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EVALUATION OF SPATIAL VARIATIONS OF NON-ROAD AND AREA SOURCE EMISSIONS IN A SEMI-ARID COASTAL URBAN AIRSHED USING GIS TOOLS

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ABSTRACT

Emissions inventory needed for photochemical modeling are typically gathered at the county level. The spatial variations of non-road and area source emissions within a county have been largely ignored due to the difficulty in collecting, processing, and analyzing the data at smaller geographic scales. This method may affect regional photochemical modeling performance with respect to emissions inputs. This study adopted Geographical Information System (GIS) tools capable of managing spatially referenced data in order to evaluate the spatial variations of emissions from non-road and area sources within a semi-arid coastal urban airshed of Corpus Christi, Texas, based on activity, survey and surrogate data. The approach consisted of establishing spatial database, disaggregating county-wide emission into finer grids, and segregating geo-referenced emissions into the photochemical model grid. The spatial database included identification of facilities location and proper emission surrogates developed for allocation of these sources into proper grids. Key area source emission categories were considered as localized minor point sources wherever suitable such as airport location and oil/gas production activities. Locations of the sources were geo-referenced using GIS tools. A top-down approach was adopted for categories where locations of sources were unavailable. Population surrogates were used for all emissions related to human activities. County-wide emission estimates were then allocated to smaller grid resolution (1 x 1 km) based on surrogates, and spatial variations were then evaluated. Categories such as residential natural gas, liquefied petroleum gas, lawn and garden equipment and other residential related emissions were apportioned using housing surrogates. Finally, area source emissions that were geo-referenced and that had low amount of emissions, such as gasoline marketing, were aggregated into corresponding grid emissions. GIS was extensively used in the study to visualize process spatial data, and perform overlay operations to derive cell based inputs to integrate geo-coded air emissions data. The data generated provided spatially resolved gridded emissions useful for characterizing the impact of anthropogenic emissions in a photochemical model. This study provided the basis for the development of an environmental knowledge management system using GIS and it will be useful for air quality planners, policy-makers and analysts.

Keywords: Emissions inventory, photochemical model, GIS, urban airshed, spatial apportionment