Građevinski fakultet
Univerzitet u Beogradu

MODELIRANJE TURBULENCIJE U OKOLINI MOSTOVSKOG STUBA PRIMENOM SOFTVERSKOG PAKETA I-RIC 2.3

Mehanika fluida – napredni kurs
Doktorske studije 2016/2017

Student:
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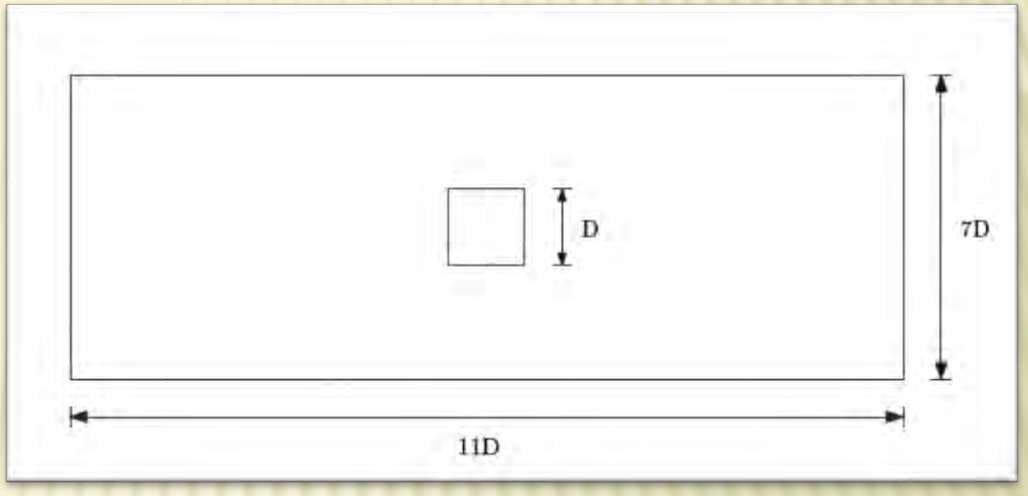
Profesor:
Prof. dr Dušan Prodanović

Beograd, maj 2017.

ZADATAK

- Dimenzije kanala:

- D = 5 m
- širina kanala - 35 m
- dužina kanala – 55 m



- Protoci:

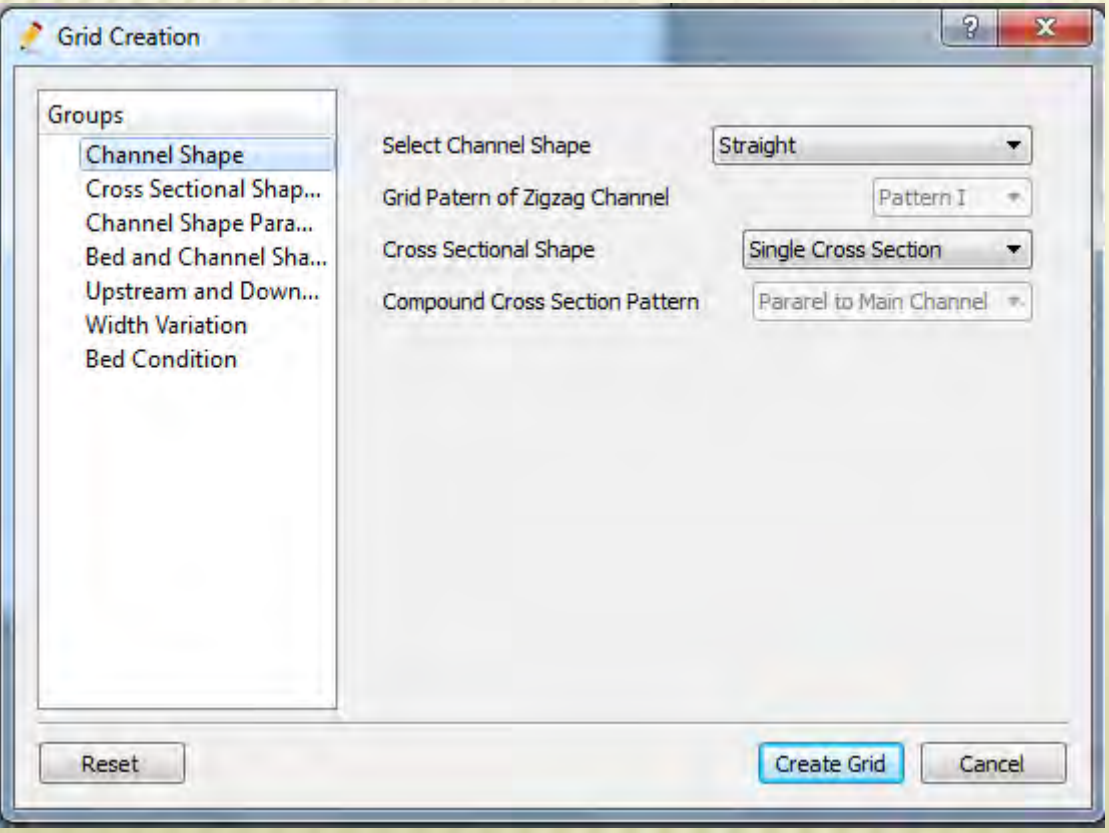
- Q_{med} = 225.9 m^3/s
  h = 3.03 m, V = 2.13 m/s, h_{kr} = 1.62 m
- Q_{50} = 479.5 m^3/s
  h = 3.87 m, V = 3.54 m/s, h_{kr} = 2.68 m

- Cilj zadatka:

- prikaz tečenja u okolini mostovskog stuba u IRIC NuysCUBE solver-u
- poređenje sa rezultatima rada na Exeter Univerzitetu u Engleskoj

METODOLOGIJA

- Kreiranje mreže
  - Grid/Select Algorithm to Create Grid../Multifunction Grid Genarator
  - Mreža 44x28x10 ćelija – $\Delta x = \Delta y = 1.25$ m



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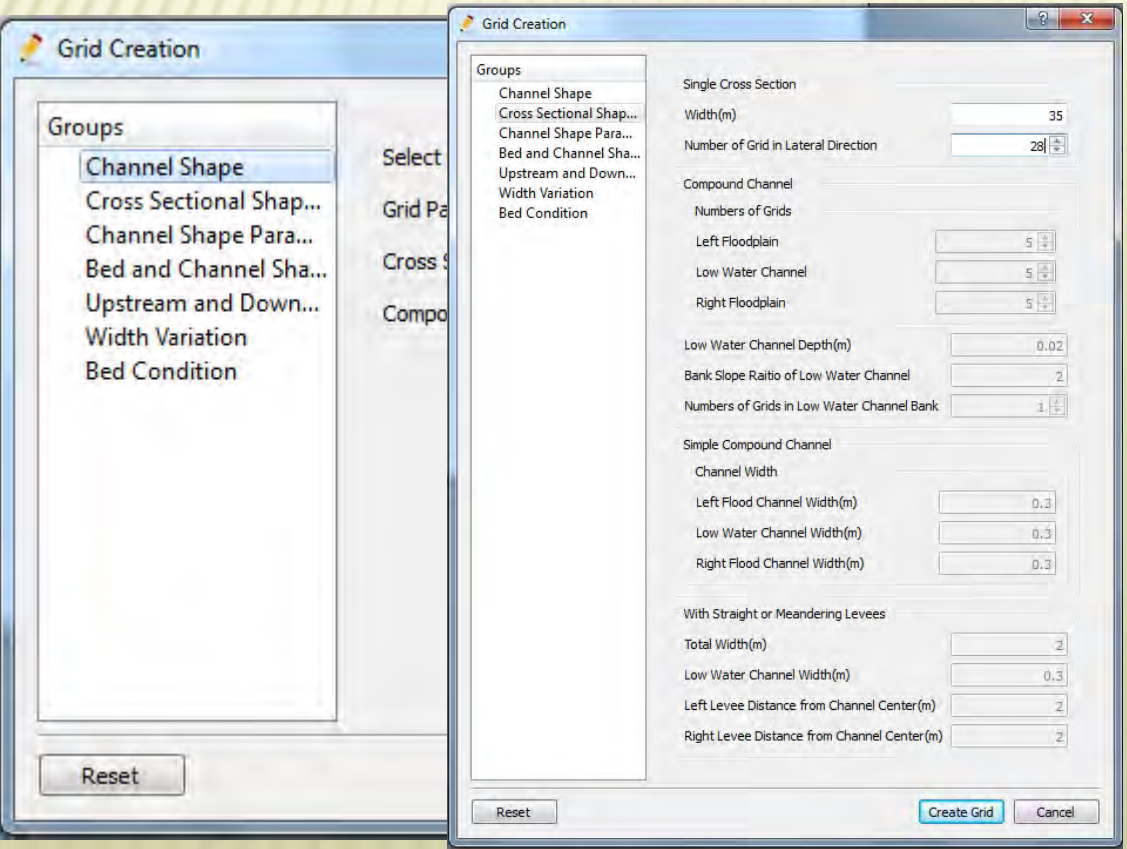

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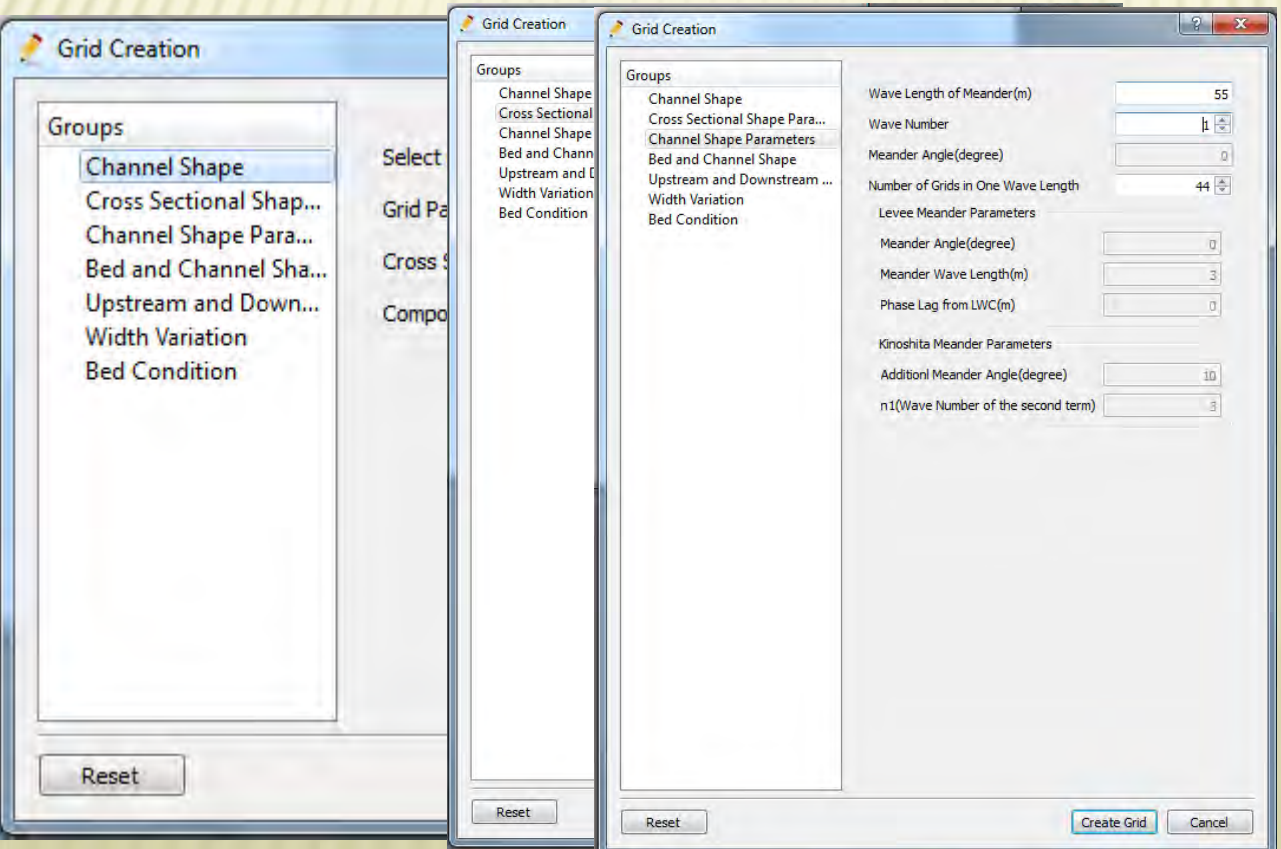

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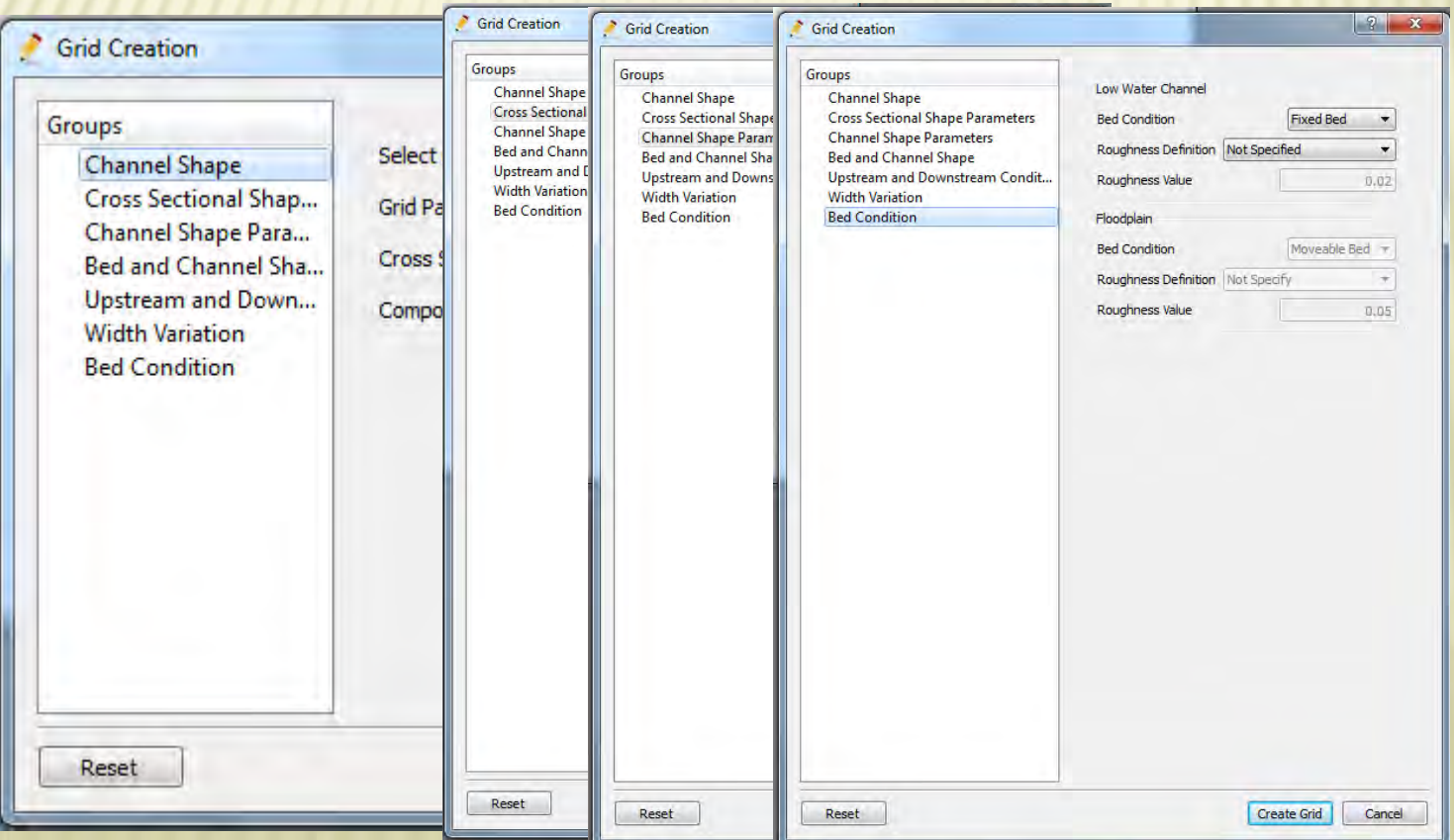

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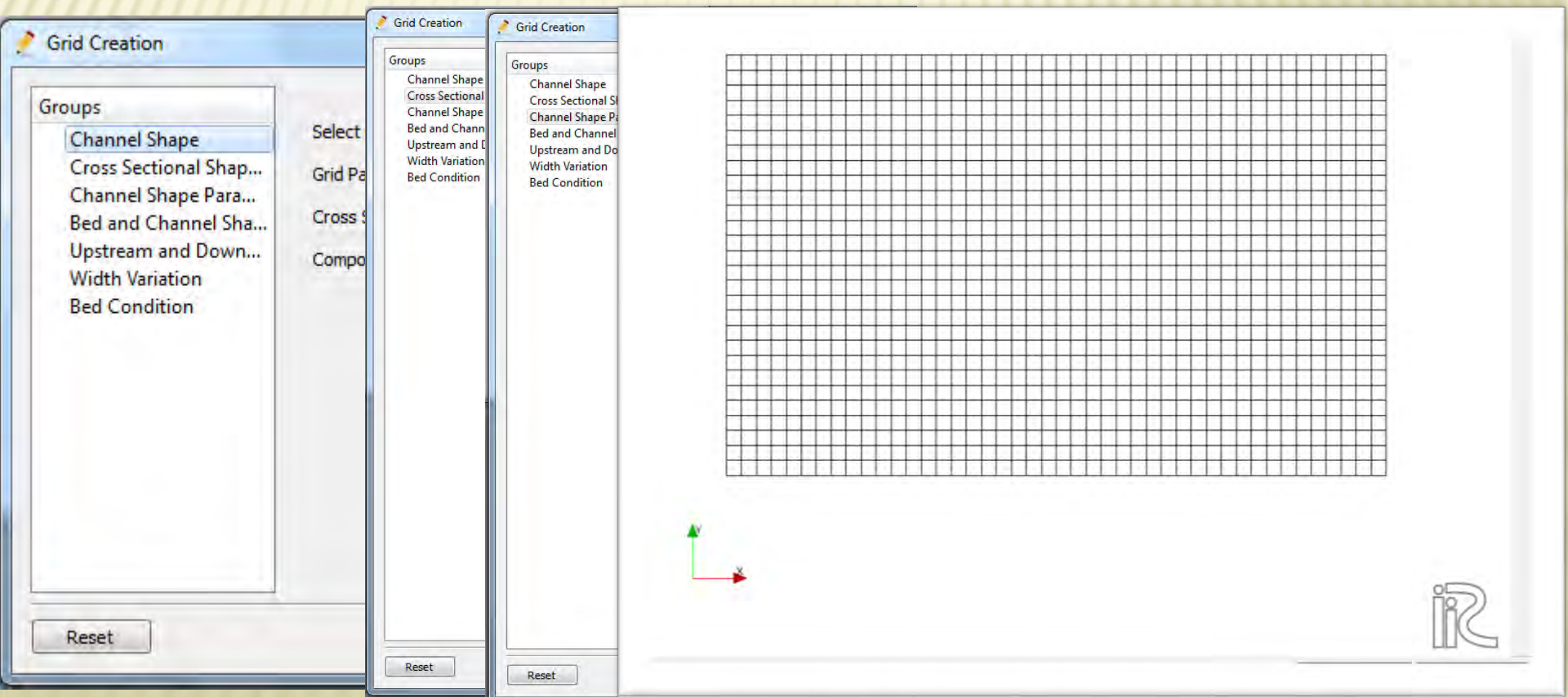
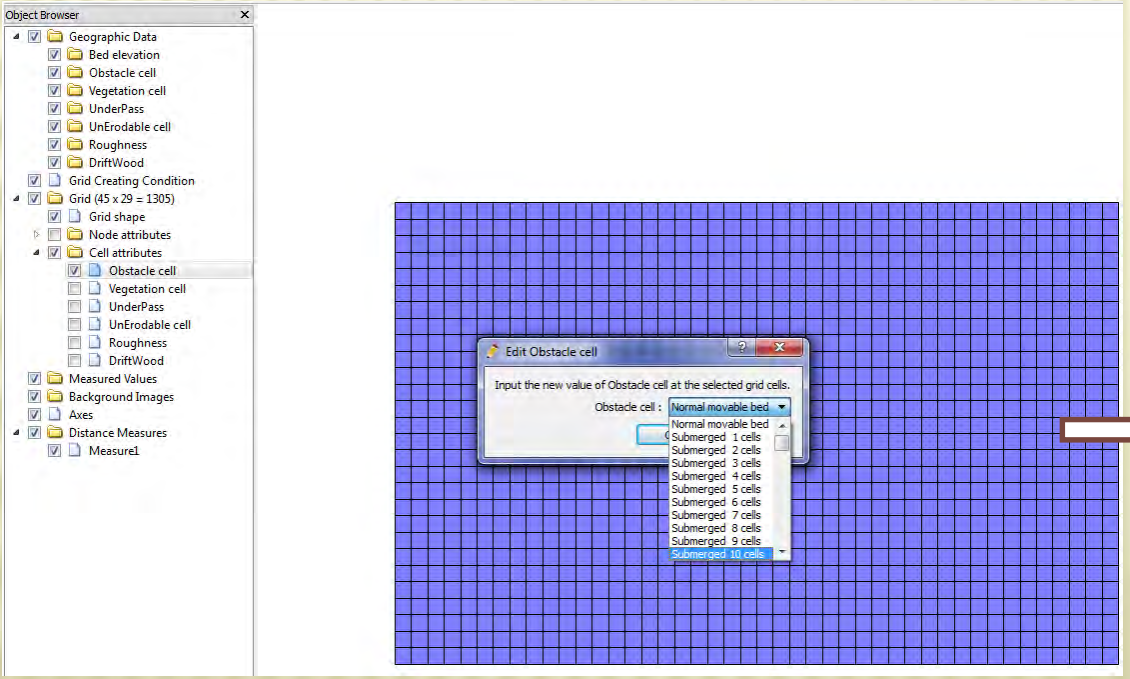


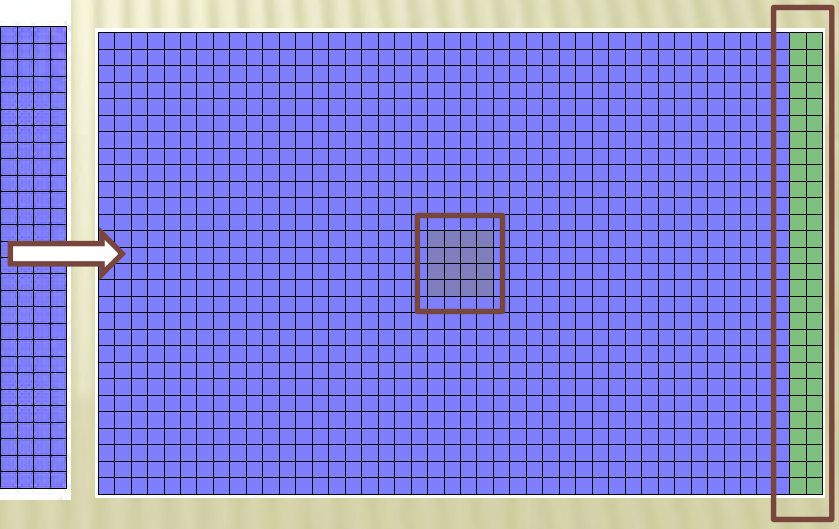
METODOLOGIJA

- Postavljanje prepreke

- Object Browser/Grid/Cell attributes/Obstacle cell

- Stub i nizvodna prepreka

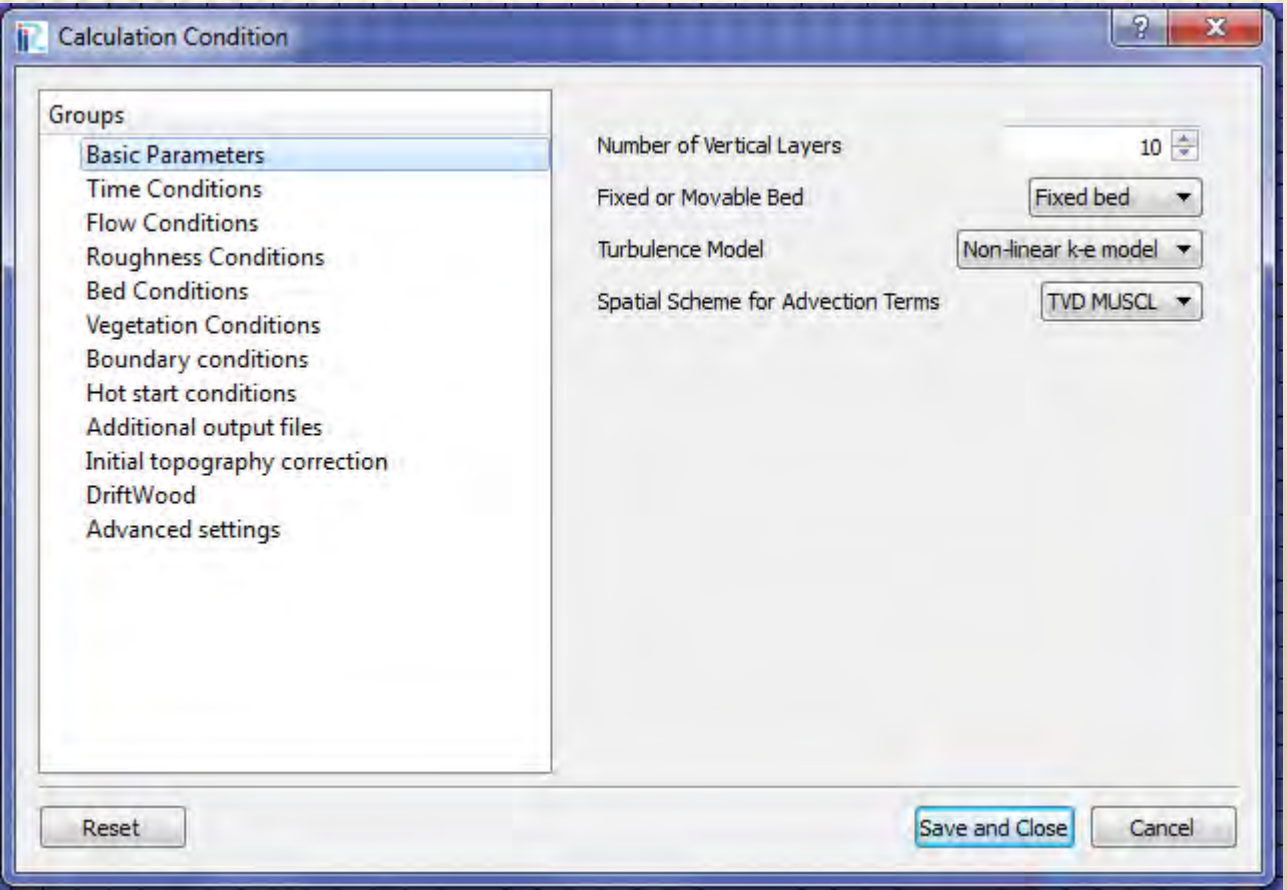




METODOLOGIJA

- Unošenje praramетara modela:

  - Calculation Condition/Setting



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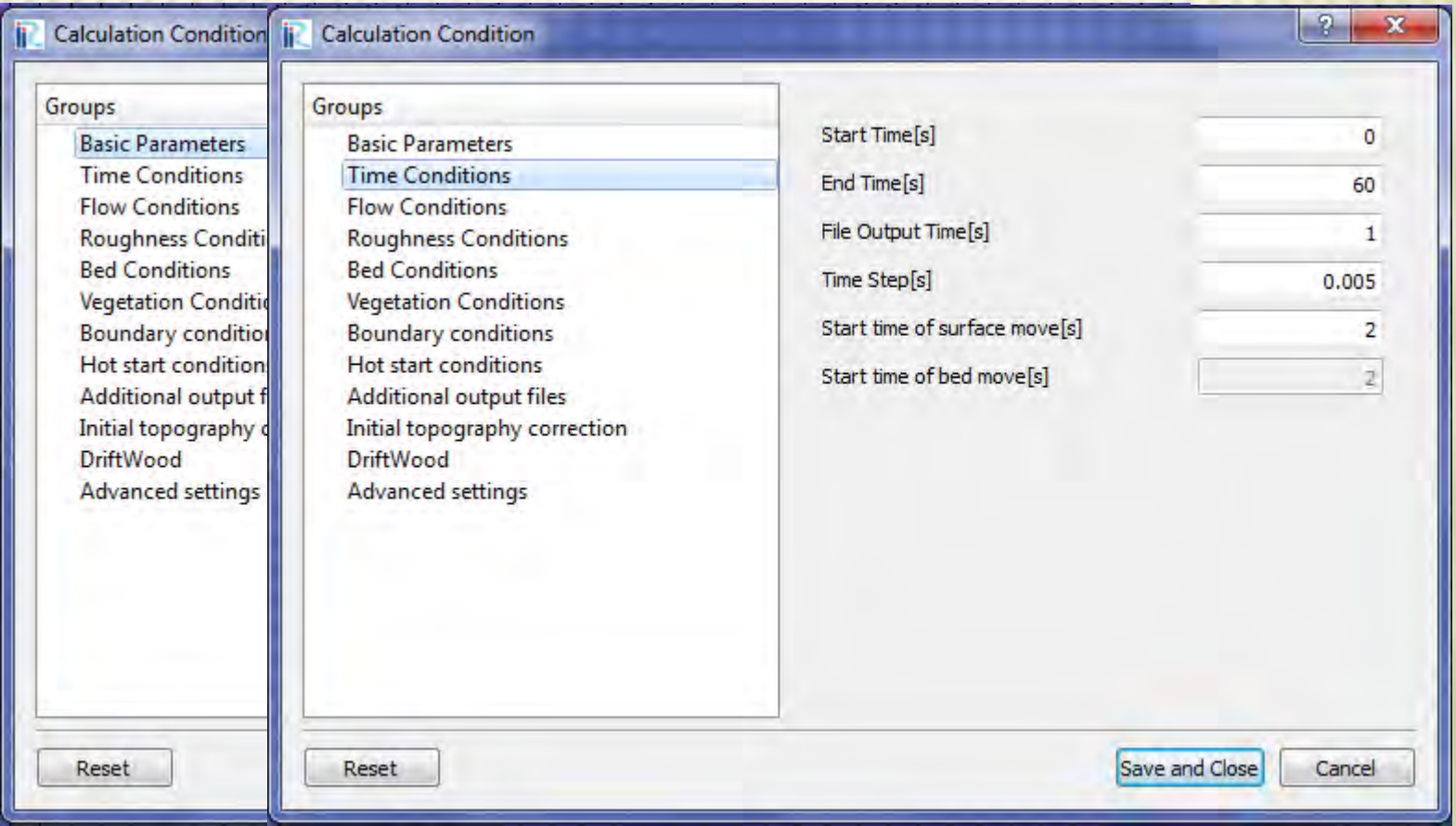

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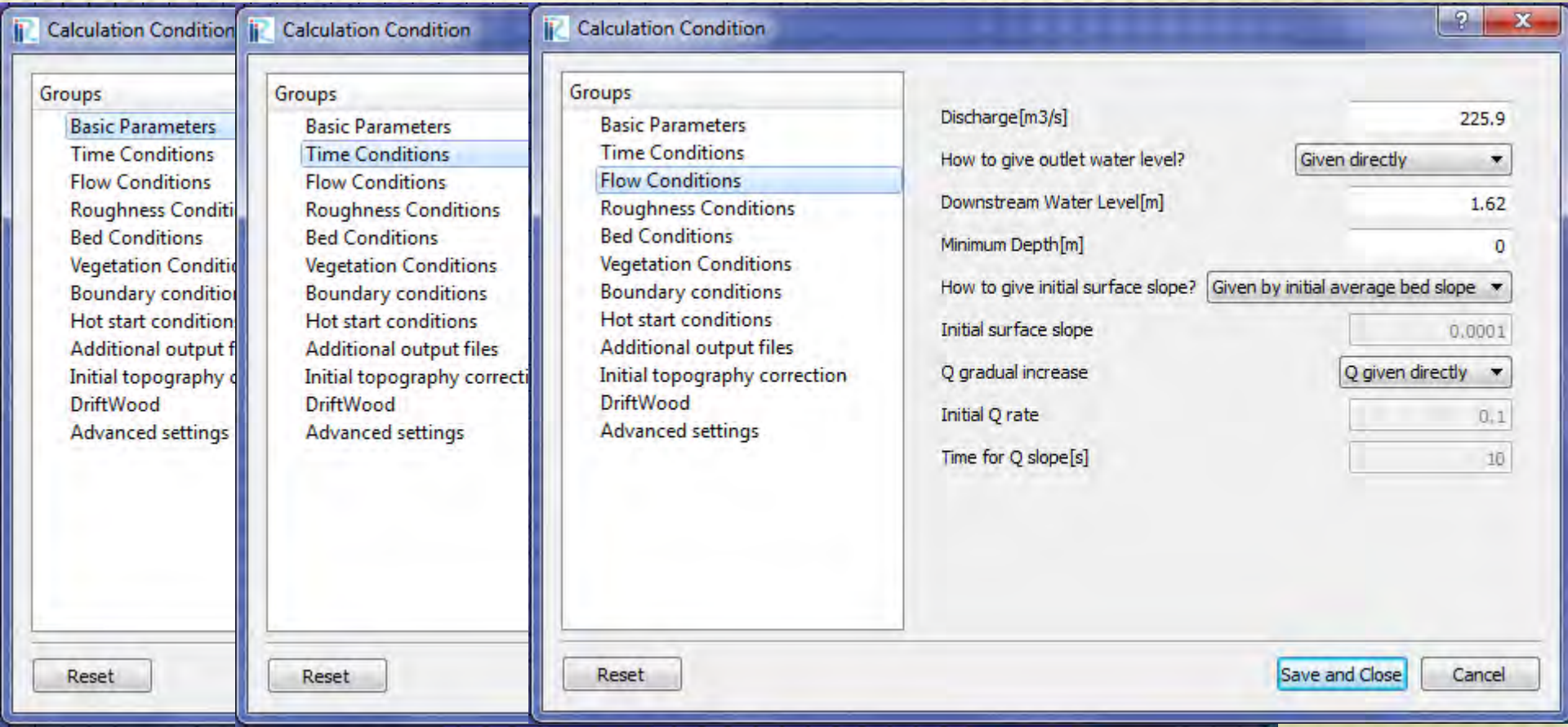
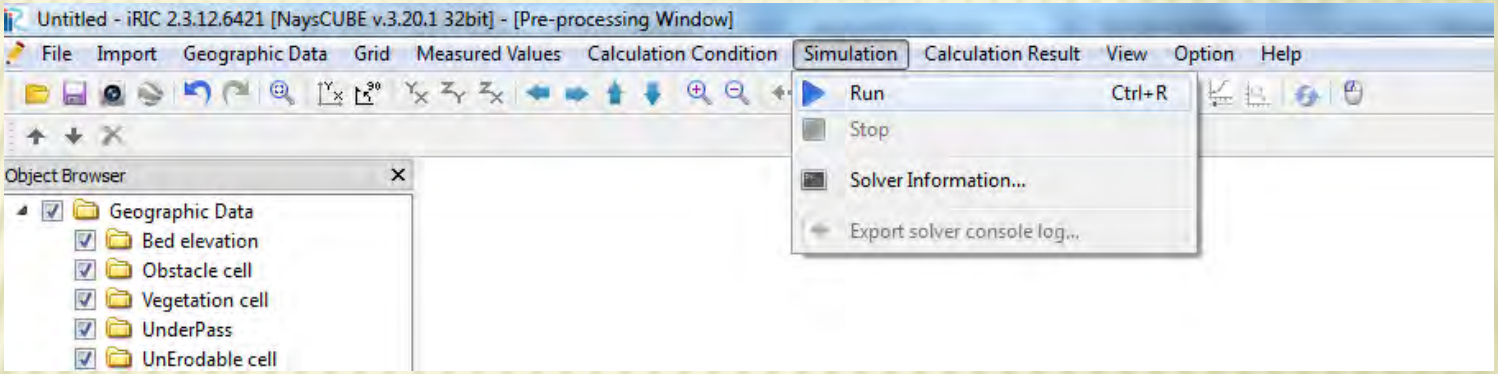


METODOLOGIJA

- Pokretanje simulacije

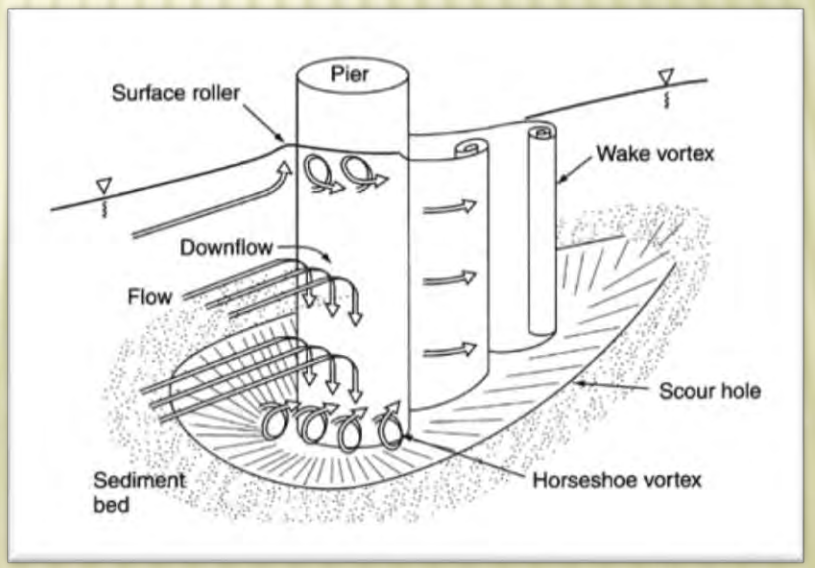
- Simulation/Run



- Neodgovarajuće vrednosti vremenskog koraka i nizvodne dubine dovode do prekida proračuna

REZULTATI

- Poređenje brzina pri dnu
- Poređenje brzina na površini
- Poređenje nivoa vode sa desne strane stuba
- Turbulentna kinetička energija pri dnu i na površini



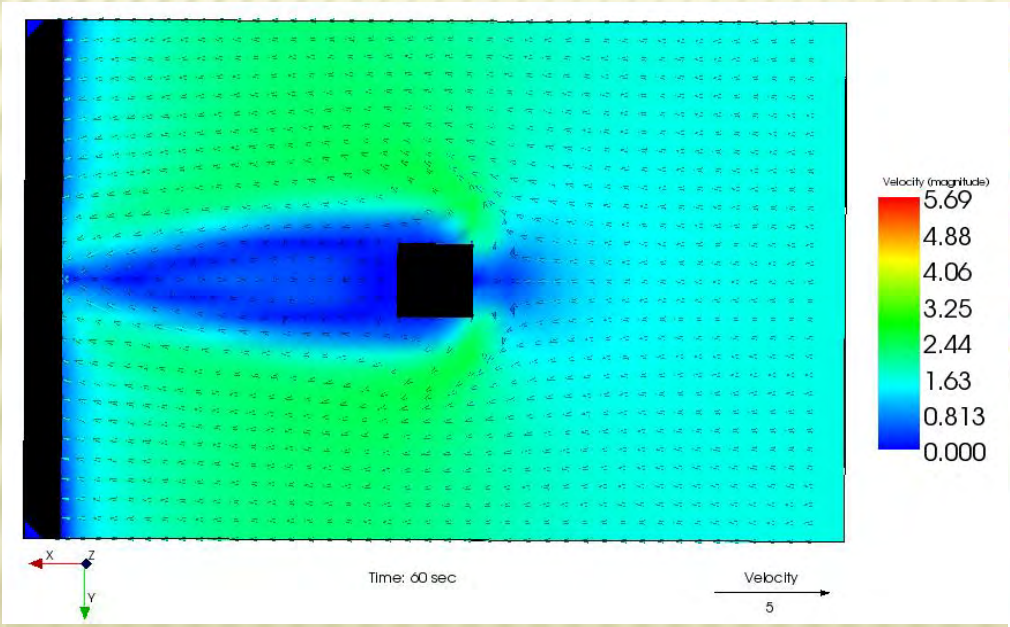
REZULTATI

- Q_{med} - srednji protok za datu godinu

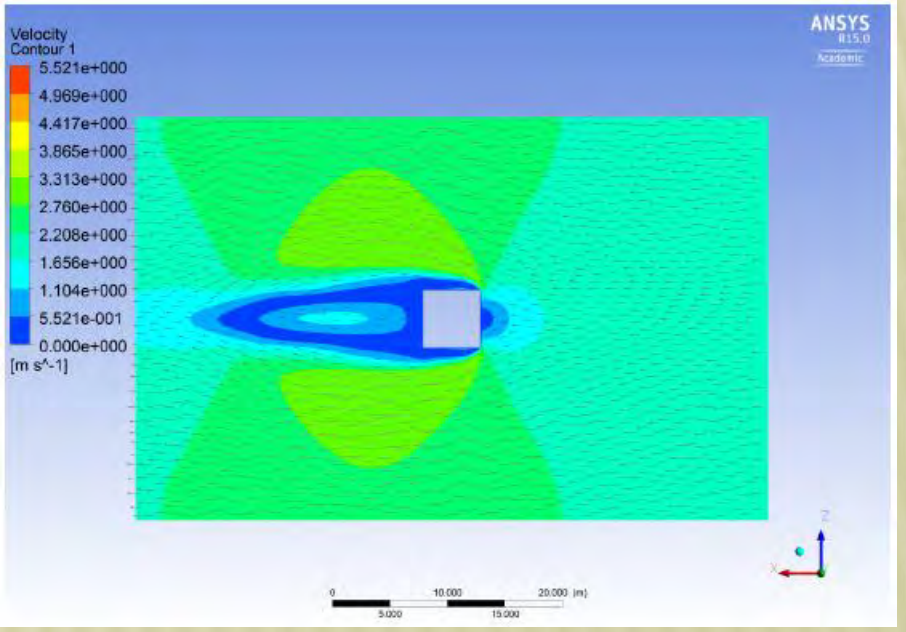
- Prepreka: pravac X = 2, Y = 28, Z = 5 ćelija

- Poređenje brzina pri dnu

Rezultati u NuysCUBE-u



Rezultati u ANSYS-u

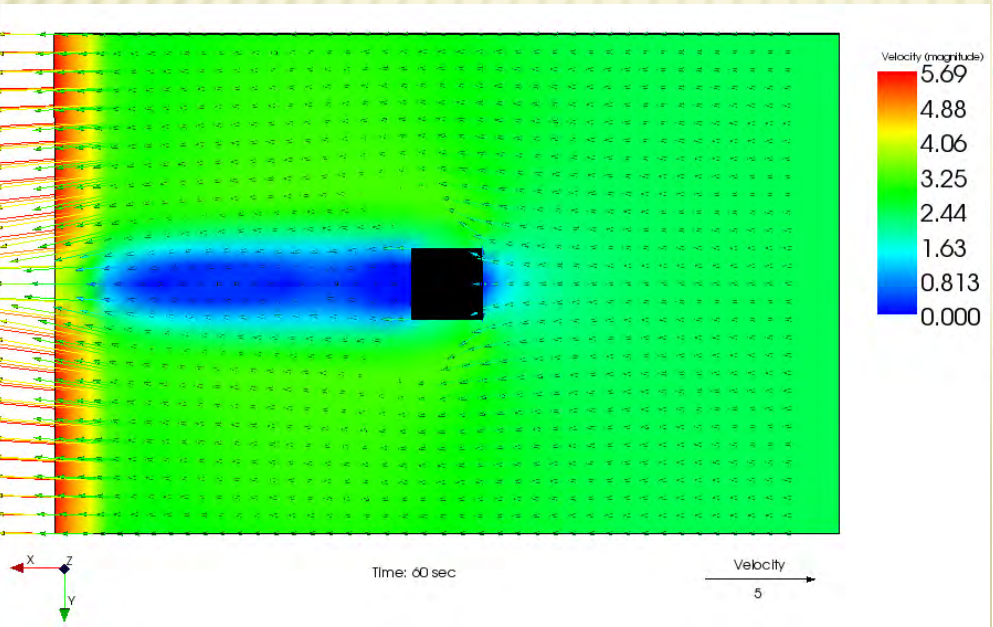


REZULTATI

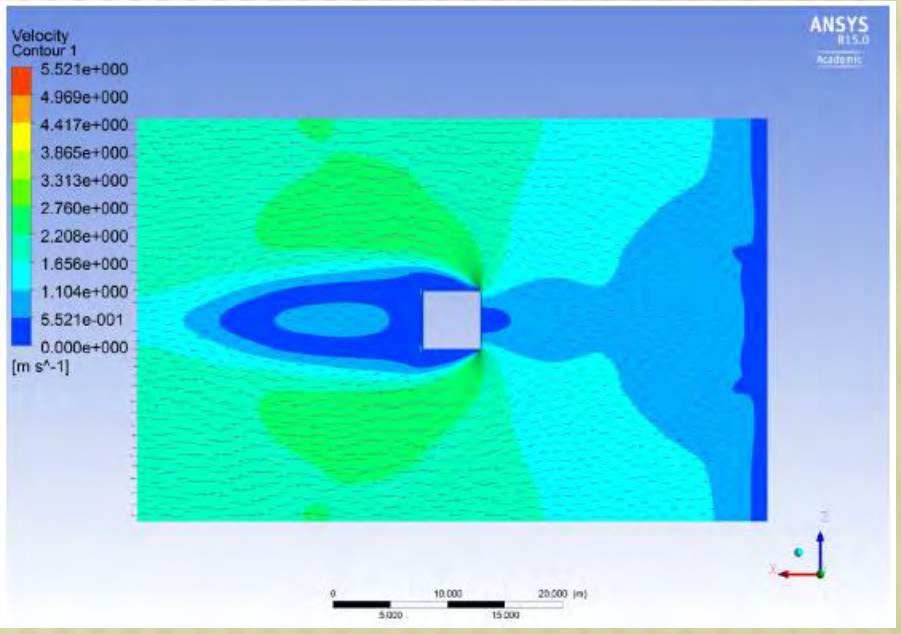
- Q_{med} - srednji protok za datu godinu

- Poređenje brzina na površini

Rezultati u NuysCUBE-u



Rezultati u ANSYS-u

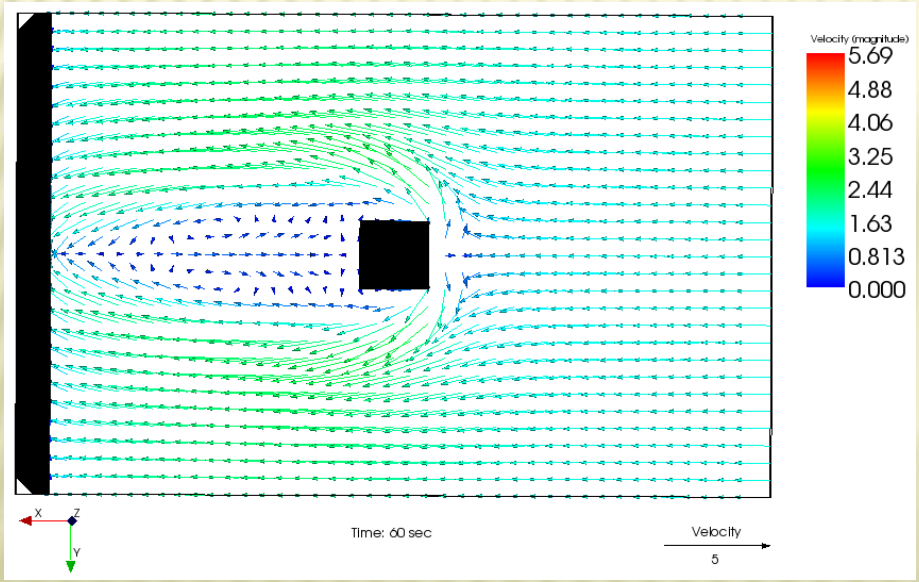


REZULTATI

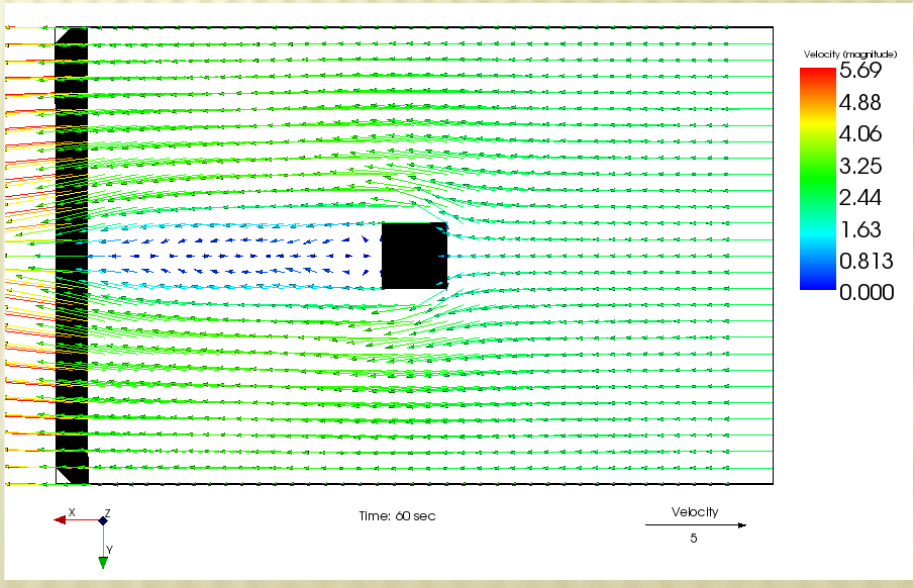
- Q_{med} - srednji protok za datu godinu

  Prikaz strujnica na dnu i na površini

- strujnice na dnu -

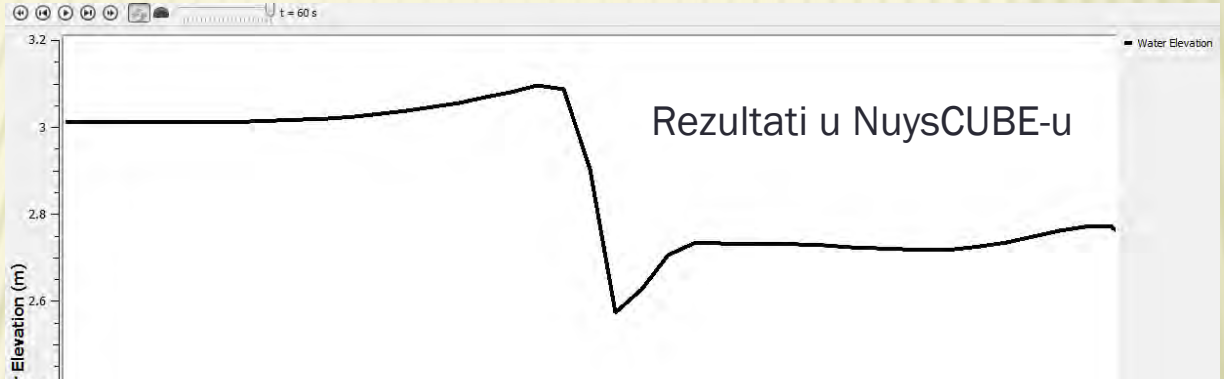


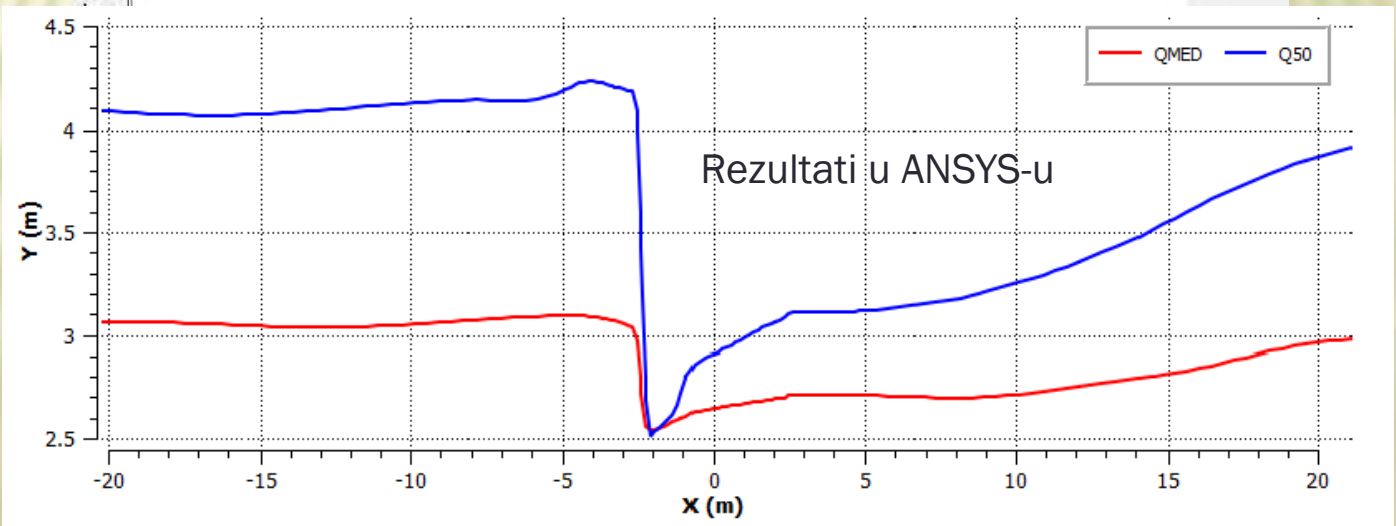
- strujnice na površini -



REZULTATI

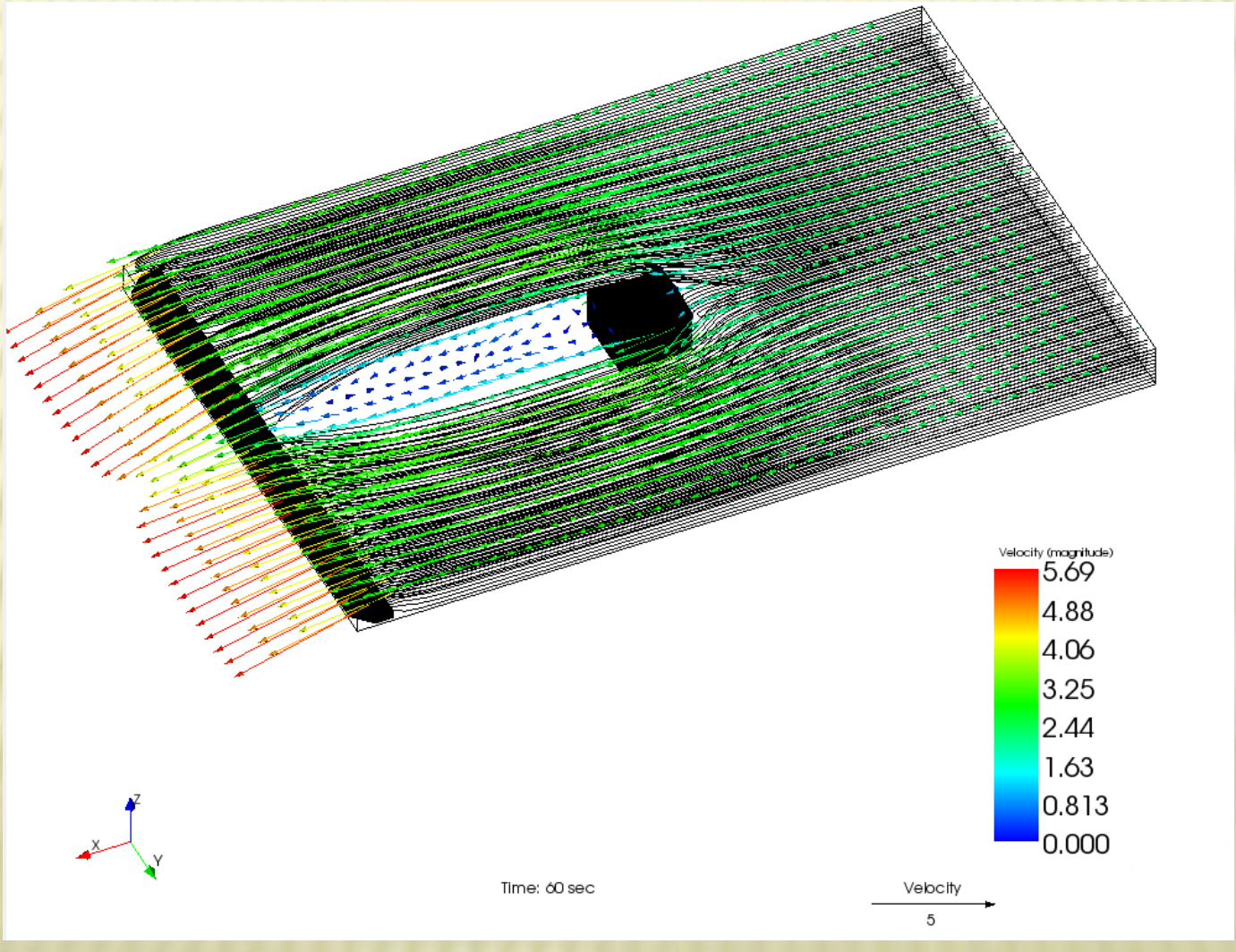
- Q_{med} - srednji protok za datu godinu
  - Nivo vode sa desne strane stuba (I = 13)





REZULTATI

Prikaz strujnica i prepreka u prostoru



REZULTATI

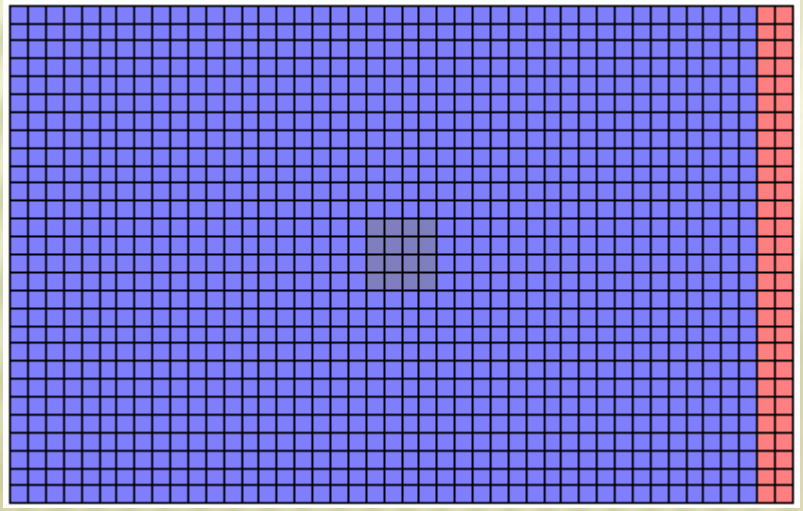
- Q_{50} - maksimalni protok za poplave koje se javljaju jednom u 50 godina

- Brzine na površini – dva tipa nizvodne prepreke

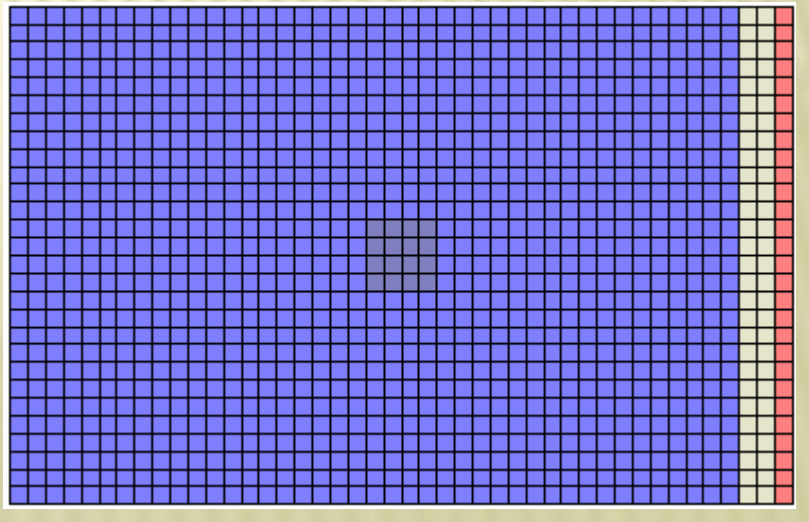
1. tip: pravac X = 2, Y = 28, Z = 1 ćelija

2. tip: pravac X = 3, Y = 28, Z = 2, 2, 1 ćelija

1. tip nizvodne prepreke



2. tip nizvodne prepreke



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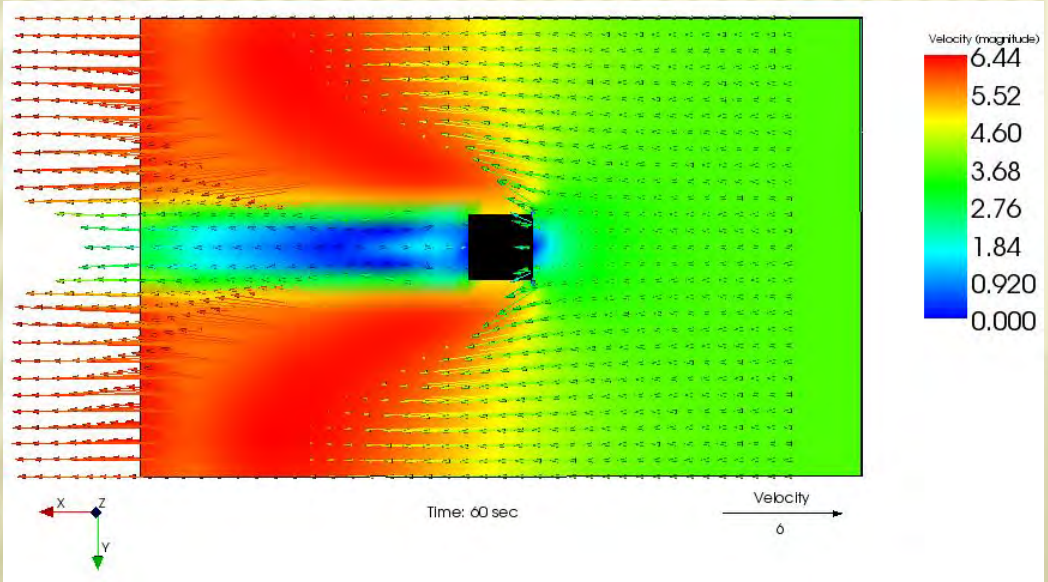

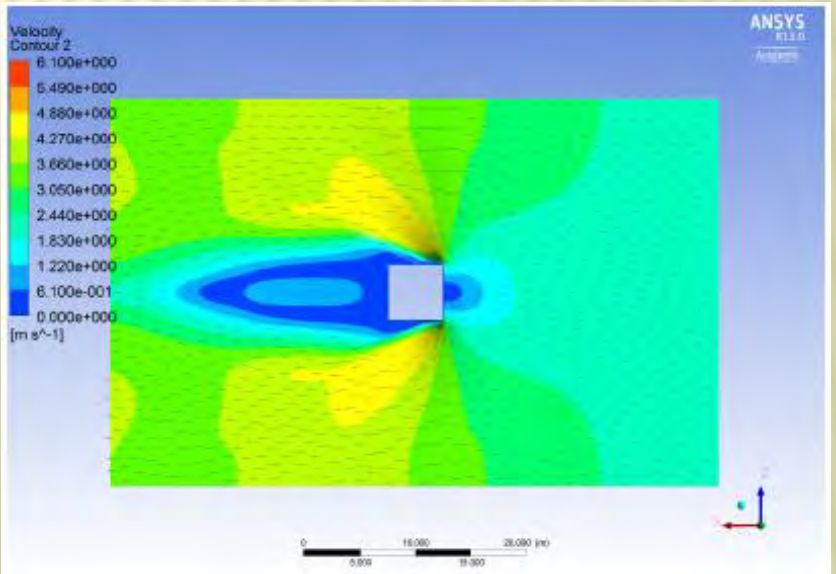

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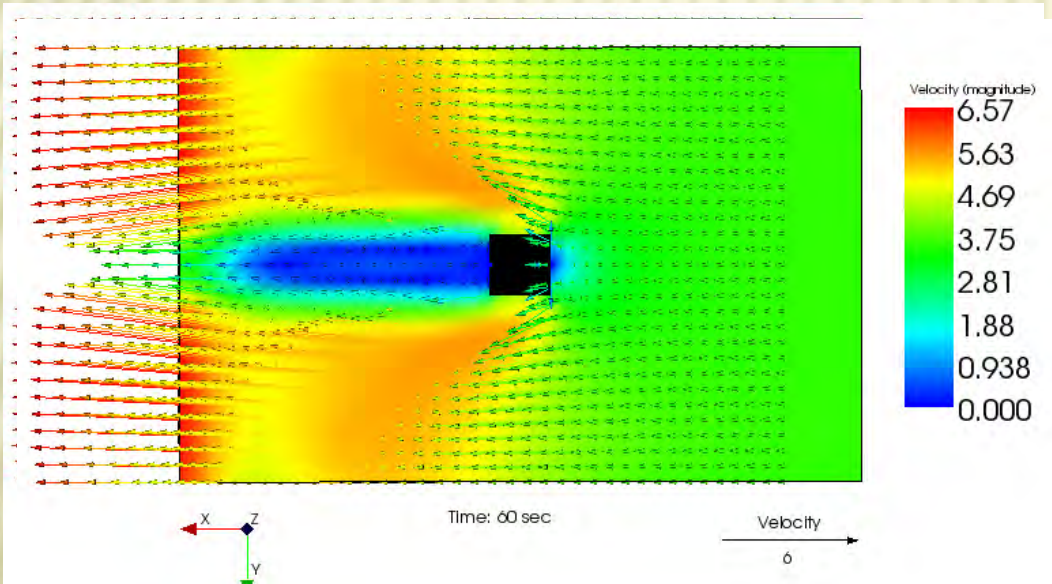

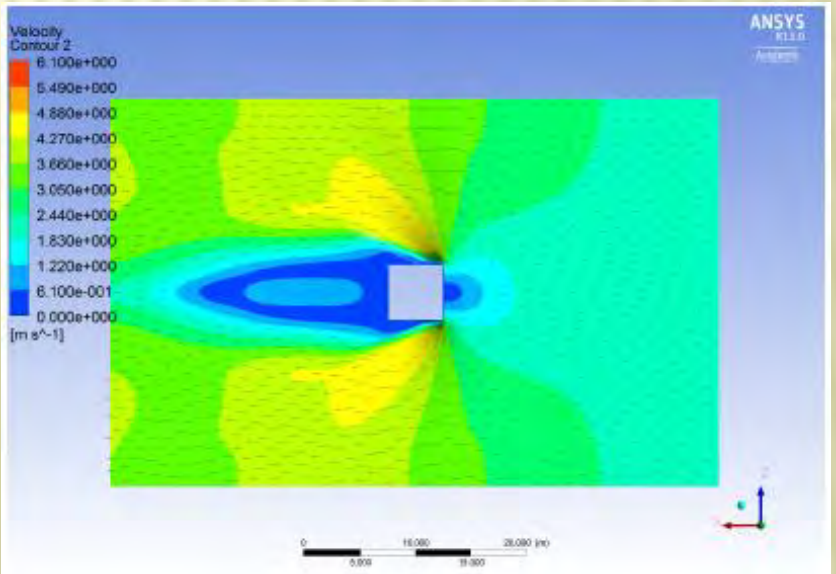

REZULTATI

- Q_{50} - maksimalni protok za poplave koje se javljaju jednom u 50 godina

- Brzine pri dnu

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Rezultati u ANSYS-u

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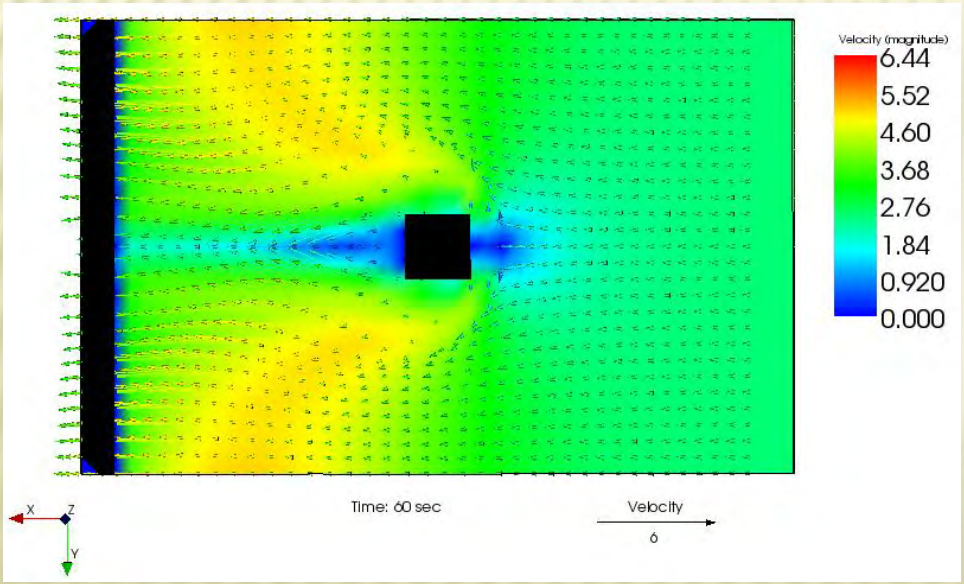

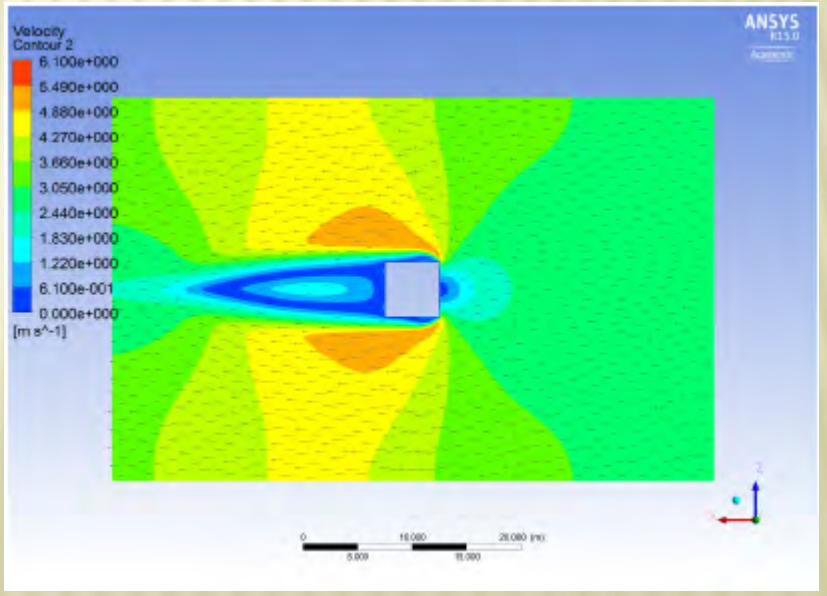

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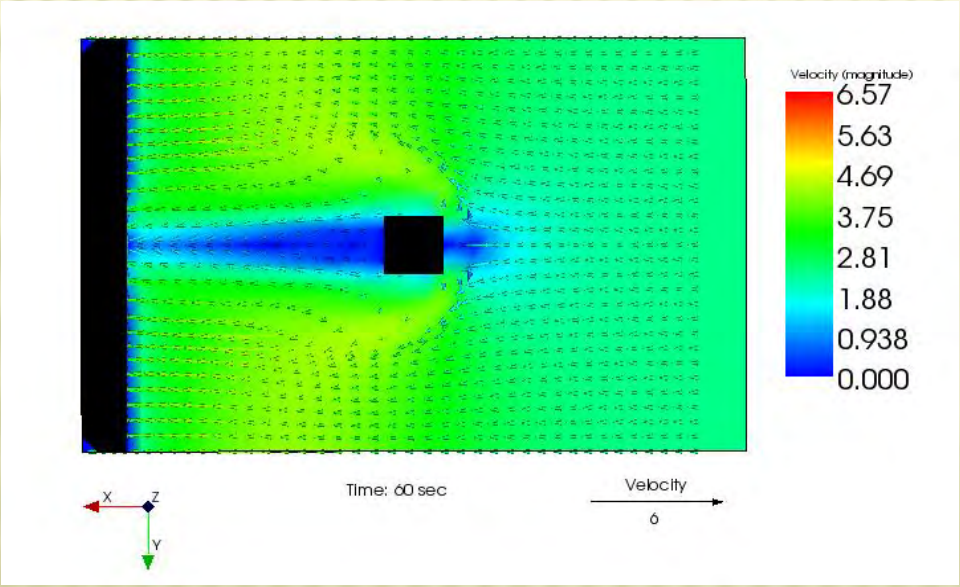
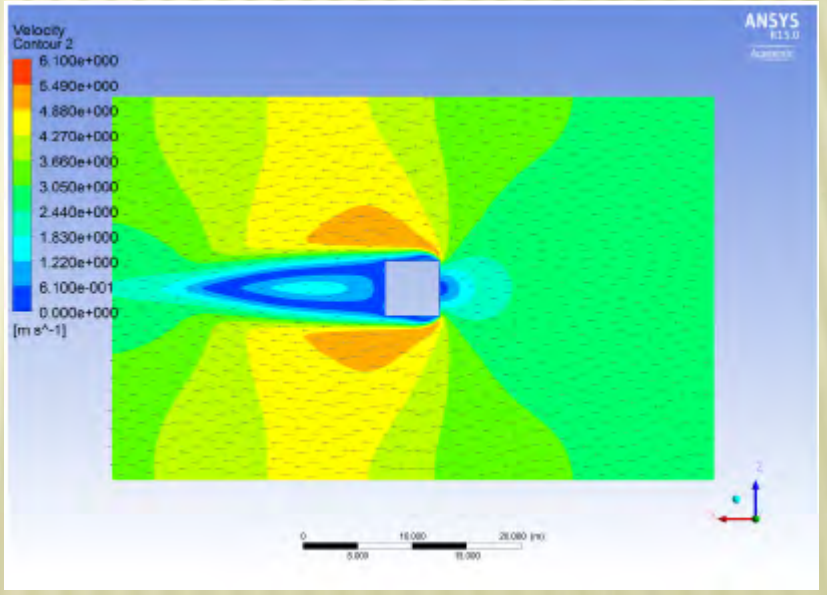
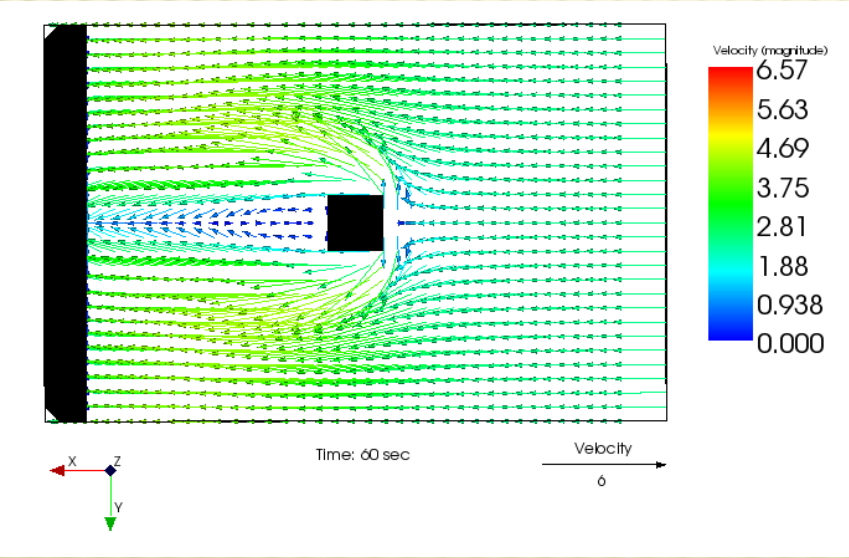




REZULTATI

- Q_{50} - maksimalni protok za poplave koje se javljaju jednom u 50 godina

- strujnice na dnu -



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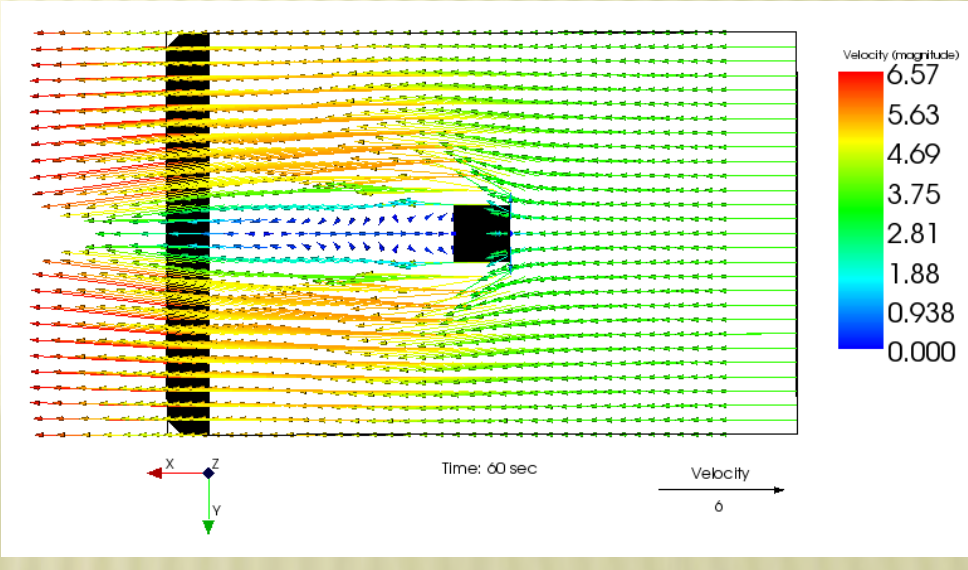
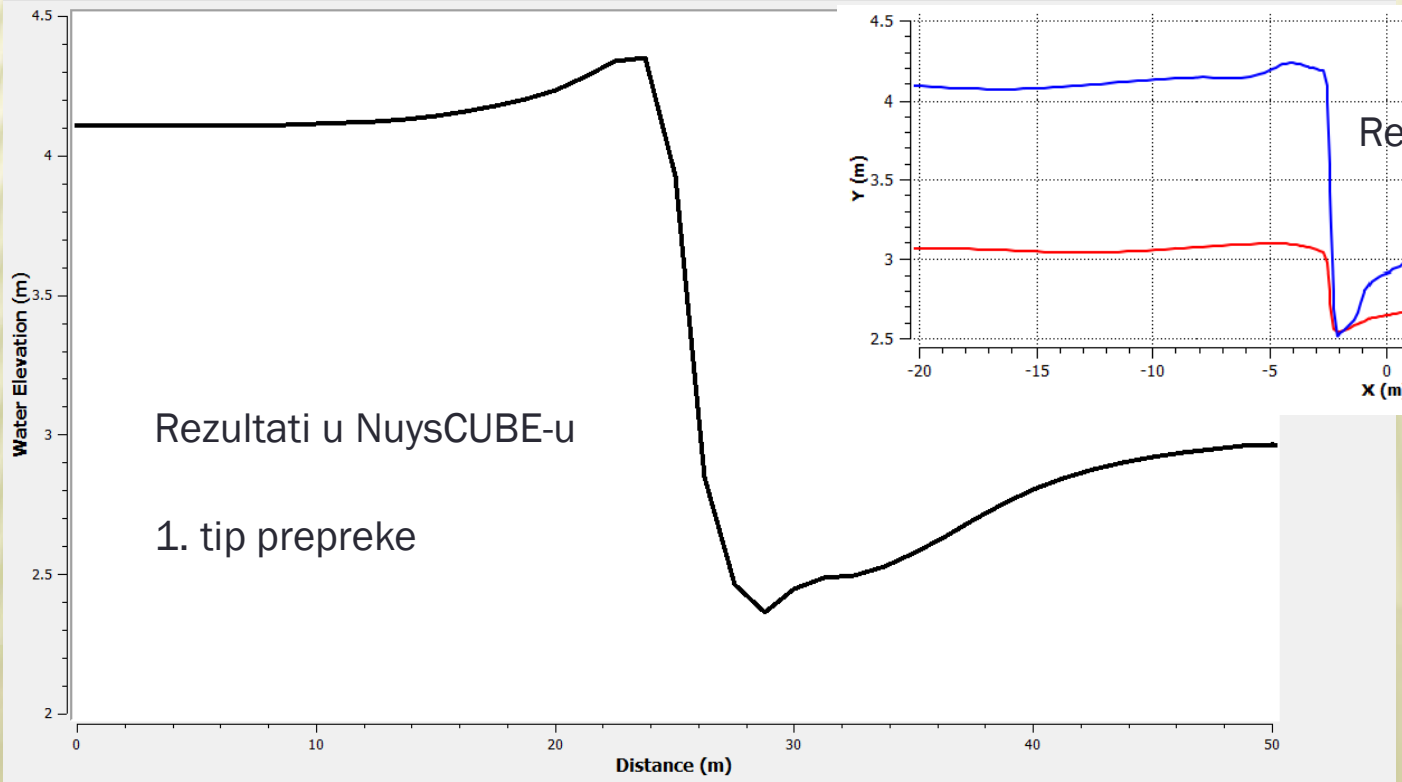


REZULTATI

- Q_{50} - maksimalni protok za poplave koje se javljaju jednom u 50 godina
  - Nivo vode sa desne strane stuba



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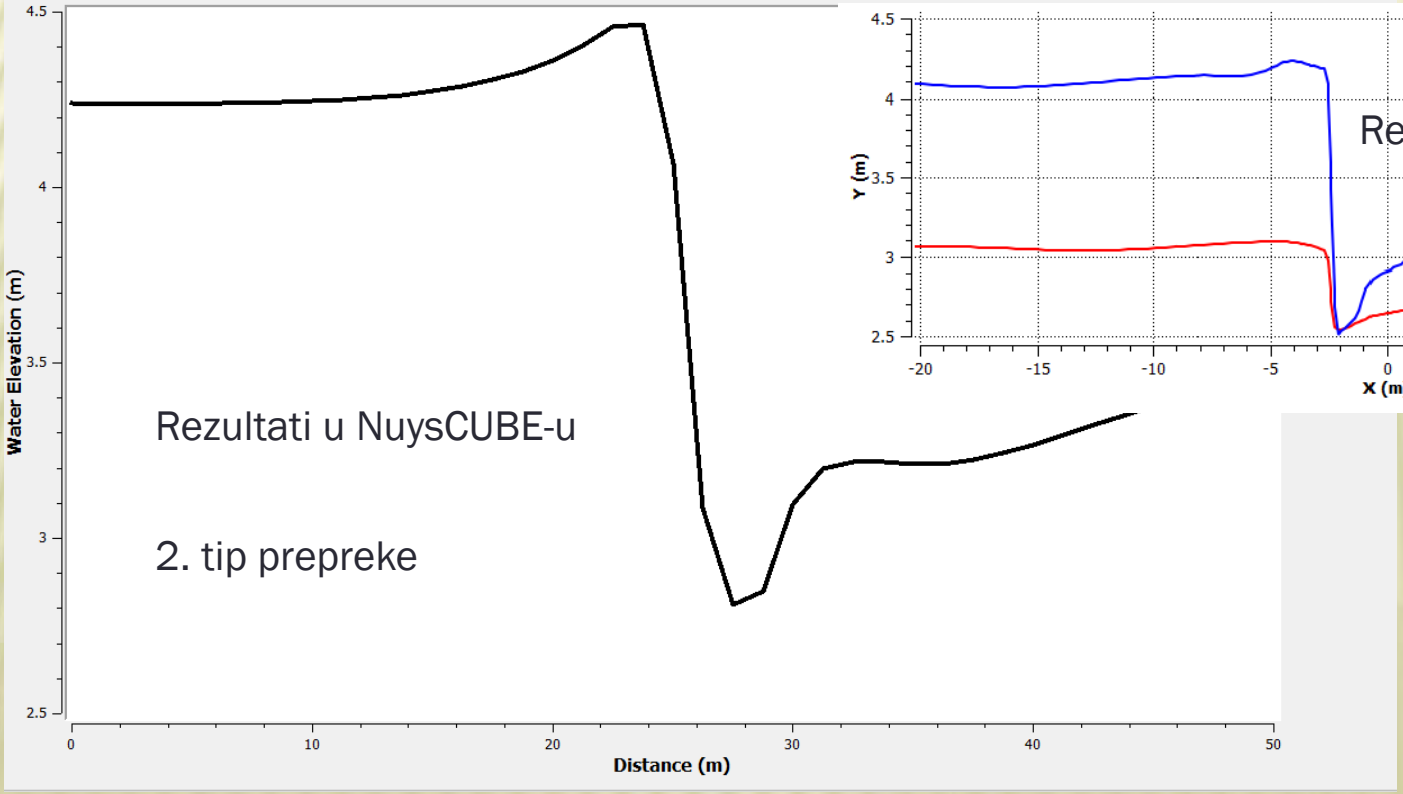

REZULTATI

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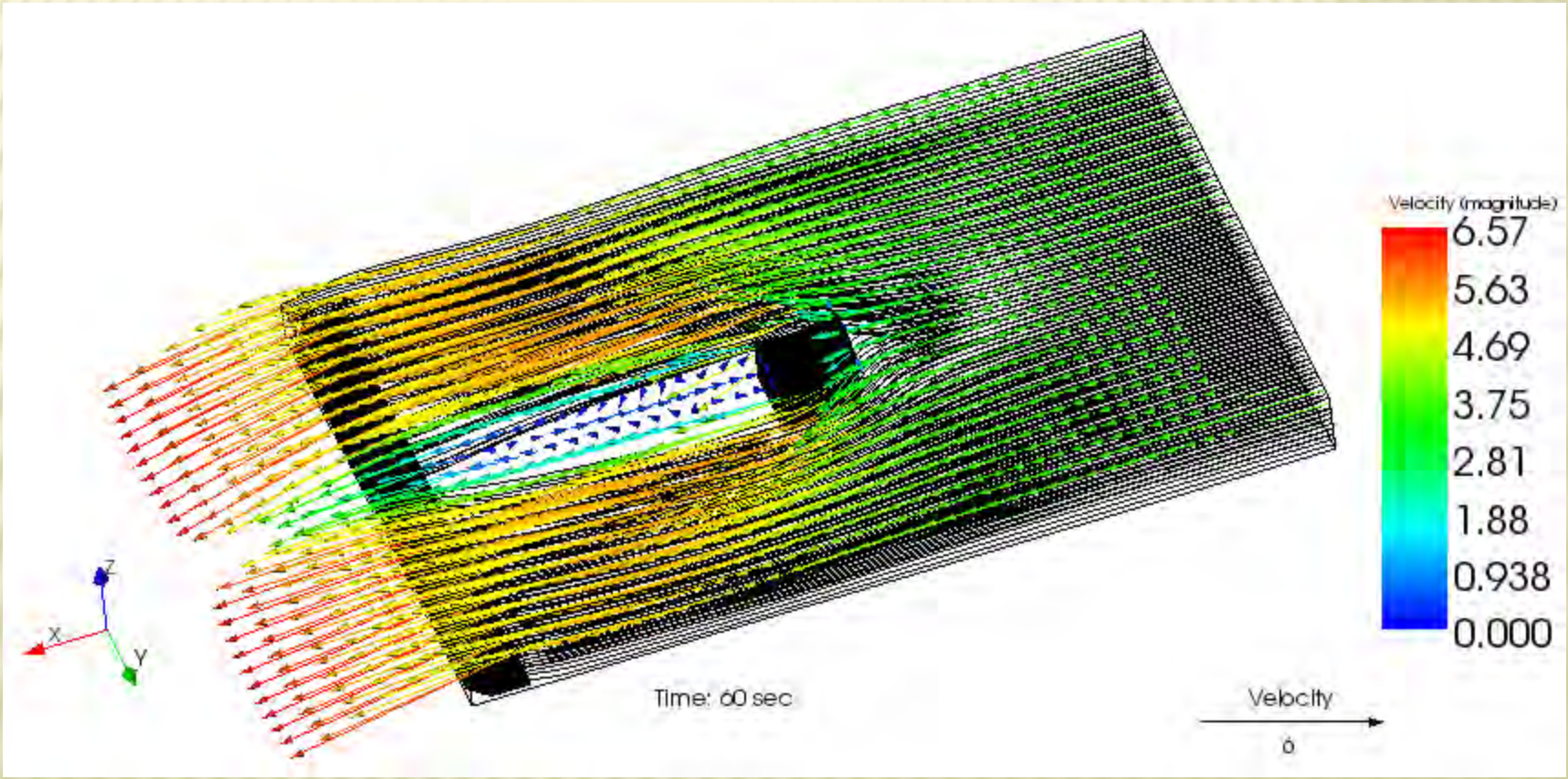
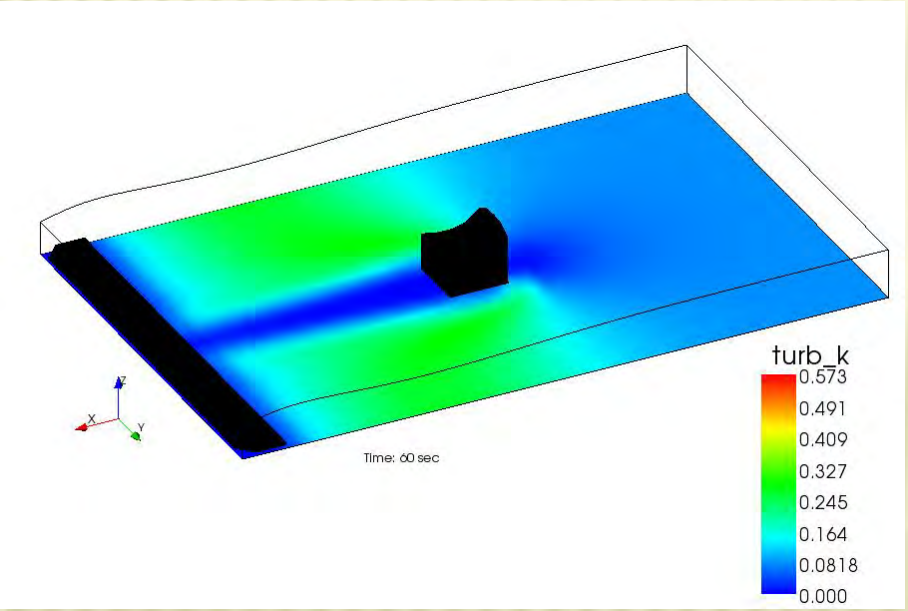
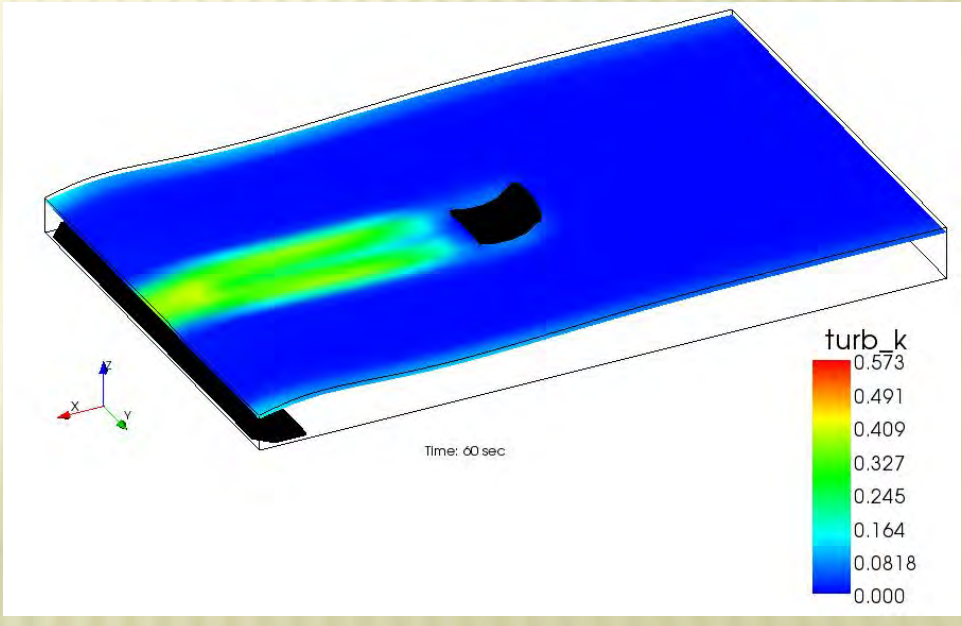


REZULTATI

- Turbulentna kinetička energija pri dnu i na površini





ZAKLJUČAK

- Prilično dobro slaganje rezultata IRIC NuysCUBE solvera i ANSYS softvera
- Proračun je stabilan i sa dužim vremenskim korakom i ređom mrežom
- Kod većeg protoka postoje odstupanja u rezultatima, pa se u ovom slučaju za dalji rad preporučuje produženje kanala nizvodno ili dodati deonicu sa većim nagibom

HVALA NA PAŽNJI!