# 3D Modelling of Porcupine River Training Works

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## ABSTRACT

Porcupines are popularly used river training works that are deployed to retard the flow velocity of rivers thereby preventing river bank erosions. They have already been used in major Indian Rivers such as The Brahmaputra and The Ganga. However, it has been seen that these structures often fail to perform adequately during periods of high floods and are often washed away. This simulation aims to map the zone of influence of scaled down porcupine structures placed in a laboratory flume of IIT Guwahati assuming steady, incompressible and turbulent flow field within OpenFOAM. Results obtained were then compared with experimental results.

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| Module Name | simpleFoam |
| Simulation Time | 36000 seconds |
| Fluid type | Newtonian |
| Viscosity | 1.5e-05 |
| Turbulence Model | kOmegaSST |
| Simulation Type | RAS |
| Computer Specifications | HP Z200 SFF Workstation<br>Intel Xeon Processor X3430 2.40 GHz, 8MB cache, 1333 MHz memory<br>8 GB RAM |
| Operating system and softwares | Linux Ubuntu 20.04 with openFOAM v8 |

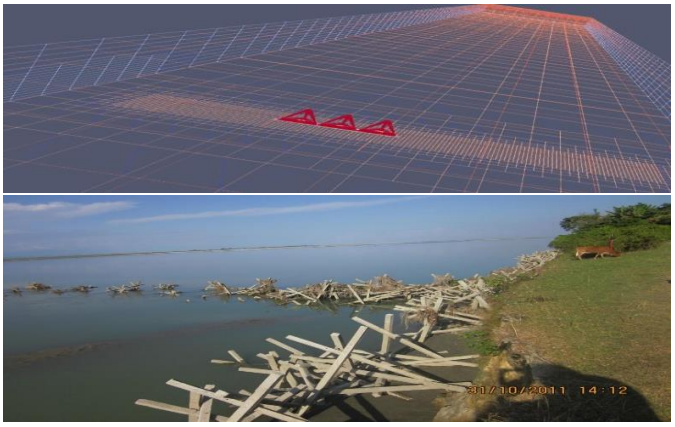

Figure 1: Top figure shows geometry used in simulation (Generated using ParaView). Red colour structures at center represent porcupines. Bottom figure shows field photograph of porcupines in Brahmaputra River (Source: Water Resources Department, Government of Assam, India)

## METHODOLOGY

This simulation deals with flow around objects. Geometrically scaled down porcupine structures were generated using CAD software, and the snappyHexMesh utility within openFOAM was used to incorporate these structures into the model (Figure 1). For solid boundaries, kqrWallFunction was used to model the boundary layer formation. The computational domain used was a full-scale rectangular laboratory flume model having dimensions 20 m in length and 1 m in width. Porcupine structures were then placed near the centre of the computational domain. Finer mesh structures were generated near the porcupine structures using snappyHexMesh utility. Finally 10 hour flow simulations were carried out. Results were generated using paraview for contour maps and probes function for velocity profiles.