NUMERICAL SIMULATION OF INFLUENCE OF VARIOUS TYPES OBSTACLES ON DUSTINESS OF COAL DEPOT

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The contribution presents a mathematical and numerical investigation of the Atmospheric Boundary Layer (ABL) flow over the real configuration given by a brown coal mine and coal depot in North Bohemia. The influence of various types of protective obstacles (as forest blocks, tree-line, walls) on the reduction of dustiness has been studied.

The mathematical models are based on the system of Reynolds Averaged Navier-Stokes (RANS) equations for a viscous incompressible flow. The full system of RANS equations in conservative form was solved using finite-volume explicit scheme and artificial compressibility method. A simple algebraic turbulent model was used for the closure of the basic system of equations. Additional transport equation for passive pollutant has been considered in order to study the pollution dispersion over the complex 3D topography. The forest stand is simulated using the additional source term in the momentum equations which depends on the local velocity magnitude, the characteristic area of the obstacle and on the drag coefficient.

Key words: *finite volume, artificial compressibility, ABL, pollution dispersion*

1. Introduction

The Atmospheric Boundary Layer (ABL) is a lowest part of the atmosphere and its thickness usually ranges from a several hundred meters to approximately two kilometers. The air pollution resulting from rapid industrialization has become a serious environmental problem namely in the North Bohemia region. From this point of view, is very praiseworthy endeavor of Sokolovska uhelna a.s. to reduce of pollution impact from an open coal depot. Influence of several types of obstacles was numerically modeled in order to decrease the level of pollutant concentrations in the downstream region which is inhabited.

2. Mathematical models

For our study, the flow in ABL is assumed to be steady, incompressible, turbulent and indifferently stratified. Two different mathematical and numerical methods has been used for numerical simulations.

2.1. The full RANS model

The governing equations of the first model can be written in the conservative, non-dimensional and vector form. The artificial compressibility method [5] is used for the numerical

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