Performance of CALPUFF Dispersion Model for Investigation the Dispersion of the Pollutants Emitted from an Industrial Complex, Daura Refinery, to an Urban Area in Baghdad

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Abstract : Air pollution is one of the biggest environmental problems in Baghdad, Iraq. The Daura refinery located nearest the center of Baghdad, represents the largest industrial area, which transmits enormous amounts of pollutants, therefore study the gaseous pollutants and particulate matter are very important to the environment and the health of the workers in refinery and the people whom leaving in areas around the refinery. Actually, some studies investigated the studied area before, but it depended on the basic Gaussian equation in a simple computer programs, however, that kind of work at that time is very useful and important, but during the last two decades new largest production units were added to the Daura refinery such as, PU_3 (Power unit_3 (Boiler 11&12)), CDU_1 (Crude Distillation unit_70000 barrel_1), and CDU_2 (Crude Distillation unit_70000 barrel_2). Therefore, it is necessary to use new advanced model to study air pollution at the region for the new current years, and calculation the monthly emission rate of pollutants through actual amounts of fuel which consumed in production unit, this may be lead to accurate concentration values of pollutants and the behavior of dispersion or transport in study area. In this study to the best of author's knowledge CALPUFF model was used and examined for first time in Iraq. CALPUFF is an advanced non-steady-state meteorological and air quality modeling system, was applied to investigate the pollutants concentration of SO_2, NO_2, CO, and PM1-10μm, at areas adjacent to Daura refinery which located in the center of Baghdad in Iraq. The CALPUFF modeling system includes three main components: CALMET is a diagnostic 3-dimensional meteorological model, CALPUFF (an air quality dispersion model), CALPOST is a post processing package, and an extensive set of preprocessing programs produced to interface the model to standard routinely available meteorological and geophysical datasets. The targets of this work are modeling and simulation the four pollutants (SO_2, NO_2, CO, and PM1-10μm) which emitted from Daura refinery within one year. Emission rates of these pollutants were calculated for twelve units includes thirty plants, and 35 stacks by using monthly average of the fuel amount consumption at this production units. Assess the performance of CALPUFF model in this study and detect if it is appropriate and get out predictions of good accuracy compared with available pollutants observation. CALPUFF model was investigated at three stability classes (stable, neutral, and unstable) to indicate the dispersion of the pollutants within deferent meteorological conditions. The simulation of the CALPUFF model showed the deferent kind of dispersion of these pollutants in this region depends on the stability conditions and the environment of the study area, monthly, and annual averages of pollutants were applied to view the dispersion of pollutants in the contour maps. High values of pollutants were noticed in this area, therefore this study recommends to more investigate and analyze of the pollutants, reducing the emission rate of pollutants by using modern techniques and natural gas, increasing the stack height of units, and increasing the exit gas velocity from stacks.

Keywords : CALPUFF, daura refinery, Iraq, pollutants

Conference Title : ICEBESE 2016 : International Conference on Environmental, Biological, Ecological Sciences and Engineering

Conference Location : Sydney, Australia

Conference Dates : December 15-16, 2016