Internship proposal, 3-4 months, 2024 - Centrale Lyon

Prediction of noise near an explosive testing site

Context:

Industrial explosions can have disastrous effects on structures and people. In order to evaluate the industrial risks generated by these explosions, INERIS (Institut national de l'environnement industriel et des risques) carries out controlled experiments on their test site in Montlaville, France. Explosions generate acoustic waves with large amplitude, which propagate in the atmosphere. They cause annoyance for people living near the test site.

In order to quantify the noise levels and to reduce them in the long term, INERIS has developed a simplified model of acoustic propagation. Acoustic measurements on the test site were carried out in order to validate the approach. The agreement between experimental and numerical results was nevertheless disappointing.

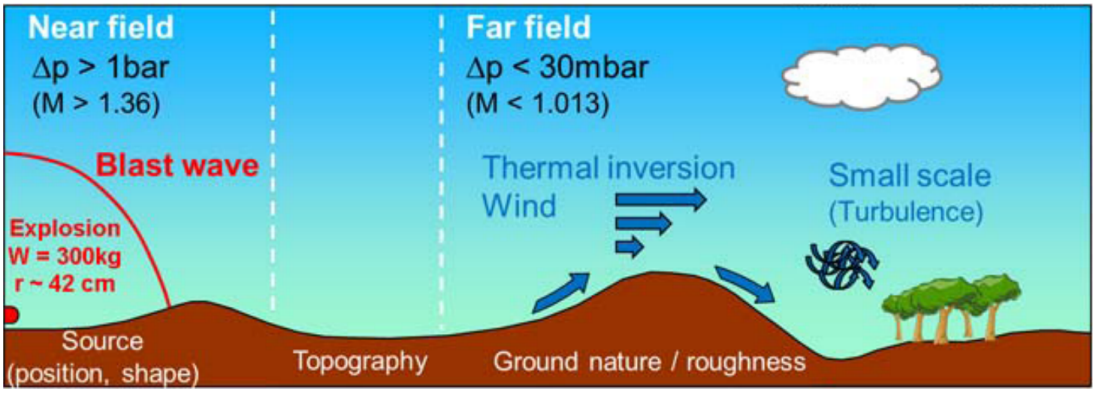

Figure 1: Sketch of the physical phenomena at play for propagation of blast waves generated by an explosion in the atmosphere. From [1].

Work:

This work is in collaboration with INERIS. We propose to use an advanced model of acoustic propagation in the atmosphere. This model, based on a paraxial approach, allows one to take into account meteorological effects (wind and temperature profiles) and ground effects (absorption, topography). The objectives are to compare the results of the paraxial model with the measurements and then to predict the sound levels generated by explosions near the residential area.

First, numerical simulations will be set up by defining the input parameters (equivalent source, topography, ground impedance, meteorological conditions). Comparisons will be made between the results of the numerical simulations and the measurements carried out by INERIS. Finally, we will study the variability of the sound levels near the residential area depending on the meteorological conditions.

Lab: The work will be performed at LMFA (Laboratoire de Mécanique des Fluides et d'Acoustique) on the campus of Ecole Centrale de Lyon.

Profile: Student in Master 1 or equivalent.

Supervision: Didier Dragna, assistant professor, didier.dragna@ec-lyon.fr

Références:

[1] Nguyen-Dinh, M., Lardjane, N., Duchenne, C. & Gainville, O., 2017, Direct simulations of outdoor blast wave propagation from source, Shock Waves **27**, 593-614.

[2] Salomons, E., 2001, Computational Atmospheric Acoustics Springer, Dordrecht, Netherlands.