We thank the reviewers for their thoughtful reviews, which helped us to improve our manuscript. Point-by-point responses are provided as follows.

Reviewer 1:

Abstract: If most of the OC is secondary and Ca is predominantly primary, how can they have similar sources (line 32)? Is it that the precursor VOC has a similar source as Ca? Could it be that the species undergo similar atmospheric processing?

Response:
The reviewer's points are well taken. Accordingly, we have revised the sentence (line 29-31; note that the line number refers to the revised version of the manuscript) as follows.
"Total OC was correlated with Ca (R^2 of 0.63), suggesting that OC precursors and Ca may have had similar sources, and the possibility that they underwent similar atmospheric processing."

Starting at Line 70: Is atmospheric re-suspended dust due to wind or human activity? If it is due to human activity is it "anthropogenic"?

Response:
It is likely that both mechanisms are important in controlling dust loadings. To remove the ambiguity, line 72 was revised as "In prior studies conducted in the Middle East, dust was identified as the major source of PM_{10} (Givehchi, et al., 2013);"

The chosen cities for comparison in Table 1 seem randomly chosen, and this is probably not the case. Are these areas or their air quality similar to Riyadh in some way?

Response:
We sought observations of OC/EC measurements made in the last 10 years in urban areas world-wide. Urban areas may be hypothesized to have similar sources of PM, e.g. vehicular exhaust and industrial emissions, albeit that the nature of the PM will vary depending on factors such as local fleet and fuel mixes and local industry. Thus, the table title is revised as "Comparison of OC and EC concentrations (μg m^{-3}) measured in urban areas world-wide". In the revision, we added one more Korean urban city and replaced the US study with two large cities as follows below. We also compared our measurements with other studies in the Middle East expected to have similar climatological conditions as Riyadh.

Combining a response to this point and to Review 2, comment 3, the related main text (lines 237-254) was revised as follows:

"Table 1 presents some comparative values of measured EC and OC concentrations in $PM_{2.5}$ in urban areas world-wide, since urban areas are expected to share some anthropogenic source types (e.g. vehicular and industrial emissions) with Riyadh. The average concentrations in this work for both EC and OC were remarkably consistent with those reported by von Schneidemesser et al. (2010) and Abdeen et al. (2014) for 11

Middle Eastern sampling sites, including Tel Aviv, a major city in Israel (OC: 4.8 and EC: 1.6 μg m^{-3}). The average OC concentrations in Riyadh were also comparable to those reported for suburban Hong Kong (4.7 μg m^{-3}, Huang et al., 2014b), higher than Cleveland and Detroit, US (3.10 and 3.54 μg m^{-3}, Snyder et al., 2010), but lower than those reported for Gwangju, Korea (5.0 μg m^{-3}, Batmunkh et al., 2016),Veneto, Italy (5.5 μg m^{-3}, Khan et al., 2016), Athens, Greece (6.8 μg m^{-3}, Grivas et al., 2012), urban Hong Kong (10.1 μg m^{-3}, Ho et al., 2006), Delhi, Indian (16.5 ± 6.6 μg m^{-3}, Satsangi et al., 2012), and Beijing, China (18.2 ± 13.8 μg m^{-3}, Zhao et al., 2013), reflective of the different mix of sources and different photochemical environments. EC concentrations also vary widely among urban regions, depending on the characteristics of local sources."

City	Duration	EC	OC	EC	OC	References
		Conc. (μg m^{-3})		S.D. (μg m^{-3})		
Athens, Greece	Jan to Aug, 2003	2.2	6.8			Grivas et al., 2012
Gwangju, Korea	Winter of 2011	1.7	5.0	0.9	2.5	Batmunkh et al., 2016
Cleveland, US	Jul, 2007 and Jan, 2008	0.33	3.10	0.01	0.78	Snyder et al., 2010
Detroit, US		0.35	3.54	0.01	0.86	
Beijing, China	Selective days in four seasons from 2009 to 2010	6.3	18.2	2.9	13.8	Zhao et al., 2013
Urban, Hong Kong	Nov, 2000 to Feb, 2001 and Jun, 2001 to Aug, 2001	5.71	10.12	0.89	1.92	Ho et al., 2006
Suburban, Hong Kong	Mar, 2011 to Feb, 2012	0.86	4.7	0.53	2.87	Huang et al., 2014b
Veneto, Italy	Apr 2012 to Feb 2013	1.3	5.5			Khan et al., 2016
Delhi, India	Dec 20, 2012 to Feb 26, 2013	12.04	16.46	4.43	6.61	Panda et al., 2016
Middle East (11 sampling sites in Palestine, Jordan and Israel)	Jan to Dec, 2007	2.1	5.3	2.2	4	von Schneidemesser, et al., 2010 Abdeen, et al., 2014
Riyadh, Saudi Arabia	Apr to Sep, 2012	2.13	4.76	2.52	4.4	this study

References added:

Batmunkh, T., Lee, K., Kim, Y. J., Bae, M.-S., Maskey, S., Park, K.: Optical and thermal characteristics of carbonaceous aerosols measured at an urban site in Gwangju, Korea, in the winter of 2011, J. Air & Waste Manage Association, 66, 151-163, DOI: 10.1080/10962247.2015.1101031, 2016.

Snyder, D. C., Rutter, A. P., Worley, C., Olson, M., Plourde, A., Bader, R. C., Dallmann, T., Schauer, J. J.: Spatial variability of carbonaceous aerosols and associated source tracers in two cities in the Midwestern United States, Atmos. Environ., 44, 1597-1608, 2010.

von Schneidemesser, E., Zhou, J., Stone, E. A., Schauer, J. J., Qasrawi, R., Abdeen, Z., Shpund, J., Vanger, A., Sharf, G., Moise, T., Brenner, S., Nassar, K., Saleh, R., Al-Mahasneh., Q. M., Sarnat, J.A.: Seasonal and spatial trends in the sources of fine particle organic carbon in Israel, Jordan, and Palestine, Atmos. Environ., 44, 3669-3678, 2010.

Starting at line 276 "Since OC concentrations had no significant weekday-weekend variation, the increase in OC/EC ratio during the weekend likely indicates the importance of regional photochemical sources of SOC, although decreased NOx emissions on weekends may promote more efficient photochemical processing of local SOC precursors" This is a curious conclusion to draw from Figures 5 and S2, but maybe not in the context of results discussed later in the manuscript. From these figures, it appears that changes in [EC] are what drive the changes in the OC/EC ratio predominantly. Perhaps the authors are intending to state primary OC emissions follow trends in EC and that the OC on Wednesdays is more primary than say on the weekends when SOC makes a larger contribution? It seems the authors allude to this when discussing figure 6. This needs to be shown first and the authors need to state the findings to support this statement more articulately.

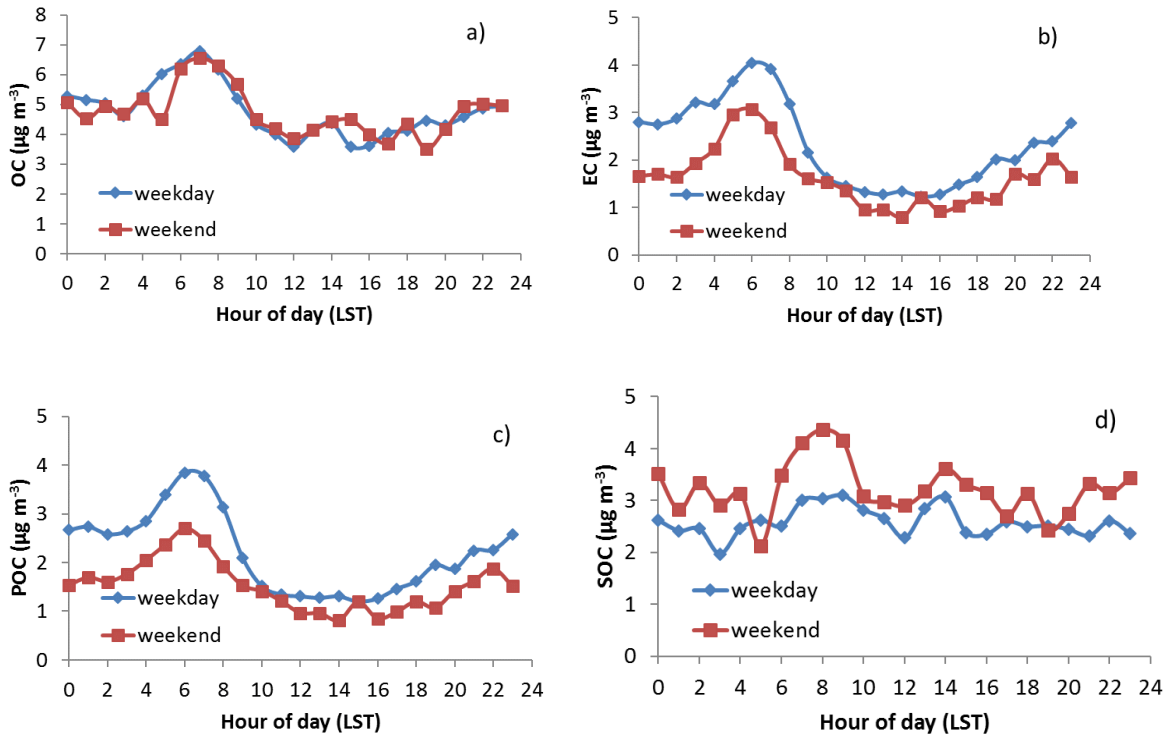
Response:
Thank you for these helpful comments. We switched the order of sections 3.2 and 3.3 and "Diurnal variation of OC and EC" now comes before "Weekend effect in OC and EC concentrations", as suggested.

Also, regarding this sentence:
"Since OC concentrations had no significant weekday-weekend variation, the increase in OC/EC ratio during the weekend likely indicates the importance of regional photochemical sources of SOC, although decreased NO_x emissions on weekends may promote more efficient photochemical processing of local SOC precursors (Gentner et al., 2012)." we have modified it as follows:
"OC concentrations had no significant weekday-weekend variation. The decrease of EC was the main driver of the increasing OC/EC ratio during the weekends, indicating reduced primary emissions and effective SOC formation / transport during the weekends."

Why not explore the diurnal profiles also separated by weekend/weekday. That would help support the statements the authors make (above) regarding OC/EC findings.

Response:
We replaced the original Fig. S3 with the following figure and added the corresponding discussion in lines 276 to 277:
"The diurnal variations of OC and EC on weekdays and weekends exhibited similar trends (Fig. S3), but EC was higher during weekdays."
Lines 345 to350:
"The diurnal variations of POC and SOC were similar on weekdays and weekends, but the weekday-to-weekend changes in POC and SOC had opposite trends. The estimated POC was 2.2±2.5 μg m^{-3} on weekdays and decreased to 1.5±1.9 μg m^{-3} on weekends. The estimated SOC was 2.6±2.9 μg m^{-3} on weekdays and increased by 23% to 3.2±4.5

μg m^{-3} on weekends. The elevated SOC during weekends was likely due to regional production and transport."



Is it possible that if calcium carbonate forms, other compounds, for example would potassium carbonate form? It does seem from Figure 8 that there are two regimes for K vs. Ca. Does that inform the OC and Ca correlation analysis further?

Response:
Yes, it is possible that other carbonates were present. We revised lines 377 to 380 as follows:
"The correlation between Ca and other dust metal species (Al, Fe, K, Fe and Mg), however, showed two divergent regimes, suggestive of an additional Ca-containing source besides dust, that may have shared the same sources as OC."

Editorial: Sometimes the authors use present tense (e.g., line 80) and sometimes past tense (e.g., line 216, 218) and it is distracting.

Response:
Revised accordingly.