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Appendix-A

Table 1: Percentage contribution to the annual total global production of CH_3CO_3 from different precursors simulated by the STOCHEM-CRI

Reactions	Contribution (%)	Closest MCM analogue	Sources
RU12O2 + NO→ CH_3CO_3 + $HOCH_2CHO$ + NO_2	9.4	C57O2, C58O2, C59O2, HC4ACO3, HC4CCO3	Isoprene degradation product
RU12O2→ CH_3CO_3 + $HOCH_2CHO$	1.7		
RU10O2 + NO→ CH_3CO_3 + $HOCH_2CHO$ + NO_2	7.7	MACRO2, MACROHO2, MACO3, HMVKAO2, HMVKBO2	Isoprene degradation product
RU10O2→ CH_3CO_3 + $HOCH_2CHO$	1.3		
RU10OOH→ CH_3CO_3 + $HOCH_2CHO$ + OH	0.8	MACROOH, MACROHOOH, MACO3H, HMVKAOOH, HMVKBOOH	Isoprene degradation product
NOA→ CH_3CO_3 + HCHO + NO_2	2.0	NOA	Isoprene degradation product
CARB6 + OH → CH_3CO_3 + CO	6.4	MGLYOX	Isoprene and toluene degradation product
CARB6→ CH_3CO_3 + CO + HO_2	9.9		
UCARB10 + O_3→ HCHO + CH_3CO_3 + CO + OH	1.2	MVK, MACR	Isoprene degradation product
UCARB10→ HCHO + CH_3CO_3 + HO_2	1.0		
UCARB12 + O_3→ $HOCH_2CHO$ + CH_3CO_3 + CO + OH	5.5	HC4ACHO, HC4CCHO	Isoprene degradation product
UCARB12→ $HOCH_2CHO$ + CH_3CO_3 + CO + HO_2	0.5		
CARB7→ CH_3CO_3 + HCHO + HO_2	2.6	ACETOL	Isoprene degradation product
CH_3CO_3H + OH→ CH_3CO_3	21.9	CH3CO3H	Many VOCs degradation product
CH_3CHO + OH→ CH_3CO_3	13.9	CH3CHO	Many VOCs degradation product and global emission
CH_3COCH_3→ CH_3CO_3 + CH_3O_2	3.2	CH3COCH3	Many VOCs including α- and β-pinene degradation product and global emission
CARB11A→ CH_3CO_3 + $C_2H_5O_2$	3.1	NC4H9O, SC4H9O	Many VOCs (≥ C_4) degradation product
CARB9→ CH_3CO_3 + CH_3CO_3	2.3	CO2C3CHO, BIACET	Many VOCs (≥ C_4) degradation product
RN11O2 + NO→ CH_3CO_3 + CH_3CHO + NO_2	1.6	MEKAO2, MEKBO2, BUTALO2	Many VOCs (≥ C_4) degradation product
RN8O2 + NO→ CH_3CO_3 + HCHO + NO_2	2.6	CH3COCH2O2, PROPALO2, CHOC2H4O2	Many VOCs (≥ C_3) degradation product
TNCARB10→ CH_3CO_3 + CH_3CO_3 + CO	0.5	C6H14O	α-pinene degradation product
Other 12 reactions (minor channels)	0.9		Many VOCs degradation product

Appendix-B

Table 2: Global aircraft observations of PAN used for STOCHEM model evaluation

Expedition	Location	Latitude	Longitude	Time frame
PEM-West-A	North Pacific	15-35^{o}N	180-150^{o}W	Sep – Oct, 1991
PEM-West-A	Japan Coast, East	25-40^{o}N	135-150^{o}E	Sep – Oct, 1991
PEM-West-A	Phillipine Sea	5-20^{o}N	135-150^{o}E	Sep – Oct, 1991
PEM-West-B	Japan coast, East	25-40^{o}N	135-150^{o}E	Feb – March, 1994
PEM-West-B	Phillipine Sea	5-20^{o}N	135-150^{o}E	Feb – March, 1994
PEM-Tropics-A	Christmas Island	0-10^{o}N	160-140^{o}W	Aug – Oct, 1996
PEM-Tropics-A	Tahiti	20-0^{o}S	160-130^{o}W	Aug – Oct, 1996
PEM-Tropics-A	Fiji	30-10^{o}S	170^{o}E-170^{o}W	Aug – Oct, 1996
PEM-Tropics-B	Christmas Island	0-10^{o}N	160-140^{o}W	March – Apr, 1999
PEM-Tropics-B	Tahiti	20-0^{o}S	160-130^{o}W	March – Apr, 1999
PEM-Tropics-B	Fiji	30-10^{o}S	170^{o}E-170^{o}W	March – Apr, 1999
PEM-Tropics-B	Hawaii	10-30^{o}N	170^{o}E-150^{o}W	March – Apr, 1999
TRACE-A	Africa coast, West	25-5^{o}S	0^{o}-10^{o}E	Sep – Oct, 1992
TRACE-A	South Atlantic	20-0^{o}S	20-10^{o}W	Sep – Oct, 1992
TRACE-A	Brazil, East	15-5^{o}S	50-40^{o}W	Sep – Oct, 1992
TRACE-A	South Africa	25-5^{o}S	15-35^{o}E	Sep – Oct, 1992
TRACE-P	Japan	20-40^{o}N	130-150^{o}E	Feb – April, 2001
SONEX	East Atlantic	35-45^{o}N	35-15^{o}W	Oct – Nov, 1997
SONEX	Ireland	50-60^{o}N	15-5^{o}W	Oct – Nov, 1997
A3B	Labrador	50-55^{o}N	60-45^{o}W	July – Aug, 1990
ARCTAS	N. American Arctic	55-85^{o}N	170-30^{o}W	April – July, 2008
POLARCAT	Greenland	55-80^{o}N	70^{o}W-15^{o}E	July, 2008
INTEX-A	Eastern N. America	25-55^{o}N	140-100^{o}W	July – Aug, 2004
MILAGRO	Mexico	15-35^{o}N	115-100^{o}W	March – May, 2006

Appendix C

Table 3: Details of the respective locations analysed in the model study, and the period in which they were conducted

Sites	Latitude, Longitude	Period	Site Description	References
Jungfraujoch, Switzerland	46.5°N, 8°E	Mar 1997- Feb 1998	Mountain Top 3580 m elevation	Zellweger et al. (2002)
Lindau, Germany	51°N, 10°E	May 1988 – April 1989	Rural	Kourtidis et al. (1993)
Athens, Greece	38°N, 23°E	Feb – Nov 1985	Urban	Tsani-Bazaca et al. (1988)
Harwell, UK	51°N, 1°W	Jan 1980 – June 1981	Rural	Brice et al. (1984)
Seoul, South Korea	37.3°N, 127°E	Jan – Dec 2011	Urban	Lee et al. (2013)
Beijing, China	40°N, 116°E	Sep 2010 – Aug 2011	Urban	Zhang et al. (2014)
Lanzhou, China	36°N, 103.7°E	June – July 2006	Suburban	Zhang et al. (2009)
Rishiri Island, Japan	45°N, 141°E	June – August 1999	Island	Tanimoto et al. (2002)
North Carolina, USA	35°N, 80°W	June – July 1992	Urban	Hartsell et al. (1994)
Frijoles Mesa, USA	36°N, 106°W	June – August 1988	Mountain Top 1950 m elevation	Gaffney et al. (1993)
Nashville, USA	36°N, 87°W	June – July 1999	Urban	Roberts et al. (1998)
Atlanta, Georgia, USA	33.5°N, 84°W	July – August 1992	Urban	Williams et al. (1993)
Mount Bachelor Observatory, USA	44°N, 122°W	April – May 2008	Mountain Top 2763 m elevation	Wolfe et al. (2007)
Summit, Greenland	72°N, 39°W	July 1999	Mountain Top 3210 m elevation	Ford et al. (2002)
Zeppelin Mountain, Ny-Ålesund, Svalbard	79°N, 12°E	1994 – 1996	Arctic	Beine and Krognes (2000)
Mauna Loa, Hawaii	19°N, 156°W	Sep 1991 – Aug 1992	Mountain Top 3394 m elevation	Walega et al.(1992) Ridley et al. (1998)
Antarctica	71°S, 8°W	July 2004 – Feb 2005	Coastal	Mills et al. (2007)
Neumayer	71°S, 8°W	Feb 1999	Antarctic	Jacobi et al. (2000)
Sacramento, USA	39°N, 121°W	Aug – Oct 2007	Urban	LaFranchi et al. (2009)
Munich, Germany	48°N, 11°E	June- Sep 1989	Urban	Rappenglück et al. (1993)

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