Supplementary Material

Reactions	Reaction Rate	Note
Isoprene Daytime Chemistry		
$ISOP + OH \rightarrow ISOPO2$	$3.10 \times 10^{-11} \exp(350./T)$	
$ISOPO2 \rightarrow 2.0*HO2 + CH2O + .333*MGLY$		
+ .5*GLYALD + 0.25*GLYX	$4.0/\times10^{\circ} \exp(-7694.71)$	
$ISOPO2 + NO \rightarrow .90*NO2 + .90*HO2 + .9*CH2O$	$2.70\times 10^{-12} \text{ or } \pi(250 \ \text{/T})$	
+ .55*MVK + 0.35*MACR + 0.1*ISOPNB	2.70×10 exp(330./1)	
$ISOPO2 + HO2 \rightarrow .937*ISOPOOH + .063*OH$	$2.06 \times 10^{-13} \exp(1300./T)$	
+ .025*MACR + .038*MVK + .063*HO2		
+ .063*CH2O		
$ISOPO2 + ISOPO2 \rightarrow 1.28*HO2 + .92*CH2O$	1.54×10^{-13}	
+ .56*MVK + .36*MACR + .48*ROH + .5*HC5		
$ISOPO2 + CH3O2 \rightarrow 1.1*HO2 + 1.22*CH2O$	8.37×10 ⁻¹⁴	
+ .28*MVK + .18*MACR + .3*HC5		
+ .24*CH3OH + .24*ROH	10	
$ISOPO2 + CH3CO3 \rightarrow .887*HO2 + .747*CH2O$	$1.68 \times 10^{-12} \exp(500./\mathrm{T})$	
+ .453*MVK + .294*MACR + .14*HC5		
$+.113*DIBOO + \{CO2\} + CH3O2$		
$ISOPO2 + CH3CO3 \rightarrow MEK + CH3COOH$	$1.87 \times 10^{-13} \exp(500./T)$	
$ISOPNB + OH \rightarrow ISOPNBO2$	$2.40 \times 10^{-12} \exp(745./T)$	
$ISOPNBO2 + NO \rightarrow .09*GLYALD + .09*HYAC$	$2.40 \times 10^{-12} \exp(360./T)$	
+ .69*CH2O + 0.88*NO2 + .44*MACRN		
+ .69*HO2 + .26*MVKN + 0.21*DHDN		
$ISOPNBO2 + HO2 \rightarrow .06*GLYALD + .06*HYAC$	$8.70 \times 10^{-14} \exp(1650./T)$	
+ .44*CH2O + .28*MACRN + .16*MVKN		
+.06*NO2 + .44*HO2 + .5*OH + .5*ISNP + .5*POOL		
	2.70 10-19	
$ISOPNB + O3 \rightarrow 0.05 * HO2 + 0.05 * OH +$	3.70×10 ⁻¹⁹	
0.11^{M} W KN + 0.32^{M} MACKN + 0.16^{H} COOH +		
$0.02*CH2O + 0.30*\{CO2\} + 0.21*CO + 0.6*C4NACID + 0.26*HDDODN + 0.26*HDD0DN + 0.26*HDD0DN + 0.26*HD00DN + 0.26*HD000DN + 0.26*HD0000DN + 0.26*HD000000000000000000000000000000000000$		
$0.00^{\circ}C4NACID + 0.30^{\circ}HFROFN + 0.1*MVKNOOH$		
$\frac{1}{1000} + \frac{1}{1000} + 1$	$4.75 \times 10^{-12} \exp(200 / \text{T})$	
+ 386*ISOPNBO2	$4.75 \times 10^{-10} \exp(200.71)$	
$\frac{1}{1000} + \frac{1}{1000} + 1$	$4.75 \times 10^{-12} \exp(200 / T)$	
+ 613*HC5	4.75×10 exp(200.71)	
$ISOPOOH + OH \rightarrow OH + IEPOX$	$1.90 \times 10^{-11} \exp(390 / T)$	
$IEPOX + OH \rightarrow IEPOXOO$	$5.78 \times 10^{-11} \exp(-400 / \text{T})$	
$\frac{1}{1000} + \frac{1}{1000} + \frac{1}{1000} + \frac{1}{1000} + \frac{1}{10000} + \frac{1}{10000000000000000000000000000000000$	$2.06 \times 10^{-13} \exp(1300 / T)$	
+ 275*GIYAID + 275*GIYX + 375*CH2O	2.00×10 exp(1500./1)	
+.251*CO + .275*MGLY + 1.125*OH		
+.825*HO2		
IEPOXOO + NO \rightarrow .725*HYAC + .275*GLYALD	$2.70 \times 10^{-12} \exp(350./T)$	
+ .275*GLYX + .375*CH2O + .074*HCOOH	1 \/	

Table S1. Isoprene oxidation chemistry in AM3. T represents temperature (K).

+ .251*CO + NO2 + .275*MGLY	
+ .125*OH+ .825*HO2	
$HC5 + OH \rightarrow HC5OO$	$3.35 \times 10^{-11} \exp(380./T)$
$HC5 + O3 \rightarrow .6^*MGLY + .1^*OH + .12^*CH2O$	6.16×10 ⁻¹⁵ exp(-1814./T)
+ .28*GLYALD + .3*O3 + .4*CO + .2*H2	
+ .2*HYAC + .2*HCOOH	
$HC5OO + NO \rightarrow NO2 + .216*GLYX$	$2.35 \times 10^{-12} \exp(350./T)$
+ .234*MGLY + .234*GLYALD + .09*RCHO +	
HO2 + .09*CO + .216*HYAC + .29*DHMOB	
+ .17*MOBA	
$HC5OO + NO \rightarrow HNO3$	3.50×10 ⁻¹³ exp(350./T)
$HC5OO + HO2 \rightarrow .1*IAP + .9*OH + .9*MGLY$	$2.06 \times 10^{-13} \exp(1300/T)$
+.9*GLYALD + .9*HO2	
$HC500 + CH302 \rightarrow 5*H02 + 33*C0 + 09*H2$	8 37×10 ⁻¹⁴
+ 18*HYAC + 25*C2H5OH + 5*HO2	0.57/10
$+ 13^{\circ}$ GI YALD + 29*MGI Y	
+ 25*MFK+ 95*CH2O + 25*CH3OH	
$\frac{1}{125} \frac{1}{125} \frac{1}$	$1.68 \times 10^{-12} \exp(500 / \text{T})$
$\pm 234*GIVAID \pm 216*HVAC \pm 29*DHMOB$	1.00×10 exp(500.71)
$\pm 17*MOBA \pm 09*PCHO \pm HO2 \pm 09*CO \pm$	
$(-11)^{-11}$ MODA + .0) Reno + $(-102 + .0)^{-10}$ CH3O2	
$HC500 + CH3C03 \rightarrow MEK + CH3C00H$	$1.87 \times 10^{-13} exp(500 /T)$
$\frac{1}{1} \frac{1}{1} \frac{1}$	$1.87 \times 10^{-12} \exp(500.71)$
$IAP + OH \rightarrow .034^{\circ}OH + .034^{\circ}DHMOB$	$5.51 \times 10^{-1} \exp(200.71)$
$+.540^{\circ}\text{HC}500$	2 70, 10-11 (280 /TT)
$MOBA + OH \rightarrow MOBAOO$	$2.79 \times 10^{17} \exp(380.71)$
$MOBA + O3 \rightarrow OH + HO2 + MEK$	2.00×10 ⁻¹⁷
$MOBAOO + NO \rightarrow RCHO + HO2 + NO2$	$2.35 \times 10^{-12} \exp(350./T)$
$MOBAOO + NO \rightarrow HNO3$	3.50×10 ⁻¹³ exp(350./T)
$MOBAOO + HO2 \rightarrow .5*OH + .5*HO2$	$2.06 \times 10^{-13} \exp(1300./T)$
+ .5*RCHO + .5*C3H7OOH	
$MVK + OH \rightarrow MVKO2$	$2.60 \times 10^{-12} \exp(610./T)$
$MVK + O3 \rightarrow .202*OH + .202*HO2$	8.50×10 ⁻¹⁶ exp(-1520./T)
+ .352*HCOOH + .535*CO + .05*CH3CHO	
+ .95*MGLY + .05*CH2O	
$MVKO2 + NO \rightarrow .965*NO2 + .249*HO2$	$2.70 \times 10^{-12} \exp(350./T)$
+ .249*CH2O + .716*CH3CO3 + .716*GLYALD	
+ .249*MGLY + .035*MVKN	
$MVKO2 + HO2 \rightarrow .38*MVKOOH + .62*OH$	$1.82 \times 10^{-13} \exp(1300./T)$
+ .37*GLYALD + .37*CH3CO3+ .13*MEK	
+ .25*HO2 + .12*CH2O + .12*MGLY	
$MVKO2 + CH3O2 \rightarrow .14*HO2 + .14*CH2O$	8.37×10 ⁻¹⁴
+ .36*CH3CO3 + .36*GLYALD + .25*ROH	
+ .5*HO2 + .14*MGLY + .25*MEK + .75*CH2O	
+ .25*CH3OH	
$MVKO2 + CH3CO3 \rightarrow .4*HO2 + .4*CH2O$	1.68×10 ⁻¹² exp(500./T)
+ .6*CH3CO3 + .6*GLYALD + .4*MGLY +	
CH3O2	
$MVKO2 + CH3CO3 \rightarrow MEK + CH3COOH$	$1.87 \times 10^{-13} \exp(500./T)$

+ 209*MVK02 MVKN + OH → 65*HCOOH + NO3 + .65*MGLY + .35*CH20 MACR + OH → .45*MAO3 + .55*MACRO2 MACR + O3 → .261*OH202*HO2 + .326*HCOOH + .569*CO + .88*MGLY + 0.12*CH20 MACR + NO3 → MAO3 + HNO3 MACRO2 + NO3 → MAO3 + HYAC + CO + HO2 MACRO2 + NO3 → NO2 + HYAC + CO + HO2 MACRO2 + NO3 → NO2 + HYAC + CO + HO2 MACRO2 + NO3 → NO2 + HYAC + CO + HO2 MACRO2 + NO3 → NO2 + HYAC + CO + HO2 MACRO2 + CO 3 → SP*MACRN MACRO2 + CO 3 → SP*MACRN MACRO2 + CH3CO3 → SP*HYAC + .255*MGLY + .395*CO + .1.255*CH2O + 1.7*HO2 + .15*ROH MACRO2 + CH3CO3 → SP*HYAC + .255*MGLY + .595*CO + .1.255*CH2O + 1.7*HO2 + .15*ROH MACRO2 + CH3CO3 → SP*HYAC MACRO2 + CH3CO3 → SP*HO2 + .143*MGLY + .857*HYAC + .857*CO + .143*CH2O + CH3O2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 + .07*MGLY + .85*HYAC + .85*NO2 + OH MACROOH + OH → MACRO2 + .07*MGLY + .85*HYAC + .185*NO2 + OH MACROOH + OH → MACRO2 + .07*MGLY + .85*HYAC + .185*NO2 + OH MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 + .07*MGLY + .85*HYAC + .185*NO2 + OH MACROOH + OH → MACRO2 + .07*MGLY + .85*HYAC + .185*NO2 + OH MACRNO2 + HO2 → .08*CH3COOH + .07*MGLY + .85*HYAC + .85*NO2 + OH MAO3 + NO3 → NO2 + CH2O + .55*CH3O3 + MAO3 + NO3 → NO2 + CH2O + .55*CH3O3 + MAO3 + NO3 → NO2 + CH2O + .55*CH3CO3 + MAO3 + NO3 → NO2 + CH2O + .15*CH3CO3 + MAO3 + CH3O2 → .44*OH + .15*CH3CO3 + MAO3 + CH3O2 → .CH3O2 + CH2O + MAO3 + CH3O2 → CH3O2 + CH2O + MAO3 + NO2 + M → MAN + M Ko= .00E-28*(300T) ³ ±0; E-0.60; WFAN → MAO3 + NO2 MAO3 + NO → NO2 + OH → NO2 MAO3 + NO3 + NO2 MA	$MVKOOH + OH \rightarrow .791*OH + .791*MEK$	8.78×10 ⁻¹² exp(200./T)	
$\begin{split} & MKKN + OH \to .65^{\circ}HCOOH + NO3 & 1.60\times 10^{-12} & \\ & +.65^{\circ}MGLY + .35^{\circ}CH2O & \\ & MACR + OH \to .45^{\circ}MAO3 + .55^{\circ}MACRO2 & \\ & 8.00\times 10^{-12}exp(380,T) & \\ & MACR + O3 \to .261^{\circ}OH + .202^{\circ}HO2 & \\ & +.326^{\circ}HCOOH + .569^{\circ}CO + .88^{\circ}MGLY + & \\ & 0.12^{\circ}CH2O & \\ & MACR + NO3 \to MAO3 + HNO3 & \\ & 3.40\times 10^{-15} & \\ & MACRO2 + HO2 \to 0.42^{\circ}MACROOH + 0.58^{\circ}OH & \\ & 1.82\times 10^{-13}exp(1300,T) & \\ & +.058^{\circ}HYAC + 0.58^{\circ}CO + 0.58^{\circ}HO2 & \\ & MACRO2 + NO3 \to NO2 + HYAC + CO + HO2 & \\ & 2.30\times 10^{-12} & \\ & MACRO2 + NO3 \to NO2 + HYAC + \\ & 0.13^{\circexp(360,T)} & \\ & MACRO2 + NO3 \to NO2 + HYAC & \\ & 0.97^{\circCO} + 0.97^{\circ}HYAC + .03^{\circ}MACRN & \\ & MACRO2 + CH3O2 \to .59^{\circ}SHYAC & \\ & 4.55^{\circMGLY} + .595^{\circ}CO + 1.255^{\circ}CH2O + \\ & 1.7^{\circHO2} + 1.595^{\circ}CO + 1.255^{\circ}CH2O + \\ & 1.7^{\circHO2} + 1.595^{\circ}CO + 1.255^{\circ}CH2O + \\ & 1.87\times 10^{-13}exp(500,T) & \\ & MACRO2 + CH3CO3 \to MEK + CH3COOH & 1.87\times 10^{-13}exp(500,T) & \\ & MACROOI + OH \to MACRO2 & 2.70\times 10^{-12} exp(380,T) & \\ & MACROOI + OH \to MACROO2 & 3.20\times 10^{-12} & \\ & MACROOI + OH \to MACROO2 & 3.20\times 10^{-12} & \\ & MACROOI + OH \to MACROO2 & 3.20\times 10^{-12} & \\ & MACROOI + NO3 + NO7 + HCOOH & \\ & 1.7^{\circMGLY + .85^{\circ}HYAC + 1.85^{\circNO2 + & \\ & 1.7^{\circHICOH & \\ & 1.7^{\circMIGUY + .85^{\circ}HYAC + 1.85^{\circNO2 + & \\ & 1.7^{\circMIGUY + .85^{\circ}HYAC + 1.85^{\circNO2 + & \\ & 1.7^{\circHIGUOH & \\ & 1.7^{\circMGUY + 1.5^{\circNO3 + 0.7^{\circHIGCOOH & \\ & 1.7^{\circMGUY + 1.5^{\circHNO4 + \\ & 1.5^{\circNO3 + $0.7^{\circHIGCOOH & \\ & 1.7^{\circHIGCOOH & \\ & 1.7^{\circHIGUOH & \\ & 1.$	+ .209*MVKO2		
$\begin{aligned} & + .65^{+}MGLY + .35^{+}CH2O & 8.00 \times 10^{-12}exp(380.7T) & MACR + OH → .45^{+}MAO3 + .55^{+}MACRO2 & 8.00 \times 10^{-12}exp(380.7T) & MACR + O3 → .261^{+}OH + .202^{+}HO2 & 1.40 \times 10^{-19}exp(-2100.7T) & .326^{+}HCOOH + .569^{+}CO + .88^{+}MGLY + & 0.12^{+}CH2O & 1.40 \times 10^{-19}exp(-2100.7T) & .326^{+}HCOOH + .569^{+}CO + .88^{+}MGLY + & 0.12^{+}CH2O & 1.82 \times 10^{-15}exp(1300.7T) & .012^{+}CH2O & 0.42^{+}MACROOH + 0.58^{+}HO2 & 2.30 \times 10^{-12} & MACRO2 + HO3 → NO2 + HYAC + CO + HO2 & 2.30 \times 10^{-12} & MACRO2 + NO → .97^{+}NO2 + 0.97^{+}HO2 + & 2.70 \times 10^{-19}exp(360.7T) & 0.97^{+}CO + 0.97^{+}HYAC + .03^{+}MACRO & 8.37 \times 10^{-14} & .55^{+}MGLY + .595^{+}CO + 1.255^{+}CH2O + & 1.7^{+}HO2 + .15^{+}NCH & 0.5 & MACRO2 - CO + HYAC + OH & 0.5 & MACRO2 - CO + HYAC + OH & 0.5 & MACRO2 + CH3CO3 → .85^{+}HO2 + .143^{+}MGLY & 1.68 \times 10^{-12}exp(500.7T) & MACRO2 + CH3CO3 → .85^{+}HO2 + .143^{+}MGLY & 1.68 \times 10^{-12}exp(500.7T) & MACRO2 + CH3CO3 → .85^{+}HO2 + .143^{+}CO + CH3O2 & .320 \times 10^{-12} & MACRO2 + CH3CO3 → .85^{+}HO2143^{+}CH2O + & 1.57 \times 10^{-12}exp(500.7T) & MACROOH + OH → MACRO2 & 1.84 \times 10^{-12}exp(500.7T) & MACROOH + OH → MACRO2 & 1.84 \times 10^{-12}exp(500.7T) & MACROOH + OH → MACRO2 & 3.20 \times 10^{-12} & MACROV + OH → MACRO2 & 3.20 \times 10^{-12} & MACROV + OH → MACRO2 & 3.20 \times 10^{-12} & 0.55^{+}CH3CO + 1.55^{+}NO3 + O1 & .30 \times 10^{-12} & 0.55^{+}CH3CO3 + & 0.55^{+}CH3CO3 + & 0.52 \times 10^{-13}exp(350.7T) & 0.55^{+}NO3 + .07^{+}HCOOH & 1.82 \times 10^{-13}exp(350.7T) & 0.55^{+}NO3 + .07^{+}HCOH & 1.82 \times 10^{-13}exp(980.7T) & 0.55^{+}CH3CO3 + & 0.55^{+}CH3CO3 + & 0.55^{+}CH3CO3 + & 0.55^{+}CH3CO3 + & 0.50^{-12}exp(300.7T) & 0.55^{+}CH3CO3 + & 0$	$MVKN + OH \rightarrow .65*HCOOH + NO3$	1.60×10^{-12}	
$\begin{split} & \text{MACR + OH } \rightarrow .45^{\text{e}}\text{MAOS + .55^{\text{e}}\text{MACRO2}} & 8.00 \times 10^{-1} \exp(380.71) \\ & \text{MACR + NO3 } \rightarrow .201^{\text{e}}\text{OH} + .202^{\text{e}}\text{HOO} \\ & 1.40 \times 10^{-15} \exp(-2100.71) \\ & + .326^{\text{e}}\text{HCOOH + .569^{\text{e}}\text{CO} + .88^{\text{e}}\text{MGLY } \\ & 0.12^{\text{e}}\text{CH2} \\ & \text{MACR + NO3 } \rightarrow \text{MAO3 + HNO3} & 3.40 \times 10^{-15} \\ & \text{MACRO2 + HO2 } \rightarrow 0.42^{\text{e}}\text{MACROOH + 0.58^{\text{e}}\text{OH}} \\ & + 0.58^{\text{e}}\text{HYAC + 0.58^{\text{e}}\text{CO} + .88^{\text{e}}\text{MO2} \\ & \text{MACRO2 + NO3 } \rightarrow \text{NO2 + HYAC + CO + HO2} & 2.30 \times 10^{-12} \\ & \text{MACRO2 + NO3 } \rightarrow \text{NO2 + HYAC + CO + HO2} & 2.30 \times 10^{-12} \\ & \text{MACRO2 + NO3 } \rightarrow \text{NO2 + 0.97^{\text{e}}\text{HO2 + 1} \\ & 0.97^{\text{e}}\text{CO + 0.97^{\text{e}}\text{HYAC + .03^{\text{e}}\text{MACRO}} \\ & \text{MACRO2 - CO + HYAC + 0H} & 0.5 \\ & \text{MACRO2 - CO + HYAC + 0H} & 0.5 \\ & \text{MACRO2 - CO + HYAC + 0H} & 0.5 \\ & \text{MACRO2 - CH3CO3 } \rightarrow 85^{\text{e}}\text{HO2 + .143^{\text{e}}\text{MGLV}} \\ & \text{H.55^{\text{e}}\text{MGLY + .595^{\text{e}}\text{CO + .1255^{\text{e}}\text{CH2O + 1}} \\ & \text{MACRO2 - CH3CO3 } \rightarrow \text{MEK + CH3COOH} & 1.87 \times 10^{-12}\exp(500.71) \\ & \text{MACRO2 + CH3CO3 } \rightarrow \text{MEK + CH3COOH} & 1.87 \times 10^{-12}\exp(200.71) \\ & \text{MACRO2 + CH3CO3 } \rightarrow \text{MEK + CH3COOH} & 1.87 \times 10^{-12}\exp(200.71) \\ & \text{MACROOH + 0H } \rightarrow \text{MACRO2} & 3.20 \times 10^{-12} \\ & \text{MACRNO2 + NO } \rightarrow .08^{\text{e}}\text{CH3COOH + .08^{\text{e}}\text{CH2O} \\ & 1.38 \times 10^{-12}\exp(330.71) \\ & \text{MACRNO2 + NO } \rightarrow .08^{\text{e}}\text{CH3COOH} & 1.82 \times 10^{-12}\exp(330.71) \\ & \text{MACRNO2 + 1.5^{\text{e}}\text{NO2 + 0.15^{\text{e}}\text{NO2 + 0}} \\ & \text{MO3 + NO } \rightarrow \text{NO2 + CH2O + .65^{\text{e}}\text{CH3CO} \\ & \text{MAO3 + NO } \rightarrow \text{NO2 + CH2O + .65^{\text{e}}\text{CH3CO2 + 0} \\ & 1.58^{\text{e}}\text{MACO2 + 0} \\ & \text{MAO3 + NO } \rightarrow \text{NO2 + 0.15^{\text{e}}\text{CH3CO3 + 0} \\ & 1.82 \times 10^{-12}\exp(980.71) \\ & + .05^{\text{e}}\text{CH3CO3} \\ & \text{MAO3 + NO } \rightarrow \text{NO2 + 0.35^{\text{e}}\text{CH3CO3 + 0} \\ & 1.68 \times 10^{-12}\exp(980.71) \\ & -15^{\text{e}}\text{MC2O3} \\ \\ & \text{MAO3 + NO } \rightarrow \text{NO2 + 0.35^{\text{e}}\text{CH3CO3 + 0} \\ & 1.68 \times 10^{-12}\exp(980.71) \\ & \text{CH3CO3} \\ & \text{MAO3 + NO2 + 0.15^{\text{e}}\text{CH3CO3 + 0} \\ \\ & \text{MAO3 + NO2 } \rightarrow \text{CH3O } + \text{CH2O + 1.68 \times 10^{-12}\exp(500.71) \\ \\ & \text{MAO3 + NO2 } \rightarrow \text{CH3O } + \text{CH2O + 1.68 \times 10^{-12}\exp(500.7$	+ .65*MGLY + .35*CH2O	12	
$\begin{split} & MACR + O3 \to .261^{\pm}OH + .202^{\pm}HO2 & 1.40 \times 10^{+2} \mathrm{exp}(-2100/T) \\ & + .326^{\pm}HOCOH + .569^{\pm}CO + .88^{\pm}MGLY + \\ & 0.12^{\pm}CH2O & 3.40 \times 10^{-15} & 3.40 \times 10^{-12} & 3.40 $	$MACR + OH \rightarrow .45*MAO3 + .55*MACRO2$	8.00×10 ⁻¹² exp(380./T)	
+ .326*HCOOH + .369*CO + .88*MGLY + 0.12°CH2O MACR + NO3 → MAO3 + HNO3 MACRO2 + HO2 → 0.42*MACROOH + 0.58*OH + 0.58*HYAC + 0.58*CO + 0.58*HO2 MACRO2 + NO3 → NO2 + HYAC + CO + HO2 2.30×10 ⁻¹² MACRO2 + NO3 → NO2 + HYAC + CO + HO2 .30×10 ⁻¹² MACRO2 → CO + HYAC + .03*MACRN MACRO2 → CO + HYAC + .04*MACRN MACRO2 + CH3O3 → .55*HYAC + .255*MGLY + .595*CO + .1255*CH2O + 1.7*HO2 + .15*ROH MACRO2 + CH3CO3 → .85*HO2 + .143*MGLY + .857*HYAC + .857*CO + .143*CH2O + CH3O2 MACRO2 + CH3CO3 → MEK + CH3COOH MACRO2 + CH3CO3 → MEK + CH3COOH MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACRNO2 + NO → .08*CH3COOH + .08*CH2O + .07*MGLY + .85*HYAC + 1.85*NO2 + 0.15*NO3 + .07*HCOOH + .07*MGLY + .85*HYAC + .15*O3 + .44*CH2O + .07*MGLY + .85*HYAC + .15*O3 + .44*CH2O + .07*MGLY + .85*HYAC + .15*O3 + .44*CH2O MAO3 + NO → NO2 + CH2O + .65*CH3O2 + MAO3 + NO3 → NO2 + CH2O + .65*CH3O2 + MAO3 + NO3 → NO2 + O.15*CH3CO3 + MAO3 + NO3 → NO2 + 0.15*CH3CO3 + MAO3 + NO3 → NO2 + 0.35*CH3CO3 + MAO3 + CH3O2 → .04*OO + .015*CH3CO3 + MAO3 + NO3 → NO2 + 0.35*CH3CO3 + MAO3 + CH3O2 → .04*OO + CH2O + MAO3 + NO3 → NO2 + 0.15*CH3CO3	$MACR + O3 \rightarrow .261 * OH + .202 * HO2$	$1.40 \times 10^{-15} \exp(-2100./T)$	
$\begin{array}{c} 0.12^{2} {\rm CH2O} & 3.40 \times 10^{-15} \\ \hline MACR VO2 + HO2 \rightarrow 0.42^{*} {\rm MACROOH} + 0.58^{*} {\rm COI} + 0.58^{*} {\rm HO2} & 1.82 \times 10^{-13} {\rm exp} (1300, {\rm T}) \\ + 0.58^{*} {\rm HYAC} + 0.58^{*} {\rm CO} + 0.95^{*} {\rm HYAC} + {\rm CO} + {\rm HO2} & 2.30 \times 10^{-12} \\ \hline MACRO2 + NO \rightarrow .97^{*} {\rm NO2} + 0.97^{*} {\rm HO2} + 2.70 \times 10^{-12} {\rm exp} (360, {\rm T}) \\ 0.97^{*} {\rm CO} + 0.97^{*} {\rm HYAC} + 0.3^{*} {\rm MACRN} & 0.5 \\ \hline MACRO2 - {\rm CO} + {\rm HYAC} + 0{\rm H} & 0.5 \\ \hline MACRO2 - {\rm CO} + {\rm HYAC} + 0{\rm H} & 0.5 \\ \hline MACRO2 - {\rm CO} + {\rm HYAC} + 0{\rm H} & 0.5 \\ \hline MACRO2 - {\rm CO} + {\rm HYAC} + 0{\rm H} & 0.5 \\ \hline MACRO2 - {\rm CO} 2 + {\rm CH3CO}59^{*} {\rm HYAC} \\ + .255^{*} {\rm MGLY} + .595^{*} {\rm CO} + 1.255^{*} {\rm CH2O} + \\ \hline 1.7^{*} {\rm HO2} + .15^{*} {\rm ROH} & 1.68 \times 10^{-12} {\rm exp} (500, {\rm T}) \\ \hline MACRO2 - {\rm CH3CO}58^{*} {\rm HO2} + .143^{*} {\rm CH2O} + \\ \hline MACRO2 - {\rm CH3CO}58^{*} {\rm HO2} + .143^{*} {\rm CH2O} & 1.87 \times 10^{-13} {\rm exp} (500, {\rm T}) \\ \hline MACROOH + {\rm OH} \rightarrow {\rm MACRO2} & 1.84 \times 10^{-12} {\rm exp} (500, {\rm T}) \\ \hline MACROOH + {\rm OH} \rightarrow {\rm MACRO2} & 3.20 \times 10^{-12} \\ \hline MACROOI + {\rm OH} \rightarrow {\rm MACRO2} & 3.20 \times 10^{-12} \\ \hline MACROOI + {\rm OH} \rightarrow {\rm MACRO2} & 3.20 \times 10^{-12} \\ \hline MACROOI + {\rm OH} \rightarrow {\rm MACRO2} + \\ 0.15^{*} {\rm NO3} + .07^{*} {\rm HCOOH} & 1.82 \times 10^{-13} {\rm exp} (1300, {\rm T}) \\ + .07^{*} {\rm MGLY} + .85^{*} {\rm HYAC} + .85^{*} {\rm NO2} + 0 \\ \hline MAO3 + {\rm NO} \rightarrow {\rm NO2} + {\rm CH3COH} & 1.82 \times 10^{-13} {\rm exp} (290, {\rm T}) \\ \hline 0.65^{*} {\rm CH} {\rm O2} \rightarrow .08^{*} {\rm CH3COOH} & 1.82 \times 10^{-13} {\rm exp} (290, {\rm T}) \\ + .05^{*} {\rm CH3O2} + .65^{*} {\rm CH3O2} + \\ 0.05^{*} {\rm CO} + .55^{*} {\rm CH3O2} + \\ \hline MAO3 + {\rm NO} \rightarrow {\rm NO2} + {\rm CH3CO} + {\rm CH2O} + \\ \hline MAO3 + {\rm NO} \rightarrow {\rm NO2} + {\rm CH3CO3} + {\rm CH1O}^{-12} {\rm exp} (500, {\rm T}) \\ \hline MAO3 + {\rm CH3O2} \rightarrow {\rm CH2O} + {\rm HO2} + {\rm CH2O} + \\ \hline 1.68 \times 10^{-12} {\rm exp} (500, {\rm T}) \\ \hline MAO3 + {\rm CH3O2} \rightarrow {\rm CH2O} + {\rm CH2O} + {\rm CH3CO} & 2.50 \times 10^{-13} {\rm exp} (500, {\rm T}) \\ \hline MAO3 + {\rm CH3O2} \rightarrow {\rm CH2O} + $	+ .326*HCOOH + .569*CO + .88*MGLY +		
$\begin{array}{llllllllllllllllllllllllllllllllllll$	0.12*CH2O	15	
$\begin{array}{llllllllllllllllllllllllllllllllllll$	$MACR + NO3 \rightarrow MAO3 + HNO3$	3.40×10 ⁻¹⁵	
$ \begin{array}{ll} +0.58^{\text{H}}\text{IYAC} + 0.58^{\text{H}}\text{O2} & \\ \hline \text{MACRO2} + \text{NO3} \rightarrow \text{NO2} + \text{HYAC} + \text{CO} + \text{HO2} & 2.30\times 10^{-12} & \\ \hline \text{MACRO2} + \text{NO} \rightarrow 97^{\text{H}}\text{NO2} + 0.97^{\text{H}}\text{HO2} + & 2.70\times 10^{-12}\text{exp}(360/\text{T}) & \\ \hline 0.97^{\text{H}}\text{CO} + 0.97^{\text{H}}\text{HYAC} + .03^{\text{H}}\text{MACRN} & \\ \hline \text{MACRO2} + \text{CH3O2} \rightarrow 595^{\text{H}}\text{HYAC} & 8.37\times 10^{-14} & \\ \hline \text{H} \text{ACRO2} + \text{CH3CO3} \rightarrow 595^{\text{H}}\text{HYAC} & 8.37\times 10^{-14} & \\ \hline \text{H} \text{ACRO2} + \text{CH3CO3} \rightarrow 595^{\text{H}}\text{HYAC} & \\ \hline \text{H} \text{ASTRO2} + .15^{\text{H}}\text{ROH} & \\ \hline \text{MACRO2} + \text{CH3CO3} \rightarrow \text{MSF}\text{HO2} + .143^{\text{H}}\text{MGLY} & 1.68\times 10^{-12}\text{exp}(500/\text{T}) & \\ \hline \text{H} \text{ACRO2} + \text{CH3CO3} \rightarrow \text{MEK} + \text{CH3COOH} & 1.87\times 10^{-13}\text{exp}(500/\text{T}) & \\ \hline \text{MACRO04} + \text{OH} \rightarrow \text{MACRO2} & 1.84\times 10^{-12}\text{exp}(200/\text{T}) & \\ \hline \text{MACROOH} + \text{OH} \rightarrow \text{MACRO2} & 3.20\times 10^{-12} & \\ \hline \text{MACROOH} + \text{OH} \rightarrow \text{MACRNO2} & 3.20\times 10^{-12} & \\ \hline \text{MACRNO2} + \text{NO} \rightarrow .08^{\text{R}}\text{CH3COOH} & 1.82\times 10^{-13}\text{exp}(350/\text{T}) & \\ \hline \text{MACRNO2} + \text{HO} \rightarrow \text{MACRNO2} & 3.20\times 10^{-12} & \\ \hline \text{MACRNO2} + \text{HO} \rightarrow 0.8^{\text{R}}\text{CH3COOH} & 1.82\times 10^{-13}\text{exp}(350/\text{T}) & \\ \hline \text{L} .05^{\text{H}}\text{MO3} + .07^{\text{H}}\text{HCOOH} & \\ \hline \text{MACRNO2} + \text{HO} \rightarrow 0.8^{\text{R}}\text{CH3COOH} & 1.82\times 10^{-13}\text{exp}(1300/\text{T}) & \\ \hline + .08^{\text{R}}\text{CH2O} + .15^{\text{R}}\text{NO3} + .07^{\text{H}}\text{COOH} & \\ \hline \text{MAO3} + \text{NO2} \rightarrow \text{OU2} + \text{CH2O} + .65^{\text{R}}\text{CH3O2} + & \\ \hline 0.65^{\text{R}}\text{CH3O2} + 4.18^{\text{A}}\text{MAO} + 0.15^{\text{R}}\text{CH3CO3} + & \\ \hline 0.15^{\text{H}}\text{MACO2} + 0.55^{\text{R}}\text{CH3CO3} + & \\ \hline 0.15^{\text{R}}\text{MACO2} + 0.29^{\text{R}}\text{CO} & \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + & \\ \hline 1.68\times 10^{-12} \text{exp}(500/\text{T}) & \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH3O} + \text{CH2O} + & \\ \hline 1.68\times 10^{-12} \text{exp}(500/\text{T}) & \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH3O} + \text{CH2O} + & \\ \hline 1.68\times 10^{-12} \text{exp}(500/\text{T}) & \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH3O} + \text{CH2O} + & \\ \hline 1.68\times 10^{-12} \text{exp}(500/\text{T}) & \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH3O} + \text{CH2O} + & \\ \hline 1.111\times 10^{2} \text{exp}(500/\text{T}) & \\ \hline \text{MAO3} + \text{NO2} + \text{M} \text{M} \text{M} \text{M} & \\ \hline \text{NAO3} + \text{NO2} + \text{M} \text{M} \text{A} \text{M} \text$	$MACRO2 + HO2 \rightarrow 0.42*MACROOH + 0.58*OH$	$1.82 \times 10^{-13} \exp(1300./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	+ 0.58*HYAC + 0.58*CO+ 0.58*HO2	a a a 12	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACRO2 + NO3 \rightarrow NO2 + HYAC + CO + HO2$	2.30×10 ⁻¹²	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACRO2 + NO \rightarrow .97*NO2 + 0.97*HO2 +$	$2.70 \times 10^{-12} \exp(360./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	0.97*CO + 0.97*HYAC + .03*MACRN		
$ \begin{array}{ll} \text{MACRO2} + CH3O2 → .595*\text{HYAC} \\ + .255*\text{MGLY} + .595*\text{CO} + 1.255*\text{CH2O} + \\ 1.7^*\text{HO2} + .15^*\text{ROH} \\ \hline \\ \text{MACRO2} + CH3CO3 → .85*\text{HO2} + .143*\text{MGLY} \\ + .857*\text{HYAC} + .857*\text{CO} + .143*\text{CH2O} + CH3O2 \\ \hline \\ \text{MACRO2} + CH3CO3 → MEK + CH3COOH \\ 1.87\times10^{-12}\text{exp}(500/\text{T}) \\ \hline \\ \text{MACROOH} + OH \to \text{MACRO2} \\ 1.84\times10^{-12}\text{exp}(200/\text{T}) \\ \hline \\ \text{MACROOH} + OH \to \text{MACRNO2} \\ 3.20\times10^{-12} \\ \hline \\ \text{MACRNO2} + NO \to .08*\text{CH3COOH} + .08*\text{CH2O} \\ + .07*\text{MGLY} + .85*\text{HYAC} + 1.85*\text{NO2} + \\ 0.15*\text{NO3} + .07*\text{HCOOH} \\ \hline \\ \text{MACRNO2} + HO2 \to .08*\text{CH3COOH} + .08*\text{CH2O} \\ + .07*\text{MGLY} + .85*\text{HYAC} + 1.85*\text{NO2} + \\ 0.15*\text{NO3} + .07*\text{HCOOH} \\ \hline \\ \text{MACRNO2} + HO2 \to .08*\text{CH3COOH} \\ + .07*\text{MGLY} + .85*\text{HYAC} + .85*\text{NO2} + 0 \\ \hline \\ \text{MACRNO2} + HO2 \to .08*\text{CH3COOH} \\ + .07*\text{MGLY} + .85*\text{HYAC} + .85*\text{NO2} + 0 \\ \hline \\ \text{MACRNO2} + HO2 \to .08*\text{CH3COOH} \\ + .07*\text{MGLY} + .85*\text{HYAC} + .85*\text{NO2} + 0 \\ \hline \\ \text{MACRNO2} + HO2 \to .08*\text{CH3COOH} \\ + .07*\text{MGLY} + .85*\text{HYAC} + .85*\text{NO2} + 0 \\ \hline \\ \text{MAO3} + \text{NO} \to \text{NO2} + \text{CH2O} + .65*\text{CH3O2} + \\ 0.65*\text{CH3O2} + .14*\text{MAOP} + 0.15*\text{CH3CO3} + \\ 0.15*\text{MACO2H} + 0.29*\text{CO} \\ \hline \\ \text{MAO3} + \text{HO2} \to .44*\text{OH} + .15*\text{O3} + .44*\text{CH2O} \\ + .29*\text{CH3O2} + 0.43*\text{CH3OC} \to 0 \\ \hline \\ \text{MAO3} + \text{CH3O2} \to \text{CH2O} + \text{HO2} + \text{CH2O} + \\ 0.65*\text{CH3O2} + 0.65*\text{CO} \\ \hline \\ \hline \\ \text{MAO3} + \text{CH3O2} \to \text{COOH} + \text{CH2O} + \\ \hline \\ \text{MAO3} + \text{CH3O2} \to \text{CH2O} + \text{HO2} + \text{CH2O} + \\ \hline \\ \text{MAO3} + \text{CH3O2} \to \text{CH3O2} + \text{CH2O} + \text{CH3CO3} \\ \hline \\ \hline \\ \text{MAO3} + \text{CH3O2} \to \text{CH3O2} + \text{CH2O} + \text{CH3CO3} \\ \hline \\ \hline \\ \text{MAO3} + \text{CH3CO3} \to \text{CH3O2} + \text{CH2O} + \text{CH3CO3} \\ \hline \\ \hline \\ \text{MAO3} + \text{NO2} + \text{M} \to \text{MPAN} + \text{M} \\ \hline \\ \text{ko} = .00E-28*(300/\text{T})^{8.90}, \\ \text{ki} = 7.70E-12*(300/\text{T})^{8.90}, \\ \text{ki} = 7.70E-12*($	$MACRO2 \rightarrow CO + HYAC + OH$	0.5	
+ .255*MGLY + .595*C0 + 1.255*CH2O + 1.7*HO2 + .15*ROH MACRO2 + CH3CO3 → .85*HO2 + .143*MGLY + .857*HYAC + .857*CO + .143*CH2O + CH3O2 MACRO2 + CH3CO3 → MEK + CH3COOH MACROOH + OH → MACRO2 MACROOH + OH → MACRO2 MACROOH + OH → HYAC + OH 4.40×10 ⁻¹² exp(380./T) MACRON + OH → MACRO2 1.84×10 ⁻¹² exp(380./T) MACRNO2 + NO → .08*CH3COOH + .08*CH2O + .07*MGLY + .85*HYAC + 1.85*NO2 + 0.15*NO3 + .07*HCOOH MACRNO2 + HO2 → .08*CH3COOH + + .07*MGLY + .85*HYAC + 1.85*NO2 + 0.15*NO3 + .07*HCOOH + .07*MGLY + .85*HYAC + .85*NO2 + OH MAO3 + NO → NO2 + CH2O + .65*CH3O2 + 0.65*CO + .35*CH3CO3 MAO3 + HO2 → .44*OH + .15*O3 + .44*CH2O + .29*CH3O2 + .41*MAOP + 0.15*CH3CO3 + 0.15*MACO2H + 0.29*CO MAO3 + NO3 → NO2 + 0.35*CH3CO3 + CH2O + 0.468*LO ⁻¹² exp(500./T) MAO3 + CH3O2 → CH2O + HO2 + CH2O + MAO3 + CH3O2 → CH3O + HO2 + CH2O + MAO3 + CH3O2 → CH3O + HO2 + CH2O + MAO3 + CH3O2 → RCOOH + CH2O + MAO3 + NO2 + M → MPAN + M ko=9.00E-28*(300/T) ^{8.90} ; ki=7.70E-12*(300/T) ^{8.90} ; ki=7.70E-12*(300/T) ^{8.90} ; ki=7.70E-12*(300/T) ^{9.80} ; ki=7.70E-12*(300	$MACRO2 + CH3O2 \rightarrow .595*HYAC$	8.37×10 ⁻¹⁴	
$\begin{split} 1.7^{2}\text{HO} 2 + .15^{2}\text{ROH} & 1.68 \times 10^{-12} \text{exp}(500.\text{T}) \\ +.857^{2}\text{HYAC} + .857^{2}\text{CO} + .143^{2}\text{CH2O} + C\text{H3O2} \\ 1.68 \times 10^{-12} \text{exp}(500.\text{T}) \\ \hline \text{MACRO2} + C\text{H3CO3} \rightarrow \text{MEK} + C\text{H3COOH} & 1.87 \times 10^{-13} \text{exp}(500.\text{T}) \\ \hline \text{MACROOH} + \text{OH} \rightarrow \text{MACRO2} & 1.84 \times 10^{-12} \text{exp}(200.\text{T}) \\ \hline \text{MACROOH} + \text{OH} \rightarrow \text{MACRNO2} & 3.20 \times 10^{-12} \\ \hline \text{MACRNO2} + \text{NO} \rightarrow .08^{2}\text{CH3COOH} + .08^{2}\text{CH2O} \\ + .07^{2}\text{MGLY} + .85^{2}\text{HYAC} + .85^{2}\text{NO2} + \\ .015^{2}\text{NO3} + .07^{2}\text{HCOOH} & 1.82 \times 10^{-13} \text{exp}(1300.\text{T}) \\ \hline + .08^{2}\text{CH2O} + .15^{2}\text{NO3} + .07^{2}\text{HCOOH} & 1.82 \times 10^{-13} \text{exp}(1300.\text{T}) \\ + .08^{2}\text{CH2O} + .15^{2}\text{NO3} + .07^{2}\text{HCOOH} & 1.82 \times 10^{-13} \text{exp}(290.\text{T}) \\ \hline \text{MAO3} + \text{NO} \rightarrow \text{NO2} + \text{CH2O} + .65^{2}\text{CH3O2} + \\ .058^{2}\text{CO} + .35^{2}\text{CH3CO3} & 5.20 \times 10^{-12} \text{exp}(290.\text{T}) \\ \hline \text{MAO3} + \text{HO2} \rightarrow .44^{2}\text{OH} + .15^{2}\text{O3} + .44^{2}\text{CH2O} \\ + .29^{2}\text{CH3O2} + .41^{2}\text{MAOP} + 0.15^{2}\text{CH3CO3} + \\ \hline \text{MAO3} + \text{NO3} \rightarrow \text{NO2} + 0.35^{2}\text{CH3CO3} + C\text{H2O} + \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + C\text{H2O} + \\ \hline \text{CH3CO3} & - \text{CH2O} + \text{HO2} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH2O} + \text{CH2O} + \\ \hline \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH2O} + \text{CH3CO3} & 2.50 \times 10^{-12} \text{exp}(500.\text{T}) \\ \hline \text{MAO3} + \text{NO2} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH3CO3} & 2.50 \times 10^{-12} \text{exp}(500.\text{T}) \\ \hline \text{MAO3} + \text{NO2} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH3CO3} & 2.50 \times 10^{-12} \text{exp}(500.\text{T}) \\ \hline \text{MAO3} + \text{NO2} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH3CO3} & 2.50 \times 10^{-12} \text{exp}(500.\text{T}) \\ \hline \text{MAO3} + \text{NO2} \rightarrow \text{MAOA} + \text{M} \\ \text{Ko} = 9.00 \text{E} .28^{2} \text{(300T)}^{3.90}; \\ \text{Ki} = 7.70 \text{E} .12^{2} (300 \text{T})^{3.90}; \\ \text{Ki} = 7.$	+ .255*MGLY + .595*CO + 1.255*CH2O +		
$\begin{array}{ll} \text{MACRO2} + \text{CH3CO3} \rightarrow \text{.85}^{*}\text{HO2} + .143^{*}\text{MGLY} & 1.68 \times 10^{-12}\text{exp}(500/\text{T}) \\ & + .857^{*}\text{HYAC} + .857^{*}\text{CO} + .143^{*}\text{CH2O} + \text{CH3CO3} \\ & \text{MACRO2} + \text{CH3CO3} \rightarrow \text{MEK} + \text{CH3COOH} & 1.87 \times 10^{-13}\text{exp}(500/\text{T}) \\ & \text{MACROOH} + \text{OH} \rightarrow \text{MACRO2} & 1.84 \times 10^{-12}\text{exp}(200/\text{T}) \\ & \text{MACROOH} + \text{OH} \rightarrow \text{MACRNO2} & 3.20 \times 10^{-12} \\ & \text{MACRNO2} + \text{NO} \rightarrow .08^{*}\text{CH3COOH} + .08^{*}\text{CH2O} \\ & + .07^{*}\text{MGLY} + .85^{*}\text{HYAC} + .185^{*}\text{NO2} + \\ & 0.15^{*}\text{NO3} + .07^{*}\text{HCOOH} \\ & \text{MACRNO2} + \text{HO2} \rightarrow .08^{*}\text{CH3COOH} \\ & + .07^{*}\text{MGLY} + .85^{*}\text{HYAC} + .85^{*}\text{NO2} + \text{OH} \\ & \text{MACRNO2} + \text{HO2} \rightarrow .08^{*}\text{CH3COOH} \\ & + .07^{*}\text{MGLY} + .85^{*}\text{HYAC} + .85^{*}\text{NO2} + \text{OH} \\ & \text{MAO3} + \text{NO} \rightarrow \text{NO2} + \text{CH2O} + .65^{*}\text{CH3O2} + \\ & 0.65^{*}\text{CO} + .35^{*}\text{CH3CO3} \\ & \text{MAO3} + \text{HO} \rightarrow \text{NO2} + \text{CH2O} + .65^{*}\text{CH3O2} + \\ & 0.55^{*}\text{CH3CO3} \\ & \text{MAO3} + \text{HO2} \rightarrow .44^{*}\text{OH} + .15^{*}\text{O3} + .44^{*}\text{CH2O} \\ & + .29^{*}\text{CH3O2} + .41^{*}\text{MAOP} + 0.15^{*}\text{CH3CO3} + \\ & 0.15^{*}\text{MACO2H} + 0.29^{*}\text{CO} \\ \\ & \text{MAO3} + \text{NO3} \rightarrow \text{NO2} + 0.35^{*}\text{CH3CO3} + \text{CH2O} + \\ & 0.65^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.65^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.65^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.65^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.63^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.63^{*}\text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ & 0.63^{*}\text{CH3O3} \rightarrow \text{NO2} + \text{CH2O} + \text{CH2O} + \\ & 0.63^{*}\text{CH3O3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH3CO3} \\ & \frac{1.57^{*}\text{NO}^{13}\text{exp}(500/\text{T}) \\ & \frac{1.68^{*}\text{10}^{12}\text{exp}(500/\text{T}) \\ & \frac{1.68^{*}\text{10}^{12}\text{exp}(500/\text{T}) \\ & \frac{1.69^{*}\text{10}^{10}\text{exp}(500/\text{T}) \\ & \frac{1.69^{*}\text{10}^{*}\text{10}^{*}\text{CH3O3} + \text{NO2} + \text{M} \rightarrow \text{MAO3} + \text{NO2} \\ & \frac{1.111 \times 10^{28}\text{exp}(500/\text{T}) \\ & \frac{1.111 \times 10^{28}\text{exp}(500/\text{T}) \\ & \frac{1.000^{*}\text{T}^{*}\text{S}^{5}\text{S} \\ & \frac{1.000^{*}\text{T}^{*}\text{S}^{5}\text{S} \\ & \frac{1.000^{*}\text{T}^{*}\text{S}^{5}\text{S} \\ & \frac{1.000^{*}\text{T}^{*}\text{S}^{5}\text{S} \\ & \frac{1.000^{*}\text{T}^$	1.7*HO2 + .15*ROH	12	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACRO2 + CH3CO3 \rightarrow .85*HO2 + .143*MGLY$	$1.68 \times 10^{-12} \exp(500./\mathrm{T})$	
$\begin{array}{ll} \mbox{MACRO2} + CH3CO3 → MEK + CH3COOH & 1.87 \times 10^{-13} exp(500.71) \\ \mbox{MACROOH} + OH → MACRO2 & 1.84 \times 10^{-12} exp(200.71) \\ \mbox{MACROOH} + OH → HYAC + OH & 4.40 \times 10^{-12} exp(380.71) \\ \mbox{MACRNO2} + OH → MACRNO2 & 3.20 \times 10^{-12} \\ \mbox{MACRNO2} + NO → .08 \times CH3COOH + .08 \times CH2O \\ \mbox{A.07 \times 10} + .07 \times MGLY + .85 \times HYAC + 1.85 \times NO2 + 0 \\ \mbox{0.15 \times NO3} + .07 \times HCOOH & 1.82 \times 10^{-12} exp(350.71) \\ \mbox{+} .015 \times NO3 + .07 \times HCOOH & 1.82 \times 10^{-13} exp(1300.71) \\ \mbox{+} .08 \times CH2O + .15 \times NO3 + .07 \times HCOOH & 1.82 \times 10^{-13} exp(1300.71) \\ \mbox{+} .08 \times CH2O + .15 \times NO3 + .07 \times HCOOH & 1.82 \times 10^{-13} exp(290.71) \\ \mbox{+} .065 \times CH2 \to .08 \times CH3COOH & 1.82 \times 10^{-13} exp(290.71) \\ \mbox{-} .065 \times CO + .35 \times CH3CO3 + 0.15 \times MO2 + 0.15 \times MAO3 + NO2 \to .44 \times OH + 0.15 \times CH3CO3 + 0.05 \times CO & 0.05 \times CO \\ \mbox{MAO3} + NO3 \to NO2 + 0.35 \times CH3CO3 + CH2O + 1.68 \times 10^{-12} exp(500.71) \\ \mbox{HAO3} + CH3O2 \to CH2O + HO2 + CH2O + 1.68 \times 10^{-12} exp(500.71) \\ \mbox{HAO3} + CH3O2 \to CH2O + HO2 + CH2O + 1.68 \times 10^{-12} exp(500.71) \\ \mbox{MAO3} + CH3O2 \to CH2O + HO2 + CH2O + 0.187 \times 10^{-13} exp(500.71) \\ \mbox{MAO3} + CH3O2 \to CH2O + HO2 + CH2O + CH3CO3 & 2.50 \times 10^{-12} exp(500.71) \\ \mbox{MAO3} + CH3O2 \to CH2O + CH2O + CH3CO3 & 2.50 \times 10^{-12} exp(500.71) \\ \mbox{MAO3} + NO2 + M \to MPAN + M & ko= 9.00E-28^{+} (300.71)^{8.90}; \\ \mbox{ki=7.70E-12^{+} ($	+ .857*HYAC + .857*CO + .143*CH2O + CH3O2	4.07.40.12 (700.77)	
$\begin{array}{ll} \mbox{MACROOH} + OH \to MACRO2 & 1.84 \times 10^{-12} \exp(200./T) \\ \mbox{MACROOH} + OH \to HYAC + OH & 4.40 \times 10^{-12} \exp(380./T) \\ \mbox{MACRNO2} + NO \to .08 \times CH3COOH + .08 \times CH2O \\ + .07 \times MGLY + .85 \times HYAC + 1.85 \times NO2 + \\ 0.15 \times NO3 + .07 \times HCOOH & 1.82 \times 10^{-12} \exp(350./T) \\ \mbox{MACRNO2} + HO2 \to .08 \times CH3COOH & 1.82 \times 10^{-13} \exp(1300./T) \\ + .08 \times CH2O + .15 \times NO3 + .07 \times HCOOH & 1.82 \times 10^{-13} \exp(1300./T) \\ \mbox{MACR} + .85 \times HYAC + .85 \times NO2 + OH & 1.82 \times 10^{-13} \exp(290./T) \\ \mbox{MAO3} + NO \to NO2 + CH2O + .65 \times CH3O2 + \\ 0.65 \times CO + .35 \times CH3CO3 & 0.53 \times CH3CO3 + \\ \mbox{MAO3} + HO2 \to .44 \times OH + .15 \times O3 + .44 \times CH2O \\ \mbox{MAO3} + HO2 \to .44 \times OH + .15 \times O3 + .44 \times CH2O \\ \mbox{MAO3} + NO3 \to NO2 + 0.35 \times CH3CO3 + \\ \mbox{O2} + 0.65 \times CO & 0. \\ \mbox{MAO3} + CH3O2 \to OH + OL2 + CH2O + \\ \mbox{CH3O2} + OL2O + HO2 + CH2O + \\ \mbox{CH3O2} + CH3O2 \to CHOOH + CH2O & 1.87 \times 10^{-12} \exp(500./T) \\ \mbox{MAO3} + CH3O2 \to CH3O2 + CH2O + CH3CO3 & 2.50 \times 10^{-12} \exp(500./T) \\ \mbox{MAO3} + NO3 \to OH3O2 + CH2O + CH3CO3 & 2.50 \times 10^{-12} \exp(500./T) \\ \mbox{MAO3} + CH3O2 \to CH3O2 + CH2O + CH3CO3 & 2.50 \times 10^{-12} \exp(500./T) \\ \mbox{MAO3} + NO2 + M \to MPAN + M & ko=9.00E-28 \times (300/T)^{8.90}; \\ \mbox{ki=7.70E-12 \times (300/T)^{8.90}; \\ ki=7.70$	$MACRO2 + CH3CO3 \rightarrow MEK + CH3COOH$	$1.87 \times 10^{-13} \exp(500./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACROOH + OH \rightarrow MACRO2$	$1.84 \times 10^{-12} \exp(200./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACROOH + OH \rightarrow HYAC + OH$	$4.40 \times 10^{-12} \exp(380./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACRN + OH \rightarrow MACRNO2$	3.20×10 ⁻¹²	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$MACRNO2 + NO \rightarrow .08*CH3COOH + .08*CH2O$	$2.70 \times 10^{-12} \exp(350./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	+ .07*MGLY + .85*HYAC+ 1.85*NO2 +		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	0.15*NO3 + .07*HCOOH		
+ .08*CH2O + .15*NO3 + .07*HCOOH + .07*MGLY + .85*HYAC + .85*NO2 + OH MAO3 + NO → NO2 + CH2O + .65*CH3O2 + 0.65*CO + .35*CH3CO3 MAO3 + HO2 → .44*OH + .15*O3 + .44*CH2O + .29*CH3O2 + .41*MAOP + 0.15*CH3CO3 + 0.15*MACO2H + 0.29*CO MAO3 + NO3 → NO2 + 0.35*CH3CO3 + CH2O + 0.65*CH3O2 + 0.65*CO MAO3 + CH3O2 → CH2O + HO2 + CH2O + CH3CO3 MAO3 + CH3O2 → CH2O + HO2 + CH2O + CH3CO3 MAO3 + CH3O2 → CH2O + HO2 + CH2O + CH3CO3 MAO3 + CH3O2 → CH2O + HO2 + CH2O + CH3CO3 MAO3 + CH3O2 → RCOOH + CH2O 1.87×10 ⁻¹³ exp(500./T) MAO3 + CH3O2 → CH3O2 + CH2O + CH3CO3 2.50×10 ⁻¹² exp(500./T) MAO3 + NO2 + M → MPAN + M ko=9.00E-28*(300/T) ^{8.90} ; ki=7.70E-12*(300/T) ^{0.20} ; f=0.60; usr53 MPAN → MAO3 + NO2 1.111×10 ²⁸ exp(- 14000./T)*usr53	MACRNO2 + HO2 \rightarrow .08*CH3COOH	$1.82 \times 10^{-13} \exp(1300./T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	+ .08*CH2O + .15*NO3 + .07*HCOOH		
$\begin{array}{c c} MAO3 + NO \rightarrow NO2 + CH2O + .65 * CH3O2 + \\ 0.65 * CO + .35 * CH3CO3 \\ \hline MAO3 + HO2 \rightarrow .44 * OH + .15 * O3 + .44 * CH2O \\ + .29 * CH3O2 + .41 * MAOP + 0.15 * CH3CO3 + \\ 0.15 * MACO2H + 0.29 * CO \\ \hline MAO3 + NO3 \rightarrow NO2 + 0.35 * CH3CO3 + CH2O + \\ 0.65 * CH3O2 + 0.65 * CO \\ \hline MAO3 + CH3O2 \rightarrow CH2O + HO2 + CH2O + \\ CH3CO3 \\ \hline MAO3 + CH3O2 \rightarrow CH2O + HO2 + CH2O + \\ CH3CO3 \\ \hline MAO3 + CH3O2 \rightarrow CH3O2 + CH2O + CH2O + CH3CO3 \\ \hline MAO3 + CH3O2 \rightarrow CH3O2 + CH2O + CH3CO3 \\ \hline MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 \\ \hline MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M \\ \hline MPAN \rightarrow MAO3 + NO2 \\ \hline MPAN \rightarrow MAO3 + NO2 \\ \hline MPAN + OH \rightarrow HYAC + CO + NO2 \\ \hline \end{array}$	+ .0/*MGLY + .85*HYAC + .85*NO2 + OH		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$MAO3 + NO \rightarrow NO2 + CH2O + .65*CH3O2 + 0.65*CH3O2 + 0.65*$	$8.70 \times 10^{-12} \exp(290.7\Gamma)$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.65*CO + .35*CH3CO3	5 3 0 40 12 (000 / T)	
+ .29*CH302 + .41*MAOP + 0.15*CH3CO3 + 0.15*MAC02H + 0.29*CO MAO3 + NO3 → NO2 + 0.35*CH3CO3 + CH2O + 0.65*CH3O2 + 0.65*CO MAO3 + CH3O2 → CH2O + HO2 + CH2O + CH3CO3 MAO3 + CH3O2 → RCOOH + CH2O MAO3 + CH3CO3 → CH3O2 + CH2O + CH3CO3 MAO3 + CH3CO3 → CH3O2 + CH2O + CH3CO3 MAO3 + NO2 + M → MPAN + M ko=9.00E-28*(300/T) ^{8.90} ; ki=7.70E-12*(300/T) ^{0.20} ; f=0.60; usr53 MPAN → MAO3 + NO2 1.111×10 ²⁸ exp(- 14000./T)*usr53 MPAN + OH → HYAC + CO + NO2 2.90×10 ⁻¹¹	$MAO3 + HO2 \rightarrow .44*OH + .15*O3 + .44*CH2O$	$5.20 \times 10^{-13} \exp(980.7T)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	+ .29*CH3O2 + .41*MAOP + 0.15*CH3CO3 + 0.15*MACO2H + 0.20*CO		
$\begin{array}{c c} MAO3 + NO3 \rightarrow NO2 + 0.35 * CH3CO3 + CH2O + \\ 0.65 * CH3O2 + 0.65 * CO \\ \hline MAO3 + CH3O2 \rightarrow CH2O + HO2 + CH2O + \\ CH3CO3 \\ \hline MAO3 + CH3O2 \rightarrow RCOOH + CH2O \\ \hline MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 \\ \hline MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M \\ \hline ko=9.00E-28 * (300/T)^{8.90}; \\ ki=7.70E-12 * (300/T)^{0.20}; \\ f=0.60; \\ usr53 \\ \hline MPAN \rightarrow MAO3 + NO2 \\ \hline MPAN + OH \rightarrow HYAC + CO + NO2 \\ \hline L111 \times 10^{28} exp(-14000./T)^{11} \\ \hline L111 \times 10^{21} exp(-11000./T)^{11} \\ \hline L111 \times 10^{21} exp(-1100./T)^{11} \\ \hline L111 \times 10^{21} exp($	$0.15^{*}MACO_{2H} + 0.29^{*}CO$	4.00, 10-12	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MA03 + N03 \rightarrow N02 + 0.35 CH3C03 + CH2O + 0.65 CH3C03 + 0.$	4.00×10 ¹²	
$\begin{array}{c} \text{MAO3} + \text{CH3O2} \rightarrow \text{CH2O} + \text{HO2} + \text{CH2O} + \\ \text{CH3CO3} & 1.87 \times 10^{-12} \text{exp}(500./1) \\ \hline \text{MAO3} + \text{CH3O2} \rightarrow \text{RCOOH} + \text{CH2O} & 1.87 \times 10^{-13} \text{exp}(500./1) \\ \hline \text{MAO3} + \text{CH3CO3} \rightarrow \text{CH3O2} + \text{CH2O} + \text{CH3CO3} & 2.50 \times 10^{-12} \text{exp}(500./1) \\ \hline \text{MAO3} + \text{NO2} + \text{M} \rightarrow \text{MPAN} + \text{M} & \text{ko=9.00E-28*(300/T)^{8.90};} \\ \text{ki=7.70E-12*(300/T)^{0.20};} \\ \text{f=0.60;} \\ \text{usr53} \\ \hline \text{MPAN} \rightarrow \text{MAO3} + \text{NO2} & 1.111 \times 10^{28} \text{exp}(-14000./1)^{*} \text{usr53} \\ \hline \text{MPAN} + \text{OH} \rightarrow \text{HYAC} + \text{CO} + \text{NO2} & 2.90 \times 10^{-11} \\ \hline \end{array}$	0.03 -CH302 + 0.03 -CU202 + 0.02	1 (9, 10-12, (500 /T)	
$\begin{array}{c c} CH3CO3 & & & & & & \\ \hline MAO3 + CH3O2 \rightarrow RCOOH + CH2O & & & & \\ 1.87 \times 10^{-13} exp(500./T) & & \\ \hline MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 & & & \\ 2.50 \times 10^{-12} exp(500./T) & & \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M & & & \\ \hline ko=9.00E-28*(300/T)^{8.90}; & & \\ \hline ki=7.70E-12*(300/T)^{0.20}; & & \\ f=0.60; & & & \\ usr53 & & \\ \hline MPAN \rightarrow MAO3 + NO2 & & & \\ 1.111 \times 10^{28} exp(- & & \\ 14000./T)^* usr53 & & \\ \hline MPAN + OH \rightarrow HYAC + CO + NO2 & & & \\ 2.90 \times 10^{-11} & & \\ \hline \end{array}$	$MAO3 + CH3O2 \rightarrow CH2O + HO2 + CH2O + CH2O + CH2O + CH2CO2$	$1.08 \times 10^{-1} \exp(500.71)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$MAO2 + CH2O2 \rightarrow BCOOH + CH2O$	$1.87 \times 10^{-13} \text{ or } \text{p}(500 \text{ /T})$	
$\begin{array}{c c} MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3 & 2.50 \times 10^{-9} exp(500.71) \\ \hline MAO3 + NO2 + M \rightarrow MPAN + M & ko=9.00E-28*(300/T)^{8.90}; \\ ki=7.70E-12*(300/T)^{0.20}; \\ f=0.60; \\ usr53 \\ \hline MPAN \rightarrow MAO3 + NO2 & 1.111 \times 10^{28} exp(-14000.7T)*usr53 \\ \hline MPAN + OH \rightarrow HYAC + CO + NO2 & 2.90 \times 10^{-11} \\ \hline \end{array}$	$MAO3 + CH3O2 \rightarrow RCOOH + CH2O$	$1.87 \times 10^{-12} \exp(500.71)$	
$\begin{array}{c} MAO3 + NO2 + M \rightarrow MPAN + M \\ ki = 7.70E - 12^{*}(300/T)^{0.20}; \\ f = 0.60; \\ usr53 \\ \hline MPAN \rightarrow MAO3 + NO2 \\ \hline 1.111 \times 10^{28} exp(-14000./T)^{*}usr53 \\ \hline MPAN + OH \rightarrow HYAC + CO + NO2 \\ \hline 2.90 \times 10^{-11} \\ \hline \end{array}$	$MAO3 + CH3CO3 \rightarrow CH3O2 + CH2O + CH3CO3$	$2.50 \times 10^{-2} \exp(500.71)$	
$MPAN \rightarrow MAO3 + NO2$ $MPAN \rightarrow HYAC + CO + NO2$ $MPAN + OH \rightarrow HYAC + CO + NO2$ $MPAN + OH \rightarrow HYAC + CO + NO2$ $MPAN + OH \rightarrow HYAC + CO + NO2$ $MPAN + OH \rightarrow HYAC + CO + NO2$	$MAO3 + NO2 + M \rightarrow MPAN + M$	$K0=9.00E-28*(300/1)^{0.00}$; $ki=7.70E-12*(300/T)^{0.20}$	
$\begin{array}{c} 1-0.00,\\ usr53\end{array}$ $\begin{array}{c} MPAN \rightarrow MAO3 + NO2 \\ 1.111 \times 10^{28} exp(-14000./T)*usr53\end{array}$ $\begin{array}{c} MPAN + OH \rightarrow HYAC + CO + NO2 \\ 2.90 \times 10^{-11} \end{array}$		f = 0.60	
$\frac{\text{usr}_{35}}{\text{MPAN} \rightarrow \text{MAO3} + \text{NO2}}$ $\frac{1.111 \times 10^{28} \text{exp}(-14000./\text{T})^* \text{usr}_{53}}{14000./\text{T})^* \text{usr}_{53}}$ $\frac{\text{MPAN} + \text{OH} \rightarrow \text{HYAC} + \text{CO} + \text{NO2}}{2.90 \times 10^{-11}}$		usr53	
$\frac{1.111\times10^{-1} \text{ CAP}^{-1}}{14000./\text{T}} \text{*usr53}$ $MPAN + OH \rightarrow HYAC + CO + NO2$ 2.90×10^{-11}	$MPAN \rightarrow MAO3 + NO2$	$1.111 \times 10^{28} \exp(-1)$	
$MPAN + OH \rightarrow HYAC + CO + NO2$ 2.90×10^{-11}		14000./T)*usr53	
	$MPAN + OH \rightarrow HYAC + CO + NO2$	2.90×10^{-11}	

$MPAN + O3 \rightarrow NO2 + .6*CH2O + HO2$	8.20×10 ⁻¹⁸	
$MACO2H + OH \rightarrow 0.35 * CH3CO3 + 0.65 * CH3O2$	1.51×10 ⁻¹¹	
+ CH2O + 0.65*CO		
$MAOP + OH \rightarrow MAO3$	$6.13 \times 10^{-13} \exp(200./T)$	
$MAOP + OH \rightarrow MAOPO2$	$3.60 \times 10^{-12} \exp(380./T)$	
$MAOPO2 + HO2 \rightarrow HYAC + 2*OH$	$1.82 \times 10^{-13} \exp(1300./T)$	
$MAOPO2 + NO \rightarrow HYAC + OH + NO2$	$2.35 \times 10^{-12} \exp(350./T)$	
$MAOPO2 + MAOPO2 \rightarrow 2*HYAC + 2*OH$	8.37×10 ⁻¹⁴	
$MAOPO2 + CH3O2 \rightarrow .7*HYAC + .7*OH +$	8.37×10 ⁻¹⁴	
CH2O + .7*HO2 + .3*C2H5OH		
$MAOPO2 + CH3CO3 \rightarrow HYAC + OH + CH3O2$	$1.68 \times 10^{-12} \exp(500./T)$	
$MAOPO2 + CH3CO3 \rightarrow CH3COOH + MEK$	$1.87 \times 10^{-13} \exp(500./T)$	
$GLYALD + OH \rightarrow 0.2*GLYX + HO2 +$	1.00×10 ⁻¹¹	MCM v3.3.1
0.8*CH2O + 0.8*CO		
$GLYX + OH \rightarrow HO2 + 2*CO$	$3.10 \times 10^{-12} \exp(340./T)$	
$GLYX + NO3 \rightarrow HNO3 + HO2 + 2*CO$	$k_1 = 1.4 \times 10^{-12} \exp(-1860./T);$	
	$k_1*(M*0.21+3.5\times10^{18})$	
	/(M*0.42+3.5×10 ¹⁸)	
$MGLY + OH \rightarrow CH3CO3 + CO$	1.50×10 ⁻¹¹	
$MGLY + NO3 \rightarrow HNO3 + CO + CH3CO3$	$1.40 \times 10^{-12} \exp(-1860./T)$	
$HYAC + OH \rightarrow MGLY + HO2$	frac=123.7exp(-T/70.);	
	2.15×10 ⁻¹² exp(305./T)*frac	
$HYAC + OH \rightarrow .5*HCOOH + OH$	$2.15 \times 10^{-12} \exp(305./T)*(1-$	
+ .5*CH3COOH + .5*CO + .5*CH3O2	frac)	
Isoprene Nighttime Chemistry		
$ISOP + NO3 \rightarrow INO2$	$3.15 \times 10^{-12} \exp(-450./T)$	
$INO2 + NO \rightarrow ISN1 + NO2 + HO2$	$2.70 \times 10^{-12} \exp(360./T)$	MCM v3.2
$INO2 + NO3 \rightarrow ISN1 + NO2 + HO2$	2.30×10 ⁻¹²	MCM v3.2
$INO2 + HO2 \rightarrow 0.22*MVK + 0.015*MACR +$	$2.05 \times 10^{-13} \exp(1300./T)$	Schwantes et
0.235*OH + 0.235*NO2 + 0.235*CH2O +		al.(2015)
0.77*INPN		
$INO2 + INO2 \rightarrow 2.0*ISN1 + 1.2*HO2$	1.30×10 ⁻¹²	
$INPN + OH \rightarrow ISN1 + OH$	1.03×10 ⁻¹⁰	
$ISN1 + OH \rightarrow 0.52 C510O2 + 0.48 ISNOO$	4.16×10 ⁻¹¹	
$ISN1 + NO3 \rightarrow ISNOO + HNO3$	$5.95 \times 10^{-12} \exp(-1860./T)$	
$ISN1 + O3 \rightarrow 0.555*NOA + 0.52*GLYX +$	2.40×10 ⁻¹⁷	
0.445*MGLY + 0.075*H2O2 + 0.445*HO2 +		
0.89*CO + 0.89*OH + 0.445*NO2	7 9 1 1 1 1 1 1 1	
$ISNOO + HO2 \rightarrow 0.15*NC4CO2H + 0.15*O3 + 0.15*$	$5.20 \times 10^{-13} \exp(980./T)$	
0.41*NC4CO3H + 0.44*NOA + 0.44*CO + 0.44*UO2 + 0.44*OH		
$\frac{0.44^{\circ}HO2 + 0.44^{\circ}OH}{1000 + 1000 + 1000 + 1000}$	$7.50 \times 10^{-12} = 10^{-12}$	
$15NOO + NO2 \rightarrow NOA + CO + HO2 + NO2$	$7.30 \times 10^{-2} \exp(290.71)$	
$15NOO + NO2 \rightarrow C5PAN1$	$K_0 = 2.7 \times 10^{-20} \text{ M}^{+} (300.71)^{7.1};$	
	$K_1 = 1.2 \times 10^{-10} (300./1)^{-10};$	
	$1C - K_0/K_1$; fcc-0.75.1.27*log 0.2.	
	$100=0.73-1.27*10g_{10}$ 0.3;	

	log ₁₀ 0.3	
	$nfc=10^{(1+(\log_{10} fc/fcc)^2)};$	
	$k_o k_1/(k_o+k_1)*nfc$	
$ISNOO + NO3 \rightarrow NOA + CO + HO2 + NO2$	4.00×10 ⁻¹²	
ISNOO + ISNOO \rightarrow 0.6*NC4CO2H + 1.4*NOA +	1.00×10 ⁻¹¹	
1.4*CO + 1.4*HO2		
$C510O2 + HO2 \rightarrow C510OOH$	2.05×10 ⁻¹³ exp(1300./T)	
$C51002 + NO \rightarrow NO2 + NOA + GLYX + HO2$	2.70×10 ⁻¹² exp(360./T)	
$C51002 + NO3 \rightarrow NO2 + NOA + GLYX + HO2$	2.30×10 ⁻¹²	
$C51002 + C51002 \rightarrow 0.6*C510OH + 1.4*NOA +$	9.20×10 ⁻¹⁴	
1.4*GLYX + 1.4*HO2		
$C510OH + OH \rightarrow NOA + GLYX + HO2$	2.69×10 ⁻¹¹	
$C510OOH + OH \rightarrow C510O2$	2.81×10 ⁻¹¹	
$NC4CO2H + OH \rightarrow NOA + HO2 + CO$	2.16×10 ⁻¹¹	
$NC4CO3H + OH \rightarrow ISNOO$	2.52×10 ⁻¹¹	
$NOA + OH \rightarrow MGLY + NO2$	1.00×10 ⁻¹²	
$C5PAN1 \rightarrow ISNOO + NO2$	$k_0 = 4.9 \times 10^{-3} \text{ M} \exp(-10^{-3} \text{ M} \exp(-10^{-3} \text{ M} + 10^{-3} \text{ M} $	
	12100./T);	
	$k_1 = 5.4 \times 10^{16} \exp(-13830./T);$	
	$fc=k_0/k_1;$	
	fcc=0.75-1.27*log ₁₀ 0.3;	
	$\log_{10} 0.3$	
	$ntc=10^{(1+(\log_{10} c/cc))};$	
	$k_0k_1/(k_0+k_1)*ntc$	
$C5PAN1 + OH \rightarrow NOA + CO + CO + NO2$	2.16×10 ⁻¹¹	
Isoprene Ozonlysis		
$ISOP + O3 \rightarrow .325*MACR + .244*MVK$	$1.00 \times 10^{-14} \exp(-1970./T)$	
+.845*CH2O + .11*H2O2 + .27*OH + .128*C3H6		
$+ .051^{\circ}CH3O2 + .522^{\circ}CO + .204^{\circ}HCOOH$		
+.199 CH3CO3 $+.020$ HO2		
ISODND + by > HC5 + NO2 + HO2	1.21×10-6 e ⁻¹	Calculated
$ISOFND + IIV \rightarrow HC3 + NO2 + HO2$	1.21×10 \$	based on 24hr
		average of
		modeled results
$MACRN + h\nu \rightarrow NO2 + HYAC + HO2 + CO$	8.48×10 ⁻⁵ s ⁻¹	
$MVKN + hv \rightarrow GLYALD + NO2 + CH3CO3$	1.36×10 ⁻⁵ s ⁻¹	
$NOA + hv \rightarrow CH3CO3 + CH2O + NO2$	8.48×10 ⁻⁶ s ⁻¹	
$ISN1 + h\nu \rightarrow NOA + 2.0*CO + 2.0*HO2$	1.36×10 ⁻⁴ s ⁻¹	
$\text{TERPN1} + \text{hv} \rightarrow \text{NO2}$	$1.21 \times 10^{-6} \mathrm{s}^{-1}$	
$TERPN2 + h\nu \rightarrow NO2$	$1.21 \times 10^{-6} \mathrm{s}^{-1}$	

Reactions	Reaction Rates (molecule ⁻¹ cm ³ s ⁻¹)	Note
$C10H16 + OH \rightarrow TERPO2$	$1.2 \times 10^{-11} \exp(440/T)$	Atkinson and
$\text{TERPO2} + \text{NO} \rightarrow 0.74 \text{*NO2} + 0.26 \text{*TERPN1}$	2.7×10 ⁻¹² exp(360/T)	Saunders et al. (2003)
$TERPO2 + HO2 \rightarrow products$	$2.9 \times 10^{-13} \exp(1300/T)$	Saunders et al. (2003)
$TERPO2 + TERPO2 \rightarrow products$	$1.68 \times 10^{-12} \exp(500/T)$	Tyndall et al. (2001)
$C10H16 + O3 \rightarrow products$	5.30×10 ⁻¹⁶ exp(-530/T)	RCAM2
$C10H16 + NO3 \rightarrow 0.1*TERPN2 + 0.9*NO2$	$1.2 \times 10^{-12} \exp(490/T)$	Atkinson and Arey (2003)

Table S2. Monoterpene oxidation chemistry in AM3. T represents temperature (K).

Table S3. Hydrolysis reactions added in AM3.

Reactions	Reaction Rate or Uptake Coefficient	Note
$GLYX \rightarrow AGLYX$	$\gamma_{glyx} = 1.0 \times 10^{-3}$	
$MGLY \rightarrow AMGLY$	$\gamma_{mgly} = 1.0 \times 10^{-7}$	
$IEPOX \rightarrow AIEPOX$	$\gamma_{iepox} = 1.0 \times 10^{-3}$	
$ISOPNB \rightarrow AONJ$	$\gamma_{IN} = 5.0 \times 10^{-3}$	Fisher et
		al.(2016)
$AONJ \rightarrow HNO3 + ROH$	$k = 9.259 \times 10^{-5} s^{-1}$	Pye et al.(2015)

Species in AM3	Formation Pathways	Lifetime ^a
ISOPNB ^b	C ₅ β-hydroxy nitrate from isoprene oxidation by OH	1.2 (1.4)
ISN1	C ₅ carbonyl nitrate from isoprene oxidation by NO ₃	3.6 (3.5)
INPN	C ₅ nitrooxy hydroperoxide from isoprene oxidation by NO ₃	8.5 (7.8)
MVKN	Methyl vinyl ketone nitrate from ISOPNB oxidation by OH	9.6 (9.3)
MACRN	Methacrolein nitrate from ISOPNB oxidation by OH	1.5 (1.4)
ISNP	C ₅ nitrooxy hydroperoxide from isoprene oxidation by OH	12 (12)
PROPNN	Propanone nitrate from oxidation of INPN and ISN1	17.6 (16.2)
DHDN°	C5 dihydroxy dinitrate from ISOPNB oxidation by OH	11.4 (10.3)
TERPN1	Nitrate from monoterpene oxidation by OH	19.6 (18.8)
TERPN2	Nitrate from monoterpene oxidation by NO ₃	14.1 (14.4)
PAN		0.72 (0.66)
HNO ₃		16(16)

Table S4. Lifetimes of major nitrates from isoprene and monoterpene in AM3.

^aLifetimes (hr) are calculated based on the total chemical loss rate, dry and wet deposition flux of each. compound during July-August of 2004; values in brackets are from July-August of 2013. It should be noted that the lifetimes listed here are 24-h average, different from estimates by Müller et al. (2014). ^bThe lifetime of ISOPNB includes impacts of aerosol hydrolysis.

^cThe lifetime of DHDN is based on dry and wet deposition since it is not removed by chemical oxidation.



Figure S1. Anthropogenic NO_x emission rate during July-August 2013 of (a) NEI11v1 inventory and (b) RCP8.5.



Figure S2. Mean vertical profiles of ozone and Σ ANs during ICARTT (top) and SEAC⁴RS (bottom). Red lines are results of AM3 with ISOPNB hydrolysis only; green lines are from AM3 with hydrolysis of ISOPNB, DHDN and TERPN1.



Figure S3. EPA AQS ozone monitoring sites in the Southeast U.S.A., from which EPA provides the MDA8 metric used in our study.



Figure S4. Ozone (ppb) along daytime flight tracks during (a) ICARTT (up to 12 km) (b) SENEX (up to 6 km) and (c) SEAC⁴RS (up to 12.5 km). Data from biomass burning, urban plumes, stratospheric air and outside of the 25-40° N latitude and 100-75° W longitude region are excluded.



Figure S5. Mean vertical profiles of Σ ANs (solid lines) and sum of ISOPN, MVKN and MACRN (dashed lines) during SEAC⁴RS from observations (black) and AM3 with hydrolysis of ISOPNB (red).



Figure S6. Ratio of major ISOPO₂ loss pathways to the total ISOPO₂ loss (sum of the three individual pathways) during ICARTT (July-August, 2004, top), SENEX (June-July, 2013, middle) and SEAC⁴RS (July-September, 2013, bottom) in the boundary layer (below 1.5km). Bold values in each panel are the mean percentage of each pathway to the total ISOPO₂ loss.



Figure S7. Modeled diurnal variation of PROPNN, ISN1, INPN and MVKN + MACRN (MVKN_MACRN) in the boundary layer of the Southeast US. The x-axis is the local time, and y-axis is the pressure. Color bar indicates the concentration in volume mixing ratio.



Figure S8. Averaged OH from 10:00 to 14:00 during July-August of 2004, 2013 in the model, and the scenario with 40% reduction in the anthropogenic NO_x emissions of 2013. Bold number in each panel is the regionally-averaged OH concentration.



Figure S9. Daily MDA8 ozone during July-August of 2004 (a) and July-August of 2013 (b) averaged over 157 EPA AQS monitoring sites shown in Figure S1. Horizontal axis is month and day of the year. Black lines, dash boxes and whiskers are the mean, interquartile range and lowest and highest observations; red dots are the mean of AM3.

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