Nature Gas Disperion Simulation with OpenFOAM

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Purpose Investigate the spatial distribution of natural gas concentration resulting from dispersion on a ship

Outline We investigate the nature gas concentration spatial distribution in 200 seconds with different wind speed and monitoring points.

Computing system: SQUID General (v60840) Purpose CPU nodes

node-hour	6000 node-hour
memory used	15000 GB
parallelize	380 nodes

Results

1.1 Geometry model

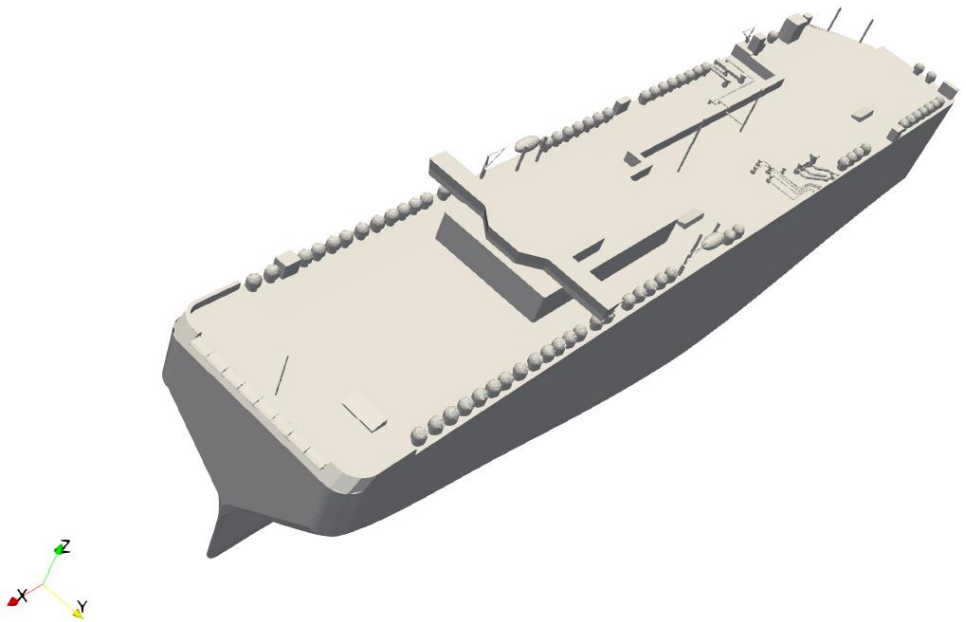

Fig. 1 3D image of the ship

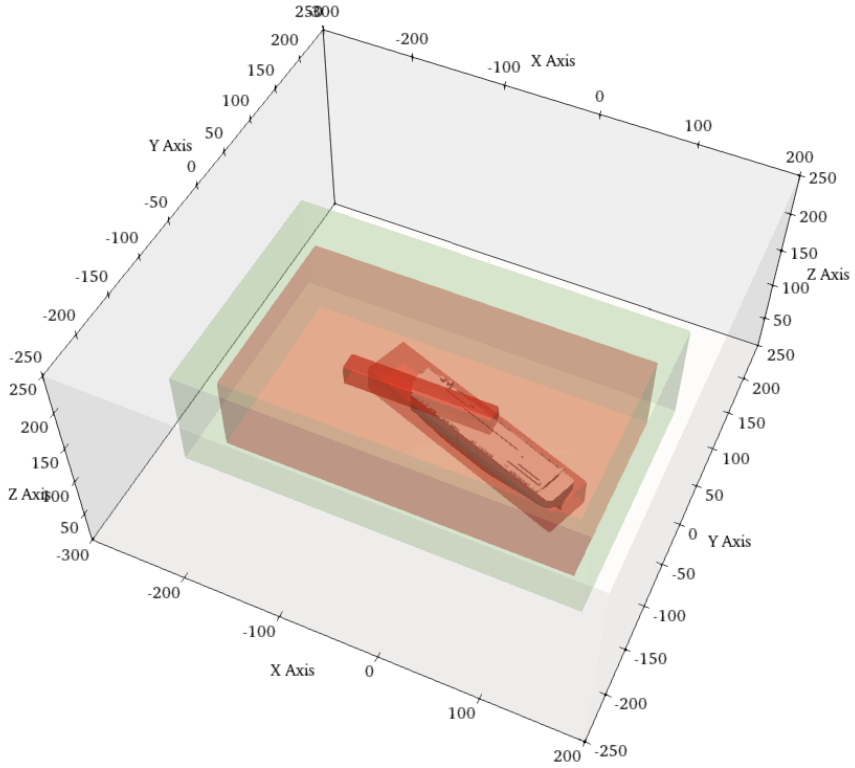

Fig. 2 Mesh refinement domain used for the case

Results

1.1 NG-concentration variation for two monitoring points

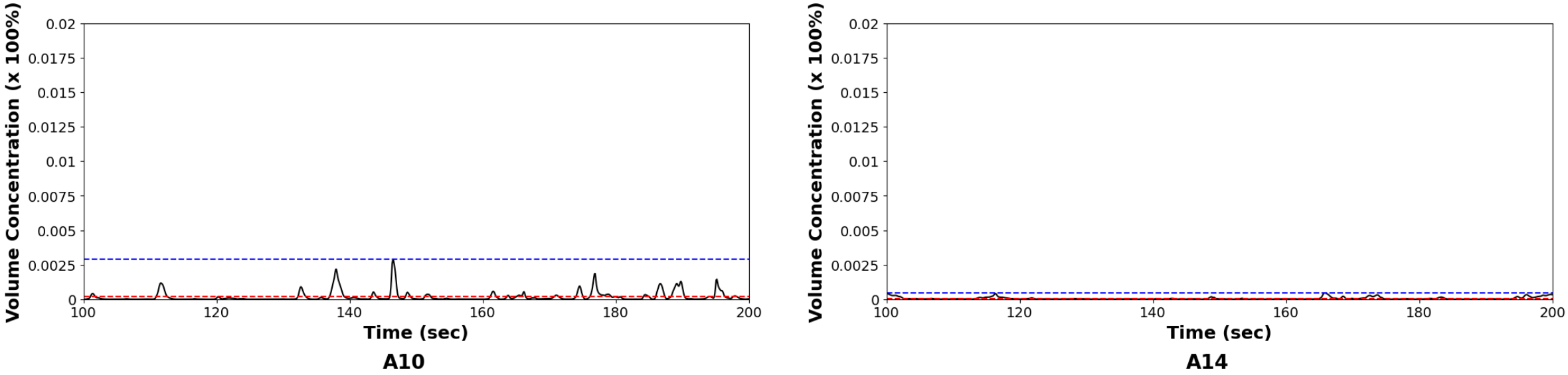

Fig. 3 Time histories of the NG-concentration variation for monitoring points at 8 m/s, where the red line: time-averaged, blue line: maximum value over time.

Results

1.2 Maximum and time-averaged NG-concentration

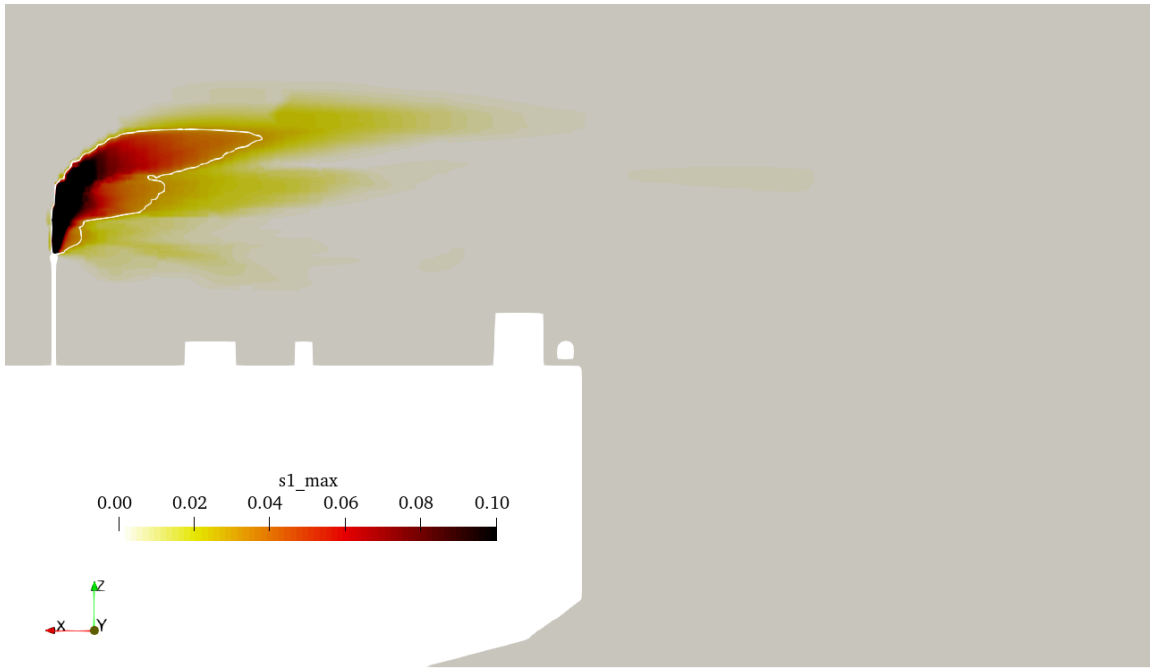

Fig. 4 Maximum NG-concentration (line: 3%) from 100s to 200s, for the cross-section of the vent post.

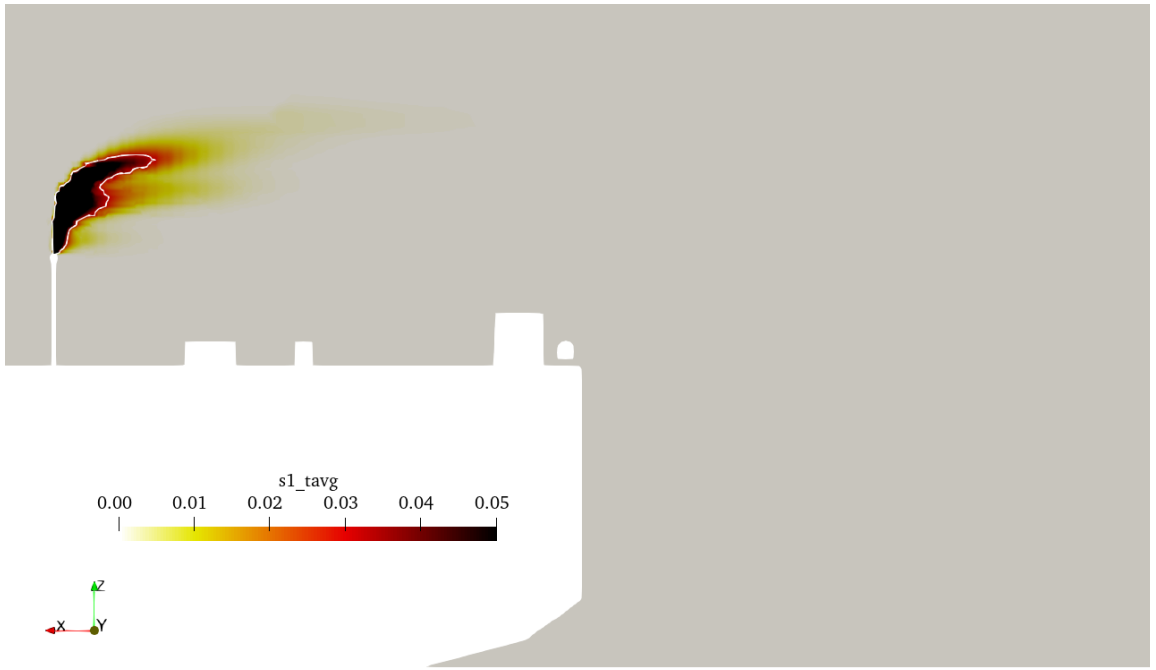

Fig. 5 Time-averaged NG-concentration (line: 3%) from 100s to 200s, for the cross-section of the vent post.

Results

1.3 Instantaneous velocity and NG concentration field

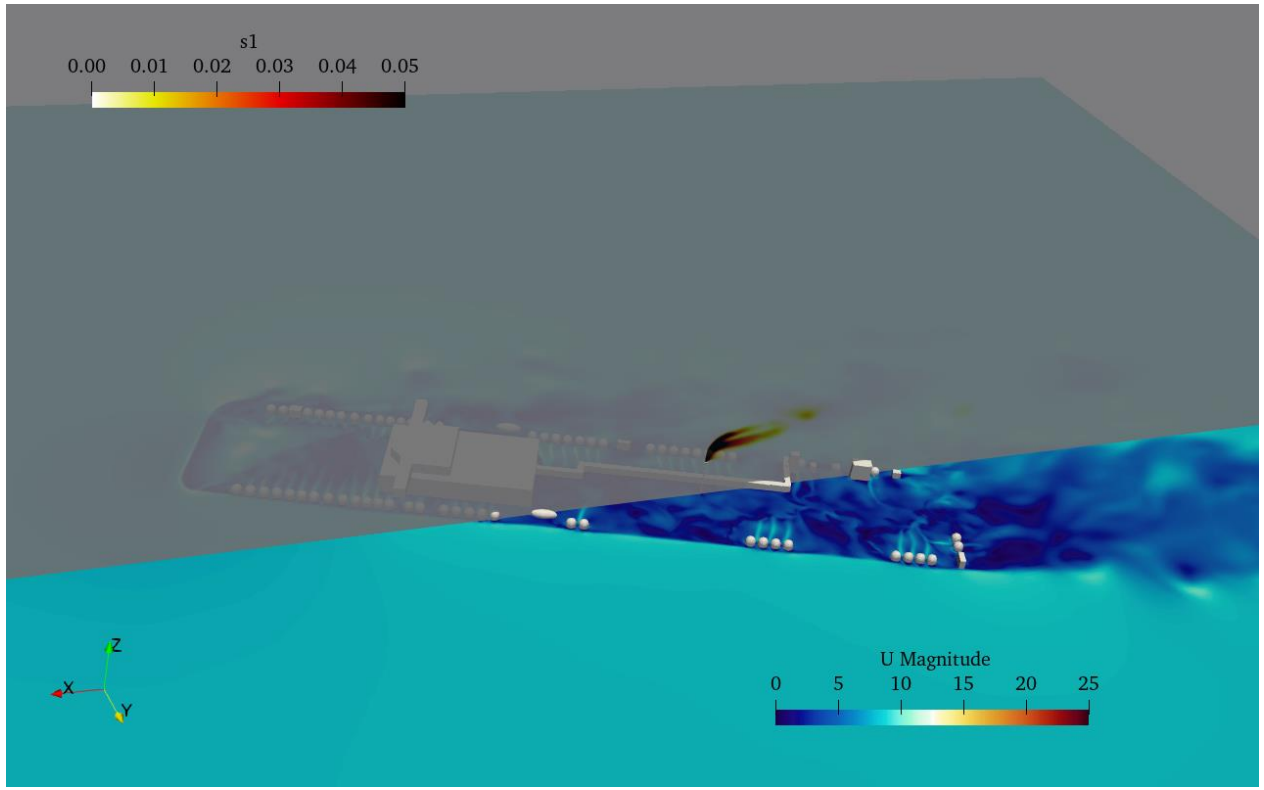

Fig. 6 Instantaneous velocity and NG concentration field at t = 200s.

Results

1.4 Instantaneous temperature and velocity field

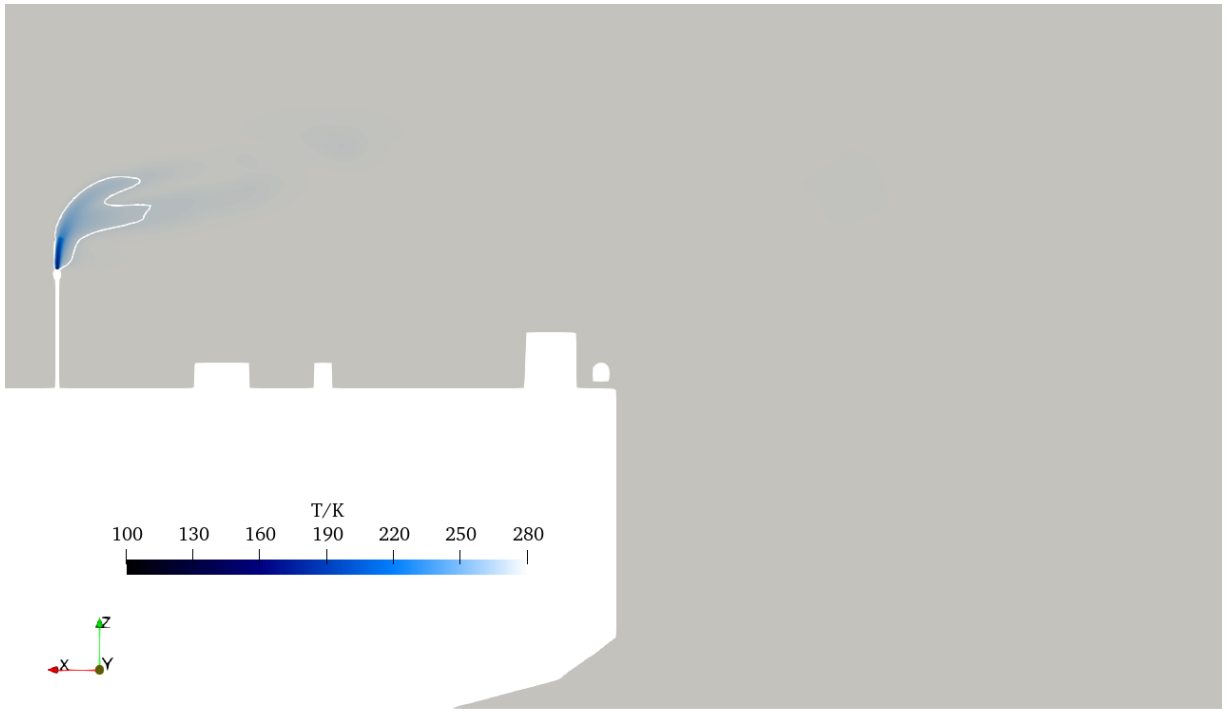

Fig. 7 Instantaneous temperature field (line: $T = 273$K) at t = 200s. ($T = 110$K at the vent)

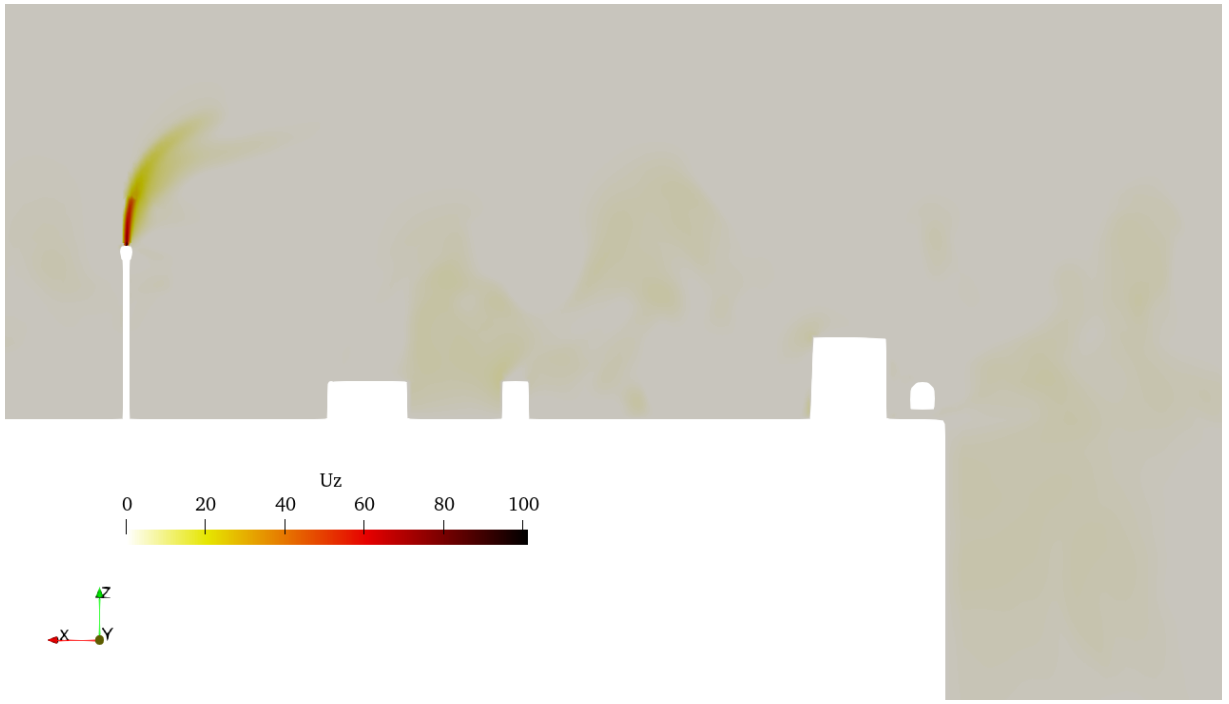

Fig. 8 Instantaneous velocity field at t = 200s. ($Uz = 101$ m/s at the vent)

Summary

1. We have investigated the nature gas concentration in 28 monitoring points in 200s at inflow wind speed U = 8m/s. The maximum concentration is observed at point A10, with a value of 0.29%. The overall safety of the ship is not affected since the monitoring points concentration is within the safety limit.