Supplementary Information for Paper:

Apportionment of Primary and Secondary Organic Aerosols in Southern California during the 2005 Study of Organic Aerosols in Riverside (SOAR-1)

Kenneth S. Docherty, Elizabeth A. Stone, Ingrid M. Ulbrich, Peter F. DeCarlo, David C. Snyder, James J. Schauer, Richard E. Peltier, Rodney J. Weber, Shane M. Murphy, John H. Seinfeld, Brett D. Grover, Delbert J. Eatough, and Jose L. Jimenez

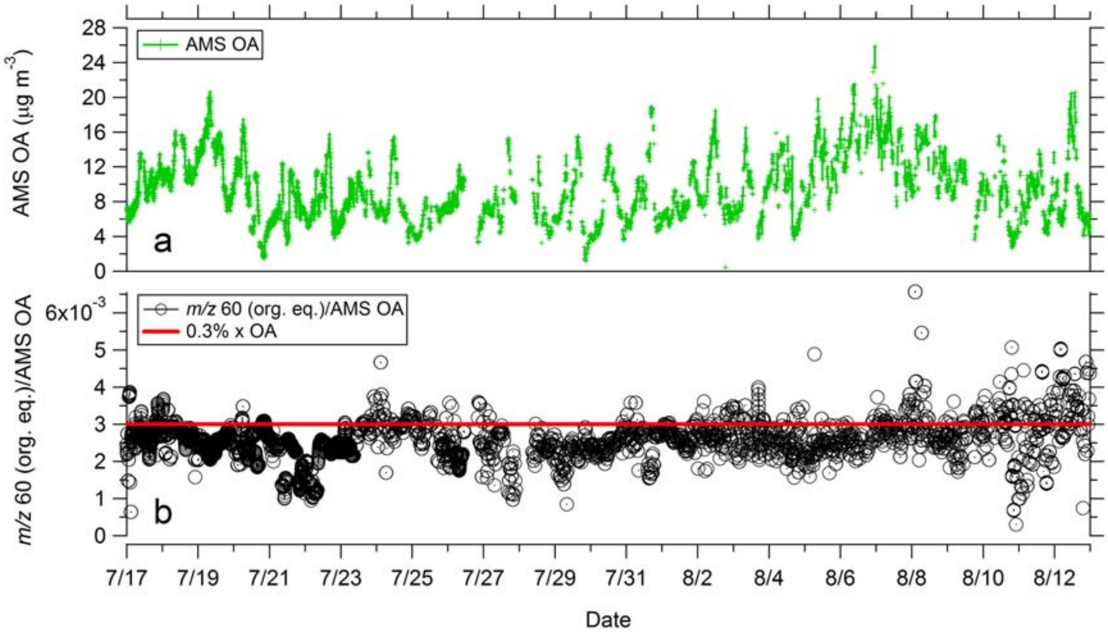

Figure S1. HR-ToF-AMS evidence indicating low contribution of BB to OA during SOAR-1. Figure S1a shows total PM_1 OA from the AMS while Figure S1b shows the contribution of *m/z* 60 to total OA (*m/z* 60/AMS OA), which is used to qualitatively indicate the presence of organics from BB. *m/*z 60/AMS OA ratios significantly greater than 0.3% have been observed to correlate with large contributions of organics from BB while ratios ranging from 0.2-0.4% are typically obtained in the absence of BB contributions. The average *m/z* 60/AMS OA ratio throughout the SOAR-1 campaign was 0.26%

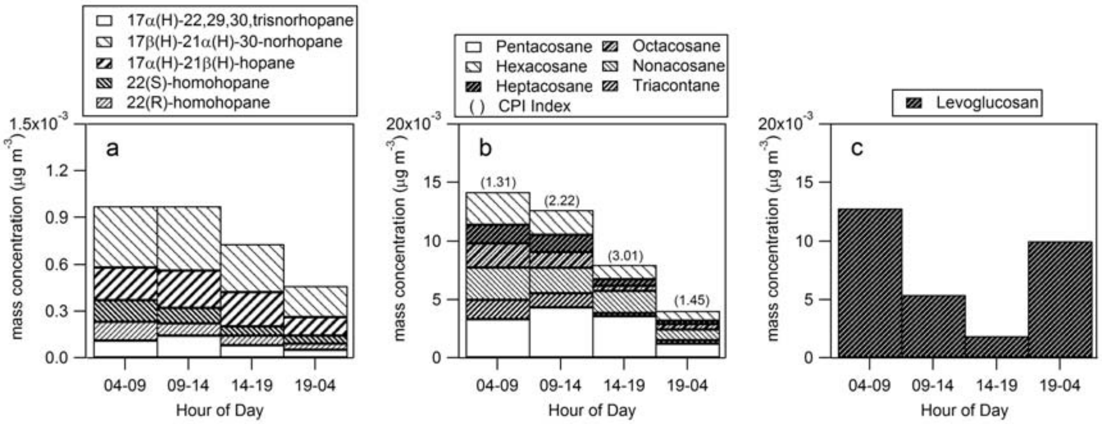

Figure S2. Average concentrations of CMB molecular markers species. Figures S2a-b show average $PM_{2.5}$ concentrations of fossil fuel combustion markers including Hopanes and *n*-alkanes. Measured $PM_{2.5}$ concentrations for levoglucosan, a BB marker species, are shown in Figure S2c.

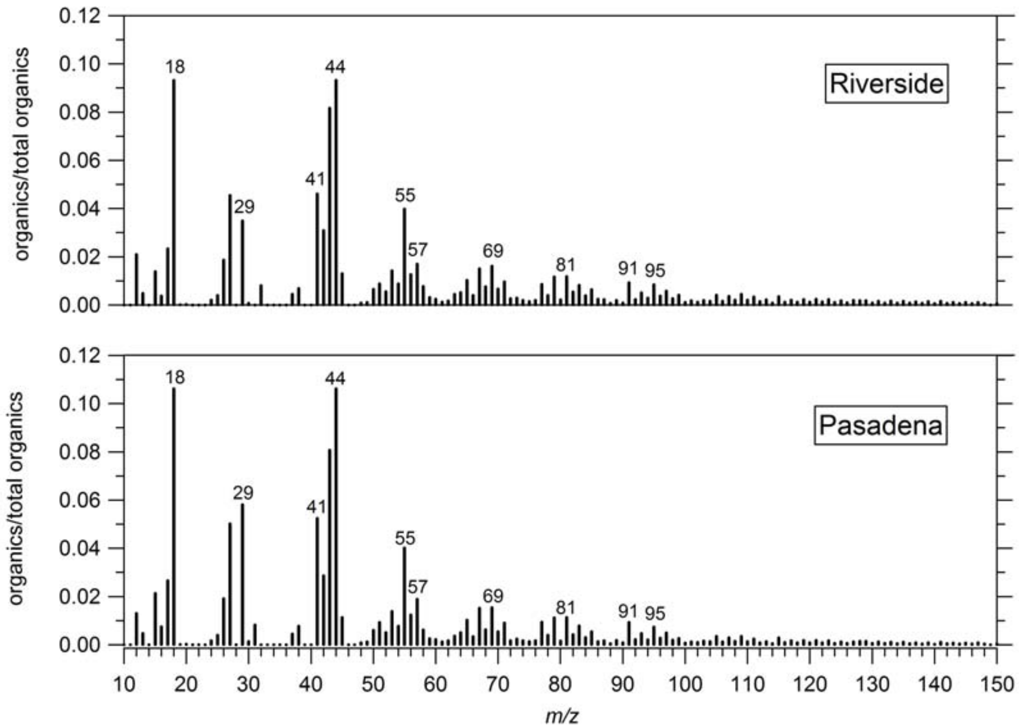

Figure S3. Comparison of Riverside and Pasadena (Caltech) AMS organic mass spectra (see text). Spectra are normalized to the total organics signal to facilitate comparison.

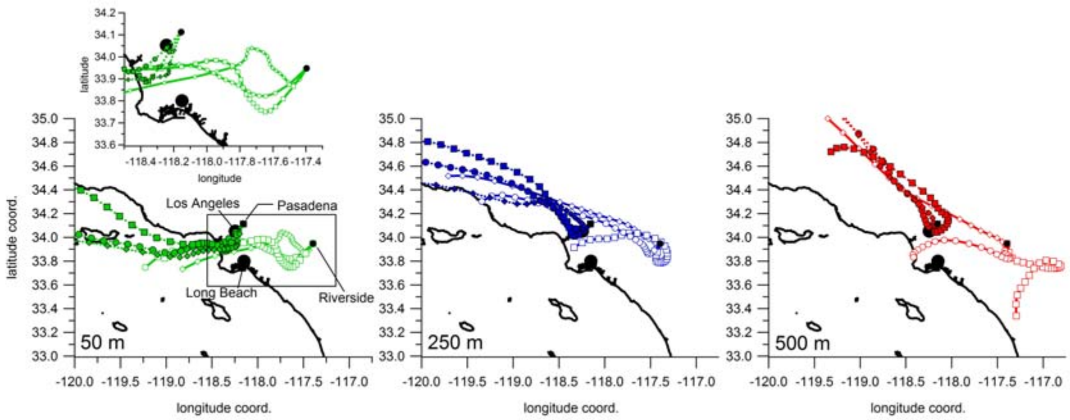

Figure S4. HYSPLIT (http://www.arl.noaa.gov/ready/open/hysplit4.html) 24-hr backward trajectories for air masses arriving in Riverside (open symbols) and Pasadena (filled symbols) at 1:00 p.m. Pacific standard time on 7/28 (○), 7/30 (□), and 8/1/2005 (◊) at start heights of 50, 250, and 500 meters above ground level. Air masses arriving in both locations at an elevation of 50 meters traveled in a westerly direction through the widespread source region of Los Angeles while air masses arriving at higher elevations moved more from the northwest with increasing elevation. In general, back trajectories show that air masses arriving at both locations were transported from the west and spent 5-8 hours traveling to Pasadena and 20-23 hours to Riverside.

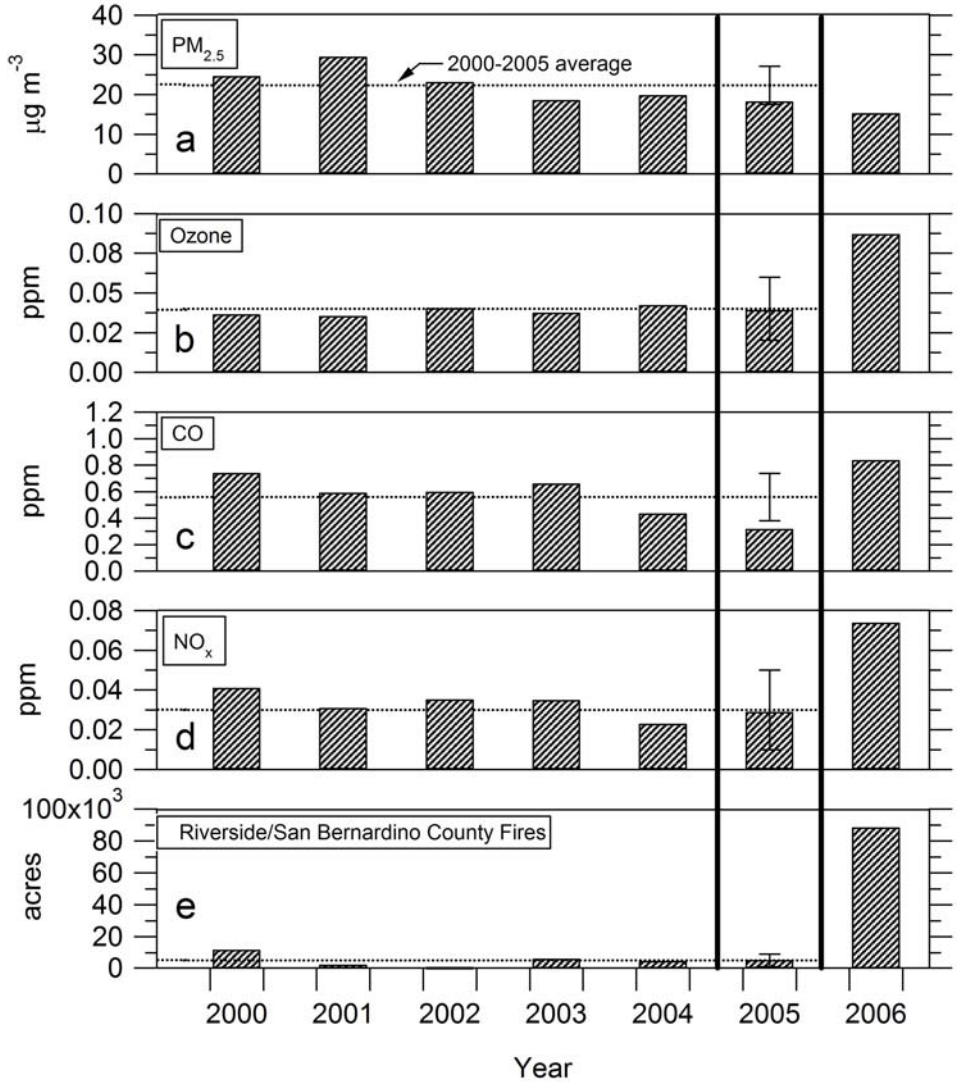

Figure S5. Riverside air quality and forest fire data for 2000-2006. Data were averaged over the period 7/15-8/15 (time and duration of SOAR-1 sampling) for each year. Pollutant concentration data include daily average $PM_{2.5}$ (a), ozone (b), CO (c), and NO_x (d) measured at the California Air Resources Board Riverside/Rubidoux monitoring site (http://www.arb.ca.gov/qaweb/site.php?s_arb_code_=33144) and reported at http://www.arb.ca.gov/adam. Figure S5e shows the total number of acres burned in Riverside and San Bernardino Counties (in fires >300 acres) as reported by the California Department of Forestry and Fire Protection (http://cdfdata.fire.ca.gov/incidents/incidents_statsevents). 2000-2005 averages are represented by the dotted line in each plot and error bars corresponding to one standard deviation (variability) are shown only above the 2005 data for visual reference. As this plot shows, pollutant concentrations (with the exception of CO, see paper text) and forest fire intensities for 2005 were all within one standard deviation of the 2000-2005 average, which indicates that atmospheric conditions during SOAR-1 appear to be representative of typical Riverside summer conditions.

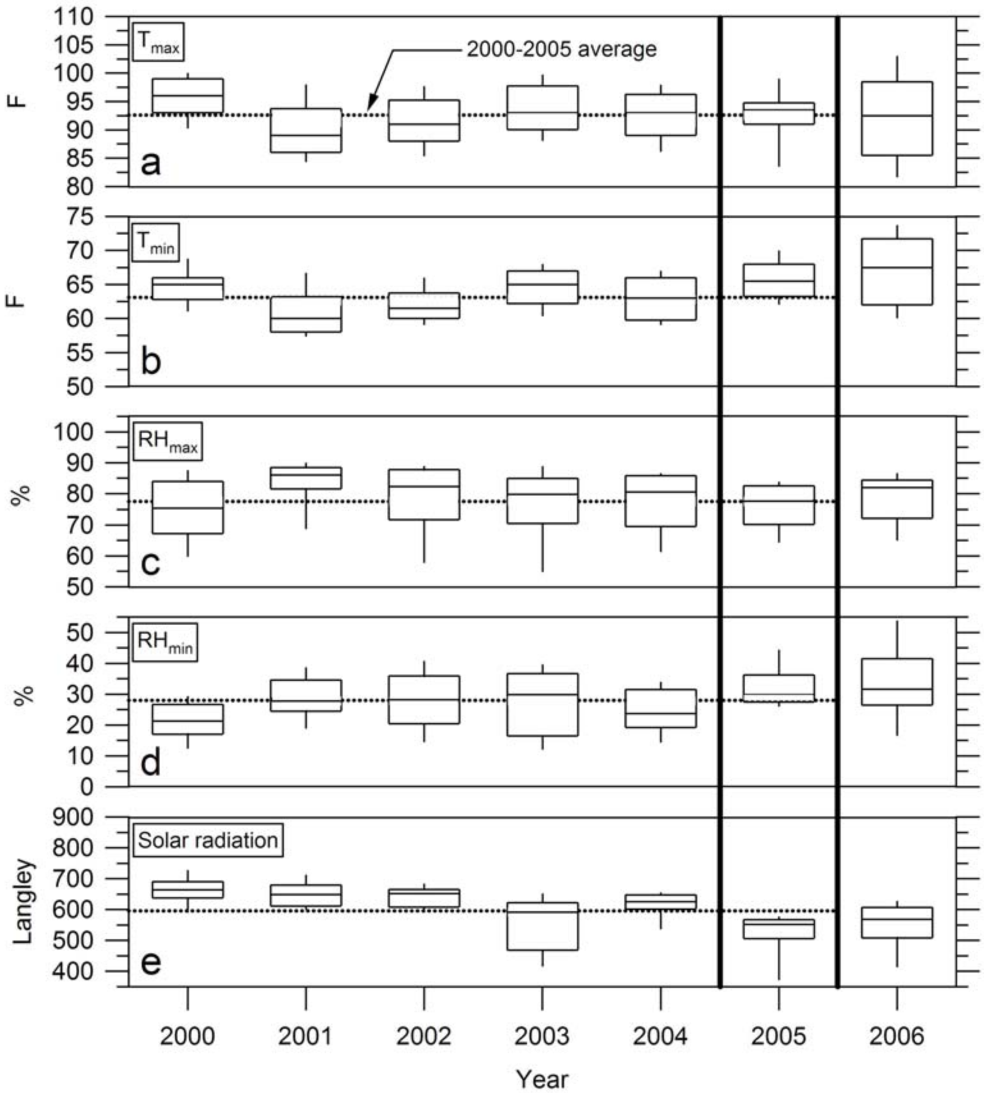

Figure S6. Riverside meteorological data over the period 7/15-8/15 for years 2000-2006 (data from http://www.ipm.ucdavis.edu/WEATHER/) including maximum and minimum air temperatures (a-b) and relative humidities (c-d) and solar intensity (e). 2000-2005 averages are represented by the dotted line in each plot.

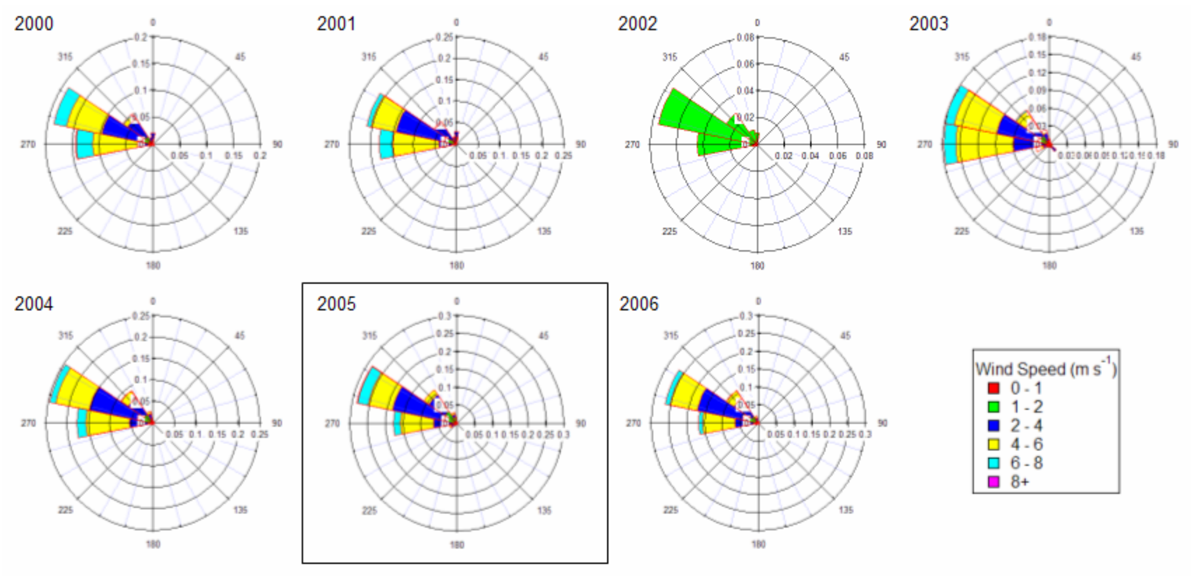

Figure S7. Wind rose plots for Riverside (measured at March Air Force Base (KRAL) and reported at http://www.wunderground.com/history/airport/KRAL/) over the period 07/15-08/15 for the years 2000-2006 showing wind speed (m s^{-1}) and direction (deg) probabilities.

Technique	$(OC/EC)_p$	$(OA/CO)_p$	CO_{BG}	Hour of Day	Reference	Method	Location	Marker	SOM/SOC (µg/µgC)	SOA/OA avg. (range)
EC tracer	0.51				Kirchstetter et al., 1999	Direct measurement	Caldecott tunnel	A	1.8	0.94 (0.91-0.95)
	0.79				Allen et al., 2001	Direct measurement	Caldecott tunnel	B	1.8	0.93 (0.90-0.94)
	0.58				Ban-Weiss, et al., 2007	Direct measurement	Caldecott tunnel	C	1.8	0.89 (0.85-0.92)
	1.20				Zhang et al., 2003	Ambient Q-AMS spectral deconvolution	Pittsburgh	D	1.8	0.83 (0.76-0.87)
	1.47				Szidat et al., 2006	Ambient $^{12}C/^{14}C$ ratio	Zurich, Switzerland	E	1.8	0.78 (0.69-0.84)
	1.96				Polidori et al., 2005	Ambient EC tracer	Southern California[a]	F	1.8	0.68 (0.52-0.78)
CO-Tracer		2.13	0.07-0.12		Kirchstetter, et al. 1999	Direct measurement	Caldecott tunnel	G		(0.90-0.92)
		3.33	0.07-0.12		Ban-Weiss, et al., 2007	Direct measurement	Caldecott tunnel	H		(0.85-0.87)
		8.00	0.07-0.12		SOAR, central estimate			I		(0.63-0.69)
		10.30	0.07-0.12		SOAR, sensitivity analysis			J		(0.53-0.60)
WSOC					Peltier et al., 2007				1.8	0.69
CMB				0500-1000					1.8	0.72
				1000-1500					1.8	0.76
				1500-2000					1.8	0.80
				2000-0500					1.8	0.83
HR-ToF-AMS PMF										0.74

[a] Precise location not disclosed due to confidentiality.

Table S1. SOA/OA values determined from the five estimation methods employed during SOAR-1. Average and range values reported for the EC-tracer method were calculated using all Sunset measurements shown in Figure 1a (i.e., standard, dual, and dual+SVOM Sunset instruments) at each $(OC/EC)_p$. In contrast, the range of values reported for the CO-tracer method at each $(OA/CO)_p$ reflect the use of different background CO (CO_{BG}) values (see text) in the calculation (e.g., range minimum corresponds to CO_{BG}=0.07). Additional details regarding $(OC/EC)_p$ and $(OA/CO)_p$ including the reference, method of calculating these ratios, and measurement location are also provided. Text markers correspond to data points designated in Figure 1a and Figure 1c.

Method	$(OC/EC)_p$	Hour of Day	SOM/SOC Sensitivity, avg. (range)		
			1.6 µg/µgC	1.8 µg/µgC	2.0 µg/µgC
EC tracer	0.51		0.93 (0.90-0.94)	0.94 (0.91-0.95)	0.94 (0.92-0.95)
	0.58		0.92 (0.89-0.94)	0.93 (0.90-0.94)	0.90 (0.90-0.95)
	0.79		0.89 (0.84-0.91)	0.89 (0.85-0.92)	0.90 (0.86-0.93)
	1.20		0.82 (0.74-0.86)	0.83 (0.76-0.87)	0.84 (0.77-0.88)
	1.47		0.77 (0.67-0.82)	0.78 (0.69-0.84)	0.79 (0.70-0.85)
	1.96		0.67 (0.53-0.75)	0.68 (0.52-0.78)	0.73 (0.63-0.79)
WSOC			0.66	0.69	0.71
CMB		0500-1000	0.70	0.72	0.74
		1000-1500	0.74	0.76	0.78
		1500-2000	0.78	0.80	0.81
		2000-0500	0.82	0.83	0.85

Table S2. Sensitivity of estimated SOA/OA ratio to SOM/SOC conversion factor. Average and range values reported for the EC-tracer method were calculated using all Sunset measurements shown in Figure 1a (i.e., standard, dual, and dual+SVOM Sunset instruments) at each $(OC/EC)_p$.