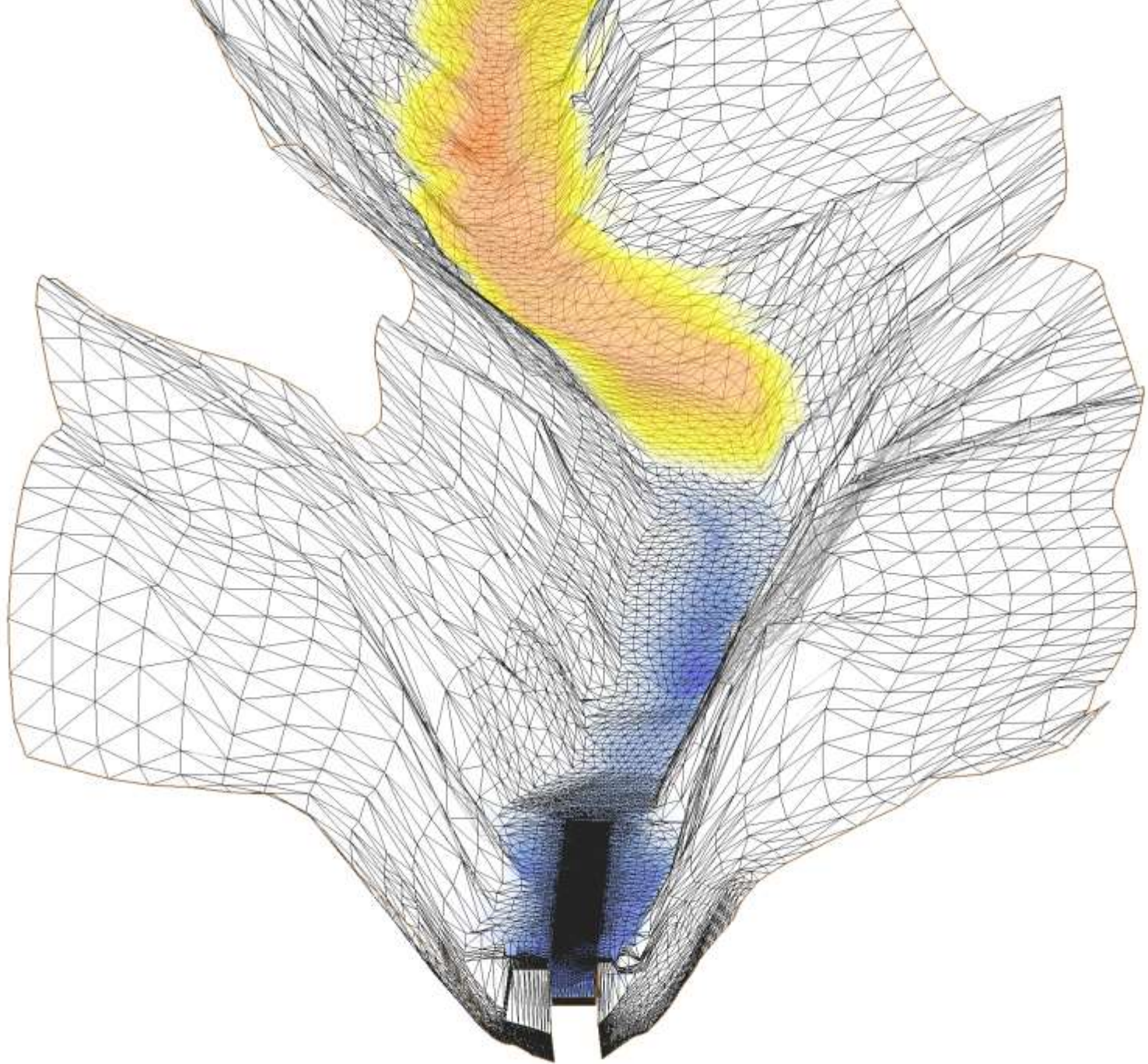


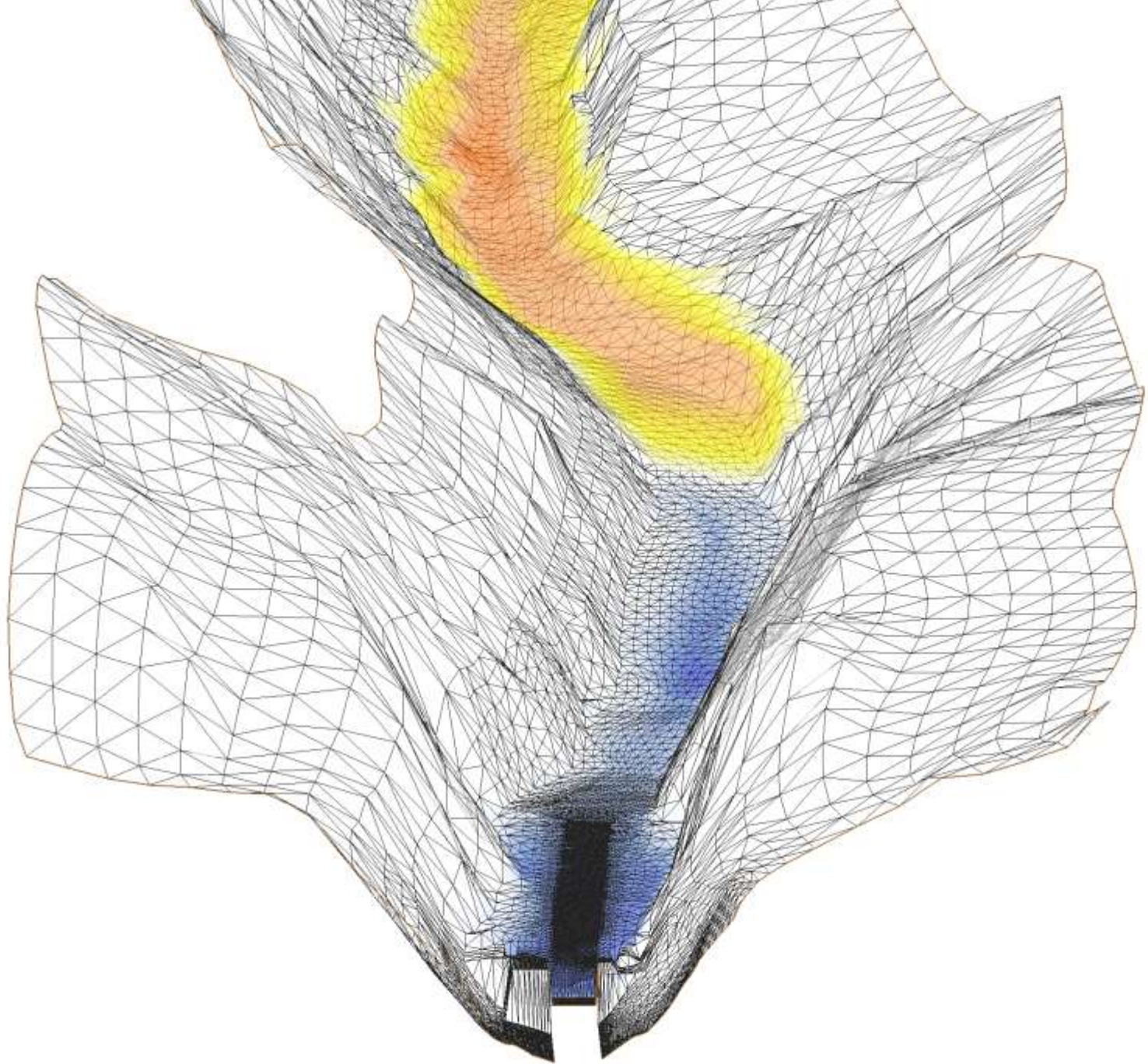


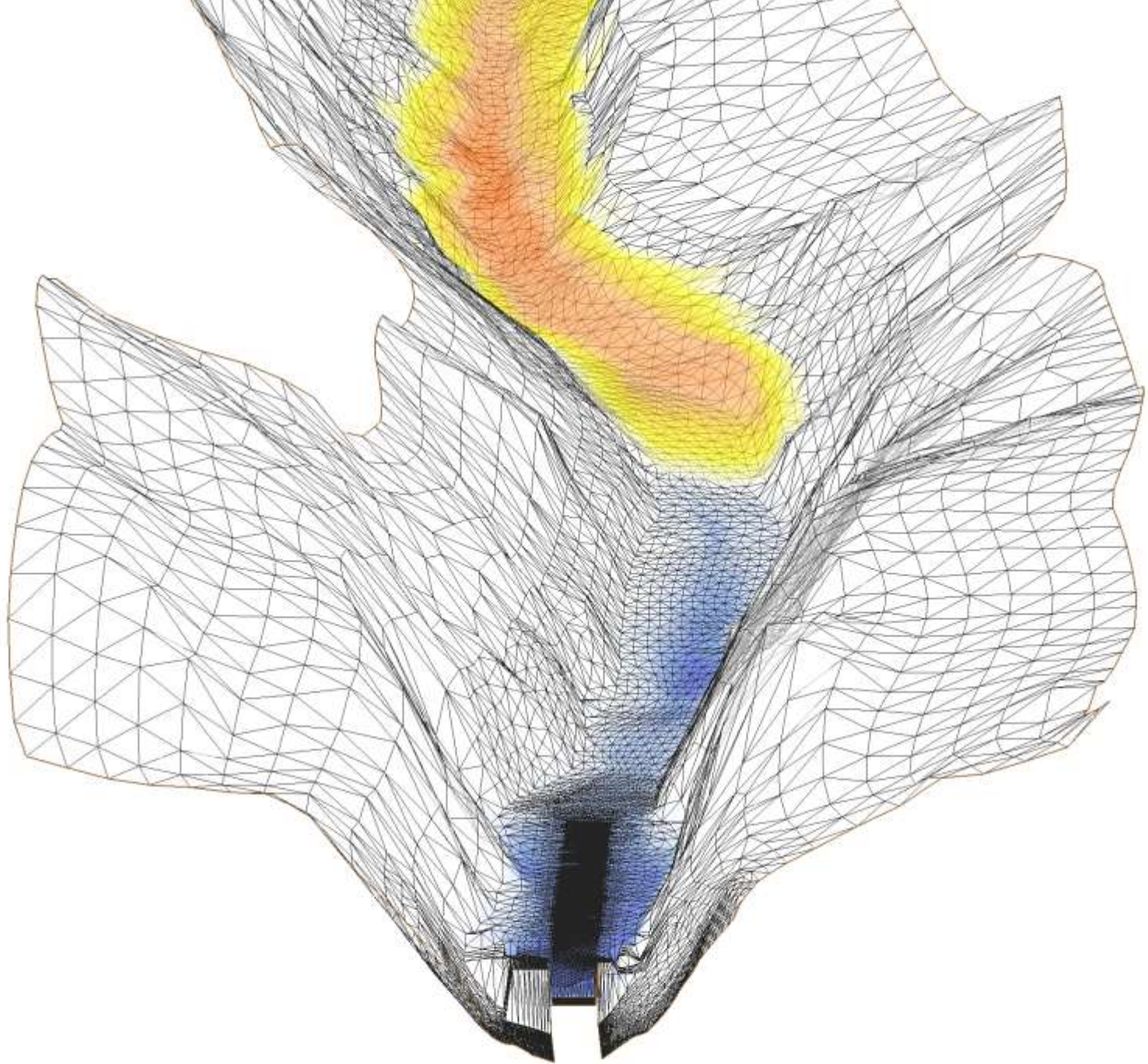
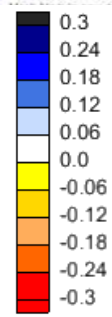


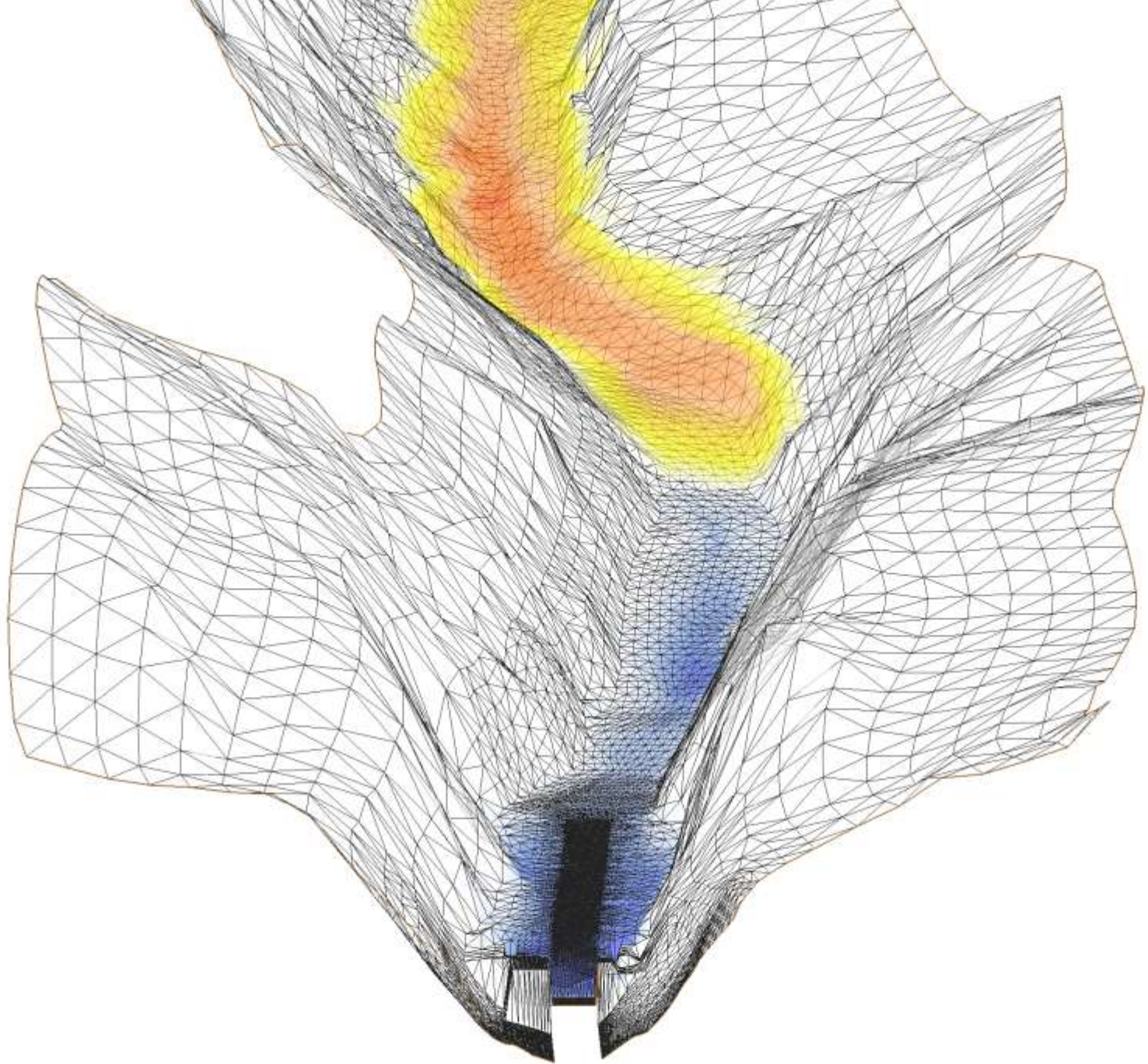
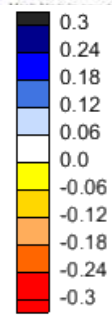


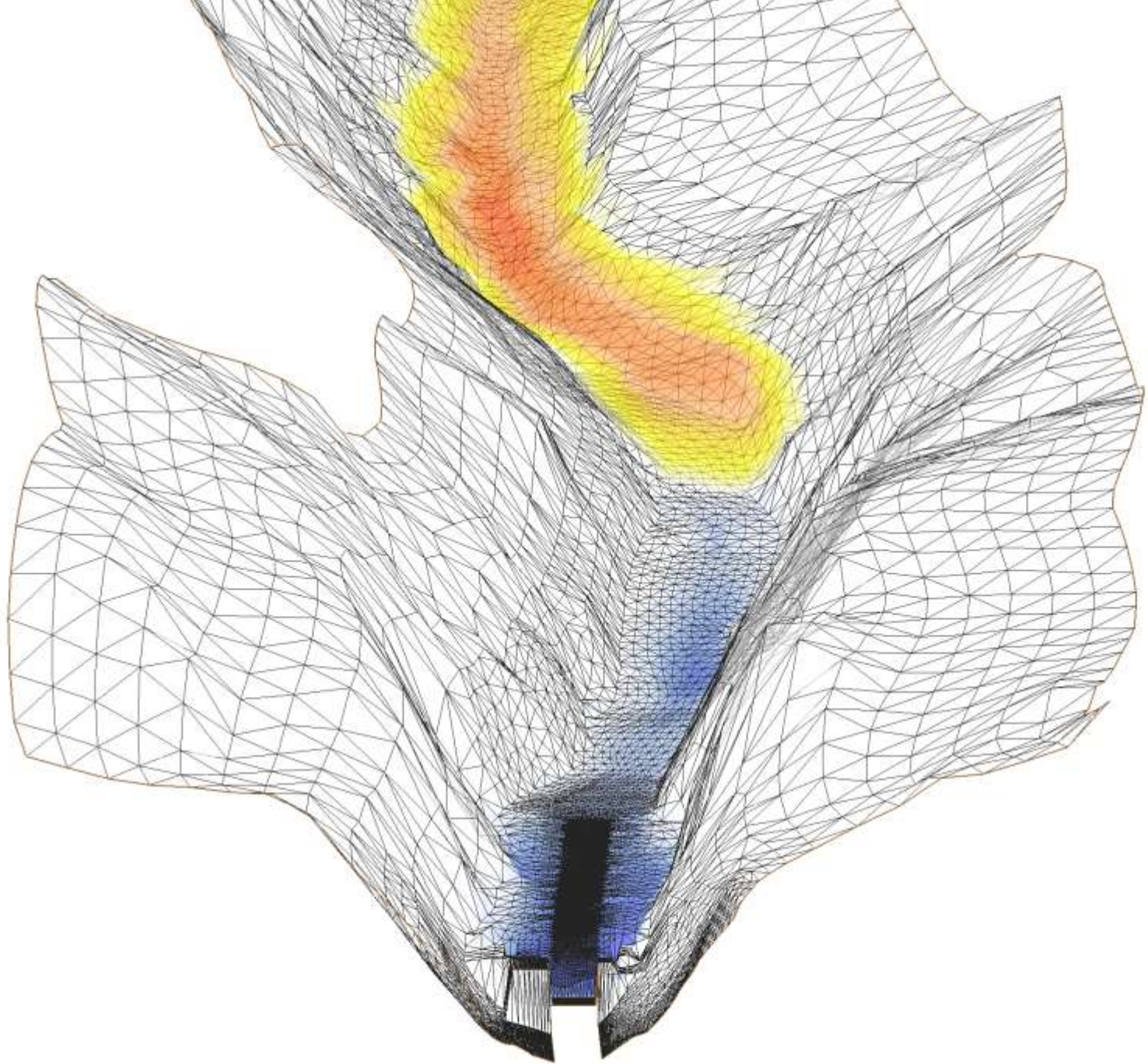


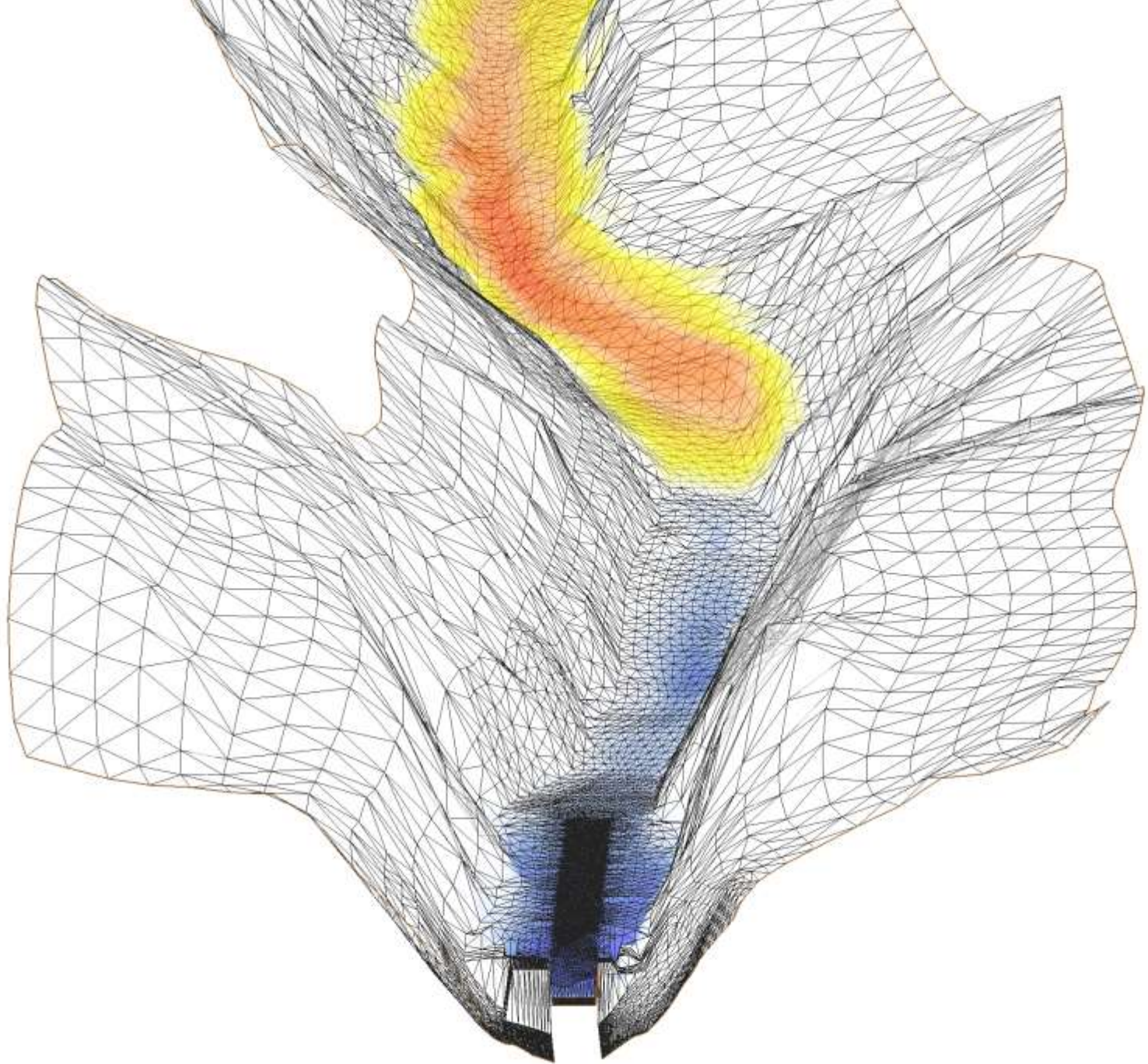


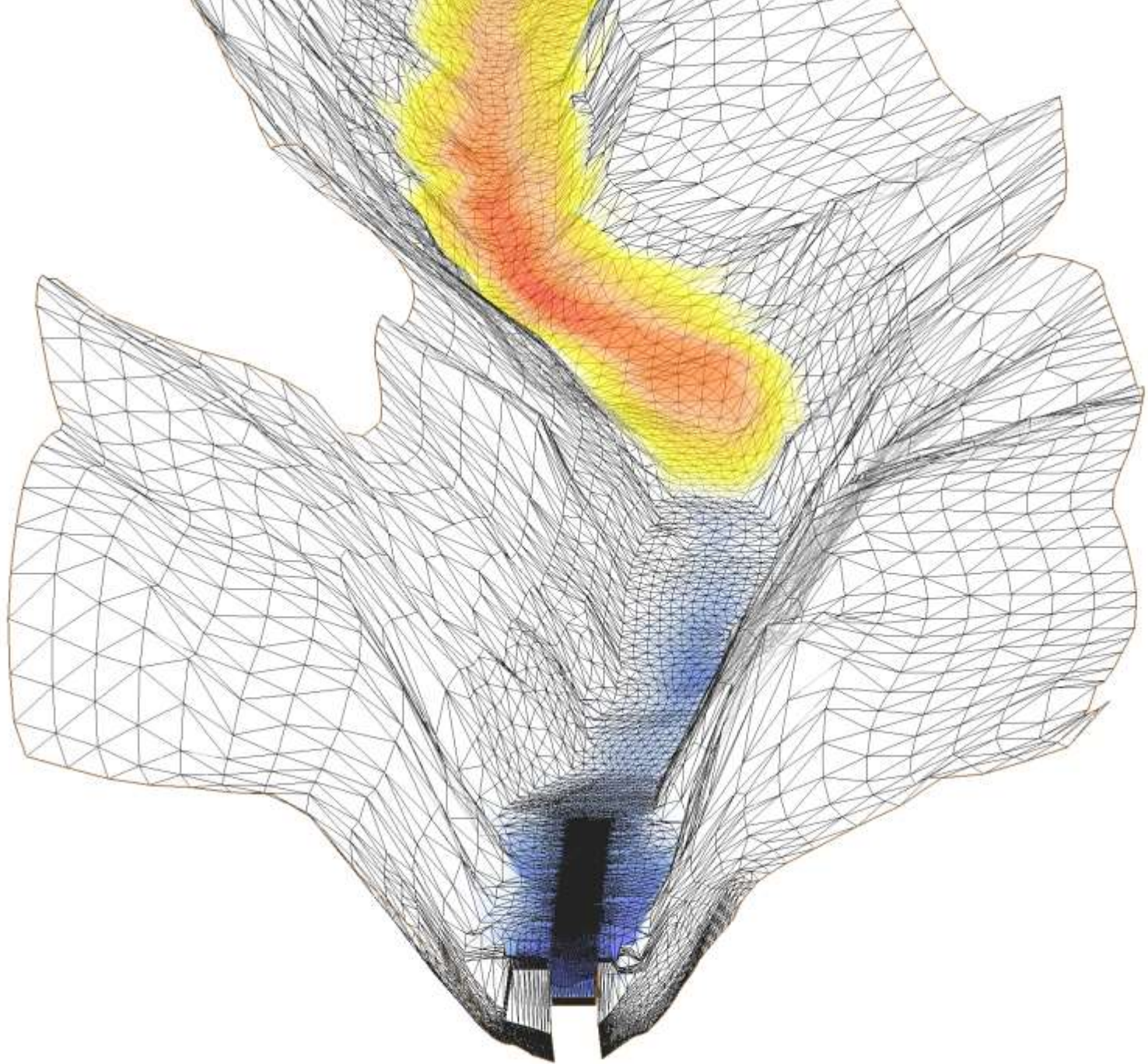
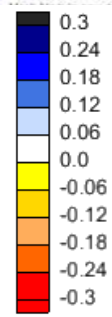


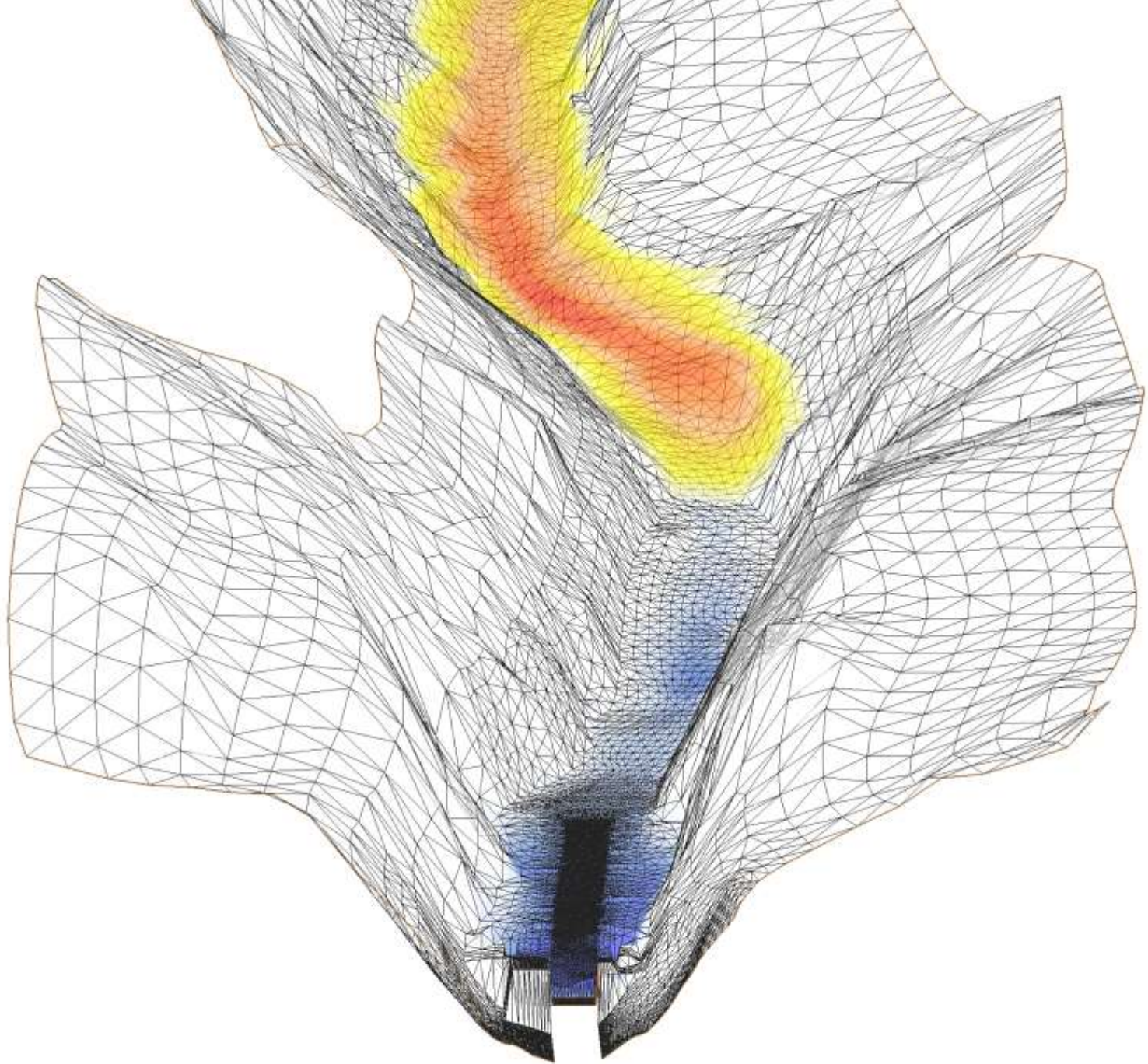


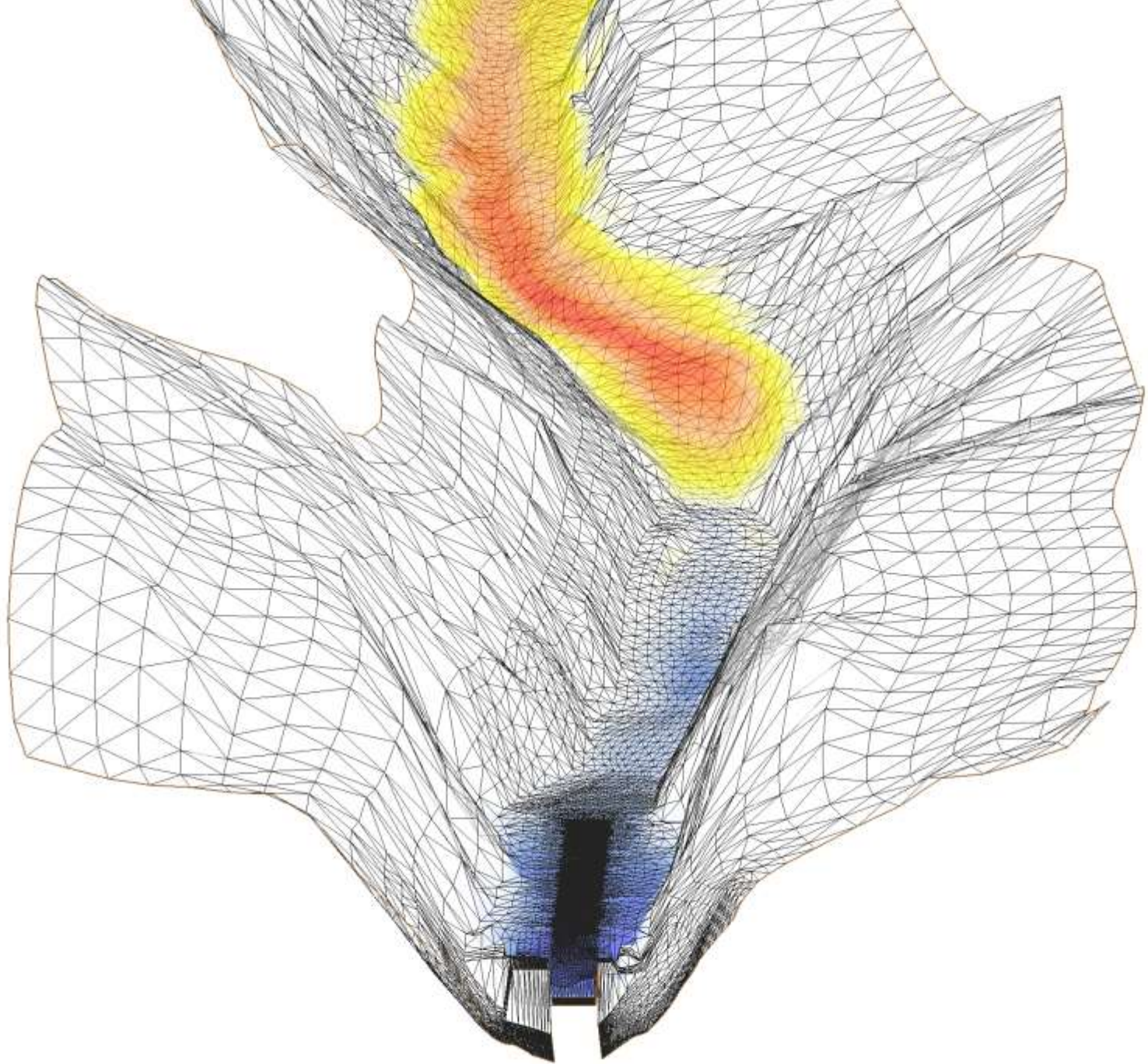
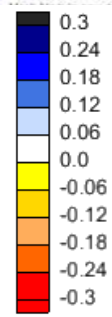


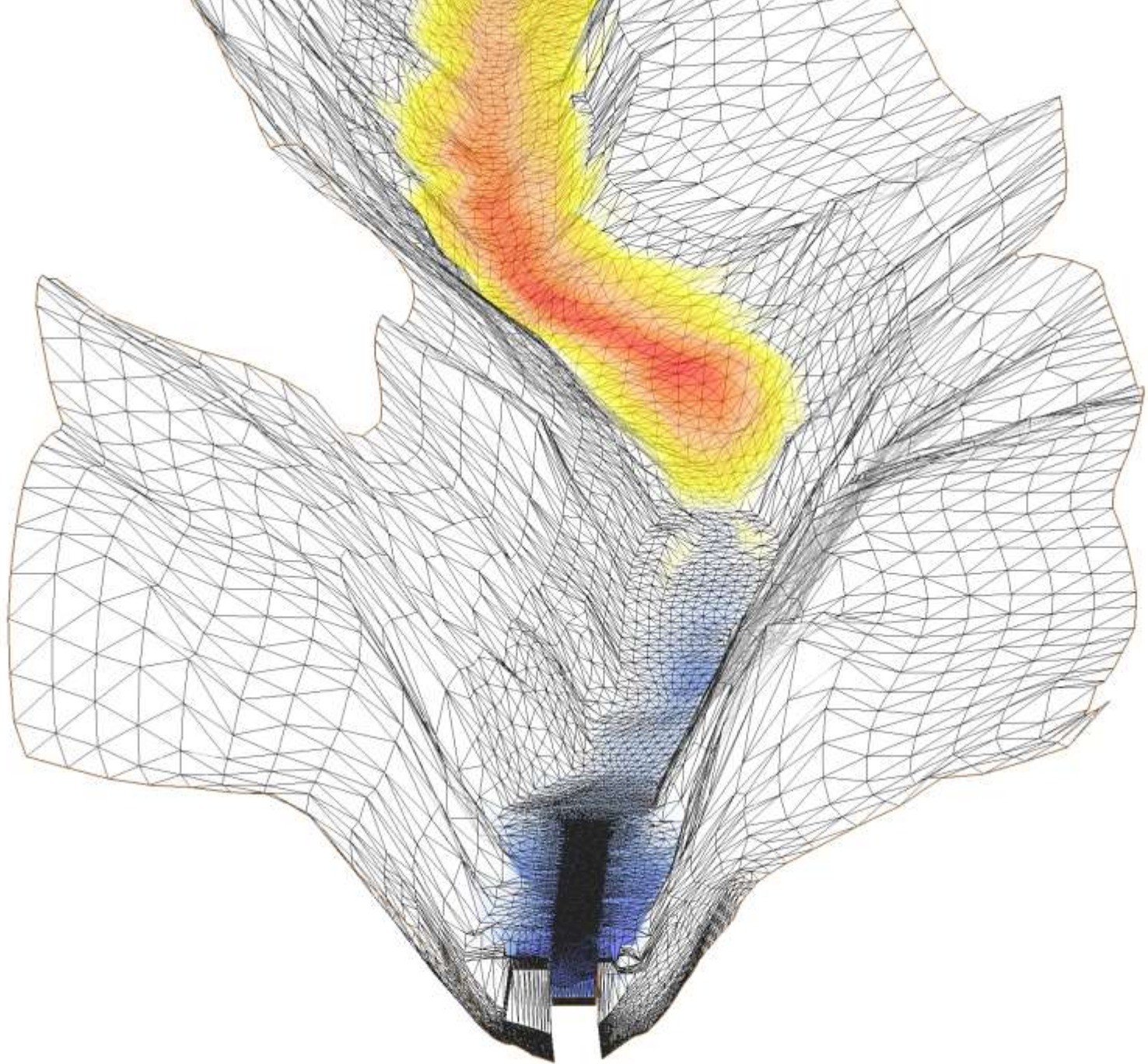


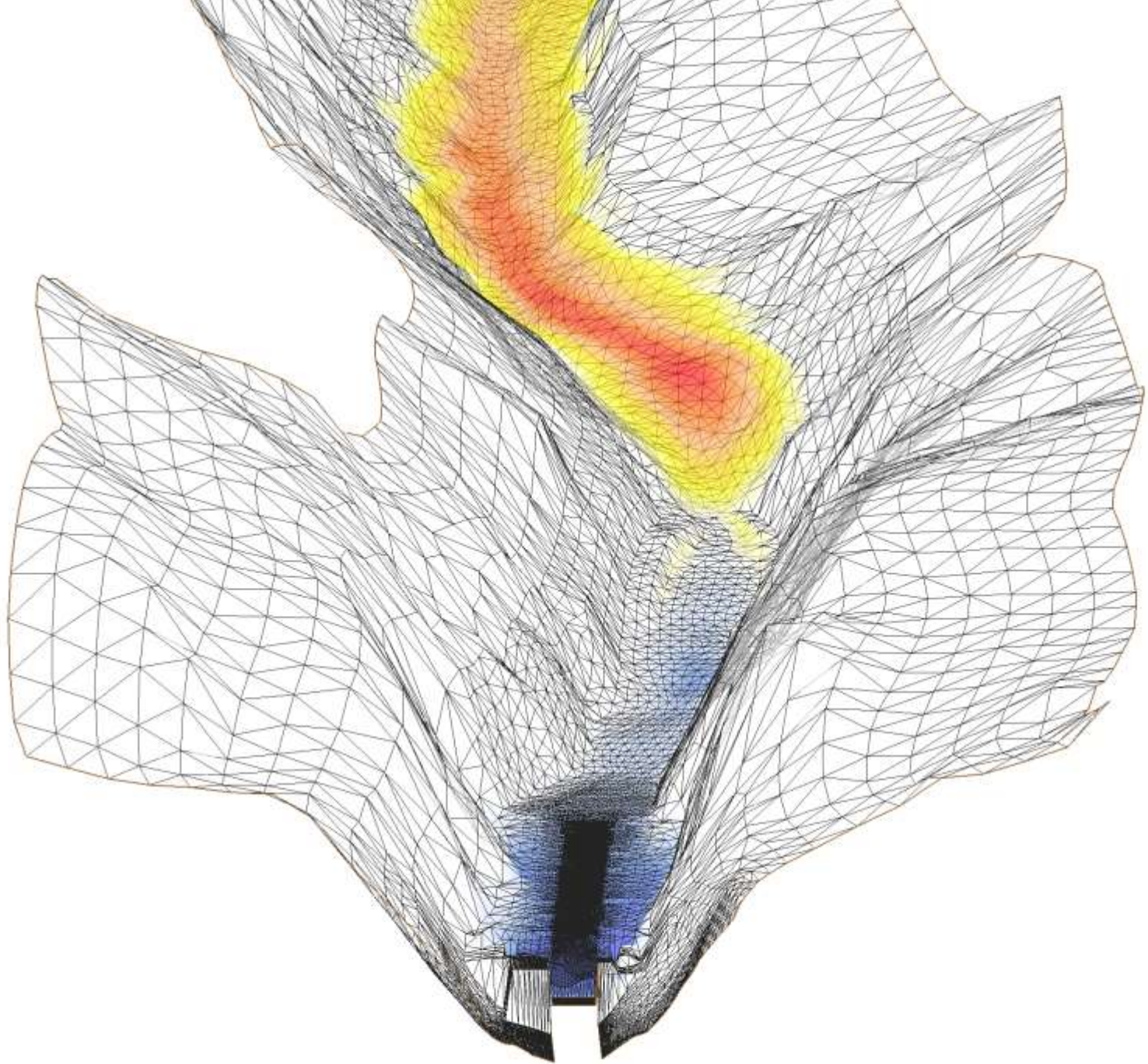
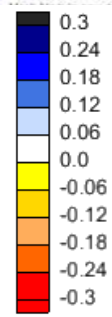


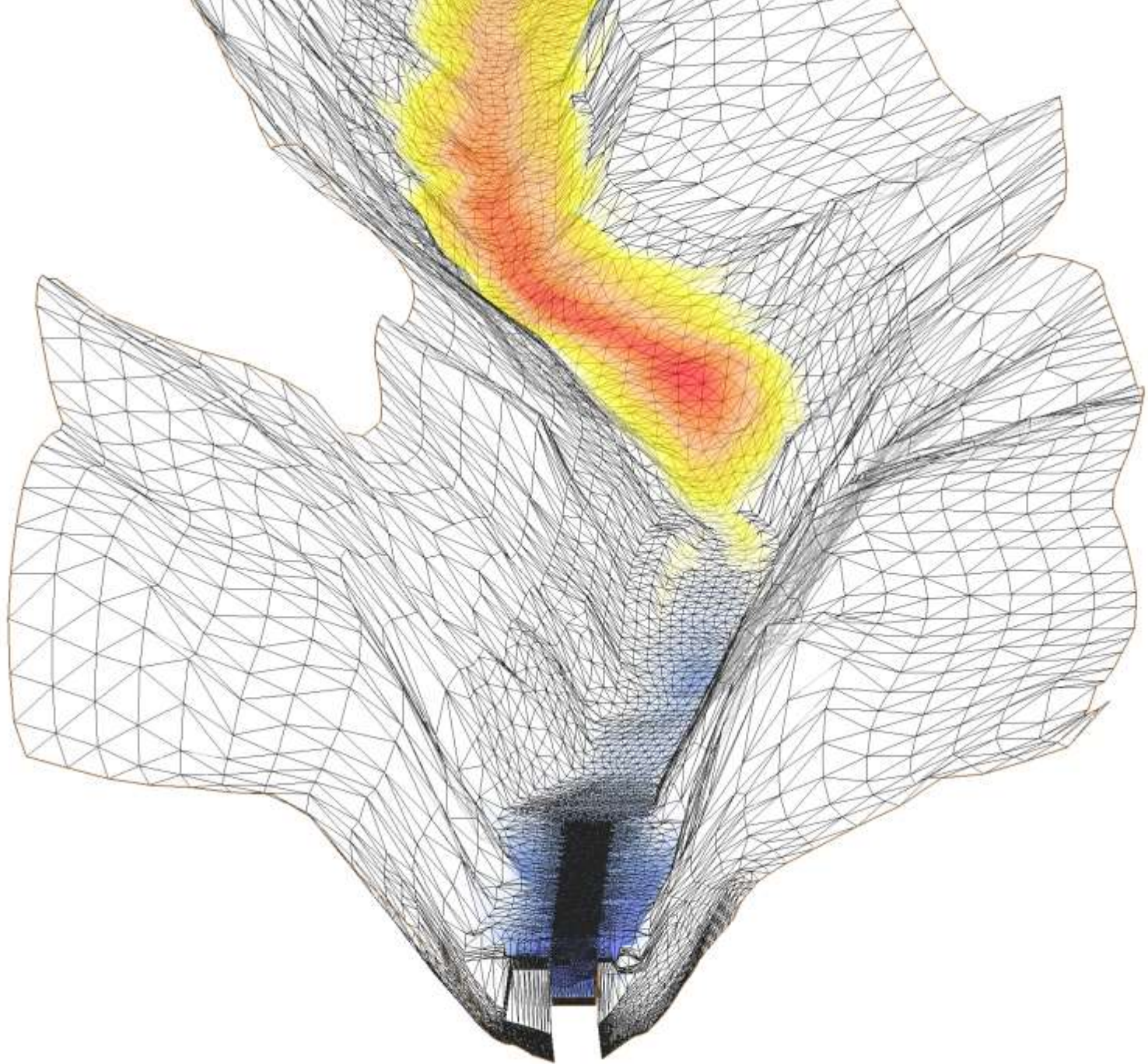
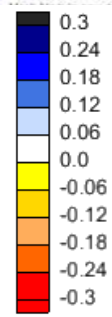


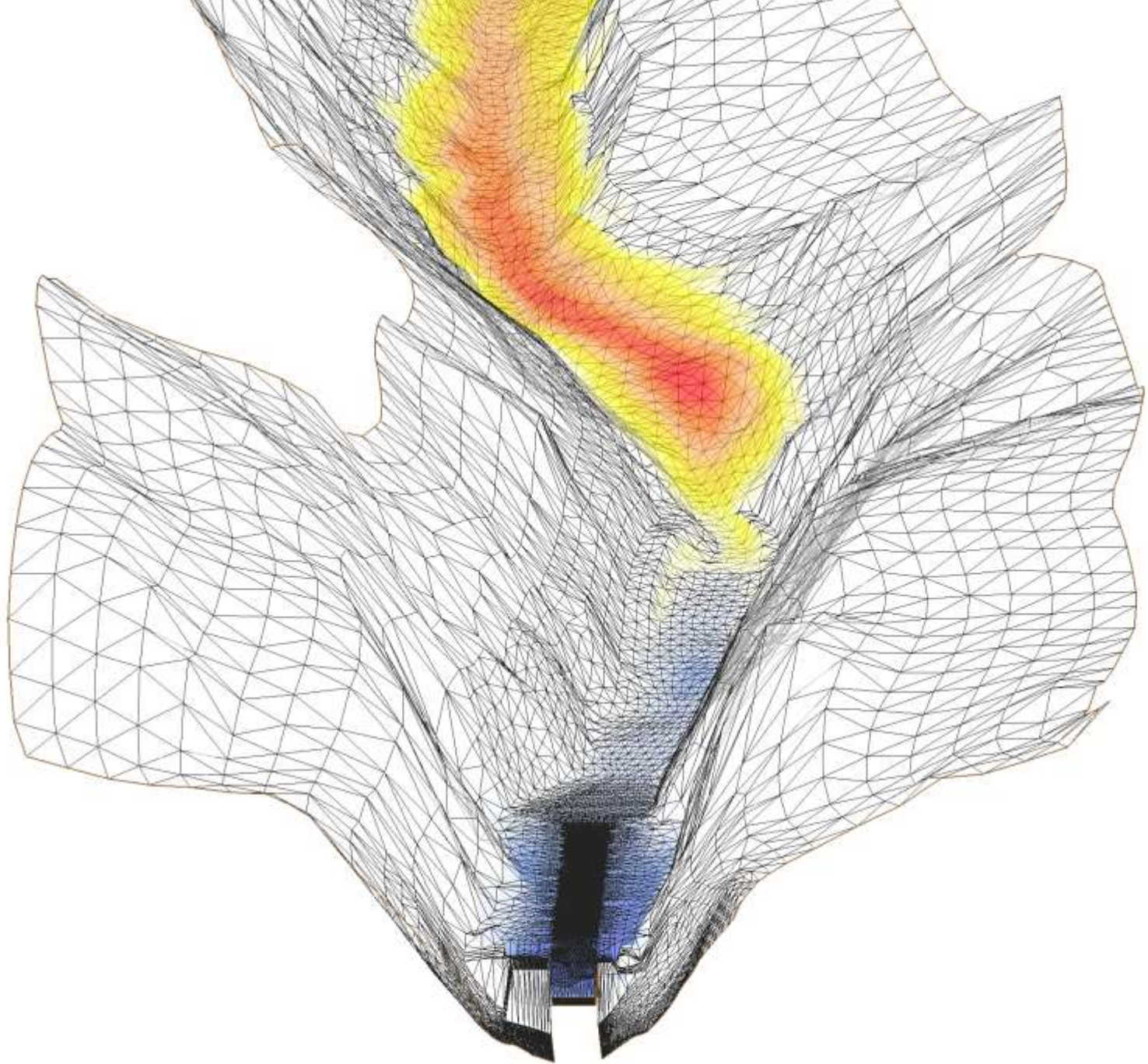


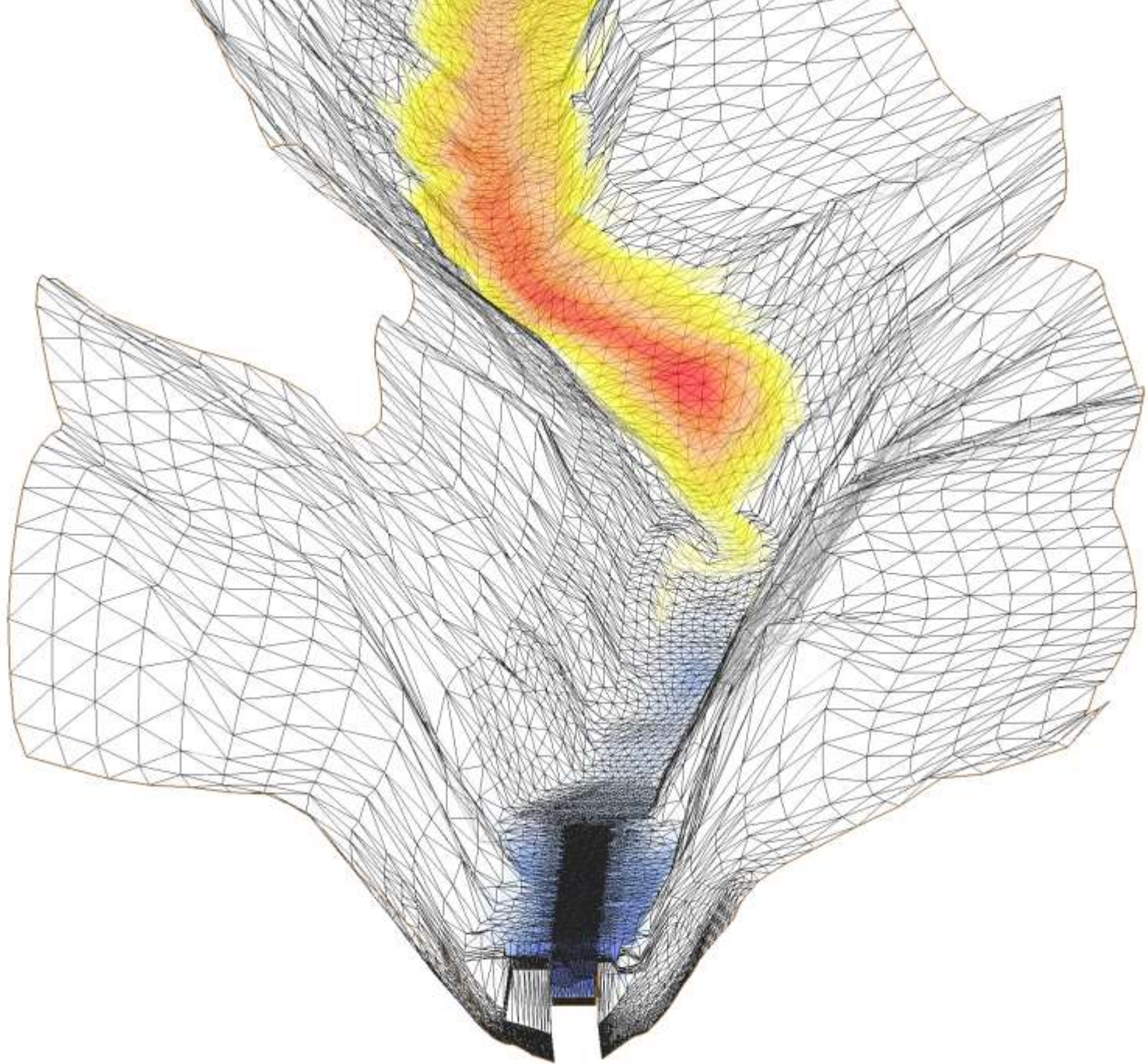
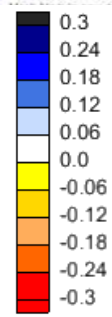


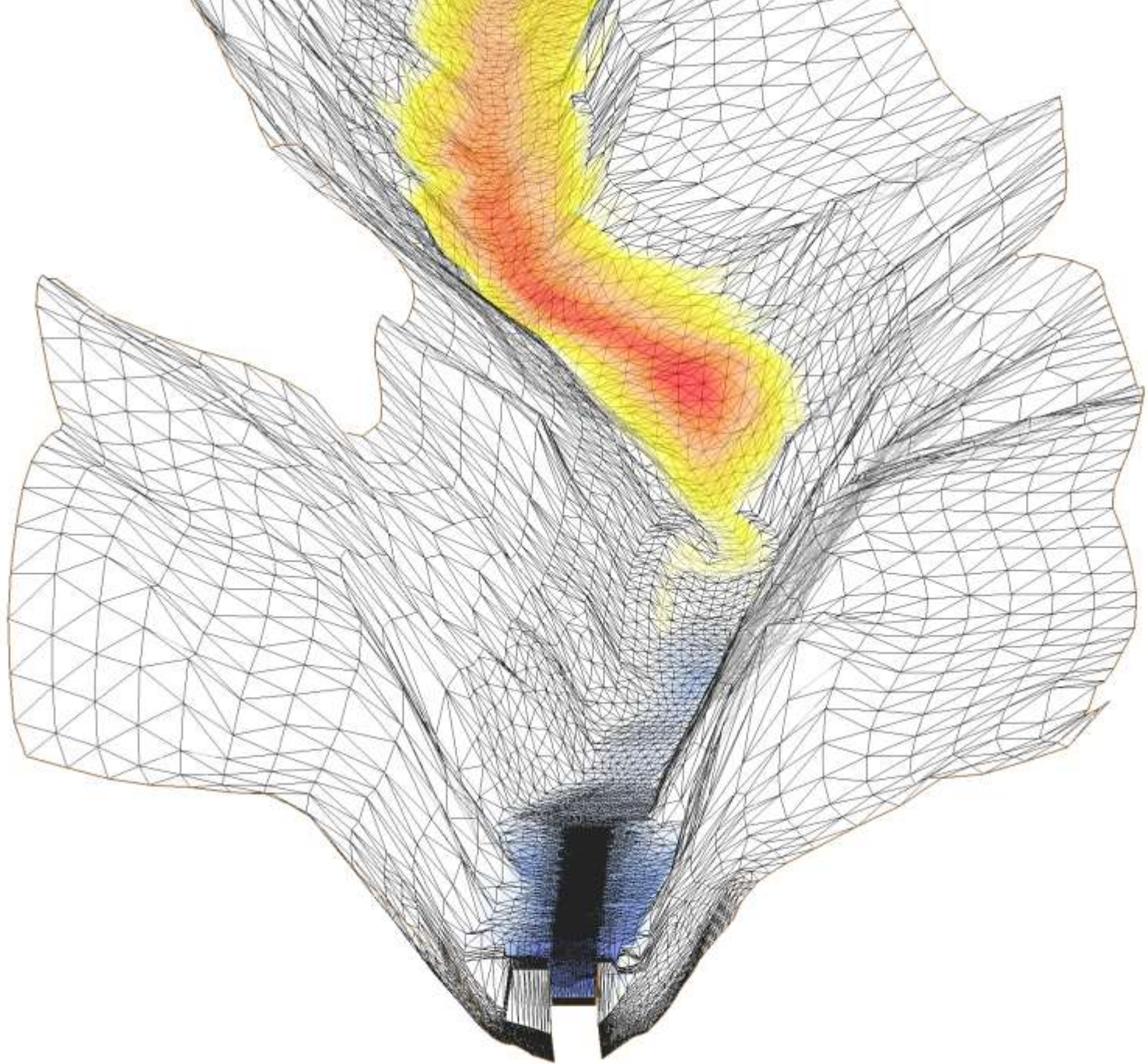
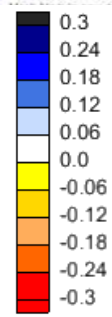


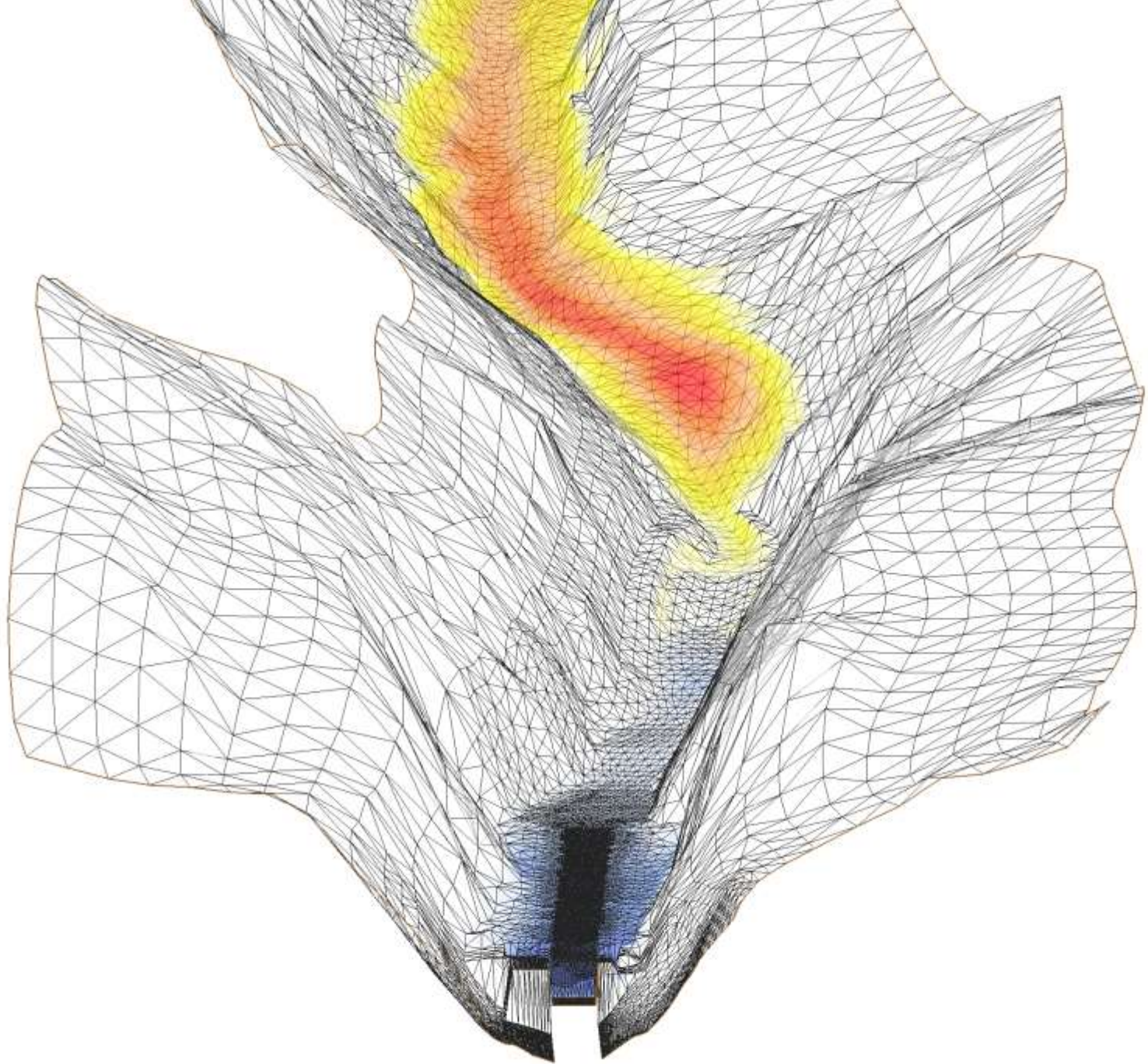


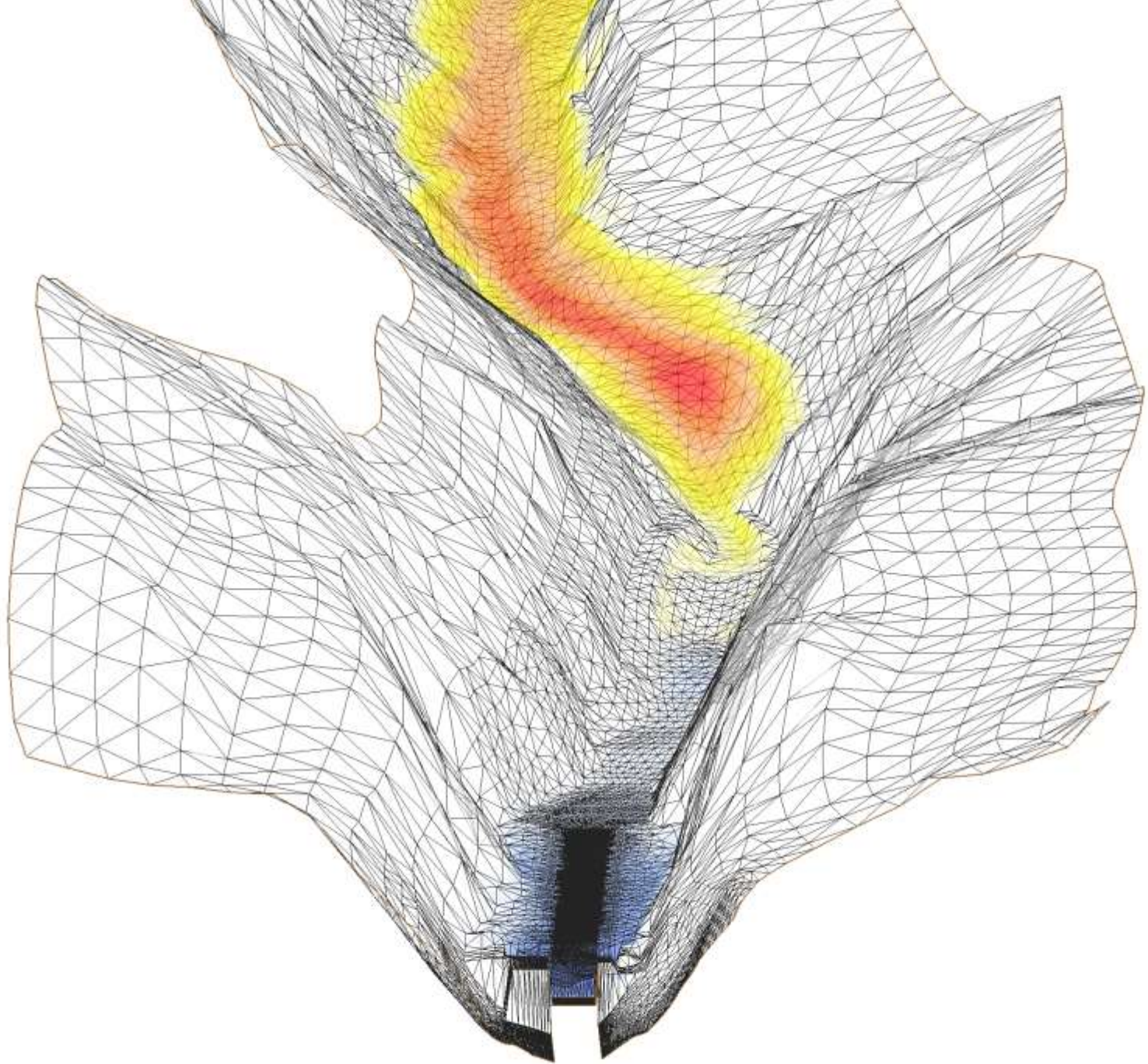
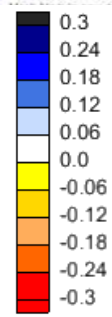


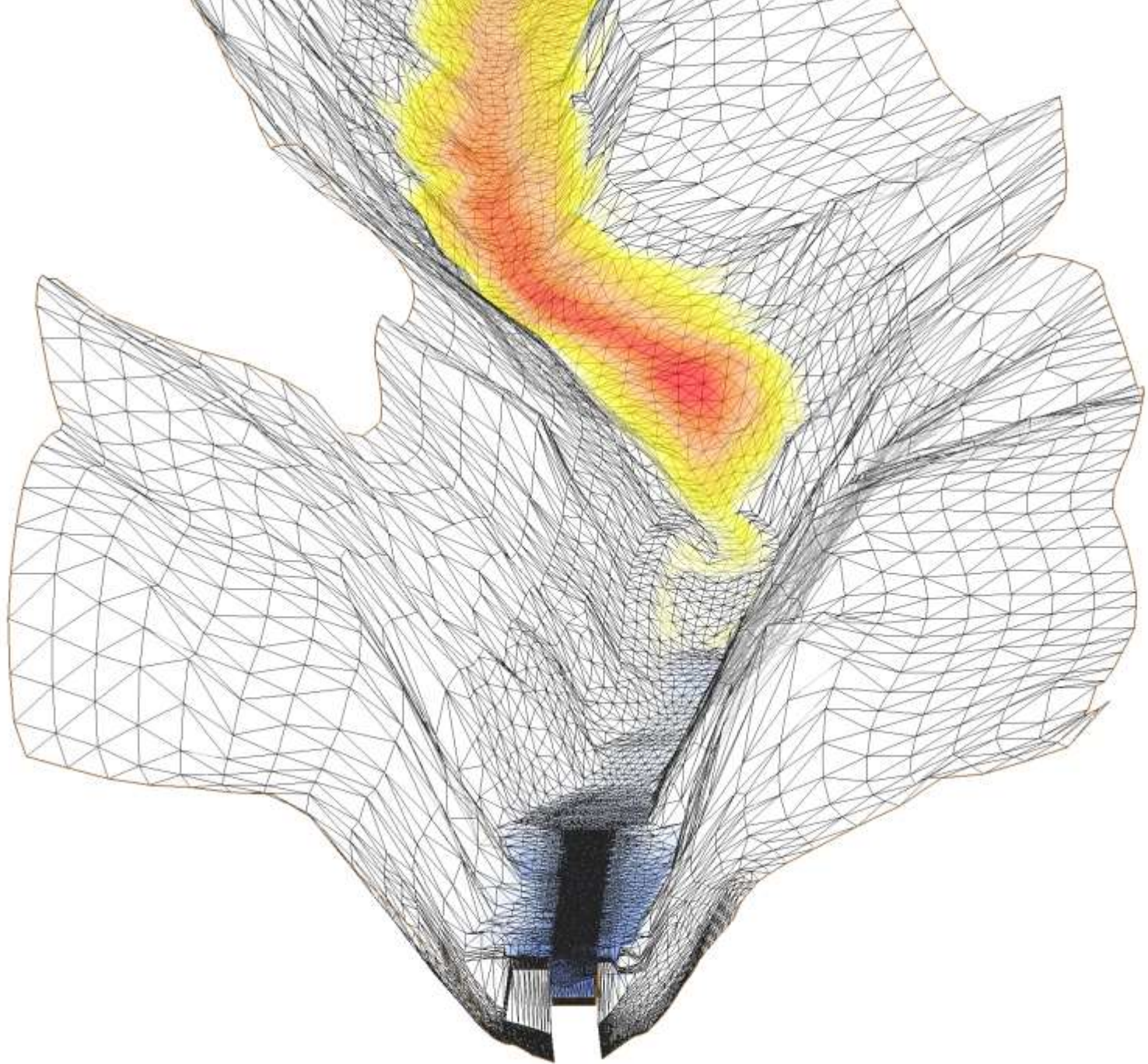
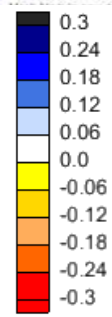




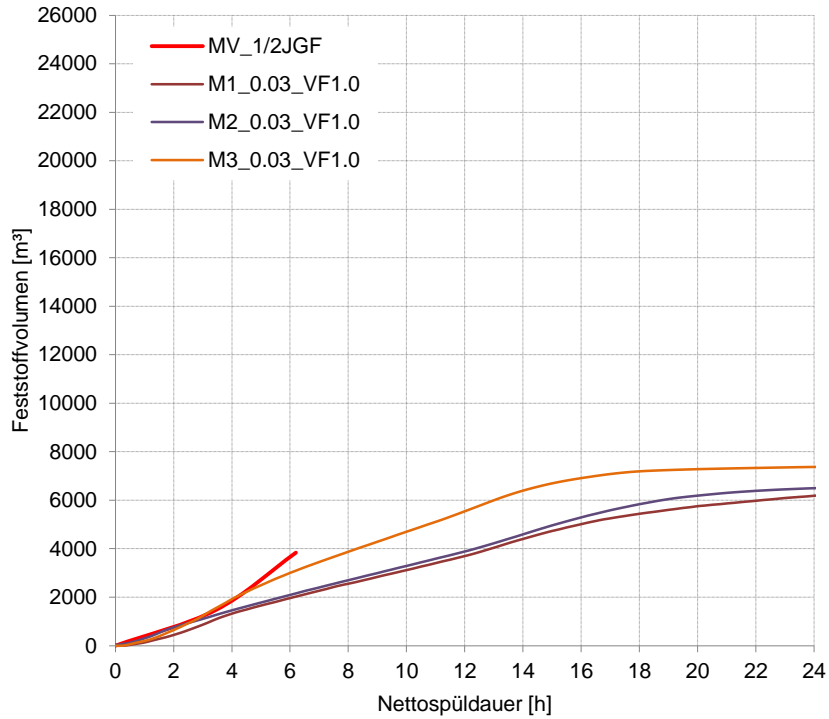




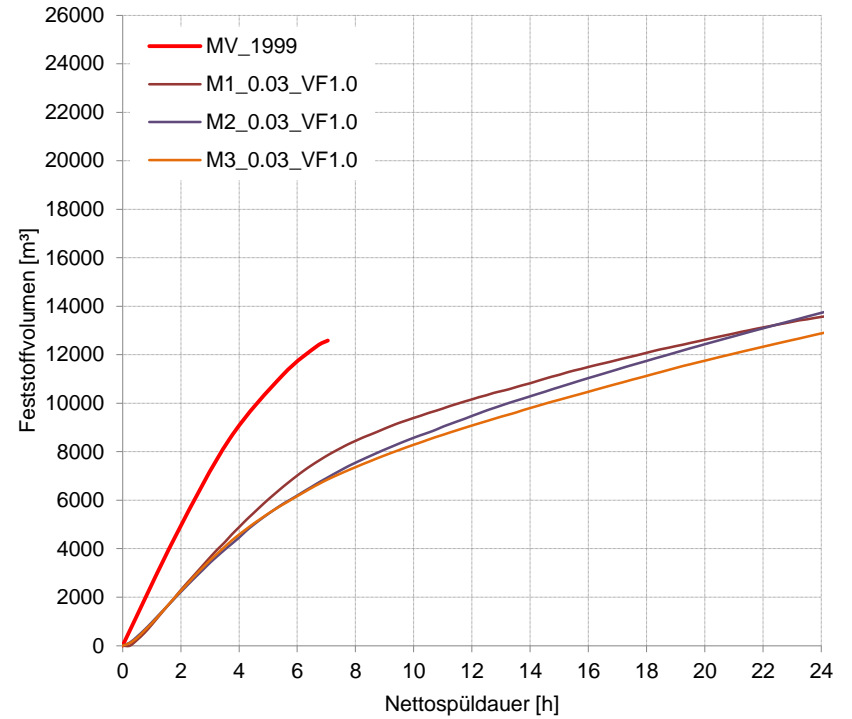




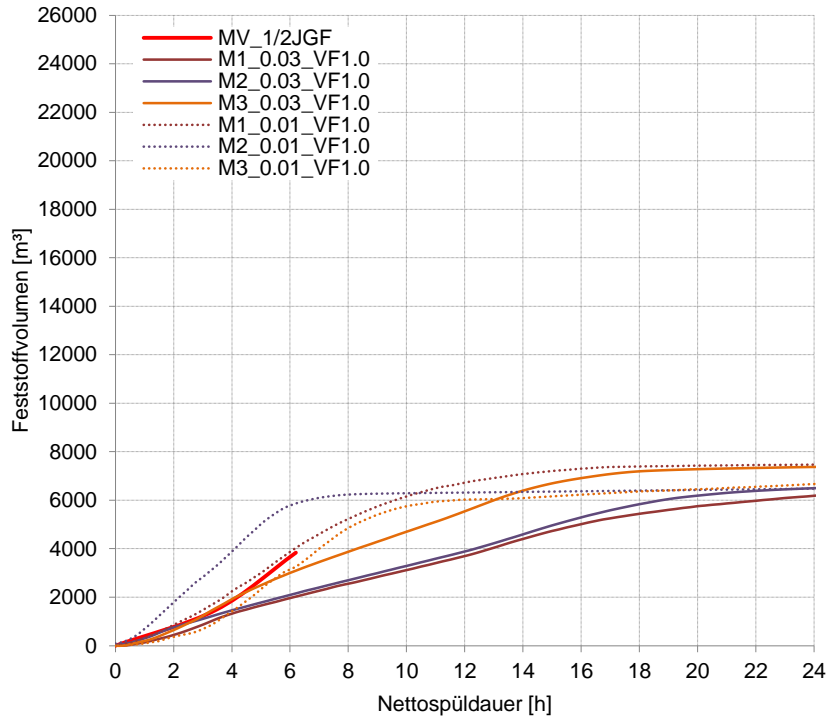
Spülung 1/2 JGF



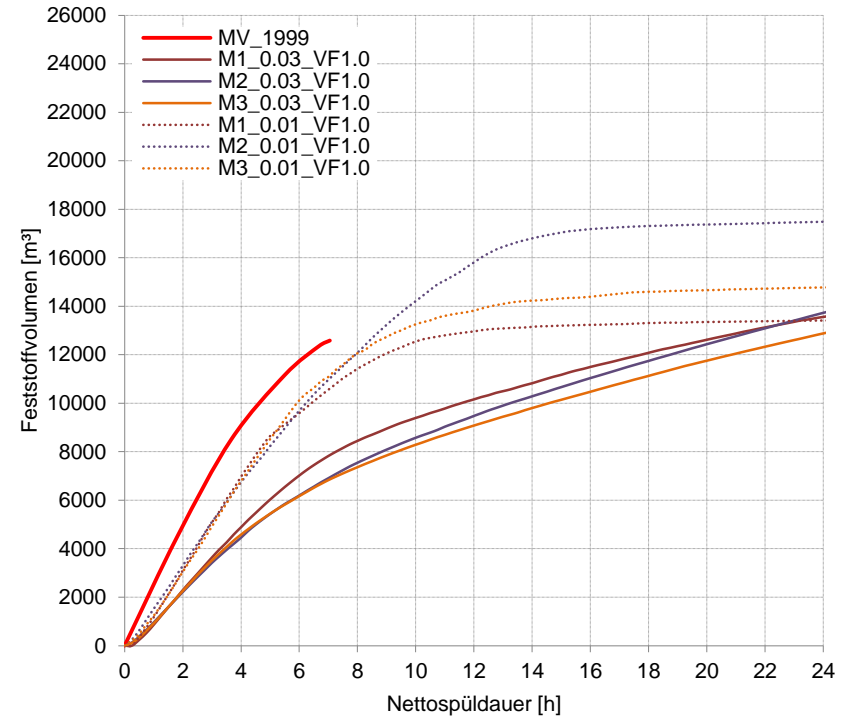
Spülung HW 1999



Spülung 1/2 JGF



Spülung HW 1999



Reduktion von Θ_{cr} 0,047 – 0,03 – 0,01



Stauraumspülung

Oszillationen

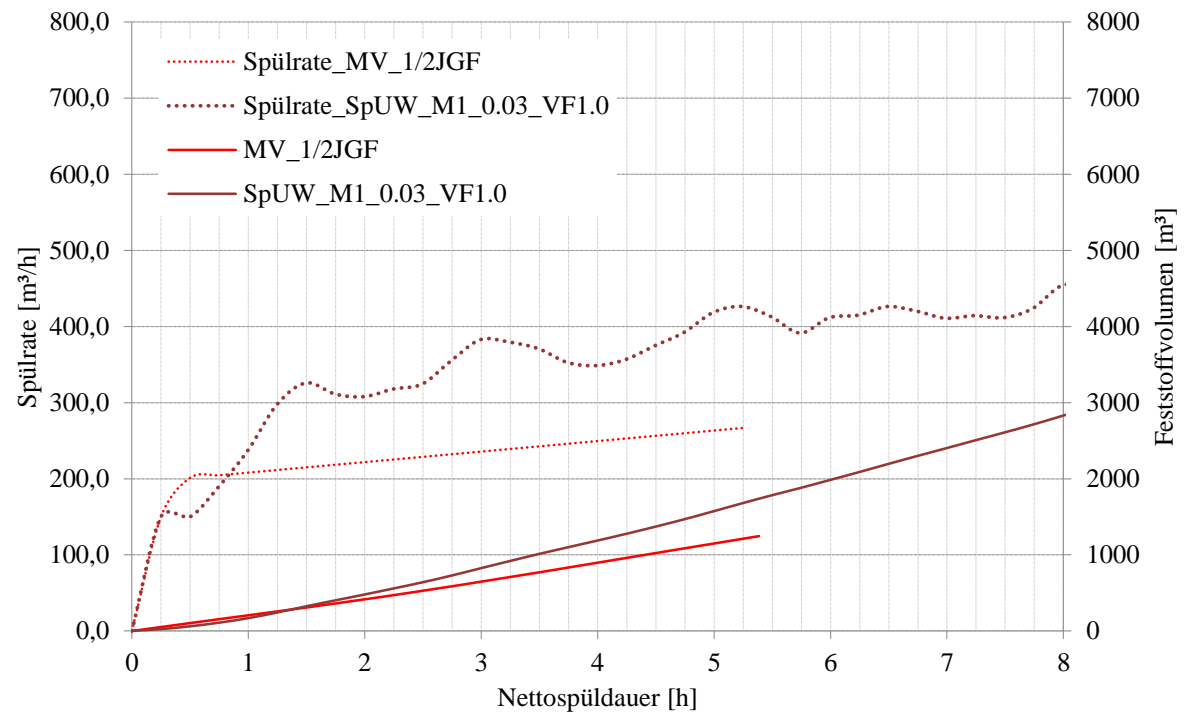
- teilweise Erliegen des Transportes
- + Netzverfeinerung

zu geringer Transport

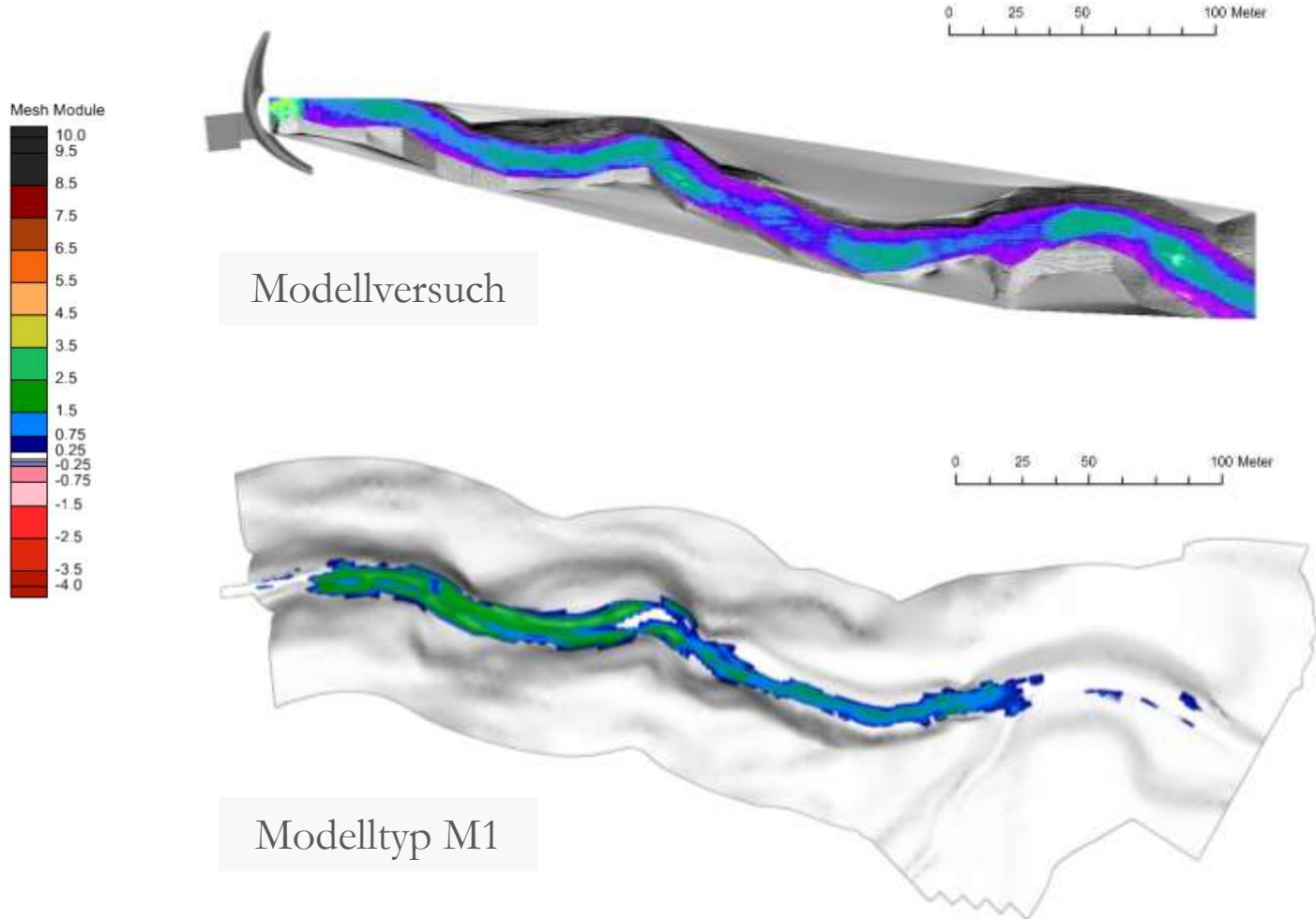
- Ergebnisse des MV nicht erreicht
- ausreichender Transport im OW und oberen Stauraum, zu geringer Transport im Bereich des GA
- + Netzverfeinerung, SCF-Formel Faktor, Theta_cr (τ crit), Verhältnis Gesamt- zu Kornrauheit
- + sehr kleine Theta_cr Annahmen



Vergleich Spülung UW
Modellversuch / Modelltyp M1



Auflandungen $\frac{1}{2}$ JGF Ende Spülung



Spülung Unterwasserstrecke

Große Sohlerosion

- kleine τ_{crit} Werte
- + M1 (1:30) Sohle fixiert; M3 Beschränkung der möglichen Erosion

zu geringer Transport

- Auflandungen an den nodestings
- + verteilter Stoffeintrag
- + Reduktion Θ_{cr} (τ_{crit})



Danke!

Kontakt

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