

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

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R+D+i for a Sustainable Development

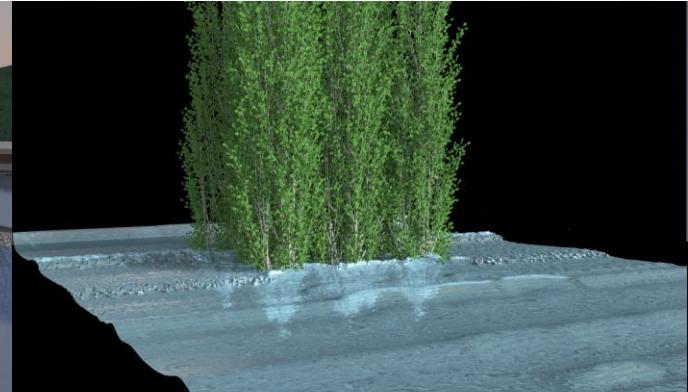
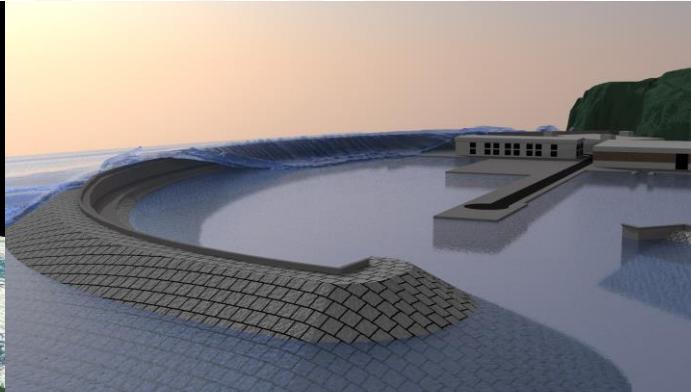
(IINFOAM GUI)

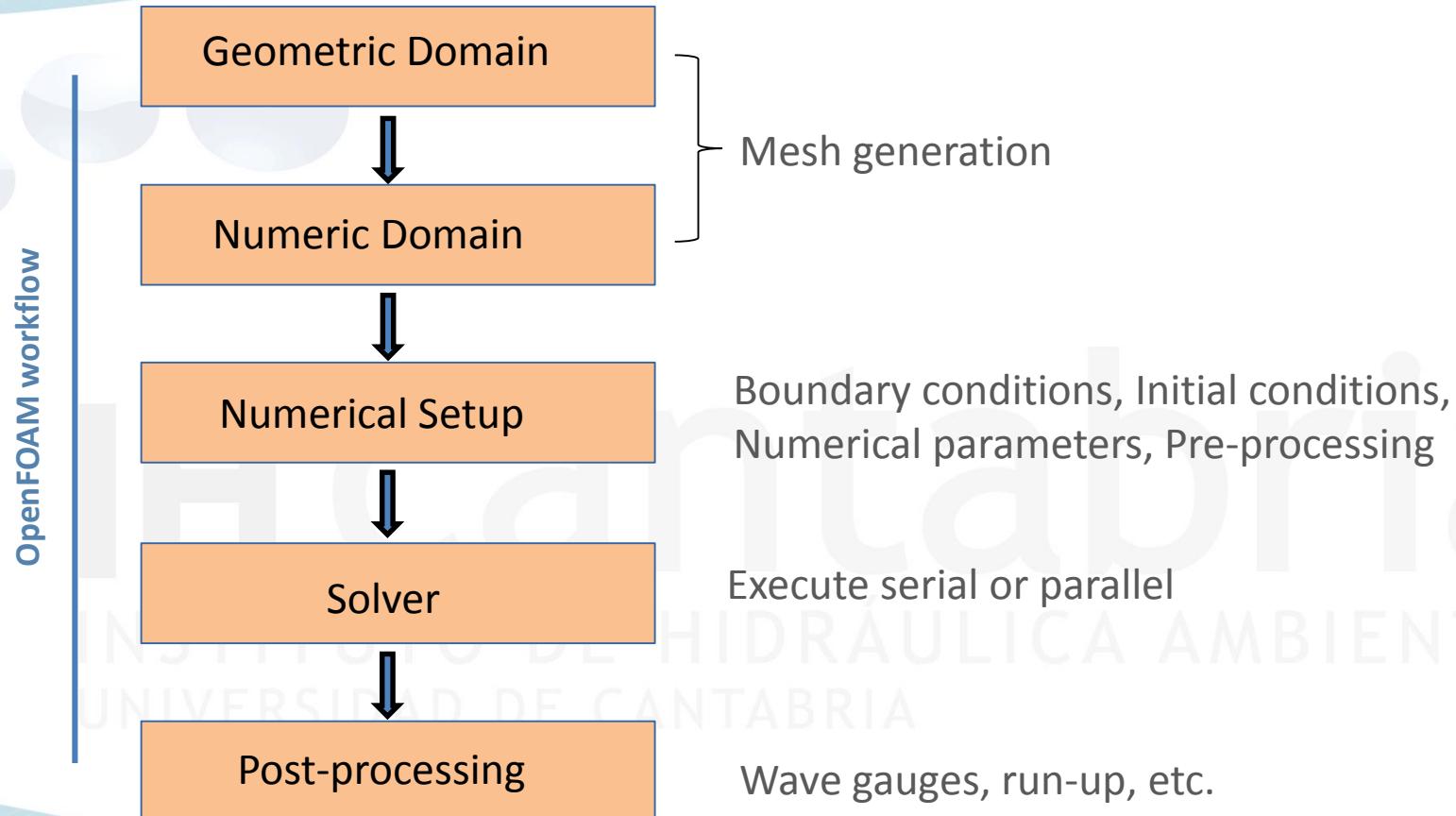


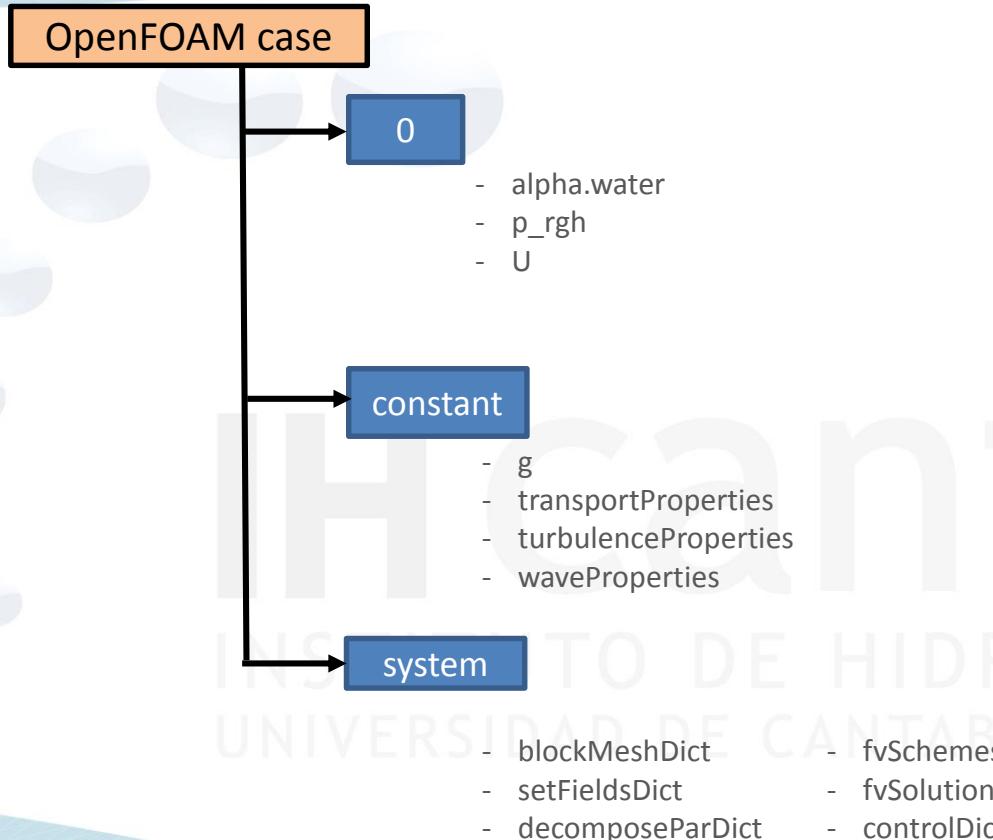
IINFOAM applied to Coastal Engineering

Regular waves in empty basin (3D)

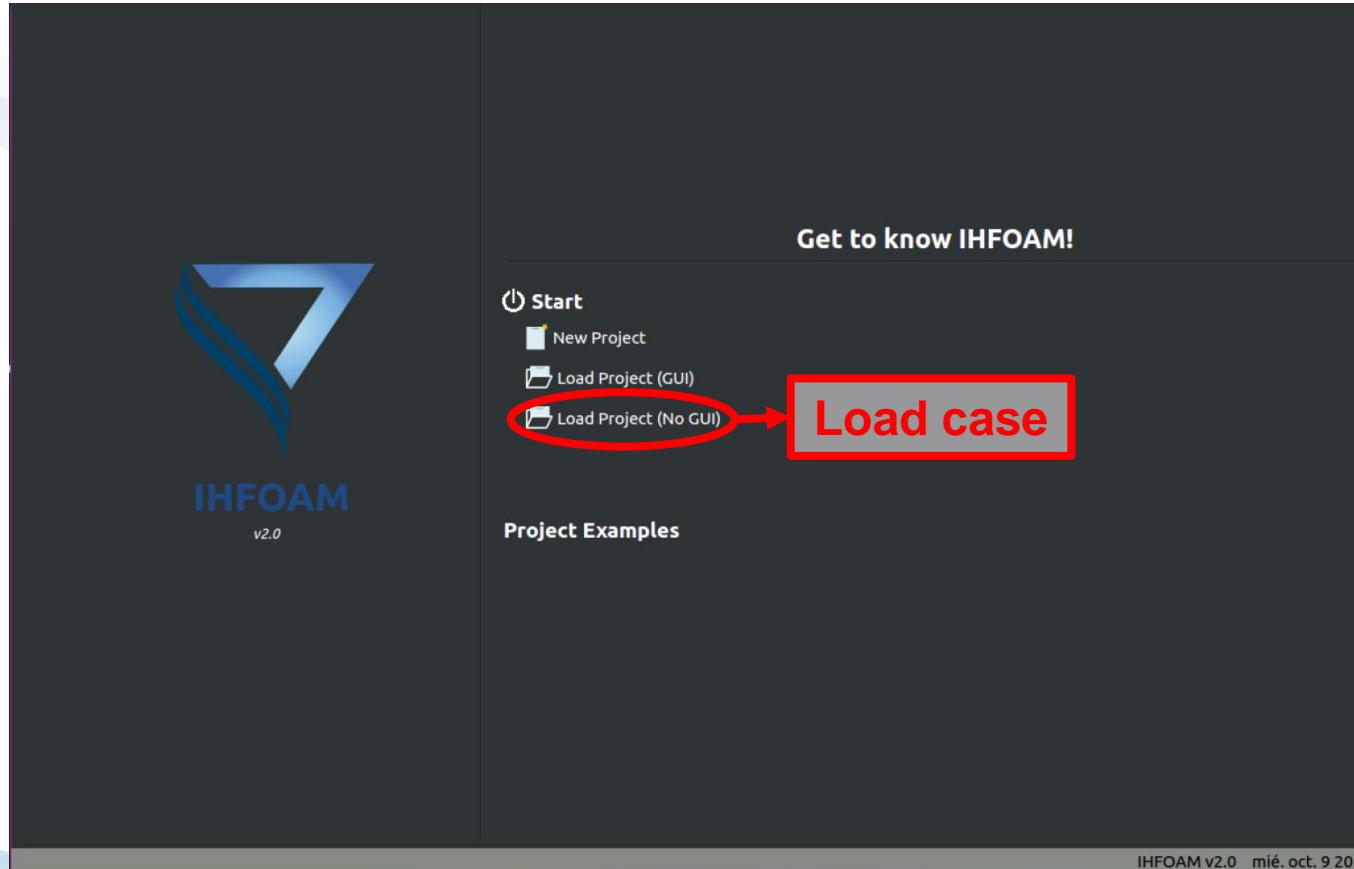
Gabriel Barajas, Javier L. Lara, María Maza, Alejandro González



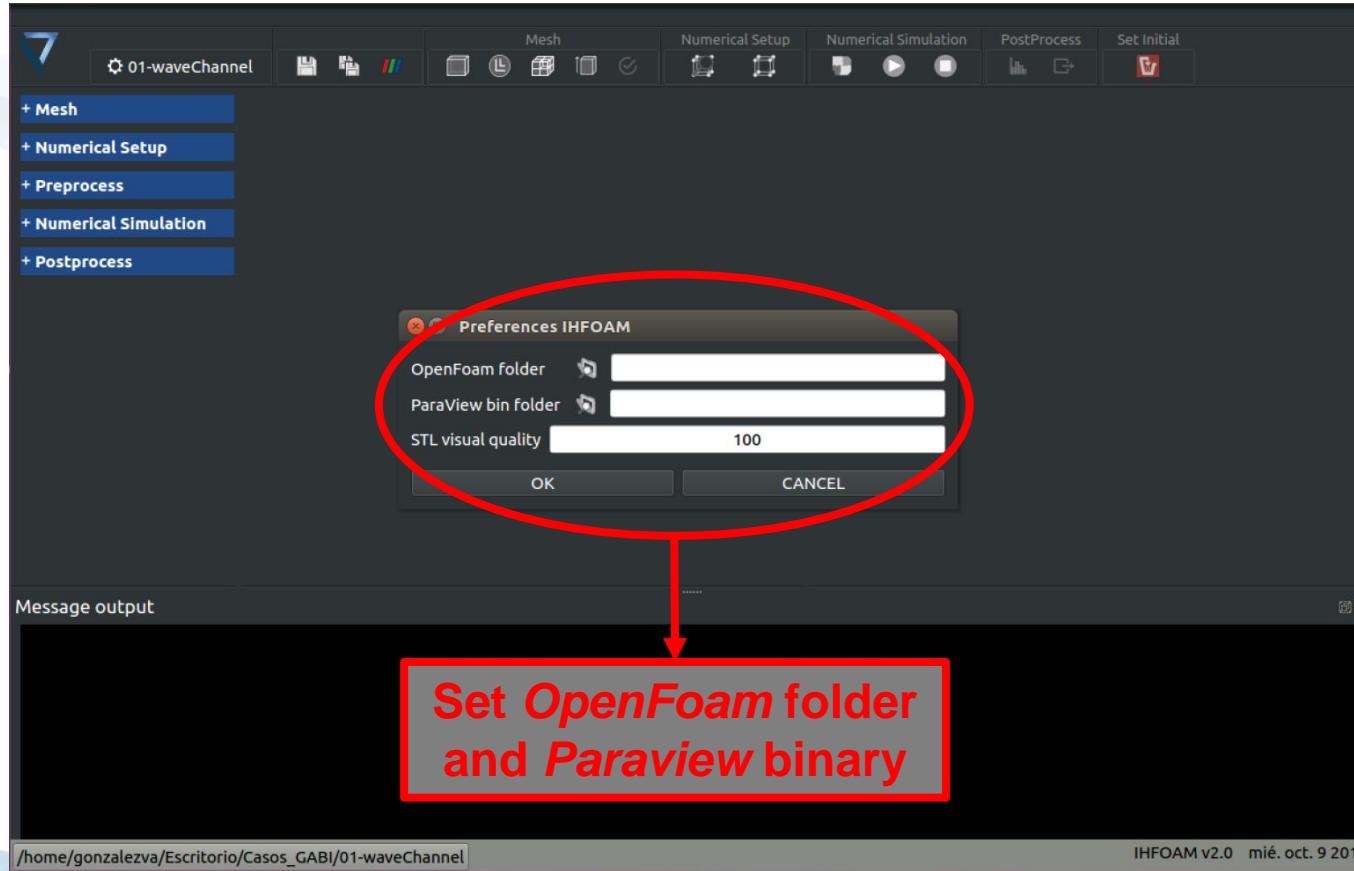


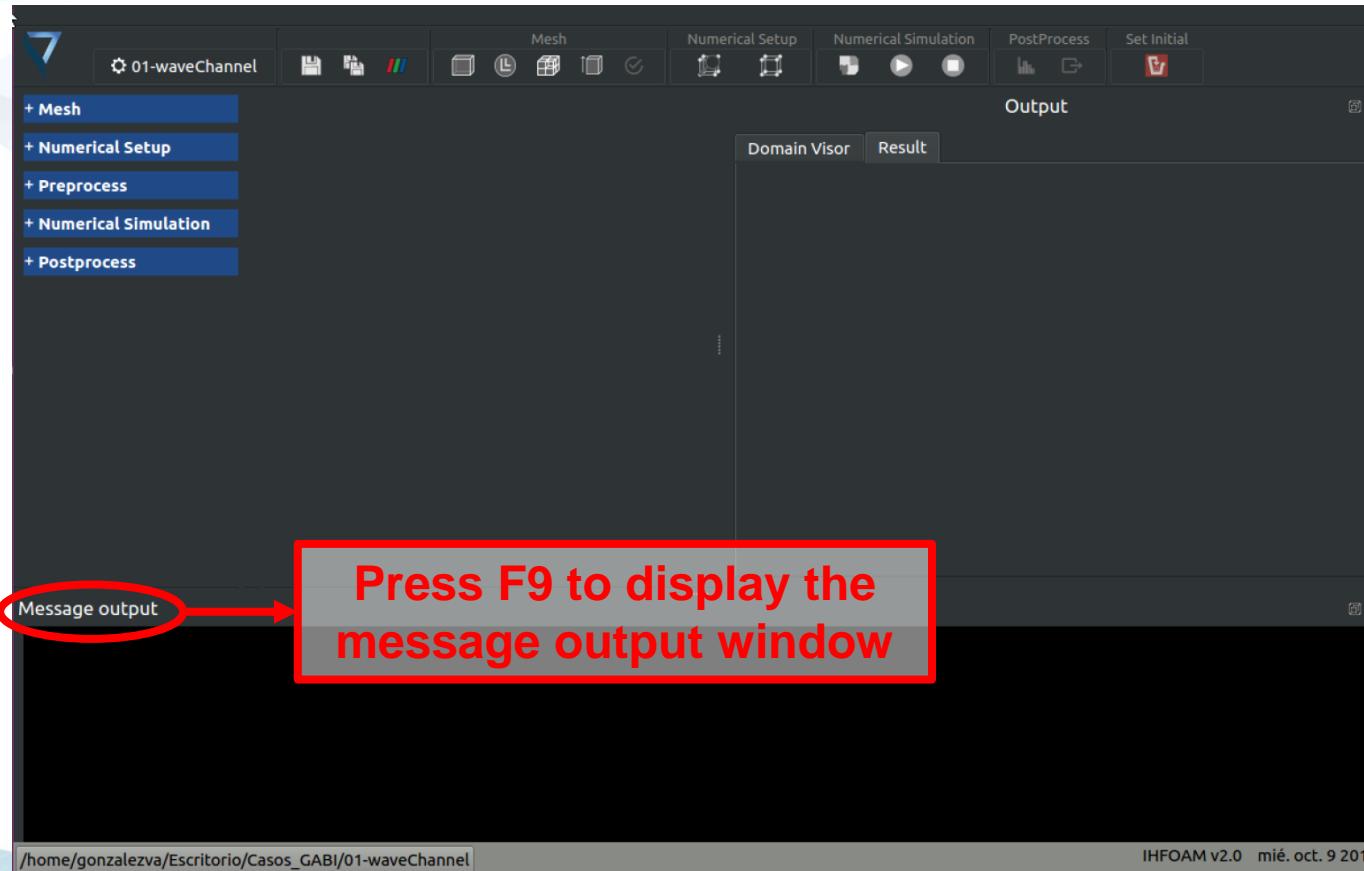


IHFOAM GUI



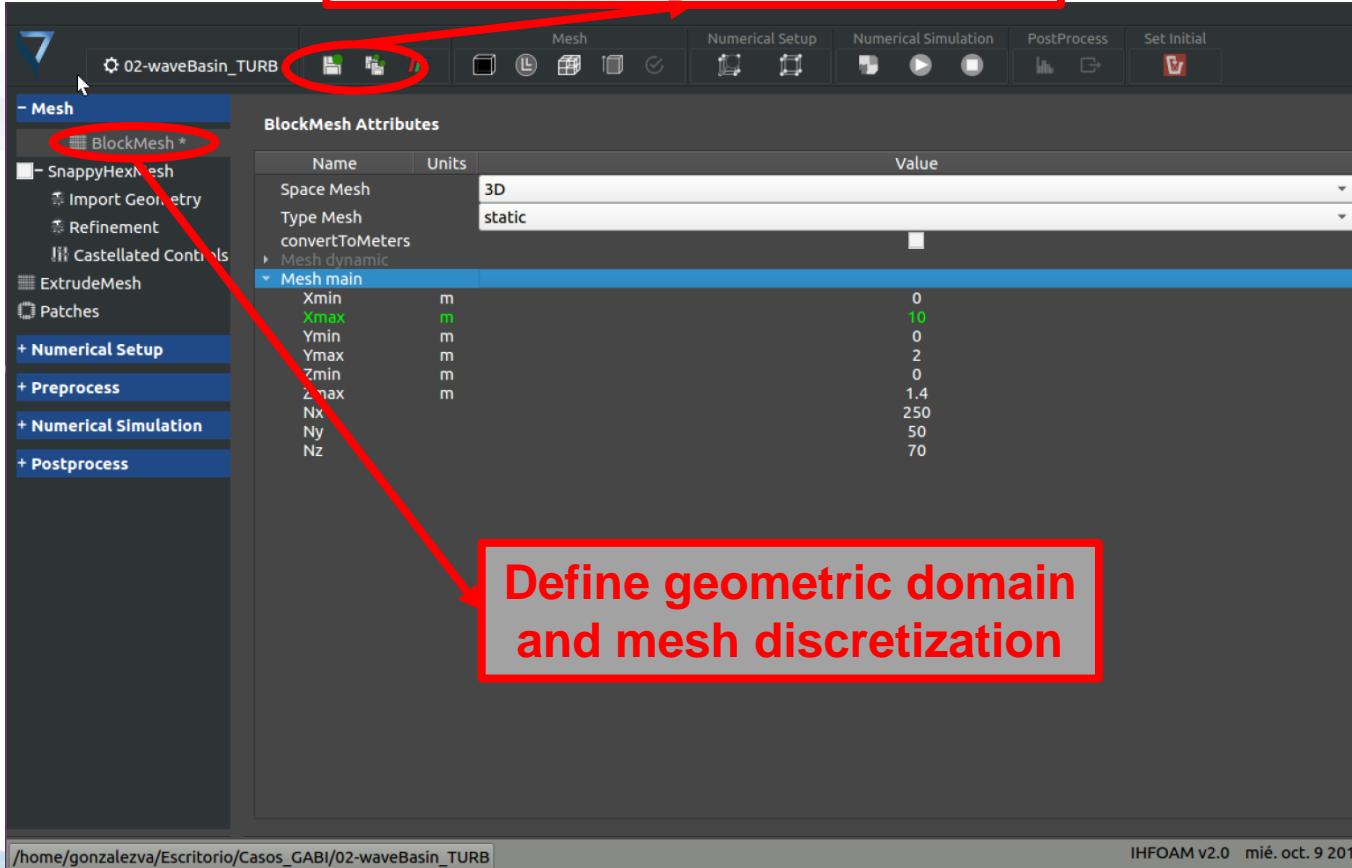
IHFOAM v2.0 mié. oct. 9 2019



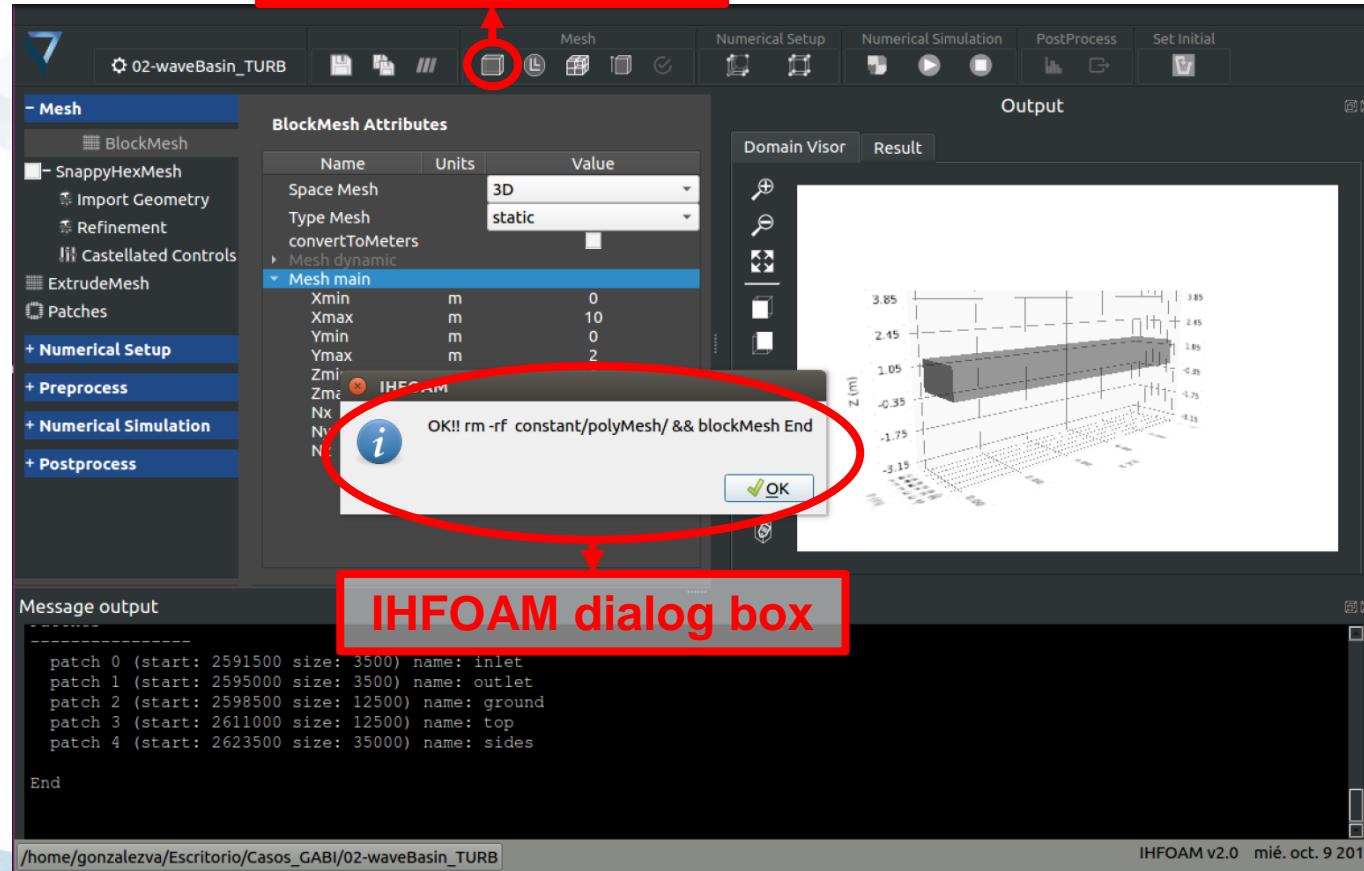


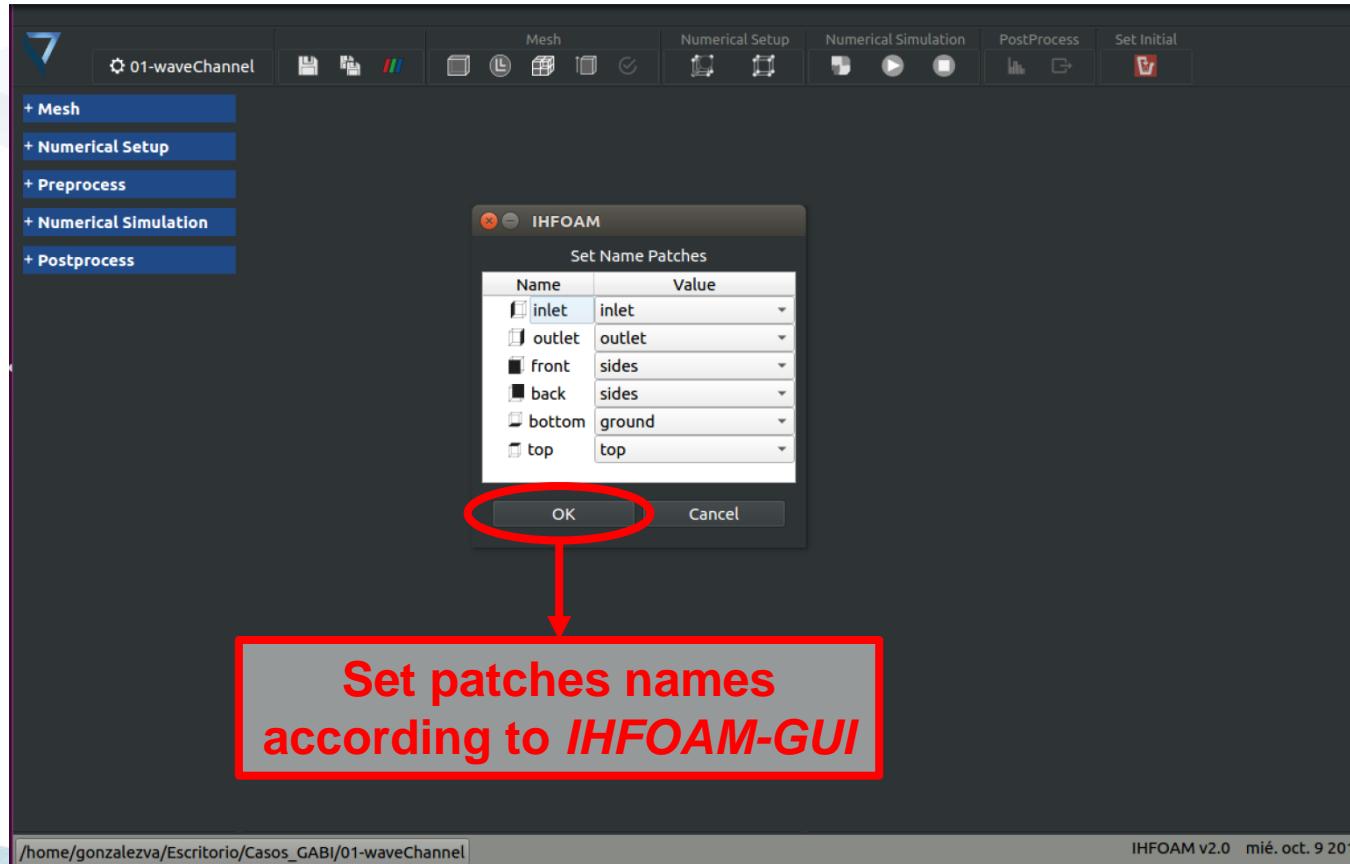
Save single pannel modified
or save all pannels modified.

Regular waves in empty
basin (3D)

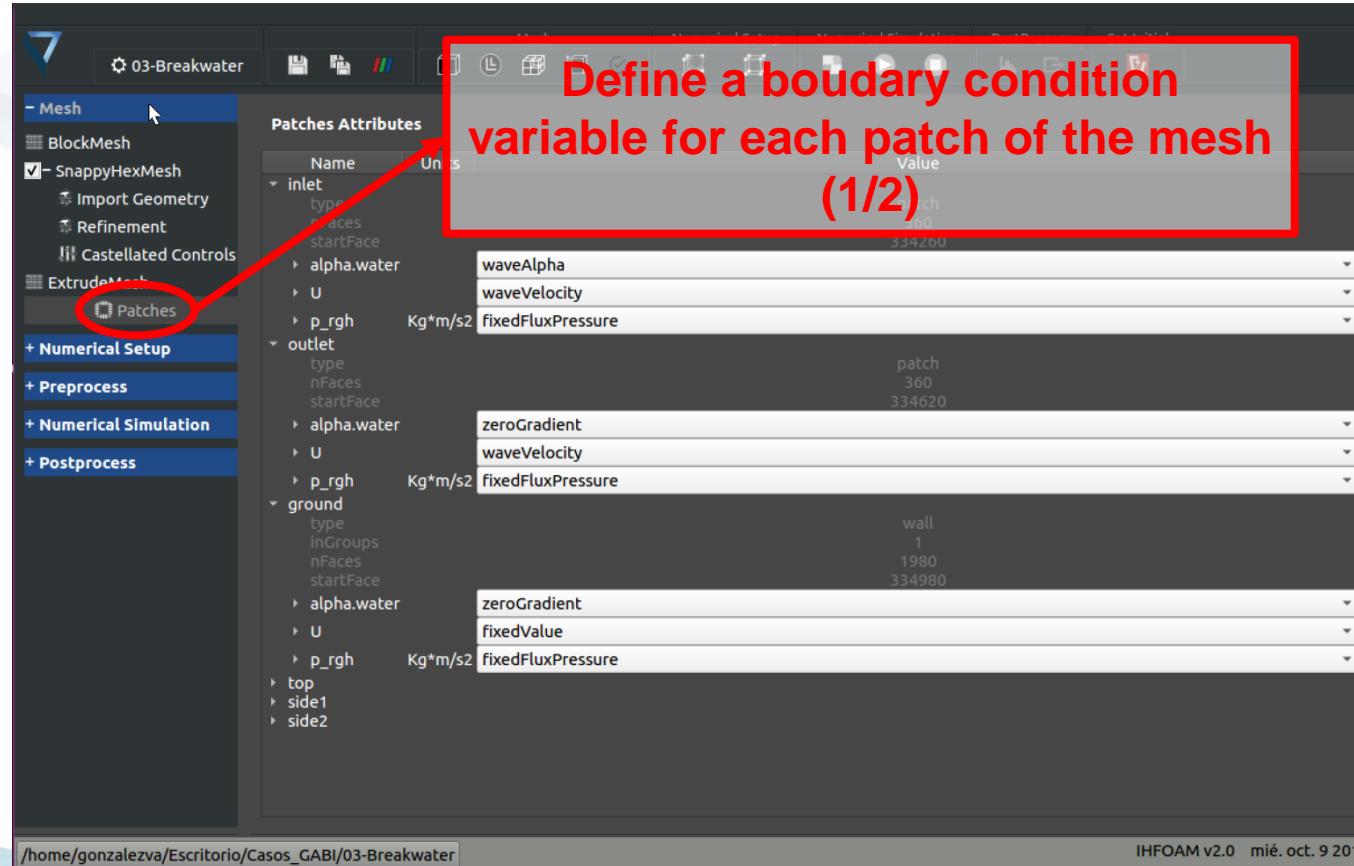


The screenshot shows the IHFOAM v2.0 software interface. On the left, there is a sidebar with categories: Mesh, Numerical Setup, Preprocess, Numerical Simulation, and Postprocess. Under Mesh, 'BlockMesh' is selected, and its attributes are displayed in the main panel. The main panel title is 'BlockMesh Attributes' with columns for Name, Units, and Value. A red box highlights the 'Space Mesh' row, which is set to '3D'. Another red box highlights the 'Type Mesh' row, which is set to 'static'. Below these, under 'Mesh main', various parameters are listed with their values: Xmin (0), Xmax (10), Ymin (0), Ymax (2), Zmin (0), Zmax (1.4), Nx (250), Ny (50), and Nz (70). At the bottom of the main panel, a red box contains the text: 'Define geometric domain and mesh discretization'. At the very bottom of the interface, the path '/home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB' is shown, along with the IHFOAM version 'IHFOAM v2.0 mié. oct. 9 2019'.

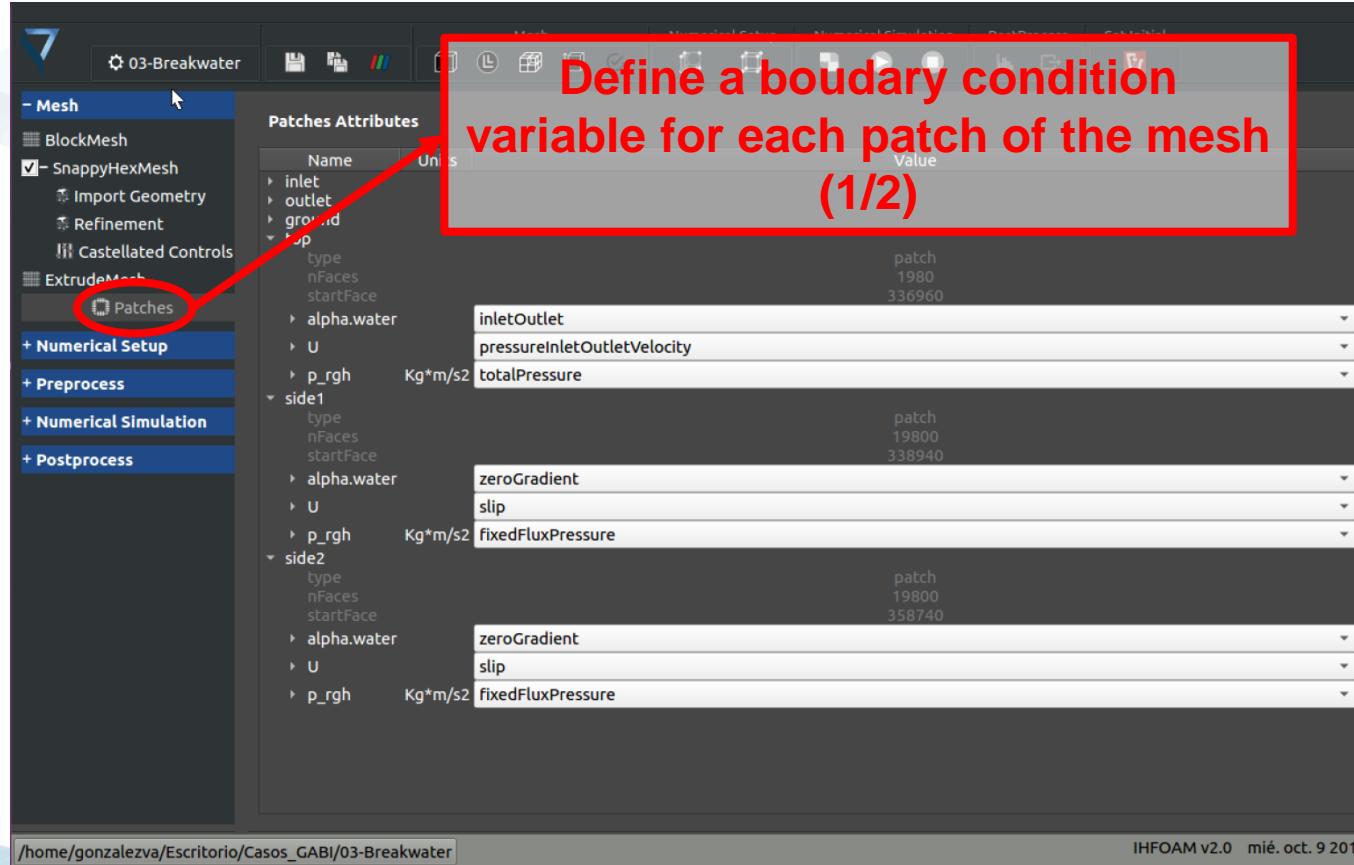




Define a boundary condition variable for each patch of the mesh (1/2)



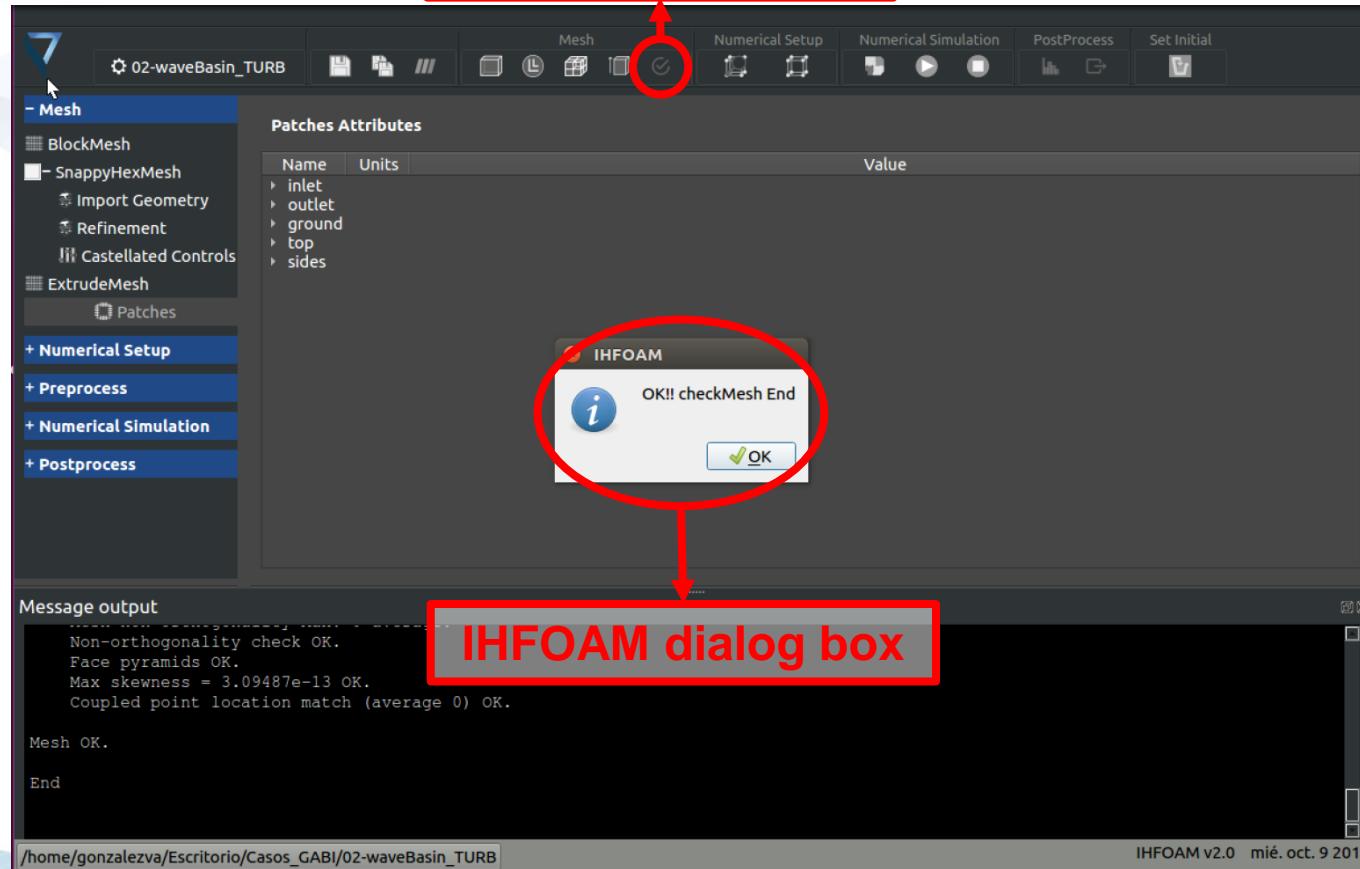
Patch	Type	Variable	Value
inlet		waveAlpha	334200
inlet		waveVelocity	334200
inlet		p_rgh	fixedFluxPressure
outlet		waveAlpha	334620
outlet		U	zeroGradient
outlet		p_rgh	fixedFluxPressure
ground		waveAlpha	334980
ground		U	zeroGradient
ground		p_rgh	fixedFluxPressure
top		waveAlpha	1980
side1		waveAlpha	1980
side2		waveAlpha	1980



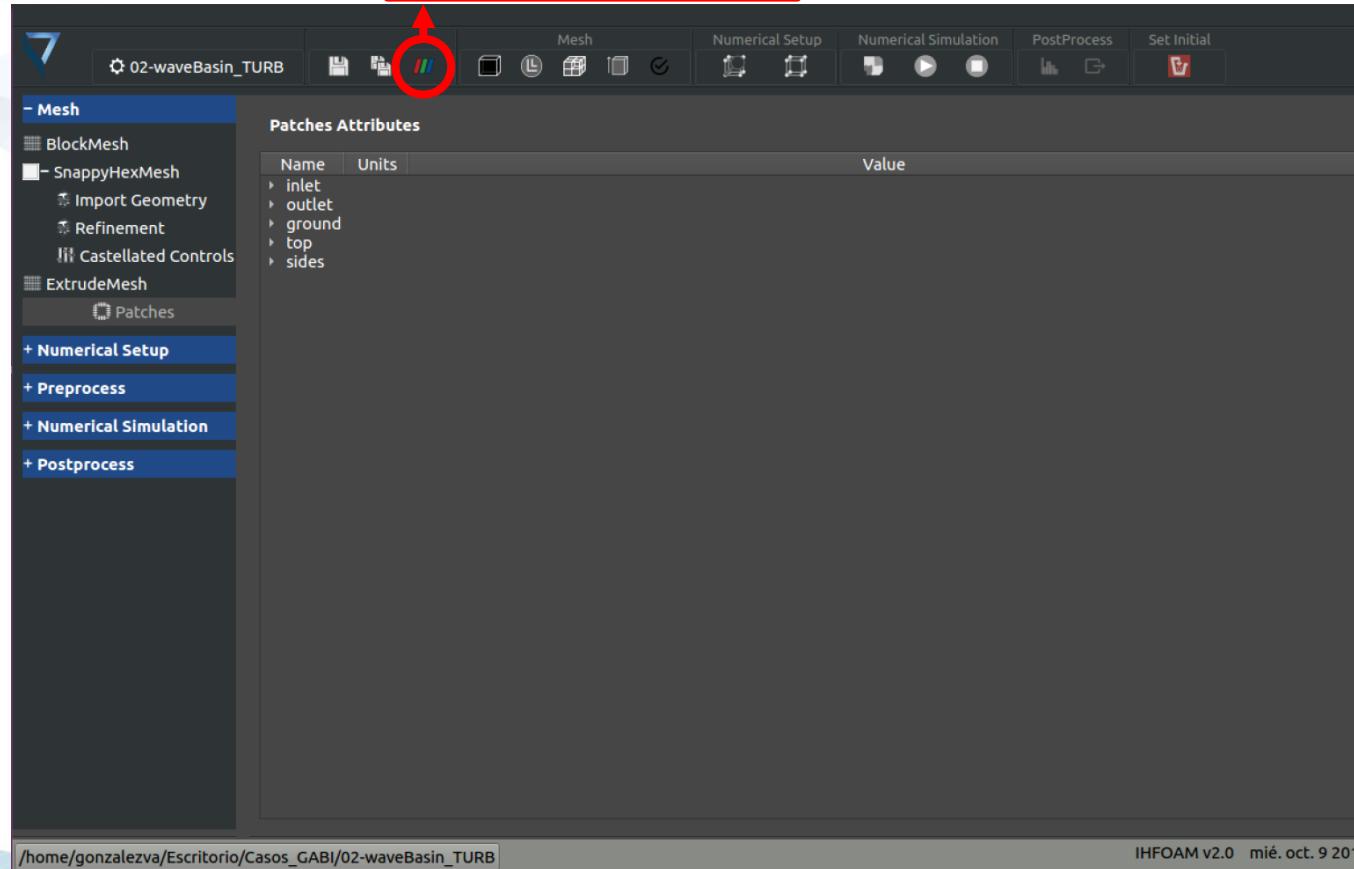
Define a boundary condition variable for each patch of the mesh (1/2)

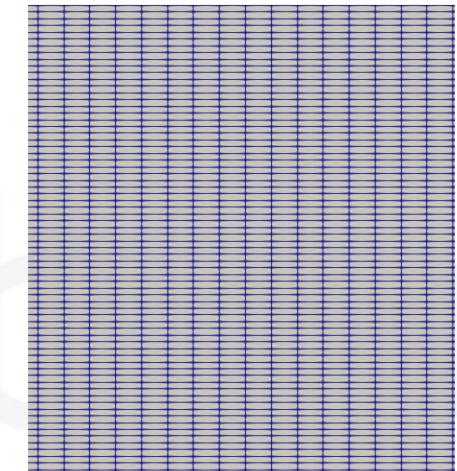
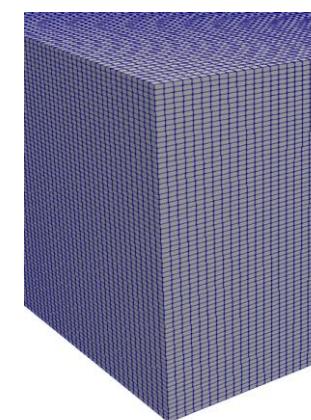
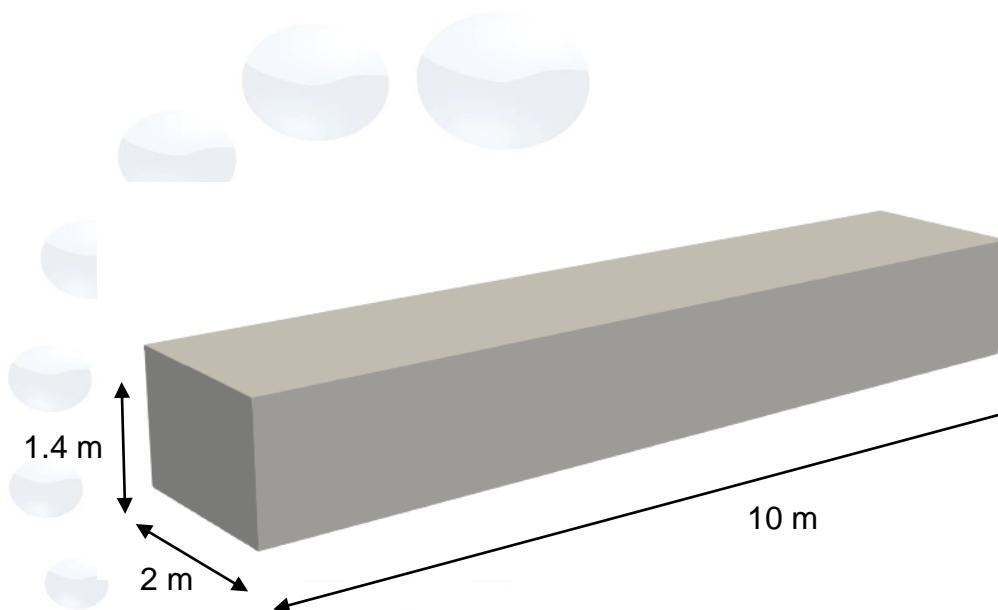
Name	Units	Value
inlet		patch 1980 336960
outlet		inletOutlet pressureInletOutletVelocity
ground		
top		
side1	Kg*m/s ²	totalPressure patch 19800 338940 zeroGradient slip fixedFluxPressure
side2	Kg*m/s ²	patch 19800 358740 zeroGradient slip fixedFluxPressure

/home/gonzalezva/Escritorio/Casos_GABI/03-Breakwater IHFOAM v2.0 mié. oct. 9 2019

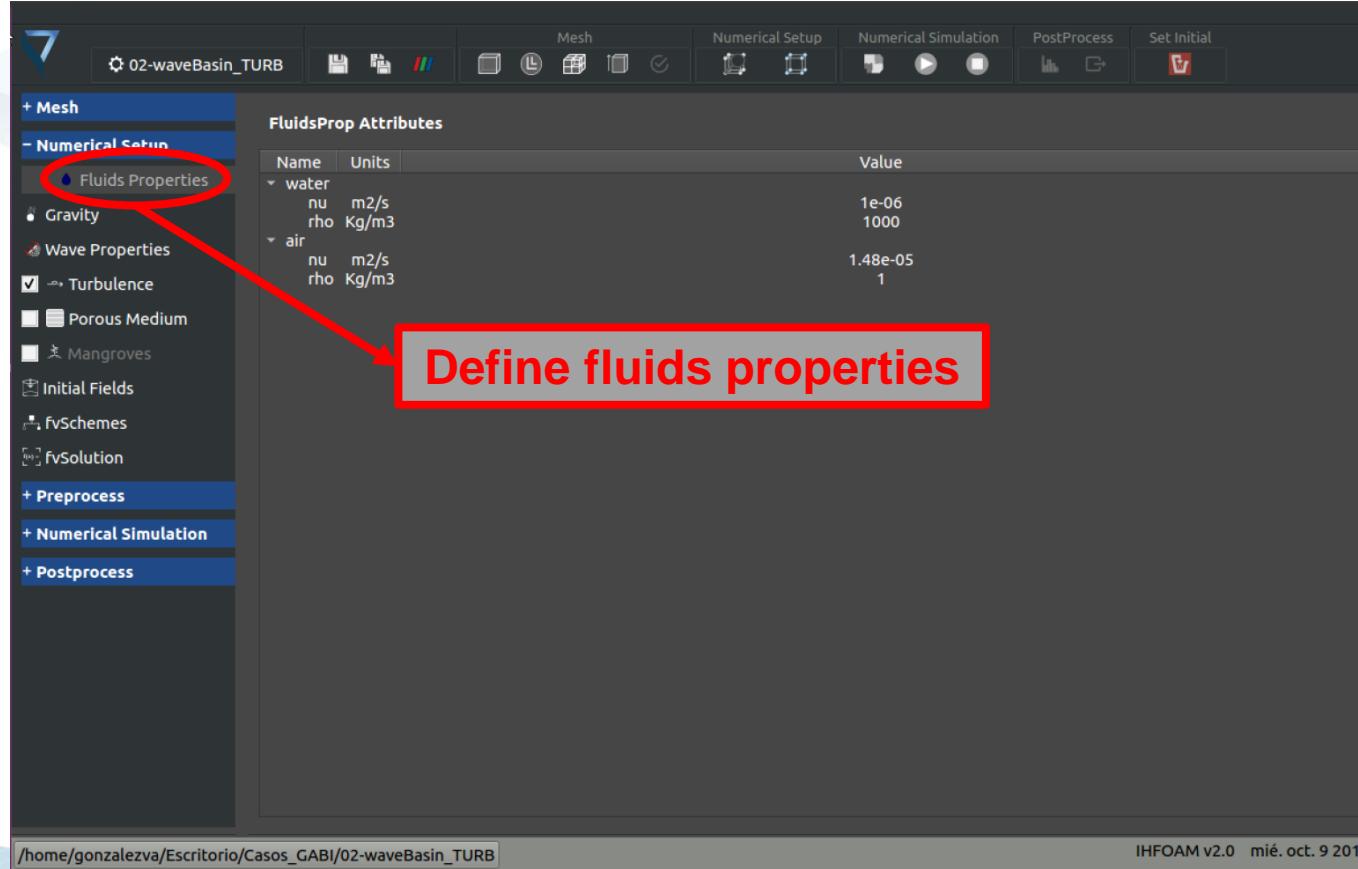


Paraview button





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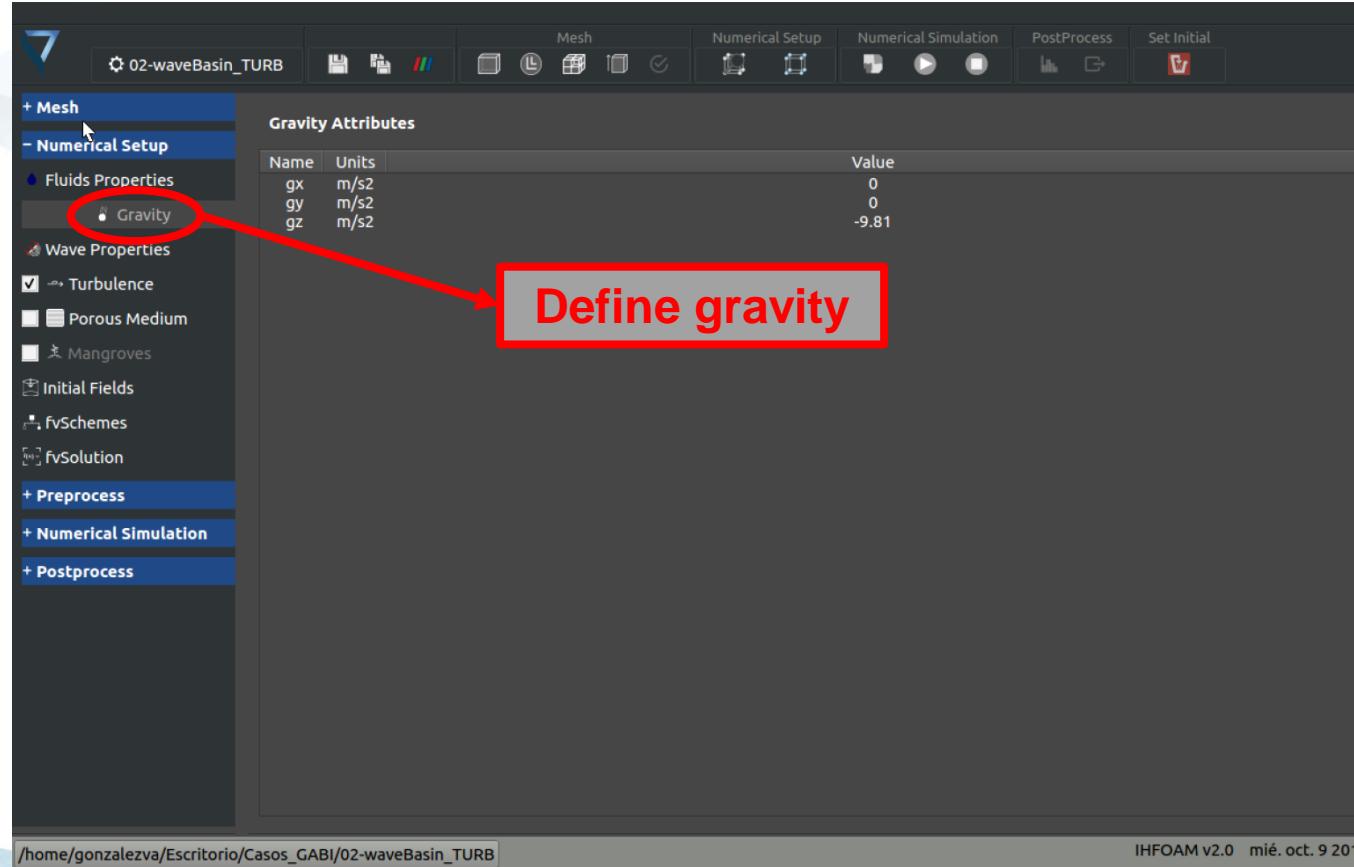
The screenshot shows the IHFOAM v2.0 software interface. On the left, there is a navigation tree with the following structure:

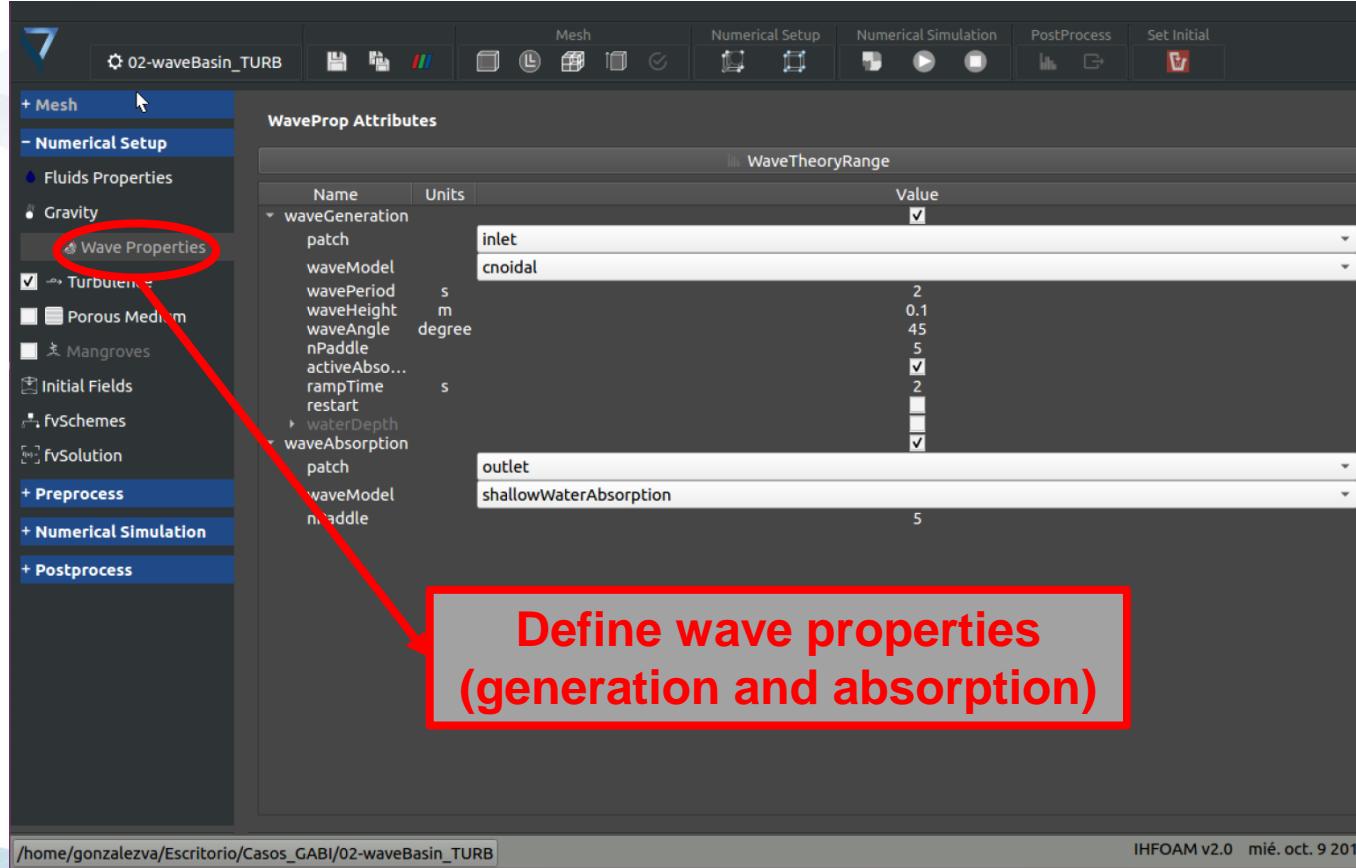
- + Mesh
- Numerical Setup
 - Fluids Properties (highlighted with a red circle)
 - Gravity
 - Wave Properties
 - Turbulence (with a checkmark)
 - Porous Medium
 - Mangroves
 - Initial Fields
 - FvSchemes
 - FvSolution
- + Preprocess
- + Numerical Simulation
- + Postprocess

A red arrow points from the text "Define fluids properties" to the "Fluids Properties" item in the navigation tree. The main panel displays the "FluidsProp Attributes" table:

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

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



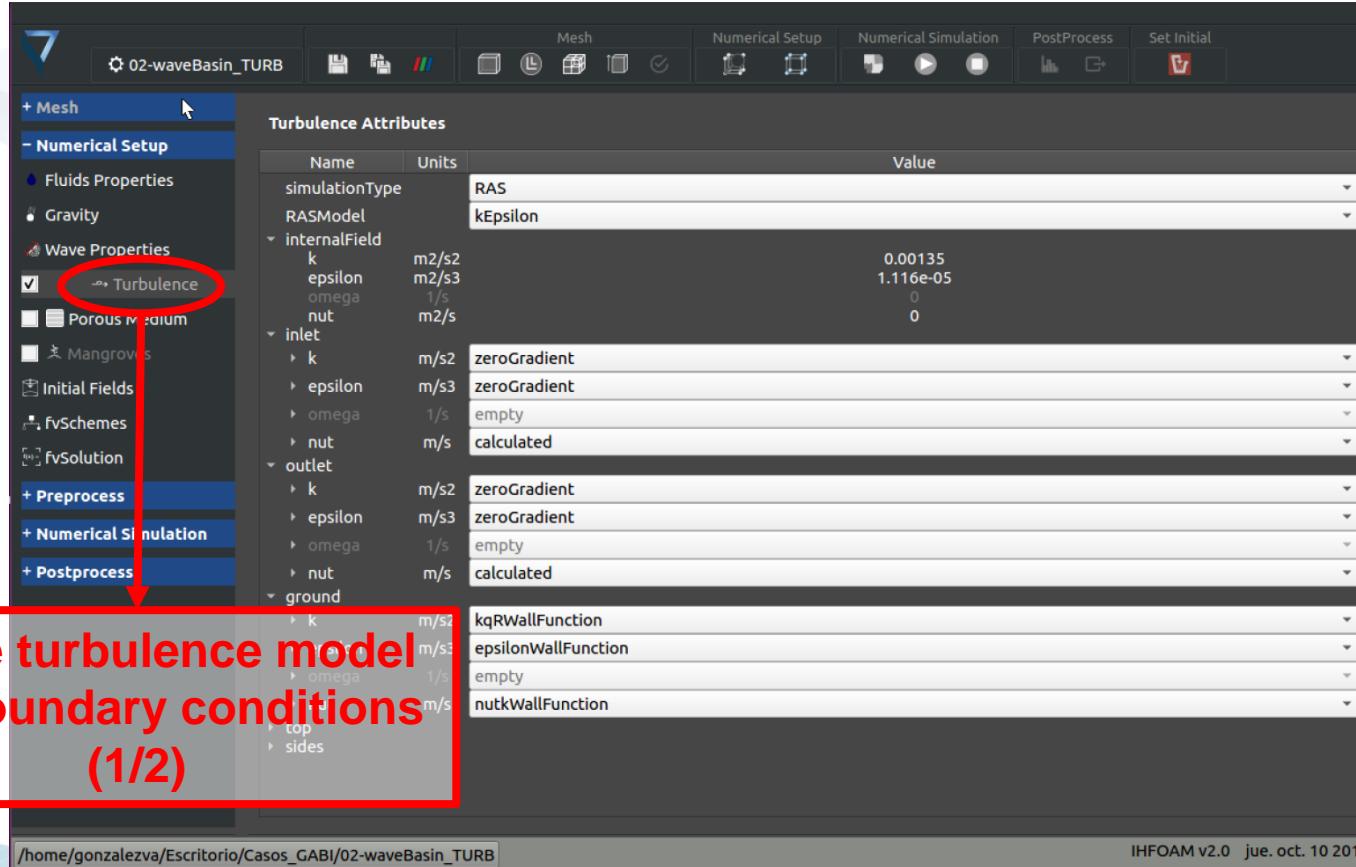


The screenshot shows the IHFOAM v2.0 software interface. The left sidebar has sections like Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties (circled in red), Turbulence, Porous Medium, Mangroves, Initial Fields, fvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main area is titled 'WaveProp Attributes' and shows a table for 'WaveTheoryRange' with columns Name, Units, and Value. It includes parameters for wave generation (patch: inlet, model: cnoidal) and wave absorption (patch: outlet, model: shallowWaterAbsorption). A red box with the text 'Define wave properties (generation and absorption)' is overlaid on the right side of the table.

Name	Units	Value
waveGeneration		
patch	inlet	✓
waveModel	cnoidal	
wavePeriod	s	2
waveHeight	m	0.1
waveAngle	degree	45
nPaddle		5
activeAbsor...		✓
rampTime	s	2
restart		
waterDepth		
waveAbsorption		
patch	outlet	
waveModel	shallowWaterAbsorption	
nPaddle		5

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

IHFOAM v2.0 mié. oct. 9 2019

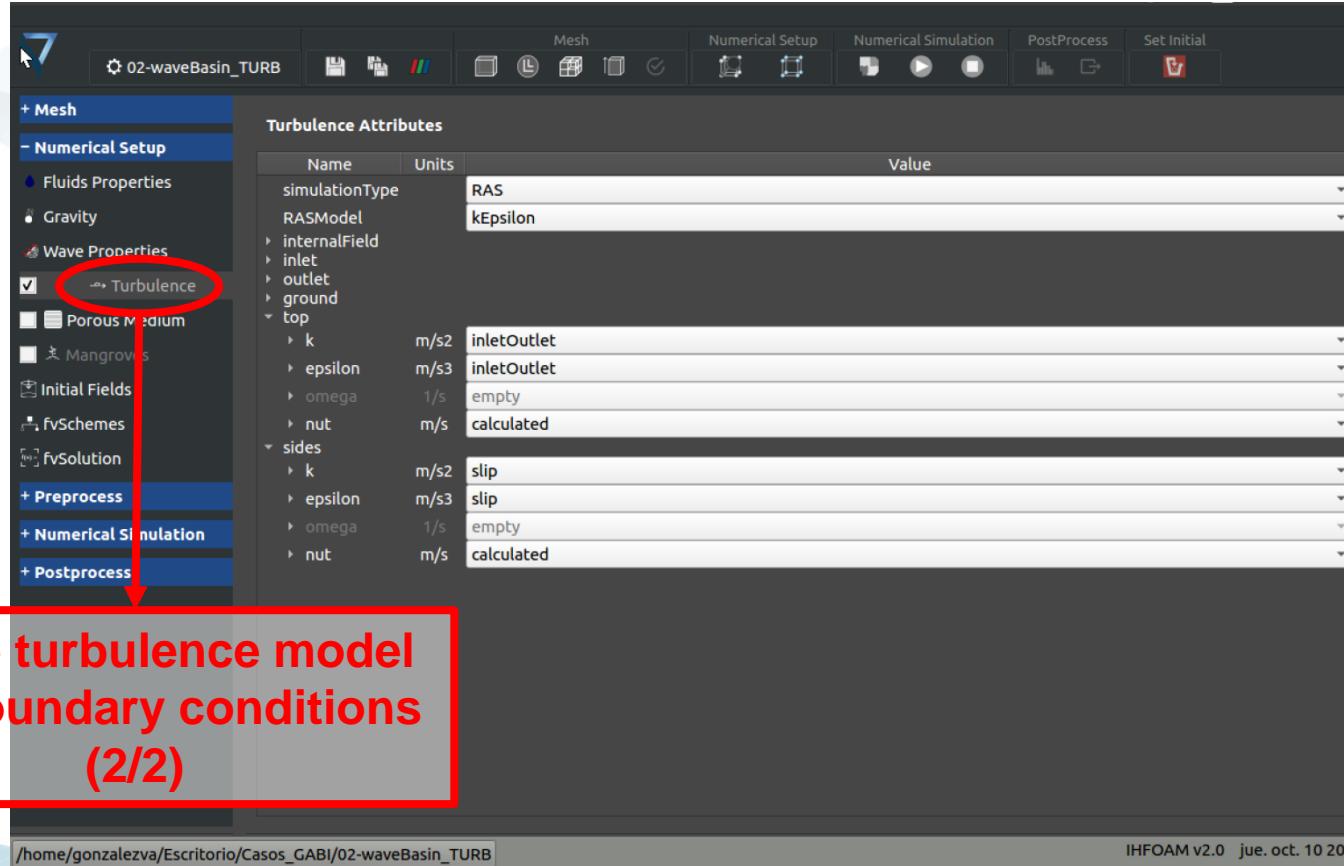


The screenshot shows the OpenFOAM graphical user interface (GUI) for a simulation named "02-waveBasin_TURB". The left sidebar contains a navigation tree with sections like Mesh, Numerical Setup, Fluids Properties, Gravity, Wave Properties (with "Turbulence" selected), Porous Medium, Mangroves, Initial Fields, fvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main panel displays "Turbulence Attributes" with a table of parameters:

Name	Units	Value
simulationType		RAS
RASModel		kEpsilon
internalField		
k	m ² /s ²	0.00135
epsilon	m ² /s ³	1.116e-05
omega	1/s	0
nut	m/s	0
inlet		
k	m/s ²	zeroGradient
epsilon	m/s ³	zeroGradient
omega	1/s	empty
nut	m/s	calculated
outlet		
k	m/s ²	zeroGradient
epsilon	m/s ³	zeroGradient
omega	1/s	empty
nut	m/s	calculated
ground		
k	m/s ²	kqrWallFunction
epsilon	m/s ³	epsilonWallFunction
omega	1/s	empty
nut	m/s	nutkWallFunction
top		
sides		

Define turbulence model and boundary conditions (1/2)

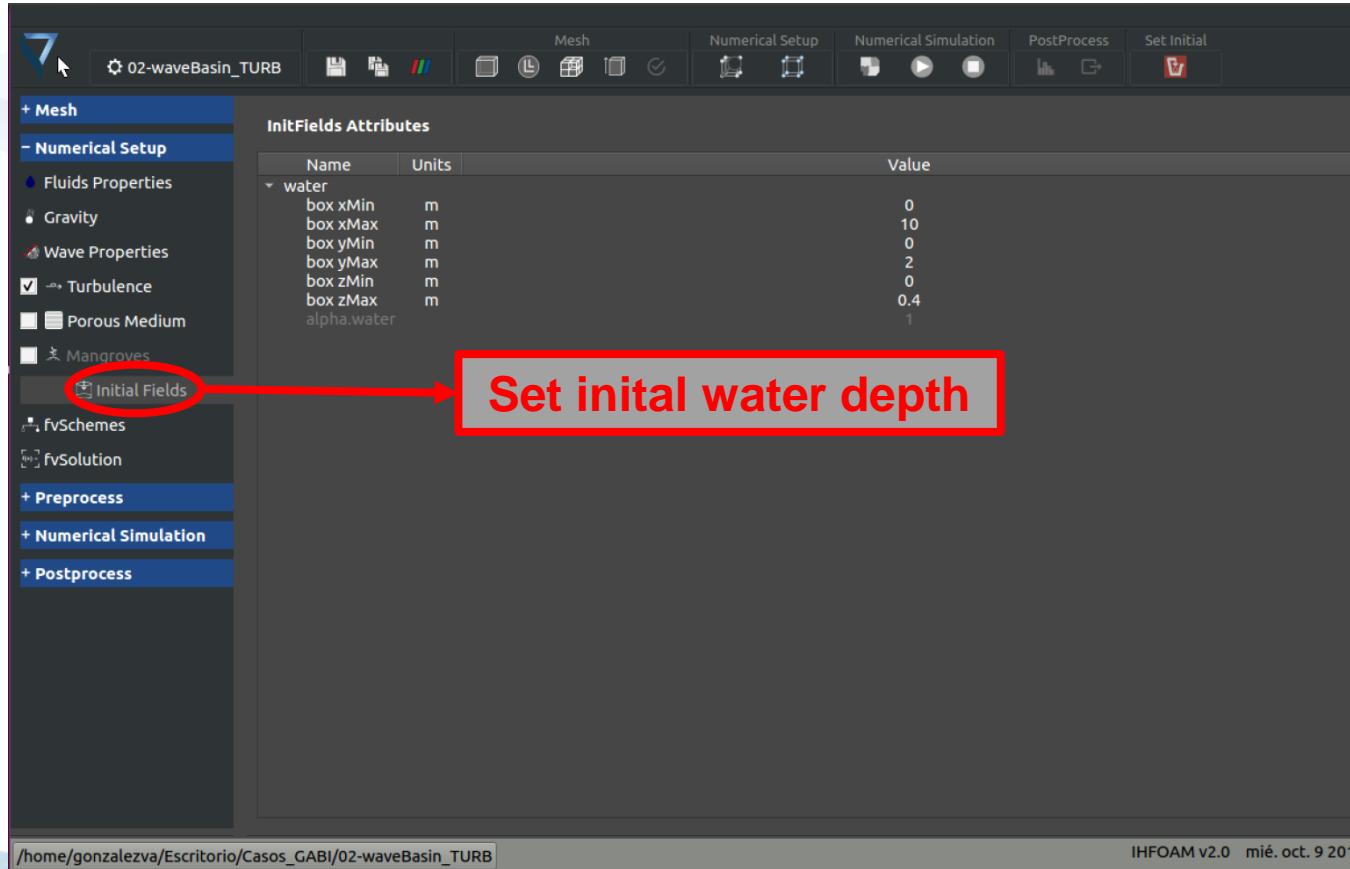
At the bottom, the file path is shown as /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB, and the software version is INFOAM v2.0 jue. oct. 10 2019.



The screenshot shows the IFOAM v2.0 software interface with the following details:

- Left Sidebar:** A tree view of simulation components:
 - + Mesh
 - Numerical Setup
 - Fluids Properties
 - Gravity
 - Wave Properties
 - Turbulence
 - Porous Medium
 - Mangroves
 - Initial Fields
 - fvSchemes
 - FvSolution
 - + Preprocess
 - + Numerical Simulation
 - + Postprocess
- Turbulence Attributes Panel:** A table showing turbulence parameters for different boundary conditions.

Name	Units	Value
simulationType		RAS
RASModel		kEpsilon
internalField		
inlet		
outlet		
ground		
top		
k	m/s ²	inletOutlet
epsilon	m/s ³	inletOutlet
omega	1/s	empty
nut	m/s	calculated
sides		
k	m/s ²	slip
epsilon	m/s ³	slip
omega	1/s	empty
nut	m/s	calculated
- Bottom Left Text Box:** Define turbulence model and boundary conditions (2/2)
- Bottom Status Bar:** /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB IFOAM v2.0 jue. oct. 10 2019



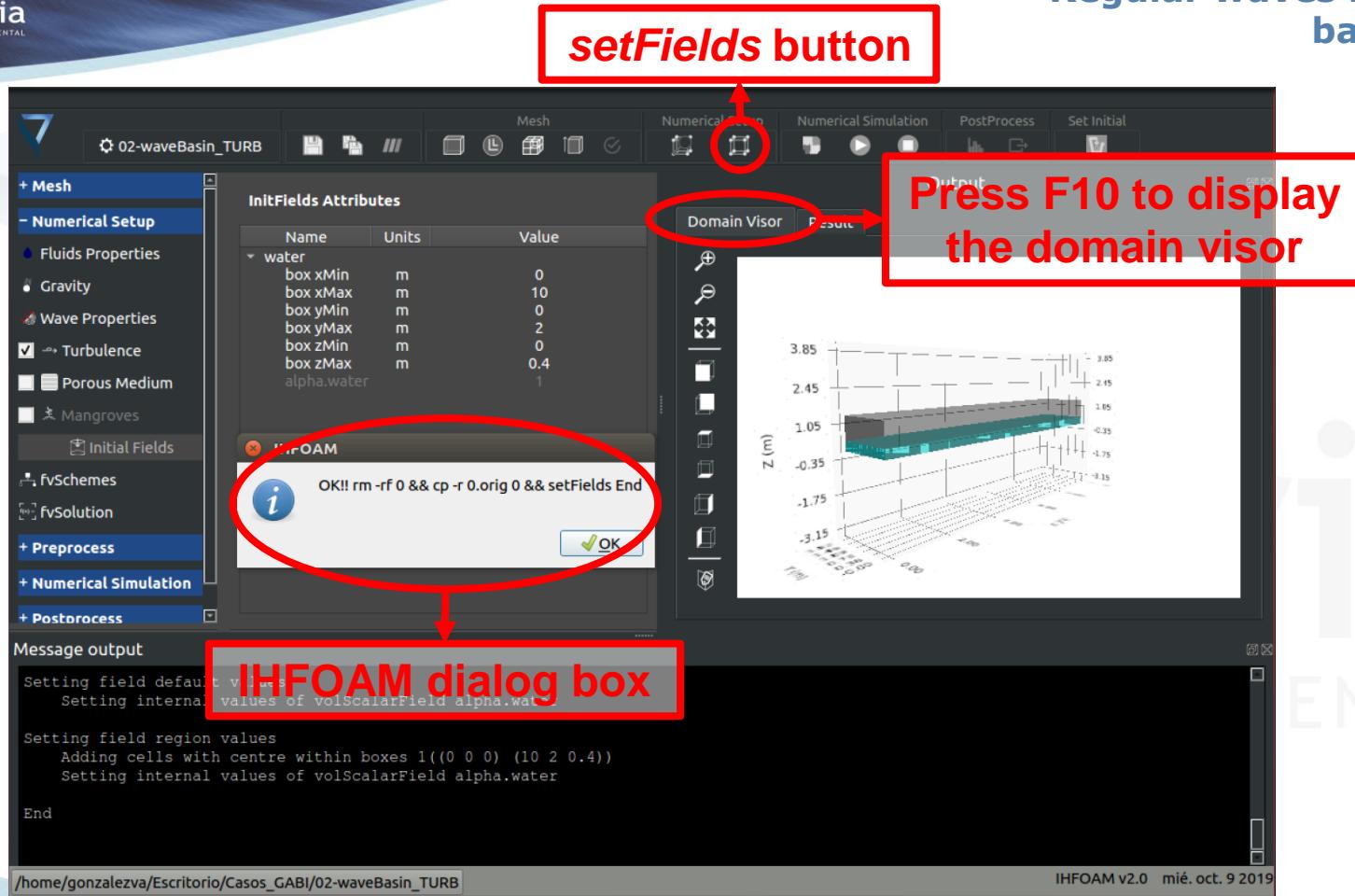
The screenshot shows the IHFOAM v2.0 software interface. The left sidebar contains a tree view of simulation components: Mesh, Numerical Setup (selected), Fluids Properties, Gravity, Wave Properties, Turbulence (checked), Porous Medium, Mangroves, Initial Fields (circled in red), FvSchemes, FvSolution, Preprocess, Numerical Simulation, and Postprocess. The right panel shows the 'InitFields Attributes' table:

Name	Units	Value
water		
box xMin	m	0
box xMax	m	10
box yMin	m	0
box yMax	m	2
box zMin	m	0
box zMax	m	0.4
alpha.water		1

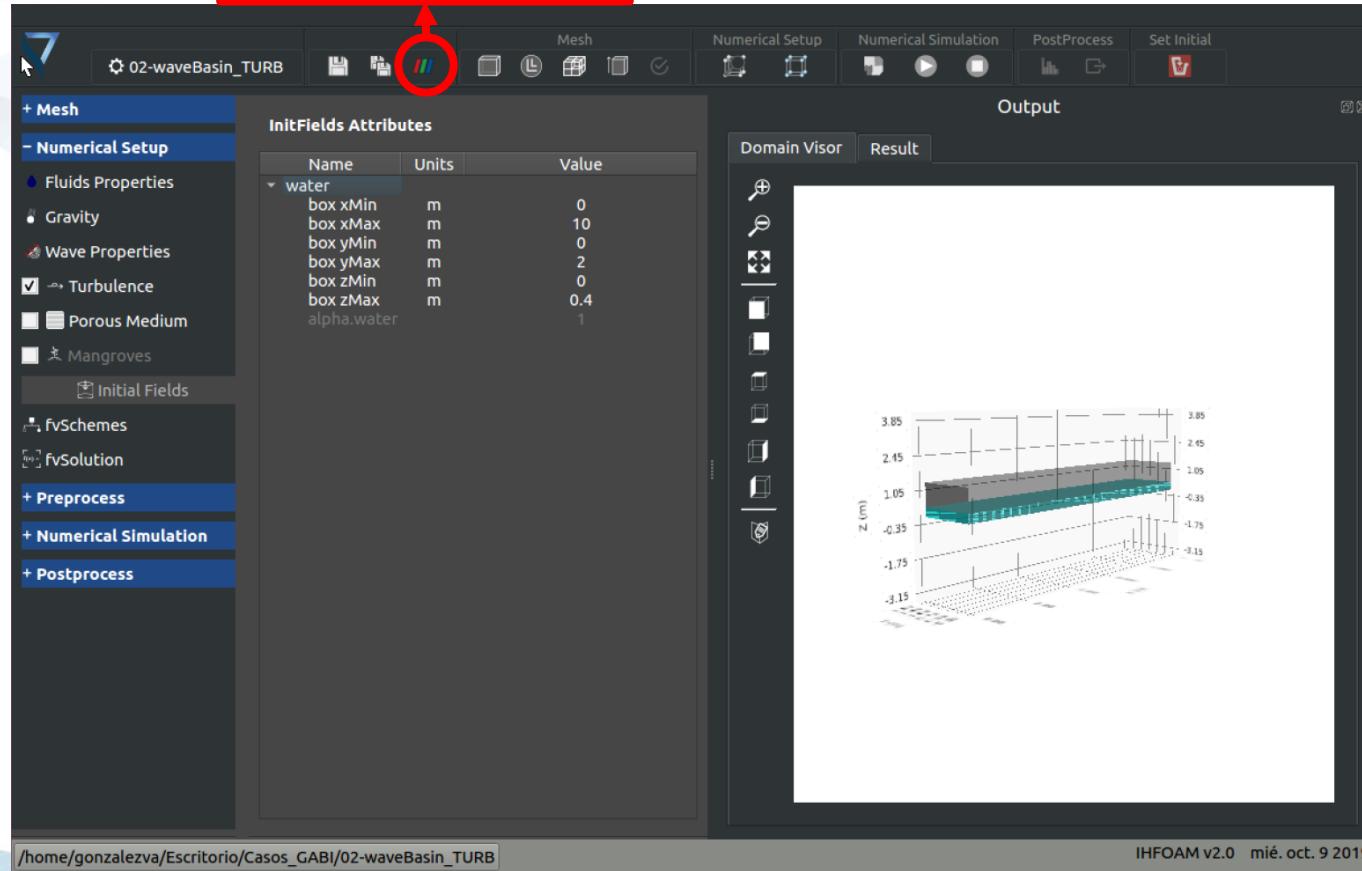
A red box highlights the text "Set initial water depth" near the "Initial Fields" button in the sidebar.

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

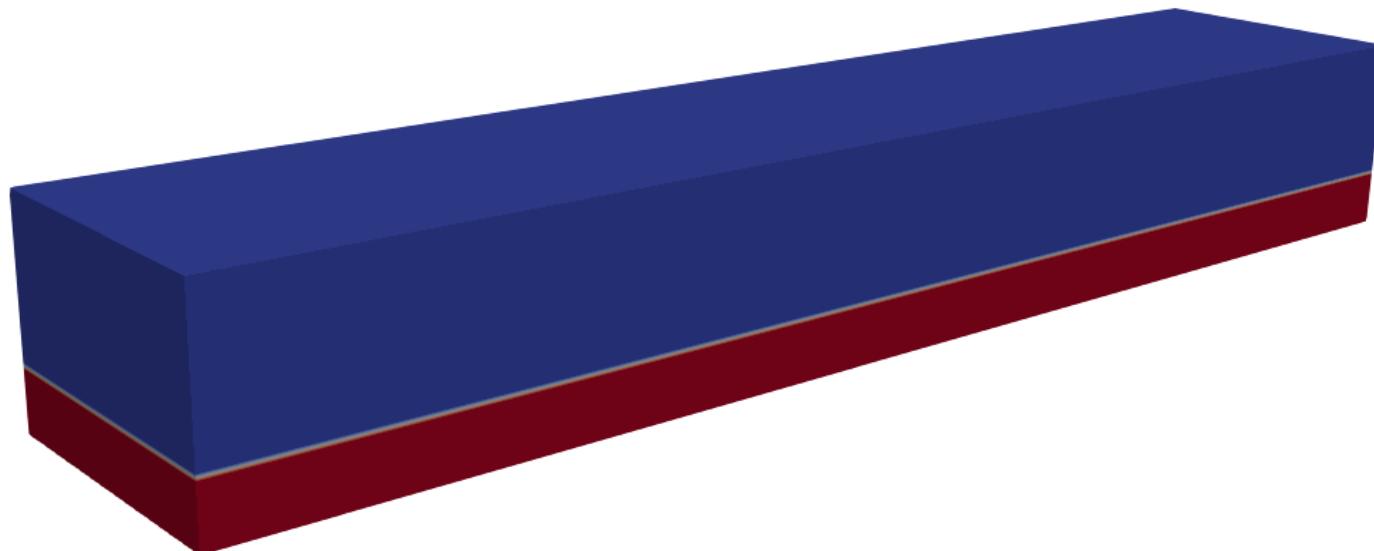
IHFOAM v2.0 mié. oct. 9 2019



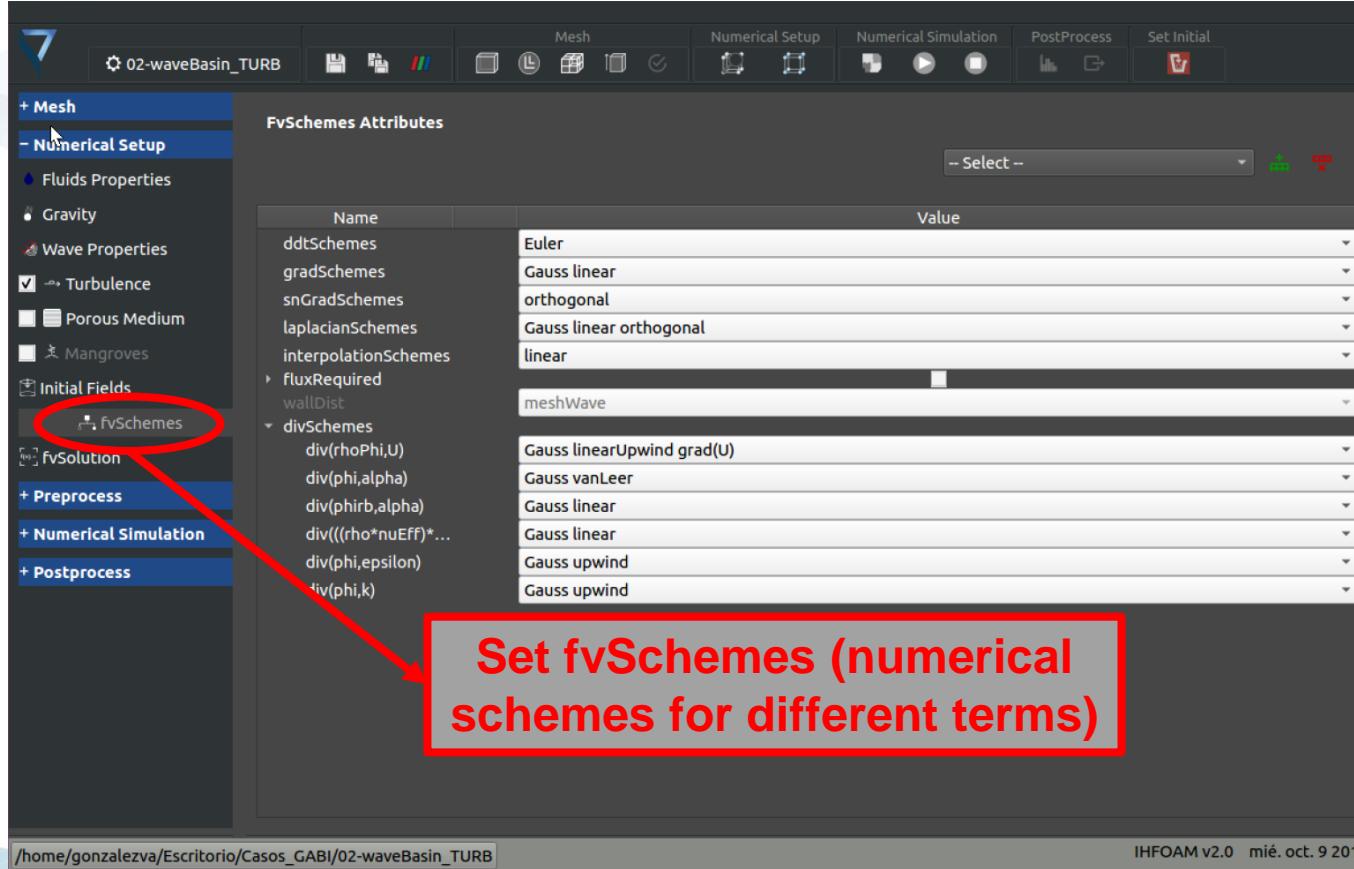
Paraview button



The screenshot shows the IHFOAM v2.0 software interface. The top menu bar includes tabs for Mesh, Numerical Setup, Numerical Simulation, PostProcess, and Set Initial. A red box highlights the "PostProcess" tab, which contains a "Paraview" button. The left sidebar has sections for Mesh, Numerical Setup (Fluids Properties, Gravity, Wave Properties, Turbulence, Porous Medium, Mangroves), Initial Fields, FvSchemes, fvSolution, Preprocess, Numerical Simulation, and Postprocess. The Numerical Setup section is currently active. The main workspace displays a 3D domain visor and a result viewer. The result viewer shows a 3D plot of a wave basin with dimensions labeled: box xMin (0 m), box xMax (10 m), box yMin (0 m), box yMax (2 m), box zMin (0 m), box zMax (0.4 m), and alpha.water (1). The plot area shows a cross-section of the basin with a wave profile. The bottom status bar indicates the file path: /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB and the version: IHFOAM v2.0 mié. oct. 9 2019.



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The screenshot shows the IHFOAM v2.0 software interface. The left sidebar contains a tree view of simulation parameters: Mesh, Numerical Setup (selected), Fluids Properties, Gravity, Wave Properties, Turbulence (checked), Porous Medium, Mangroves, Initial Fields (with FvSchemes checked), fvSolution, Preprocess, Numerical Simulation, and Postprocess. The main panel displays the 'fvSchemes Attributes' configuration. It includes a toolbar at the top with icons for saving, opening, meshing, numerical setup, simulation, postprocessing, and initial conditions. Below the toolbar is a dropdown menu labeled 'Select'. The configuration table has two columns: 'Name' and 'Value'. The 'Name' column lists various numerical schemes, and the 'Value' column shows their corresponding settings. A red circle highlights the 'FvSchemes' entry in the sidebar, and a red arrow points from this circle to a red-bordered callout box containing the text 'Set fvSchemes (numerical schemes for different terms)'.

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

Set fvSchemes (numerical schemes for different terms)

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

IHFOAM v2.0 mié. oct. 9 2019

02-waveBasin_TURB

Mesh Numerical Setup PostProcess Set Initial

+ Mesh - Numerical Setup

- Fluids Properties
- Gravity
- Wave Properties
- Turbulence
- Porous Medium
- Mangroves
- Initial Fields
- fvschemes
- fvSolution**

Set fvSolution (equations solvers, tolerances and algorithms) (1/2)

Name	Value
PIMPLE	
momentumPredictor	no
nCorrectors	2
nNonOrthogonalCorr...	0
"alpha.water.*"	
alphaOuterCorrectors	
cAlpha	
nAlphaCorr	
nAlphaSubCycles	
"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"	

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

IINFOAM v2.0 jue. oct. 10 2019

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

PIMPLE

- "alpha.water": PBiCG, DILU, 1e-06, 0.1
- "pcorr": PBiCG, DILU, 1e-06, 0
- p_rgh
- p_rghFinal
- "(U|k|epsilon|omega)"
- solver: PBiCG
- preconditioner: DILU
- tolerance: 1e-06
- relTol: 0.1

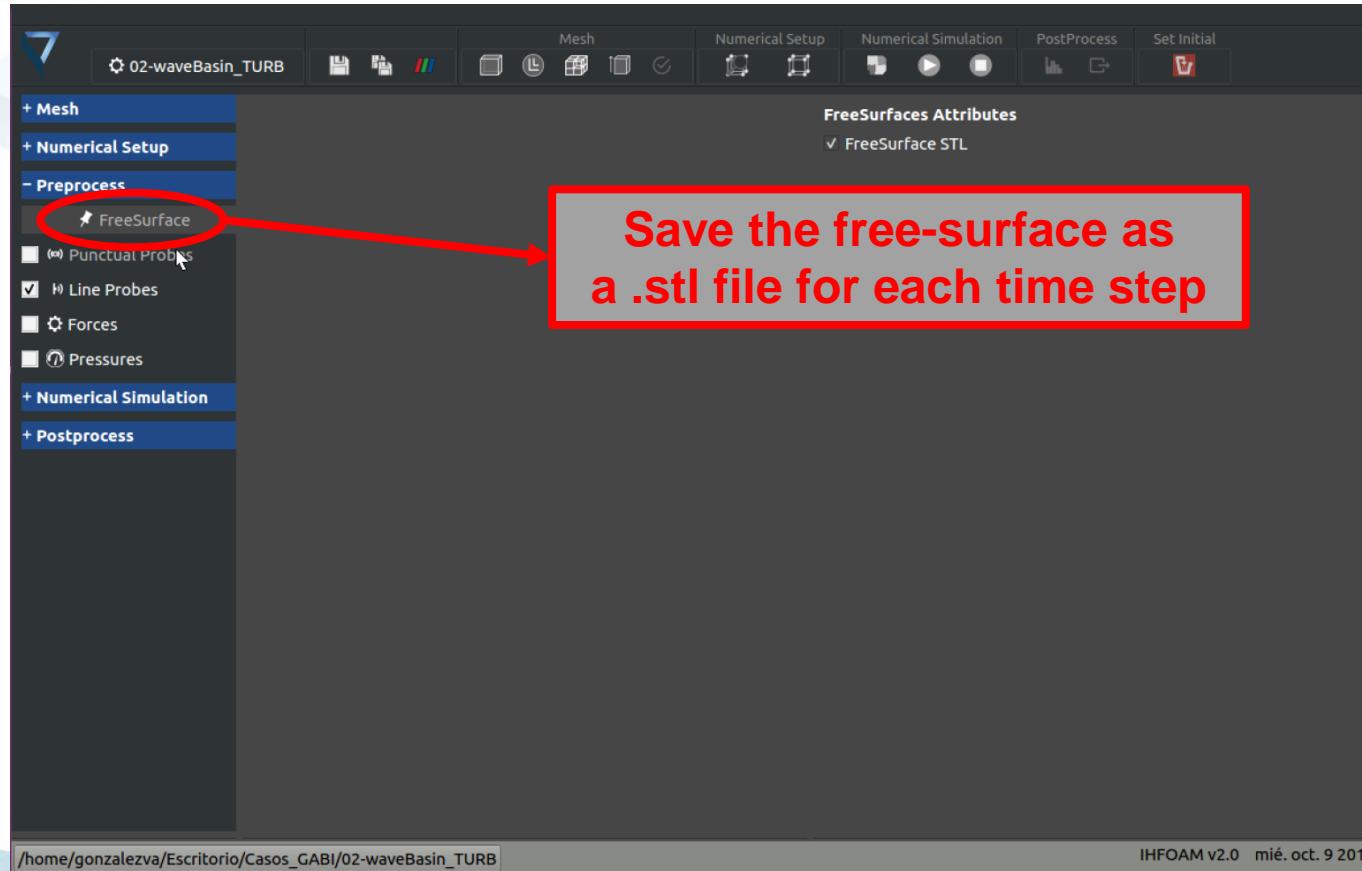
"(U|k|epsilon|omega)Final"

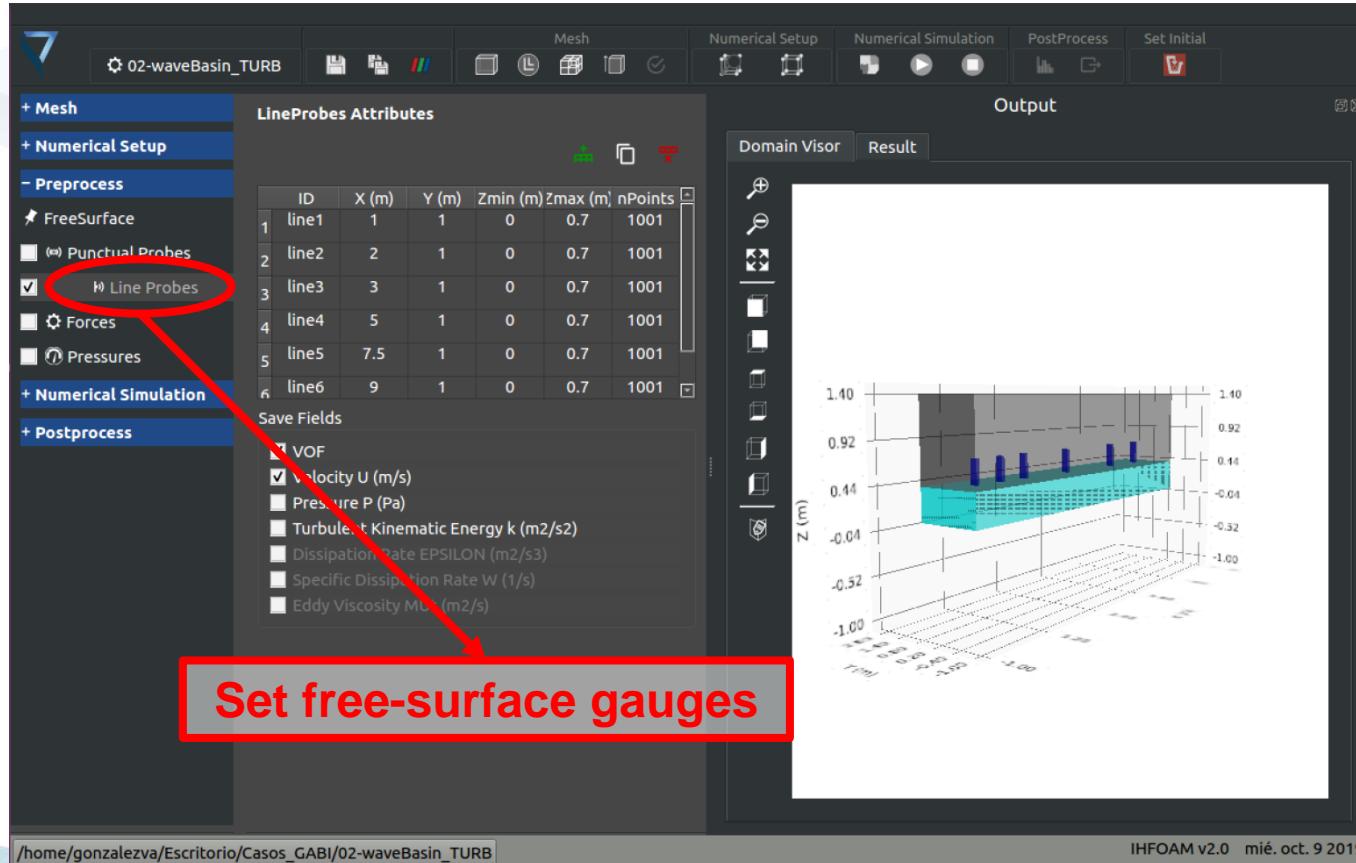
- solver: PBiCG
- preconditioner: DILU
- tolerance: 1e-06
- relTol: 0

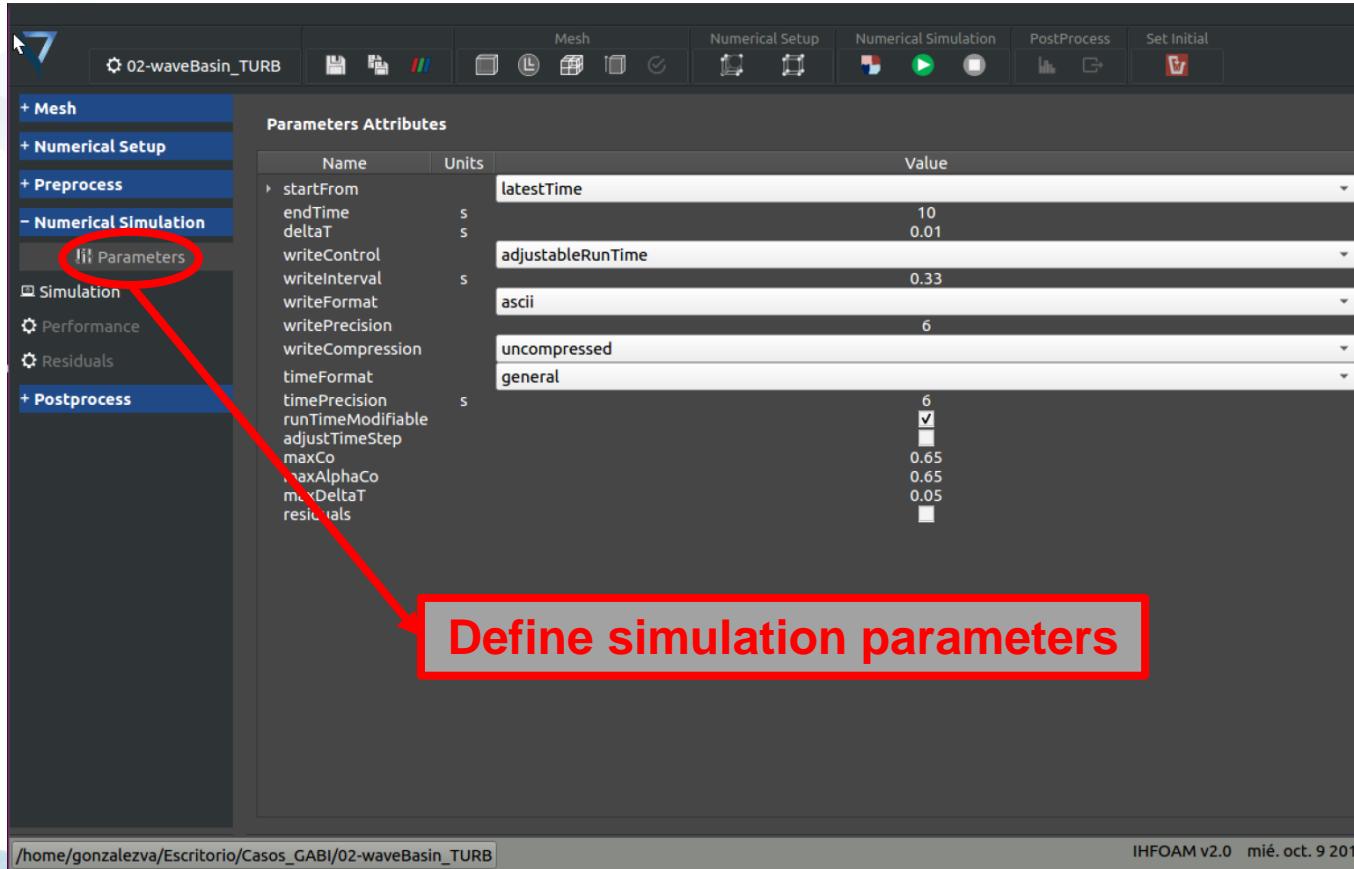
The left sidebar shows the navigation tree:

- + Mesh
- Numerical Setup (selected)
- Fluids Properties
- Gravity
- Wave Properties
- Turbulence
- Porous Medium
- Mangroves
- Initial Fields
- fvSchemes
- fvSolution (highlighted with a red circle)
- + Preprocess
- + Numerical Simulation
- + Postprocess

The status bar at the bottom shows the path: /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB and the version: IHFOAM v2.0 jue. oct. 10 2019.




 A screenshot of the IHFOAM v2.0 software interface. The left side shows a navigation tree with sections like Mesh, Numerical Setup, Preprocess (FreeSurface, Punctual Probes, Line Probes, Forces, Pressures), Numerical Simulation, and Postprocess. The 'Line Probes' section is highlighted with a red circle, and a red arrow points from it to a red box containing the text 'Set free-surface gauges'. The central part of the interface displays 'LineProbes Attributes' with a table of six entries for 'line1' through 'line6', each with coordinates (X, Y, Zmin, Zmax) and nPoints. Below this is a 'Save Fields' section with checkboxes for VOF, Velocity U (m/s), Pressure P (Pa), etc. On the right, a 3D 'Domain Visor' window shows a 3D domain with a grid and several vertical blue line segments representing the free-surface gauges. The bottom status bar shows the path '/home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB' and the date 'mié. oct. 9 2019'.

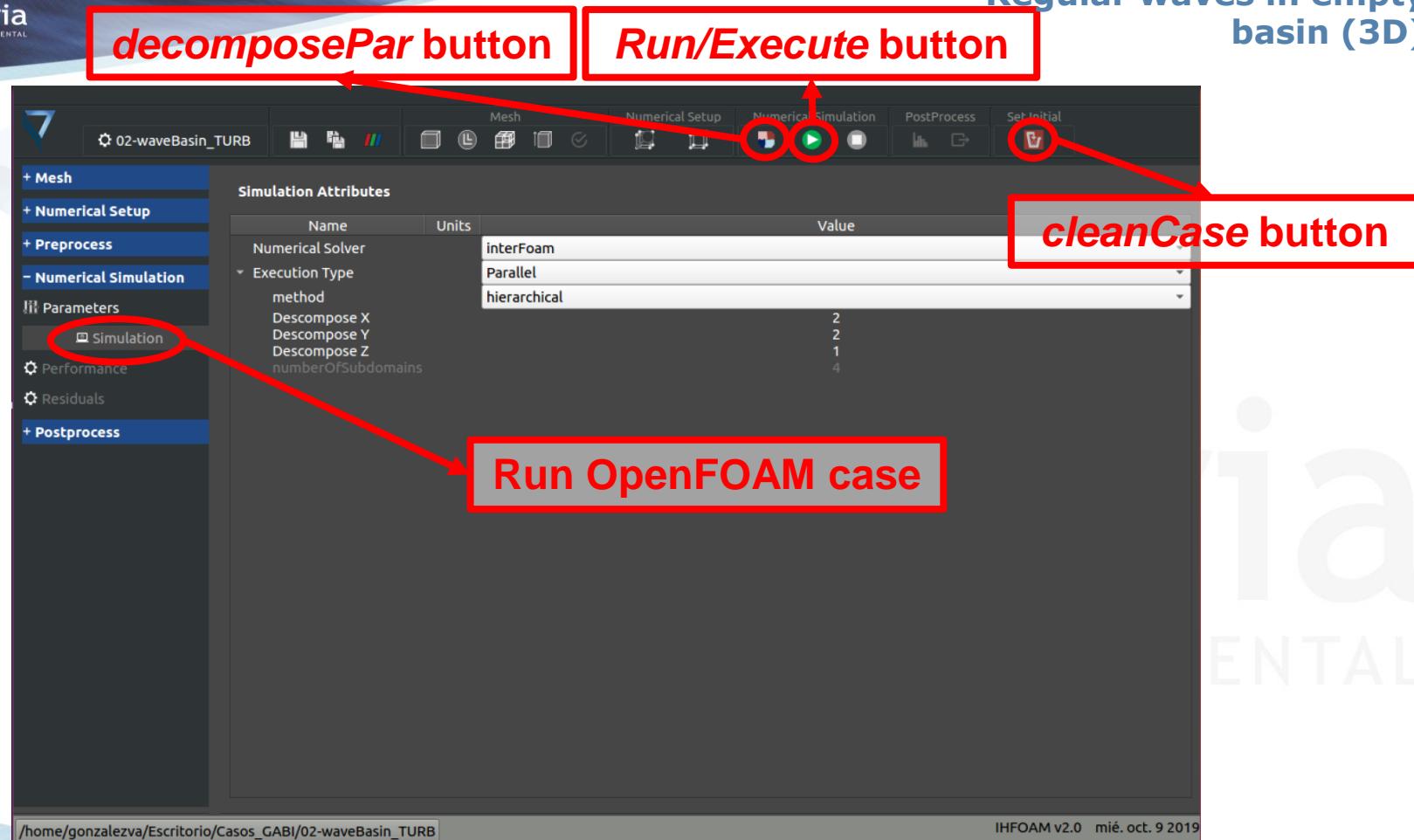


The screenshot shows the IHFOAM v2.0 software interface. On the left, a sidebar lists project components: Mesh, Numerical Setup, Preprocess, Numerical Simulation (which is expanded), Parameters (highlighted with a red oval), Simulation, Performance, Residuals, and Postprocess. The main area displays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

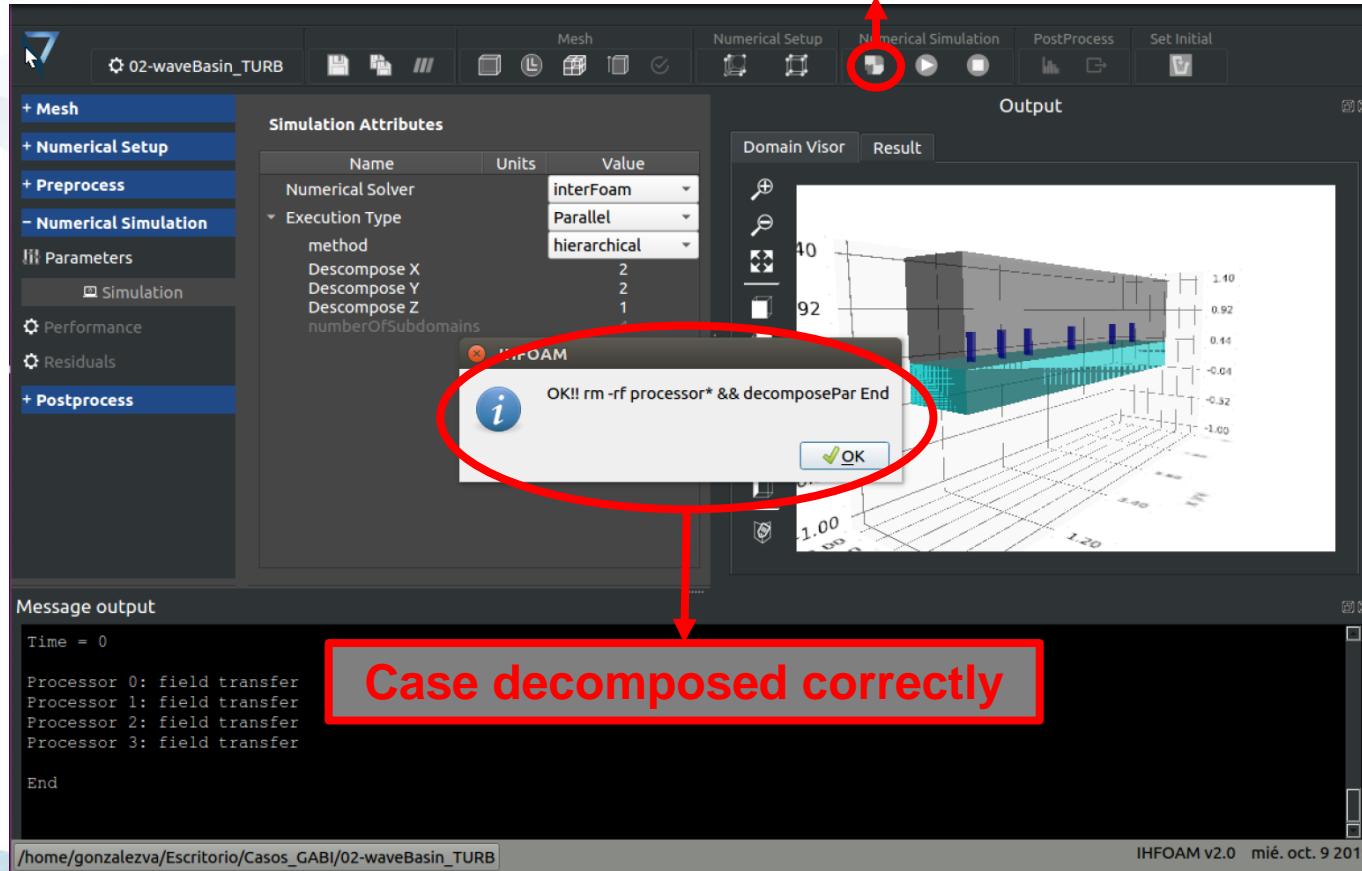
Name	Units	Value
startFrom		latestTime
endTime	s	10
deltaT	s	0.01
writeControl		adjustableRunTime
writeInterval	s	0.33
writeFormat		ascii
writePrecision		6
writeCompression		uncompressed
timeFormat	s	general
timePrecision		6
runTimeModifiable		<input checked="" type="checkbox"/>
adjustTimeStep		<input type="checkbox"/>
maxCo		0.65
maxAlphaCo		0.65
maxDeltaT		0.05
residuals		<input type="checkbox"/>

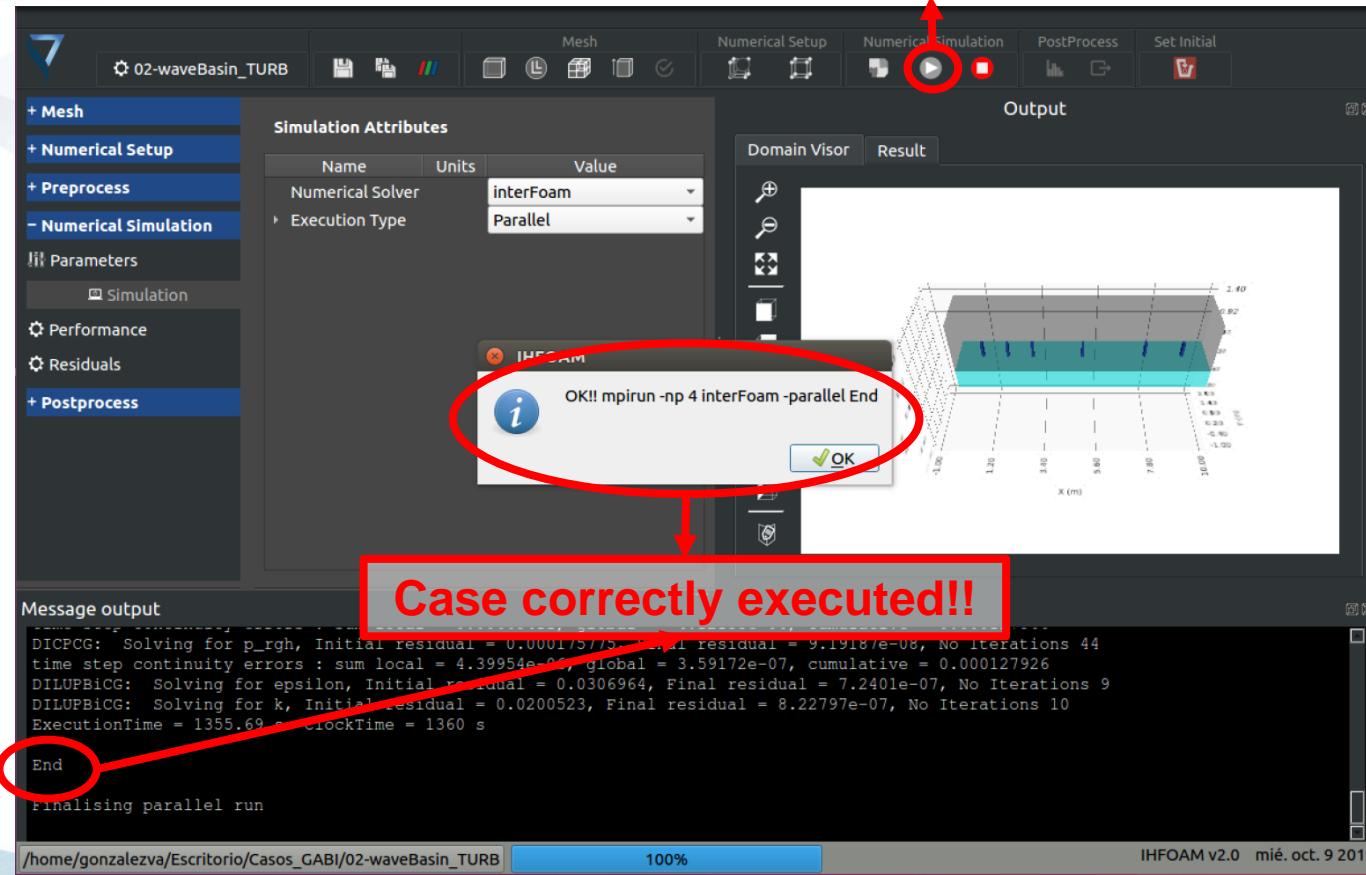
A large red arrow points from the "Parameters" section in the sidebar to a red-bordered callout box containing the text "Define simulation parameters".

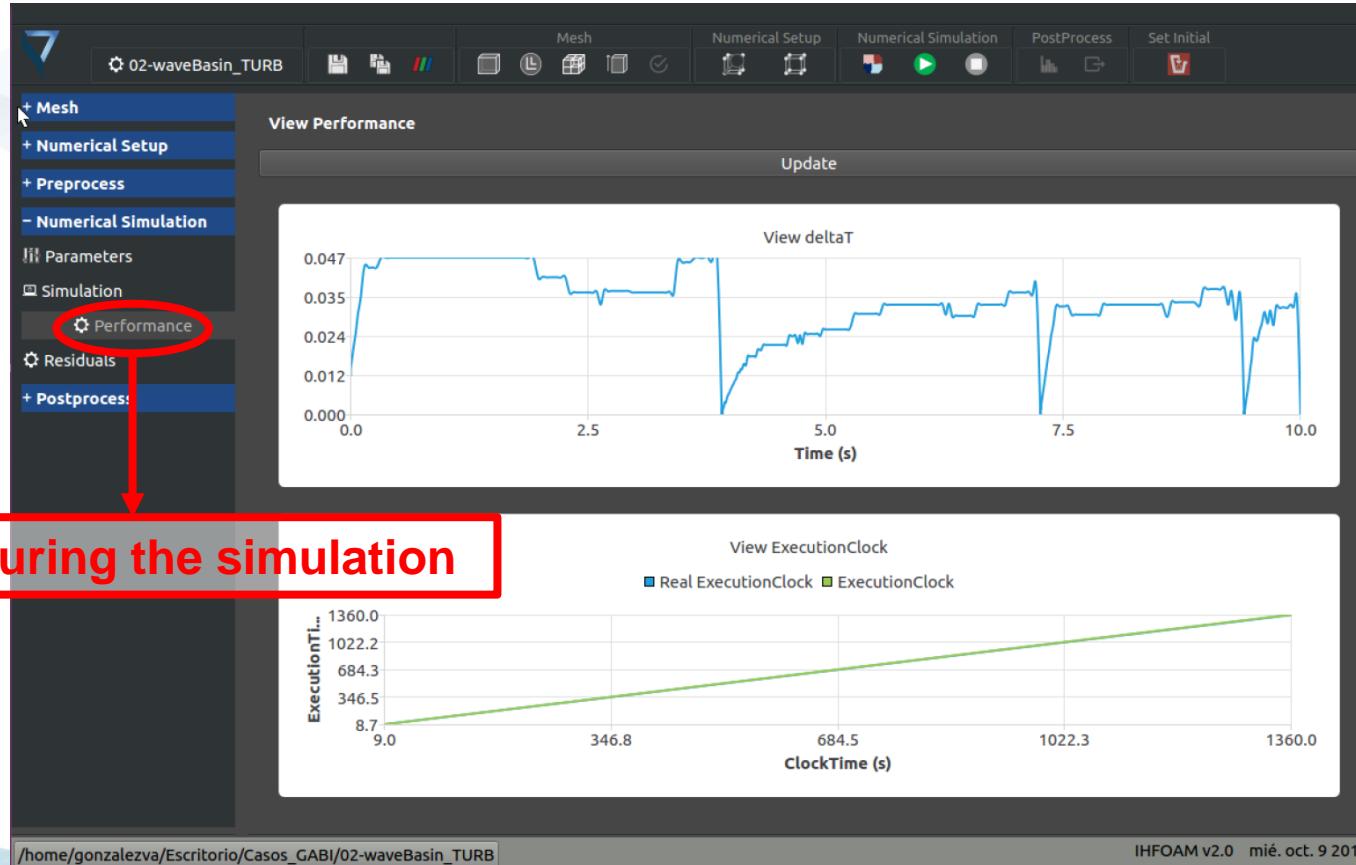
At the bottom of the interface, the path is shown as: /home/gonzalezva/Escritorio/Casos_GABI/02-waveBasin_TURB. The bottom right corner indicates the version: IHFOAM v2.0 mié. oct. 9 2019.

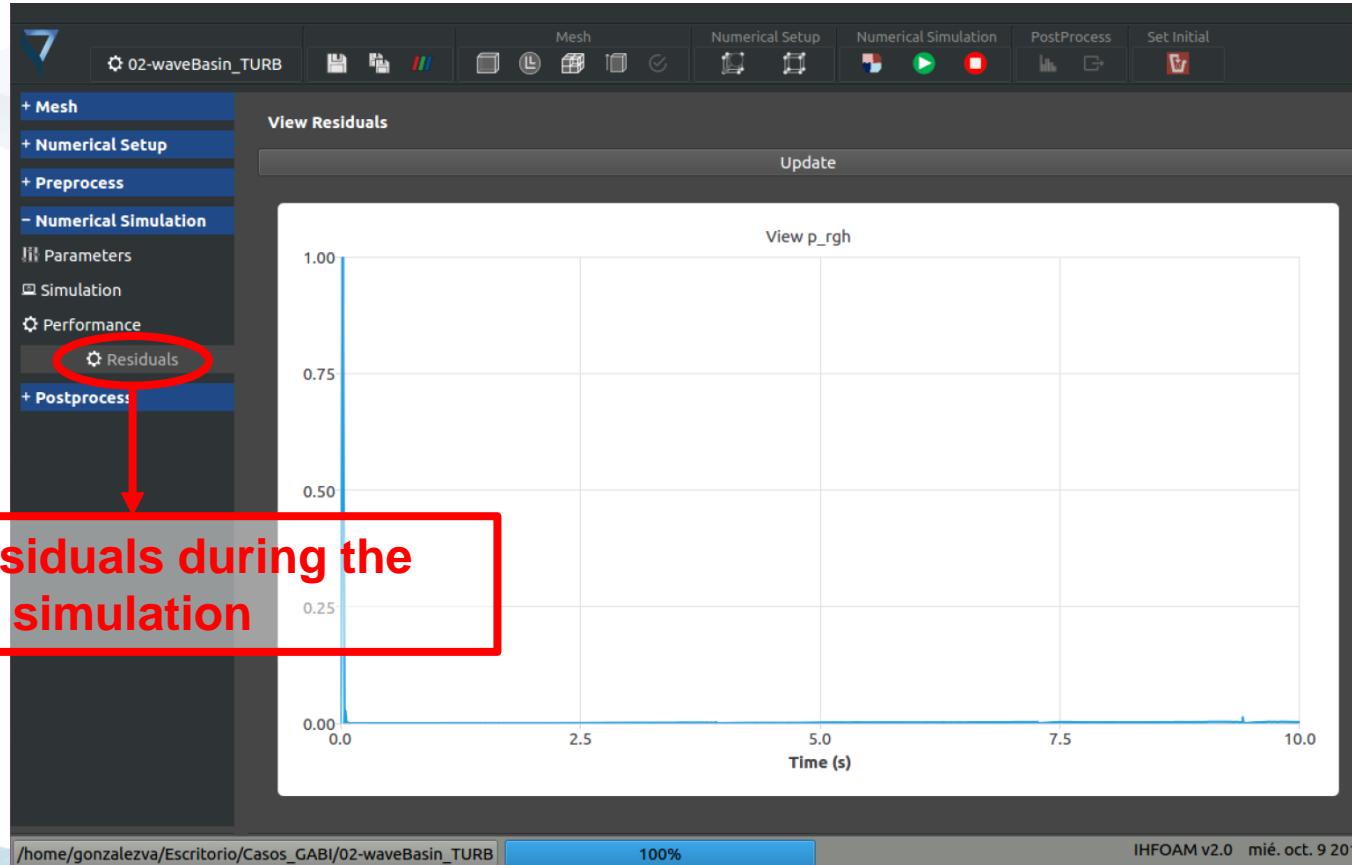


decomposePar button

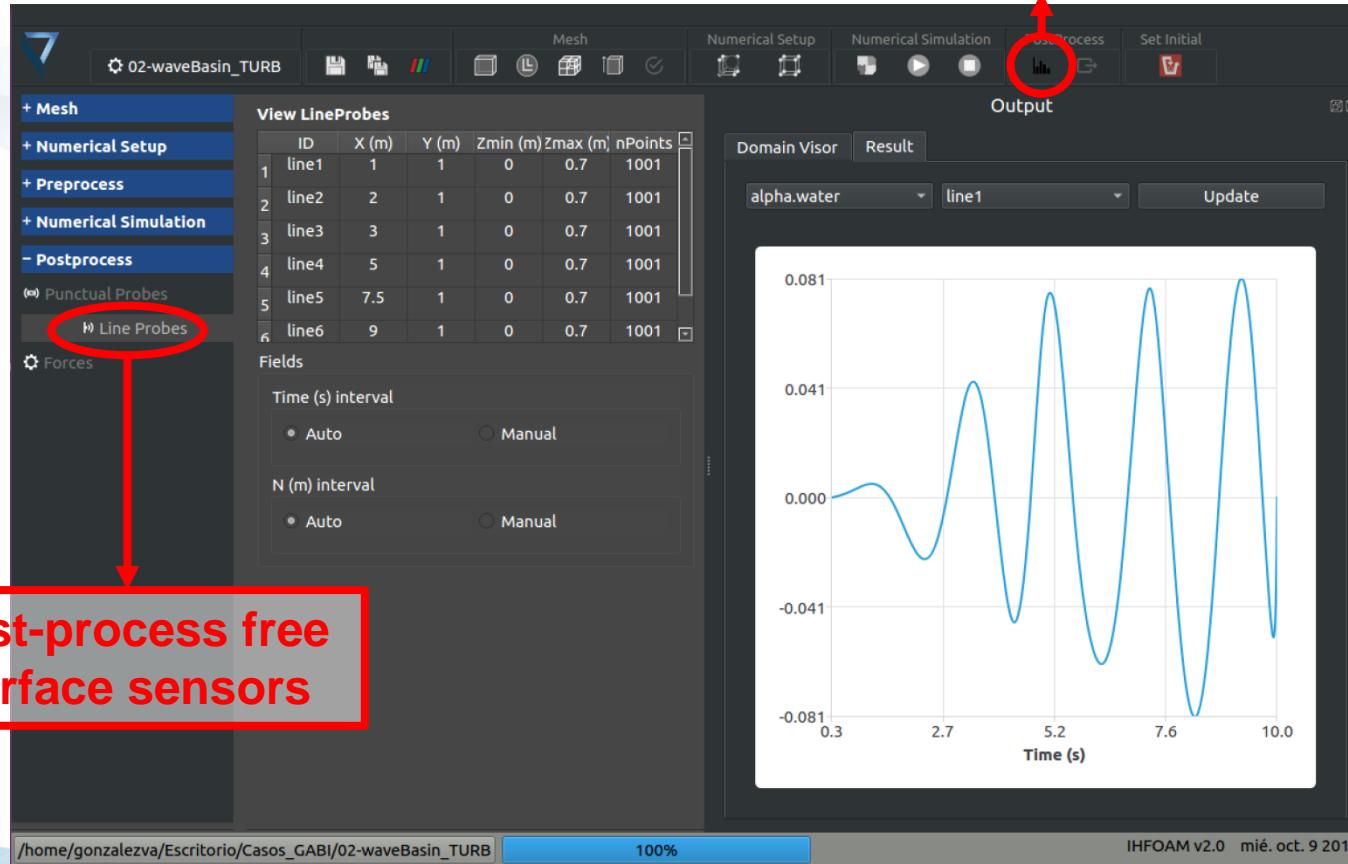




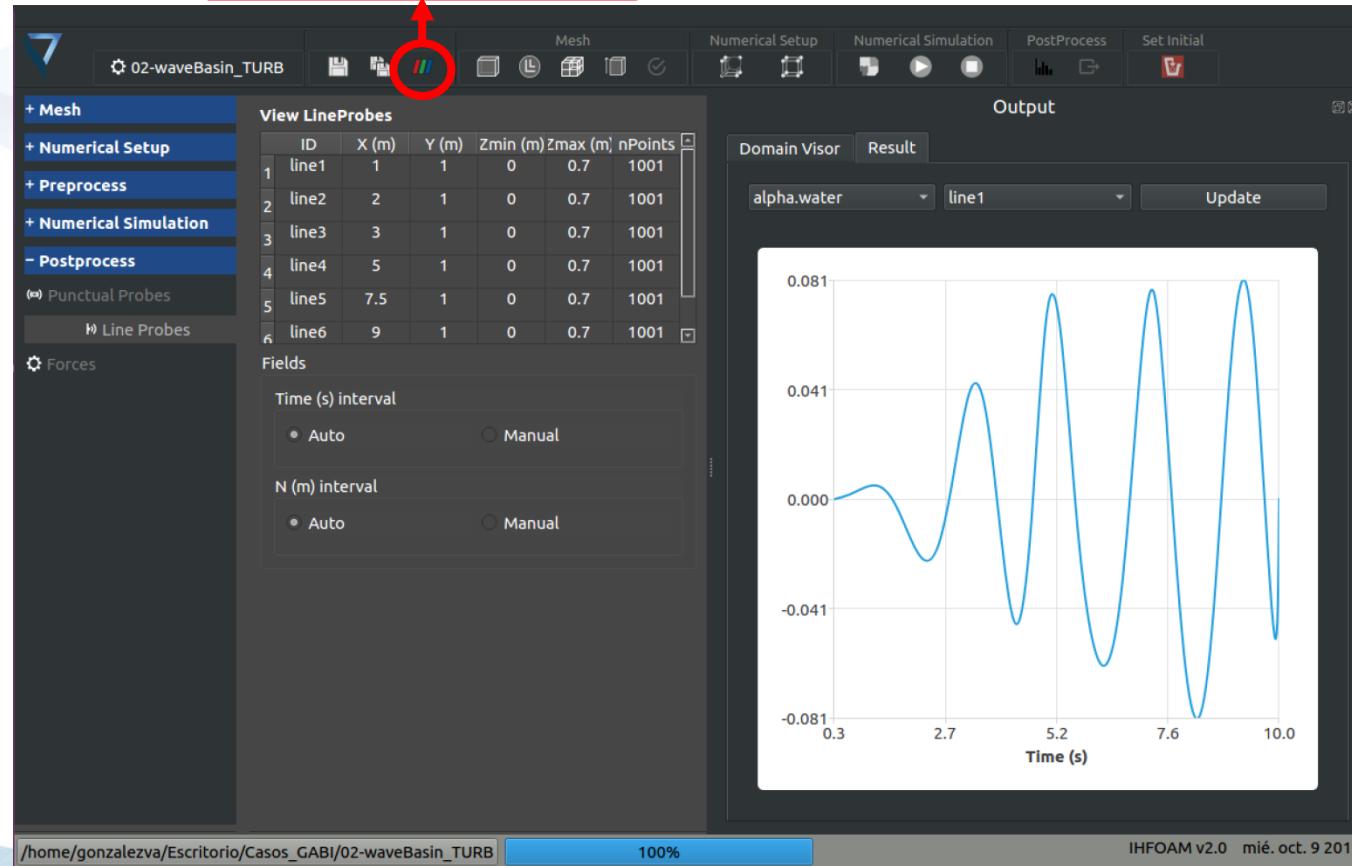


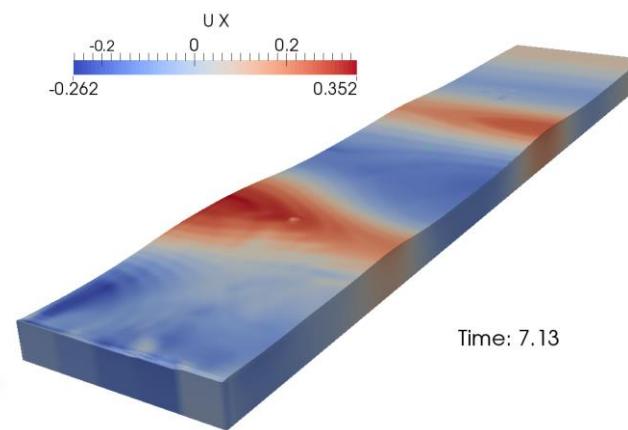
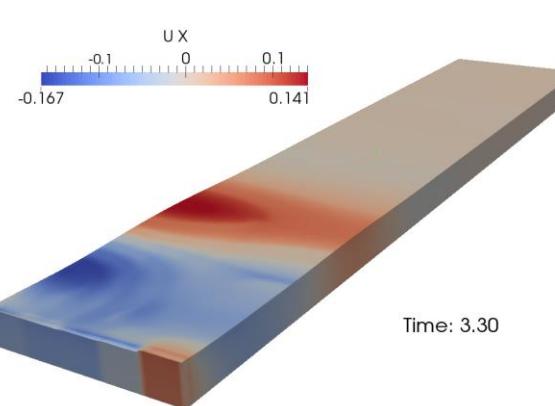
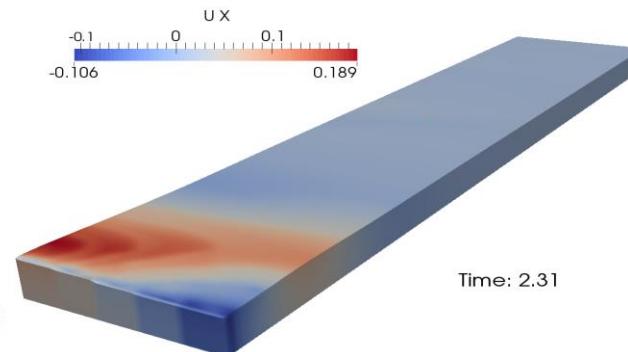
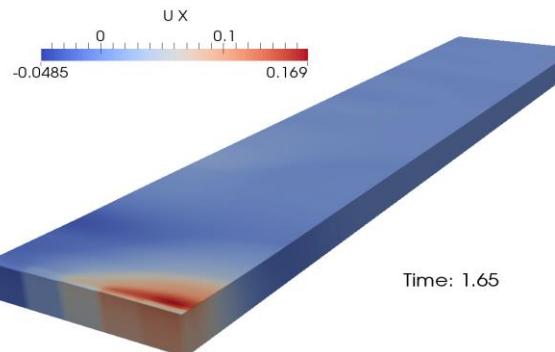


plot free surface sensors



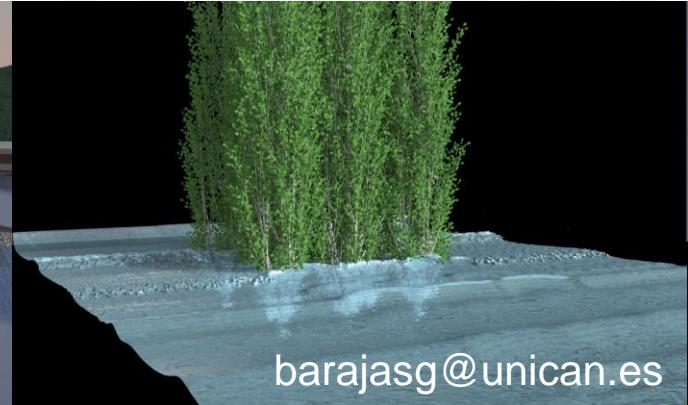
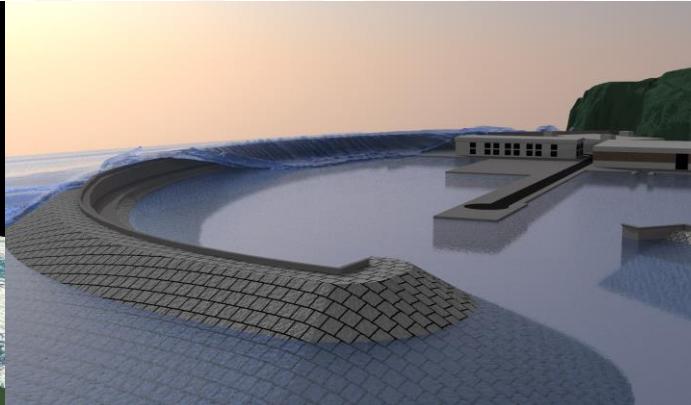
Post-process free
surface sensors







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