

Dispersion and Chemical Evolution Modeling of Aircraft Emissions in Airport Areas

Weeded GHEDHAIFI
ONERA-DMPH
BP 72, 92322 CHATILLON CEDEX
Tel: +33 1 46 73 4 7 89
Weeded.ghedhaifi@onera.fr

The presented work is part of IESTA (Infrastructure d'Evaluation des Systèmes de Transport Aérien), an ONERA research program which aims at evaluating future concepts for air transport systems. Its first application, called "Clean Airport", has to provide simulations of noise and atmospheric impact of aviation in airport areas.

Our contribution is focused on dispersion modeling using an ONERA CFD software: CEDRE (Calcul d'Écoulements (Diphasiques) (Réactifs) pour l'Énergétique). It is based on Navier-Stokes equations resolution and allows a description of emitted gases dispersion taking into account sources (aircraft) characteristics (momentum, temperature, exhaust gases composition), wind direction and velocity, buildings, topography, etc. Furthermore, the code includes chemistry modeling allowing the description of chemical species evolution in aircraft plumes.

The first step in the use of CEDRE is its validation against atmospheric processes. Indeed, representative atmospheric phenomena have been simulated to evaluate the code ability to give a satisfactory description of atmospheric flows.

Some developments, such as moving emission sources representing aircraft and real atmosphere, have to be introduced into CEDRE to make it usable to predict pollution impact in airport areas in agreement with "Clean Airport" demand.

A simplified numerical study has been carried out using CEDRE to simulate the evolution of a passive scalar in a domain representing Orly airport with three buildings (two terminals and a control tower). Figure 1 illustrates the mesh of the simulated area and Figure 2 represents the dispersion of a passive scalar.

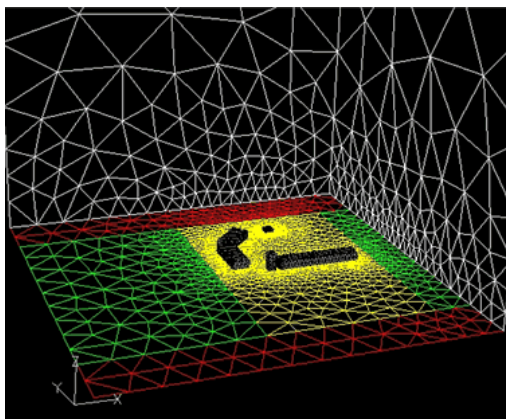


Figure 1: Tetrahedral mesh

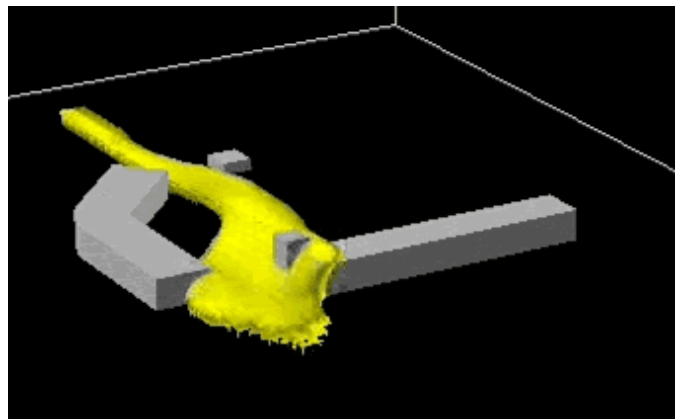


Figure 2: Dispersion of a passive scalar

References

1. IESTA: <http://www.onera.fr/iesta/english.php>
2. CEDRE: <http://cedre.onera.fr/>