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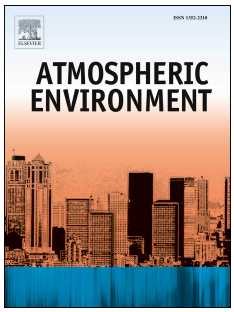

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Air Quality Impacts of Implementing Emission Reduction Strategies at Southern California Airports

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Abstract

Reducing aviation emissions will be a major concern in the coming years, as the relative contribution of aviation to overall emissions is projected to increase in the future. The South Coast Air Basin of California (SoCAB) is an extreme nonattainment area with many airports located upwind of the most polluted regions in the basin. Techniques to reduce aviation emissions have been studied in the past, and strategies that can be implemented at airports include taxi-out times reduction, ground support equipment electrification and aviation biofuel implementation. These strategies have been analyzed only at the national scale, their effectiveness to improve air quality within the SoCAB given the local meteorology and chemical regimes is unclear. This work studies how the adoption of the techniques at commercial SoCAB airports affect ozone (O_3) and fine particulate matter ($PM_{2.5}$) concentrations. In addition, potential impacts on public exposure to $PM_{2.5}$ and O_3 resulting from changes in the concentration of these pollutants are estimated. In addition, the work calculates aviation emissions for each scenario and simulate the transport and atmospheric chemistry of the pollutants using the Community Multiscale Air Quality (CMAQ) model. The simultaneous application of all reduction strategies is projected to reduce the aviation-attributable population weighted ground-level $PM_{2.5}$ by 36% in summer and 32% in winter. On the other hand, O_3 increases by 16% in winter. Occurring mostly in densely populated areas, the decrease in ground-level $PM_{2.5}$ would have a positive health impact and help the region achieve attainment of national ambient air quality standards.

Keywords: Airport emissions; Biofuels; Air quality modeling; Health impact; Particulate matter; Ozone

1. Introduction

1.1. Context

The South Coast Air Basin (SoCAB) of California is among the worst air quality regions in the United States (Razeghi et al., 2016), currently designated as an extreme nonattainment area (EPA, 2017a). With global air transportation growing by 5% per year (Lee et al., 2009; Boeing, 2013; Kousoulidou et al., 2016) the relative contribution of aviation to overall emissions could increase from 3% to 15% by 2050 (Sgouridis et al., 2011). The SoCAB region contains several major US airports including the Los Angeles International Airport (LAX, the 3rd largest by passenger traffic), many of which are located upwind of the most polluted areas in SoCAB. Population exposure to poor air quality – i.e. elevated concentrations of fine particulate matter (PM2.5) and ozone (O3) – has been linked with human health effects including premature mortality and morbidity (Shen et al., 2017). Airport operations are linked to mortality, and in the US alone they are estimated to cause ~350 early deaths in 2018 (Ashok et al., 2013). Under these constraints, it is beneficial to identify and assess strategies that minimize the relative impact of airports and air traffic on air quality in the SoCAB.