Estimation of Carbon Dioxide Emissions Based on Near Roadway Monitoring Using Fast Response Instruments

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Introduction

A comparison between on-road measured carbon dioxide (CO₂) concentrations and modeled concentrations was presented as a function of vehicle mode of operation (congestion and free flow). Modeled CO₂ concentrations were calculated using (1) 5 min measurements of traffic and meteorology conditions near a roadway that is restricted to light-duty vehicles (LDVs), (2) Motor Vehicle Emission Simulator (MOVES) modeling and (3) inverse dispersion model calculations. The modeled concentrations were able to be compared to measured concentrations. Because changes in ambient air quality near roadways is very episodic due to rapid changes in traffic patterns and meteorological conditions. Near roadway monitoring programs designed to respond to changes in traffic conditions need to be measured in time periods as short as 5 minutes. The analysis is based on the assumption that air-quality models adequately describe the dilution process due to both traffic and atmospheric turbulence. The approach used to verify this assumption was to use MOVES to determine EFs for CO₂ and then estimate dilution using measured CO₂ concentrations.

Model Procedure

Traffic data  
(N)  
5-min average  
MOVES  
Emission factor (EF)  
5-min average  
Meteorology data  
5-min average  
CALINE dilution factor  
Comparison  
C model  
C measure  
5-min average

- The variation in CO₂ concentrations with vehicle speed for 5-min measurements can be detected by near roadway monitoring.
- The good agreement on measured and modeled CO₂ concentrations indicates that simultaneous measurements of meteorological and traffic conditions can be used to determine CO₂ concentrations near roadways.

Future Work

- 1. CO₂ emission near roadway for highly congested traffic conditions.
- 2. CO₂ emission near roadway for traffic fleet with diesel trucks.

References