

CFD modelling of pollutant transport



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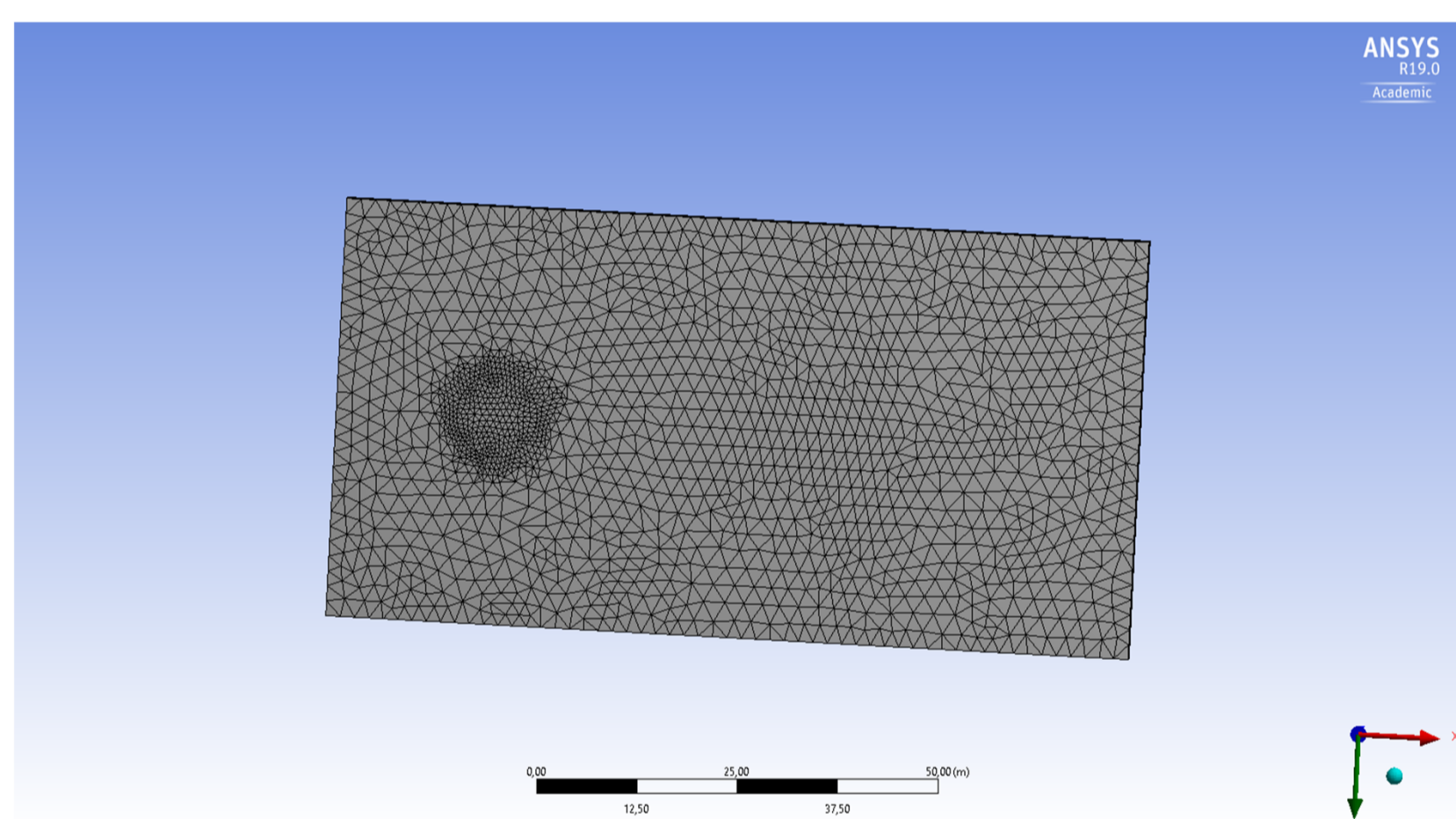
Abstract

With the increase of the human activities in the Arctic, including land and sea, is resulting in higher release of pollutants to the environment. These pollutants can be categorised as gases released in the air such as carbon dioxide, sulphur dioxide, NOx, etc., and waste released in seas such as chemical toxins, microplastic, etc.

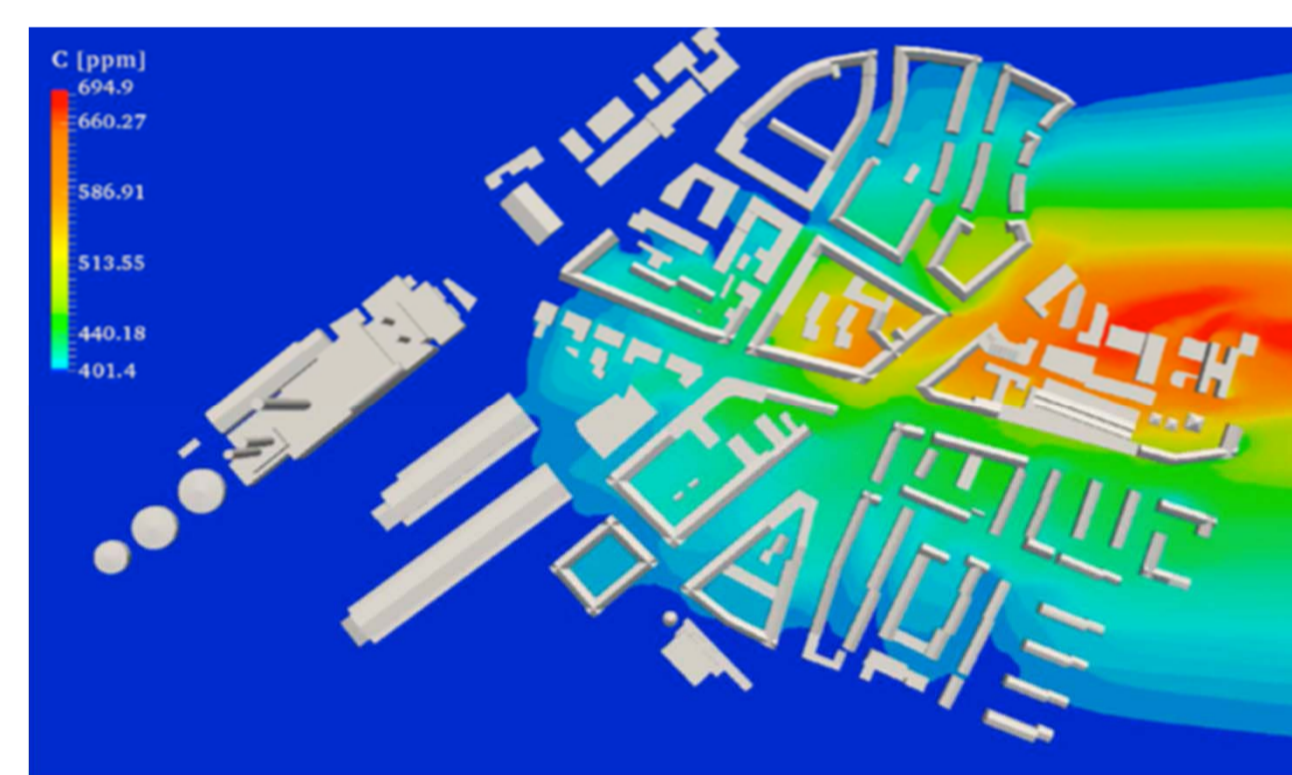
This work presents a computational fluid dynamics (CFD) study presenting a two-phase Euler model for pollutant transport. In this study, it is possible to see the outcome as a tool for mapping the pollutant in the environment close to the source. ANSYS® fluent is used to solve the CFD simulations including CO₂ and air in a two-phase Euler model. A free mesh is built for the solution using ANSYS meshing tools with increased mesh intensity in critical regions. Mesh sensitivity study is conducted to ensure the correctness and reliability of the results.

The results show the pollutant transport in the domain. The simulation not only predicted the spread of the pollutant discharged but also indicated the concentration at any given point in space. This study is very relevant for project planning to assess the impact of pollutant discharge to nearby surroundings.

ANSYS® Mesh

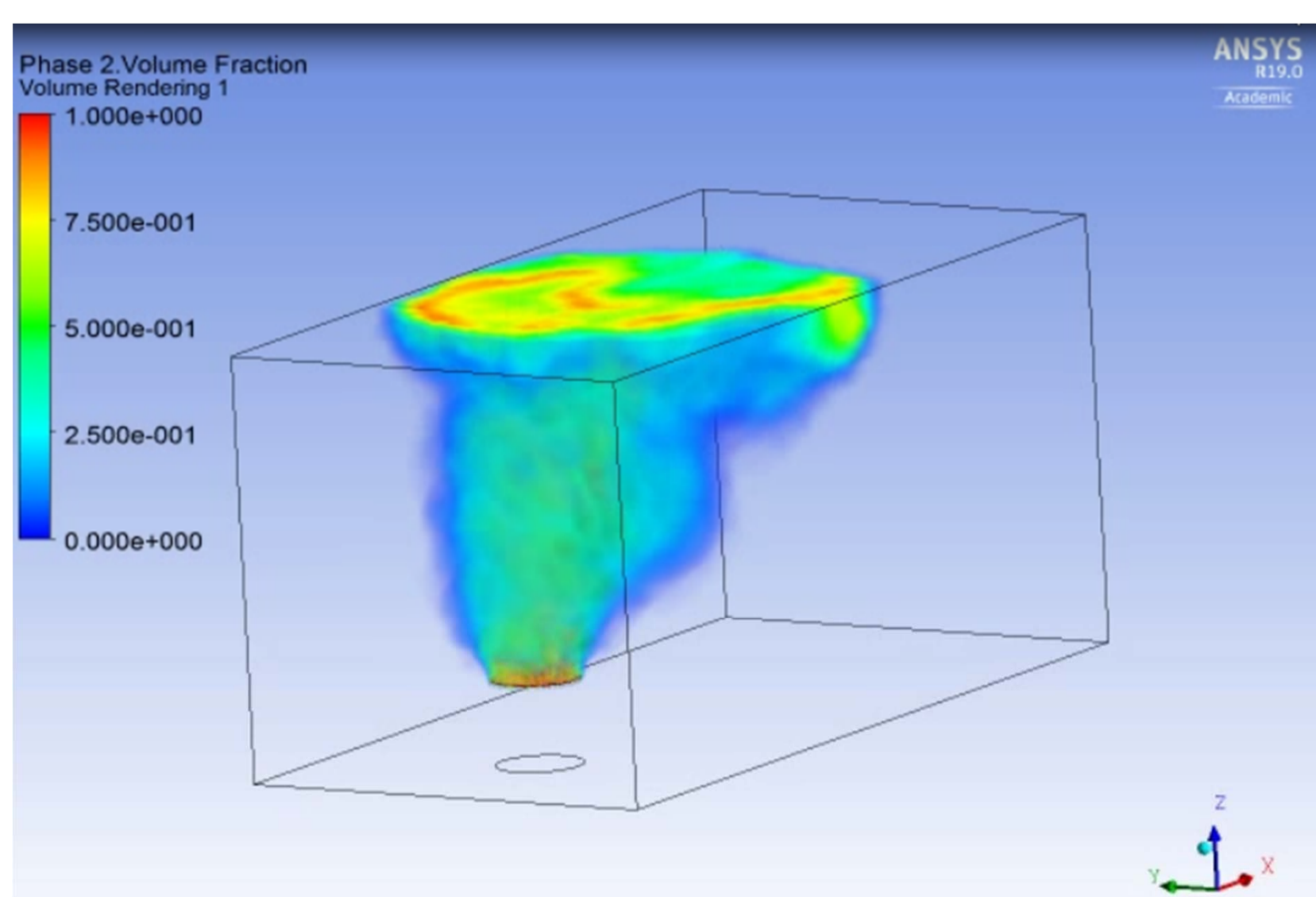


CO₂ concentration in the urban area*

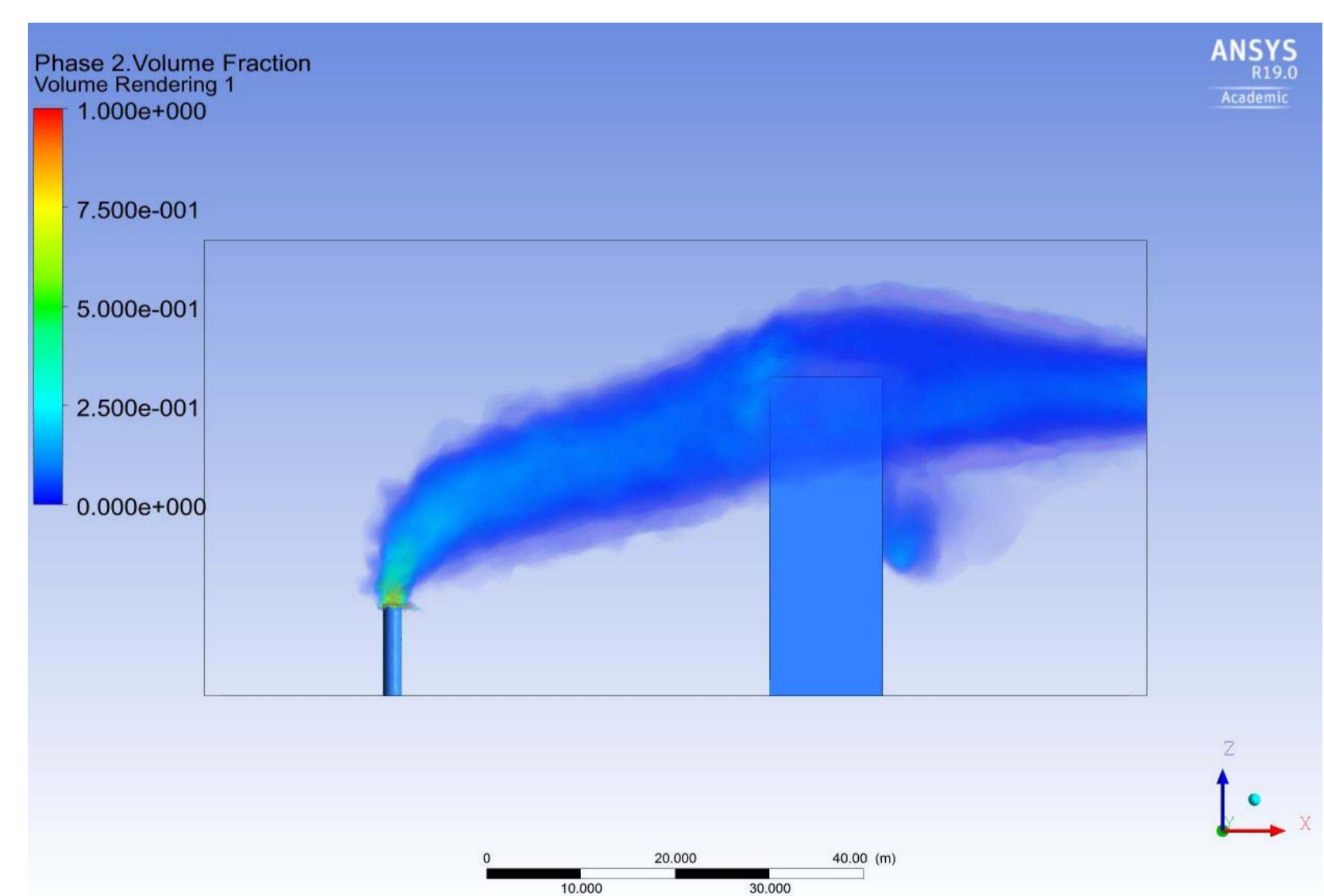


* Toja-Silva, F., Chen, J., Hachinger, S., & Hase, F. (2017). CFD simulation on CO₂ dispersion from urban thermal power plant: Analysis of turbulent Schmidt number and comparison with Gaussian plume model. *Journal of Wind Engineering & Industrial Aerodynamics*

ANSYS® Simulation Results (Heavy Discharge)



ANSYS® Simulation Results (Around Obstruction)



Conclusion & Future Work

This study helped us to develop better understanding about pollutant transport using ANSYS®. The presented work is a preliminary study which can be extended to large scale depending on the real problem. The given work confirms the correctness of the methodology, however, will require real time data for validation.

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