

The background image shows a modern architectural complex at night. On the left, a curved building with a grid-like facade is brightly lit from within. In the center, a multi-story building with a colorful, modular facade (red, orange, yellow, green) is also brightly lit. To the right, another building with a similar grid-like facade is partially visible, its lights reflecting off the glass. The sky is dark, and streetlights are visible in the distance.

IHCantabria

UNIVERSIDAD DE CANTABRIA

R+D+i for a Sustainable Development

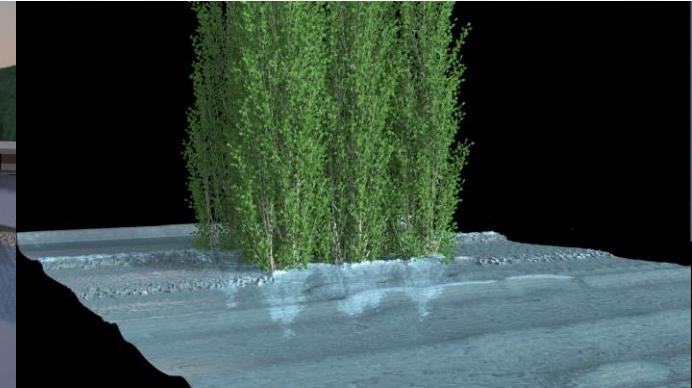
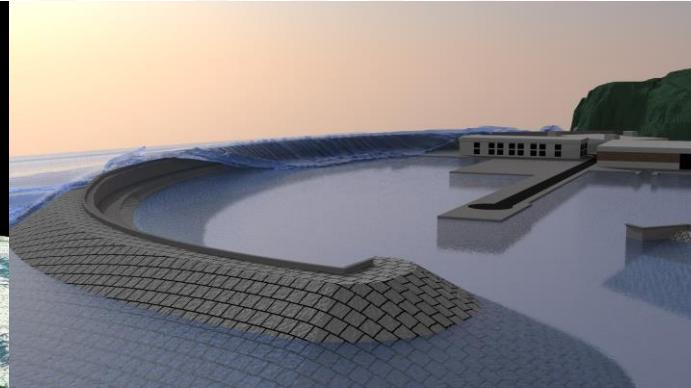
(IHFOAM GUI)

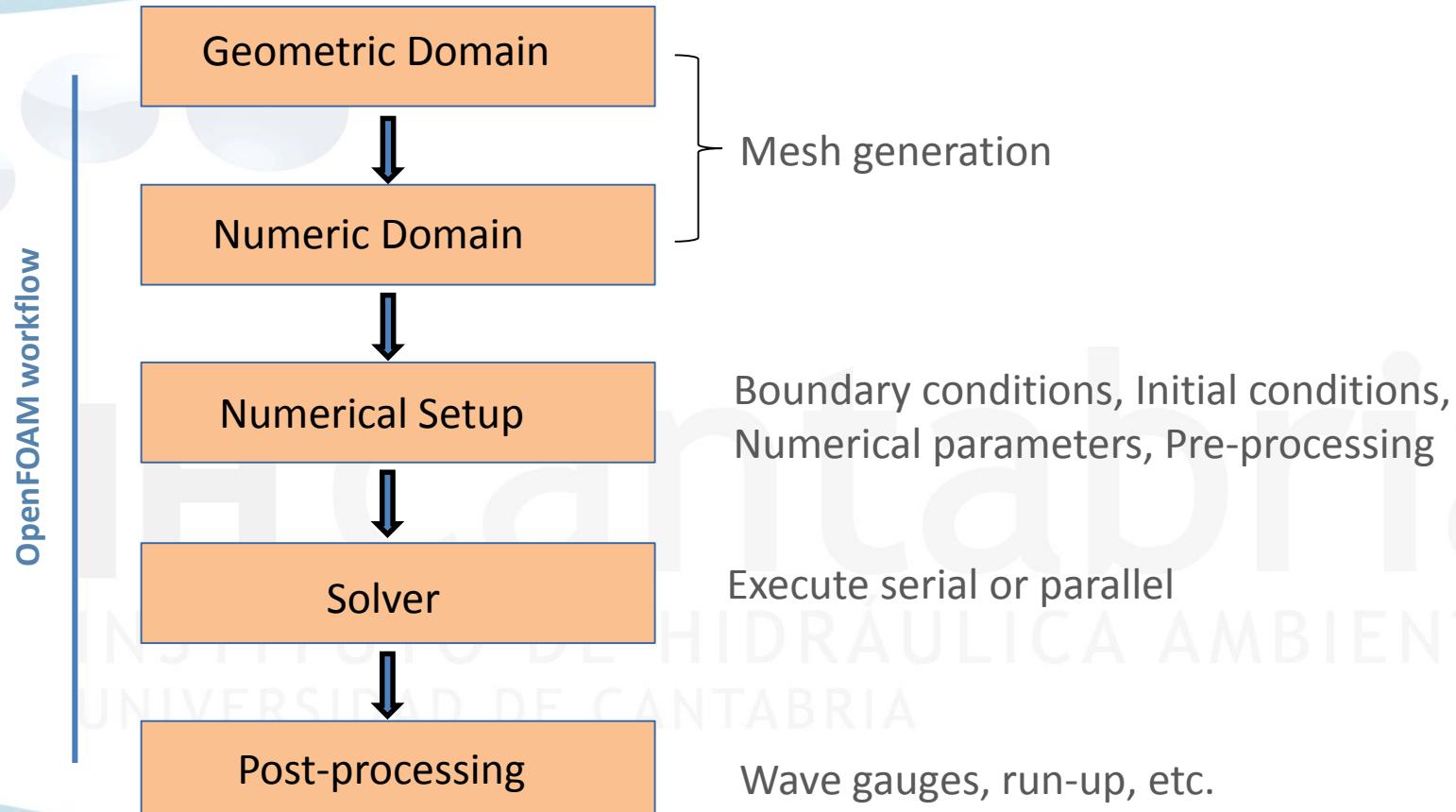


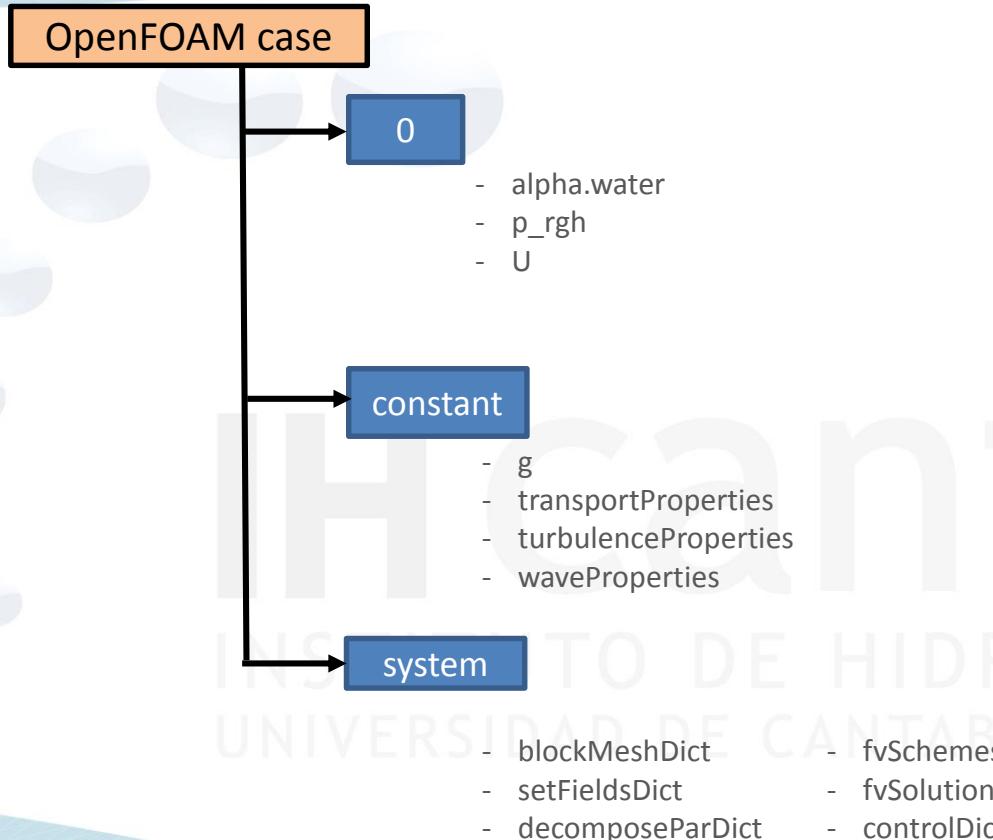
IHFOAM applied to Coastal Engineering

Regular waves in empty channel (2D)

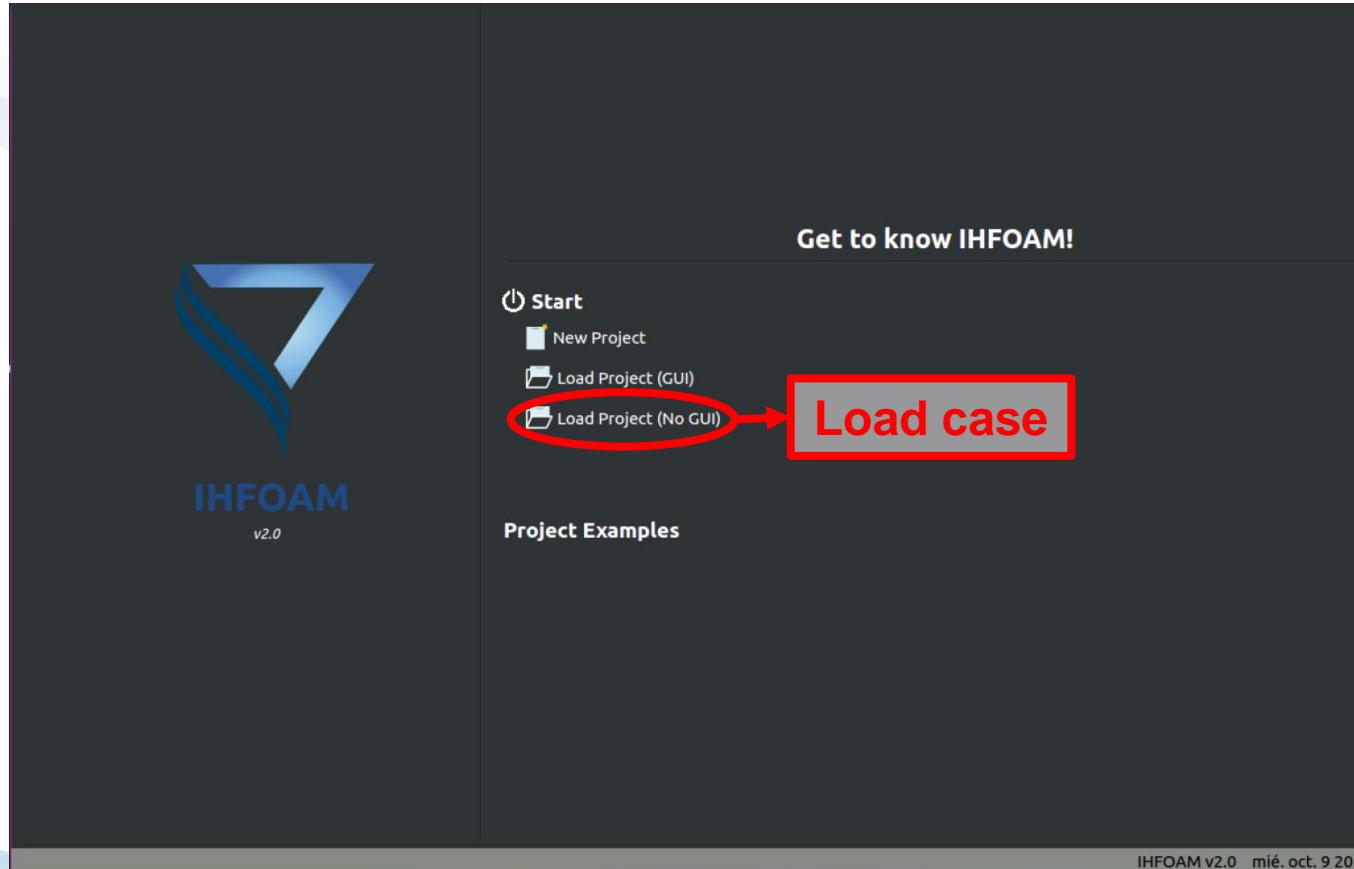
Gabriel Barajas, Javier L. Lara, María Maza, Alejandro Gonzalez



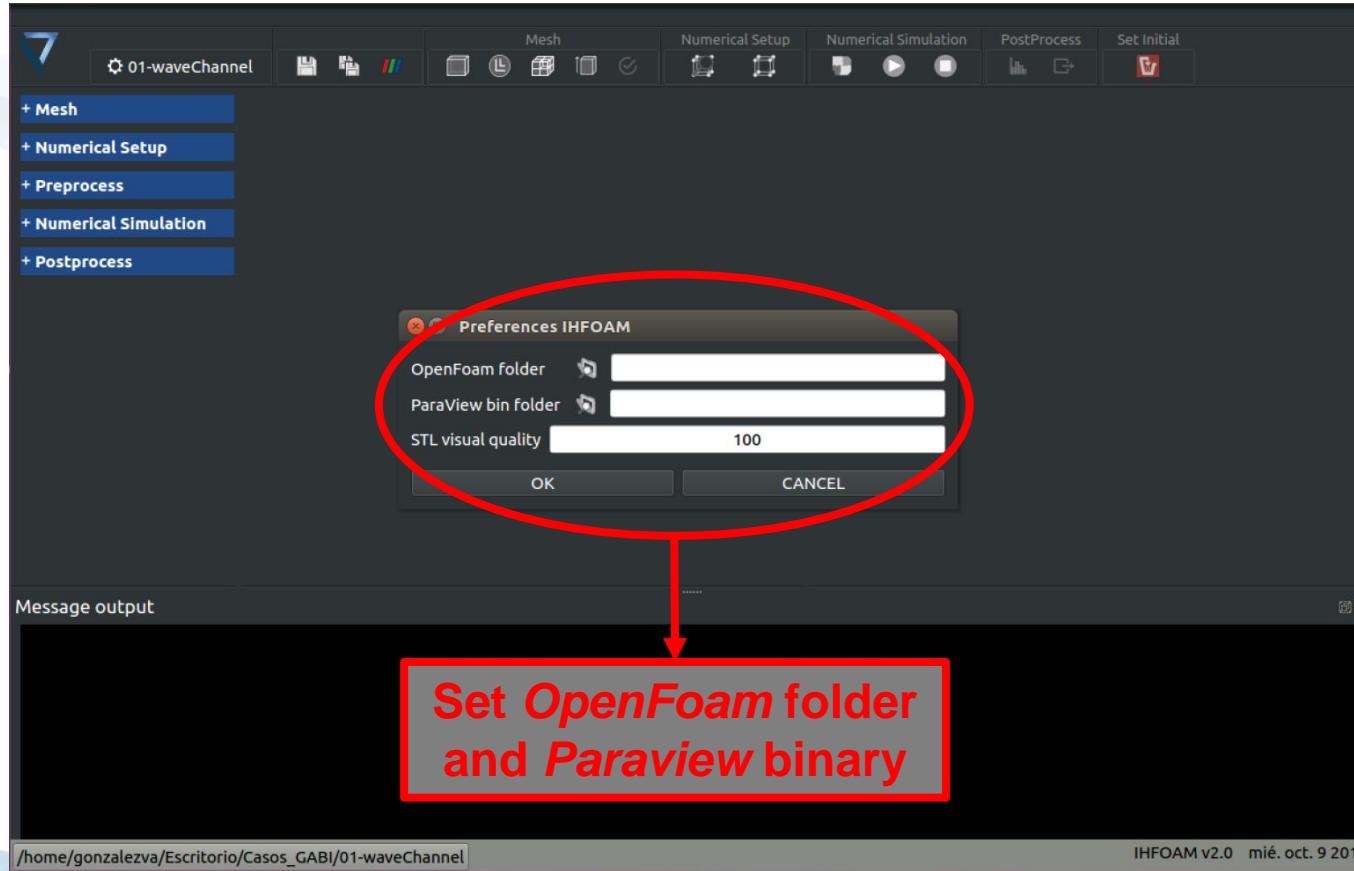


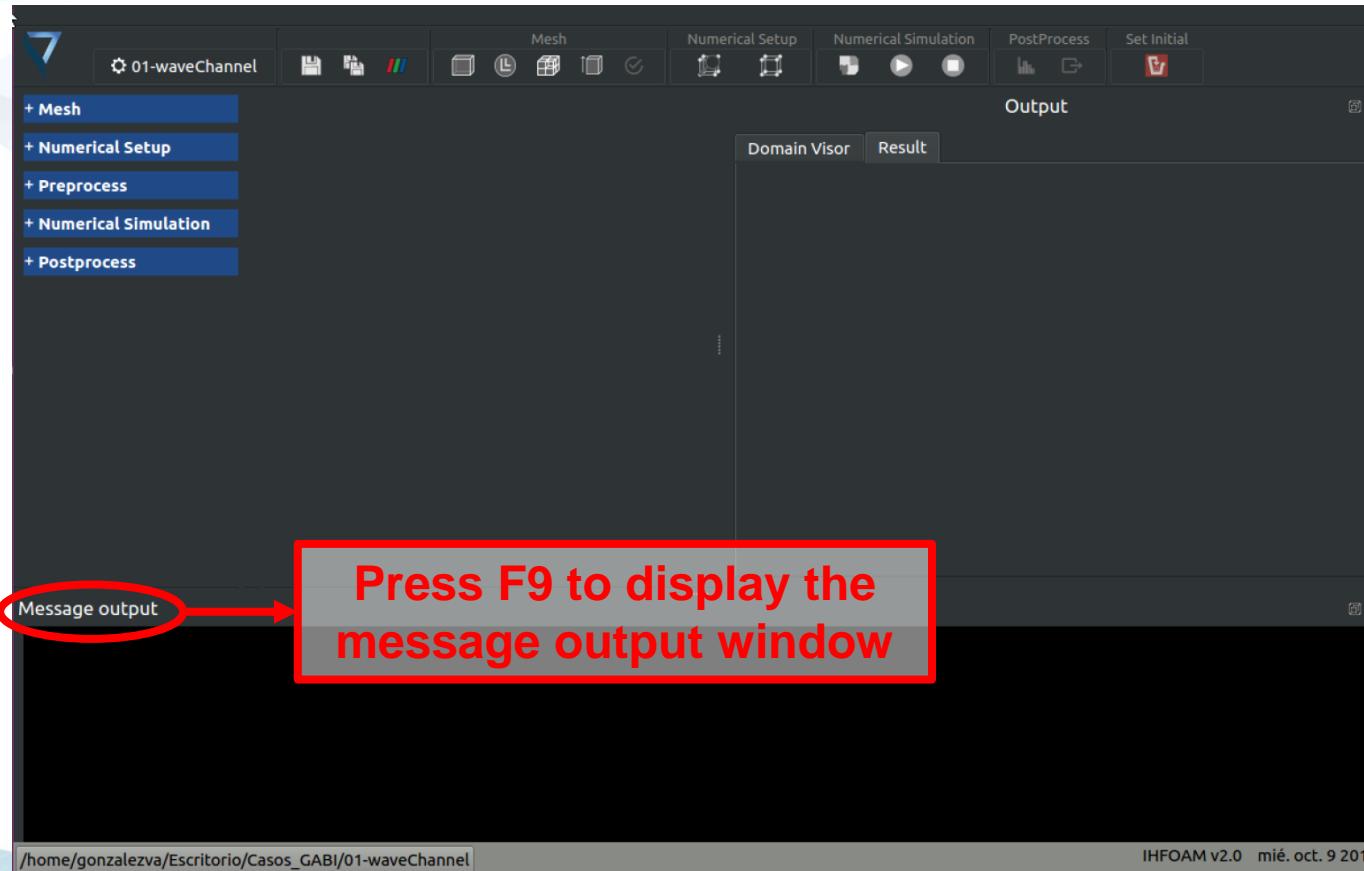


IHFOAM GUI



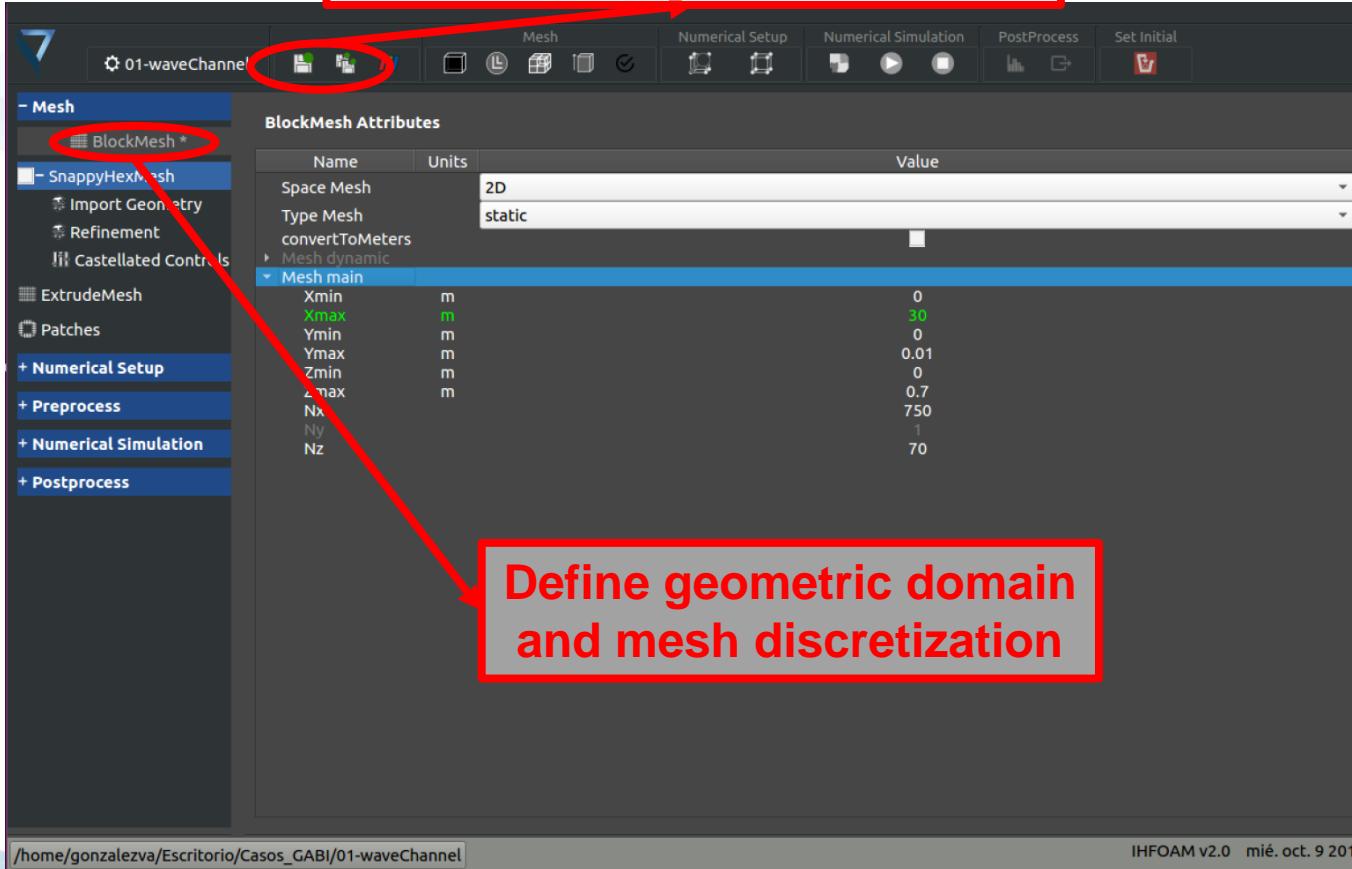
IHFOAM v2.0 mié. oct. 9 2019





Save single pannel modified
or save all pannels modified.

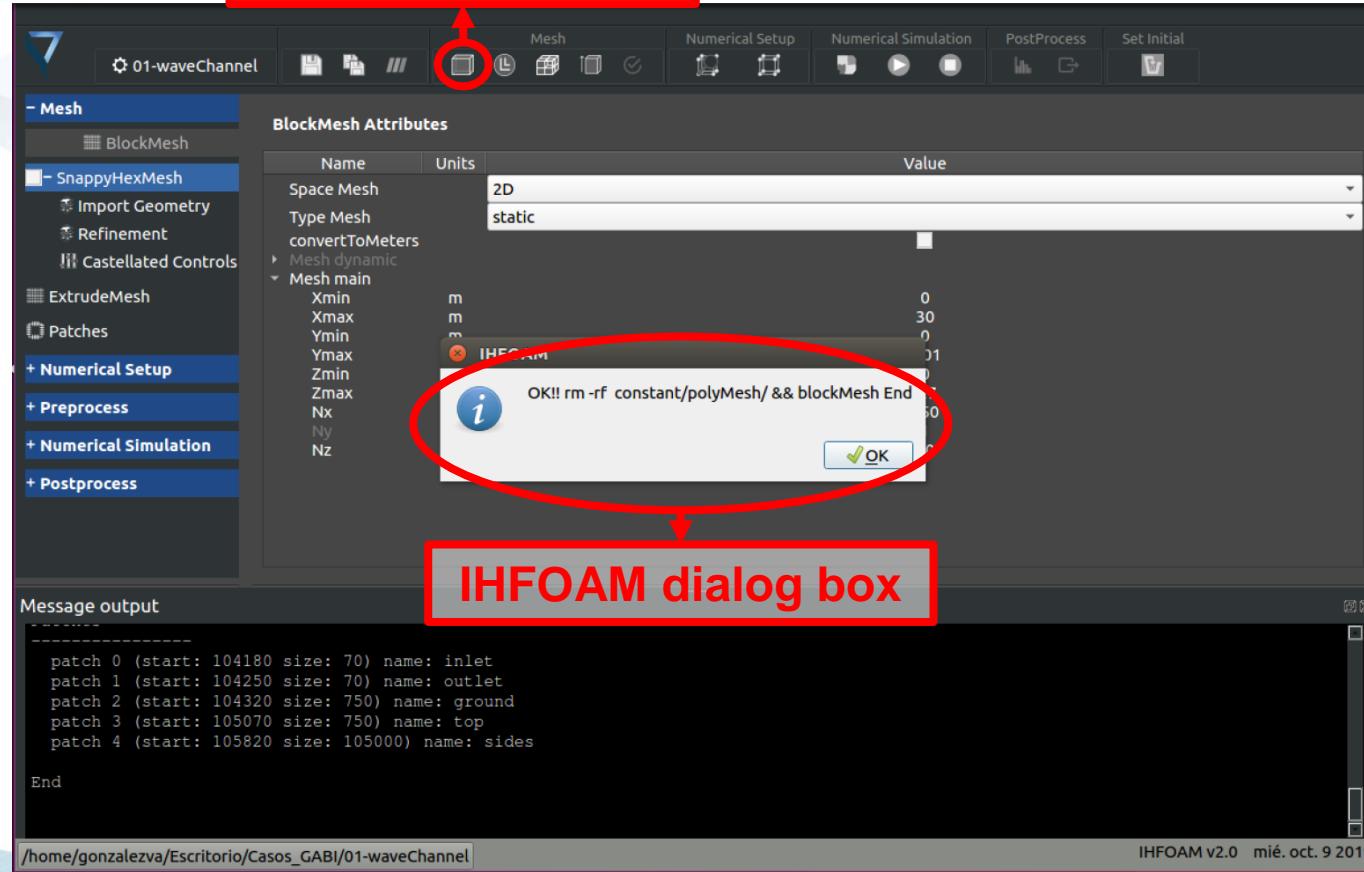
Regular waves in empty
channel (2D)

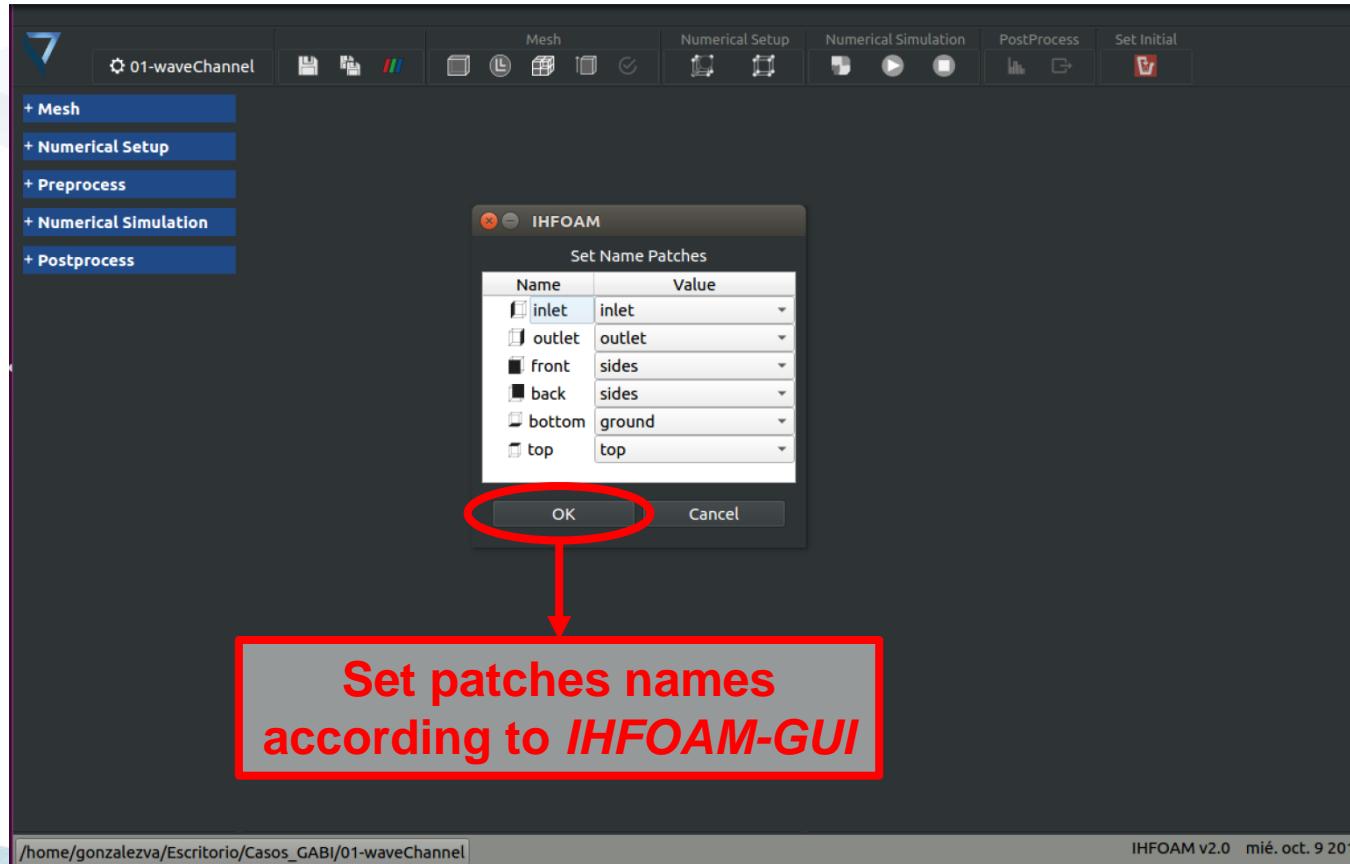


The screenshot shows the HFOAM v2.0 software interface. On the left, there is a navigation tree with sections like Mesh, Numerical Setup, Preprocess, Numerical Simulation, and Postprocess. Under Mesh, 'BlockMesh' is selected, indicated by a red circle. The main panel displays 'BlockMesh Attributes' with a table of parameters:

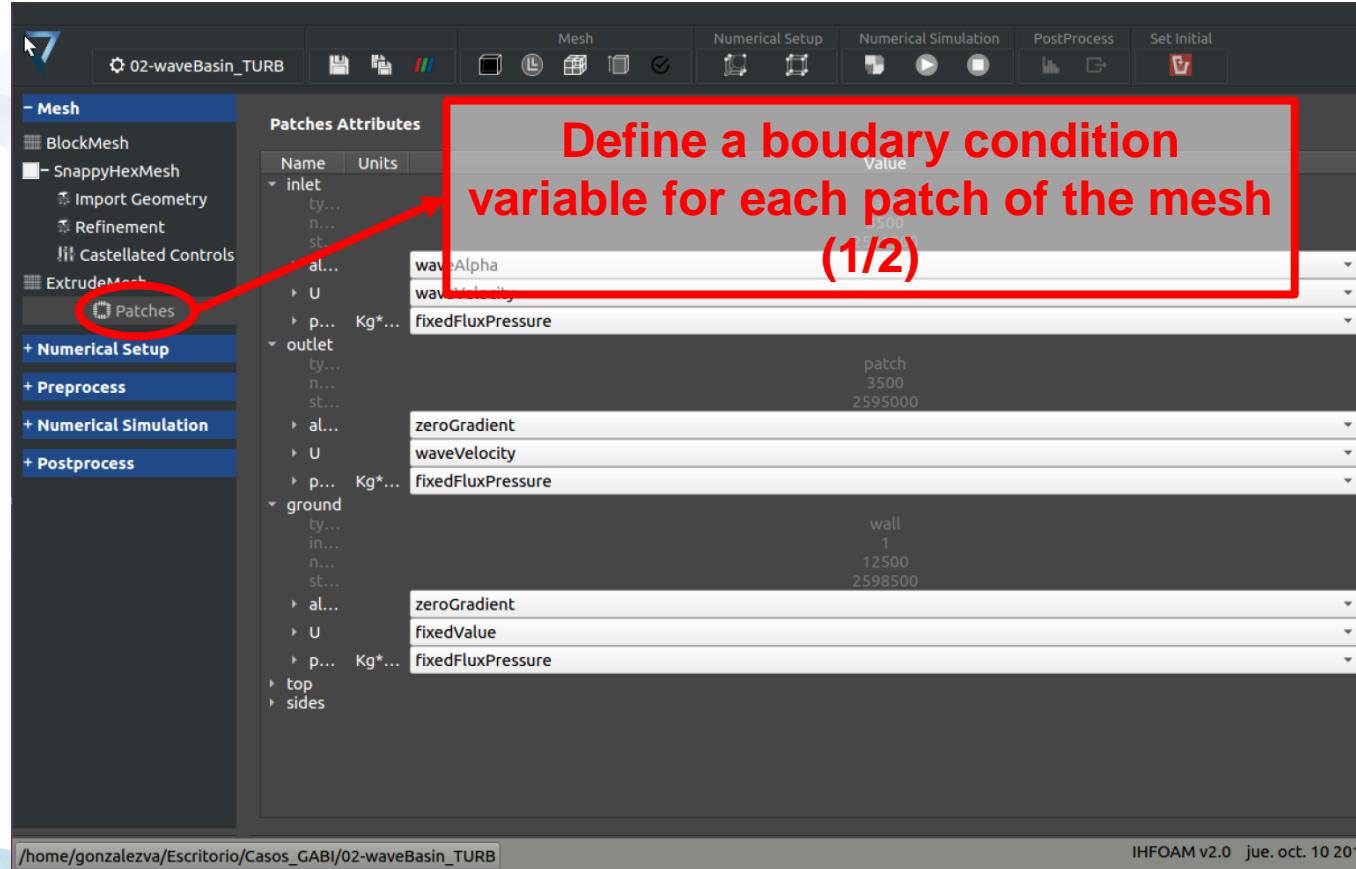
Name	Units	Value
Space Mesh	2D	
Type Mesh	static	
convertToMeters		
Mesh dynamic		
Mesh main		
Xmin	m	0
Xmax	m	30
Ymin	m	0
Ymax	m	0.01
Zmin	m	0
Zmax	m	0.7
Nx		750
<td></td> <td>1</td>		1
Nz		70

A large red box surrounds the text 'Define geometric domain and mesh discretization' at the bottom of the main panel. A red arrow points from the 'Save' icons in the toolbar to this text. The status bar at the bottom shows the path '/home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel' and the version 'HFOAM v2.0 mié. oct. 9 2019'.





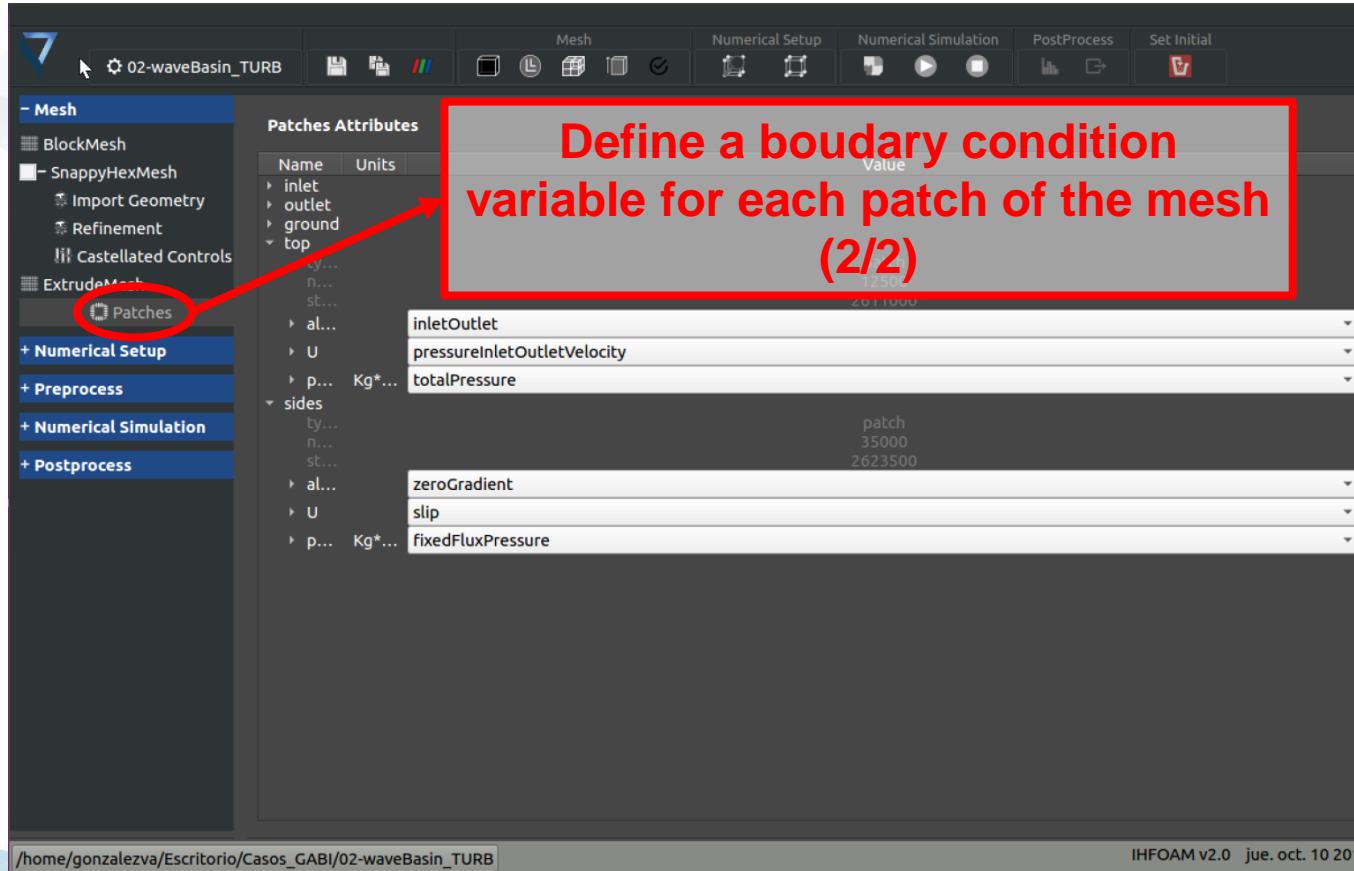
Define a boundary condition variable for each patch of the mesh (1/2)



Name	Units	Value
inlet		waveAlpha waveVelocity fixedFluxPressure
outlet		patch 3500 2595000
ground		wall 1 12500 2598500
top		zeroGradient
sides		fixedValue fixedFluxPressure

/home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB

IHFOAM v2.0 jue. oct. 10 2019



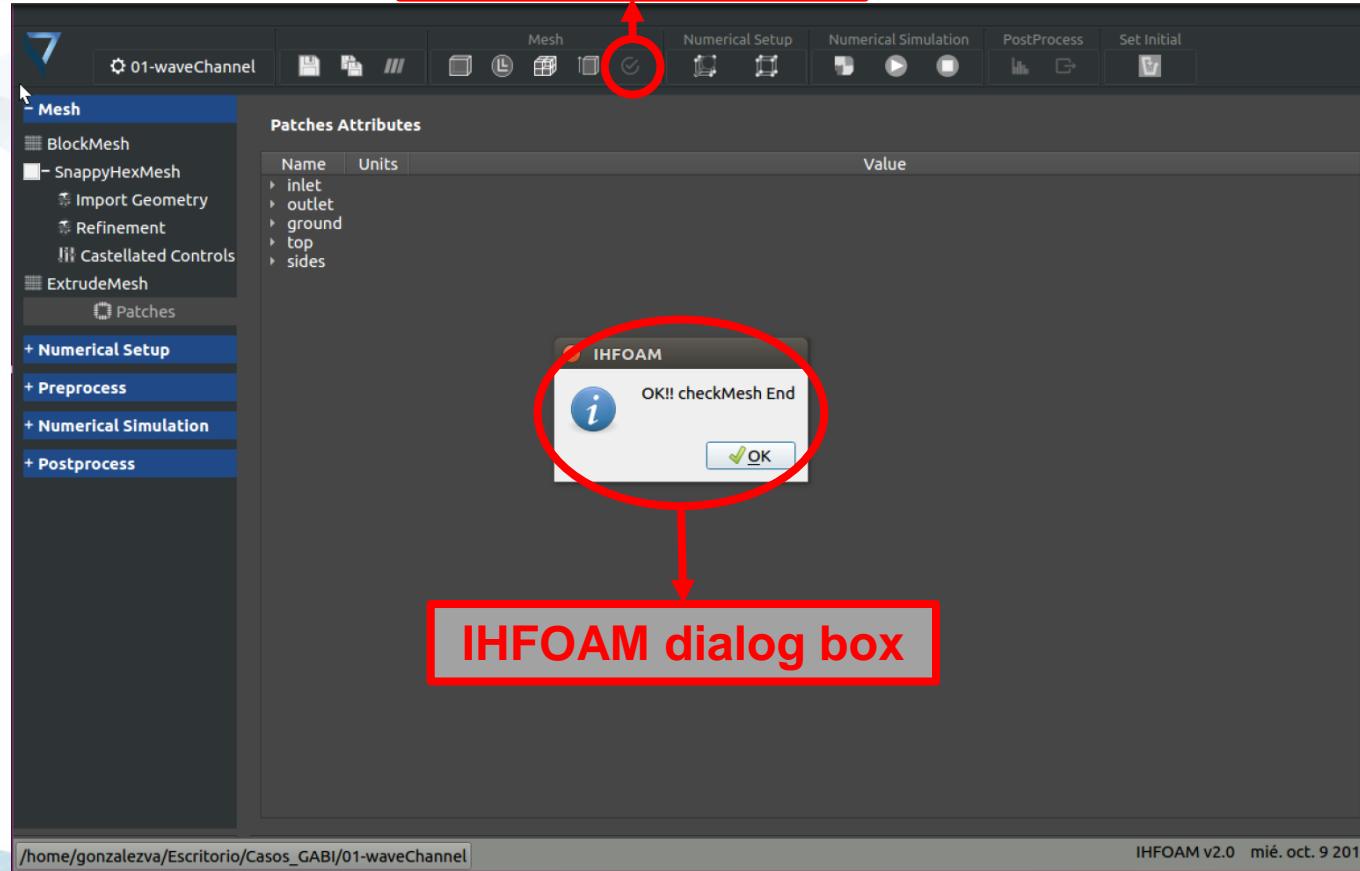
Define a boundary condition variable for each patch of the mesh (2/2)

The screenshot shows the IHFOAM v2.0 software interface. The left sidebar has sections: Mesh, BlockMesh, SnappyHexMesh, Import Geometry, Refinement, Castellated Controls, ExtrudeMesh, and Patches (which is highlighted with a red circle). The main area is titled "Patches Attributes" and lists patches with their attributes:

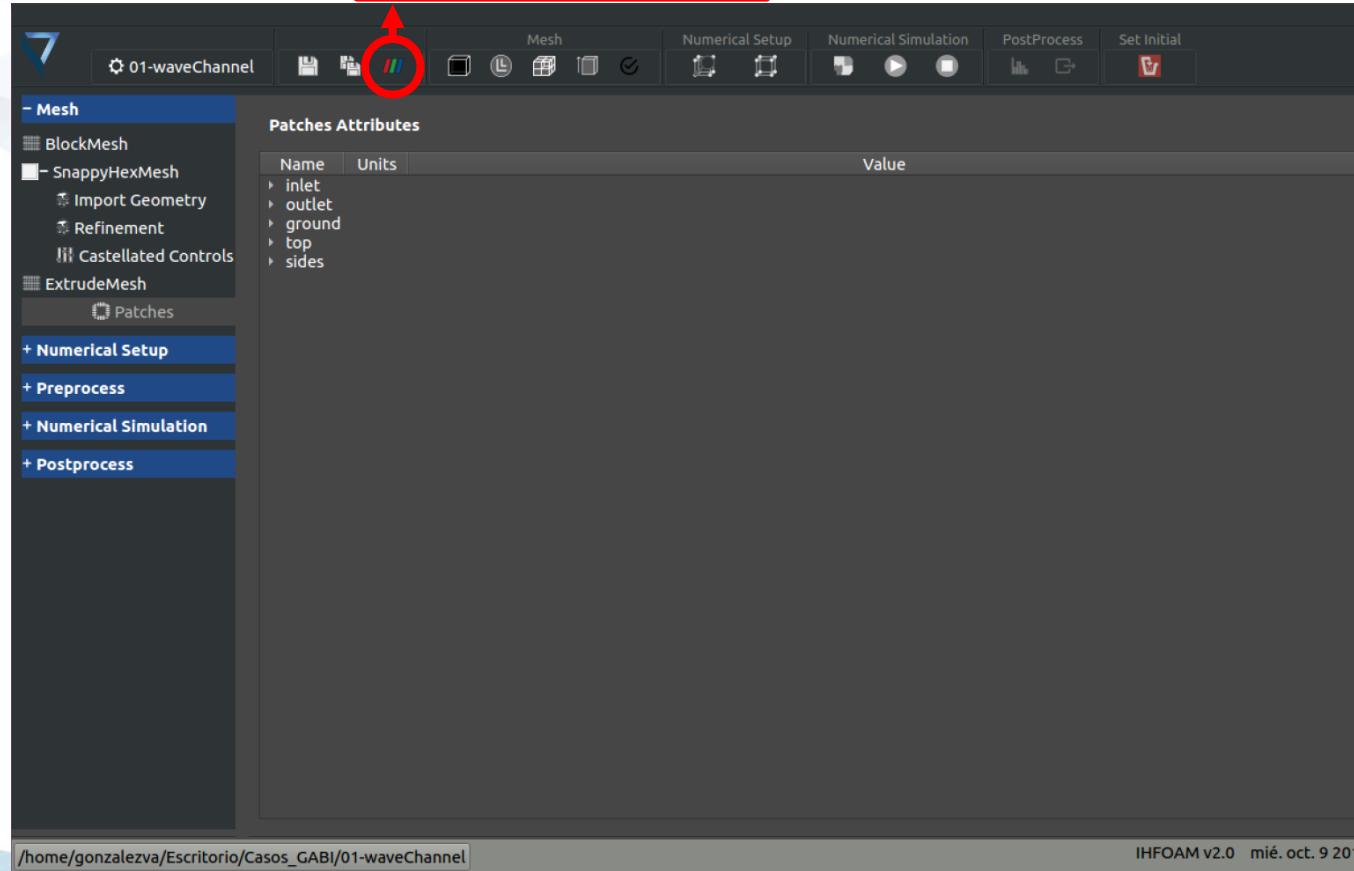
Name	Units	Value
inlet		
outlet		
ground		
top		
al...	inletOutlet	
U	pressureInletOutletVelocity	
p...	Kg*m^-3	totalPressure
sides		
ty...	patch	2011000
n...		1250
st...		
al...	zeroGradient	
U	slip	
p...	Kg*m^-3	fixedFluxPressure

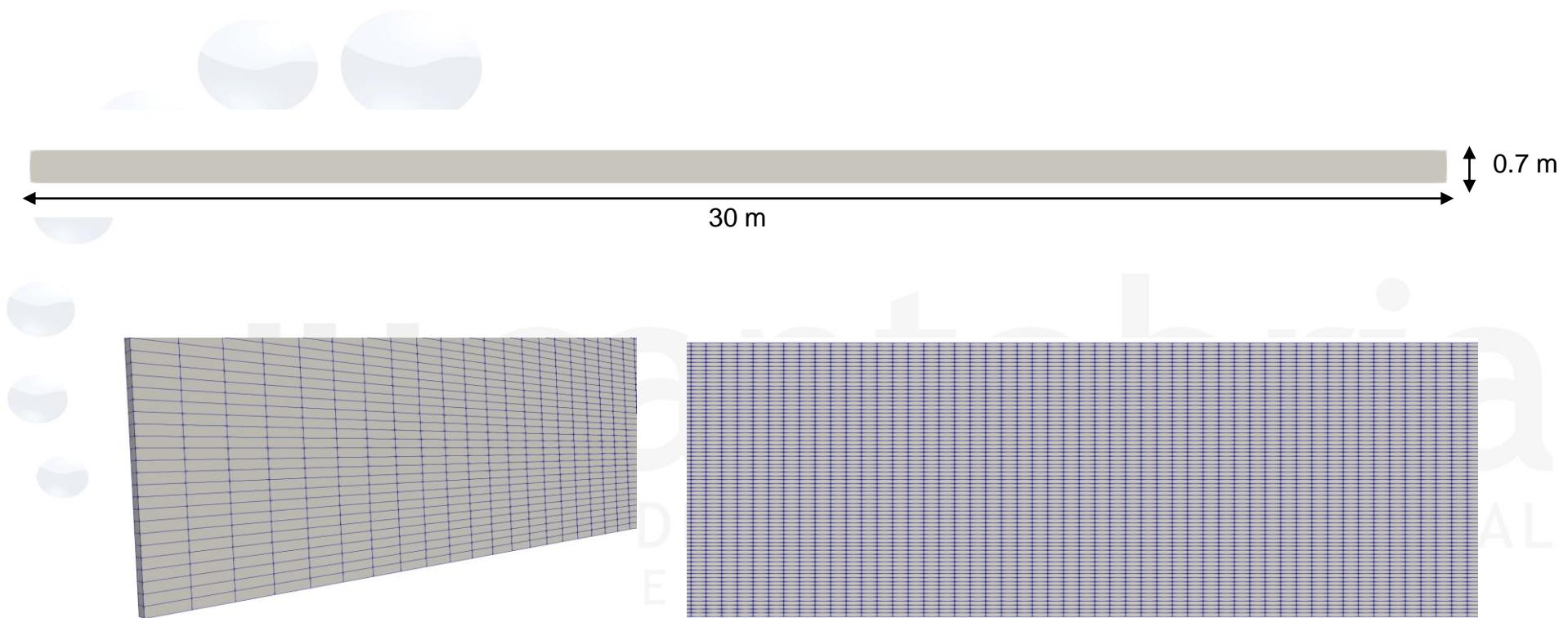
/home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB

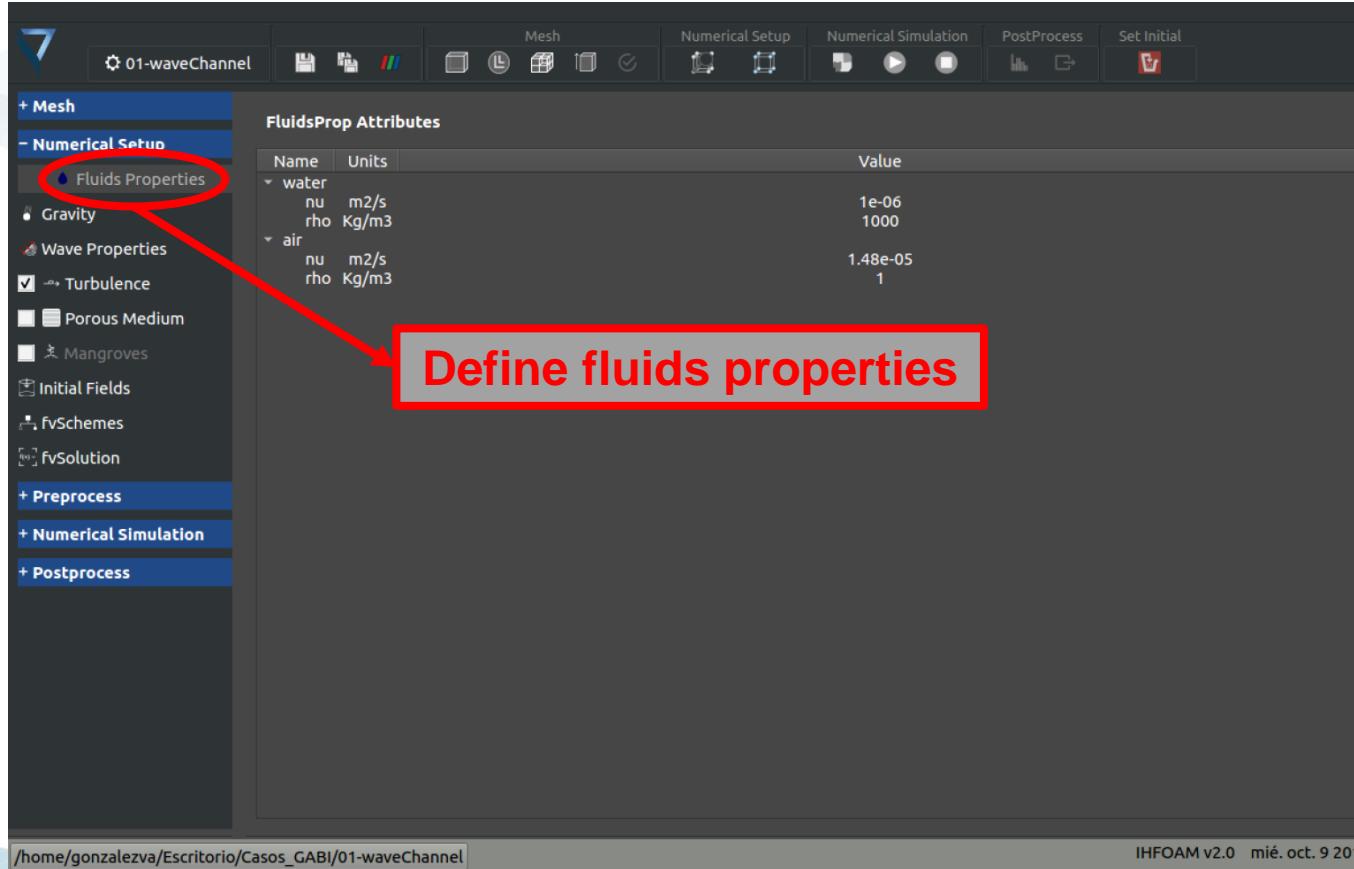
IHFOAM v2.0 jue. oct. 10 2019



Paraview button

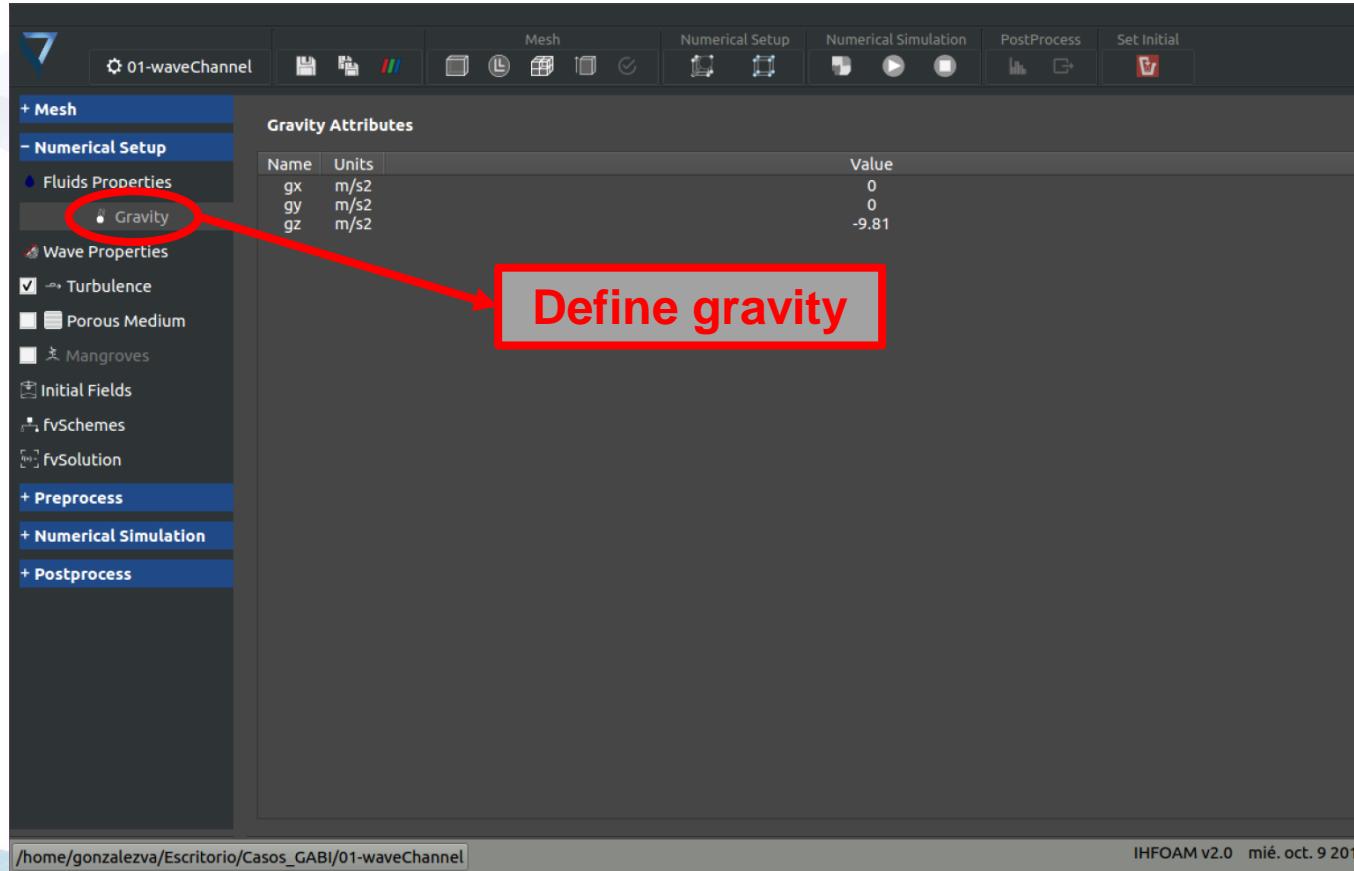






The screenshot shows the IFOAM v2.0 software interface. On the left, there is a navigation tree with categories like Mesh, Numerical Setup, Preprocess, Numerical Simulation, and Postprocess. Under Numerical Setup, 'Fluids Properties' is selected and highlighted with a red circle. A red arrow points from this circle to a red-bordered box containing the text 'Define fluids properties'. The main panel displays 'FluidsProp Attributes' with a table showing properties for water and air.

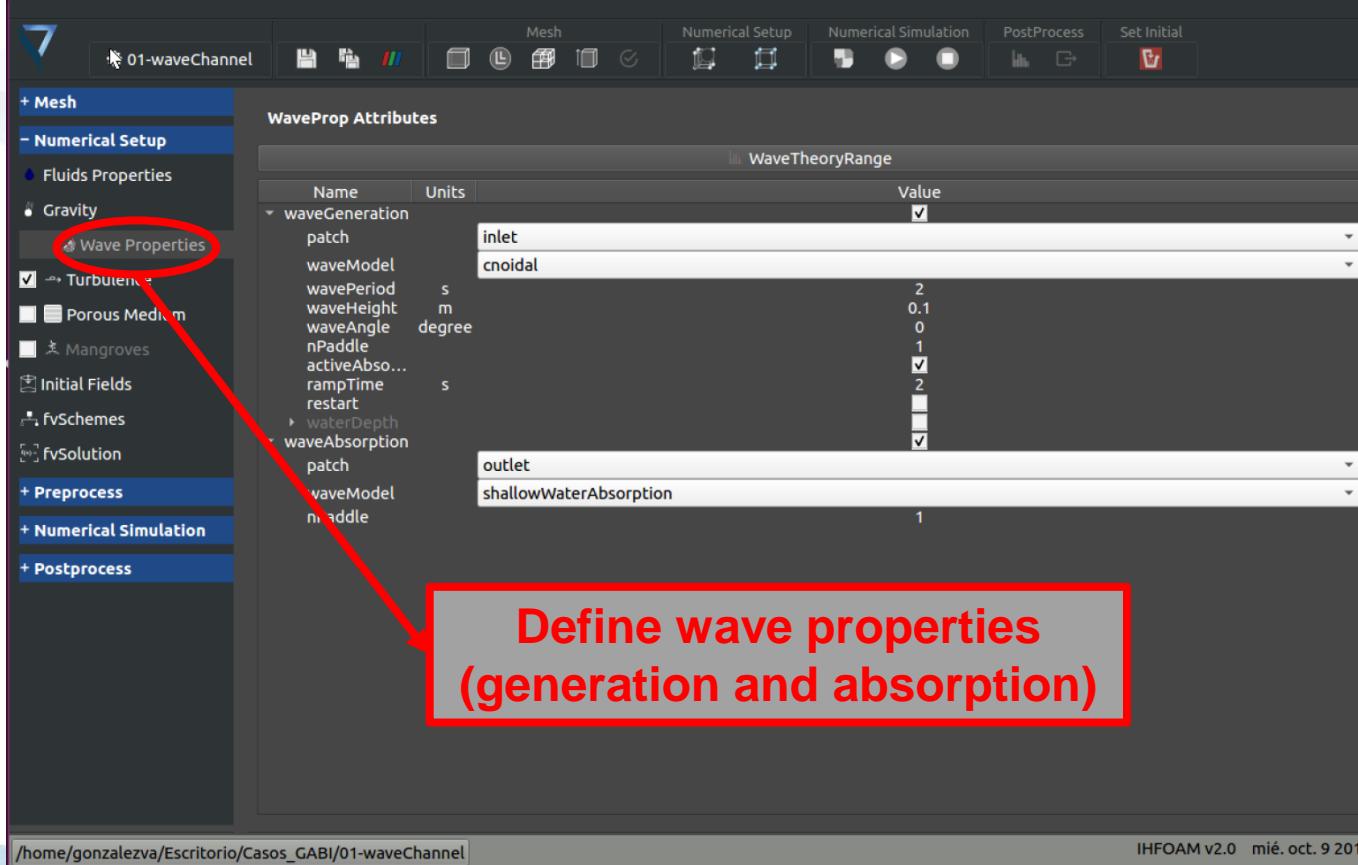
Name	Units	Value
water		
nu	m ² /s	1e-06
rho	Kg/m ³	1000
air		
nu	m ² /s	1.48e-05
rho	Kg/m ³	1



The screenshot shows the IHFOAM v2.0 software interface. On the left, there is a navigation tree with categories like Mesh, Numerical Setup, Fluid Properties, Wave Properties, Preprocess, Numerical Simulation, and Postprocess. Under Fluid Properties, the 'Gravity' item is highlighted with a red circle and has a red arrow pointing to a red box containing the text 'Define gravity'. The main panel displays a 'Gravity Attributes' table with three rows: gx (m/s²) with value 0, gy (m/s²) with value 0, and gz (m/s²) with value -9.81. The status bar at the bottom shows the file path /home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel and the version IHFOAM v2.0 mié. oct. 9 2019.

Name	Units	Value
gx	m/s ²	0
gy	m/s ²	0
gz	m/s ²	-9.81

/home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel IHFOAM v2.0 mié. oct. 9 2019



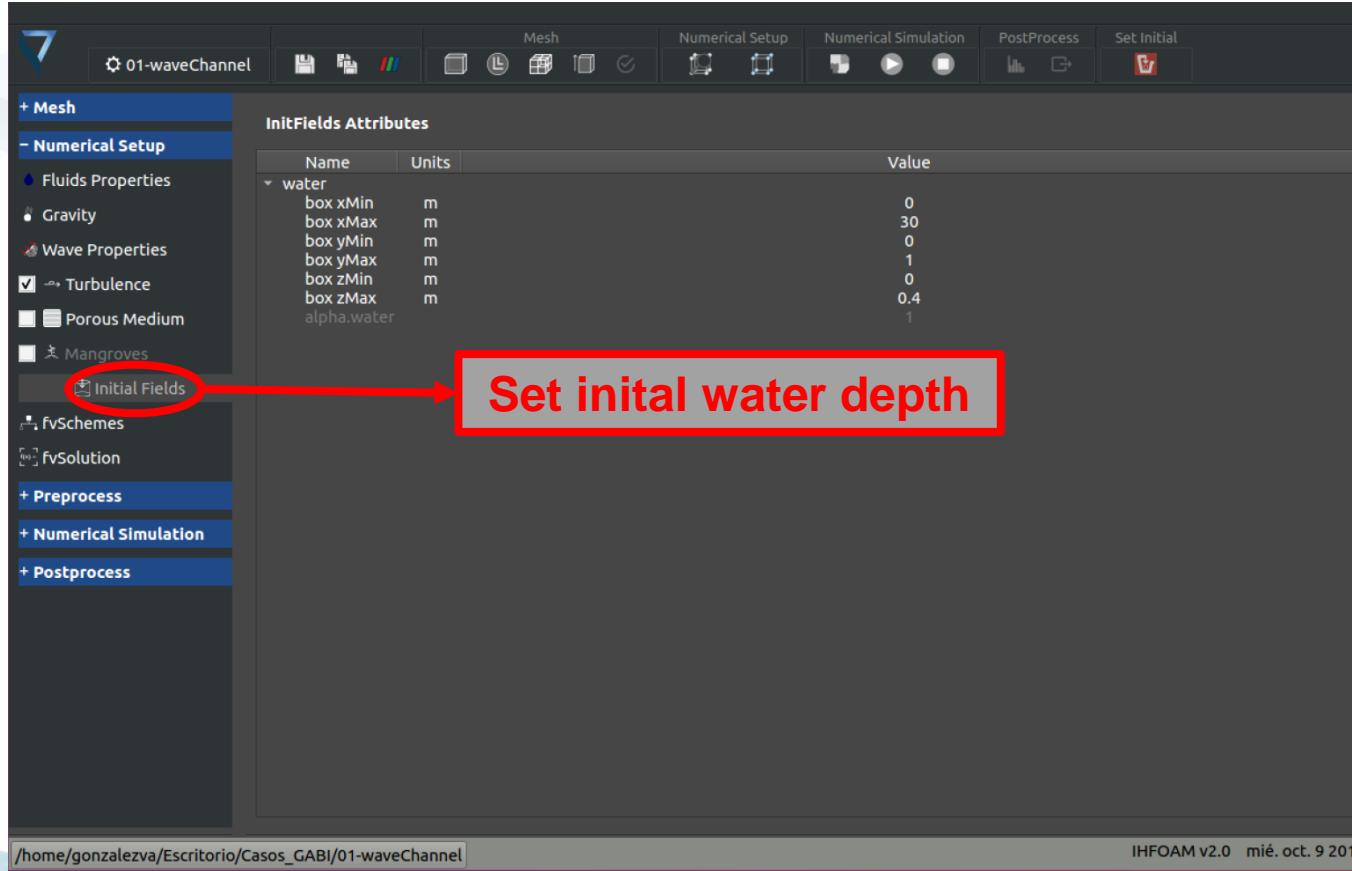
The screenshot shows the IFOAM v2.0 software interface. The left sidebar has sections like Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties (circled in red), Turbulence, Porous Medium, Mangroves, Initial Fields, FvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main area is titled 'WaveProp Attributes' under 'Numerical Setup'. It shows 'WaveTheoryRange' with a table:

Name	Units	Value
patch	inlet	✓
waveModel	cnoidal	
wavePeriod	s	2
waveHeight	m	0.1
waveAngle	degree	0
nPaddle		1
activeAbsor...		✓
rampTime	s	2
restart		
waterDepth		
waveAbsorption		
patch	outlet	
waveModel	shallowWaterAbsorption	
middle		1

A red box contains the text: **Define wave properties
(generation and absorption)**.

Path: /home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel

IFOAM v2.0 mié, oct. 9 2019



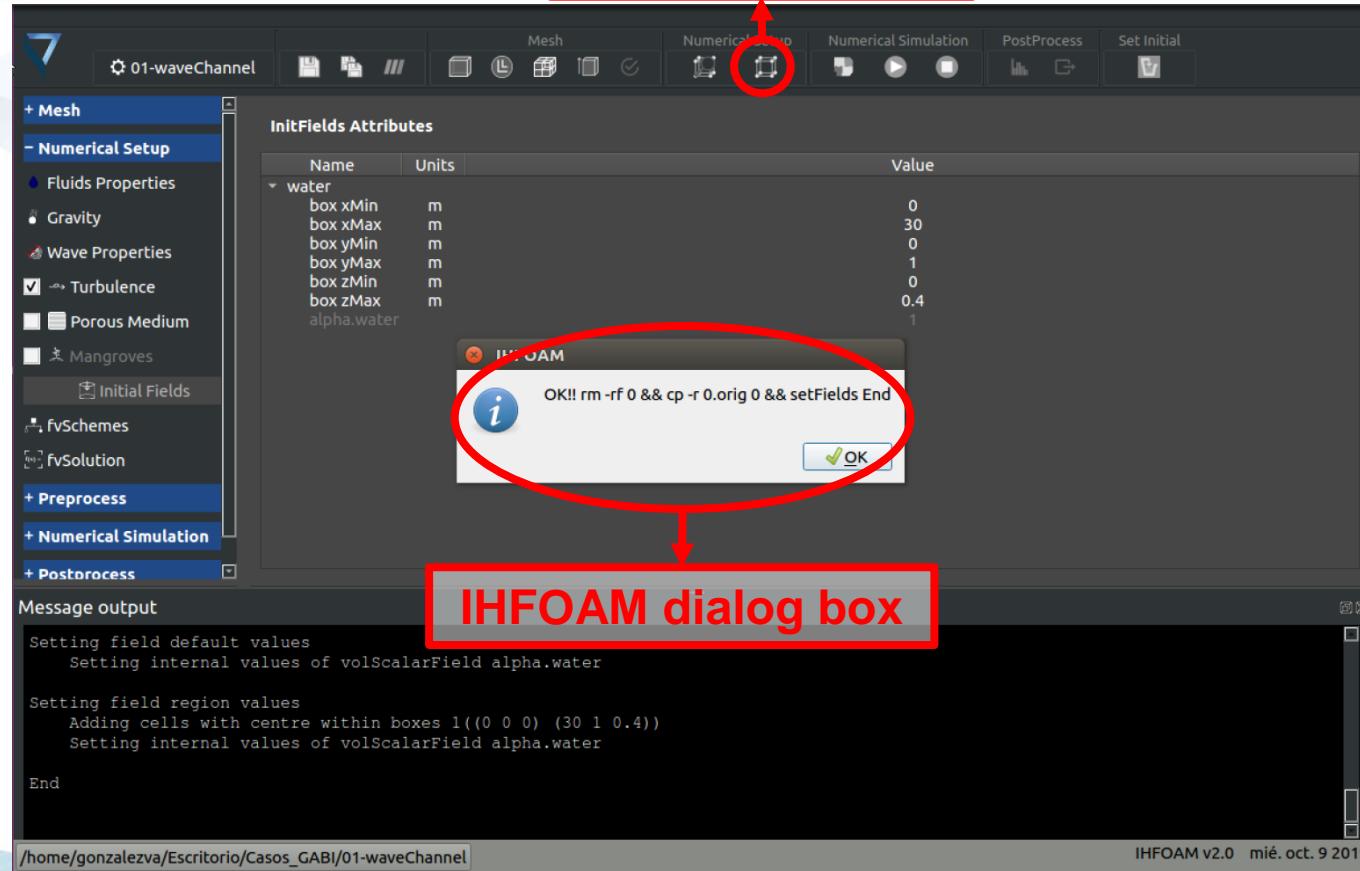
The screenshot shows the IHFOAM v2.0 software interface. On the left, there is a sidebar with various tabs: Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties, Turbulence (which is checked), Porous Medium, Mangroves, Initial Fields (which is highlighted with a red arrow), fvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main area displays 'InitFields Attributes' with a table:

Name	Units	Value
water		
box xMin	m	0
box xMax	m	30
box yMin	m	0
box yMax	m	1
box zMin	m	0
box zMax	m	0.4
alpha.water		1

A red box highlights the text "Set initial water depth" near the "Initial Fields" button in the sidebar.

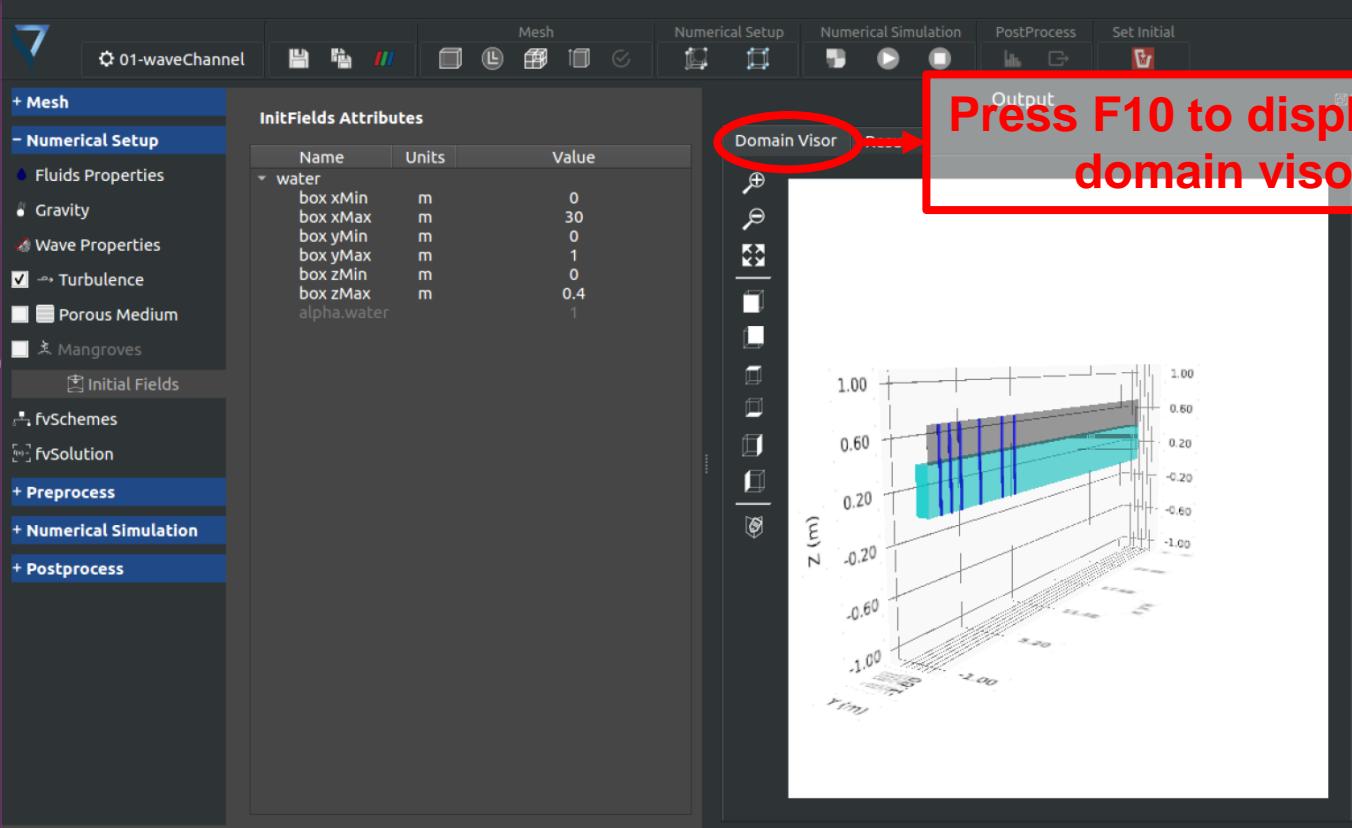
Path: /home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel

IHFOAM v2.0 mié. oct. 9 2019



setFields button

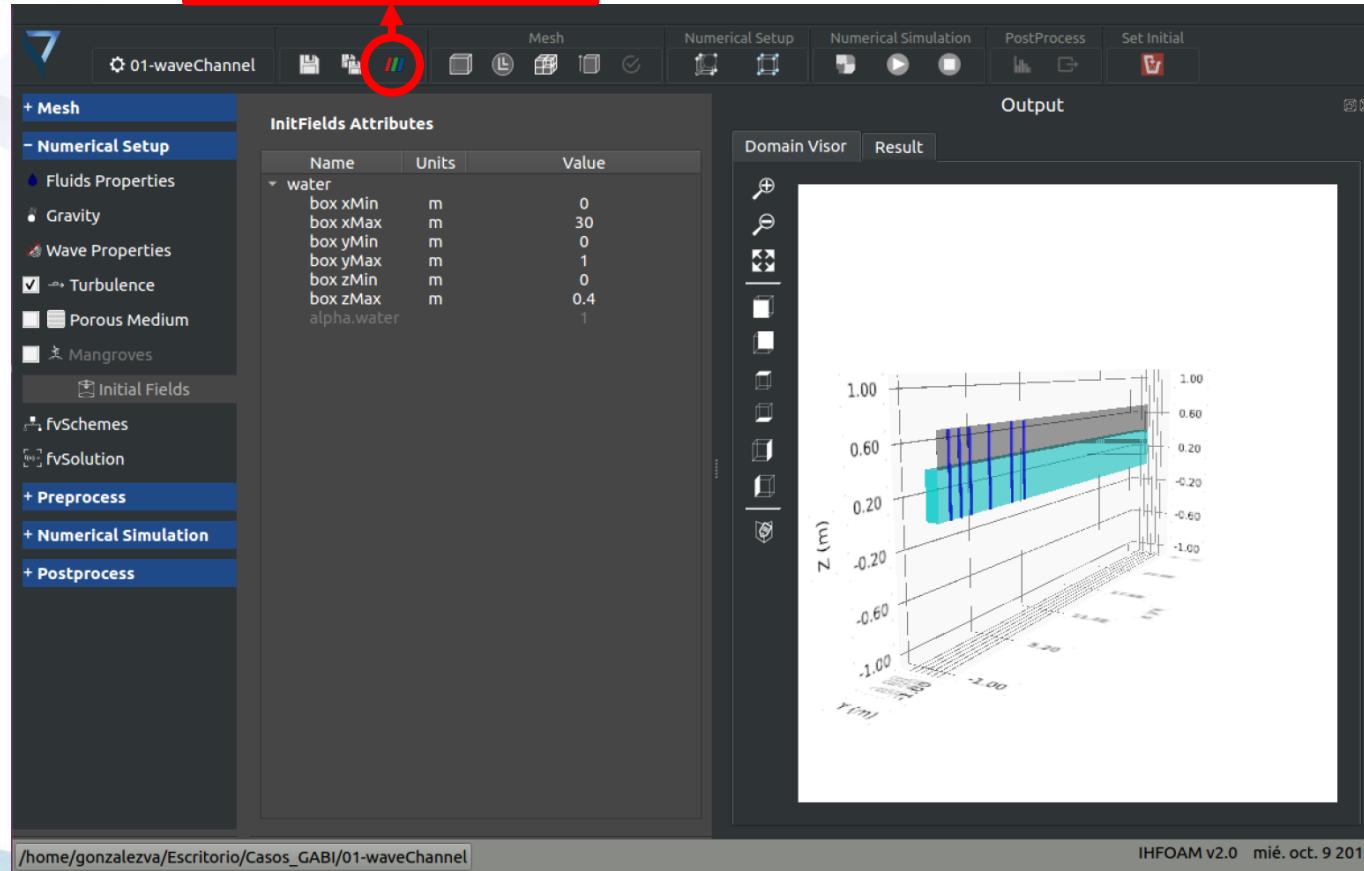
IHFOAM dialog box



Press F10 to display the domain visor

The screenshot shows the IFOAM v2.0 software interface. The left sidebar contains a navigation menu with sections like Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties, Turbulence, Porous Medium, Mangroves, Initial Fields, fvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main workspace displays a 2D simulation of a wave in a channel. The right side features a toolbar with various icons, and the top has a menu bar with Mesh, Numerical Setup, Numerical Simulation, PostProcess, and Set Initial. A red box highlights the 'Domain Visor' icon in the toolbar, and a red arrow points to it from the text 'Press F10 to display the domain visor'. The bottom status bar shows the path '/home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel' and the date 'IHOAM v2.0 mié. oct. 9 2019'.

Paraview button





ii cui cui cui id
INSTITUTO DE HIDRÁULICA AMBIENTAL
UNIVERSIDAD DE CANTABRIA

01-waveChannel

Mesh Numerical Setup Numerical Simulation PostProcess Set Initial

+ Mesh - Numerical Setup

- Fluids Properties
- Gravity
- Wave Properties
- Turbulence
- Porous Medium
- Mangroves
- Initial Fields
 - + fvSchemes
- + fvSolution

+ Preprocess + Numerical Simulation + Postprocess

FvSchemes Attributes

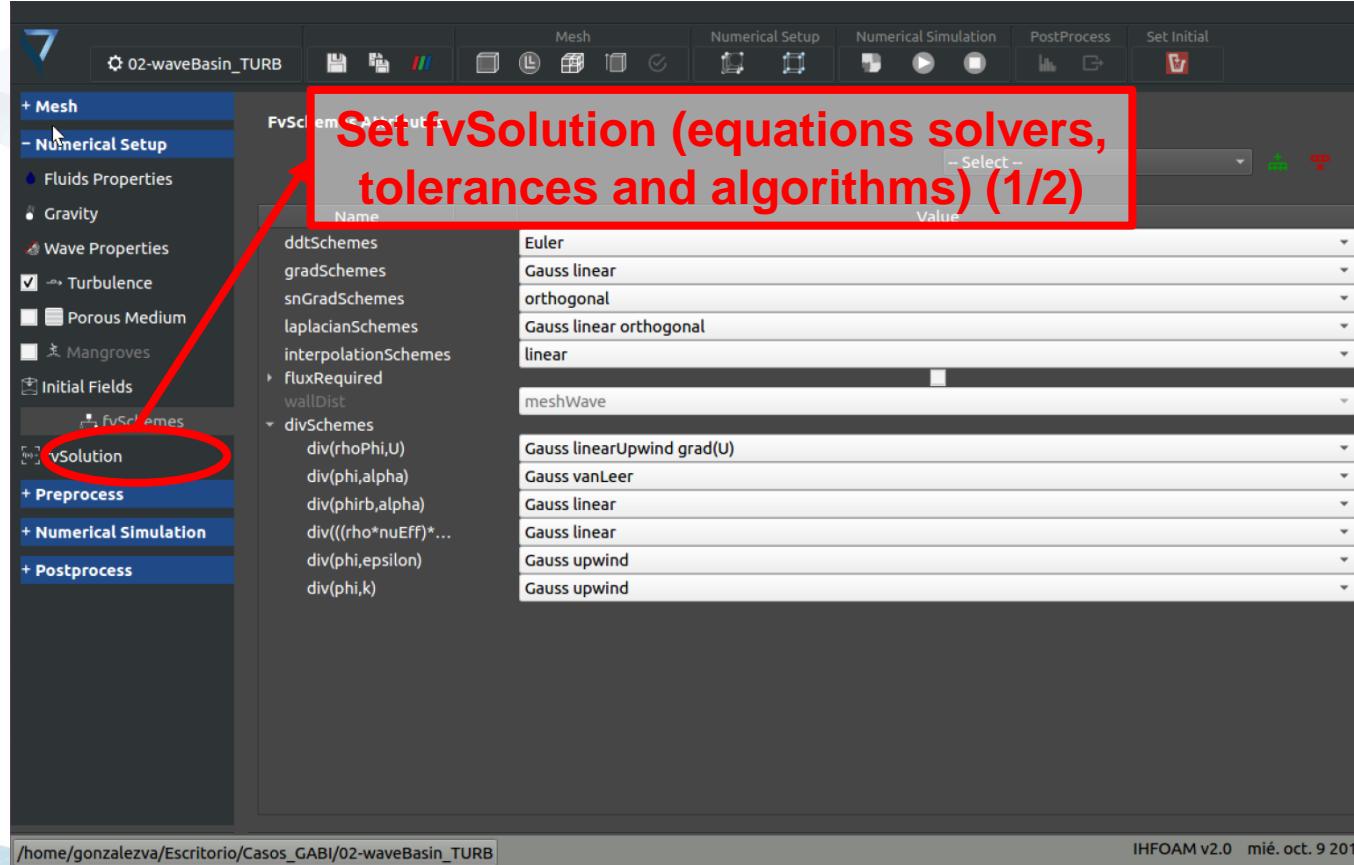
-- Select --

Name	Value
ddtSchemes	Euler
gradSchemes	Gauss linear
snGradSchemes	orthogonal
laplacianSchemes	Gauss linear orthogonal
interpolationSchemes	linear
fluxRequired	meshWave
wallDist	
+ divSchemes	
div(rhoPhi,U)	Gauss linearUpwind grad(U)
div(phi,alpha)	Gauss vanLeer
div(phirb,alpha)	Gauss linear
div(((rho*nuEff)*dev2(T(grad(U))))	Gauss linear

Set fvSchemes (numerical schemes for different terms)

/home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel

IINFOAM v2.0 mié. oct. 9 2019

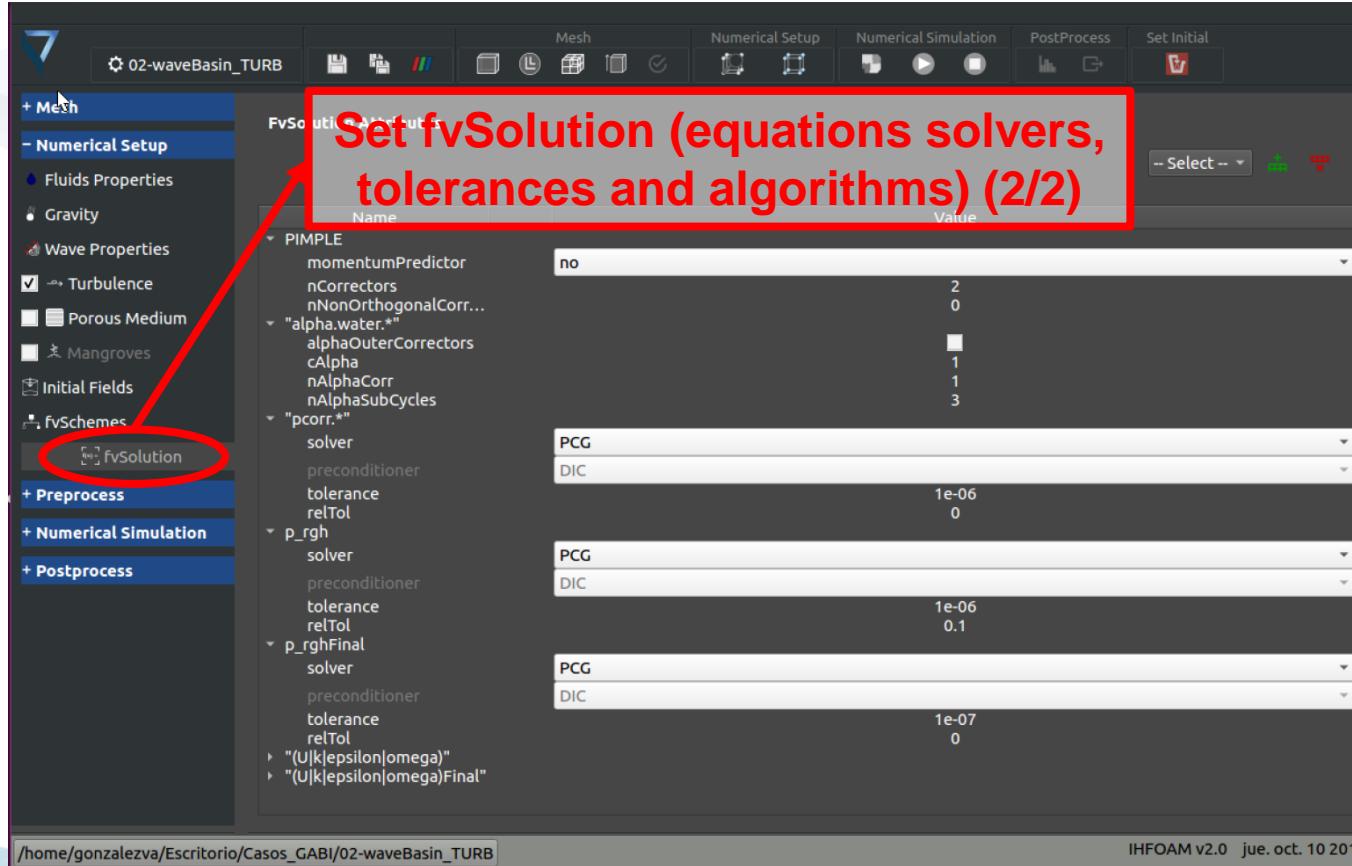


The screenshot shows the IHFOAM v2.0 software interface. On the left, there is a sidebar with various tabs: Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties, Turbulence (selected), Porous Medium, Mangroves, Initial Fields, fvSchemes (circled in red), fvSolution (circled in red), Preprocess, Numerical Simulation, and Postprocess.

The main window displays the "fvSolution" settings. A red box highlights the "Set fvSolution (equations solvers, tolerances and algorithms) (1/2)" section. This section contains a table with two columns: "Name" and "Value".

Name	Value
ddtSchemes	Euler
gradSchemes	Gauss linear
snGradSchemes	orthogonal
laplacianSchemes	Gauss linear orthogonal
interpolationSchemes	linear
fluxRequired	
wallDist	meshWave
divSchemes	
div(rhoPhi,U)	Gauss linearUpwind grad(U)
div(phi,alpha)	Gauss vanLeer
div(phirb,alpha)	Gauss linear
div(((rho*nuEff)*...	Gauss linear
div(phi,epsilon)	Gauss upwind
div(phi,k)	Gauss upwind

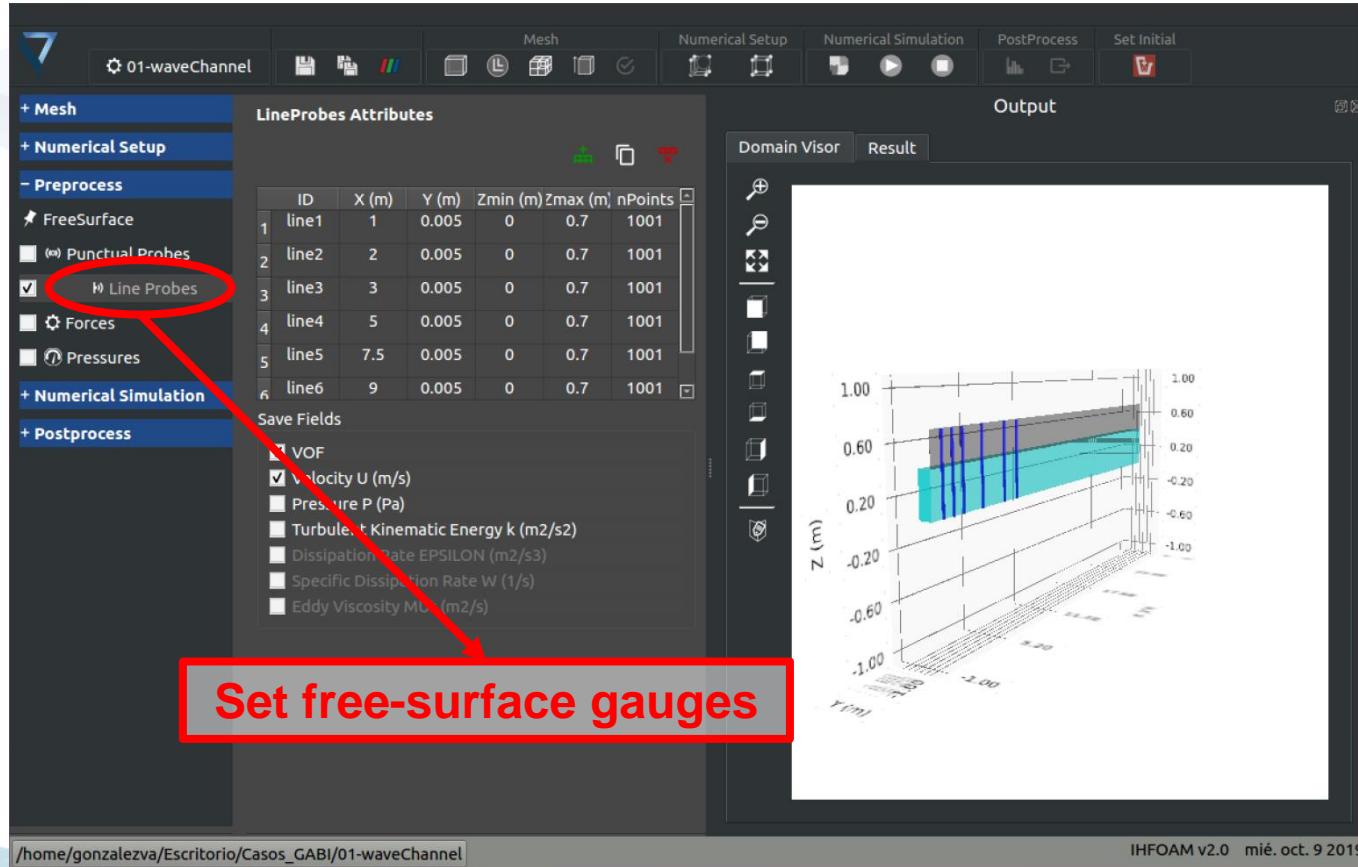
At the bottom of the interface, the path is shown as /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB and the version is IHFOAM v2.0 mié. oct. 9 2019.

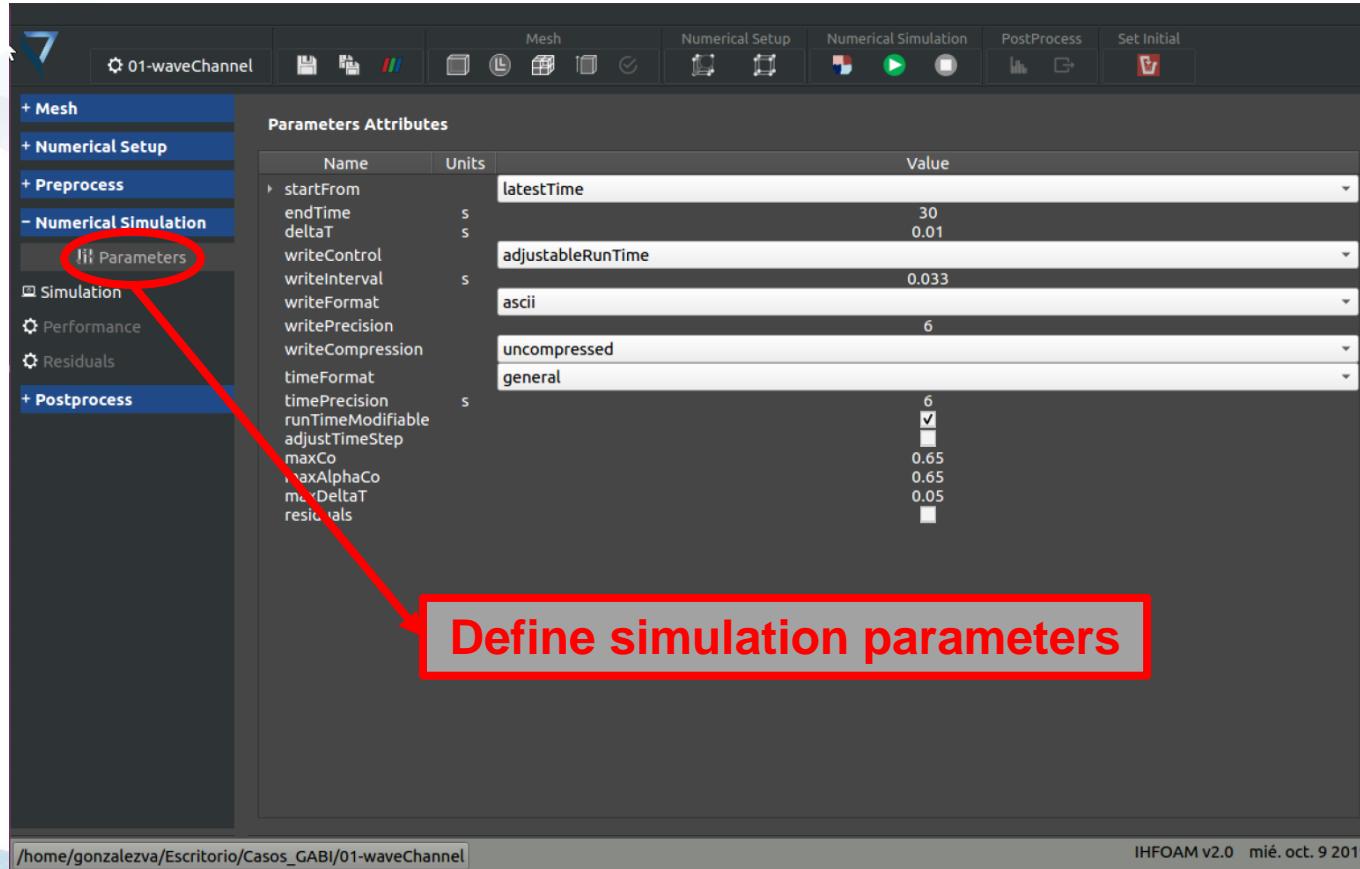


The screenshot shows the OpenFOAM fvSolution panel configuration. A red box highlights the title "Set fvSolution (equations solvers, tolerances and algorithms) (2/2)".

fvSolution Settings:

- PIMPLE**
 - momentumPredictor: no
 - nCorrectors: 2
 - nNonOrthogonalCorr: 0
 - "alpha.water.*"
 - alphaOuterCorrectors: 1
 - cAlpha: 1
 - nAlphaCorr: 1
 - nAlphaSubCycles: 3
 - "pcorr."
 - solver: PCG
 - preconditioner: DIC
 - tolerance: 1e-06
 - relTol: 0
- p_rgh**
 - solver: PCG
 - preconditioner: DIC
 - tolerance: 1e-06
 - relTol: 0.1
- p_rghFinal**
 - solver: PCG
 - preconditioner: DIC
 - tolerance: 1e-07
 - relTol: 0
- "(U|k|epsilon|omega)"**
- "(U|k|epsilon|omega)Final"**





The screenshot shows the IHFOAM v2.0 software interface. On the left, a sidebar lists project components: Mesh, Numerical Setup, Preprocess, Numerical Simulation (selected), Parameters (highlighted with a red circle), Simulation, Performance, Residuals, and Postprocess. The main area displays a table of simulation parameters:

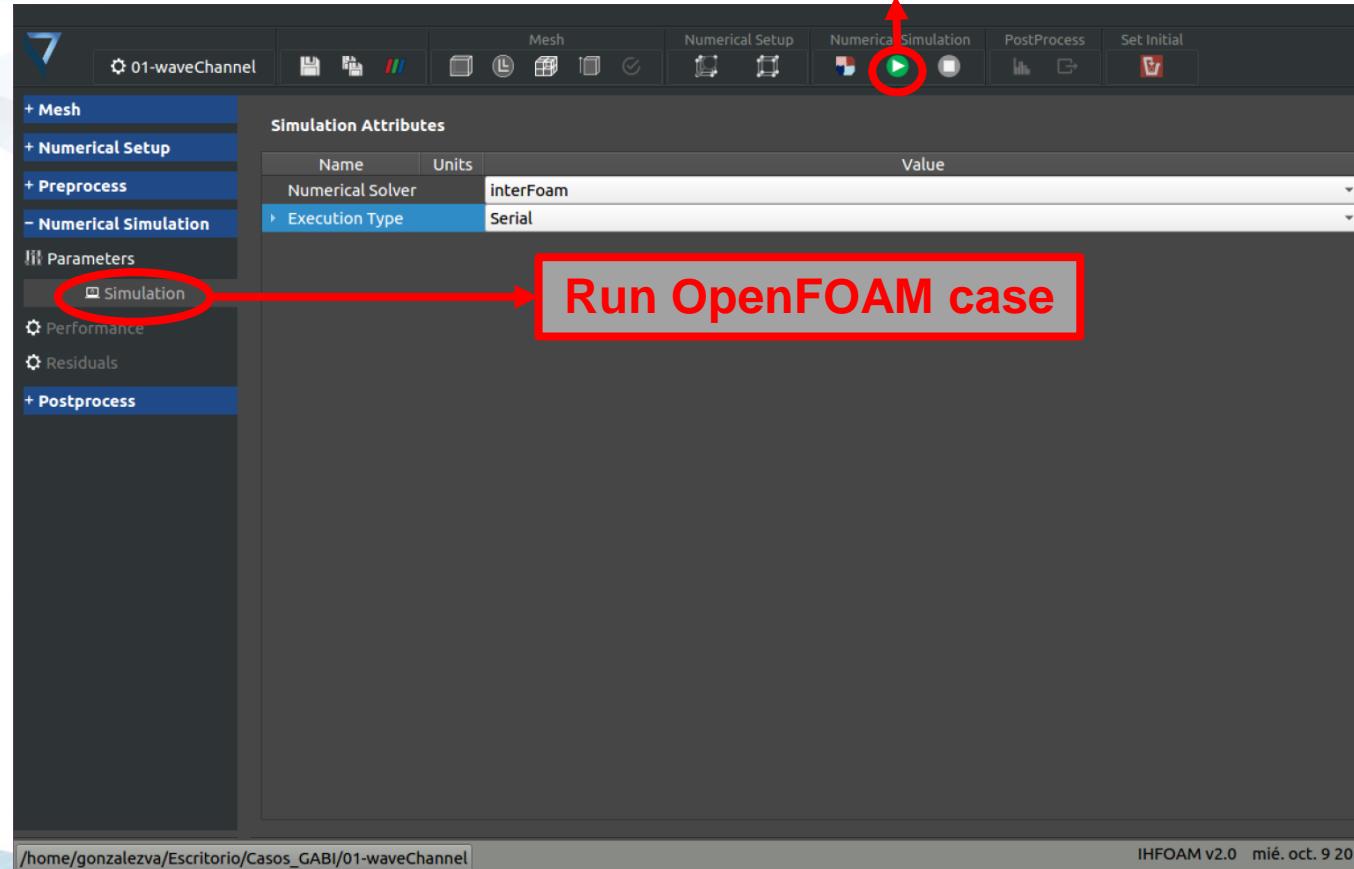
Name	Units	Value
startFrom		latestTime
endTime	s	30
deltaT	s	0.01
writeControl		adjustableRunTime
writeInterval	s	0.033
writeFormat		ascii
writePrecision		6
writeCompression		uncompressed
timeFormat		general
timePrecision	s	6
runTimeModifiable		<input checked="" type="checkbox"/>
adjustTimeStep		<input type="checkbox"/>
maxCo		0.65
maxAlphaCo		0.65
m./DeltaT		0.05
residuals		<input type="checkbox"/>

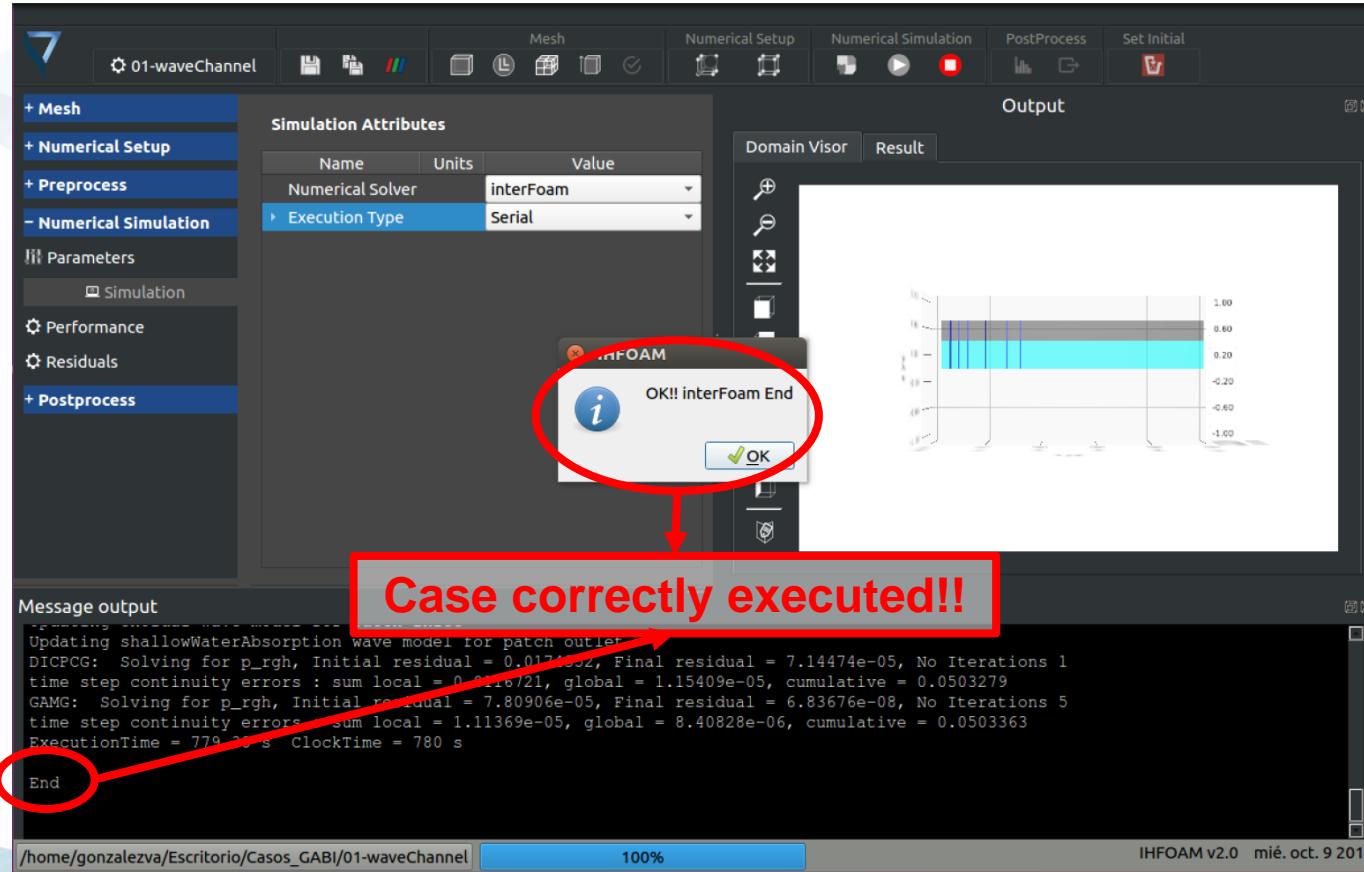
A large red arrow points from the "Parameters" section in the sidebar to a red-bordered callout box containing the text "Define simulation parameters".

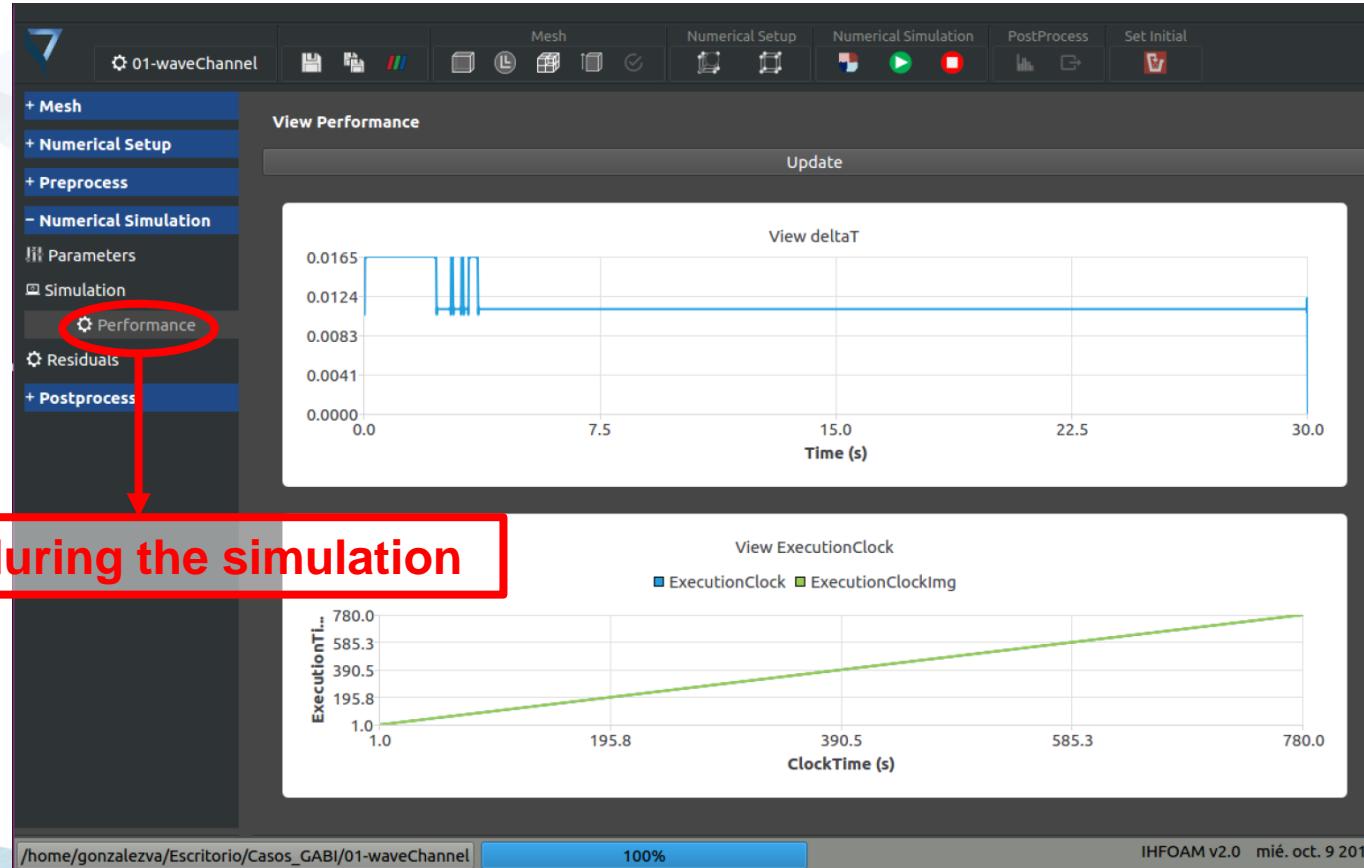
Path: /home/gonzalezva/Escritorio/Casos_GABI/01-waveChannel

IHFOAM v2.0 mié. oct. 9 2019

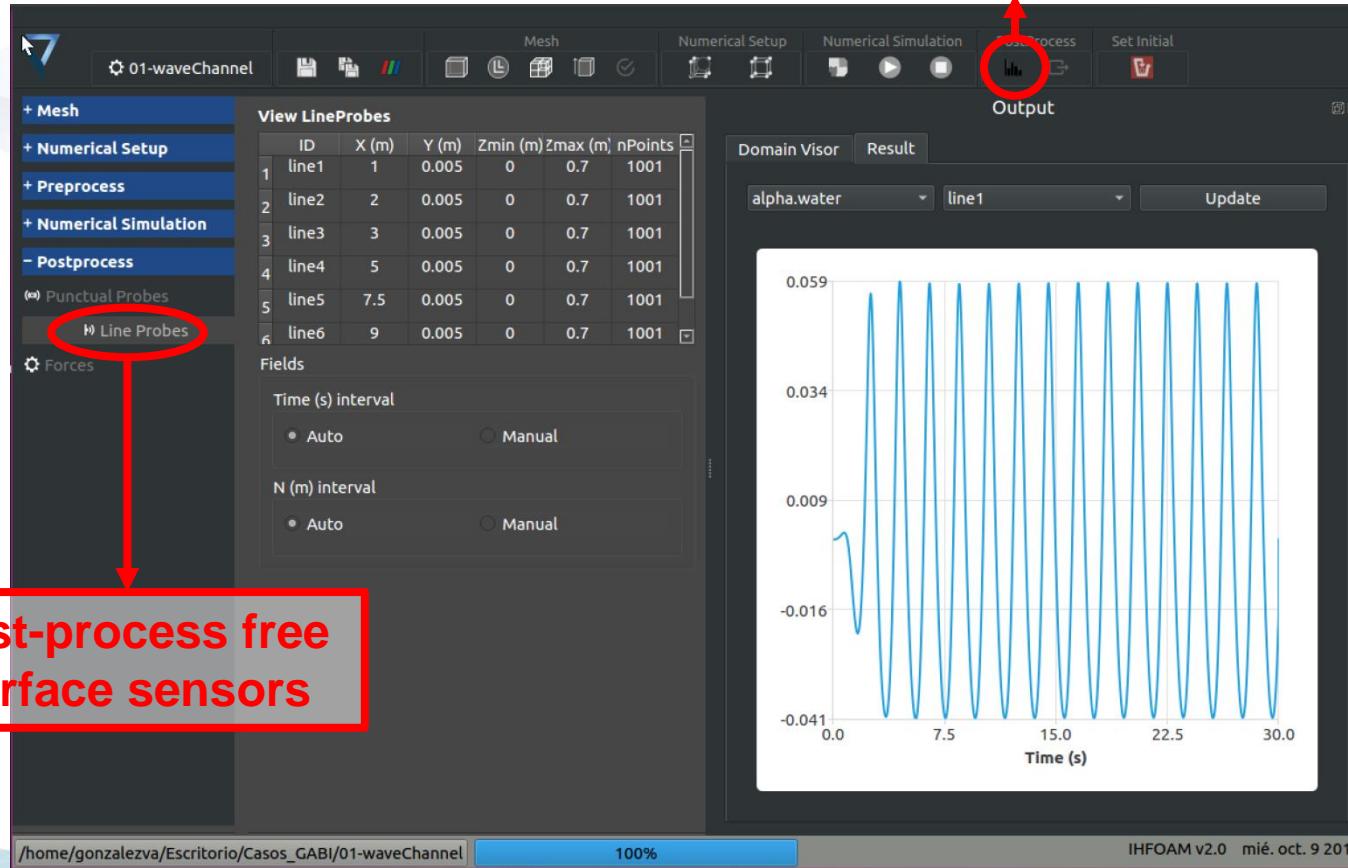
Run/Execute button



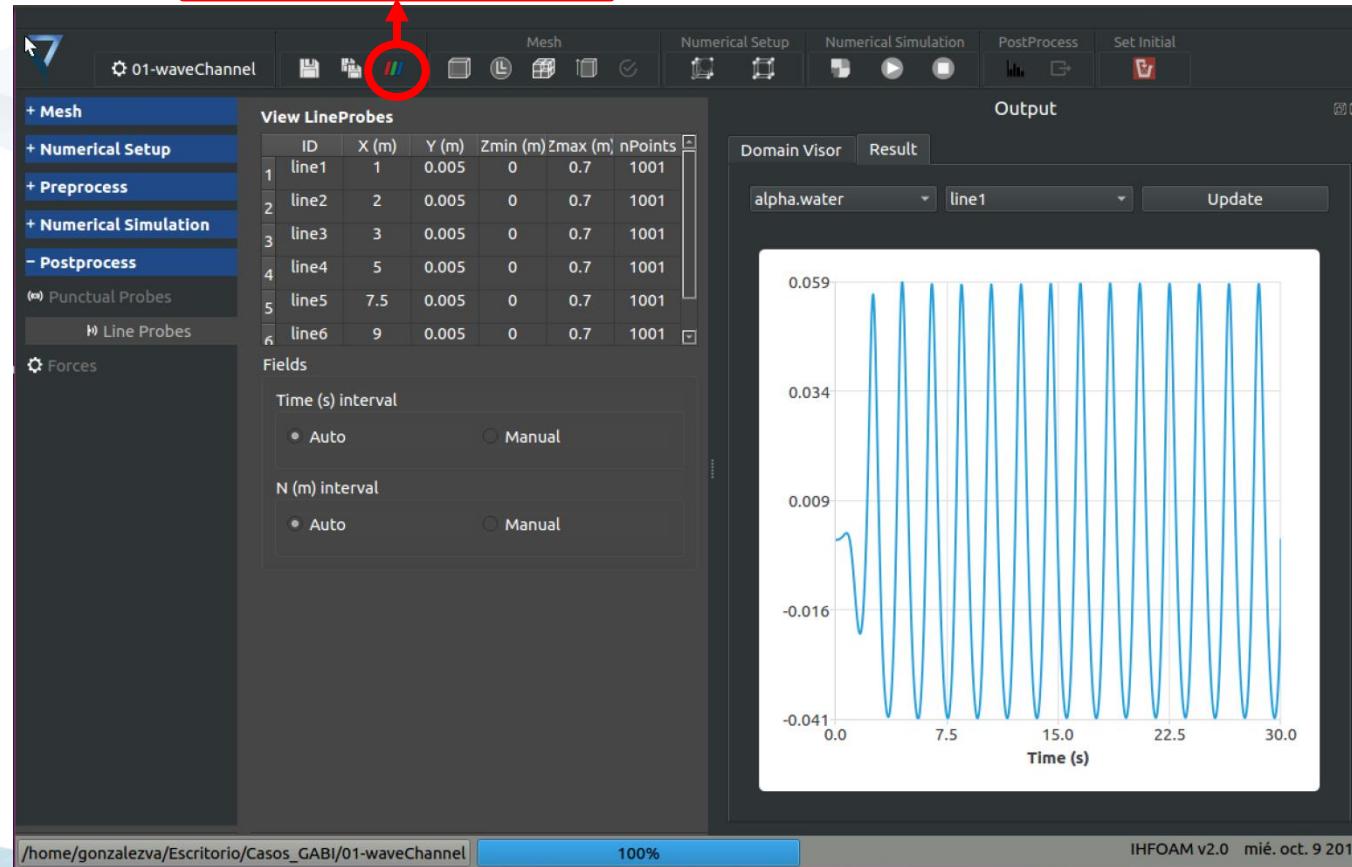




plot free surface sensors

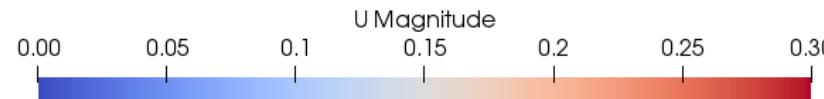


Paraview button





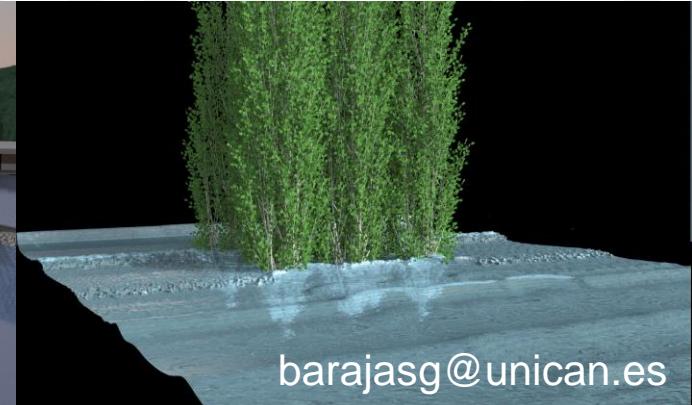
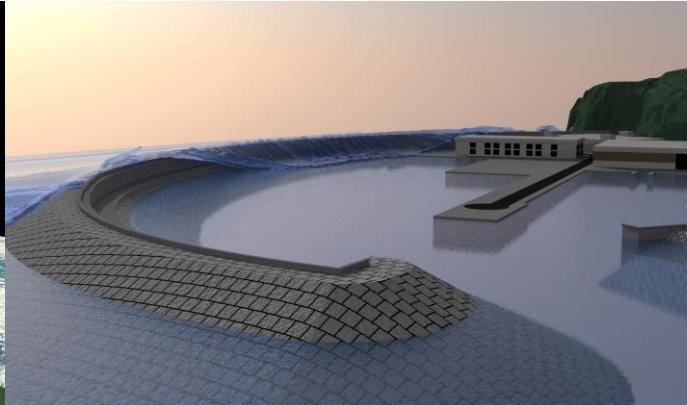
Time: 30.00 s.



Time: 30.00 s.



Gabriel Barajas, Javier L. Lara, María Maza, Alejandro Gonzalez



barajasg@unican.es