Evaluation of regional air quality models over Sydney, Australia: surface ozone and PM2.5

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Radarweg 29, Amsterdam

Elsevier Inc[a,b], *Global Customer Service*[b,*]

[a]*1600 John F Kennedy Boulevard, Philadelphia*
[b]*360 Park Avenue South, New York*

Abstract

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2010 MSC: 00-01, 99-00

1. Introduction

Air quality models are valuable tools to investigate the complex and dynamic interactions between meteorology and chemistry leading to poor air quality episodes

2. Methods

2.1. Description of models

2.2. Description of observations

2.3. Statistical analyses

Ozone.

$$NMSE = \frac{\Sigma_{i=1}^{N}(M_i - O_i)^2}{Nx\overline{M}x\overline{O}} \tag{1}$$

where $\overline{M}$ is the average modeled value

*Corresponding author
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Table 1: HCHO yields from various species, and lifetime against oxidation by OH.

Species	HCHO Yield (molar %)	Life vs OH	Notes	Source
Isoprene	315±50		High NO_X	a
	285±30		High NO_X	a
	225	35 min	High NO_X	b
	150		Low NO_X	b
	150		Low NO_X	d
	450		High NO_X	d
α-Pinene	28±3		Low NO_X	c
	X±3		X NO_X	d
	230±90		High NO_X	a
	190±50		High NO_X	a
	19	1 hour		b
β-Pinene	65±6		Low NO_X	c
	X±3		X NO_X	d
	540±50		High NO_X	a
	450±80		High NO_X	a
	45	40 min		b
Methane	100	1 year		b
Ethane	180	10 days		b
Propane	60	2 days		b
Methylbutanol	.13(per C)	1 hour		b
HCHO	100	2 hour		b
Acetone	.67(per C)	10 days		b
Methanol	100	2 days		b

a **?**]: Table 2, Yield from Isoprene reaction with OH, two values are from two referenced papers therein.

b **?**]: lifetimes assume [OH] is 1e15 mol cm^{-3}.

c [**?**]: Calculated through change in concentration of parent and product linear least squares regression. Estimates assume 20° C conditions.

d **?**]: "prompt yield": change in HCHO per change in $ISOP_0$. $[ISOP]_0 = [ISOP]\exp(k_1[\text{OH}]t)$; where k_1 is first order loss rate. Effectively relates HCHO abundance with isoprene emission strength

PM2.5.

3. Model evaluation results

3.1. Ozone

Region/domain-wide analysis.

Spatial analysis.

3.2. PM2.5

Region/domain-wide analysis.

Spatial analysis.

3.3. PM2.5 speciation

4. Discussion

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References

[1] R. Feynman, F. Vernon Jr., The theory of a general quantum system interacting with a linear dissipative system, Annals of Physics 24 (1963) 118–173. `doi:10.1016/0003-4916(63)90068-X`.

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