DIFFERENCES BETWEEN CMAQ FINE MODE PARTICLE AND $PM_{2.5}$ CONCENTRATIONS AND THEIR IMPACT ON MODEL PERFORMANCE EVALUATION IN THE LOWER FRASER VALLEY

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Total mass concentrations of particles in two CMAQ fine modes (hereafter "PM_{i+j}") have been widely used as approximations of $PM_{2.5}$ mass concentrations in CMAQ evaluations and applications. To understand the uncertainty related to this practice, this paper focuses on differences between modeled concentrations and compositions of PM_{i+j} and $PM_{2.5}$ based on aerodynamic diameter, and the impact of the differences on modeling results and on model performance evaluation. For demonstration purposes, CMAQ version 4.3 was used to simulate an episode from July 31 to August 7, 1993 in the Lower Fraser Valley, which covers part of southwest British Columbia in Canada and northwest Washington State in the United States. The analysis is focused on the first layer of a 33×30 grid cell domain with 5km resolution.

PM_{i+j} and $PM_{2.5}$ are conceptually different. Statistically, PM_{i+j} and $PM_{2.5}$ correlate well in our modeling scenario. However, quantitative differences between PM_{i+j} and $PM_{2.5}$ vary significantly with time and location, reaching a maximum of 4776% and an average of 39.9%. Extremely high % differences appear at low $PM_{2.5}$ levels. The fractions of the modeled data points that carry relatively moderate (but still meaningful) % differences between PM_{i+j} and $PM_{2.5}$ are higher than those carrying extreme % differences. The differences between PM_{i+j} and $PM_{2.5}$ have direct impact on model performance evaluation. The quantitative impact varies widely with time and location. Although not significant for the current CMAQ versions, the difference between modeled PM_{i+j} and $PM_{2.5}$ compositions also exists and can impact model performance evaluation on a particle component basis. The difference in compositions may become more significant with future improvements to the coarse mode particle formation processes in the model.