Seasonal Contribution of Mineral Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia

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Abstract

Dust storms are significant contributors to ambient levels of particulate matter (PM) in many areas of the world. Central Asia, an area that is relatively understudied in this regard, is anticipated to be affected by dust storms due to its proximity to several major deserts that are in and generally surround Central Asia (e.g., the Aral Sea region, the Taklimakan desert in Western China). To investigate the relative importance of mineral dust (dust specifically composed of soil related minerals and oxides) in Central Asia, PM_{10} and $PM_{2.5}$, and by difference, coarse particles (particles with diameters between 2.5 and 10 µm) were measured at two sites, Bishkek and Lidar Station Teplokluchenka (Lidar), in the Kyrgyz Republic. Samples were collected every other day from July 2008 to July 2009. Daily samples were analyzed for mass and organic and elemental carbon. Samples were also composited on a bi-weekly basis and analyzed for elemental constituents and ionic components. In addition, samples collected on days with relatively high and low PM concentrations were analyzed before, and separately, from the biweekly composites to investigate the chemical differences between the episodic events. Data from the episodic samples were averaged into the composited averages. Using the elemental component data, several observational models were examined to estimate the contribution of mineral dust to ambient PM levels. A mass balance was also conducted.

Results indicate that at both sites, mineral dust (as approximated by the "dust oxide" model) and organic matter (OM) were the dominant contributors to PM_{10} and $PM_{2.5}$. Mineral dust was a more significant contributor to the coarse PM ($PM_{10-2.5}$) during high event samples at both sites, although the relative contribution is greater at the Lidar site (average ± standard deviation = 42 ± 29 %) as compared with the Bishkek site (26 ± 16%). Principal Components Analysis (PCA) was performed using data from both sites, and PCA indicated that mineral dust explained the majority of the variance in PM concentrations, and that the major apportioned factors of PM_{10} and $PM_{2.5}$ were chemically similar between sites.

1. Introduction

The connection between adverse health effects and particulate matter (PM) is well-established (Dockery et al., 1993; Solomon et al., 2012). Atmospheric dust, i.e., mineral dust, has both natural and anthropogenic sources, and can be a major contributor to fine (particles < 2.5 µm aerodynamic diameter) and coarse (particles in the size range between 2.5 and 10 µm aerodynamic diameter) PM in many areas of the world, particularly during dust storm events (Chen et al., 2013; Shen et al., 2007) where large amounts of mineral dust are injected into the atmosphere from the large deserts in and surrounding Central Asia. High levels of atmospheric dust are of concern due to their aforementioned impact on health (Tao et al., 2012) and influence on radiative forcing (Sokolik and Toon, 1996). In addition, mineral dust can impact the chemistry of the atmosphere due to its alkaline composition and its relatively high surface area of mineral dust particles (Stone et al., 2011).

Dust storms observed in eastern Asia typically occur in the spring, i.e., March-May, as a result of low precipitation, higher wind speeds, and increased agricultural tilling relative to the rest of the year (Seinfeld et al., 2004). The occurrence of dust storms originating from Mongolia and Northern China has been the subject of investigation in the past decade (Gong et al., 2004; Shen et al., 2007; Zhang et al., 2003). A recent study of the effect of dust storms in Northern China and hospital admissions for respiratory disease found a positive association between the two, and to a greater extent for the segment of the population over 65 years of age (Tao et al., 2012). However, relatively few studies have investigated dust originating from the major deserts in and around Central Asia, including the Aral Sea, which is located to the west-northwest of the Kyrgyz Republic. The Aral Sea, once the 4th largest lake on earth, has lost more than 2/3 of its original volume and has undergone a decrease in surface area of 50% as of 1994 (Singer et al., 2003). One objective of this work was to investigate the impact of mineral dust from deserts in and around Central Asia on regional PM levels and high PM episodes.

The estimation of mineral dust contribution to PM concentrations is not straightforward. Mineral dust can be of both natural and anthropogenic origin and the chemical characteristics of mineral dust can reflect this combination of sources in addition to aging during transport (Beuck et al., 2011; Darmenova and Sokolik, 2007). Recent work has used titanium as a reference element to calculate elemental enrichment factors to distinguish between mineral dust originating from the southern U.S. and North African/Saharan dust (Bozlaker et al., 2013) Meteorological circulation models, i.e., emission and transport models have been employed to estimate dust storm impacts in Asia (Gong et al., 2004; Zhang et al., 2003). However, essentially no direct measurements of PM composition have occurred within Central Asia to estimate mineral dust contributions or to validate model estimates.

Results presented here describe the bulk chemical constituents of PM collected at two remote sites in Central Asia over the course of the study period (Summer 2008 - Summer 2009). The differential contributions of mineral dust to coarse and fine PM during periods of relatively high and low measured PM levels, as well as seasonal contributions, are investigated through the application of several observational models. A mass balance was also conducted.

2. Experimental

2.1. Description of Sampling Region and Sampling Sites

The sampling region and two sampling sites have been described (Miller-Schulze et al., 2011). Briefly, The Kyrgyz Republic is bordered by China to the east, Kazakhstan to the north, Uzbekistan to the west, and Tajikistan to the south. The population of the Kyrgyz Republic is approximately 5.6 million with a large component living in the capital, Bishkek (https://www.cia.gov/library/publications/the-world-factbook/geos/kg.html). The Bishkek site was located 23 km south of the Bishkek city center, at 42^{o} 40’ 47 N, 74^{o} 41’ 39.14” E at an elevation of 1744 m asl. The Lidar Station Teplokluchenka (Lidar), site was at 42^{o} 27’ 49.38” N, 78^{o} 31’ 44.17” E at an elevation of 1920 m asl. The distance between sampling sites was approximately 315 km direct.

2.2. Sample Collection and Filter Compositing

Sample collection has been described (Miller-Schulze et al., 2011). In general, samples were collected every other day at each sampling site for 24 hr from 8AM to 8AM. On each sampling day, both sites collected eight samples using the URG 3000ABC sampler (URG Corporation, U.S.A.). Each URG sampler collected 2 PM_{10} samples on quartz-fiber filters, 2 PM_{10} samples on Teflon filters, 2 $PM_{2.5}$ samples on quartz-fiber filters, and 2 $PM_{2.5}$ samples on Teflon filters. Teflon and quartz-fiber filters were obtained from VWR (VWR International, U.S.A.). Prior to use, the quartz-fiber filters were baked at 550 ^{o}C for a minimum of 12 hr. Teflon filters were equilibrated and pre-weighed prior to use, as described below.

Samples were shipped at reduced temperatures in a specially designed shipping container by overnight mail to the Wisconsin State Laboratory of Hygiene (WSLH, WI USA) where each Teflon filter was post-weighed. Filters (or sections of filters) were composited into bi-weekly (6-8 filter sections) or monthly (15-16 filter sections) samples. Composites for total elemental analysis and ions were prepared from ¼ sections of one of the duplicate Teflon filters, while composites for water soluble organic carbon (WSOC) were prepared from 1.5 cm^2 punches of the quartz-fiber filters. Selected sampling dates (event periods) were chosen based upon gravimetric mass data to identify 12 “event” sampling periods with exceptionally high PM levels and 12 with exceptionally low PM levels. For these samples, one or two (full) filters from each “event” date were analyzed separately from the composites. For both event and bi-weekly/monthly composite strategies, PM_{10} and $PM_{2.5}$ samples were composited in the same fashion in terms of the fraction of each filter used for each chemical analysis performed.

2.3. Chemical Analysis

PM mass was determined gravimetrically on all Teflon filters using a high-precision microbalance (MX5, Mettler-Toledo, U.S.A) with 1 µg readability. Teflon filters were equilibrated in a temperature (21 ± 2 ^{o}C) and humidity (35 ± 3% RH) controlled weighing room for a minimum of 18 hrs before both pre- and post- weighing. Static charge on the filters was eliminated with a polonium (Po)-ionization source. The total uncertainty associated with the mass measurement was <7% or +/- 4 µg, which ever was greater. The median precision (as relative percent difference) of duplicate filter samples collected for each size fraction was less than 7.5% for all sites and size fractions, and is detailed in Table SI-1.

Fine PM and PM_{10} filters were analyzed for water soluble ions, elemental carbon (EC) and organic carbon (OC), and total elements as described in the subsequent paragraphs.

Water soluble ions (ammonium, chloride, nitrate, and sulfate) were extracted from the filter samples with milliQ water (15.0 mL, for 2 hours, with continuous agitation, in the dark, in pre-cleaned polypropylene tubes) and quantified using an established low-level ion chromatographic (IC) technique (Thermo Scientific Dionex, U.S.A.). QA/QC samples included sample and milliQ spikes, replicates, method and filter blanks, and primary and secondary standard checks.

EC and OC concentrations were determined with a thermal-optical EC/OC analyzer (Sunset Laboratories, U.S.A.) using the ACE-Asia base-case protocol (Schauer et al., 2003).

Total elements were determined from one of the Teflon filters in each size range. Samples were analyzed by first extracting the filter-collected PM in Teflon bombs with a mixed acid microwave-aided digestion. The extracted elements were then quantified using high resolution (magnetic sector) inductively coupled plasma-mass spectrometry (SF-ICPMS) (Thermo Finnigan Element 2 mass spectrometer, Thermo Scientific, U.S.A.). Further details of this procedure are available in (von Schneidemesser et al., 2010). Data on percent recovery of method spikes and extractions of certified reference materials for the elemental analysis can be found in Table SI-2. The elemental concentrations in field filter blanks (as a percentage of the median concentrations of the composite and event samples) are detailed in Table SI-3. The median propagated uncertainties for each element (as a percentage of the median concentrations of the composite and event samples) is given in Table SI-4.

2.4. Estimation of Uncertainties

Figures (with the exception of Figure 1) present monthly averaged biweekly chemical component data. The analytical uncertainties were estimated from a sum-of-squares error propagation analysis of major uncertainty components associated with each analytical method. For metals, this included instrument precision, blank variation, and digestion recovery precision. For soluble ions and EC/OC, this included instrument precision and blank variation.

Coarse PM concentrations and concentration of PM constituents were obtained by subtracting blank corrected $PM_{2.5}$ values from blank corrected PM_{10} values. When concentrations of PM_{10} constituents were relatively equivalent to the concentrations of $PM_{2.5}$ constituents, the calculated coarse particle concentration was in some cases a negative number, but were not statistically different from zero. The median percentage of bi-weekly composites, maximum event, and minimum events for elemental and ionic constituents which resulted in negative concentrations for coarse constituents at the Bishkek site was 15% (range = 4-58%) , and 6% (range = 2-62%) at the LIDAR site. With regards to the calculation of mineral dust contributions, all positive values for elemental concentrations were used and the resulting uncertainty was used to determine statistical significance. When subtraction of $PM_{2.5}$ from PM_{10} (or blank subtraction) resulted in a negative value, the concentration was assigned a value of "zero" to not affect the calculation of mineral dust or mass reconciliation.

2.5. Principal Components Analysis

The Principal Components Analysis (PCA) was conducted using SAS version 9.2 (SAS Institute, Inc., U.S.A.) with varimax rotation, an orthogonal rotation chosen in order to simplify interpretation of the resultant factors by maximizing the variance of the loadings on each factor. Factors with eigenvalues greater than 1.0 were identified as a significant factor in the PCA. Eigenvalues represent the relative measure of the variation explained by each factor, percent of variance represents the percentage of variability in the data explained by that factor, and cumulative percent represents the total amount of variability explained by the sum of the factors including that factor.

3. Results and Discussion

3.1. General Trends in Particulate Matter Levels

Temporal variations in daily fine and coarse PM mass are shown in Figure 1A-1D. Seasonal averages of observed PM mass, in addition to EC, OC, ionic constituents, and mineral dust, are given in Tables 1A and 1B. Coarse PM concentrations at both sites were observed to be lower in the late fall-winter (Nov, Dec, Jan, Feb). This trend is more pronounced at the Lidar site as compared with the Bishkek site, primarily because of the low and relatively invariant PM concentrations during the winter months. An increase in coarse PM from the relatively low winter levels is observed beginning in February at Bishkek and March at Lidar. In general, coarse and fine PM concentrations varied together. Strong correlations were not observed in the PM concentrations between sites (PM_{10}, Pearson's R= 0.269; $PM_{10-2.5}$, Pearson's R= 0.334; $PM_{2.5}$, Pearson's R = 0.123, with the PM_{10} and $PM_{10-2.5}$ relationships being significant at p=0.05). The concentrations of both fine PM and coarse PM (in addition to PM_{10}, data not shown) were observed to be similar at both sites.

3.2. Evaluation of Different Dust Models

There are a variety of observational or empirical methods for calculating the contribution of mineral dust to PM from elemental constituents considered to be associated with crustal material (Beuck et al., 2011; von Schneidemesser et al., 2010). The dust "oxide" model uses the measured concentrations of selected metal ions and the calculated molecular weights of the resulting oxide to estimate the concentration of mineral dust (von Schneidemesser et al., 2010). This dust oxide model is similar to the model employed by Malm and others in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network (Malm and Hand, 2007) to calculate the major constituents of mineral dust. The dust oxide model is employed here as the "base-case" and is given in equation 1, where [element] represents the measured concentration of each element in mass/volume:

(1) Mineral $Dust_{Oxide}$ = 1.889 [Al] + 1.400 [Ca] + 1.430 [Fe] + 1.205 [K] + 1.658 [Mg] + 1.582 [Mn] + 1.348 [Na] + 1.094 [Rb] + 1.534 [Sc] + 2.139 [Si] + 1.668 [Ti]

Similar estimations of mineral related material have been employed in other studies (Beuck et al., 2011; Cheung et al., 2011). Silicon was not measured in this study and was estimated using the measured aluminum concentration multiplied by a factor of 4.6 (Seinfeld and Pandis, 2006), based on the abundances of these two elements in soil. This ratio of Si/Al also reflects the ratio of Si/Al found in analysis of soils from China's Central Loess Plateau (Gallet et al., 1996; Jahn et al., 2001), in addition to our own analysis of soil samples surrounding the Bishkek and Lidar sampling sites as well as the Aral Sea (data not shown). The use of a constant multiplier to estimate the concentration of Si from measured Al is a source of uncertainty (and possible underestimation) in this estimation of crustal material. However, no evidence was available to suggest that a ratio of >4.6 was warranted.

Two additional models used to estimate the contribution of mineral dust to PM were compared as well: the "carbonate model" and the "Al-based" model. The carbonate dust model was evaluated based on the assumption that carbonate is a major component of mineral dust in Central Asia (Schettler et al., 2014). The "Al-based" model was evaluated based on the observation that Al could be used as a tracer of mineral dust and that this mineral dust was originating exclusively from the Aral Sea region. Assumptions and a more explicit description of these methods are described in detail in the Supplemental Information (SI).

Table 2 presents the linear regression statistics for the comparison of the carbonate and Al-Based model to the base case model that was used to estimate the mineral dust contribution to PM_{10} and $PM_{2.5}$ at the Bishkek and Lidar sites for the monthly composite samples. Based on the slopes for these regressions, estimates of mineral dust using the carbonate model are 15-19% greater than base case for both sites and size fractions (due to the numerically larger constant multipliers in the carbonate calculation). Estimates of mineral dust by the Al-based model are 60-65% greater than the base case for both sites and size fractions (due to the numerically larger constant multipliers in the Al-based model calculation). Based on the relatively small uncertainties in the slopes for both the carbonate and Al-Based model versus the base-case, it is clear that these models are different both from each other and from the base-case.

3.3. Bulk Chemical Characteristics and Mass Balance

The chemical characteristics of the PM_{10} monthly composite samples collected at both sites are presented in Figure 2A (Bishkek) and 2C (Lidar). Analogous data for $PM_{2.5}$ are presented in Figures 2B (Bishkek) and 2D (Lidar) The contribution of mineral dust was calculated using Equation 1, organic matter (OM) was estimated using a constant multiplier ratio of 2.0:1 (OM:OC), and the other components were used directly in these figures. This OM:OC ratio of 2.0:1 was chosen based on the work of Turpin and Lim (Turpin and Lim, 2001), who developed this value to represent OM in "non-urban" fine particles. Although this ratio may not fully account for OM in the coarse particle size range, which is not well characterized, it is not expected that this will appreciably change the mass balance calculation. The mass balance was calculated by summing the concentrations of the major bulk chemical constituents (sulfate, nitrate, ammonium, chloride, mineral dust, OM, and EC) in the monthly composites. In order to calculate percent mass balance, the sum of the bulk chemical constituents was divided by the measured PM mass. The contributions of trace elements and rare earth metals were considered to be negligible for the purposes of this calculation.

Organic matter and mineral dust are the dominant contributors to PM at both sites. Mineral dust contributed approximately between 12 - 27% and between 9 - 33% of the observed PM_{10} mass at the Bishkek and Lidar sites, respectively. Mineral dust was a smaller contributor to fine PM mass, contributing 3 - 16% of the observed $PM_{2.5}$ mass at Bishkek and 3 - 29% at Lidar. OM contributed between 19 - 37% and 18 - 59% of the observed PM_{10} mass at the Bishkek and Lidar sites, respectively. OM was a larger contributor to fine PM, making up 23 - 48% of the measured fine PM at Bishkek and between 22 - 80% at Lidar. OM contributed more to the PM_{10} levels in the winter (December - February) on a percentage basis (relative to the measured mass) at both sites and for both size fractions-this trend is more easily observed at the Lidar site (Figure 2C), although there was an instance in January at Bishkek where the low level of OM resulted in the value being less than the uncertainty threshold (2 times the analytical uncertainty). Nitrate and sulfate were consistently the largest contributors to the ionic fraction of both PM_{10} and $PM_{2.5}$, although neither contributed more than 10% for any of the monthly averages. For example, the maximum contribution to PM_{10} at Bishkek by sulfate was 8.4%, and the nitrate contribution to PM_{10} for this month at Bishkek was 9.2%. The ionic fraction was slightly higher at Bishkek than Lidar, possibly suggesting an influence from the city of Bishkek to the north.

At both sites, the mass balance for PM_{10} was relatively low, ranging from 39 - 106% (average 60%) at the Lidar site and 47 - 86% (average 57%) at the Bishkek site, as shown in Figures 2A and 2C. This low mass balance was also observed for fine PM, where at Bishkek the mass balance was 45 - 86% (average 63%) and at Lidar, 37 - 108% (average 64%). In general, the mass balance was better in the winter months (December-February) when PM_{10} and fine PM concentrations were lowest and combustion sources likely influenced the sites more than dust transported from the deserts within and surrounding Central Asia. This is suggested by the higher fractions of OC, EC, nitrate, and sulfate during the winter at both sites. Relatively low influence by mineral dust in the winter and little air mass transport into the region was presented in another recent study of this area (Kulkarni et al., 2014).

The lack of mass closure shown in Figures 2A - 2D motivated an investigation of the additional methods described above for the estimation of mineral dust. However, neither the carbonate or Al-based models were consistently more successful at totally reconstructing the observed concentrations of PM_{10}; the carbonate model gave an average percent reconstruction (range in parentheses) of 64% (42 – 110%) at the Lidar site and 60% (51 – 88%) at the Bishkek site, and the Al-based model gave an average % reconstruction of 73% (48 – 120%) at the Lidar site and 70% (59-104%) at the Bishkek site. While the average extent of mass closure increased for both the carbonate and Al-based models as compared with the oxide model, for both these additional models, there are numerous months at both sites where the mass closure was is <65%. Recently published work using aerosol optical depth (Chen et al., 2013) and meteorological models (Kulkarni et al., 2014) suggest that the assumption of the Aral Sea as a dominant source region of mineral dust for these receptor sites is unlikely, and that other deserts in the region such as the Taklimakan desert in Western China, are likely more important sources of mineral dust at these receptor sites.

While the employment of different dust models resulted in greater mass closure for certain months, no single dust model consistently improved mass closure. It appears that months which exhibit the lowest mass closure are those when the measured PM is highest, i.e., the fall, summer, and spring months, although this trend is more apparent at Lidar than Bishkek (Figures SI-2A, SI-2B for $PM_{10-2.5}$, SI-2C and SI-2D for $PM_{2.5}$). One possible explanation for the low mass closure is an underestimation of the contribution by mineral dust to PM, which we were not able to successfully estimate due to a lack of chemical information on crustal material from further removed mineral dust source regions. Another possible reason for the low mass closure is a miscalculation (underestimation) of organic mass, i.e., that the constant multiplier of 2.0 (OM:OC) did not accurately represent the contribution of OM to PM. The application of constant multipliers the OM:OC (and Si:Al) ratios likely leads to uncertainty in estimates of these components, however, no evidence was available that suggested different (higher) multipliers would be more appropriate. In addition, unestimated aerosol-bound water could explain some of the un-reconstructed PM mass. Lastly, imprecision in the filter weighing, as discussed in section 2.3, could contribute to the lack of mass closure in some samples (although these errors are expected to be random and likely would not result in a systematic underestimation).

3.4. Chemical Characteristics of Maximum and Minimum Event Days

Chemical characteristics of twelve of relatively high and twelve relatively low (i.e., background) PM mass concentration days (“event” sampling periods) were investigated to help better understand the sources and chemistry of PM impacting the Bishkek and Lidar sites. Filters representing PM events were analyzed separately from the monthly filter composites and later averaged into the respective monthly data. Event results are presented for coarse and fine PM at the Lidar site in Figures 3A - 3D and for the Bishkek site in Figures SI-2A through SI-2D.

Figures 3A and 3B indicate that mineral dust (as estimated by the oxide model) was the largest contributor to coarse PM mass during both high and low events at the Lidar site. During high event days, mineral dust contributed an average (± standard deviation) of 42 ± 29% of the observed coarse PM, and an average (± standard deviation) of 20 ± 16% for the low events. OM was not present above the threshold value (analytical uncertainty multiplied by 2) for the majority of the high events at Lidar and for none of the low events. The same was true of the Bishkek high and low events for the coarse fraction. This indicates that mineral dust was the dominant contributor during periods of high observed PM, while OM was not a significant fraction of the sources impacting these sites during high PM events. Additional contributions to coarse PM from sulfate and ammonium were observed with a higher relative contribution at the Lidar site during the low event days and at Bishkek during the high event days. At Bishkek, the higher sulfate and nitrate and lack of ammonium in high event coarse PM may have been due to the influence of the city of Bishkek where gas phase acids interact with the coarse mineral dust during transport from Bishkek to the sampling site. The smaller amounts at the Lidar site and some fraction at Bishkek may also have been nitrate and sulfate present in coarse PM associated with the mineral dust or an impact from local soils.

The contributions to fine PM events (Figures 3B and 3D for the Lidar site and SI-2B and 2D for the Bishkek site) were similar to coarse PM. Mineral dust contributed 19 ± 17% to the observed fine PM mass at the Lidar during the high event days and 6 ± 5% during the low event days. However, at Bishkek, the contribution of mineral dust to fine PM during the high and low event days was similar (12 ± 11% and 10 ± 9%, respectively). This same trend between high and low event days was observed for OM with contributions of 33 ± 21% and 42 ± 15%, respectively, at Lidar as compared with 30 ± 12% and 35 ± 14%, respectively, at Bishkek.

Mineral dust contributed more to coarse PM during maximum event days in the spring and summer as compared with the winter. At the Lidar site, from March - June, the mineral dust contribution to coarse PM was > 39%. On a percentage basis, similar results were observed for minimum event days. High mineral dust contributions to fine and coarse PM during maximum event days were consistent with previous studies in eastern Asia (see Introduction), which have shown spring as having the highest frequency of dust storms. The similarity in the relative contribution of mineral dust between the high and low events during this season indicates that mineral dust was a dominant contributor to ambient PM.

3.5. Results of Principal Components Analysis

Principal Components Analysis (PCA) was employed to identify shared sources of PM at Bishkek and Lidar. The chemical composition data from both sites, segregated by particle size, were combined for this analysis. A detailed analysis of the sources of carbonaceous PM in this region was published elsewhere (Miller-Schulze et al., 2011). The objective of the PCA in this work was to assess if there was a discrete factor that could be attributed to mineral dust.

Detailed results of the PCA can be found in Tables SI-1A, 1B, and 1C for $PM_{10-2.5}$, $PM_{2.5}$, and PM_{10}, respectively. Correlations between mineral dust-associated elements, and between PM and mineral dust, are in Tables SI-2A, SI-2B and SI-2C for PM_{10}, $PM_{10-2.5}$, and $PM_{2.5}$, respectively, at Bishkek and SI-2D, SI-2E and SI-2F for PM_{10}, $PM_{10-2.5}$, and $PM_{2.5}$, respectively, for Lidar. $PM_{2.5}$ EC and $PM_{10-2.5}$ and $PM_{2.5}$ Pt were removed from this analysis because more than 90% of the composite samples were below the limit of detection. After removing these analytes, 56 analytes and 96 samples for PM_{10}, 54 analytes and 96 samples for $PM_{10-2.5}$, and 55 analytes and 96 samples for $PM_{2.5}$ were considered for PCA. Bi-weekly composites were used rather than monthly averages as presented earlier. Based on varimax-rotated PCA, seven source factors were resolved for $PM_{2.5}$ and PM_{10} and six for $PM_{10-2.5}$, which accounted for approximately 91%, 92%, and 89% of the total variance, respectively. To facilitate interpretation of each of the retained factors, factor loadings greater than 0.70 in absolute value shown in Tables SI-1A, 1B and 1C were considered to be significant.

The dominant factor (Factor 1, Tables SI-1A, 1B, 1C) had high elemental loadings for Mg, Al, Ca, Fe, Ti, and alkali metals in all three PM size fractions, indicating the impact of mineral dust at both sites (Kulkarni et al., 2006; Nyanganyura et al., 2007; Solomon et al., 2008; Thurston and Spengler, 1985). Factor 1 accounted for 60%, 62%, and 57% of the variance for $PM_{2.5}$, PM_{10}, and $PM_{10-2.5}$, respectively.

High elemental loadings for rare earth elements were also observed in Factor 1 for all three size fractions, further indicating that this factor was associated with mineral dust, as rare earth elements have been shown to be associated with this source (Kulkarni et al., 2006; Nyanganyura et al., 2007).

The second factor in all three size fractions had high loadings for Pb and Zn (although Zn was not significantly loaded on this factor in the coarse fraction). This second factor had high loadings for As and Cd in $PM_{10-2.5}$, and high loadings for Cu and Rh in fine PM. The high loadings for Pb, Zn, As, and Cd in $PM_{10-2.5}$ indicate that Factor 2 was associated with a high temperature incineration/combustion source (Kulkarni et al., 2006; Morawska and Zhang, 2002) for $PM_{10-2.5}$. The combustion element loadings in Factor 2 (Pb, As, Zn, Cd) for $PM_{10-2.5}$ are split between factors 2 (Cu, Zn, Pb) and 4 (As, Cd) in $PM_{2.5}$. In addition, the Cu and Rh loading is high in Factor 4 in $PM_{10-2.5}$. These combustion elements seem to be split between Factors 2 and 4 for all three size fractions, indicating that both Factors 2 and 4 resulted from a combination of different types of combustion sources, i.e., incineration, internal combustion engines, etc. Factors 2 and 4 also had low loadings for the alkali metals and Mg, Al, Ca, Fe, and Ti, in addition to low loadings for rare earth elements, indicating that these factors were not strongly related to mineral dust. Factors 2 and 4 were generally consistent between $PM_{10-2.5}$ and PM_{10} for these combustion-related elements.

The relatively high loadings for nitrate, ammonium, and sulfate in Factor 3 for all three size fractions (although the sulfate and ammonium loadings were low in the coarse fraction) indicate the possibility that this factor was the result of secondary inorganic aerosol formation (Solomon et al., 2008; Wang et al., 2012). The secondary inorganic aerosol formation associated with Factor 3 here likely encompasses the reactions between ammonium and nitrate to form ammonium nitrate in addition to gas-particulate reactions involving nitric acid, sulfuric acid, and sulfate and nitrate ions (Baek and Aneja, 2004).

Overall, the total percent variance explained by the first four major factors (i.e., mineral dust, mobile and stationary combustion, and secondary species) was approximately 82% for $PM_{2.5}$, 85% for PM_{10}, and 84% for $PM_{10-2.5}$.

The PCA indicates that proximal combustion sources were a significant but relatively minor source of PM at both sampling sites and that the dominant contributor to measured PM in the region was mineral dust.

3.6. Seasonality of Mineral Dust Concentrations

Figures 4A, B, and C show the relationship between calculated mineral dust concentrations at each site for the PM_{10} (4A) and $PM_{10-2.5}$, (4B) and $PM_{2.5}$ (4C) monthly composite samples. Tables 1A and 1B show the seasonal averages for mineral dust for each site and size fraction. The ratio of mineral dust measured at Bishkek to mineral dust measured at Lidar is shown in Figure SI-3 of the SI.

With one exception in the fall season (September composite, at Bishkek), the highest observed concentrations of mineral dust occurred in the spring and summer, consistent with the literature regarding Asian dust (Seinfeld et al., 2004) as well as published work on the Kyrgyz Republic and Central Asia specifically (Chen et al., 2013) related to the seasonality of mineral dust storms.

Levels of mineral dust were higher at Bishkek as compared with Lidar in the fall on a monthly average basis, in addition to selected months in the summer (July 2008) and winter (December 2008) for all three size fraction. The contribution of mineral dust to PM was also greater on a percentage basis at Bishkek for the months of September and October, and relatively equal in November (November is the month that is almost directly on the 1/1 line in figures 4A - 4C). Based on the work of Kulkarni, et al (2014), this could indicate an influence of dust from long-range sources (Africa and the Middle East) at Bishkek.

Mineral dust concentrations were greater in Lidar as compared with Bishkek in June, August, April, and May for all three size fractions, and in January for PM_{10} and coarse PM. Recent work has speculated that mineral dust from Western China was likely influencing the Lidar site during June, August, April, and May.

4. Conclusion

PM_{10} and fine particulate matter mass and chemical composition were obtained for one year at two sites in the Kyrgyz Republic, Central Asia. One site was located south of Bishkek, the capital of the Kyrgyz Republic, and the other in the eastern part of the country, about 315 km to the east of Bishkek. Results presented in this manuscript indicate that mineral dust, as approximated by the more conventional dust oxide model, and organic matter, were the dominant contributors to both PM_{10} and fine PM in the region. These components contributed approximately 50% of the PM_{10} and fine PM at both sites. Mineral dust contributed a greater relative fraction to both PM_{10} and $PM_{10-2.5}$ as compared with $PM_{2.5}$, while $PM_{2.5}$ had higher contributions from ionic species and organic matter. Mineral dust also contributed more to high concentration sampling periods relative to periods when PM mass was low. Historically, dust storms are more frequently observed in Eastern Asia during the spring. Similar results were observed at both sites. High mineral dust concentrations at both sites were also observed in the summer, whereas the lowest concentrations of mineral dust were observed during the winter. Organic matter and ionic constituents were typically higher during the entire year in $PM_{2.5}$ relative to PM_{10} and $PM_{10-2.5}$; although the Lidar site had higher ionic concentrations in coarse PM during a few of the warmer months.

PCA indicated that a majority of the variance in the PM data at both sites can be explained by mineral dust. The dust models employed in this study may under-predict the mineral dust contribution to fine, coarse, and PM_{10}, as evidenced by the low mass balance of major components, so dust may contribute an even greater percentage to PM in the area than estimated here. Additional sources of mineral dust (i.e., other than local soil and Aral Sea soil) are possible reasons for this underestimation.

Results from this study describe for the first time the chemical characteristics and seasonality of ambient PM in Central Asia, an area where little data on PM mass and chemical composition has been previously reported. Further studies of the impacts of mineral dust and its sources, as well as other sources within Central Asia, and the extent to which the impact of these sources change seasonally are needed to develop emissions control approaches to reduce PM levels and to better understand potential health impacts from fine and coarse PM in the region.

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Main Manuscript Figure and Table Captions For:

The Seasonal Contribution of Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia

Justin P. Miller-Schulze, Martin Shafer, James J. Schauer, Jongbae Heo, Paul A. Solomon, Jeffrey Lantz, Maria Artamonova, Boris Chen, Sanjar Imashev, Leonid Sverdlik, Greg Carmichael, Jeff DeMinter

FIGURES

Figure 1A-1D: Temporal variability of $PM_{10-2.5}$ at Bishkek site (1A), $PM_{10-2.5}$ at Lidar site (1B), $PM_{2.5}$ at Bishkek site (1C), and $PM_{10-2.5}$ at Lidar site (1D). High event dates indicated by blue circles, low event dates indicated by red X. Legend in (1D) applies to all four figure panes.

Figure 2A-2D: Mass balance for monthly composites of PM_{10} and $PM_{2.5}$ at Bishkek (2A, 2B, respectively) and Lidar (2C, 2D, respectively). The total measured fine and coarse mass is plotted above the stacked bars as points to show approximate mass reconciliation. Legend in (1A) applies to all four figure panes. Error bars for total mass represent the propagated analytical uncertainty for the calculated monthly PM concentrations.

Figure 3A-3D: Chemical composition for $PM_{10-2.5}$ and $PM_{2.5}$ high (3A and 3C, respectively) and low (3B and 3D, respectively) concentration periods at the Lidar site. Y-axis scales are different (between 3A/3C and 3B/3D. Legend in (3C) applies to all four figure panes. Only data greater than 2 times the propagated uncertainty is plotted. Error bars for total mass represent the propagated analytical uncertainty for the calculated monthly PM concentrations.

Figure 4A-4C: Comparison of mineral dust (by Dust-oxide model) between sites for PM_{10} (4A) and $PM_{2.5}$ (4B) and between $PM_{10-2.5}$ (4C). The 1/1 line is shown in all figures for reference. Seasons represent months as follows: Winter: December, January, February; Spring: March, April, May; Summer: July 2008, August, June, July 2009; Fall: September, October, November).

TABLES

Table 1A-1B: Seasonal averages for Bishkek and Lidar PM and chemical constituents (1A and 1B, respectively). Seasons represent months as follows: Winter; December, January, February; Spring: March, April, May; Summer: July 2008, August, June, July 2009; Fall: September, October, November. SEM = Standard Error of Mean.

Table 2A: Regression equation parameters and statistics for different mineral dust models versus Dust-oxide model for PM_{10} and $PM_{2.5}$ size fractions at both Bishkek and Lidar.

Supplemental Information (SI) Figure and Table Captions For:

Seasonal Contribution of Mineral Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia

Justin P. Miller-Schulze, Martin Shafer, James J. Schauer, Jongbae Heo, Paul Solomon, Jeffrey Lantz, Maria Artamonova, Boris Chen, Sanjar Imashev, Leonid Sverdlik, Greg Carmichael, Jeff DeMinter

FIGURES

Figure SI-1A-SI-1D: Relationship between the percentage of mass reconstruction (i.e., mass balance) using each of the three dust models described in the main manuscript and measured PM_{10} at Lidar (SI-1A) and Bishkek (SI-1B) and $PM_{2.5}$ at Bishkek (SI-1C) and Lidar (SI-1C).

Figure SI-2A-SI-2D: Bulk chemical data for monthly composite of $PM_{10-2.5}$ filter samples during high events at Bishkek site (SI-2A) and low events (SI-2B) and $PM_{2.5}$ samples at Bishkek site during high Events (SI-2C) and low Events (SI-2D). Note the difference in scales of y-axes. Legend in (SI-2B) applies to all four figure panes.

Figure SI-3: Ratio of monthly average concentration of mineral dust at Bishkek to monthly average concentration of mineral dust at Lidar for all three PM size fractions.

TABLES

Table SI-1: Gravimetric Mass Precision for parallel collected duplicate filters for each size fraction.

Table SI-2: Data for method spike and Certified Reference Material recovery (Percent of spiked or known)

Table SI-3: Mean field filter blank elemental concentrations as a percentage of median composite and event concentrations

Table SI-4: Median propagated uncertainty of concentration values as a percentage of median composite and event concentrations

Table SI-5: Elemental and ionic constituent concentrations at Lidar in PM_{10} samples

Table SI-6: Elemental and ionic constituent concentrations at Lidar in $PM_{2.5}$ samples

Table SI-7: Elemental and ionic constituent concentrations at Bishkek in PM_{10} samples

Table SI-8: Elemental and ionic constituent concentrations at Bishkek in $PM_{2.5}$ samples

Table SI-9A-SI-9C: Results of PCA analysis for $PM_{10-2.5}$ (SI-9A), $PM_{2.5}$ (SI-9B), and PM_{10} (SI-9C). Loadings with values >0.7 are considered significant and bolded in the table.

Eigenvalues represent the relative measure of the variation explained by each factor, % of Variance represents the percentage of variability in the data explained by that factor, cumulative % represents the total amount of variability explained by the sum of the factors including that factor.

Table SI-10A-SI-10C: Correlation matrices for mineral dust oxide constituents for PM_{10} at Bishkek (SI-10A), $PM_{10-2.5}$ at Bishkek (SI-10B), and $PM_{2.5}$ at Bishkek (SI-10C)

Table SI-11A-SI-11C: Correlation matrices for mineral dust oxide constituents for PM_{10} at Lidar (SI-11A), $PM_{10-2.5}$ at Lidar (SI-11B), and $PM_{2.5}$ at Lidar (SI-11C)

Seasonal Contribution of Mineral Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia

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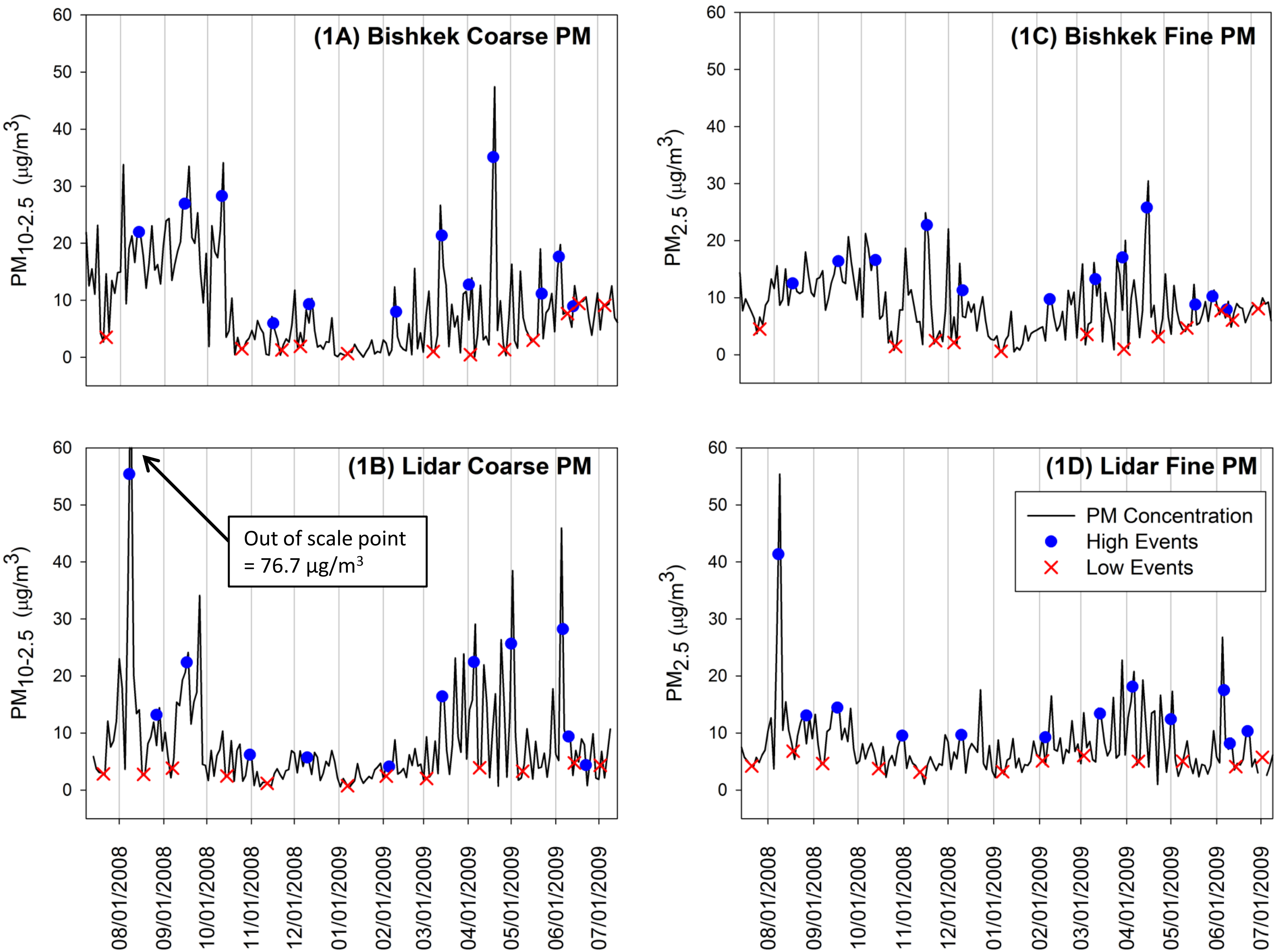
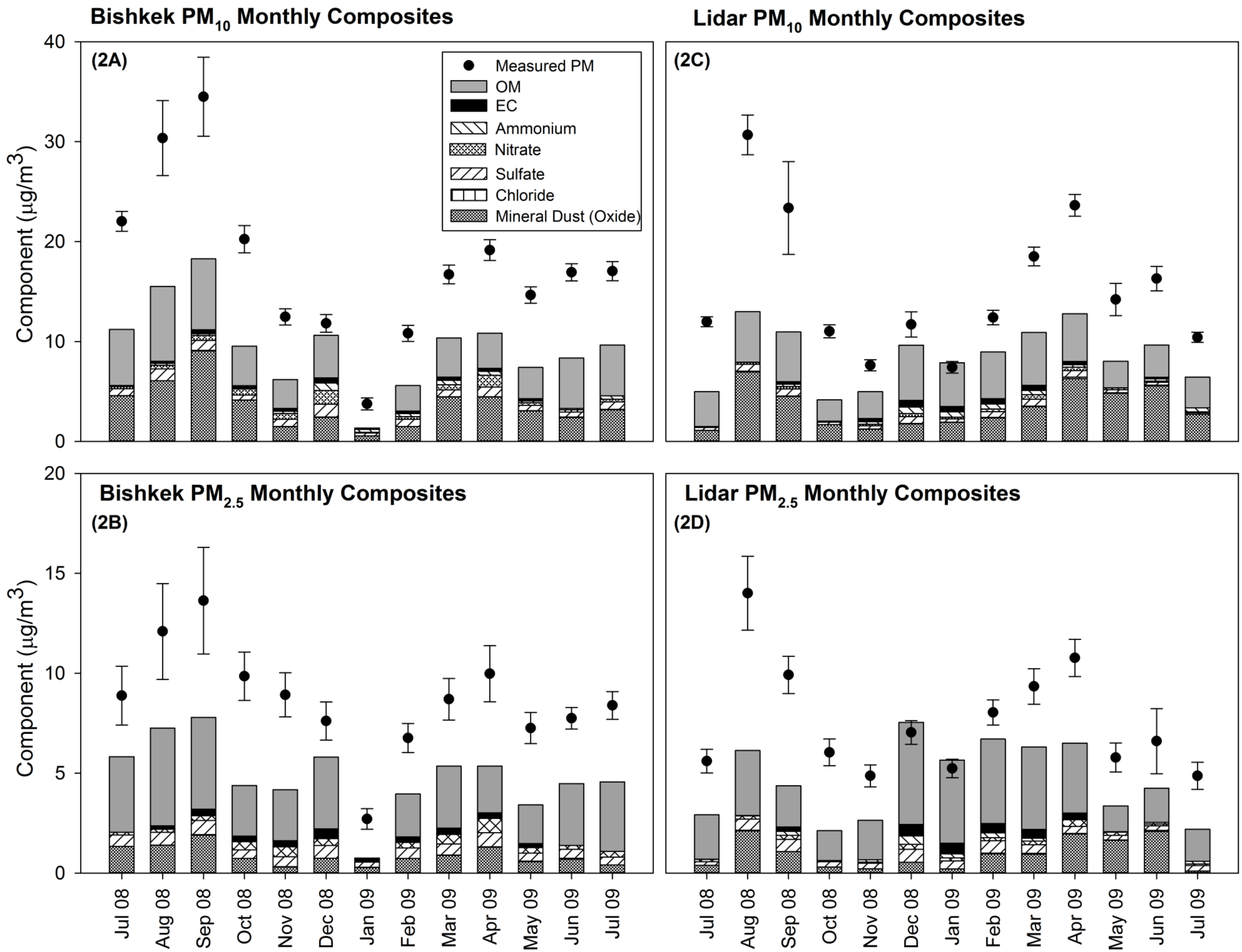
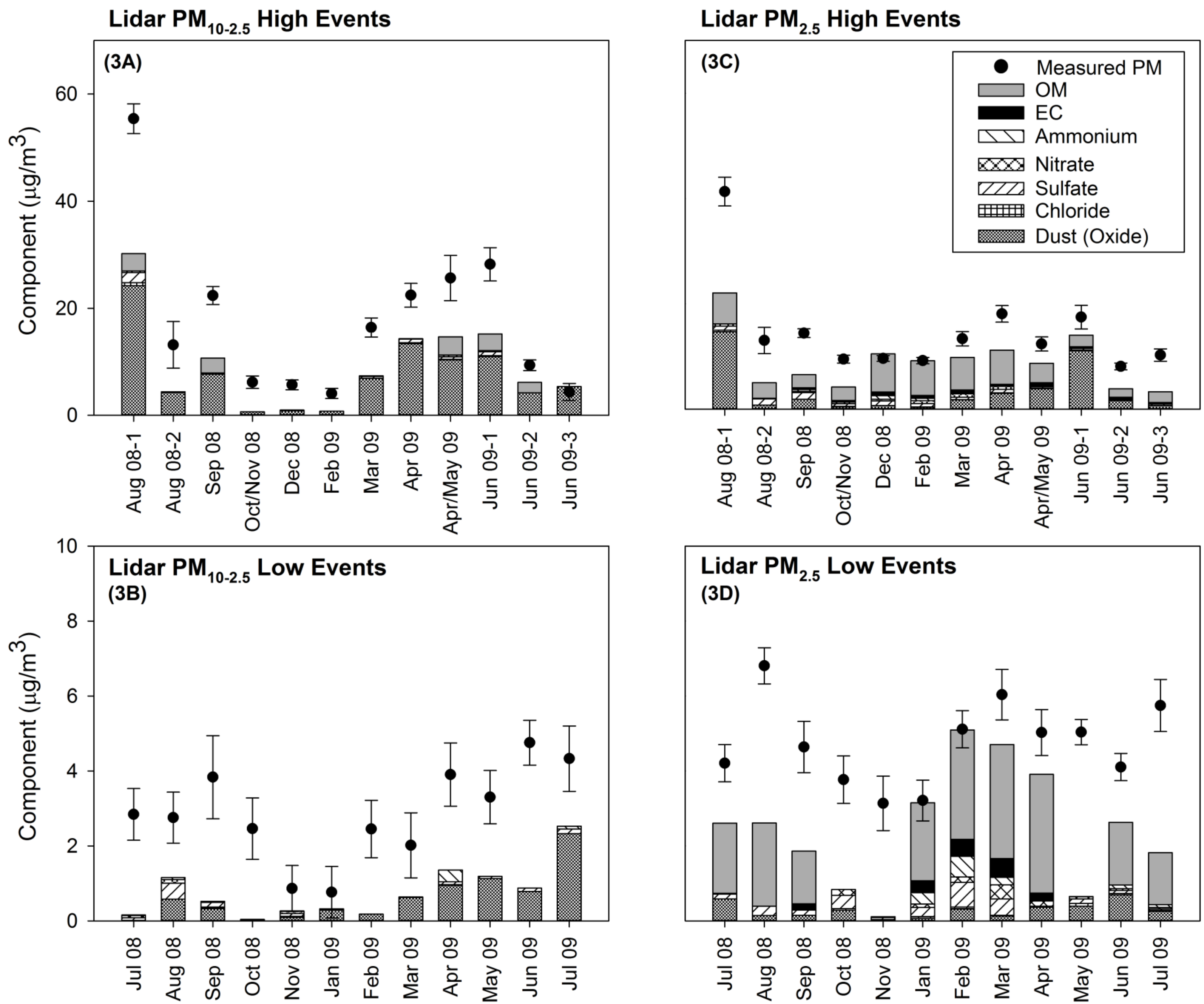
Main Manuscript Tables and Figures



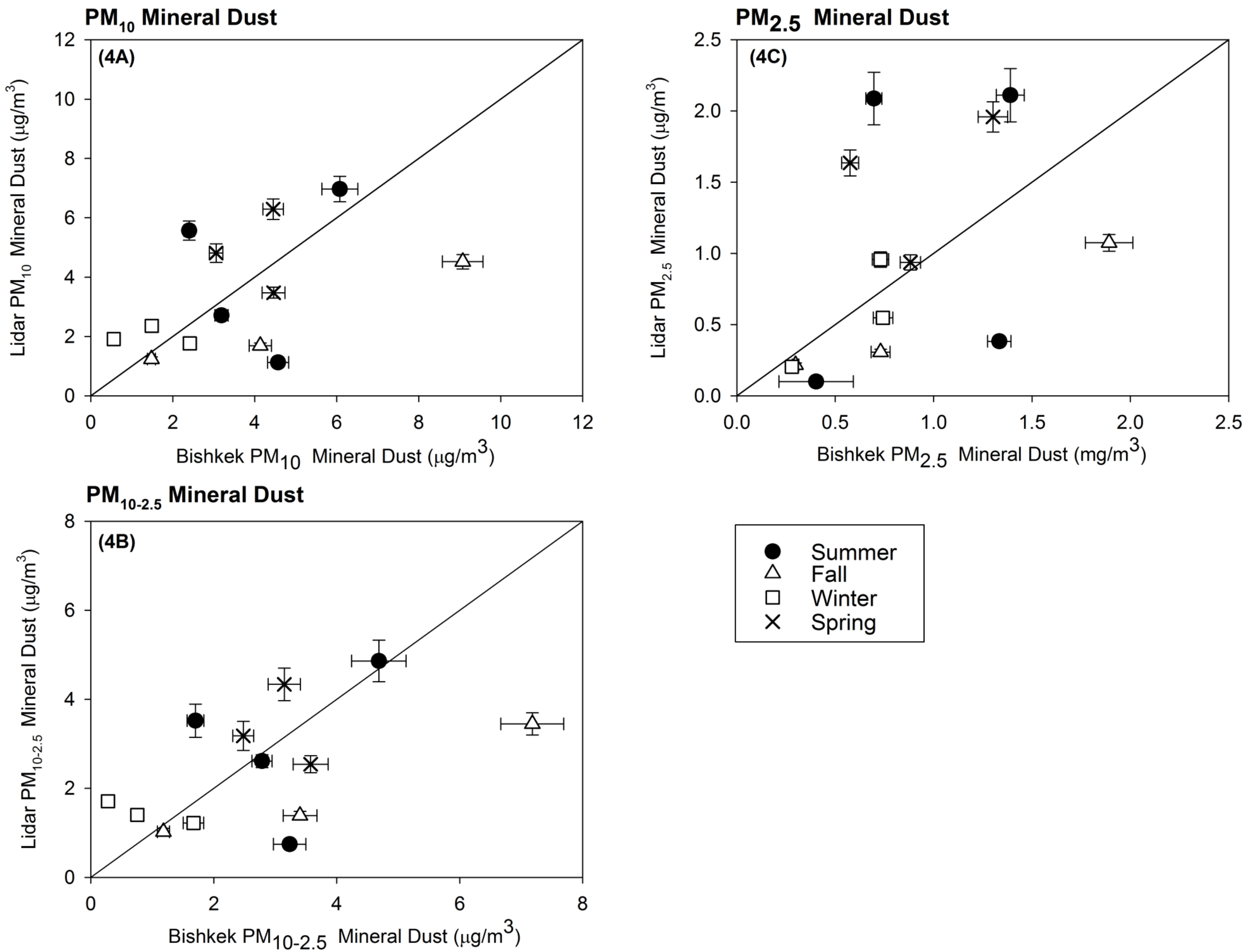
(1A) Bishkek Coarse PM
(1B) Lidar Coarse PM
(1C) Bishkek Fine PM
(1D) Lidar Fine PM
PM10-2.5 (μg/m3)
PM2.5 (μg/m3)
Out of scale point
= 76.7 μg/m3
PM Concentration
High Events
Low Events
08/01/2008
09/01/2008
10/01/2008
11/01/2008
12/01/2008
01/01/2009
02/01/2009
03/01/2009
04/01/2009
05/01/2009
06/01/2009
07/01/2009



Bishkek PM10 Monthly Composites
Lidar PM10 Monthly Composites
Bishkek PM2.5 Monthly Composites
Lidar PM2.5 Monthly Composites
(2A)
(2B)
(2C)
(2D)
Measured PM
OM
EC
Ammonium
Nitrate
Sulfate
Chloride
Mineral Dust (Oxide)
Component (µg/m3)
Jul 08
Aug 08
Sep 08
Oct 08
Nov 08
Dec 08
Jan 09
Feb 09
Mar 09
Apr 09
May 09
Jun 09
Jul 09



Lidar $PM_{10-2.5}$ High Events
(3A)
Component (µg/m3)
0
20
40
60
Aug 08-1
Aug 08-2
Sep 08
Oct/Nov 08
Dec 08
Feb 09
Mar 09
Apr 09
Apr/May 09
Jun 09-1
Jun 09-2
Jun 09-3
Lidar $PM_{2.5}$ High Events
(3C)
Measured PM
OM
EC
Ammonium
Nitrate
Sulfate
Chloride
Dust (Oxide)
Lidar $PM_{10-2.5}$ Low Events
(3B)
0
2
4
6
8
10
Jul 08
Aug 08
Sep 08
Oct 08
Nov 08
Jan 09
Feb 09
Mar 09
Apr 09
May 09
Jun 09
Jul 09
Lidar $PM_{2.5}$ Low Events
(3D)



PM10 Mineral Dust
(4A)
Lidar PM10 Mineral Dust (μg/m3)
Bishkek PM10 Mineral Dust (μg/m3)
PM2.5 Mineral Dust
(4C)
Lidar PM2.5 Mineral Dust (μg/m3)
Bishkek PM2.5 Mineral Dust (mg/m3)
PM10-2.5 Mineral Dust
(4B)
Lidar PM10-2.5 Mineral Dust (μg/m3)
Bishkek PM10-2.5 Mineral Dust (μg/m3)
Summer
Fall
Winter
Spring

Table 1A

Bishkek PM10	PM10 (µg/m³)		Organic Carbon (µg/m³)		Elemental Carbon (µg/m³)		Dust (Oxide) (µg/m³)		Chloride (ng/m³)		Sulfate (ng/m³)		Nitrate (ng/m³)		Ammonium (ng/m³)	
	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM
Winter	8.8	2.5	1.3	0.45	0.30	0.11	1.5	0.53	20.0	11	760	280	580	410	440	150
Spring	17.0	1.3	1.8	0.11	0.29	0.03	4.0	0.47	33.0	1.5	730	130	650	270	340	80.0
Summer	22.0	3.2	2.9	0.29	0.13	0.03	4.1	0.81	30.0	8.3	780	140	270	31.0	190	54.0
Fall	22.0	6.5	2.3	0.63	0.32	0.04	4.9	2.2	33.0	9.8	730	140	560	33.0	160	48.0
Annual	18.0	2.2	2.1	0.25	0.25	0.03	3.6	0.62	29.0	4.0	750	78	500	110	280	50.0

Bishkek Coarse	PM10-2.5 (µg/m³)		Organic Carbon (µg/m³)		Elemental Carbon (µg/m³)		Dust (Oxide) (µg/m³)		Chloride (ng/m³)		Sulfate (ng/m³)		Nitrate (ng/m³)		Ammonium (ng/m³)	
	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM
Winter	3.1	1.0	0.19	0.09	0.02	0.0	0.9	0.41	7.7	4.9	200	84.0	170	130	48.0	43.0
Spring	8.2	0.52	0.53	0.06	0.03	0.01	3.1	0.32	19.0	1.5	170	46.0	180	150	18.0	9.0
Summer	12.0	2.2	1.0	0.11	0.02	0.01	3.1	0.62	15.0	5.1	290	100	85.0	46.0	100	43.0
Fall	12.0	5.0	0.71	0.32	0.02	0.02	3.9	1.8	17.0	3.6	190	60.0	170	51.0	46.0	16.0
Annual	9.1	1.6	0.63	0.11	0.02	0.01	2.8	0.5	15.0	2.2	220	38.0	150	43.0	57.0	18.0

Bishkek PM2.5	PM2.5 (µg/m³)		Organic Carbon (µg/m³)		Elemental Carbon (µg/m³)		Dust (Oxide) (µg/m³)		Chloride (ng/m³)		Sulfate (ng/m³)		Nitrate (ng/m³)		Ammonium (ng/m³)	
	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM	AVG	SEM
Winter	5.7	1.5	1.1	0.35	0.30	0.10	0.58	0.15	8.6	1.6	470	110	230	86.0	500	110
Spring	8.6	0.8	1.2	0.17	0.27	0.03	0.9	0.2	16.0	1.4	560	87.0	490	130	450	150
Summer	9.3	1.0	1.9	0.19	0.13	0.02	1.0	0.24	17.0	10.0	510	58.0	190	35.0	110	35.0
Fall	11.0	1.4	1.6	0.34	0.30	0.02	0.97	0.48	18.0	10.0	540	83.0	380	75.0	120	49.0
Annual	8.7	0.73	1.5	0.15	0.24	0.03	0.87	0.13	15.0	3.6	520	37.0	310	49.0	280	65.0

Table 1B

Lidar PM10	PM10 ($\mu g/m^3$) AVG	SEM	Organic Carbon ($\mu g/m^3$) AVG	SEM	Elemental Carbon ($\mu g/m^3$) AVG	SEM	Dust (Oxide) ($\mu g/m^3$) AVG	SEM	Chloride (ng/m^3) AVG	SEM	Sulfate (ng/m^3) AVG	SEM	Nitrate (ng/m^3) AVG	SEM	Ammonium (ng/m^3) AVG	SEM
Winter	11.0	1.6	2.4	0.17	0.58	0.04	2.0	0.18	36.0	11.0	530	110	250	42.0	560	52.0
Spring	19.0	2.7	2.1	0.41	0.32	0.11	4.9	0.81	92.0	29.0	550	120	320	80.0	230	110
Summer	17.0	4.6	1.9	0.23	0.11	0.02	4.1	1.3	40.0	17.0	350	110	120	25.0	160	93.0
Fall	14.0	4.8	1.6	0.43	0.24	0.05	2.5	1.0	17.0	7.10	430	140	150	49.0	160	75.0
Annual	15.0	1.9	2.0	0.16	0.30	0.06	3.4	0.56	46.0	11.0	460	58.0	210	31.0	270	60.0

Lidar Coarse	PM10-2.5 ($\mu g/m^3$) AVG	SEM	Organic Carbon ($\mu g/m^3$) AVG	SEM	Elemental Carbon ($\mu g/m^3$) AVG	SEM	Dust (Oxide) ($\mu g/m^3$) AVG	SEM	Chloride (ng/m^3) AVG	SEM	Sulfate (ng/m^3) AVG	SEM	Nitrate (ng/m^3) AVG	SEM	Ammonium (ng/m^3) AVG	SEM
Winter	3.7	0.78	0.18	0.04	0.07	0.02	1.4	0.14	25.0	3.0	34.00	10.0	77.0	32.0	270	38.0
Spring	10.0	1.4	0.63	0.03	0.04	0.02	3.4	0.52	59.0	34.0	220	69.0	120	77.0	170	76.0
Summer	9.7	2.4	0.75	0.06	0.02	0.01	2.9	0.86	25.0	6.7	75.0	26.0	21.0	7.20	100	64.0
Fall	7.1	3.3	0.68	0.39	0.02	0.01	2.0	0.75	20.0	9.1	94.0	58.0	52.0	15.0	59.0	41.0
Annual	7.8	1.2	0.58	0.10	0.04	0.01	2.5	0.37	32.0	8.4	100	27.0	63.0	20.0	150	34.0

Lidar PM2.5	PM2.5 ($\mu g/m^3$) AVG	SEM	Organic Carbon ($\mu g/m^3$) AVG	SEM	Elemental Carbon ($\mu g/m^3$) AVG	SEM	Dust (Oxide) ($\mu g/m^3$) AVG	SEM	Chloride (ng/m^3) AVG	SEM	Sulfate (ng/m^3) AVG	SEM	Nitrate (ng/m^3) AVG	SEM	Ammonium (ng/m^3) AVG	SEM
Winter	6.8	0.82	2.2	0.15	0.52	0.03	0.57	0.22	16	11	560	78.0	180	34.0	290	65.0
Spring	8.6	1.5	1.5	0.43	0.29	0.09	1.5	0.3	32	8.20	340	59.0	230	55.0	63.0	43.0
Summer	7.8	2.1	1.1	0.19	0.1	0.01	1.2	0.54	20	12	310	84.0	110	19.0	59.0	30.0
Fall	6.9	1.5	0.92	0.09	0.21	0.04	0.53	0.27	3.7	3.40	380	120	100	44.0	110	59.0
Annual	7.5	0.76	1.4	0.18	0.27	0.05	0.96	0.21	18	5.10	390	46.0	150	22.0	120	34.0

Table 2

Model (vs. Oxide)	Site	Size Fraction	Slope	Slope Uncertainty	Y-Intercept	Y-Intercept Uncertainty	Correlation Coefficient
Carbonate	Bishkek	PM10	1.18	0.02	0.01	0.08	1.00
Al-Based	Bishkek	PM10	1.60	0.04	0.3	0.2	1.00
Carbonate	Lidar	PM10	1.189	0.009	0.05	0.03	1.00
Al-Based	Lidar	PM10	1.61	0.04	0.1	0.2	1.00
Carbonate	Bishkek	PM2.5	1.17	0.01	0.01	0.01	1.00
Al-Based	Bishkek	PM2.5	1.65	0.05	0.01	0.05	1.00
Carbonate	Lidar	PM2.5	1.158	0.007	0.009	0.008	1.00
Al-Based	Lidar	PM2.5	1.64	0.02	0.02	0.2	1.00

Seasonal Contribution of Mineral Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia

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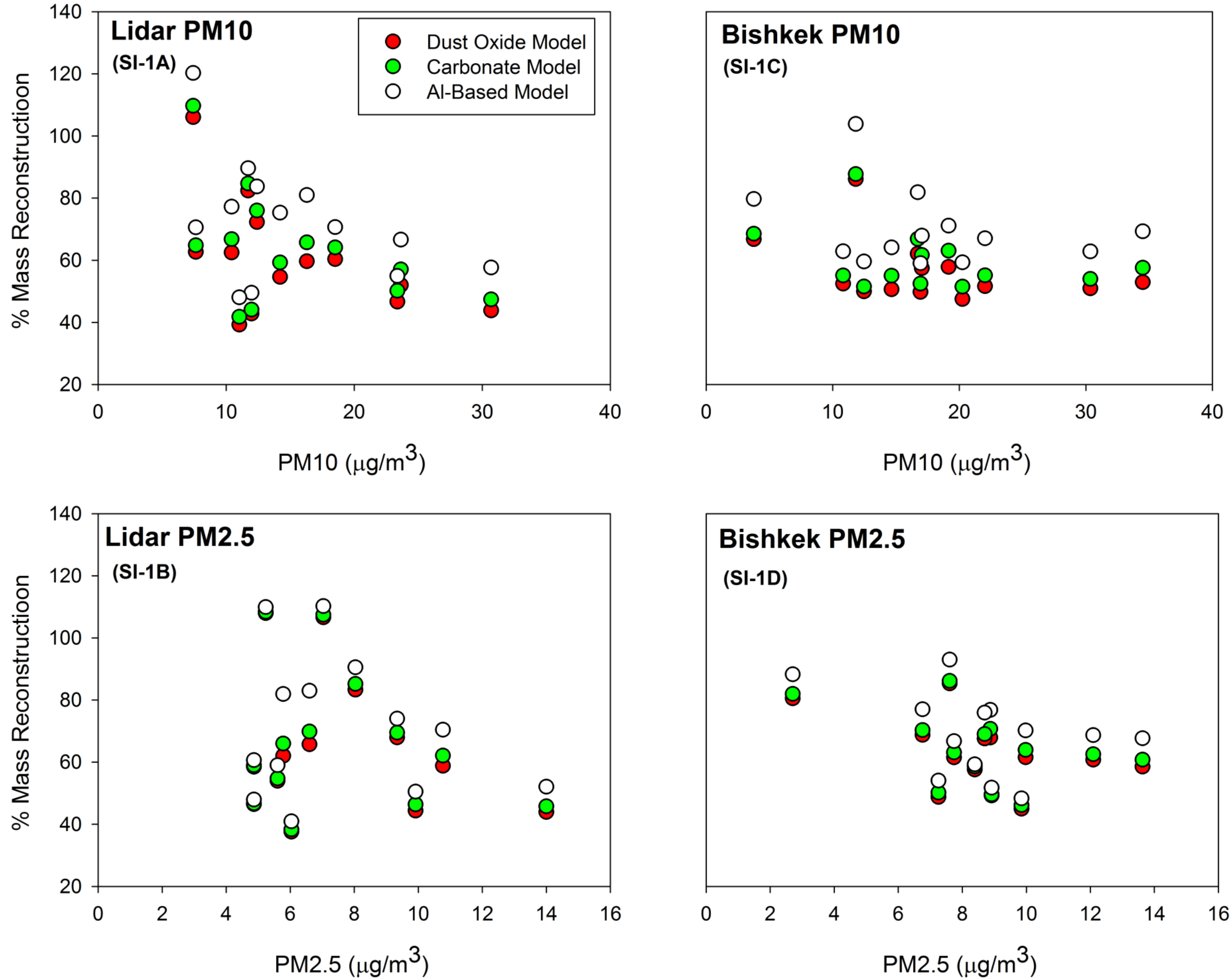
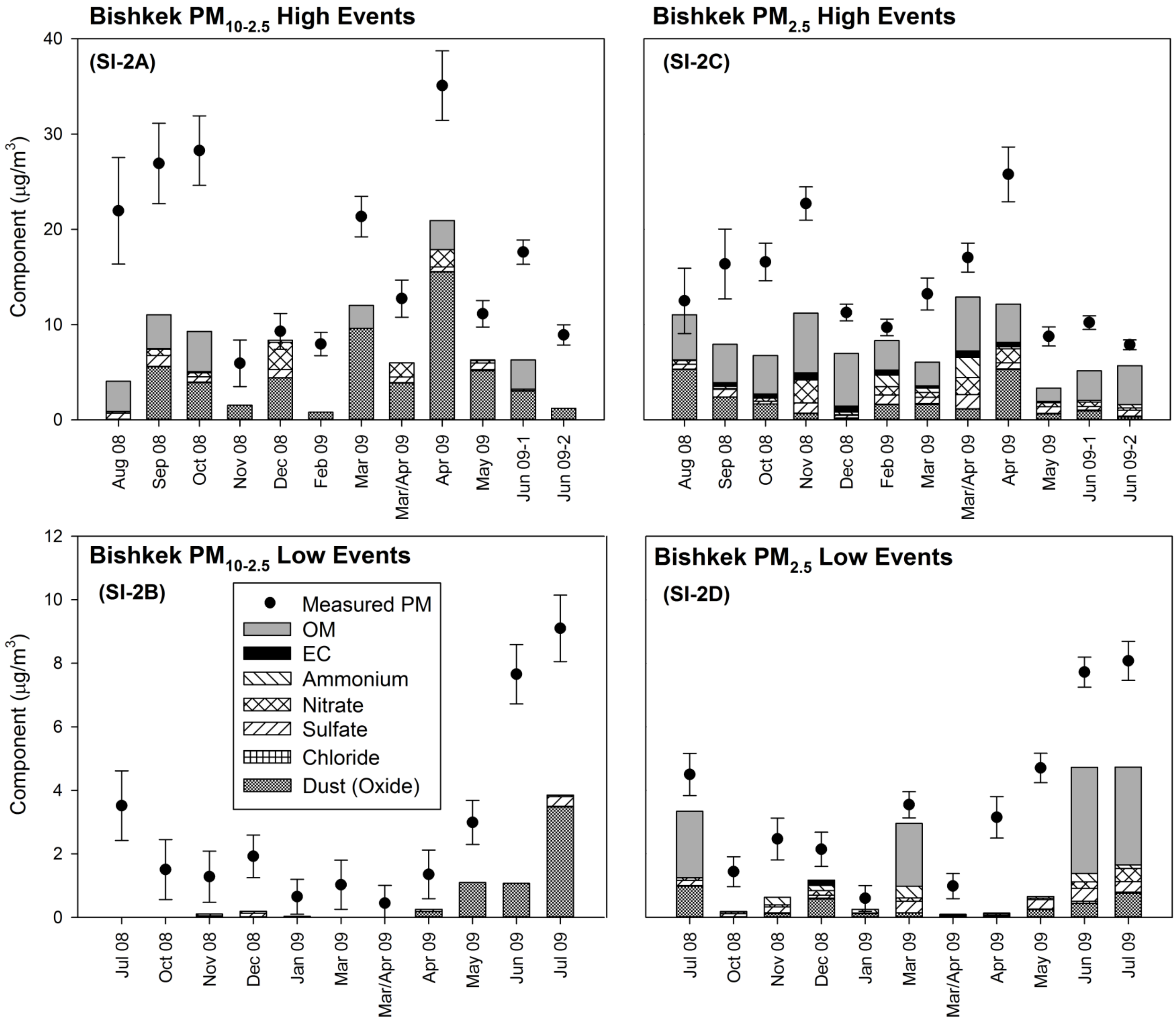
SI Tables and Figures



Lidar PM10
(SI-1A)
Dust Oxide Model
Carbonate Model
Al-Based Model
% Mass Reconstructioon
PM10 (μg/m3)
Bishkek PM10
(SI-1C)
PM10 (μg/m3)
Lidar PM2.5
(SI-1B)
% Mass Reconstructioon
PM2.5 (μg/m3)
Bishkek PM2.5
(SI-1D)
PM2.5 (μg/m3)



Bishkek PM10-2.5 High Events
(SI-2A)
Bishkek PM2.5 High Events
(SI-2C)
Bishkek PM10-2.5 Low Events
(SI-2B)
Bishkek PM2.5 Low Events
(SI-2D)
Component (μg/m3)
Measured PM
OM
EC
Ammonium
Nitrate
Sulfate
Chloride
Dust (Oxide)
Aug 08
Sep 08
Oct 08
Nov 08
Dec 08
Feb 09
Mar 09
Mar/Apr 09
Apr 09
May 09
Jun 09-1
Jun 09-2
Jul 08
Jan 09
Jun 09
Jul 09

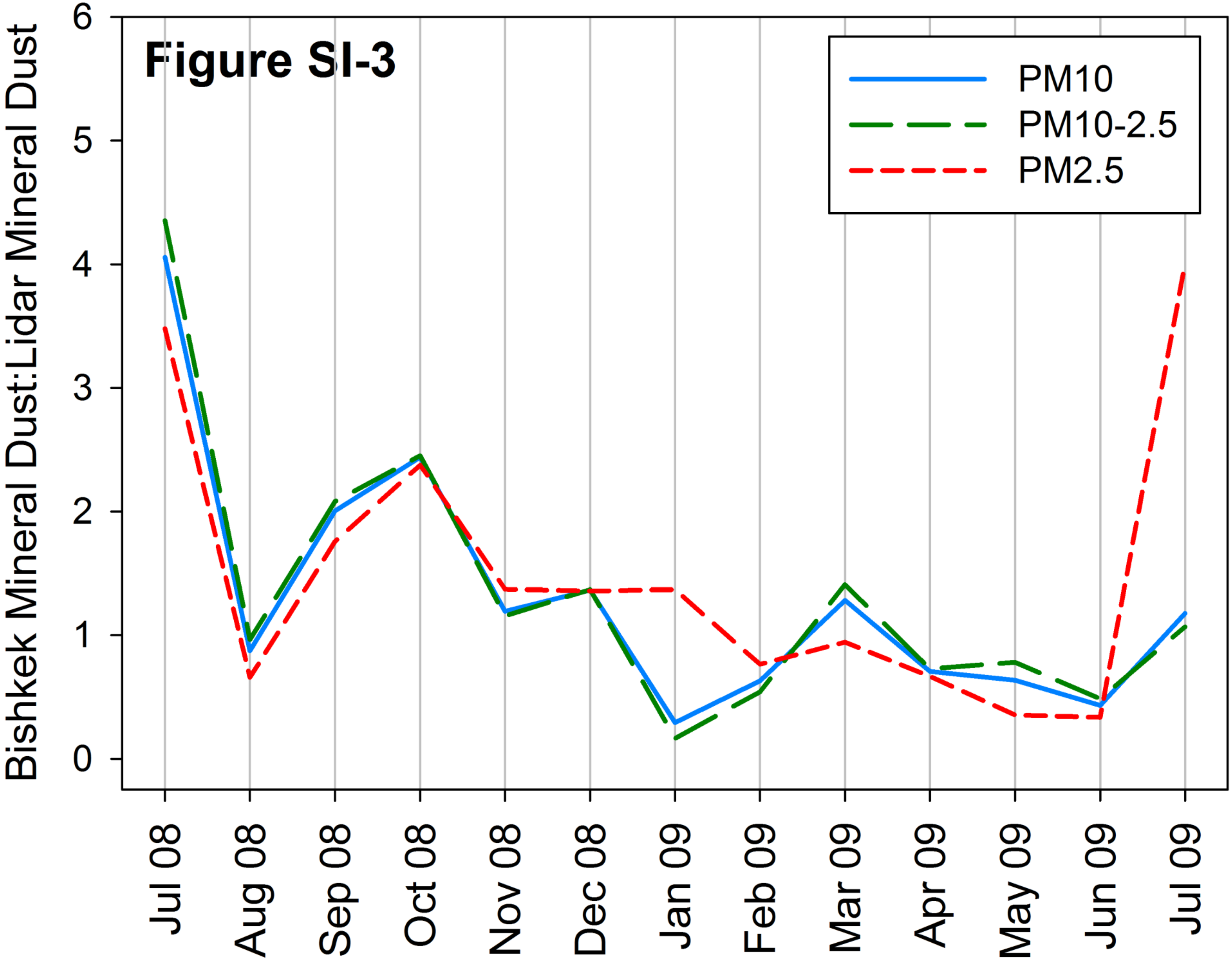


Figure SI-3
PM10
PM10-2.5
PM2.5
Bishkek Mineral Dust:Lidar Mineral Dust
0
1
2
3
4
5
6
Jul 08
Aug 08
Sep 08
Oct 08
Nov 08
Dec 08
Jan 09
Feb 09
Mar 09
Apr 09
May 09
Jun 09
Jul 09

Table SI-1

Site and Size Fraction	Median RPD (%)	n > 25%
Bishkek PM10 (n = 181)	**2.8**	**9**
Bishkek PM2.5 (n = 176)	**7.4**	**12**
Lidar PM10 (n = 179)	**2.3**	**5**
Lidar PM2.5 (n = 172)	**4.2**	**4**

RPD = Relative Percent Difference (between parallel collected "duplicate" filters of each size fraction)

Table SI-2

#Mixed element spike carried through complete digestion and SF-ICPMS protocols. Average ± 1 stdev of 22 values for each element.

##Certified reference materials (CRM) included: NIST San Joaquin Soil (2709a); NIST Urban Particulate Material (1648a); NIST Marine Sediment (2702) and NIST Used Autocatalyst (2557). Average ± 1 stdev of between 12 and 85 values (mean = 51) depending upon specific element.

Element	Method Spike (% recovery)#		CRM (% recovery)##	
	Value	Stdev	Value	Stdev
Ag	119.0	14.3	120.2	16.0
Al	109.7	6.5	93.4	12.7
As	105.9	5.8	101.8	6.7
B	110.8	12.4	103.6	13.9
Ba	105.3	6.0	95.8	5.6
Ca	105.7	6.4	95.3	8.1
Cd	98.4	3.9	106.6	13.4
Ce	104.3	3.2	90.0	18.0
Co	103.6	5.5	96.7	6.5
Cr	103.8	5.6	90.7	8.6
Cs	103.9	3.1	99.3	8.9
Cu	102.9	8.9	93.8	8.1
Dy	104.8	2.4	74.5	14.6
Eu	105.3	2.4	142.5	30.6
Fe	105.4	4.4	94.4	6.6
Gd	103.4	3.9		
K	118.3	11.1	106.2	10.5
La	104.0	3.0	83.9	17.7
Li	111.2	10.8	106.4	11.8
Lu	104.8	2.9		
Mg	105.4	5.2	90.3	9.4
Mn	103.6	4.7	98.7	6.3
Mo	104.8	4.6	99.2	8.1
Na	112.7	9.8	105.8	10.0
Nb	105.0	3.4	115.8	3.8
Nd	105.0	2.6	86.9	18.3
Ni	103.4	9.5	96.0	9.0
P	97.1	5.4	89.4	5.9
Pb	104.8	2.7	99.7	7.8
Pd	123.9	16.3	90.6	10.6
Pr	104.5	2.7		
Pt	95.1	6.2	86.5	7.1
Rb	101.4	5.4	82.9	15.3
Rh	105.5	4.3	95.0	7.8
S	101.4	6.6	95.6	12.3
Sb	101.4	3.3	91.8	11.1
Sc	105.5	5.5	91.9	13.2
Sm	104.7	2.1	88.4	13.3
Sn	103.3	9.6	93.9	16.8
Sr	103.4	3.7	93.7	12.7
Th	110.5	4.0	92.5	13.0
Ti	107.6	10.6	98.1	8.5
Tl	106.0	2.8	95.6	8.5
Tm	105.2	2.9		
U	105.7	4.1	93.9	9.6
V	104.6	5.3	101.0	6.9
W	105.2	2.4	105.5	10.3
Y	104.4	4.6	83.0	5.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE SI-3

Element	PM10			PM2.5		
	Bi-Weekly Composite	Maximum Event	Minimum Event	Bi-Weekly Composite	Maximum Event	Minimum Event
Ag	2.55	1.69	15.3	8.89	7.24	33.7
Al	0.68	0.24	2.88	3.09	1.02	7.29
As	0.41	0.22	1.27	0.62	0.48	1.41
B	6.07	3.64	11.9	5.54	4.51	7.87
Ba	1.34	0.53	6.73	7.57	3.02	19.3
Ca	1.09	0.38	5.86	6.52	1.90	15.0
Cd	2.10	1.70	5.80	3.24	1.97	7.16
Ce	0.40	0.15	1.83	2.10	0.63	5.56
Co	0.60	0.24	2.85	2.73	1.17	10.5
Cr	33.6	21.8	636	84.5	73.3	439
Cs	0.26	0.10	1.03	0.87	0.48	2.96
Cu	19.2	12.2	119	11.2	32.3	197
Dy	0.06	0.02	0.32	0.34	0.14	1.10
Eu	0.78	0.29	3.78	4.00	1.47	10.4
Fe	0.70	0.27	3.30	3.71	1.36	10.5
Gd	0.05	0.02	0.22	0.33	0.12	1.00
Ho	0.20	0.07	0.97	1.07	0.46	2.50
K	0.94	0.43	4.01	2.69	1.52	12.8
La	0.42	0.15	1.85	2.10	0.63	5.68
Li	0.02	0.01	0.10	0.09	0.03	0.26
Lu	1.00	0.33	3.29	5.24	2.21	13.5
Mg	1.08	0.40	5.06	5.78	1.73	14.1
Mn	0.88	0.33	3.97	4.33	1.60	12.3
Mo	15.4	7.48	52.2	28.2	24.6	51.8
Na	4.68	1.98	28.3	18.3	11.7	52.4
Nb	0.33	0.14	1.94	1.47	0.62	5.19
Nd	0.24	0.09	1.12	1.34	0.51	4.30
Ni	9.03	5.00	46.2	5.36	7.74	10.8
P	3.60	1.78	9.96	13.51	8.05	23.4
Pb	0.78	0.75	2.71	1.54	1.28	4.71
Pd	0.92	0.35	4.29	9.49	3.78	22.3
Pr	0.30	0.11	1.37	1.65	0.60	4.32
Pt	3.52	3.61	21.3	185	157	1507
Rb	0.60	0.22	2.84	2.13	1.06	7.47
Rh	14.5	7.17	72.5	59.4	49.1	nd
S	0.25	0.20	0.82	0.43	0.27	0.70
Sb	2.29	2.00	9.19	4.11	2.44	13.4
Sc	0.72	0.25	3.42	3.05	1.19	6.48
Sm	0.06	0.02	0.25	0.31	0.13	0.82
Sn	22.9	17.6	240	67.5	75.5	nd
Sr	0.41	0.15	2.00	2.44	0.71	7.01
Th	0.35	0.12	1.69	1.31	0.67	3.70
Ti	1.35	0.53	7.16	6.09	2.47	20.0
Tl	0.27	0.15	1.00	0.56	0.35	1.52
U	0.44	0.18	1.73	2.38	0.92	7.01
V	0.37	0.14	0.84	0.89	0.40	1.92
W	1.01	0.94	10.8	11.8	4.93	19.0
Y	0.30	0.10	1.22	1.11	0.53	3.86
Yb	0.08	0.03	0.33	0.45	0.19	1.37
Zn	14.4	13.6	74.8	23.5	23.2	131

TABLE SI-4

Element	PM10			PM2.5		
	Bi-Weekly Composite	Maximum Event	Minimum Event	Bi-Weekly Composite	Maximum Event	Minimum Event
Ag	34.5	35.0	73.8	69.9	58.7	40.3
Al	9.1	9.2	11.8	9.1	9.4	12.1
As	20.3	20.6	27.2	16.0	15.4	18.6
B	9.6	9.5	12.3	9.7	10.0	11.0
Ba	7.7	7.8	11.8	9.9	9.5	17.3
Ca	8.6	8.6	14.3	11.0	10.0	20.2
Cd	8.3	7.9	15.3	10.7	7.0	10.5
Ce	6.0	5.9	7.8	6.0	6.1	9.2
Co	7.4	6.2	18.3	11.4	8.9	38.3
Cr	10.7	16.8	76.4	13.0	47.0	83.2
Cs	5.3	5.1	7.9	6.6	6.1	10.6
Cu	15.8	33.9	83.0	9.1	82.1	117
Dy	9.7	7.0	23.4	12.9	10.1	23.0
Eu	8.9	8.1	18.5	15.7	9.9	28.6
Fe	6.7	6.6	10.2	7.1	7.1	11.5
Gd	8.4	7.1	17.1	15.0	10.1	27.3
Ho	9.7	8.4	21.1	15.1	11.2	38.3
K	16.9	17.2	19.5	12.7	13.6	16.4
La	6.1	6.2	8.0	6.6	6.4	8.7
Li	10.3	9.9	38.6	17.3	14.2	81.0
Lu	13.3	8.6	31.5	24.4	17.6	67.2
Mg	7.6	7.4	12.3	8.6	8.9	19.7
Mn	6.0	6.2	8.0	6.6	6.4	7.6
Mo	13.5	14.5	53.3	15.8	21.7	42.6
Na	9.1	9.3	36.5	22.7	23.3	99.0
Nb	13.6	13.4	19.8	15.0	14.0	24.7
Nd	6.4	6.0	9.4	8.5	7.7	14.8
Ni	13.6	18.0	93.6	36.6	46.9	63.4
P	6.7	6.7	11.3	8.8	7.8	12.8
Pb	7.8	8.0	12.0	8.2	8.6	12.5
Pd	11.8	11.0	45.9	34.1	24.6	114.8
Pr	6.3	6.2	9.7	8.2	6.7	11.8
Pt	50.4	117	54.4	151	717	75.3
Rb	6.6	6.6	9.4	7.2	7.0	13.7
Rh	38.6	29.7	106	78.0	118	nd
S	9.3	9.3	10.0	9.2	9.1	9.7
Sb	6.7	6.3	11.3	6.8	6.4	13.3
Sc	11.3	9.5	21.9	17.9	14.5	37.9
Sm	9.0	7.1	16.8	13.8	10.1	27.9
Sn	30.5	57.7	349	43.0	189	nd
Sr	9.1	9.2	11.6	9.7	9.5	11.4
Th	17.6	17.6	20.0	20.1	19.0	24.9
Ti	7.8	7.9	12.7	9.5	8.6	20.7
Tl	5.2	3.4	13.4	9.1	5.3	16.0
Tm	12.0	10.0	40.6	26.9	22.4	103
U	7.2	7.0	10.1	9.0	7.7	11.9
V	6.6	6.2	8.5	6.8	6.4	7.5
W	7.7	15.9	229	55.9	80.4	314
Y	6.1	5.7	13.2	6.8	7.6	26.0
Yb	11.9	7.5	21.9	24.0	13.5	42.4
Zn	31.6	15.3	53.6	13.4	20.1	43.0

TABLE SI-5

SITE: LIDAR

PARTICLE SIZE: PM10

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Ag	Al	As	B	Ba	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Eu	Fe	Gd	Ho
Biweekly	7b_08-C	7/14-30/08	0.013	68	0.17	0.89	0.91	64	0.025	0.08	0.03	0.33	0.011	0.16	0.004	0.002	59	0.009	0.001
Biweekly	8a_08-C	8/01-15/08	0.038	603	0.76	2.99	8.02	800	0.071	0.76	0.32	1.47	0.128	1.34	0.037	0.016	639	0.084	0.008
Biweekly	8b_08-C	8/17-31/08	0.011	198	0.60	2.05	2.43	204	0.110	0.24	0.08	0.66	0.038	0.73	0.013	0.005	163	0.023	0.003
Biweekly	9a_08-C	9/02-14/08	0.020	171	0.59	2.30	5.46	299	0.088	0.34	0.22	1.39	0.045	1.00	0.014	0.007	286	0.026	0.003
Biweekly	9b_08-C	9/16-30/08	0.041	291	0.77	2.21	7.13	377	0.129	0.49	0.28	1.53	0.064	1.42	0.022	0.010	404	0.040	0.004
Biweekly	10a_08-C	10/02-14/08	0.012	116	0.26	1.16	2.06	143	0.032	0.16	0.09	0.62	0.021	0.45	0.008	0.003	138	0.014	0.002
Biweekly	10b_08-C	10/16-30/08	0.004	73	0.11	0.60	1.24	90	0.018	0.10	0.04	0.46	0.013	0.18	0.005	0.002	80	0.009	0.001
Biweekly	11a_08-C	11/01-15/08	0.002	27	0.08	0.92	0.41	31	0.027	0.03	0.05	0.40	0.008	0.15	0.002	0.001	34	0.003	0.000
Biweekly	11b_08-C	11/17-29/08	0.009	106	0.31	1.48	2.07	114	0.058	0.16	0.09	0.73	0.031	0.73	0.008	0.003	131	0.013	0.002
Biweekly	12a_08-C	12/01-15/08	0.025	100	0.33	1.44	2.52	107	0.043	0.16	0.09	0.68	0.031	0.61	0.009	0.004	141	0.015	0.002
Biweekly	12b_08-C	12/17-31/08	0.007	85	0.36	1.47	1.88	116	0.056	0.12	0.09	0.41	0.031	0.52	0.008	0.003	110	0.012	0.001
Biweekly	1a_09-C	1/02-14/09	0.004	62	0.16	1.27	1.05	66	0.042	0.08	0.04	0.21	0.020	0.60	0.005	0.002	59	0.007	0.001
Biweekly	1b_09-C	1/16-30/09	0.016	150	0.41	2.73	3.00	162	0.063	0.23	0.11	1.61	0.040	1.04	0.014	0.005	180	0.021	0.003
Biweekly	2a_09-C	2/01-15/09	0.009	131	0.21	1.71	1.94	119	0.033	0.17	0.08	0.43	0.026	0.53	0.010	0.004	126	0.017	0.002
Biweekly	2b_09-C	2/17-27/09	0.011	137	0.19	1.63	2.28	257	0.046	0.20	0.09	0.63	0.024	0.57	0.011	0.004	146	0.019	0.002
Biweekly	3a_09-C	3/01-15/09	0.009	208	0.33	1.82	3.55	258	0.044	0.30	0.14	0.74	0.039	0.64	0.017	0.006	219	0.028	0.003
Biweekly	3b_09-C	3/17-31/09	0.012	168	0.43	2.25	4.64	307	0.036	0.30	0.23	0.75	0.031	2.40	0.013	0.006	210	0.024	0.003
Biweekly	3/4a_09-C	4/02-14/09	0.017	453	0.60	3.38	6.88	637	0.059	0.67	0.29	1.35	0.105	1.18	0.031	0.012	456	0.056	0.006
Biweekly	4b_09-C	4/16-30/09	0.008	243	0.28	1.60	3.48	364	0.013	0.33	0.17	0.71	0.040	0.48	0.017	0.007	230	0.030	0.003
Biweekly	5a_09-C	5/02-14/09	0.013	473	0.33	1.86	6.29	505	0.036	0.61	0.24	1.25	0.091	0.85	0.034	0.012	418	0.057	0.007
Biweekly	5b_09-C	5/16-30/09	0.007	101	0.17	1.03	1.74	109	0.019	0.13	0.07	0.30	0.019	0.36	0.007	0.002	113	0.011	0.001
Biweekly	6a_09-C	6/01-15/09	0.016	432	0.42	2.15	6.46	651	0.025	0.54	0.21	0.92	0.092	26.73	0.029	0.011	435	0.046	0.006
Biweekly	6b_09-C	6/17-29/09	0.013	211	0.40	1.75	3.21	222	0.075	0.27	0.10	0.54	0.040	0.52	0.015	0.005	187	0.024	0.003
Biweekly	7a_09-C	7/01-09/09	0.007	150	0.23	1.68	2.53	186	0.032	0.21	0.08	3.13	0.033	0.50	0.010	0.004	170	0.017	0.002
Max Event	LE1-C-8_08	8/07+8/09 2008	0.120	2181	2.39	7.43	27.06	3158	0.121	2.68	1.18	4.30	0.482	3.17	0.129	0.054	2179	0.278	0.025
Max Event	LE2-C-8_08	8/25+8/29 2008	0.017	301	0.92	2.97	3.93	337	0.193	0.38	0.14	0.69	0.064	0.68	0.022	0.008	249	0.035	0.004
Max Event	LE3-C-9_08	9/16+9/18 2008	0.031	542	1.13	2.88	8.66	735	0.232	0.74	0.37	1.84	0.096	1.29	0.039	0.016	600	0.066	0.008
Max Event	LE4-C-10/11_08	10/30+11/01 2008	0.002	63	0.14	1.61	0.84	71	0.020	0.08	0.05	0.27	0.016	0.10	0.004	0.002	80	0.006	0.001
Max Event	LE5-C-12_08	12/09+12/11 2008	0.004	89	0.18	1.19	1.35	68	0.041	0.12	0.06	0.13	0.021	0.16	0.007	0.003	89	0.011	0.001
Max Event	LE6-C-2_09	2/03+2/07 2009	0.004	67	0.18	1.97	1.15	74	0.027	0.09	0.04	0.13	0.016	0.44	0.005	0.002	61	0.008	0.001
Max Event	LE7-C-3_09	3/13+3/15 2009	0.018	491	0.66	2.76	7.91	707	0.074	0.73	0.30	1.41	0.089	1.16	0.041	0.015	532	0.064	0.008
Max Event	LE8-C-4_09	4/04+4/06 2009	0.023	941	0.82	4.15	11.50	1265	0.085	1.33	0.44	2.07	0.208	1.95	0.064	0.024	870	0.108	0.012
Max Event	LE9-C-4/5_09	4/30+5/02 2009	0.021	845	0.57	3.16	11.22	970	0.060	1.12	0.40	1.77	0.185	1.22	0.060	0.022	811	0.095	0.012
Max Event	LE10-C-6_09	6/05+6/07 2009	0.030	1258	1.08	4.07	18.23	1923	0.039	1.59	0.61	2.40	0.269	104.71	0.083	0.032	1266	0.134	0.016
Max Event	LE11-C-6_09	6/09+6/11 2009	0.012	337	0.33	2.40	4.89	414	0.025	0.42	0.16	0.72	0.073	0.75	0.023	0.008	332	0.035	0.004
Max Event	LE12-C-6_09	6/21+6/23 2009	0.014	381	0.32	2.00	4.37	391	0.045	0.46	0.14	0.55	0.063	0.44	0.027	0.009	265	0.043	0.005
Min Event	LM1-C-7_08	7/20+7/22 2008	0.004	32	0.23	0.83	0.38	26	0.037	0.04	0.01	0.77	0.006	0.00	0.002	0.001	28	0.003	0.000
Min Event	LM2-C-8_08	8/19/2008	0.001	40	0.45	0.74	0.69	42	0.057	0.06	0.02	-0.31	0.009	3.79	0.003	0.001	45	0.008	0.001
Min Event	LM3-C-9_08	9/06+9/08 2008	0.007	28	0.16	1.14	0.36	31	0.011	0.03	0.01	0.05	0.005	0.02	0.002	0.001	22	0.004	0.000
Min Event	LM4-C-10_08	10/14+10/16 2008	0.001	8	0.06	0.42	0.06	8	0.003	0.01	0.00	-0.04	0.002	-0.09	0.001	0.000	6	0.001	0.000
Min Event	LM5-C-11_08	11/11+11/13 2008	0.002	8	0.04	0.64	0.10	6	0.026	0.01	0.00	0.14	0.001	-0.02	0.001	0.000	5	0.001	0.000
Min Event	LM6-C-1-09	1/06+1/08 2009	0.000	20	0.05	0.82	0.28	21	0.010	0.03	0.01	-0.10	0.005	-0.02	0.002	0.001	19	0.003	0.000
Min Event	LM7-C-2_09	2/01+2/05 2009	0.001	28	0.16	0.90	0.40	21	0.011	0.03	0.02	-0.03	0.009	0.11	0.002	0.001	32	0.003	0.000
Min Event	LM8-C-3_09	3/01+3/05 2009	0.002	44	0.11	1.17	0.60	54	0.018	0.06	0.03	0.06	0.007	0.10	0.003	0.001	39	0.005	0.001
Min Event	LM9-C-4_09	4/06+4/10 2009	0.001	80	0.10	1.18	0.87	83	0.008	0.09	0.03	0.02	0.013	0.10	0.006	0.002	60	0.009	0.001
Min Event	LM10-C-5_09	5/08+5/10 2009	0.006	95	0.10	0.79	1.22	78	0.017	0.11	0.04	0.40	0.016	0.33	0.007	0.002	85	0.011	0.001
Min Event	LM11-C-6_09	6/13+6/15 2009	0.016	64	0.09	1.14	0.99	58	0.013	0.08	0.02	0.00	0.012	0.40	0.005	0.002	52	0.008	0.001
Min Event	LM12-C-7_09	7/01+7/03 2009	0.002	159	0.15	1.21	1.58	162	0.018	0.17	0.06	0.13	0.029	0.24	0.011	0.003	119	0.015	0.002

TABLE SI-5

SITE: LIDAR

PARTICLE SIZE: PM10

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	K	La	LI	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb	Pd	Pr	Pt	Rb
Biweekly	7b_08-C	7/14-30/08	59	0.033	0.057	0.000	21	1.57	0.015	22	0.026	0.030	0.08	6.3	1.00	0.006	0.008	0.003	0.16
Biweekly	8a_08-C	8/01-15/08	582	0.356	0.783	0.003	225	16.58	0.081	270	0.217	0.297	0.98	17.7	3.43	0.045	0.081	0.002	1.84
Biweekly	8b_08-C	8/17-31/08	171	0.106	0.197	0.001	63	4.33	0.349	54	0.062	0.094	0.37	7.9	3.59	0.015	0.024	0.010	0.51
Biweekly	9a_08-C	9/02-14/08	345	0.150	0.362	0.001	66	9.59	0.082	93	0.154	0.119	0.80	15.0	6.08	0.015	0.033	0.007	0.81
Biweekly	9b_08-C	9/16-30/08	459	0.209	0.369	0.002	96	12.53	0.099	95	0.200	0.183	0.99	22.7	5.76	0.022	0.050	0.042	0.99
Biweekly	10a_08-C	10/02-14/08	146	0.073	0.140	0.001	39	4.14	0.033	37	0.065	0.064	0.30	6.8	2.21	0.009	0.017	0.020	0.34
Biweekly	10b_08-C	10/16-30/08	87	0.043	0.071	0.000	23	2.06	0.018	32	0.031	0.038	0.17	3.3	0.80	0.004	0.010	0.005	0.19
Biweekly	11a_08-C	11/01-15/08	51	0.015	0.033	0.000	10	0.88	0.011	15	0.012	0.013	0.12	1.9	0.59	0.002	0.003	-0.002	0.10
Biweekly	11b_08-C	11/17-29/08	174	0.068	0.144	0.001	33	3.29	0.032	53	0.052	0.062	0.38	5.4	2.28	0.008	0.017	-0.001	0.33
Biweekly	12a_08-C	12/01-15/08	173	0.068	0.157	0.001	29	3.64	0.030	49	0.069	0.067	0.28	6.3	2.16	0.009	0.017	0.029	0.36
Biweekly	12b_08-C	12/17-31/08	169	0.053	0.136	0.001	28	2.65	0.028	49	0.043	0.053	0.25	5.2	2.49	0.007	0.014	0.005	0.28
Biweekly	1a_09-C	1/02-14/09	116	0.035	0.081	0.001	18	1.41	0.028	32	0.021	0.032	0.21	3.2	1.50	0.005	0.008	0.004	0.21
Biweekly	1b_09-C	1/16-30/09	219	0.094	0.195	0.001	40	3.87	0.061	64	0.073	0.094	0.45	8.4	3.06	0.013	0.024	-0.005	0.38
Biweekly	2a_09-C	2/01-15/09	130	0.073	0.166	0.001	30	2.69	0.022	32	0.054	0.074	0.24	5.0	1.53	0.010	0.019	-0.005	0.27
Biweekly	2b_09-C	2/17-27/09	160	0.095	0.163	0.001	52	3.73	0.030	48	0.074	0.087	0.39	7.5	2.34	0.012	0.022	-0.005	0.34
Biweekly	3a_09-C	3/01-15/09	216	0.134	0.235	0.001	65	5.79	0.044	62	0.094	0.119	0.42	9.2	2.23	0.017	0.032	0.000	0.54
Biweekly	3b_09-C	3/17-31/09	306	0.126	0.214	0.001	63	8.37	0.044	68	0.149	0.112	0.71	10.0	2.14	0.014	0.030	0.030	0.51
Biweekly	3/4a_09-C	4/02-14/09	485	0.309	0.631	0.002	169	13.33	0.071	274	0.208	0.260	0.84	16.3	3.10	0.031	0.069	0.016	1.60
Biweekly	4b_09-C	4/16-30/09	263	0.155	0.303	0.001	109	6.78	0.028	93	0.126	0.137	0.59	8.2	0.83	0.018	0.036	0.004	0.66
Biweekly	5a_09-C	5/02-14/09	374	0.267	0.543	0.003	148	10.23	0.064	146	0.166	0.248	0.57	12.2	1.84	0.032	0.065	0.003	1.19
Biweekly	5b_09-C	5/16-30/09	120	0.055	0.115	0.001	34	3.15	0.020	43	0.054	0.050	0.22	6.2	1.13	0.008	0.013	-0.003	0.30
Biweekly	6a_09-C	6/01-15/09	350	0.234	0.587	0.002	156	10.57	0.040	178	0.156	0.212	0.57	12.5	1.50	0.032	0.056	0.001	1.26
Biweekly	6b_09-C	6/17-29/09	193	0.124	0.207	0.001	67	5.05	0.033	64	0.080	0.109	0.40	10.3	2.61	0.015	0.030	0.028	0.51
Biweekly	7a_09-C	7/01-09/09	201	0.094	0.168	0.001	54	4.29	0.276	56	0.061	0.083	0.74	8.0	1.86	0.010	0.023	0.019	0.45
Max Event	LE1-C-8_08	8/07+8/09 2008	1994	1.224	2.955	0.011	822	57.79	0.287	1148	0.794	1.025	2.96	41.6	8.26	0.143	0.276	0.007	6.93
Max Event	LE2-C-8_08	8/25+8/29 2008	279	0.179	0.337	0.002	102	7.23	0.070	78	0.104	0.158	0.40	11.6	5.82	0.024	0.042	0.031	0.84
Max Event	LE3-C-9_08	9/16+9/18 2008	526	0.334	0.593	0.003	197	16.55	0.112	138	0.252	0.289	1.45	26.7	7.78	0.040	0.078	0.013	1.47
Max Event	LE4-C-10/11_08	10/30+11/01 2008	86	0.036	0.078	0.000	21	2.18	0.014	29	0.027	0.031	0.34	3.3	0.81	0.003	0.008	0.012	0.21
Max Event	LE5-C-12_08	12/09+12/11 2008	152	0.053	0.100	0.001	22	2.26	0.015	33	0.041	0.047	0.15	4.2	1.32	0.007	0.012	-0.002	0.28
Max Event	LE6-C-2_09	2/03+2/07 2009	89	0.042	0.073	0.000	21	1.61	0.015	24	0.021	0.036	0.12	2.7	1.03	0.005	0.009	0.000	0.21
Max Event	LE7-C-3_09	3/13+3/15 2009	481	0.323	0.590	0.003	157	14.18	0.085	134	0.216	0.288	0.99	19.0	3.89	0.039	0.077	0.000	1.31
Max Event	LE8-C-4_09	4/04+4/06 2009	743	0.615	1.216	0.005	346	21.50	0.096	492	0.339	0.510	1.24	23.6	3.97	0.061	0.134	0.009	2.79
Max Event	LE9-C-4/5_09	4/30+5/02 2009	737	0.465	1.120	0.005	266	18.74	0.066	276	0.311	0.436	1.02	20.0	2.09	0.052	0.116	-0.001	2.44
Max Event	LE10-C-6_09	6/05+6/07 2009	925	0.674	1.758	0.006	443	29.96	0.100	507	0.442	0.619	1.53	25.2	2.48	0.095	0.164	0.008	3.68
Max Event	LE11-C-6_09	6/09+6/11 2009	318	0.185	0.457	0.002	129	8.13	0.029	125	0.120	0.162	0.43	13.4	1.64	0.021	0.044	0.002	0.98
Max Event	LE12-C-6_09	6/21+6/23 2009	233	0.228	0.328	0.002	125	6.61	0.028	81	0.103	0.196	0.42	12.4	2.05	0.027	0.053	-0.002	0.82
Min Event	LM1-C-7_08	7/20+7/22 2008	28	0.016	0.023	0.000	10	0.63	0.014	6	0.008	0.012	-0.01	4.8	0.81	0.002	0.003	0.002	0.07
Min Event	LM2-C-8_08	8/19/2008	46	0.026	0.045	0.000	13	1.14	0.073	31	0.013	0.026	-0.01	2.7	3.92	0.003	0.007	0.001	0.12
Min Event	LM3-C-9_08	9/06+9/08 2008	25	0.017	0.021	0.000	9	0.64	0.012	8	0.009	0.015	0.06	3.1	0.63	0.002	0.004	0.019	0.07
Min Event	LM4-C-10_08	10/14+10/16 2008	7	0.004	0.004	0.000	3	0.14	0.006	3	0.007	0.003	-0.01	0.5	0.24	0.001	0.001	0.037	0.02
Min Event	LM5-C-11_08	11/11+11/13 2008	9	0.003	0.004	0.000	2	0.11	0.001	2	0.002	0.003	0.06	0.6	0.11	0.000	0.001	-0.003	0.02
Min Event	LM6-C-1-09	1/06+1/08 2009	31	0.013	0.018	0.000	7	0.34	0.006	9	0.005	0.010	0.32	1.0	0.54	0.002	0.003	-0.001	0.06
Min Event	LM7-C-2_09	2/01+2/05 2009	40	0.016	0.034	0.000	7	0.94	0.007	8	0.011	0.014	0.06	1.8	0.72	0.001	0.004	-0.001	0.08
Min Event	LM8-C-3_09	3/01+3/05 2009	46	0.027	0.038	0.000	15	0.93	0.023	9	0.017	0.024	0.10	2.1	0.76	0.003	0.006	0.004	0.10
Min Event	LM9-C-4_09	4/06+4/10 2009	63	0.043	0.068	0.000	27	1.50	0.009	27	0.024	0.037	0.10	3.2	0.38	0.005	0.010	0.000	0.17
Min Event	LM10-C-5_09	5/08+5/10 2009	66	0.051	0.092	0.001	28	1.93	0.010	25	0.035	0.047	0.10	3.2	0.64	0.007	0.012	0.019	0.21
Min Event	LM11-C-6_09	6/13+6/15 2009	51	0.038	0.058	0.000	18	1.35	0.007	19	0.017	0.033	0.09	4.0	0.70	0.004	0.009	-0.002	0.15
Min Event	LM12-C-7_09	7/01+7/03 2009	114	0.080	0.154	0.001	57	2.92	0.018	37	0.044	0.069	0.16	4.7	0.52	0.010	0.018	-0.003	0.35

TABLE SI-5

SITE: LIDAR

PARTICLE SIZE: PM10

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Rh	S	Sb	Sc	Sm	Sn	Sr	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Cl	SO_4	NO_3	NH_4
Biweekly	7b_08-C	7/14-30/08	0.000	70	0.161	0.012	0.006	0.24	0.49	0.018	6.48	0.005	0.000	0.006	0.61	0.009	0.02	0.003	0.88	6.9	270	80	14
Biweekly	8a_08-C	8/01-15/08	0.001	299	0.157	0.116	0.055	0.25	7.03	0.124	64.44	0.031	0.003	0.075	2.57	0.050	0.18	0.025	10.43	141.0	614	232	14
Biweekly	8b_08-C	8/17-31/08	0.000	244	0.162	0.038	0.017	0.12	1.33	0.048	17.52	0.018	0.001	0.019	1.13	0.069	0.07	0.008	10.98	8.2	743	161	19
Biweekly	9a_08-C	9/02-14/08	0.000	425	0.228	0.033	0.020	0.17	3.23	0.040	40.40	0.028	0.001	0.051	1.67	0.053	0.06	0.007	4.76	26.4	903	256	378
Biweekly	9b_08-C	9/16-30/08	0.000	419	0.240	0.059	0.031	0.20	3.39	0.066	53.54	0.033	0.002	0.061	2.07	0.049	0.09	0.012	5.46	32.9	512	236	69
Biweekly	10a_08-C	10/02-14/08	0.000	200	0.655	0.024	0.010	0.04	1.13	0.024	17.09	0.012	0.001	0.017	0.80	0.013	0.04	0.005	2.62	4.6	332	126	15
Biweekly	10b_08-C	10/16-30/08	0.000	127	0.084	0.015	0.006	0.05	0.66	0.013	8.77	0.007	0.000	0.009	0.36	0.008	0.02	0.003	8.54	5.5	152	32	16
Biweekly	11a_08-C	11/01-15/08	0.000	97	0.083	0.005	0.003	0.07	0.26	0.005	3.48	0.006	0.000	0.004	0.27	0.125	0.01	0.001	1.07	24.4	209	119	18
Biweekly	11b_08-C	11/17-29/08	0.000	309	0.245	0.023	0.012	0.11	1.18	0.034	15.08	0.026	0.001	0.021	0.64	0.045	0.03	0.004	12.03	8.7	450	158	485
Biweekly	12a_08-C	12/01-15/08	0.000	317	0.210	0.021	0.012	0.19	1.14	0.025	17.05	0.017	0.001	0.024	0.75	0.018	0.04	0.004	4.00	11.6	650	273	621
Biweekly	12b_08-C	12/17-31/08	0.000	392	0.269	0.018	0.011	0.14	1.09	0.016	12.63	0.021	0.001	0.016	0.63	0.099	0.03	0.004	4.86	39.7	739	331	684
Biweekly	1a_09-C	1/02-14/09	0.000	236	0.149	0.012	0.006	0.09	0.68	0.012	6.19	0.011	0.001	0.010	0.37	0.065	0.02	0.003	2.80	40.5	312	158	708
Biweekly	1b_09-C	1/16-30/09	0.000	455	0.505	0.032	0.017	0.20	1.93	0.030	19.61	0.022	0.001	0.030	0.83	0.016	0.06	0.007	5.62	9.4	325	181	387
Biweekly	2a_09-C	2/01-15/09	0.000	264	0.193	0.024	0.014	0.09	1.28	0.024	15.19	0.012	0.001	0.018	0.63	0.033	0.04	0.006	3.51	90.4	680	372	475
Biweekly	2b_09-C	2/17-27/09	0.000	335	0.157	0.029	0.016	0.05	1.81	0.024	18.83	0.013	0.001	0.018	0.77	0.039	0.05	0.006	2.94	25.1	453	197	468
Biweekly	3a_09-C	3/01-15/09	0.000	246	0.250	0.043	0.022	0.08	2.51	0.043	25.62	0.015	0.001	0.031	1.03	0.049	0.08	0.009	3.15	63.7	806	584	535
Biweekly	3b_09-C	3/17-31/09	0.001	269	0.182	0.037	0.019	0.08	3.62	0.035	33.70	0.019	0.001	0.048	1.63	0.056	0.05	0.007	3.72	73.2	573	319	307
Biweekly	3/4a_09-C	4/02-14/09	0.001	386	0.247	0.080	0.043	0.21	5.90	0.101	56.14	0.026	0.002	0.078	2.21	0.058	0.13	0.016	4.93	230.4	992	561	463
Biweekly	4b_09-C	4/16-30/09	0.000	155	0.139	0.050	0.024	0.08	2.99	0.047	33.80	0.010	0.001	0.039	1.34	0.020	0.08	0.009	2.20	67.5	330	126	11
Biweekly	5a_09-C	5/02-14/09	0.000	214	0.180	0.082	0.045	0.13	3.99	0.110	45.80	0.018	0.003	0.056	1.62	0.224	0.14	0.017	3.59	59.4	384	224	41
Biweekly	5b_09-C	5/16-30/09	0.000	110	0.084	0.019	0.009	0.06	1.09	0.021	15.06	0.008	0.001	0.018	0.67	0.012	0.03	0.004	1.51	55.0	232	130	11
Biweekly	6a_09-C	6/01-15/09	0.003	214	0.111	0.074	0.038	0.10	5.88	0.095	45.13	0.019	0.002	0.064	1.49	0.049	0.12	0.016	2.45	120.8	429	162	62
Biweekly	6b_09-C	6/17-29/09	0.000	219	0.154	0.042	0.020	0.11	1.48	0.053	21.89	0.017	0.001	0.025	0.76	0.031	0.07	0.008	2.83	8.3	184	67	387
Biweekly	7a_09-C	7/01-09/09	0.000	190	0.102	0.029	0.016	0.18	1.79	0.033	17.52	0.012	0.001	0.022	0.69	0.020	0.05	0.006	3.60	15.2	157	105	400
Max Event	LE1-C-8_08	8/07+8/09 2008	0.003	878	0.363	0.410	0.188	0.81	30.11	0.446	229.30	0.082	0.010	0.298	8.09	0.175	0.57	0.084	14.64	880	2631	705	22
Max Event	LE2-C-8_08	8/25+8/29 2008	0.000	375	0.169	0.061	0.028	0.08	2.14	0.077	28.61	0.031	0.002	0.033	1.80	0.037	0.10	0.012	4.08	38	1057	239	22
Max Event	LE3-C-9_08	9/16+9/18 2008	0.001	646	0.302	0.110	0.053	0.13	5.31	0.122	70.73	0.046	0.003	0.070	2.86	0.055	0.18	0.021	6.67	71	876	439	305
Max Event	LE4-C-10/11_08	10/30+11/01 2008	0.000	144	0.092	0.011	0.006	0.25	0.55	0.013	8.17	0.014	0.000	0.010	0.72	0.006	0.02	0.002	1.24	81	366	275	14
Max Event	LE5-C-12_08	12/09+12/11 2008	0.000	272	0.175	0.018	0.009	0.05	0.69	0.021	10.99	0.011	0.001	0.015	0.58	0.015	0.03	0.004	1.90	28	819	427	478
Max Event	LE6-C-2_09	2/03+2/07 2009	0.000	193	0.178	0.014	0.006	0.09	0.76	0.014	6.29	0.009	0.000	0.011	0.50	0.036	0.02	0.003	2.06	55	762	411	279
Max Event	LE7-C-3_09	3/13+3/15 2009	0.001	331	0.395	0.100	0.052	0.13	6.03	0.106	58.94	0.028	0.003	0.066	2.25	0.046	0.18	0.022	4.87	121	751	682	311
Max Event	LE8-C-4_09	4/04+4/06 2009	0.002	552	0.321	0.157	0.084	0.20	10.09	0.203	92.77	0.038	0.005	0.127	3.13	0.118	0.26	0.033	5.67	319	1326	684	152
Max Event	LE9-C-4/5_09	4/30+5/02 2009	0.001	276	0.329	0.128	0.079	0.13	6.90	0.183	86.92	0.031	0.005	0.104	3.07	0.074	0.24	0.032	3.55	159	750	444	87
Max Event	LE10-C-6_09	6/05+6/07 2009	0.011	441	0.214	0.210	0.111	0.19	14.92	0.259	127.52	0.051	0.007	0.178	3.83	0.113	0.33	0.045	4.52	371	1003	312	87
Max Event	LE11-C-6_09	6/09+6/11 2009	0.000	181	0.144	0.064	0.029	0.16	3.79	0.091	34.25	0.014	0.002	0.049	1.21	0.028	0.10	0.013	2.51	50	225	120	76
Max Event	LE12-C-6_09	6/21+6/23 2009	0.000	180	0.164	0.076	0.037	0.19	2.29	0.096	29.88	0.016	0.002	0.036	1.09	0.061	0.13	0.014	3.32	29	231	102	175
Min Event	LM1-C-7_08	7/20+7/22 2008	0.000	66	0.037	0.007	0.003	-0.01	0.22	0.006	2.30	0.005	0.000	0.002	0.25	0.003	0.01	0.001	0.70	13	208	79	22
Min Event	LM2-C-8_08	8/19/2008	0.001	161	0.077	0.006	0.005	0.10	0.43	0.008	3.77	0.005	0.000	0.006	0.24	0.004	0.01	0.002	3.63	29	678	112	45
Min Event	LM3-C-9_08	9/06+9/08 2008	0.000	62	0.031	0.006	0.003	0.23	0.18	0.006	2.41	0.005	0.000	0.003	0.35	0.010	0.01	0.001	0.76	35	270	56	22
Min Event	LM4-C-10_08	10/14+10/16 2008	0.000	31	0.012	0.004	0.001	-0.01	0.05	0.004	0.54	0.001	0.000	0.001	0.14	0.002	0.00	0.000	-0.06	66	176	91	12
Min Event	LM5-C-11_08	11/11+11/13 2008	0.000	30	0.013	0.001	0.001	-0.01	0.06	0.001	0.44	0.001	0.000	0.001	0.12	0.002	0.00	0.000	0.15	33	126	81	13
Min Event	LM6-C-1-09	1/06+1/08 2009	0.000	101	0.065	0.006	0.002	0.02	0.29	0.005	1.55	0.003	0.000	0.003	0.21	0.002	0.01	0.001	0.31	53	221	125	200
Min Event	LM7-C-2_09	2/01+2/05 2009	0.000	173	0.081	0.005	0.002	0.01	0.20	0.006	3.07	0.004	0.000	0.006	0.38	0.007	0.01	0.001	0.47	28	652	148	472
Min Event	LM8-C-3_09	3/01+3/05 2009	0.000	135	0.066	0.010	0.005	0.00	0.55	0.008	4.65	0.005	0.000	0.006	0.36	0.003	0.02	0.002	0.70	34	513	331	130
Min Event	LM9-C-4_09	4/06+4/10 2009	0.000	62	0.048	0.015	0.007	0.02	0.63	0.017	6.71	0.003	0.000	0.008	0.48	0.005	0.03	0.003	0.35	30	101	94	320
Min Event	LM10-C-5_09	5/08+5/10 2009	0.000	99	0.065	0.019	0.009	0.00	0.63	0.024	9.05	0.006	0.001	0.012	0.46	0.018	0.03	0.003	0.68	23	175	62	11
Min Event	LM11-C-6_09	6/13+6/15 2009	0.000	57	0.038	0.012	0.006	0.02	0.37	0.016	5.66	0.004	0.000	0.007	0.34	0.004	0.02	0.002	0.88	21	173	57	42
Min Event	LM12-C-7_09	7/01+7/03 2009	0.000	82	0.037	0.031	0.014	0.01	1.21	0.038	12.74	0.007	0.001	0.016	0.67	0.011	0.05	0.006	0.70	34	161	69	153

TABLE SI-6

SITE: LIDAR

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Ag	Al	As	B	Ba	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Eu	Fe	Gd	Ho
Biweekly	7b_08-S	7/14-30/08	0.001	23.5	0.39	2.15	0.49	17.9	0.053	0.020	0.008	0.23	0.0048	23.27	0.0014	0.0008	15.9	0.0017	0.0003
Biweekly	8a_08-S	8/01-15/08	0.004	220.3	0.52	2.91	2.34	242.6	0.033	0.252	0.127	0.53	0.0466	1.20	0.0124	0.0047	202.6	0.0165	0.0024
Biweekly	8b_08-S	8/17-31/08	0.002	25.6	0.38	1.76	0.32	24.2	0.052	0.027	0.013	0.18	0.0063	0.55	0.0014	0.0006	24.6	0.0019	0.0003
Biweekly	9a_08-S	9/02-14/08	0.005	72.4	0.35	1.84	1.05	108.5	0.052	0.098	0.045	0.86	0.0220	34.01	0.0055	0.0021	91.3	0.0065	0.0009
Biweekly	9b_08-S	9/16-30/08	0.003	46.1	0.31	1.40	0.57	53.3	0.052	0.059	0.029	0.29	0.0101	0.86	0.0029	0.0012	51.5	0.0039	0.0005
Biweekly	10a_08-S	10/02-14/08	0.000	27.2	0.14	1.01	0.28	28.0	0.014	0.031	0.010	0.28	0.0051	1.10	0.0016	0.0007	23.0	0.0026	0.0003
Biweekly	10b_08-S	10/16-30/08	0.001	9.2	0.05	0.77	0.12	10.3	0.008	0.014	0.004	0.26	0.0025	0.06	0.0006	0.0003	10.3	0.0008	0.0001
Biweekly	11a_08-S	11/01-15/08	-0.002	7.8	0.06	0.96	0.09	6.5	0.013	0.008	0.004	0.19	0.0027	1.44	0.0004	0.0002	7.7	0.0006	0.0001
Biweekly	11b_08-S	11/17-29/08	0.004	15.1	0.14	1.92	0.19	14.9	0.021	0.021	0.010	0.17	0.0074	0.15	0.0011	0.0004	15.6	0.0016	0.0002
Biweekly	12a_08-S	12/01-15/08	0.002	29.4	0.27	1.65	0.34	26.4	0.042	0.037	0.019	0.27	0.0112	0.99	0.0021	0.0009	27.5	0.0030	0.0004
Biweekly	12b_08-S	12/17-31/08	0.009	27.4	0.23	1.36	0.38	21.0	0.064	0.031	0.028	0.55	0.0128	141.32	0.0019	0.0008	22.5	0.0021	0.0004
Biweekly	1a_09-S	1/02-14/09	0.014	6.2	0.08	1.19	0.08	6.1	0.014	0.008	0.006	0.07	0.0038	4.11	0.0005	0.0002	5.4	0.0005	0.0001
Biweekly	1b_09-S	1/16-30/09	0.012	15.3	0.17	1.87	0.16	11.7	0.018	0.020	0.009	0.18	0.0052	1.96	0.0011	0.0004	12.2	0.0015	0.0002
Biweekly	2a_09-S	2/01-15/09	0.004	31.5	0.17	1.78	0.43	26.9	0.032	0.040	0.022	0.22	0.0091	0.25	0.0021	0.0009	37.0	0.0032	0.0004
Biweekly	2b_09-S	2/17-27/09	0.004	76.0	0.23	2.74	0.68	92.5	0.045	0.096	0.033	0.48	0.0123	0.24	0.0050	0.0019	60.2	0.0066	0.0009
Biweekly	3a_09-S	3/01-15/09	0.001	35.1	0.15	1.90	0.40	41.6	0.016	0.048	0.018	0.22	0.0067	0.13	0.0027	0.0010	32.2	0.0035	0.0005
Biweekly	3b_09-S	3/17-31/09	0.003	71.8	0.20	1.72	0.88	83.1	0.019	0.105	0.056	0.31	0.0128	0.24	0.0042	0.0019	76.1	0.0068	0.0008
Biweekly	3/4a_09-S	4/02-14/09	0.003	97.1	0.25	2.52	1.06	122.6	0.025	0.111	0.057	0.49	0.0211	0.94	0.0054	0.0023	91.9	0.0072	0.0011
Biweekly	4b_09-S	4/16-30/09	0.004	124.5	0.31	3.38	1.43	153.3	0.027	0.151	0.073	0.63	0.0248	2.05	0.0070	0.0030	126.2	0.0096	0.0015
Biweekly	5a_09-S	5/02-14/09	0.002	98.4	0.16	2.00	1.05	95.5	0.025	0.114	0.049	0.36	0.0222	1.26	0.0060	0.0024	95.8	0.0082	0.0011
Biweekly	5b_09-S	5/16-30/09	0.004	95.9	0.21	2.66	1.03	93.2	0.028	0.111	0.047	0.39	0.0212	2.21	0.0057	0.0024	94.7	0.0079	0.0011
Biweekly	6a_09-S	6/01-15/09	0.007	200.3	0.22	2.37	1.93	230.6	0.048	2.230	0.076	0.40	0.0350	2.03	0.0106	0.0042	161.3	0.0190	0.0021
Biweekly	6b_09-S	6/17-29/09	0.002	38.8	0.23	1.91	0.46	37.3	0.044	0.042	0.014	0.11	0.0078	0.27	0.0025	0.0008	30.8	0.0031	0.0005
Biweekly	7a_09-S	7/01-09/09	0.000	6.1	0.04	0.52	0.04	5.7	0.001	0.006	0.002	-0.02	0.0011	-0.01	0.0003	0.0001	5.0	0.0004	0.0001
Max Event	LE1-S-8_08	8/07+8/09 2008	0.015	849.8	1.67	7.74	9.39	953.5	0.099	1.005	0.545	1.77	0.1845	1.71	0.0470	0.0186	802.5	0.0648	0.0095
Max Event	LE2-S-8_08	8/25+8/29 2008	0.003	44.4	0.37	1.96	0.54	44.5	0.068	0.050	0.028	0.09	0.0112	0.15	0.0022	0.0009	50.6	0.0032	0.0005
Max Event	LE3-S--9_08	9/16+9/18 2008	0.009	106.7	0.56	2.13	1.18	122.5	0.131	0.132	0.075	0.54	0.0199	0.47	0.0060	0.0027	119.6	0.0089	0.0012
Max Event	LE4-S-10/11_08	10/30+11/01 2008	-0.003	28.2	0.14	1.90	0.31	22.8	0.019	0.030	0.014	0.28	0.0082	0.09	0.0015	0.0006	29.5	0.0021	0.0003
Max Event	LE5-S--12_08	12/09+12/11 2008	0.003	33.9	0.21	2.00	0.40	23.4	0.066	0.045	0.026	0.21	0.0130	0.30	0.0023	0.0009	32.2	0.0033	0.0005
Max Event	LE6-S-2_09	2/03+2/07 2009	0.005	19.0	0.16	2.15	0.37	28.0	0.030	0.031	0.018	0.04	0.0094	0.15	0.0016	0.0006	23.4	0.0024	0.0003
Max Event	LE7-S-3_09	3/13+3/15 2009	0.004	108.0	0.33	2.40	1.10	127.1	0.034	0.145	0.053	0.36	0.0182	0.27	0.0081	0.0030	93.0	0.0108	0.0015
Max Event	LE8-S-4_09	4/04+4/06 2009	0.011	167.0	0.36	3.77	2.00	192.3	0.041	0.194	0.106	0.64	0.0380	0.47	0.0089	0.0038	160.0	0.0122	0.0019
Max Event	LE9-S-4/5_09	4/30+5/02 2009	0.007	232.7	0.23	3.09	2.61	229.2	0.049	0.275	0.128	0.45	0.0555	0.61	0.0142	0.0057	228.8	0.0198	0.0027
Max Event	LE10-S-6_09	6/05+6/07 2009	0.010	652.0	0.48	3.28	5.96	743.6	0.072	2.894	0.241	1.00	0.1156	1.73	0.0348	0.0129	526.7	0.0496	0.0068
Max Event	LE11-S-6_09	6/09+6/11 2009	0.000	95.6	0.15	2.99	1.13	101.0	0.026	0.750	0.042	0.20	0.0166	0.42	0.0048	0.0021	78.4	0.0083	0.0009
Max Event	LE12-S-7_09	6/21+6/23 2009	0.001	43.1	0.16	1.80	0.35	37.0	0.014	0.038	0.016	0.01	0.0081	0.25	0.0023	0.0008	33.6	0.0029	0.0004
Min Event	LM1-S-7_08	7/20+7/22 2008	0.001	35.3	0.92	4.59	0.34	34.8	0.115	0.038	0.012	0.29	0.0103	0.26	0.0027	0.0011	27.4	0.0040	0.0006
Min Event	LM2-S-8_08	8/19/2008	0.001	7.7	0.38	0.86	0.20	7.1	0.035	0.007	0.002	-0.03	0.0019	0.06	0.0005	0.0003	6.3	0.0006	0.0002
Min Event	LM3-S--9_08	9/06+9/08 2008	-0.002	7.6	0.13	0.99	0.12	10.5	0.016	0.010	0.005	0.12	0.0026	0.05	0.0005	0.0002	9.7	0.0007	0.0001
Min Event	LM4-S-10_08	10/14+10/16 2008	-0.003	17.7	0.12	0.87	0.16	16.5	0.010	0.019	0.006	0.20	0.0029	0.10	0.0011	0.0004	14.3	0.0013	0.0002
Min Event	LM5-S--11_08	11/11+11/13 2008	-0.005	1.9	0.03	0.80	0.03	0.7	0.015	0.002	0.001	-0.05	0.0009	-0.03	0.0002	0.0001	1.3	0.0002	0.0000
Min Event	LM6-S-1_09	1/06+1/08 2009	0.048	3.6	0.07	1.21	0.03	4.1	0.006	0.006	0.003	-0.01	0.0017	0.04	0.0004	0.0001	4.0	0.0003	0.0000
Min Event	LM7-S-2_09	2/01+2/05 2009	0.003	16.9	0.15	1.31	0.22	14.1	0.032	0.021	0.011	0.06	0.0071	0.31	0.0011	0.0005	16.3	0.0016	0.0002
Min Event	LM8-S-3_09	3/01+3/05 2009	0.001	7.1	0.07	1.61	0.08	9.0	0.006	0.010	0.004	0.06	0.0018	-0.01	0.0006	0.0002	7.5	0.0009	0.0001
Min Event	LM9-S-4_09	4/06+4/10 2009	-0.001	16.8	0.07	1.52	0.18	69.8	0.008	0.017	0.010	0.13	0.0034	0.25	0.0009	0.0005	16.9	0.0010	0.0002
Min Event	LM10-S-5_09	5/08+5/10 2009	-0.003	24.4	0.07	1.80	0.20	18.7	0.009	0.024	0.007	0.05	0.0051	0.06	0.0014	0.0005	23.5	0.0019	0.0003
Min Event	LM11-S-6_09	6/13+6/15 2009	0.015	12.9	0.08	2.30	0.21	18.0	0.081	5.201	0.008	0.01	0.0029	5.28	0.0005	0.0004	9.1	0.0140	0.0001
Min Event	LM12-S-7_09	7/01+7/03 2009	0.001	15.3	0.11	1.29	0.11	14.3	0.003	0.014	0.005	-0.04	0.0028	-0.02	0.0008	0.0003	12.6	0.0010	0.0002

TABLE SI-6

SITE: LIDAR

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	K	La	LI	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb	Pd	Pr	Pt	Rb
Biweekly	7b_08-S	7/14-30/08	26.1	0.0094	0.027	0.0001	6.0	0.38	0.021	11.4	0.0064	0.0078	1.57	2.63	2.80	0.0042	0.0022	0.0001	0.069
Biweekly	8a_08-S	8/01-15/08	201.6	0.1125	0.333	0.0011	89.5	5.61	0.041	91.1	0.0844	0.0912	0.67	4.90	1.69	0.0068	0.0252	0.0002	0.657
Biweekly	8b_08-S	8/17-31/08	32.4	0.0125	0.039	0.0001	9.1	0.66	0.018	12.6	0.0165	0.0104	0.64	1.52	1.79	0.0013	0.0027	0.0003	0.076
Biweekly	9a_08-S	9/02-14/08	82.3	0.0438	0.125	0.0004	30.1	2.11	0.045	29.3	0.0299	0.0390	1.25	4.34	7.02	0.0064	0.0102	0.0003	0.249
Biweekly	9b_08-S	9/16-30/08	56.4	0.0274	0.054	0.0002	16.0	1.32	0.027	12.2	0.0188	0.0228	0.66	3.00	1.88	0.0011	0.0060	0.0001	0.130
Biweekly	10a_08-S	10/02-14/08	21.5	0.0143	0.028	0.0001	8.6	0.53	0.018	6.5	0.0076	0.0126	0.82	1.49	0.93	0.0009	0.0031	-0.0001	0.059
Biweekly	10b_08-S	10/16-30/08	13.9	0.0051	0.008	0.0001	3.2	0.23	0.009	7.1	0.0034	0.0038	0.01	0.39	0.34	0.0005	0.0011	0.0000	0.030
Biweekly	11a_08-S	11/01-15/08	18.7	0.0038	0.013	0.0000	2.8	0.22	0.004	2.6	0.0031	0.0031	0.76	0.55	0.44	0.0004	0.0008	0.0000	0.032
Biweekly	11b_08-S	11/17-29/08	39.6	0.0085	0.017	0.0001	4.8	0.38	0.014	9.0	0.0143	0.0074	0.21	1.01	0.83	0.0011	0.0019	0.0006	0.070
Biweekly	12a_08-S	12/01-15/08	87.4	0.0164	0.038	0.0002	7.3	0.67	0.020	14.3	0.0107	0.0142	0.78	1.73	1.61	0.0011	0.0039	0.0000	0.128
Biweekly	12b_08-S	12/17-31/08	96.2	0.0130	0.038	0.0001	6.9	0.55	0.016	13.7	0.0077	0.0115	1.31	1.36	17.26	0.0205	0.0032	0.0001	0.145
Biweekly	1a_09-S	1/02-14/09	29.5	0.0038	0.007	0.0000	2.0	0.13	0.011	1.2	0.0018	0.0027	1.34	0.61	0.78	0.0006	0.0008	0.0000	0.040
Biweekly	1b_09-S	1/16-30/09	43.1	0.0094	0.006	0.0000	4.0	0.27	0.007	3.4	0.0054	0.0076	1.99	0.93	0.88	0.0011	0.0021	-0.0001	0.065
Biweekly	2a_09-S	2/01-15/09	72.0	0.0181	0.045	0.0002	8.2	0.90	0.013	17.7	0.0161	0.0163	0.58	1.64	1.19	0.0009	0.0041	0.0002	0.106
Biweekly	2b_09-S	2/17-27/09	94.7	0.0435	0.066	0.0004	26.2	1.26	0.017	31.6	0.0279	0.0370	0.22	3.40	2.02	0.0024	0.0099	0.0004	0.180
Biweekly	3a_09-S	3/01-15/09	38.1	0.0217	0.040	0.0002	10.7	0.90	0.014	8.6	0.0155	0.0185	0.46	1.70	0.67	0.0012	0.0051	0.0001	0.086
Biweekly	3b_09-S	3/17-31/09	86.5	0.0465	0.113	0.0003	27.4	2.13	0.019	27.1	0.0449	0.0369	0.03	2.81	0.98	0.0025	0.0104	0.0000	0.199
Biweekly	3/4a_09-S	4/02-14/09	105.5	0.0492	0.144	0.0004	37.2	2.57	0.026	49.5	0.0394	0.0395	1.33	3.06	1.21	0.0040	0.0111	0.0001	0.304
Biweekly	4b_09-S	4/16-30/09	129.9	0.0666	0.182	0.0006	47.2	3.26	0.039	56.0	0.0535	0.0537	2.11	4.29	1.37	0.0060	0.0149	0.0001	0.367
Biweekly	5a_09-S	5/02-14/09	80.6	0.0525	0.150	0.0005	38.0	2.20	0.021	33.7	0.0382	0.0443	0.61	3.01	0.81	0.0036	0.0121	0.0001	0.267
Biweekly	5b_09-S	5/16-30/09	82.6	0.0511	0.139	0.0005	36.7	2.20	0.027	35.3	0.0372	0.0431	0.75	3.41	1.06	0.0041	0.0116	0.0002	0.259
Biweekly	6a_09-S	6/01-15/09	128.5	0.1588	0.247	0.0009	76.2	3.77	0.024	230.9	0.0531	0.0735	0.52	4.76	0.84	0.0067	0.0213	0.0316	0.455
Biweekly	6b_09-S	6/17-29/09	34.6	0.0200	0.037	0.0002	13.0	0.81	0.014	16.9	0.0101	0.0162	0.12	2.53	1.16	0.0010	0.0044	0.0001	0.092
Biweekly	7a_09-S	7/01-09/09	3.5	0.0026	0.009	0.0000	2.3	0.09	0.004	3.4	0.0016	0.0022	0.10	0.31	0.04	0.0002	0.0006	0.0000	0.014
Max Event	LE1-S-8_08	8/07+8/09 2008	827.6	0.4493	1.366	0.0040	349.7	23.37	0.132	357.3	0.3562	0.3604	1.19	17.46	5.70	0.0267	0.1003	0.0007	2.694
Max Event	LE2-S-8_08	8/25+8/29 2008	62.5	0.0222	0.070	0.0002	15.2	1.41	0.019	12.9	0.0192	0.0183	0.07	2.04	1.68	0.0012	0.0046	0.0000	0.152
Max Event	LE3-S--9_08	9/16+9/18 2008	134.0	0.0625	0.118	0.0005	40.8	3.21	0.049	24.9	0.0450	0.0512	0.42	6.07	3.51	0.0030	0.0138	0.0001	0.291
Max Event	LE4-S-10/11_08	10/30+11/01 2008	43.5	0.0138	0.041	0.0001	9.7	0.86	0.009	9.1	0.0092	0.0118	0.37	1.29	0.66	0.0007	0.0029	0.0000	0.094
Max Event	LE5-S--12_08	12/09+12/11 2008	143.6	0.0193	0.045	0.0002	7.0	0.72	0.016	17.3	0.0141	0.0179	0.29	1.87	1.61	0.0013	0.0046	0.0000	0.190
Max Event	LE6-S-2_09	2/03+2/07 2009	71.2	0.0133	0.029	0.0001	6.2	0.92	0.009	9.4	0.0082	0.0129	0.71	1.26	1.06	0.0006	0.0033	0.0000	0.106
Max Event	LE7-S-3_09	3/13+3/15 2009	92.9	0.0659	0.121	0.0006	32.2	2.61	0.022	18.7	0.0488	0.0572	1.15	4.01	1.46	0.0046	0.0154	0.0002	0.246
Max Event	LE8-S-4_09	4/04+4/06 2009	202.4	0.0870	0.295	0.0007	63.8	4.84	0.036	108.5	0.0733	0.0677	0.50	4.93	1.59	0.0067	0.0190	0.0000	0.553
Max Event	LE9-S-4/5_09	4/30+5/02 2009	196.2	0.1278	0.409	0.0011	92.5	5.53	0.031	77.3	0.0821	0.1077	0.76	5.83	1.01	0.0084	0.0295	0.0001	0.674
Max Event	LE10-S-6_09	6/05+6/07 2009	390.0	0.3675	0.834	0.0028	249.1	12.08	0.053	491.7	0.1704	0.2387	0.92	9.53	1.21	0.0216	0.0661	0.0433	1.500
Max Event	LE11-S-6_09	6/09+6/11 2009	77.8	0.0643	0.116	0.0003	33.9	2.01	0.015	63.3	0.0299	0.0339	0.41	3.14	0.77	0.0032	0.0095	0.0124	0.224
Max Event	LE12-S-7_09	6/21+6/23 2009	29.9	0.0173	0.051	0.0002	15.7	0.74	0.011	18.1	0.0102	0.0147	0.15	1.72	0.52	0.0011	0.0040	0.0002	0.090
Min Event	LM1-S-7_08	7/20+7/22 2008	37.9	0.0176	0.052	0.0003	13.5	0.62	0.035	9.0	0.0136	0.0145	4.07	6.12	2.50	0.0018	0.0044	-0.0001	0.112
Min Event	LM2-S-8_08	8/19/2008	10.6	0.0036	0.011	0.0001	3.5	0.17	0.010	7.9	0.0155	0.0029	0.05	0.59	2.07	0.0013	0.0009	0.0007	0.020
Min Event	LM3-S--9_08	9/06+9/08 2008	14.2	0.0046	0.011	0.0000	2.7	0.30	0.004	2.6	0.0030	0.0039	0.06	1.45	0.75	0.0002	0.0010	0.0000	0.031
Min Event	LM4-S-10_08	10/14+10/16 2008	12.4	0.0091	0.019	0.0001	5.5	0.30	0.024	3.7	0.0048	0.0075	0.12	1.19	0.55	0.0005	0.0019	0.0000	0.038
Min Event	LM5-S--11_08	11/11+11/13 2008	7.3	0.0009	0.004	0.0000	0.4	0.03	0.002	-2.0	0.0041	0.0008	0.19	0.13	0.14	0.0000	0.0002	0.0001	0.009
Min Event	LM6-S-1_09	1/06+1/08 2009	12.9	0.0032	0.008	0.0000	1.5	0.08	0.007	0.6	0.0012	0.0019	0.37	0.25	0.25	-0.0001	0.0005	0.0000	0.018
Min Event	LM7-S-2_09	2/01+2/05 2009	43.9	0.0088	0.021	0.0001	3.7	0.52	0.010	5.6	0.0063	0.0085	0.71	1.27	1.19	0.0004	0.0021	-0.0001	0.069
Min Event	LM8-S-3_09	3/01+3/05 2009	11.7	0.0041	0.011	0.0001	2.5	0.12	0.011	0.0	0.0025	0.0038	0.81	0.53	0.26	0.0000	0.0010	0.0000	0.020
Min Event	LM9-S-4_09	4/06+4/10 2009	17.2	0.0077	0.017	0.0001	6.6	0.41	0.006	6.3	0.0067	0.0065	0.40	1.39	0.23	0.0007	0.0017	-0.0001	0.040
Min Event	LM10-S-5_09	5/08+5/10 2009	16.9	0.0118	0.024	0.0001	6.9	0.39	0.012	4.2	0.0224	0.0102	0.36	1.70	0.28	0.0008	0.0028	0.0003	0.064
Min Event	LM11-S-6_09	6/13+6/15 2009	19.9	0.1792	0.012	0.0000	4.4	0.31	0.006	346.6	0.0030	0.0046	0.30	4.30	0.44	0.0012	0.0051	0.0701	0.033
Min Event	LM12-S-7_09	7/01+7/03 2009	8.8	0.0064	0.021	0.0001	5.8	0.23	0.011	8.6	0.0041	0.0056	0.26	0.76	0.09	0.0005	0.0015	0.0001	0.034

TABLE SI-6

SITE: LIDAR

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Rh	S	Sb	Sc	Sm	Sn	Sr	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Cl	SO_4	NO_3	NH_4
Biweekly	7b_08-S	7/14-30/08	0.0013	114	0.109	0.0037	0.0014	0.01	0.173	0.0041	1.2	0.0079	0.0001	0.0019	0.23	0.0029	0.0096	0.0007	33.73	-8.4	187	112	12
Biweekly	8a_08-S	8/01-15/08	0.0003	141	0.073	0.0417	0.0159	0.22	2.749	0.0490	23.3	0.0164	0.0011	0.0352	1.44	0.0197	0.0672	0.0071	2.53	65.8	394	199	11
Biweekly	8b_08-S	8/17-31/08	0.0002	138	0.053	0.0079	0.0020	0.05	0.183	0.0129	2.4	0.0079	0.0001	0.0031	0.32	0.0056	0.0084	0.0007	1.17	-5.8	724	131	8
Biweekly	9a_08-S	9/02-14/08	0.0021	312	0.139	0.0127	0.0075	0.12	0.827	0.0136	8.9	0.0150	0.0004	0.0087	0.52	0.0088	0.0269	0.0027	41.08	-8.4	505	187	356
Biweekly	9b_08-S	9/16-30/08	0.0001	193	0.089	0.0085	0.0038	0.01	0.397	0.0083	5.6	0.0090	0.0002	0.0052	0.54	0.0049	0.0153	0.0013	3.70	-7.7	724	200	54
Biweekly	10a_08-S	10/02-14/08	0.0000	109	0.210	0.0059	0.0025	0.00	0.177	0.0056	2.2	0.0044	0.0001	0.0020	0.26	0.0026	0.0109	0.0007	1.84	-13.9	338	123	-4
Biweekly	10b_08-S	10/16-30/08	0.0001	73	0.031	0.0024	0.0009	-0.02	0.079	0.0016	1.0	0.0019	0.0000	0.0011	0.11	0.0010	0.0027	0.0002	0.11	1.3	183	-14	-3
Biweekly	11a_08-S	11/01-15/08	0.0000	67	0.050	0.0023	0.0005	0.04	0.059	0.0029	0.7	0.0039	0.0000	0.0010	0.11	0.0025	0.0042	0.0001	1.36	5.1	265	118	1
Biweekly	11b_08-S	11/17-29/08	0.0001	140	0.088	0.0075	0.0014	0.04	0.137	0.0095	1.7	0.0110	0.0001	0.0024	0.31	0.0042	0.0054	0.0005	1.44	15.9	285	3	221
Biweekly	12a_08-S	12/01-15/08	0.0000	329	0.193	0.0061	0.0025	0.05	0.228	0.0057	3.0	0.0112	0.0002	0.0049	0.30	0.0033	0.0139	0.0013	3.27	4.3	579	173	324
Biweekly	12b_08-S	12/17-31/08	0.0084	309	0.231	0.0048	0.0022	0.82	0.224	0.0041	2.1	0.0138	0.0002	0.0029	0.30	0.0032	0.0210	0.0011	98.77	5.1	707	323	512
Biweekly	1a_09-S	1/02-14/09	0.0002	104	0.052	0.0012	0.0006	0.00	0.060	0.0012	0.5	0.0037	0.0000	0.0010	0.17	0.0007	0.0037	0.0003	2.63	12.0	551	190	264
Biweekly	1b_09-S	1/16-30/09	-0.0001	143	0.153	0.0026	0.0014	0.11	0.116	0.0028	1.3	0.0051	0.0001	0.0021	0.33	0.0015	0.0079	0.0006	5.75	-7.1	254	107	146
Biweekly	2a_09-S	2/01-15/09	0.0000	262	0.161	0.0061	0.0029	0.04	0.286	0.0055	4.4	0.0091	0.0002	0.0046	0.28	0.0029	0.0102	0.0010	2.24	29.2	648	204	357
Biweekly	2b_09-S	2/17-27/09	0.0000	348	0.142	0.0129	0.0068	-0.04	0.583	0.0114	7.3	0.0103	0.0004	0.0055	0.63	0.0041	0.0260	0.0025	2.17	46.4	606	86	135
Biweekly	3a_09-S	3/01-15/09	0.0000	101	0.087	0.0071	0.0032	0.10	0.350	0.0084	4.0	0.0056	0.0002	0.0036	0.37	0.0039	0.0131	0.0012	1.09	59.5	439	304	212
Biweekly	3b_09-S	3/17-31/09	0.0001	133	0.098	0.0140	0.0065	0.02	0.786	0.0130	11.1	0.0076	0.0004	0.0126	0.66	0.0073	0.0218	0.0022	1.28	37.3	425	59	80
Biweekly	3/4a_09-S	4/02-14/09	0.0002	149	0.096	0.0178	0.0067	0.13	1.194	0.0197	11.0	0.0078	0.0005	0.0151	0.89	0.0110	0.0294	0.0031	2.10	44.9	527	442	61
Biweekly	4b_09-S	4/16-30/09	0.0002	180	0.113	0.0229	0.0092	0.11	1.435	0.0236	15.1	0.0090	0.0006	0.0186	1.36	0.0133	0.0528	0.0038	2.99	-0.5	180	232	7
Biweekly	5a_09-S	5/02-14/09	0.0001	131	0.095	0.0208	0.0079	-0.04	0.849	0.0228	10.2	0.0083	0.0005	0.0114	0.58	0.0081	0.0331	0.0033	2.04	46.4	267	175	13
Biweekly	5b_09-S	5/16-30/09	0.0002	161	0.106	0.0197	0.0077	-0.03	0.833	0.0218	10.1	0.0093	0.0004	0.0112	0.68	0.0081	0.0373	0.0031	2.44	4.7	190	157	2
Biweekly	6a_09-S	6/01-15/09	0.0003	161	0.073	0.0376	0.0135	56.14	1.883	0.0391	16.3	0.0101	0.0009	0.0209	0.67	0.0139	0.0598	0.0058	4.18	92.6	236	110	39
Biweekly	6b_09-S	6/17-29/09	0.0000	116	0.077	0.0071	0.0030	-0.03	0.261	0.0117	4.0	0.0062	0.0002	0.0039	0.26	0.0036	0.0140	0.0011	1.04	-3.6	233	66	131
Biweekly	7a_09-S	7/01-09/09	0.0000	8	0.001	0.0011	0.0005	0.00	0.043	0.0013	0.5	0.0016	0.0000	0.0006	0.13	0.0009	0.0017	0.0002	-0.02	-3.3	275	78	130
Max Event	LE1-S-8_08	8/07+8/09 2008	0.0014	454	0.229	0.1615	0.0608	0.91	11.636	0.1872	94.8	0.0510	0.0041	0.1497	4.90	0.0780	0.2476	0.0277	7.59	324.1	750	407	-4
Max Event	LE2-S-8_08	8/25+8/29 2008	0.0001	166	0.060	0.0078	0.0035	-0.04	0.383	0.0084	5.5	0.0093	0.0002	0.0065	0.54	0.0054	0.0119	0.0013	1.28	7.4	1187	97	6
Max Event	LE3-S--9_08	9/16+9/18 2008	0.0001	445	0.191	0.0199	0.0083	0.00	0.970	0.0169	13.1	0.0199	0.0005	0.0115	0.89	0.0109	0.0317	0.0030	10.87	12.4	1282	244	328
Max Event	LE4-S-10/11_08	10/30+11/01 2008	0.0000	151	0.101	0.0054	0.0019	0.01	0.219	0.0045	3.0	0.0131	0.0001	0.0034	0.35	0.0032	0.0072	0.0006	0.76	69.4	496	311	1
Max Event	LE5-S--12_08	12/09+12/11 2008	0.0001	471	0.276	0.0062	0.0027	0.04	0.235	0.0067	3.6	0.0125	0.0003	0.0056	0.23	0.0041	0.0115	0.0011	4.32	4.6	903	329	669
Max Event	LE6-S-2_09	2/03+2/07 2009	0.0000	243	0.193	0.0042	0.0019	0.03	0.274	0.0041	2.3	0.0088	0.0001	0.0039	0.26	0.0029	0.0077	0.0007	1.93	32.0	675	500	461
Max Event	LE7-S-3_09	3/13+3/15 2009	0.0001	149	0.167	0.0229	0.0102	0.06	1.068	0.0284	10.1	0.0111	0.0006	0.0103	0.84	0.0101	0.0396	0.0039	1.97	40.6	444	676	201
Max Event	LE8-S-4_09	4/04+4/06 2009	0.0003	255	0.155	0.0298	0.0114	0.05	2.182	0.0312	20.3	0.0146	0.0007	0.0284	1.35	0.0209	0.0487	0.0053	2.22	132.0	654	566	93
Max Event	LE9-S-4/5_09	4/30+5/02 2009	0.0002	196	0.192	0.0450	0.0195	-0.03	1.988	0.0466	24.7	0.0163	0.0011	0.0274	1.19	0.0175	0.0758	0.0076	2.76	40.8	297	187	19
Max Event	LE10-S-6_09	6/05+6/07 2009	0.0008	285	0.145	0.1220	0.0439	76.14	5.761	0.1283	51.1	0.0275	0.0029	0.0669	1.74	0.0364	0.1905	0.0188	6.59	154.7	319	168	0
Max Event	LE11-S-6_09	6/09+6/11 2009	0.0000	133	0.052	0.0174	0.0060	27.22	0.919	0.0184	9.7	0.0067	0.0004	0.0119	0.59	0.0092	0.0262	0.0026	2.24	37.2	243	110	74
Max Event	LE12-S-7_09	6/21+6/23 2009	0.0001	61	0.032	0.0084	0.0027	0.03	0.313	0.0081	3.1	0.0059	0.0002	0.0040	0.41	0.0042	0.0122	0.0012	0.54	18.5	248	109	193
Min Event	LM1-S-7_08	7/20+7/22 2008	0.0003	262	0.086	0.0074	0.0031	-0.04	0.282	0.0083	1.9	0.0192	0.0002	0.0039	0.40	0.0052	0.0129	0.0016	1.88	-2.6	124	23	4
Min Event	LM2-S-8_08	8/19/2008	0.0000	105	0.028	0.0051	0.0008	0.00	0.048	0.0128	0.3	0.0030	0.0001	0.0012	0.07	0.0046	0.0030	0.0001	0.25	-4.1	250	16	-8
Min Event	LM3-S--9_08	9/06+9/08 2008	0.0000	80	0.042	0.0021	0.0007	0.01	0.066	0.0020	1.2	0.0032	0.0000	0.0013	0.09	0.0040	0.0023	0.0002	0.62	-6.8	144	18	-5
Min Event	LM4-S-10_08	10/14+10/16 2008	0.0000	96	0.029	0.0039	0.0016	-0.04	0.102	0.0045	1.3	0.0025	0.0001	0.0016	0.15	0.0026	0.0069	0.0006	0.40	40.2	359	154	0
Min Event	LM5-S--11_08	11/11+11/13 2008	0.0000	58	0.030	0.0041	0.0002	-0.05	0.015	0.0075	0.1	0.0017	0.0000	0.0005	0.04	0.0012	0.0008	0.0001	-0.16	6.2	52	23	2
Min Event	LM6-S-1_09	1/06+1/08 2009	0.0000	72	0.029	0.0005	0.0003	-0.06	0.050	0.0009	0.5	0.0021	0.0000	0.0006	0.13	0.0004	0.0013	0.0002	0.12	41.9	246	87	303
Min Event	LM7-S-2_09	2/01+2/05 2009	0.0000	269	0.142	0.0033	0.0017	0.02	0.153	0.0028	1.6	0.0071	0.0001	0.0027	0.22	0.0023	0.0056	0.0007	1.70	58.7	656	148	548
Min Event	LM8-S-3_09	3/01+3/05 2009	-0.0001	76	0.026	0.0009	0.0007	0.00	0.076	0.0012	0.8	0.0026	0.0000	0.0008	0.16	0.0041	0.0030	0.0002	0.37	19.3	439	378	199
Min Event	LM9-S-4_09	4/06+4/10 2009	0.0000	48	0.030	0.0035	0.0013	0.42	0.219	0.0031	2.5	0.0015	0.0001	0.0026	0.20	0.0021	0.0044	0.0004	1.62	9.0	25	141	7
Min Event	LM10-S-5_09	5/08+5/10 2009	0.0000	106	0.051	0.0078	0.0020	-0.05	0.142	0.0160	2.5	0.0051	0.0001	0.0022	0.20	0.0044	0.0074	0.0007	0.39	76.2	118	57	11
Min Event	LM11-S-6_09	6/13+6/15 2009	0.0005	92	0.029	0.0019	0.0010	120.04	0.088	0.0022	1.2	0.0029	0.0001	0.0013	0.14	0.0016	0.0037	0.0004	6.60	37.2	82	50	96
Min Event	LM12-S-7_09	7/01+7/03 2009	0.0001	21	0.003	0.0028	0.0012	-0.01	0.108	0.0032	1.2	0.0041	0.0001	0.0016	0.31	0.0024	0.0043	0.0005	-0.04	26.6	38	41	73

TABLE SI-7

SITE:	BISHKEK
PARTICLE SIZE:	PM10
UNITS:	ng m^{-3}

Sample Type	Sample ID	Date Range	Ag	Al	As	B	Ba	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Eu	Fe	Gd	Ho
Biweekly	7a_08-C	7/08-14/08	0.0074	326.2	0.61	3.29	3.19	369.5	0.095	0.318	0.122	1.322	0.053	1.130	0.0215	0.0055	242.8	0.0221	0.0044
Biweekly	7b_08-C	7/16-30/08	0.0882	237.6	1.02	3.56	2.88	257.8	0.254	0.247	0.085	0.704	0.055	11.848	0.0162	0.0042	179.6	0.0187	0.0031
Biweekly	8a_08-C	8/01-15/08	0.0197	435.4	1.86	5.46	7.55	495.7	0.522	0.562	0.291	1.518	0.106	1.788	0.0306	0.0137	484.1	0.0427	0.0058
Biweekly	8b_08-C	8/17-31/08	0.0139	252.3	0.99	3.49	4.77	260.8	0.222	0.311	0.185	1.094	0.060	1.245	0.0170	0.0051	318.1	0.0203	0.0033
Biweekly	9a_08-C	9/02-14/08	0.0188	432.9	1.09	3.98	7.62	525.1	0.169	0.575	0.267	1.653	0.093	1.591	0.0320	0.0094	490.5	0.0355	0.0063
Biweekly	9b_08-C	9/16-30/08	0.0215	611.5	2.22	3.96	8.80	796.2	0.530	0.728	0.331	1.840	0.115	2.021	0.0449	0.0169	567.0	0.0594	0.0087
Biweekly	10a_08-C	10/02-14/08	0.0170	410.0	0.77	2.49	5.21	672.0	0.227	0.495	0.226	1.226	0.103	1.115	0.0297	0.0138	322.8	0.0401	0.0055
Biweekly	10b_08-C	10/16-30/08	0.0049	71.6	0.49	0.86	0.83	99.9	0.079	0.066	0.028	0.286	0.020	0.252	0.0048	0.0017	49.6	0.0052	0.0009
Biweekly	11a_08-C	11/01-15/08	0.0107	117.5	0.45	1.26	1.48	97.0	0.069	0.106	0.053	0.387	0.039	0.498	0.0080	0.0029	73.0	0.0093	0.0016
Biweekly	11b_08-C	11/17-29/08	0.0020	72.7	0.23	0.72	0.70	60.7	0.015	0.067	0.032	0.324	0.014	0.204	0.0044	0.0019	53.0	0.0065	0.0008
Biweekly	12a_08-C	12/01-15/08	0.0085	229.4	0.49	2.18	2.80	123.6	0.070	0.199	0.116	0.538	0.044	1.356	0.0149	0.0052	149.6	0.0170	0.0031
Biweekly	12b_08-C	12/17-31/08	0.0055	95.6	0.22	1.40	0.89	43.4	0.028	0.077	0.051	0.215	0.014	0.351	0.0064	0.0025	43.8	0.0075	0.0013
Biweekly	1a_09-C	1/02-14/09	0.0015	45.2	0.11	0.98	0.42	29.5	0.013	0.038	0.015	0.101	0.007	3.083	0.0029	0.0010	23.1	0.0033	0.0006
Biweekly	1b_09-C	1/16-30/09	0.0010	29.1	0.15	0.73	0.31	24.1	0.010	0.036	0.012	0.148	0.005	0.164	0.0016	0.0009	20.3	0.0025	0.0003
Biweekly	2a_09-C	2/01-15/09	0.0025	83.8	0.13	0.99	0.81	62.4	0.018	0.089	0.041	0.208	0.012	0.186	0.0055	0.0020	60.5	0.0071	0.0011
Biweekly	2b_09-C	2/17-27/09	0.0050	99.1	0.22	2.23	1.23	180.9	0.025	0.113	0.061	0.346	0.012	0.253	0.0066	0.0035	82.2	0.0088	0.0017
Biweekly	3a_09-C	3/01-15/09	0.0066	261.4	0.43	1.51	3.32	359.8	0.031	0.303	0.182	0.766	0.035	0.892	0.0170	0.0069	235.5	0.0233	0.0036
Biweekly	3b_09-C	3/17-31/09	0.0070	287.8	0.35	1.56	3.30	296.9	0.056	0.278	0.139	0.698	0.038	0.867	0.0187	0.0075	194.1	0.0244	0.0035
Biweekly	3/4a_09-C	4/02-14/09	0.0084	150.9	0.50	1.76	2.18	144.3	0.098	0.154	0.091	0.537	0.026	2.396	0.0095	0.0036	124.3	0.0114	0.0019
Biweekly	4b_09-C	4/16-30/09	0.0111	348.5	0.32	1.94	4.91	751.6	0.051	0.474	0.242	1.399	0.045	0.993	0.0276	0.0097	411.7	0.0336	0.0053
Biweekly	5a_09-C	5/02-14/09	0.0091	164.3	0.28	1.73	3.09	141.8	0.056	0.194	0.112	0.643	0.037	0.729	0.0102	0.0058	181.1	0.0162	0.0022
Biweekly	5b_09-C	5/16-30/09	0.0060	191.6	0.28	1.68	2.44	370.4	0.041	0.181	0.068	0.449	0.027	0.641	0.0127	0.0045	127.2	0.0146	0.0025
Biweekly	6a_09-C	6/01-15/09	0.0071	153.0	0.21	2.93	2.74	248.9	0.037	0.152	0.064	0.542	0.024	1.159	0.0101	0.0040	123.5	0.0125	0.0023
Biweekly	6b_09-C	6/17-27/09	0.0088	127.2	0.62	2.18	2.02	131.0	0.134	0.126	0.055	0.456	0.020	1.040	0.0081	0.0036	95.0	0.0099	0.0016
Biweekly	7a_09-C	7/01-15/09	0.0104	175.9	0.34	2.78	2.53	291.4	0.051	0.191	0.090	0.560	0.038	1.066	0.0107	0.0047	152.0	0.0148	0.0022
Max Event	BE1-C-8_08	8/13+8/15 2008	0.0062	99.9	0.49	2.71	1.98	134.7	0.109	0.157	0.095	0.426	0.029	0.503	0.0077	0.0024	149.1	0.0089	0.0015
Max Event	BE2-C-9_08	9/14+9/16 2008	0.0214	402.3	3.20	4.50	7.56	765.4	0.937	0.634	0.392	1.953	0.087	2.137	0.0296	0.0099	560.5	0.0373	0.0056
Max Event	BE3-C-10_08	10/10+10/12 2008	0.0081	312.2	0.57	2.28	5.05	548.6	0.113	0.436	0.229	0.797	0.082	0.766	0.0253	0.0075	270.5	0.0312	0.0049
Max Event	BE4-C-11_08	11/15+11/17 2008	0.0124	137.6	0.56	1.83	2.17	116.7	0.122	0.128	0.086	0.441	0.053	0.844	0.0096	0.0026	102.4	0.0100	0.0021
Max Event	BE5-C-12_08	12/09+12/13 2008	0.0095	307.4	0.64	2.71	3.88	171.5	0.102	0.310	0.173	0.551	0.062	0.918	0.0205	0.0060	205.6	0.0250	0.0044
Max Event	BE6-C-2_09	2/09+2/11 2009	0.0035	157.9	0.23	1.23	1.61	99.8	0.028	0.189	0.097	0.402	0.020	0.368	0.0104	0.0033	148.4	0.0127	0.0020
Max Event	BE7-C-3_09	3/13+3/15 2009	0.0139	614.3	1.00	2.51	8.38	1171.8	0.052	0.804	0.424	1.944	0.094	2.102	0.0445	0.0156	655.5	0.0541	0.0088
Max Event	BE8-C-3/4_09	3/31+4/04 2009	0.0140	292.6	0.86	3.07	4.36	309.3	0.205	0.308	0.192	0.876	0.049	1.181	0.0194	0.0065	250.8	0.0226	0.0040
Max Event	BE9-C-4_09	4/18+4/20 2009	0.0327	1067.9	0.85	4.07	16.02	2799.9	0.156	1.643	0.857	4.751	0.145	2.974	0.0914	0.0307	1471.2	0.1110	0.0175
Max Event	BE10-C-5_09	5/22+5/24 2009	0.0064	281.8	0.31	1.96	4.34	991.3	0.051	0.286	0.095	0.521	0.035	0.958	0.0201	0.0058	169.2	0.0213	0.0038
Max Event	BE11-C-6_09	6/03+6/05 2009	0.0062	207.4	0.22	2.79	3.26	529.5	0.022	0.230	0.091	0.442	0.033	0.664	0.0154	0.0048	164.2	0.0174	0.0029
Max Event	BE12-C-6_09	6/13+6/15 2009	0.0027	73.5	0.21	3.34	1.13	73.8	0.042	0.057	0.034	0.258	0.013	2.713	0.0037	0.0012	100.2	0.0038	0.0008
Min Event	BM1-C-7_08	7/20+7/24 2008	0.0021	36.5	0.58	1.11	0.43	39.4	0.133	0.039	0.015	0.070	0.007	0.162	0.0022	0.0007	30.5	0.0023	0.0004
Min Event	BM2-C-10_08	10/24+10/26 2008	-0.0003	1.4	0.08	0.30	0.01	0.8	0.005	0.001	0.000	-0.065	0.000	-0.046	0.0000	-0.0001	1.2	0.0001	0.0000
Min Event	BM3-C-11_08	11/21+11/23 2008	-0.0002	10.3	0.04	0.47	0.13	5.6	0.004	0.010	0.006	-0.049	0.002	0.038	0.0007	0.0002	8.3	0.0007	0.0001
Min Event	BM4-C-12_09	12/03+12/07 2008	0.0008	30.4	0.06	0.75	0.29	21.1	0.005	0.032	0.021	-0.011	0.005	0.058	0.0020	0.0004	20.6	0.0024	0.0004
Min Event	BM5-C-1_09	1/06+1/08 2009	0.0000	7.8	0.03	0.39	0.08	4.2	0.001	0.007	0.002	-0.080	0.001	-0.030	0.0005	0.0001	3.4	0.0007	0.0001
Min Event	BM6-C-3_09	3/07+3/09 2009	0.0016	11.4	0.08	0.59	0.11	7.6	0.008	0.010	0.004	0.061	0.003	0.061	0.0006	0.0001	6.8	0.0007	0.0001
Min Event	BM7-C-3/4_09	3/27+4/06 2009	0.0014	3.2	0.03	0.22	0.04	4.4	0.005	0.001	0.002	0.003	0.000	5.683	0.0001	0.0000	2.8	0.0002	0.0001
Min Event	BM8-C-4_09	4/26+4/28 2009	0.0004	14.2	0.04	0.66	0.08	28.2	0.002	0.012	0.007	-0.038	0.001	0.053	0.0008	0.0003	10.4	0.0011	0.0001
Min Event	BM9-C-5_09	5/16+5/18 2009	0.0053	75.9	0.31	1.10	1.09	111.3	0.047	0.086	0.034	0.252	0.018	0.719	0.0050	0.0015	71.4	0.0062	0.0010
Min Event	BM10-C-6_09	6/09+6/11 2009	0.0025	94.9	0.14	3.49	3.50	95.7	0.028	0.080	0.042	0.322	0.012	0.404	0.0052	0.0024	69.0	0.0064	0.0011
Min Event	BM11-C-6_09	6/17+6/19 2009	0.0033	56.1	0.09	1.52	0.75	53.9	0.009	0.049	0.018	0.148	0.008	0.623	0.0034	0.0009	35.1	0.0039	0.0006
Min Event	BM12-C-7_09	7/05+7/07 2009	0.0120	222.5	0.39	2.55	3.80	494.6	0.058	0.266	0.118	0.579	0.065	2.422	0.0149	0.0048	187.6	0.0176	0.0029

TABLE SI-7

SITE: BISHKEK
PARTICLE SIZE: PM10
UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	K	La	Li	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb	Pd	Pr	Pt	Rb
Biweekly	7a_08-C	7/08-14/08	222.2	0.1485	0.3459	0.0016	94.0	6.92	0.073	63.7	0.074	0.138	0.586	11.99	3.47	0.0117	0.0357	0.0020	0.684
Biweekly	7b_08-C	7/16-30/08	212.7	0.1183	0.5295	0.0012	61.6	5.16	0.045	59.1	0.060	0.109	0.283	14.90	5.70	0.0149	0.0282	0.0021	0.668
Biweekly	8a_08-C	8/01-15/08	470.1	0.2529	0.5961	0.0022	123.4	16.84	0.096	159.5	0.199	0.221	0.902	31.66	9.85	0.0192	0.0596	0.0004	1.396
Biweekly	8b_08-C	8/17-31/08	376.4	0.1310	0.4100	0.0013	65.6	10.13	0.072	87.9	0.121	0.124	0.602	20.06	6.81	0.0135	0.0324	0.0016	0.843
Biweekly	9a_08-C	9/02-14/08	556.5	0.2487	0.5936	0.0028	126.9	15.52	0.097	137.7	0.200	0.229	0.920	28.91	8.40	0.0208	0.0601	0.0033	1.398
Biweekly	9b_08-C	9/16-30/08	531.0	0.3384	0.6773	0.0035	189.4	16.71	0.140	183.3	0.214	0.297	1.257	32.85	12.98	0.0285	0.0783	0.0007	1.681
Biweekly	10a_08-C	10/02-14/08	355.6	0.2360	0.4174	0.0021	131.3	11.55	0.127	98.7	0.130	0.201	0.801	21.02	9.66	0.0175	0.0534	0.0004	1.312
Biweekly	10b_08-C	10/16-30/08	59.5	0.0318	0.0600	0.0003	19.7	1.70	0.028	16.7	0.018	0.027	0.114	5.98	2.23	0.0024	0.0074	0.0002	0.210
Biweekly	11a_08-C	11/01-15/08	99.4	0.0493	0.1545	0.0006	16.6	1.96	0.050	26.4	0.027	0.046	0.256	11.36	3.94	0.0036	0.0116	0.0004	0.294
Biweekly	11b_08-C	11/17-29/08	42.0	0.0313	0.0661	0.0004	18.1	1.39	0.015	20.4	0.020	0.029	0.199	2.72	1.41	0.0043	0.0071	0.0005	0.109
Biweekly	12a_08-C	12/01-15/08	137.5	0.0921	0.2690	0.0012	35.9	5.27	0.065	54.7	0.060	0.088	0.458	16.62	5.69	0.0062	0.0225	0.0003	0.367
Biweekly	12b_08-C	12/17-31/08	68.3	0.0365	0.1034	0.0005	12.9	0.98	0.037	30.5	0.019	0.034	0.216	5.57	1.69	0.0057	0.0087	0.0004	0.109
Biweekly	1a_09-C	1/02-14/09	22.0	0.0186	0.0299	0.0002	8.3	0.65	0.014	12.0	0.009	0.017	0.106	3.01	0.80	0.0015	0.0043	0.0002	0.045
Biweekly	1b_09-C	1/16-30/09	17.3	0.0178	0.0210	0.0001	5.4	0.47	0.018	8.8	0.010	0.014	0.073	1.91	0.95	0.0013	0.0037	0.0000	0.025
Biweekly	2a_09-C	2/01-15/09	45.2	0.0401	0.0909	0.0005	15.5	1.62	0.018	14.4	0.035	0.037	0.193	4.17	1.08	0.0028	0.0097	0.0002	0.108
Biweekly	2b_09-C	2/17-27/09	57.6	0.0549	0.1047	0.0008	28.0	2.01	0.026	19.9	0.044	0.045	0.412	5.14	1.63	0.0060	0.0127	0.0002	0.181
Biweekly	3a_09-C	3/01-15/09	173.4	0.1364	0.3294	0.0014	79.5	6.67	0.043	69.0	0.101	0.126	0.666	11.37	2.16	0.0103	0.0323	0.0008	0.479
Biweekly	3b_09-C	3/17-31/09	138.5	0.1263	0.2742	0.0015	77.6	4.51	0.042	74.5	0.080	0.118	0.696	8.43	3.37	0.0129	0.0301	0.0003	0.439
Biweekly	3/4a_09-C	4/02-14/09	116.2	0.0709	0.2319	0.0009	35.1	3.14	0.056	84.0	0.053	0.066	0.827	7.49	6.54	0.0067	0.0168	0.0010	0.305
Biweekly	4b_09-C	4/16-30/09	239.2	0.1964	0.5091	0.0019	117.6	8.65	0.052	71.3	0.171	0.201	1.113	16.93	2.80	0.0105	0.0512	0.0011	0.650
Biweekly	5a_09-C	5/02-14/09	132.2	0.0820	0.2691	0.0009	36.8	4.67	0.049	71.0	0.085	0.075	0.403	11.38	3.41	0.0101	0.0198	0.0005	0.371
Biweekly	5b_09-C	5/16-30/09	102.1	0.0867	0.2110	0.0011	74.5	3.78	0.064	102.1	0.047	0.080	0.234	11.09	2.84	0.0090	0.0207	0.0005	0.338
Biweekly	6a_09-C	6/01-15/09	127.5	0.0750	0.1721	0.0010	52.5	3.36	0.048	102.6	0.039	0.066	0.304	8.23	2.45	0.0060	0.0179	0.0011	0.350
Biweekly	6b_09-C	6/17-27/09	97.5	0.0575	0.1123	0.0006	36.4	2.96	0.029	45.5	0.034	0.051	0.253	7.10	2.93	0.0064	0.0131	0.0006	0.266
Biweekly	7a_09-C	7/01-15/09	215.5	0.0898	0.1955	0.0008	60.7	4.46	0.046	75.4	0.052	0.079	0.331	9.46	4.59	0.0079	0.0211	0.0003	0.498
Max Event	BE1-C-8_08	8/13+8/15 2008	176.3	0.0639	0.1397	0.0004	33.4	5.23	0.031	46.8	0.061	0.054	0.237	7.35	2.92	0.0002	0.0153	0.0002	0.460
Max Event	BE2-C-9_08	9/14+9/16 2008	618.3	0.2844	0.5673	0.0022	166.6	18.80	0.129	153.7	0.236	0.243	1.653	38.50	13.16	0.0043	0.0647	0.0006	1.515
Max Event	BE3-C-10_08	10/10+10/12 2008	348.5	0.1992	0.3884	0.0019	105.0	12.70	0.068	78.7	0.129	0.173	0.630	19.41	4.64	0.0028	0.0457	0.0003	1.134
Max Event	BE4-C-11_08	11/15+11/17 2008	143.7	0.0558	0.2350	0.0008	17.0	2.65	0.070	34.0	0.042	0.055	0.392	8.55	7.32	0.0006	0.0139	0.0008	0.459
Max Event	BE5-C-12_08	12/09+12/13 2008	210.7	0.1442	0.3982	0.0018	53.9	7.45	0.088	68.8	0.092	0.133	0.770	30.36	7.87	0.0031	0.0352	0.0004	0.579
Max Event	BE6-C-2_09	2/09+2/11 2009	96.7	0.0829	0.1917	0.0008	27.1	4.04	0.026	24.5	0.093	0.077	0.459	10.29	2.07	0.0009	0.0199	0.0001	0.229
Max Event	BE7-C-3_09	3/13+3/15 2009	536.9	0.3565	0.8939	0.0033	238.8	20.08	0.079	196.0	0.263	0.329	1.651	26.12	3.94	0.0218	0.0845	0.0029	1.500
Max Event	BE8-C-3/4_09	3/31+4/04 2009	250.1	0.1393	0.4742	0.0017	77.4	6.39	0.091	218.1	0.104	0.134	0.461	14.54	9.79	0.0100	0.0338	0.0016	0.633
Max Event	BE9-C-4_09	4/18+4/20 2009	830.0	0.6639	1.6773	0.0063	418.0	30.79	0.142	214.2	0.611	0.698	4.206	56.87	8.61	0.0304	0.1749	0.0029	2.277
Max Event	BE10-C-5_09	5/22+5/24 2009	148.9	0.1371	0.3804	0.0015	161.4	5.14	0.068	286.5	0.063	0.129	0.306	9.31	2.94	0.0123	0.0331	0.0012	0.502
Max Event	BE11-C-6_09	6/03+6/05 2009	169.3	0.1103	0.2833	0.0011	92.6	4.69	0.044	149.4	0.066	0.102	0.262	8.62	2.40	0.0090	0.0268	0.0018	0.488
Max Event	BE12-C-6_09	6/13+6/15 2009	146.0	0.0249	0.1040	0.0003	15.7	1.56	0.021	166.5	0.014	0.023	0.158	5.27	2.25	0.0016	0.0058	0.0008	0.202
Min Event	BM1-C-7_08	7/20+7/24 2008	34.4	0.0171	0.0184	0.0002	11.3	1.03	0.009	7.5	0.010	0.015	0.023	4.52	1.77	0.0003	0.0039	0.0002	0.078
Min Event	BM2-C-10_08	10/24+10/26 2008	0.7	0.0007	0.0038	0.0000	0.3	0.03	-0.002	-0.6	0.000	0.000	-0.002	0.66	0.17	-0.0010	0.0001	0.0003	0.005
Min Event	BM3-C-11_08	11/21+11/23 2008	7.7	0.0047	0.0009	0.0000	2.6	0.21	-0.002	2.3	0.009	0.004	0.209	0.25	0.17	0.0021	0.0011	0.0007	0.015
Min Event	BM4-C-12_09	12/03+12/07 2008	18.2	0.0146	0.0130	0.0001	8.5	0.50	0.002	6.5	0.007	0.013	0.175	0.53	0.28	-0.0010	0.0038	0.0001	0.044
Min Event	BM5-C-1_09	1/06+1/08 2009	3.1	0.0032	0.0011	0.0000	1.8	0.08	-0.002	1.0	0.002	0.003	0.055	0.19	0.06	-0.0006	0.0009	0.0001	0.010
Min Event	BM6-C-3_09	3/07+3/09 2009	8.3	0.0052	0.0013	0.0000	2.7	0.17	0.015	2.0	0.002	0.005	0.205	1.69	0.33	-0.0009	0.0012	0.0002	0.014
Min Event	BM7-C-3/4_09	3/27+4/06 2009	3.3	0.0009	0.0787	0.0000	0.5	0.02	0.005	2.1	0.006	0.000	-0.092	0.23	0.35	0.0026	0.0002	0.0017	0.001
Min Event	BM8-C-4_09	4/26/+4/28 2009	6.0	0.0060	0.0953	0.0001	5.9	0.20	0.001	2.1	0.003	0.006	-0.060	0.55	0.10	0.0006	0.0014	0.0010	0.014
Min Event	BM9-C-5_09	5/16+5/18 2009	70.0	0.0390	0.1709	0.0003	27.8	3.13	0.035	32.3	0.022	0.037	0.088	13.45	3.24	0.0028	0.0093	0.0006	0.214
Min Event	BM10-C-6_09	6/09+6/11 2009	66.4	0.0396	0.0965	0.0005	25.1	2.24	0.016	24.1	0.019	0.037	0.107	4.63	1.80	0.0024	0.0099	0.0010	0.173
Min Event	BM11-C-6_09	6/17+6/19 2009	46.4	0.0225	0.0678	0.0003	15.1	0.87	0.013	42.2	0.011	0.021	0.192	3.49	0.63	0.0017	0.0054	0.0010	0.099
Min Event	BM12-C-7_09	7/05+7/07 2009	255.5	0.1196	0.3387	0.0010	89.7	5.35	0.055	124.3	0.066	0.116	0.356	10.50	8.33	0.0072	0.0298	0.0011	0.729

TABLE SI-7

SITE:	BISHKEK
PARTICLE SIZE:	PM10
UNITS:	ng m^{-3}

Sample Type	Sample ID	Date Range	Rh	S	Sb	Sc	Sm	Sn	Sr	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Cl	SO_4	NO_3	NH_4
Biweekly	7a_08-C	7/08-14/08	0.0001	207	0.118	0.061	0.0279	0.191	1.71	0.064	23.35	0.0226	0.0017	0.0254	1.78	0.023	0.144	0.0108	4.81	16.9	585	213	89
Biweekly	7b_08-C	7/16-30/08	0.0005	313	0.243	0.046	0.0194	0.570	1.58	0.052	18.83	0.0456	0.0013	0.0248	0.84	0.025	0.152	0.0084	8.04	22.7	786	240	122
Biweekly	8a_08-C	8/01-15/08	0.0007	406	0.349	0.079	0.0399	0.267	4.32	0.082	59.29	0.0735	0.0025	0.0701	2.46	0.045	0.144	0.0155	11.53	10.0	1177	347	37
Biweekly	8b_08-C	8/17-31/08	0.0001	382	0.284	0.048	0.0232	0.157	2.31	0.044	39.14	0.0376	0.0014	0.0619	1.74	0.036	0.156	0.0082	6.57	21.1	1187	369	322
Biweekly	9a_08-C	9/02-14/08	0.0003	440	0.368	0.088	0.0411	0.202	3.86	0.092	59.44	0.0456	0.0028	0.0796	2.32	0.067	0.211	0.0170	22.18	33.5	1069	462	236
Biweekly	9b_08-C	9/16-30/08	0.0007	534	0.564	0.124	0.0552	0.270	5.97	0.119	66.53	0.0729	0.0038	0.0919	3.03	0.058	0.220	0.0242	15.25	70.1	902	524	129
Biweekly	10a_08-C	10/02-14/08	0.0005	363	0.422	0.083	0.0380	0.172	3.60	0.082	38.50	0.0468	0.0022	0.0674	1.74	0.029	0.139	0.0138	7.85	20.1	688	1008	74
Biweekly	10b_08-C	10/16-30/08	0.0001	134	0.147	0.014	0.0054	0.044	0.49	0.011	5.50	0.0160	0.0004	0.0067	0.30	0.025	0.021	0.0020	2.67	18.0	314	205	51
Biweekly	11a_08-C	11/01-15/08	0.0002	350	0.573	0.024	0.0093	0.173	0.73	0.017	11.11	0.0306	0.0007	0.0429	0.60	0.029	0.044	0.0047	5.87	45.5	868	961	62
Biweekly	11b_08-C	11/17-29/08	0.0000	150	0.073	0.017	0.0061	0.009	0.48	0.012	5.87	0.0108	0.0004	0.0157	0.60	0.008	0.021	0.0026	2.45	11.3	568	181	384
Biweekly	12a_08-C	12/01-15/08	0.0002	395	0.459	0.040	0.0184	0.170	1.21	0.037	20.48	0.0357	0.0012	0.0621	1.17	0.046	0.075	0.0081	7.73	42.4	1272	1384	1039
Biweekly	12b_08-C	12/17-31/08	0.0000	362	0.188	0.015	0.0069	0.130	0.45	0.011	7.25	0.0134	0.0005	0.0174	0.65	0.003	0.045	0.0036	3.03				465
Biweekly	1a_09-C	1/02-14/09	0.0001	117	0.053	0.008	0.0033	0.046	0.23	0.006	3.09	0.0047	0.0002	0.0060	0.36	-0.002	0.014	0.0014	1.16	11.1	329	72	332
Biweekly	1b_09-C	1/16-30/09	0.0001	83	0.041	0.006	0.0021	0.002	0.18	0.004	2.71	0.0038	0.0001	0.0031	0.44	0.002	0.009	0.0009	1.23	4.8	248	96	220
Biweekly	2a_09-C	2/01-15/09	0.0001	204	0.110	0.021	0.0078	0.223	0.51	0.020	8.49	0.0077	0.0005	0.0144	0.64	0.035	0.028	0.0029	1.73	14.7	526	221	362
Biweekly	2b_09-C	2/17-27/09	0.0003	241	0.113	0.016	0.0088	0.011	1.09	0.013	11.99	0.0078	0.0010	0.0143	0.83	0.031	0.030	0.0043	1.97	7.4	932	330	250
Biweekly	3a_09-C	3/01-15/09	0.0003	274	0.210	0.050	0.0234	0.073	2.64	0.042	29.71	0.0138	0.0014	0.0385	1.25	0.038	0.085	0.0096	3.85	26.7	632	400	445
Biweekly	3b_09-C	3/17-31/09	0.0003	295	0.478	0.051	0.0236	0.145	2.29	0.039	25.30	0.0138	0.0015	0.0475	0.93	0.013	0.093	0.0097	5.07	36.5	735	607	453
Biweekly	3/4a_09-C	4/02-14/09	0.0002	360	0.445	0.028	0.0128	0.236	1.67	0.025	18.26	0.0144	0.0008	0.0322	0.84	0.068	0.047	0.0057	6.52	42.0	1272	1392	547
Biweekly	4b_09-C	4/16-30/09	0.0003	242	0.282	0.053	0.0372	0.131	3.99	0.045	46.18	0.0158	0.0021	0.0493	1.89	0.062	0.103	0.0127	5.46	30.6	666	977	215
Biweekly	5a_09-C	5/02-14/09	0.0004	298	0.314	0.043	0.0142	0.101	1.88	0.036	24.17	0.0213	0.0009	0.0367	0.89	0.037	0.049	0.0058	5.26	7.3	506	279	209
Biweekly	5b_09-C	5/16-30/09	0.0003	262	0.128	0.038	0.0149	0.108	5.37	0.032	13.95	0.0273	0.0010	0.0335	0.74	0.030	0.065	0.0066	3.70	56.7	553	259	153
Biweekly	6a_09-C	6/01-15/09	0.0002	173	0.100	0.029	0.0137	0.428	3.02	0.029	11.51	0.0233	0.0010	0.0246	0.84	0.010	0.048	0.0053	3.91	77.9	498	275	216
Biweekly	6b_09-C	6/17-27/09	0.0004	175	0.097	0.022	0.0095	0.070	1.01	0.020	11.02	0.0193	0.0007	0.0241	0.74	0.005	0.038	0.0037	2.64	27.5	508	187	63
Biweekly	7a_09-C	7/01-15/09	0.0003	255	0.133	0.034	0.0141	4.599	2.91	0.029	17.09	0.0269	0.0009	0.0251	0.91	0.021	0.053	0.0058	2.92	32.5	743	255	351
Max Event	BE1-C-8_08	8/13+8/15 2008	0.0001	185	0.130	0.020	0.0109	0.048	1.25	0.023	17.30	0.0260	0.0006	0.0226	1.20	0.014	0.035	0.0033	3.51	75.0	1189	562	99
Max Event	BE2-C-9_08	9/14+9/16 2008	0.0003	764	0.542	0.085	0.0426	0.399	5.91	0.080	69.11	0.1142	0.0022	0.0816	3.05	0.072	0.137	0.0142	13.06	76.1	1930	765	295
Max Event	BE3-C-10_08	10/10+10/12 2008	0.0002	232	0.325	0.065	0.0326	0.061	3.03	0.067	38.21	0.0347	0.0018	0.0547	2.26	0.031	0.125	0.0128	4.07	77.0	808	756	161
Max Event	BE4-C-11_08	11/15+11/17 2008	0.0002	411	1.180	0.026	0.0112	0.195	0.82	0.024	16.14	0.0359	0.0008	0.0693	0.83	0.041	0.050	0.0056	11.48	49.9	1150	2436	51
Max Event	BE5-C-12_08	12/09+12/13 2008	0.0002	496	0.526	0.063	0.0270	0.141	1.60	0.060	29.06	0.0459	0.0016	0.0821	1.52	0.082	0.114	0.0113	9.52	41.8	1117	2914	472
Max Event	BE6-C-2_09	2/09+2/11 2009	0.0000	353	0.199	0.031	0.0164	0.002	0.99	0.027	22.02	0.0176	0.0007	0.0305	1.25	0.056	0.051	0.0051	3.08	28.7	851	525	335
Max Event	BE7-C-3_09	3/13+3/15 2009	0.0005	478	0.263	0.117	0.0596	0.217	8.08	0.109	76.18	0.0311	0.0035	0.0809	2.82	0.133	0.206	0.0221	7.72	65.4	747	368	309
Max Event	BE8-C-3/4_09	3/31+4/04 2009	0.0002	733	0.786	0.057	0.0250	0.199	3.89	0.051	35.48	0.0252	0.0017	0.0697	1.53	0.228	0.097	0.0109	9.89	73.0	2104	3271	724
Max Event	BE9-C-4_09	4/18+4/20 2009	0.0007	747	0.871	0.158	0.1247	0.295	14.11	0.135	160.22	0.0490	0.0067	0.1521	5.37	0.224	0.313	0.0417	12.02	98.2	1112	3283	242
Max Event	BE10-C-5_09	5/22+5/24 2009	0.0006	519	0.143	0.056	0.0248	0.238	17.97	0.050	21.01	0.0225	0.0016	0.0742	0.92	0.019	0.097	0.0093	3.74	198.6	1381	656	205
Max Event	BE11-C-6_09	6/03+6/05 2009	0.0003	234	0.098	0.041	0.0199	0.105	8.85	0.045	18.08	0.0301	0.0011	0.0425	1.16	0.018	0.067	0.0075	4.65	124.1	547	415	132
Max Event	BE12-C-6_09	6/13+6/15 2009	0.0001	105	0.080	0.012	0.0046	0.942	0.41	0.012	5.12	0.0202	0.0003	0.0222	0.89	0.013	0.019	0.0020	3.42	91.2	595	248	165
Min Event	BM1-C-7_08	7/20+7/24 2008	0.0000	112	0.057	0.008	0.0026	0.013	0.31	0.008	2.99	0.0150	0.0002	0.0037	0.23	0.006	0.011	0.0010	1.29	8.3	182	22	11
Min Event	BM2-C-10_08	10/24+10/26 2008	0.0000	19	0.009	0.000	0.0001	-0.009	0.00	0.000	0.02	0.0011	0.0000	0.0001	0.03	-0.001	0.000	0.0000	-0.07	13.9	105	43	11
Min Event	BM3-C-11_08	11/21+11/23 2008	0.0000	29	0.020	0.014	0.0011	-0.027	0.06	0.011	1.02	0.0036	0.0001	0.0009	0.28	0.017	0.003	0.0003	1.84	28.2	239	56	174
Min Event	BM4-C-12_09	12/03+12/07 2008	0.0000	46	0.037	0.007	0.0023	0.154	0.13	0.006	2.13	0.0018	0.0002	0.0018	0.31	0.043	0.009	0.0011	0.29	13.7	228	66	228
Min Event	BM5-C-1_09	1/06+1/08 2009	0.0000	13	-0.001	0.002	0.0006	0.008	0.05	0.001	0.53	0.0005	0.0000	0.0007	0.14	-0.001	0.003	0.0002	-0.01	17.2	13	10	147
Min Event	BM6-C-3_09	3/07+3/09 2009	0.0000	119	0.043	0.001	0.0009	-0.001	0.06	0.001	0.75	0.0027	0.0001	0.0009	0.13	-0.001	0.003	0.0002	0.75	19.8	405	51	112
Min Event	BM7-C-3/4_09	3/27+4/06 2009	0.0002	7	0.013	0.002	0.0004	0.483	0.01	0.005	0.12	0.0018	0.0000	0.0004	0.02	0.003	0.001	0.0001	1.69	18.2	26	4	11
Min Event	BM8-C-4_09	4/26+4/28 2009	0.0000	15	0.004	0.004	0.0010	0.098	0.10	0.002	1.16	0.0015	0.0000	0.0006	0.19	0.013	0.004	0.0004	-0.02	9.5	87	38	11
Min Event	BM9-C-5_09	5/16+5/18 2009	0.0001	227	0.104	0.014	0.0061	0.070	1.08	0.013	6.55	0.0184	0.0004	0.0089	0.29	0.008	0.023	0.0025	2.42	30.8	323	78	11
Min Event	BM10-C-6_09	6/09+6/11 2009	0.0000	92	0.044	0.016	0.0078	0.266	0.57	0.016	6.31	0.0090	0.0004	0.0092	0.62	0.007	0.028	0.0031	1.50	54.4	332	169	171
Min Event	BM11-C-6_09	6/17+6/19 2009	0.0001	32	0.036	0.010	0.0035	0.071	0.27	0.009	3.76	0.0060	0.0003	0.0100	0.54	0.005	0.016	0.0016	1.21	45.2	558	208	143
Min Event	BM12-C-7_09	7/05+7/07 2009	0.0002	339	0.180	0.042	0.0208	18.245	5.02	0.039	22.03	0.0386	0.0012	0.0417	0.84	0.018	0.068	0.0076	3.24	52.9	633	251	167

TABLE SI-8

SITE: BISHKEK

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Ag	Al	As	B	Ba	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Eu	Fe	Gd	Ho
Biweekly	7a_08-S	7/08-14/08	0.0076	69.6	0.42	2.08	1.09	94.6	0.132	0.091	0.048	0.395	0.0192	73.270	0.0046	0.0019	71.1	0.0029	0.0008
Biweekly	7b_08-S	7/16-30/08	0.0068	79.3	0.79	2.09	1.60	102.3	0.233	0.108	0.056	0.436	0.0258	5.139	0.0051	0.0023	95.5	0.0065	0.0010
Biweekly	8a_08-S	8/01-15/08	0.0046	85.9	0.49	2.23	1.32	105.4	0.096	0.116	0.047	0.325	0.0256	0.411	0.0061	0.0026	87.0	0.0030	0.0012
Biweekly	8b_08-S	8/17-31/08	0.0067	80.0	0.81	3.15	0.93	69.5	0.160	0.080	0.033	1.235	0.0201	0.395	0.0054	0.0023	60.1	0.0010	0.0013
Biweekly	9a_08-S	9/02-14/08	0.0098	120.4	0.51	2.36	1.65	127.3	0.100	0.135	0.058	0.428	0.0286	0.549	0.0082	0.0026	101.8	0.0019	0.0015
Biweekly	9b_08-S	9/16-30/08	0.0098	100.7	1.24	2.27	1.79	124.0	0.309	0.128	0.070	0.502	0.0269	0.645	0.0067	0.0028	108.6	0.0038	0.0013
Biweekly	10a_08-S	10/02-14/08	0.0175	72.9	0.40	1.98	1.10	94.6	0.132	0.096	0.045	0.450	0.0327	0.488	0.0045	0.0022	75.3	0.0002	0.0010
Biweekly	10b_08-S	10/16-30/08	0.0033	8.3	0.23	0.77	0.15	15.3	0.031	0.012	0.004	0.068	0.0047	0.590	0.0005	0.0002	9.2	-0.0059	0.0001
Biweekly	11a_08-S	11/01-15/08	0.0052	16.9	0.30	1.22	0.37	11.9	0.049	0.017	0.011	0.151	0.0116	0.263	0.0012	0.0007	12.7	-0.0052	0.0003
Biweekly	11b_08-S	11/17-29/08	0.0009	19.0	0.12	0.65	0.22	13.7	0.010	0.020	0.012	0.094	0.0062	0.344	0.0012	0.0004	14.8	-0.0062	0.0002
Biweekly	12a_08-S	12/01-15/08	0.0060	69.4	0.33	1.84	0.85	30.8	0.058	0.065	0.031	0.250	0.0187	0.548	0.0048	0.0017	39.4	-0.0014	0.0009
Biweekly	12b_08-S	12/17-31/08	0.0140	26.9	0.12	1.22	0.41	21.3	0.021	0.025	0.014	0.155	0.0064	0.679	0.0015	0.0006	13.7	-0.0038	0.0003
Biweekly	1a_09-S	1/02-14/09	0.0015	19.5	0.10	0.83	0.23	15.4	0.016	0.019	0.008	0.138	0.0048	0.276	0.0011	0.0005	11.5	-0.0053	0.0002
Biweekly	1b_09-S	1/16-30/09	0.0060	15.2	0.11	0.64	0.24	15.6	0.018	0.019	0.007	0.274	0.0040	0.284	0.0010	0.0008	12.0	-0.0045	0.0004
Biweekly	2a_09-S	2/01-15/09	0.0249	37.6	0.11	0.85	0.44	20.2	0.017	0.042	0.019	0.237	0.0067	0.240	0.0023	0.0009	34.2	-0.0031	0.0005
Biweekly	2b_09-S	2/17-27/09	0.0041	53.3	0.15	0.98	0.54	69.9	0.020	0.063	0.028	0.223	0.0057	2.704	0.0033	0.0014	42.6	-0.0028	0.0007
Biweekly	3a_09-S	3/01-15/09	0.0050	66.6	0.25	1.17	0.91	59.5	0.026	0.074	0.048	0.249	0.0094	0.383	0.0045	0.0019	48.0	-0.0021	0.0009
Biweekly	3b_09-S	3/17-31/09	0.0056	46.8	0.13	1.06	0.49	42.1	0.016	0.048	0.022	0.164	0.0063	0.231	0.0037	0.0010	33.6	-0.0025	0.0007
Biweekly	3/4a_09-S	4/02-14/09	0.0086	64.1	0.62	1.73	1.12	64.8	0.137	0.076	0.041	0.433	0.0148	1.308	0.0041	0.0016	61.9	-0.0031	0.0008
Biweekly	4b_09-S	4/16-30/09	0.0491	89.6	0.14	1.17	1.20	133.5	0.027	0.115	0.062	0.379	0.0116	0.302	0.0069	0.0026	85.3	0.0012	0.0013
Biweekly	5a_09-S	5/02-14/09	0.0980	44.8	0.14	1.55	0.64	36.5	0.031	0.051	0.022	0.341	0.0099	6.948	0.0030	0.0012	44.3	-0.0039	0.0006
Biweekly	5b_09-S	5/16-30/09	0.0031	23.6	0.18	1.41	0.37	43.8	0.022	0.027	0.014	0.161	0.0054	0.695	0.0014	0.0007	20.8	-0.0054	0.0004
Biweekly	6a_09-S	6/01-15/09	0.0050	33.8	0.21	2.61	1.19	56.6	0.045	0.039	0.017	0.304	0.0092	0.486	0.0021	0.0010	31.5	NA	0.0004
Biweekly	6b_09-S	6/17-27/09	0.0051	43.6	0.47	2.37	0.69	45.4	0.099	0.054	0.014	0.549	0.0352	0.521	0.0031	0.0017	41.0	NA	0.0011
Biweekly	7a_09-S	7/01-15/09	0.0046	19.2	0.19	1.69	0.34	33.6	0.040	0.022	0.012	0.227	0.0078	73.497	0.0012	0.0004	17.6	0.0009	0.0002
Max Event	BE1-S-8_08	8/13+8/15 2008	0.0125	294.5	0.68	4.92	4.74	386.7	0.167	0.427	0.174	1.065	0.1006	0.961	0.0214	0.0092	335.0	0.0299	0.0042
Max Event	BE2-S-9_08	9/14+9/16 2008	0.0089	135.9	1.67	2.48	1.58	164.7	0.507	0.161	0.083	0.455	0.0306	0.643	0.0085	0.0032	130.2	0.0116	0.0016
Max Event	BE3-S-10_08	10/10+10/12 2008	0.0147	93.5	0.35	2.36	1.45	130.1	0.147	0.136	0.065	0.273	0.0439	0.453	0.0069	0.0032	97.1	0.0098	0.0012
Max Event	BE4-S-11_08	11/15+11/17 2008	0.0112	38.1	0.48	1.94	0.92	25.6	0.138	0.039	0.028	0.176	0.0319	0.605	0.0027	0.0012	29.0	0.0008	0.0006
Max Event	BE5-S-12_08	12/09+12/13 2008	0.0005	13.0	0.09	0.59	0.14	9.1	0.009	0.013	0.006	0.044	0.0024	0.211	0.0004	0.0002	10.6	-0.0018	0.0001
Max Event	BE6-S-2_09	2/09+2/11 2009	0.0064	104.3	0.19	1.19	1.23	51.6	0.041	0.122	0.058	0.557	0.0182	0.598	0.0065	0.0025	109.3	0.0064	0.0011
Max Event	BE7-S-3_09	3/13+3/15 2009	0.0036	96.1	0.49	1.12	1.23	133.6	0.028	0.137	0.072	0.279	0.0127	0.446	0.0072	0.0027	92.4	0.0079	0.0012
Max Event	BE8-S-3/4_09	3/31+4/04 2009	0.0096	62.8	0.64	2.38	1.46	69.8	0.236	0.090	0.054	0.250	0.0180	0.897	0.0044	0.0020	74.5	0.0038	0.0009
Max Event	BE9-S-4_09	4/18+4/20 2009	0.0066	310.4	0.32	1.51	3.85	498.8	0.056	0.410	0.200	0.966	0.0351	0.653	0.0243	0.0087	297.4	0.0286	0.0047
Max Event	BE10-S-5_09	5/22+5/24 2009	0.0033	28.3	0.18	1.30	0.59	118.5	0.022	0.030	0.018	0.077	0.0052	0.366	0.0017	0.0008	24.2	0.0002	0.0004
Max Event	BE11-S-6_09	6/03+6/05 2009	0.0018	48.6	0.15	2.24	0.90	126.6	0.024	0.055	0.025	0.252	0.0108	0.275	0.0028	0.0013	41.5	0.0012	0.0006
Max Event	BE12-S-6_09	6/13+6/15 2009	0.0023	18.1	0.25	3.08	0.56	17.9	0.069	0.019	0.011	0.093	0.0101	0.206	0.0012	0.0006	19.3	-0.0005	0.0002
Min Event	BM1-S-7_08	7/20+7/24 2008	0.0036	58.4	0.67	1.74	0.66	68.2	0.171	0.067	0.027	0.197	0.0132	0.219	0.0039	0.0014	46.9	0.0056	0.0007
Min Event	BM2-S-10_08	10/24+10/26 2008	0.0001	1.4	0.05	0.23	0.02	0.5	0.006	0.001	0.000	-0.041	0.0005	0.074	0.0001	0.0001	0.7	0.0001	0.0000
Min Event	BM3-S-11_08	11/21+11/23 2008	0.0005	6.4	0.04	0.35	0.08	7.6	0.005	0.008	0.021	0.033	0.0021	0.008	0.0003	0.0002	7.2	-0.0016	0.0000
Min Event	BM4-S-12_08	12/03+12/07 2008	0.0043	37.3	0.22	2.03	0.61	13.5	0.056	0.035	0.030	0.063	0.0131	0.281	0.0025	0.0009	22.0	-0.0001	0.0005
Min Event	BM5-S-1_09	1/06+1/08 2009	0.0012	5.4	0.02	0.63	0.17	21.4	0.006	0.004	0.003	0.109	0.0010	0.061	0.0002	0.0002	4.3	-0.0015	0.0000
Min Event	BM6-S-3_09	3/07+3/09 2009	0.0020	7.5	0.10	0.62	0.16	10.3	0.015	0.008	0.005	0.033	0.0027	0.068	0.0006	0.0002	6.8	-0.0015	0.0001
Min Event	BM7-S-3/4_09	3/27+4/06 2009	0.0002	3.5	0.02	0.18	0.02	4.5	0.003	0.001	0.001	-0.023	0.0002	0.019	0.0000	0.0000	0.9	-0.0025	0.0000
Min Event	BM8-S-4_09	4/26+4/28 2009	0.0001	2.7	0.05	0.62	0.04	6.7	0.012	0.003	0.002	0.035	0.0007	-0.005	0.0002	0.0000	3.4	-0.0017	0.0000
Min Event	BM9-S-5_09	5/16+5/18 2009	0.0031	13.1	0.19	0.91	0.24	19.0	0.029	0.015	0.012	0.050	0.0054	0.455	0.0007	0.0004	13.5	-0.0011	0.0001
Min Event	BM10-S-6_09	6/09+6/11 2009	0.0034	25.0	0.22	3.12	2.64	28.8	0.055	0.033	0.014	0.324	0.0064	0.302	0.0019	0.0016	27.7	0.0003	0.0004
Min Event	no sample																		
Min Event	BM12-S-7_09	7/05+7/07 2009	0.0152	37.5	0.18	1.69	0.77	84.7	0.076	0.046	0.032	0.559	0.0166	293.253	0.0021	0.0010	34.7	0.0012	0.0005

TABLE SI-8

SITE: BISHKEK

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	K	La	Li	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb	Pd	Pr	Pt	Rb
Biweekly	7a_08-S	7/08-14/08	79.8	0.0418	0.0488	0.0012	22.0	2.17	0.034	19.2	0.0251	0.0369	0.41	5.15	12.64	0.0092	0.0099	0.0002	0.256
Biweekly	7b_08-S	7/16-30/08	105.0	0.0476	0.0918	0.0003	22.3	3.14	0.037	33.5	0.0375	0.0403	0.30	10.57	4.77	0.0028	0.0114	0.0003	0.316
Biweekly	8a_08-S	8/01-15/08	95.0	0.0515	0.1163	0.0006	25.7	2.81	0.030	27.2	0.0311	0.0454	0.20	6.23	2.17	0.0031	0.0123	0.0018	0.329
Biweekly	8b_08-S	8/17-31/08	78.9	0.0387	0.0677	0.0006	18.8	1.73	0.034	18.5	0.0249	0.0331	0.57	6.74	4.24	0.0019	0.0092	-0.0072	0.217
Biweekly	9a_08-S	9/02-14/08	114.1	0.0603	0.1036	0.0007	35.3	2.94	0.034	27.6	0.0337	0.0533	0.23	8.18	5.14	0.0035	0.0141	0.0007	0.347
Biweekly	9b_08-S	9/16-30/08	133.8	0.0568	0.1152	0.0005	32.1	3.32	0.058	31.9	0.0418	0.0494	0.37	8.39	6.63	0.0031	0.0129	-0.0020	0.359
Biweekly	10a_08-S	10/02-14/08	98.7	0.0435	0.0843	0.0004	22.7	2.54	0.054	21.3	0.0301	0.0376	0.32	6.57	6.28	0.0018	0.0100	0.0090	0.368
Biweekly	10b_08-S	10/16-30/08	14.9	0.0047	0.0059	0.0001	2.4	0.32	0.013	4.3	0.0026	0.0044	0.18	3.17	1.03	0.0004	0.0012	0.0002	0.046
Biweekly	11a_08-S	11/01-15/08	32.2	0.0078	0.0251	0.0002	2.2	0.42	0.024	10.0	0.0151	0.0070	0.11	5.19	2.78	0.0010	0.0020	-0.0004	0.076
Biweekly	11b_08-S	11/17-29/08	15.4	0.0085	0.0068	0.0001	5.2	0.39	0.011	7.0	0.0050	0.0075	0.05	1.22	0.80	0.0009	0.0023	0.0050	0.042
Biweekly	12a_08-S	12/01-15/08	60.5	0.0304	0.0680	0.0004	9.7	1.86	0.037	18.9	0.0172	0.0285	0.19	9.16	4.35	0.0022	0.0074	0.0026	0.130
Biweekly	12b_08-S	12/17-31/08	43.8	0.0114	0.0224	0.0002	4.6	0.33	0.023	11.7	0.0052	0.0106	0.30	3.00	1.37	0.0005	0.0028	0.0057	0.056
Biweekly	1a_09-S	1/02-14/09	17.7	0.0089	0.0054	0.0001	4.0	0.50	0.010	8.7	0.0044	0.0086	0.14	3.06	1.17	0.0006	0.0022	0.0009	0.036
Biweekly	1b_09-S	1/16-30/09	13.5	0.0089	0.0050	0.0003	3.2	0.26	0.027	6.1	0.0049	0.0069	0.11	1.97	1.39	0.0005	0.0022	0.0040	0.051
Biweekly	2a_09-S	2/01-15/09	24.7	0.0177	0.0381	0.0002	6.0	0.84	0.018	9.3	0.0162	0.0170	0.11	3.72	1.12	0.0008	0.0045	-0.0002	0.061
Biweekly	2b_09-S	2/17-27/09	31.9	0.0293	0.0361	0.0003	17.2	1.02	0.018	14.0	0.0229	0.0277	1.20	3.00	1.69	0.0012	0.0069	-0.0048	0.085
Biweekly	3a_09-S	3/01-15/09	38.5	0.0348	0.0454	0.0004	15.4	1.34	0.022	13.7	0.0236	0.0314	0.21	4.48	1.73	0.0019	0.0085	0.0133	0.088
Biweekly	3b_09-S	3/17-31/09	22.8	0.0223	0.0259	0.0002	13.8	0.80	0.019	10.6	0.0128	0.0204	0.13	1.52	0.99	0.0014	0.0054	0.0079	0.066
Biweekly	3/4a_09-S	4/02-14/09	62.7	0.0337	0.0673	0.0003	15.8	1.49	0.063	26.8	0.0240	0.0334	0.55	4.32	9.33	0.0023	0.0080	0.0166	0.148
Biweekly	4b_09-S	4/16-30/09	50.9	0.0525	0.0783	0.0005	34.5	1.99	0.021	15.6	0.0422	0.0479	0.36	5.15	1.41	0.0032	0.0125	0.0127	0.147
Biweekly	5a_09-S	5/02-14/09	29.5	0.0221	0.0528	0.0003	11.0	0.95	0.023	13.4	0.0166	0.0209	2.10	2.96	2.05	0.0025	0.0054	0.0023	0.090
Biweekly	5b_09-S	5/16-30/09	19.0	0.0131	0.0130	0.0002	9.4	0.79	0.023	14.4	0.0179	0.0119	0.09	3.73	1.48	0.0024	0.0033	-0.0032	0.054
Biweekly	6a_09-S	6/01-15/09	34.0	0.0176	0.0395	0.0002	13.6	1.09	0.020	28.3	0.0127	0.0157	-1.07	2.98	2.95	0.0024	0.0042	0.0025	0.090
Biweekly	6b_09-S	6/17-27/09	50.2	0.0282	0.0635	0.0006	13.8	1.12	0.076	27.3	0.0105	0.0225	-0.79	2.55	3.26	0.0026	0.0087	0.0018	0.132
Biweekly	7a_09-S	7/01-15/09	61.9	0.0102	0.0157	0.0001	7.6	0.57	0.018	11.1	0.0051	0.0091	0.15	1.55	8.95	0.0061	0.0024	0.0002	0.078
Max Event	BE1-S-8_08	8/13+8/15 2008	367.6	0.1845	0.5364	0.0016	88.2	9.96	0.069	111.4	0.1242	0.1662	0.75	15.93	4.35	0.0097	0.0442	0.0001	1.269
Max Event	BE2-S-9_08	9/14+9/16 2008	177.3	0.0734	0.1641	0.0006	48.8	4.20	0.043	39.6	0.0493	0.0615	0.55	11.91	6.11	0.0041	0.0166	0.0001	0.428
Max Event	BE3-S-10_08	10/10+10/12 2008	138.8	0.0603	0.1604	0.0005	26.0	3.64	0.050	24.8	0.0451	0.0513	0.28	7.63	5.56	0.0037	0.0136	0.0003	0.510
Max Event	BE4-S-11_08	11/15+11/17 2008	81.4	0.0164	0.0857	0.0003	3.5	1.08	0.046	17.7	0.0135	0.0153	0.20	7.63	7.99	0.0026	0.0038	0.0002	0.212
Max Event	BE5-S-12_08	12/09+12/13 2008	14.8	0.0058	0.0024	0.0001	2.5	0.29	0.002	4.5	0.0046	0.0054	0.04	0.43	0.52	0.0005	0.0014	0.0000	0.028
Max Event	BE6-S-2_09	2/09+2/11 2009	67.6	0.0494	0.1345	0.0005	14.5	2.66	0.045	26.7	0.0534	0.0477	0.36	11.27	2.81	0.0032	0.0125	0.0002	0.154
Max Event	BE7-S-3_09	3/13+3/15 2009	75.3	0.0644	0.0657	0.0005	35.1	2.94	0.020	20.0	0.0494	0.0566	0.34	4.52	1.76	0.0037	0.0152	0.0004	0.182
Max Event	BE8-S-3/4_09	3/31+4/04 2009	84.9	0.0382	0.0990	0.0004	17.1	1.90	0.053	43.3	0.0316	0.0359	0.21	5.38	10.82	0.0024	0.0093	0.0001	0.170
Max Event	BE9-S-4_09	4/18+4/20 2009	166.3	0.1878	0.2861	0.0018	129.1	7.03	0.040	42.6	0.1516	0.1701	1.11	13.83	3.29	0.0105	0.0443	0.0004	0.506
Max Event	BE10-S-5_09	5/22+5/24 2009	25.9	0.0156	0.0209	0.0001	17.4	0.89	0.029	32.1	0.0099	0.0139	0.07	2.12	1.20	0.0024	0.0036	0.0001	0.076
Max Event	BE11-S-6_09	6/03+6/05 2009	42.8	0.0266	0.0486	0.0002	22.6	1.33	0.030	35.4	0.0242	0.0231	0.14	2.31	2.24	0.0028	0.0062	0.0001	0.126
Max Event	BE12-S-6_09	6/13+6/15 2009	26.5	0.0088	0.0197	0.0001	3.8	0.64	0.010	7.3	0.0072	0.0086	0.05	1.83	3.95	0.0004	0.0022	0.0001	0.059
Min Event	BM1-S-7_08	7/20+7/24 2008	56.0	0.0305	0.0555	0.0003	17.5	1.46	0.017	20.8	0.0166	0.0262	0.26	7.23	2.13	0.0015	0.0073	0.0003	0.158
Min Event	BM2-S-10_08	10/24+10/26 2008	2.2	0.0002	0.0010	0.0000	0.4	0.02	0.006	1.5	0.0003	0.0001	0.07	0.60	0.16	0.0001	0.0001	0.0000	0.009
Min Event	BM3-S-11_08	11/21+11/23 2008	9.0	0.0033	0.0026	0.0001	1.6	0.17	0.001	3.6	0.0033	0.0026	0.04	0.19	0.33	0.0007	0.0008	0.0001	0.023
Min Event	BM4-S-12_08	12/03+12/07 2008	51.0	0.0170	0.0455	0.0003	4.0	1.41	0.025	12.4	0.0143	0.0155	0.18	11.34	3.81	0.0012	0.0041	0.0001	0.086
Min Event	BM5-S-1_09	1/06+1/08 2009	7.1	0.0024	0.0011	0.0001	1.5	0.47	0.003	6.8	0.0012	0.0023	0.04	0.46	0.08	0.0011	0.0006	0.0000	0.013
Min Event	BM6-S-3_09	3/07+3/09 2009	12.2	0.0039	0.0022	0.0000	2.2	0.16	0.007	3.5	0.0022	0.0036	0.04	2.41	0.60	0.0001	0.0009	0.0004	0.023
Min Event	BM7-S-3/4_09	3/27+4/06 2009	2.7	0.0003	-0.0016	0.0000	0.2	0.01	0.000	2.1	0.0001	0.0003	0.00	0.20	0.61	-0.0003	0.0001	0.0000	0.003
Min Event	BM8-S-4_09	4/26+4/28 2009	3.3	0.0017	0.0028	0.0000	1.0	0.07	0.001	2.7	0.0011	0.0020	0.02	0.56	0.19	0.0007	0.0006	0.0003	0.008
Min Event	BM9-S-5_09	5/16+5/18 2009	15.8	0.0069	0.0088	0.0001	4.4	0.93	0.016	8.1	0.0044	0.0067	0.04	5.78	1.76	0.0001	0.0017	0.0000	0.048
Min Event	BM10-S-6_09	6/09+6/11 2009	30.3	0.0145	0.0193	0.0001	6.9	0.97	0.018	11.7	0.0083	0.0132	0.17	2.72	3.42	0.0010	0.0034	0.0001	0.074
Min Event	no sample																		
Min Event	BM12-S-7_09	7/05+7/07 2009	74.9	0.0216	0.0408	0.0002	16.0	0.98	0.021	23.8	0.0113	0.0195	0.64	1.69	30.63	0.0268	0.0051	0.0001	0.154

TABLE SI-8

SITE: BISHKEK

PARTICLE SIZE: PM2.5

UNITS: ng m^{-3}

Sample Type	Sample ID	Date Range	Rh	S	Sb	Sc	Sm	Sn	Sr	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Cl	SO_4	NO_3	NH_4
Biweekly	7a_08-S	7/08-14/08	0.0026	265.2	0.16	0.0146	0.0081	0.202	0.68	0.0157	7.74	0.0235	0.0002	0.0091	0.393	0.0098	0.0238	0.0032	50.67	-3.7	758.5	134.0	21.9
Biweekly	7b_08-S	7/16-30/08	0.0002	213.8	0.15	0.0153	0.0080	66.026	0.87	0.0169	11.20	0.0313	0.0004	0.0141	0.526	0.0156	0.0285	0.0027	7.60	12.5	384.4	131.0	15.5
Biweekly	8a_08-S	8/01-15/08	0.0002	135.1	0.10	0.0178	0.0085	0.082	0.78	0.0180	9.67	0.0234	0.0005	0.0123	0.589	0.0094	0.0320	0.0032	4.37	5.6	679.2	200.1	20.7
Biweekly	8b_08-S	8/17-31/08	0.0002	237.0	0.15	0.0202	0.0074	0.093	0.50	0.0231	5.62	0.0241	0.0005	0.0135	0.542	0.0103	0.0284	0.0036	2.97	15.0	604.4	93.7	144.8
Biweekly	9a_08-S	9/02-14/08	0.0001	267.4	0.21	0.0208	0.0112	0.101	0.93	0.0241	9.83	0.0224	0.0006	0.0157	0.627	0.0126	0.0395	0.0043	4.93	-3.4	706.2	156.4	193.2
Biweekly	9b_08-S	9/16-30/08	0.0002	308.9	0.29	0.0193	0.0086	0.122	1.10	0.0193	12.36	0.0357	0.0005	0.0173	0.867	0.0150	0.0323	0.0031	7.65	69.8	702.5	325.0	167.8
Biweekly	10a_08-S	10/02-14/08	0.0000	266.9	0.31	0.0155	0.0068	0.125	0.72	0.0149	8.39	0.0302	0.0003	0.0190	0.545	0.0098	0.0245	0.0024	4.22	-0.4	633.9	772.9	23.6
Biweekly	10b_08-S	10/16-30/08	0.0001	64.6	0.07	0.0014	0.0007	0.021	0.09	0.0014	1.38	0.0080	-0.0001	0.0014	0.109	0.0026	0.0024	0.0001	1.16	-5.0	216.6	64.1	15.9
Biweekly	11a_08-S	11/01-15/08	0.0005	213.6	0.43	0.0113	0.0017	0.071	0.13	0.0120	2.03	0.0184	0.0001	0.0089	0.296	0.0094	0.0060	0.0006	3.82	32.5	708.2	940.5	28.2
Biweekly	11b_08-S	11/17-29/08	0.0002	97.2	0.04	0.0040	0.0015	0.024	0.14	0.0031	1.62	0.0083	-0.0001	0.0039	0.356	0.0299	0.0061	0.0008	0.84	4.6	300.4	46.3	268.3
Biweekly	12a_08-S	12/01-15/08	0.0003	343.6	0.38	0.0135	0.0060	0.101	0.37	0.0130	5.74	0.0292	0.0002	0.0220	0.542	0.0110	0.0250	0.0027	5.28	7.9	656.9	521.7	771.3
Biweekly	12b_08-S	12/17-31/08	0.0001	225.8	0.16	0.0046	0.0021	0.041	0.17	0.0035	1.87	0.0092	0.0000	0.0051	0.365	0.0035	0.0092	0.0009	2.33	4.9	621.0	171.6	570.6
Biweekly	1a_09-S	1/02-14/09	0.0001	163.8	0.08	0.0021	0.0017	0.027	0.13	0.0028	1.57	0.0060	-0.0001	0.0049	0.234	0.0016	0.0075	0.0006	1.47	20.4	290.1	47.7	378.2
Biweekly	1b_09-S	1/16-30/09	-0.0001	109.2	0.07	0.0039	0.0016	0.030	0.10	0.0028	1.46	0.0095	0.0003	0.0028	0.299	0.0055	0.0052	0.0005	1.36	3.2	223.6	74.7	201.5
Biweekly	2a_09-S	2/01-15/09	0.0000	197.3	0.11	0.0064	0.0034	0.027	0.24	0.0056	4.18	0.0074	0.0001	0.0082	0.358	0.0054	0.0109	0.0013	1.57	4.8	624.2	340.2	753.6
Biweekly	2b_09-S	2/17-27/09	0.0001	207.3	0.09	0.0086	0.0046	0.029	0.48	0.0080	5.57	0.0051	0.0001	0.0064	0.410	0.0036	0.0176	0.0016	1.97	10.2	425.6	217.8	325.7
Biweekly	3a_09-S	3/01-15/09	0.0001	234.7	0.20	0.0115	0.0064	0.066	0.60	0.0103	6.62	0.0083	0.0002	0.0117	0.509	0.0050	0.0229	0.0026	2.52	16.6	541.1	389.5	521.2
Biweekly	3b_09-S	3/17-31/09	-0.0002	88.2	0.16	0.0098	0.0039	0.046	0.34	0.0077	3.54	0.0049	0.0001	0.0076	0.361	0.0032	0.0162	0.0016	1.36	12.7	583.6	566.3	558.3
Biweekly	3/4a_09-S	4/02-14/09	0.0001	425.3	0.61	0.0106	0.0059	0.141	0.82	0.0102	7.39	0.0168	0.0001	0.0134	0.327	0.0095	0.0205	0.0022	6.57	19.1	949.1	951.8	1127.7
Biweekly	4b_09-S	4/16-30/09	0.0000	151.5	0.14	0.0205	0.0091	0.075	0.95	0.0144	10.61	0.0077	0.0003	0.0117	0.762	0.0055	0.0353	0.0033	1.58	9.9	467.5	476.7	157.9
Biweekly	5a_09-S	5/02-14/09	0.0001	148.0	0.17	0.0076	0.0044	0.109	0.45	0.0077	4.70	0.0111	0.0002	0.0078	0.371	0.0055	0.0320	0.0018	4.21	16.6	377.0	360.9	159.4
Biweekly	5b_09-S	5/16-30/09	0.0000	107.1	0.06	0.0101	0.0026	0.052	0.81	0.0107	2.35	0.0134	0.0000	0.0052	0.285	0.0133	0.0243	0.0009	1.71	21.1	440.2	186.0	153.8
Biweekly	6a_09-S	6/01-15/09	0.0003	153.5	0.10	0.0088	0.0029	0.079	0.94	0.0107	3.53	0.0232	NA	0.0095	0.250	0.0046	0.0176	0.0011	3.18	58.5	522.4	270.9	202.2
Biweekly	6b_09-S	6/17-27/09	0.0001	196.1	0.11	0.0106	0.0058	0.107	0.40	0.0083	4.24	0.0200	NA	0.0074	0.225	0.0024	0.0152	0.0019	4.72	35.9	358.1	122.9	163.1
Biweekly	7a_09-S	7/01-15/09	0.0027	134.3	0.07	0.0035	0.0016	0.240	0.43	0.0034	1.84	0.0170	0.0000	0.0032	0.158	0.0011	0.0081	0.0005	39.12	3.8	391.9	288.7	136.5
Max Event	BE1-S-8_08	8/13+8/15 2008	0.0003	327.0	0.22	0.0595	0.0299	0.112	2.85	0.0608	39.15	0.0382	0.0018	0.0459	1.624	0.0296	0.1065	0.0110	11.83	51.6	497.1	399.9	76.0
Max Event	BE2-S-9_08	9/14+9/16 2008	0.0002	426.1	0.23	0.0272	0.0109	0.100	1.31	0.0219	15.57	0.0529	0.0006	0.0162	0.887	0.0221	0.0418	0.0043	6.10	15.7	800.8	108.3	220.0
Max Event	BE3-S-10_08	10/10+10/12 2008	0.0002	276.8	0.39	0.0228	0.0092	0.066	0.88	0.0231	12.15	0.0297	0.0005	0.0213	0.721	0.0122	0.0347	0.0033	3.71	6.0	266.7	335.1	41.4
Max Event	BE4-S-11_08	11/15+11/17 2008	0.0013	465.3	1.19	0.0076	0.0029	0.179	0.32	0.0056	4.99	0.0332	0.0001	0.0253	0.417	0.0188	0.0133	0.0014	10.94	50.3	1075.7	2401.2	69.1
Max Event	BE5-S-12_08	12/09+12/13 2008	0.0006	79.5	0.07	0.0015	0.0010	0.016	0.08	0.0019	1.18	0.0032	-0.0001	0.0010	0.161	0.0022	0.0028	0.0004	0.80	12.0	279.3	58.7	252.7
Max Event	BE6-S-2_09	2/09+2/11 2009	0.0006	478.6	0.30	0.0153	0.0092	0.073	0.65	0.0147	12.99	0.0208	0.0003	0.0234	0.733	0.0153	0.0282	0.0034	4.51	36.5	967.1	871.2	1210.0
Max Event	BE7-S-3_09	3/13+3/15 2009	0.0006	198.0	0.12	0.0174	0.0102	0.035	1.32	0.0157	11.93	0.0112	0.0005	0.0122	0.886	0.0076	0.0303	0.0033	1.68	74.1	660.7	504.2	457.1
Max Event	BE8-S-3/4_09	3/31+4/04 2009	0.0003	650.3	0.89	0.0119	0.0067	0.194	1.28	0.0105	9.87	0.0218	0.0002	0.0179	0.421	0.0098	0.0209	0.0024	7.50	31.4	1494.7	1786.9	2110.1
Max Event	BE9-S-4_09	4/18+4/20 2009	0.0006	323.5	0.27	0.0681	0.0318	0.110	3.35	0.0502	36.69	0.0158	0.0017	0.0346	2.353	0.0170	0.1154	0.0116	2.70	55.3	637.3	1461.3	213.8
Max Event	BE10-S-5_09	5/22+5/24 2009	0.0004	129.5	0.07	0.0062	0.0027	0.052	2.63	0.0053	3.01	0.0124	0.0000	0.0109	0.307	0.0036	0.0088	0.0008	1.44	62.5	699.0	396.8	148.3
Max Event	BE11-S-6_09	6/03+6/05 2009	0.0003	134.8	0.10	0.0170	0.0041	0.064	2.65	0.0233	4.56	0.0315	0.0001	0.0149	0.344	0.0071	0.0154	0.0016	4.15	83.9	391.3	451.2	167.9
Max Event	BE12-S-6_09	6/13+6/15 2009	0.0002	162.0	0.14	0.0051	0.0017	0.047	0.19	0.0039	2.59	0.0307	0.0000	0.0085	0.240	0.0025	0.0058	0.0007	2.82	92.1	605.4	256.0	335.6
Min Event	BM1-S-7_08	7/20+7/24 2008	0.0000	134.3	0.06	0.0119	0.0054	115.554	0.43	0.0103	5.47	0.0173	0.0003	0.0053	0.403	0.0121	0.0207	0.0019	3.87	17.6	160.9	78.5	11.0
Min Event	BM2-S-10_08	10/24+10/26 2008	0.0001	36.0	0.01	0.0002	0.0001	-0.039	0.00	0.0002	0.29	0.0008	0.0001	0.0002	0.012	0.0000	0.0003	0.0000	0.27	5.1	117.8	58.5	10.9
Min Event	BM3-S-11_08	11/21+11/23 2008	0.0010	53.2	0.03	0.0011	0.0006	0.016	0.06	0.0011	0.77	0.0029	-0.0001	0.0007	0.171	0.0981	0.0016	0.0001	0.33	31.6	183.7	62.7	236.3
Min Event	BM4-S-12_08	12/03+12/07 2008	0.0007	258.3	0.29	0.0113	0.0031	0.093	0.23	0.0161	3.58	0.0200	0.0001	0.0166	0.500	0.0131	0.0130	0.0014	3.97	21.4	94.4	142.6	171.0
Min Event	BM5-S-1_09	1/06+1/08 2009	0.0005	24.2	0.00	0.0009	0.0005	0.006	0.08	0.0008	0.95	0.0007	-0.0001	0.0009	0.060	0.0008	0.0014	0.0002	1.13	19.5	6.7	14.7	112.9
Min Event	BM6-S-3_09	3/07+3/09 2009	0.0003	193.6	0.09	0.0009	0.0007	0.038	0.06	0.0012	0.69	0.0049	-0.0001	0.0011	0.130	0.0005	0.0025	0.0002	1.81	11.8	357.6	103.6	371.5
Min Event	BM7-S-3/4_09	3/27+4/06 2009	0.0003	10.3	0.02	0.0000	0.0000	-0.005	0.01	0.0001	0.15	0.0007	-0.0001	0.0002	0.004	0.0001	0.0002	0.0001	0.40	12.1	17.9	2.7	10.8
Min Event	BM8-S-4_09	4/26+4/28 2009	0.0002	39.5	0.01	0.0005	0.0005	0.019	0.04	0.0004	0.24	0.0014	-0.0001	0.0003	0.106	0.0000	0.0011	0.0000	0.02	7.7	22.0	45.9	10.8
Min Event	BM9-S-5_09	5/16+5/18 2009	0.0001	137.9	0.05	0.0018	0.0011	0.031	0.20	0.0022	1.24	0.0116	-0.0001	0.0018	0.116	0.0345	0.0037	0.0003	1.33	22.9	295.5	49.7	51.8
Min Event	BM10-S-6_09	6/09+6/11 2009	0.0002	176.7	0.08	0.0033	0.0025	0.043	0.30	0.0053	2.57	0.0120	0.0000	0.0048	0.170	0.0040	0.0085	0.0008	2.15	60.7	410.6	202.6	263.4
Min Event	no sample																						
Min Event	BM12-S-7_09	7/05+7/07 2009	0.0109	187.1	0.12	0.0075	0.0035	0.885	1.33	0.0068	3.82	0.0256	0.0001	0.0082	0.206	0.0043	0.0205	0.0013	151.89	32.9	330.8	410.6	113.7

Table SI-9A

PM10-2.5

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
OC	0.57	0.44	0.02	0.14	-0.23	0.11	0.61
SO_4^{2-}	0.61	0.28	0.01	0.07	0.44	0.24	0.72
NO_3^-	0.09	0.36	**0.68**	-0.04	0.37	0.09	0.74
NH_4^+	-0.03	0.07	0.13	0.04	**0.76**	-0.05	0.61
Cl	**0.86**	-0.08	-0.16	0.12	0.29	0.04	0.88
Li	**0.88**	0.29	0.30	0.13	-0.01	0.04	0.97
B	0.14	**0.82**	0.30	0.05	-0.02	0.17	0.81
Na	**0.91**	0.11	-0.03	-0.23	0.15	0.08	0.92
Mg	**0.95**	0.23	0.16	0.04	-0.03	0.02	0.98
Al	**0.94**	0.26	0.18	0.07	0.00	-0.01	0.98
P	0.59	0.68	0.39	0.04	-0.01	0.05	0.96
K	**0.90**	0.37	0.13	0.08	0.03	-0.01	0.96
Ca	**0.86**	0.22	0.33	0.10	-0.08	0.06	0.93
Sc	**0.93**	0.29	0.08	0.01	0.03	-0.01	0.96
Ti	**0.86**	0.38	0.28	0.12	-0.04	-0.01	0.98
V	**0.75**	0.53	0.26	0.11	-0.07	0.03	0.93
Cr	0.65	0.44	0.38	0.03	-0.05	-0.17	0.78
Mn	**0.87**	0.42	0.18	0.11	-0.02	0.00	0.97
Fe	**0.89**	0.31	0.26	0.12	-0.04	-0.03	0.98
Co	**0.82**	0.40	0.34	0.12	-0.03	-0.01	0.96
Ni	0.54	0.41	0.49	-0.03	-0.17	-0.02	0.73
Cu	0.18	-0.01	0.02	**0.97**	0.02	-0.01	0.97
Zn	0.30	0.59	0.22	-0.18	0.13	-0.20	0.58
As	0.43	**0.86**	-0.02	0.13	0.00	0.05	0.94
Rb	**0.95**	0.26	0.06	0.14	0.04	0.00	0.99
Sr	**0.84**	0.17	0.13	0.10	0.05	0.13	0.79
Y	**0.85**	0.38	0.16	0.02	0.00	-0.02	0.90
Nb	**0.84**	0.37	0.31	0.13	-0.05	-0.03	0.96
Mo	0.37	0.43	0.09	-0.09	0.14	-0.22	0.41
Rh	0.36	0.00	-0.03	**0.92**	0.05	-0.04	0.98
Pd	**0.93**	0.05	-0.09	0.25	0.08	-0.14	0.96
Ag	**0.71**	0.14	-0.17	-0.03	0.18	-0.08	0.59
Cd	0.09	**0.93**	-0.12	-0.02	-0.04	0.01	0.90
Sn	0.02	0.00	0.00	-0.04	-0.02	**0.89**	0.79
Sb	0.28	0.63	0.44	-0.05	0.15	-0.07	0.70
Cs	**0.94**	0.24	0.05	0.15	0.09	0.01	0.97
Ba	**0.89**	0.34	0.19	0.20	0.01	0.00	0.98
La	**0.94**	0.28	0.16	0.02	0.00	-0.02	0.99
Ce	**0.88**	0.30	0.22	-0.23	-0.01	-0.02	0.97
Pr	**0.92**	0.28	0.22	0.12	-0.01	-0.02	0.99
Nd	**0.92**	0.27	0.24	0.12	-0.02	-0.02	0.99
Sm	**0.92**	0.27	0.23	0.11	-0.01	-0.02	0.99
Eu	**0.93**	0.27	0.17	0.13	-0.02	-0.04	0.98
Gd	**0.96**	0.16	0.06	0.07	0.07	-0.06	0.97
Dy	**0.90**	0.29	0.26	0.12	-0.04	-0.02	0.98
Ho	**0.90**	0.29	0.27	0.12	-0.03	-0.02	0.98
Tm	**0.89**	0.31	0.26	0.12	-0.03	0.00	0.97
Yb	**0.95**	0.24	0.16	0.09	0.01	-0.03	0.99
Lu	**0.93**	0.26	0.20	0.07	0.01	-0.04	0.98
W	0.44	0.12	**0.65**	0.02	0.05	-0.07	0.64
Tl	0.44	**0.85**	0.10	0.09	0.14	0.05	0.96
Pb	0.29	**0.89**	0.14	-0.02	0.08	-0.08	0.92
Th	**0.93**	0.24	0.04	0.11	0.02	-0.04	0.94
U	**0.81**	0.40	0.29	0.19	0.10	0.06	0.94
Eigenvalues	30.7	9.0	3.3	2.5	1.3	1.1	
% of Variance	56.9	16.7	6.2	4.6	2.4	2.1	
Cumulative %	56.9	73.6	79.7	84.3	86.7	88.8	

Table SI-9B

PM2.5

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
OC	0.24	0.14	0.64	0.18	-0.06	0.44	-0.32	0.83
EC	-0.03	-0.03	**0.79**	-0.10	-0.07	0.42	-0.08	0.82
SO_4^{2-}	0.13	0.05	**0.78**	0.28	-0.13	0.01	-0.08	0.72
NO_3^-	0.14	0.07	**0.82**	0.09	-0.04	-0.13	0.19	0.77
NH_4^+	-0.12	0.02	**0.75**	-0.02	-0.01	-0.13	0.07	0.59
Cl	**0.80**	0.00	0.06	-0.03	0.11	-0.08	-0.16	0.68
Li	**0.98**	0.02	0.01	0.10	0.07	0.06	-0.01	0.98
B	0.68	0.02	0.02	0.39	0.06	0.38	-0.12	0.78
Na	**0.72**	0.03	-0.05	-0.01	0.65	0.00	0.00	0.95
Mg	**0.98**	0.02	-0.02	0.05	0.11	0.04	0.01	0.98
Al	**0.98**	0.02	0.02	0.09	0.12	0.04	0.02	0.99
P	0.64	-0.03	0.20	0.57	0.08	-0.05	0.17	0.81
K	**0.94**	0.08	0.09	0.21	0.02	0.12	-0.07	0.96
Ca	**0.97**	0.04	0.01	0.08	0.11	0.02	0.03	0.97
Sc	**0.98**	0.01	0.02	0.10	0.10	0.03	0.02	0.99
Ti	**0.98**	0.01	0.06	0.13	0.04	0.03	0.02	0.99
V	**0.95**	-0.02	0.08	0.14	-0.07	0.10	0.03	0.93
Cr	**0.78**	0.21	0.08	0.29	-0.06	0.19	0.08	0.79
Mn	**0.98**	0.02	0.03	0.18	0.03	0.03	0.00	0.99
Fe	**0.98**	0.02	0.03	0.12	0.07	0.04	0.02	0.99
Co	**0.98**	0.04	0.07	0.13	0.00	0.03	0.01	0.98
Ni	0.18	0.10	-0.09	0.07	-0.04	**0.78**	0.32	0.77
Cu	-0.06	**0.99**	-0.03	-0.03	-0.01	0.03	0.01	0.98
Zn	-0.03	**0.99**	0.02	0.05	0.01	0.06	0.01	0.99
As	0.49	0.02	0.10	**0.79**	-0.03	0.13	-0.06	0.90
Rb	**0.96**	0.05	0.01	0.19	0.05	0.07	-0.03	0.97
Sr	**0.96**	0.08	0.03	0.08	0.03	-0.02	-0.01	0.93
Y	**0.97**	0.05	0.03	0.10	0.10	0.07	0.08	0.98
Nb	**0.98**	0.00	0.06	0.11	0.00	0.04	0.02	0.98
Mo	0.70	0.06	0.27	0.51	-0.08	-0.01	0.12	0.84
Rh	0.03	**0.99**	0.03	-0.03	0.00	0.02	0.00	0.97
Pd	**0.70**	0.69	0.01	0.03	0.09	0.09	0.02	0.98
Ag	0.08	0.06	0.14	0.00	0.05	0.19	**0.83**	0.75
Cd	0.11	0.08	0.22	**0.90**	0.14	0.03	-0.01	0.89
Sn	0.09	-0.02	-0.16	0.14	**0.89**	-0.05	0.02	0.84
Sb	0.09	0.06	**0.81**	0.32	-0.01	-0.11	0.15	0.81
Cs	**0.94**	0.06	0.06	0.23	0.06	0.04	0.00	0.95
Ba	**0.95**	0.04	0.08	0.19	0.06	0.01	0.03	0.96
La	**0.93**	0.01	0.01	0.08	0.35	0.04	0.03	0.99
Ce	0.31	0.00	-0.06	-0.05	**0.90**	0.01	0.04	0.91
Pr	**0.98**	0.02	0.04	0.12	0.09	0.05	0.03	0.99
Nd	**0.98**	0.02	0.06	0.12	0.06	0.04	0.04	0.99
Sm	**0.97**	0.02	0.06	0.13	0.08	0.04	0.06	0.98
Eu	**0.98**	0.02	0.06	0.14	0.07	0.05	0.04	0.99
Gd	**0.95**	0.00	-0.02	0.05	0.24	0.09	-0.03	0.97
Dy	**0.98**	0.01	0.06	0.11	0.08	0.05	0.05	0.98
Ho	**0.98**	0.01	0.05	0.12	0.08	0.05	0.05	0.99
Tm	**0.98**	0.00	0.01	0.10	0.10	0.08	0.00	0.98
Yb	**0.98**	0.02	0.05	0.11	0.08	0.05	0.04	0.99
Lu	**0.96**	0.04	0.05	0.15	0.06	0.03	0.05	0.96
W	0.61	-0.01	0.00	0.17	-0.04	-0.25	-0.01	0.47
Tl	0.47	0.20	0.25	**0.74**	-0.02	-0.03	-0.01	0.88
Pb	0.04	**0.89**	0.26	0.32	-0.05	-0.04	0.06	0.97
Th	**0.98**	0.01	-0.02	0.09	0.09	0.03	-0.01	0.97
U	**0.95**	0.03	0.13	0.16	0.01	-0.03	0.02	0.95
Eigenvalues	32.9	4.4	4.0	3.7	2.4	1.4	1.1	
% of Variance	59.8	8.0	7.2	6.8	4.4	2.6	2.0	
Cumulative %	59.8	67.8	75.0	81.8	86.2	88.8	90.8	

Table SI-9C

PM10

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
OC	0.46	0.55	0.47	-0.03	-0.09	-0.02	0.03	0.75
EC	-0.03	0.13	**0.88**	-0.02	0.09	0.01	-0.12	0.81
SO_4^{2-}	0.50	0.57	0.47	0.00	-0.07	-0.11	0.07	0.82
NO_3^-	0.18	0.30	0.58	-0.04	0.55	-0.17	0.04	0.80
NH_4^+	-0.12	0.01	**0.82**	-0.01	-0.02	0.04	0.03	0.68
Cl	**0.89**	0.01	0.08	0.09	-0.29	-0.05	0.05	0.90
Li	**0.95**	0.23	0.05	0.13	0.11	-0.02	0.02	0.99
B	0.67	0.61	0.12	0.04	-0.08	-0.02	0.09	0.85
Na	**0.93**	0.16	0.07	0.08	-0.18	-0.04	0.07	0.94
Mg	**0.97**	0.19	0.00	0.09	0.06	-0.01	0.02	0.99
Al	**0.96**	0.23	0.04	0.12	0.07	-0.01	0.01	0.99
P	0.64	0.61	0.10	0.02	0.37	0.02	-0.01	0.93
K	**0.93**	0.34	0.05	0.05	0.00	0.07	0.02	0.98
Ca	**0.92**	0.19	0.02	0.09	0.24	-0.03	0.05	0.95
Sc	**0.95**	0.27	0.04	0.09	0.02	0.00	0.01	0.98
Ti	**0.92**	0.29	0.07	0.08	0.19	0.05	-0.02	0.99
V	**0.89**	0.38	0.08	0.01	0.15	0.04	-0.03	0.97
Cr	**0.77**	0.35	0.04	0.00	0.35	0.18	-0.02	0.88
Mn	**0.92**	0.35	0.03	0.07	0.09	0.04	-0.01	0.98
Fe	**0.94**	0.25	0.03	0.10	0.16	0.03	-0.01	0.99
Co	**0.91**	0.30	0.09	0.05	0.21	0.05	-0.01	0.98
Ni	**0.76**	0.34	0.10	-0.02	0.46	0.07	-0.03	0.93
Cu	0.30	-0.02	-0.05	**0.95**	0.02	0.01	0.00	0.99
Zn	0.37	**0.72**	0.21	-0.07	0.18	-0.01	-0.03	0.74
As	0.47	**0.84**	-0.01	0.06	-0.04	0.02	-0.06	0.95
Rb	**0.95**	0.27	0.01	0.12	-0.05	0.02	0.02	0.99
Sr	**0.89**	0.17	0.04	0.07	0.00	-0.06	0.11	0.85
Y	**0.91**	0.34	0.06	0.09	0.09	-0.02	-0.01	0.96
Nb	**0.92**	0.26	0.06	0.07	0.21	0.07	-0.03	0.98
Mo	0.52	0.46	0.04	-0.07	0.11	0.26	0.04	0.57
Rh	0.55	0.01	-0.03	**0.83**	-0.04	0.02	0.00	0.99
Pd	**0.94**	0.09	0.00	0.20	-0.13	0.08	-0.02	0.96
Ag	**0.73**	0.34	-0.01	-0.05	-0.15	0.16	0.03	0.70
Cd	0.06	**0.94**	-0.04	0.02	0.03	-0.02	-0.08	0.90
Sn	0.01	0.06	-0.06	0.00	0.00	-0.02	**0.98**	0.97
Sb	0.21	0.51	0.50	-0.01	0.45	-0.05	0.00	0.76
Cs	**0.94**	0.26	0.04	0.14	-0.05	0.00	0.04	0.97
Ba	**0.92**	0.30	0.06	0.15	0.11	0.05	0.01	0.99
La	**0.96**	0.24	0.04	0.08	0.09	0.03	-0.01	0.99
Ce	**0.95**	0.23	0.04	0.10	0.13	0.03	-0.01	0.99
Pr	**0.95**	0.23	0.05	0.10	0.14	0.02	0.00	0.99
Nd	**0.95**	0.23	0.05	0.10	0.16	0.02	0.00	0.99
Sm	**0.95**	0.24	0.05	0.09	0.16	0.01	0.00	0.99
Eu	**0.95**	0.23	0.05	0.11	0.11	0.03	-0.01	0.99
Gd	**0.98**	0.17	0.03	0.07	0.00	0.03	-0.01	0.99
Dy	**0.94**	0.25	0.06	0.11	0.18	0.00	-0.01	0.99
Ho	**0.94**	0.25	0.06	0.11	0.17	0.00	0.00	0.99
Tm	**0.94**	0.25	0.06	0.12	0.15	-0.01	0.00	0.99
Yb	**0.96**	0.22	0.05	0.09	0.08	0.00	0.00	0.99
Lu	**0.95**	0.24	0.06	0.08	0.11	-0.01	-0.01	0.99
W	0.59	0.17	0.33	0.02	0.43	-0.02	-0.03	0.67
Pt	0.07	-0.02	-0.02	0.02	-0.03	**0.96**	-0.02	0.92
Tl	0.47	**0.84**	0.08	0.10	0.03	-0.02	0.09	0.95
Pb	0.26	**0.87**	0.20	-0.03	0.20	0.00	0.20	0.94
Th	**0.95**	0.22	0.01	0.13	-0.04	0.02	-0.01	0.97
U	**0.89**	0.33	0.17	0.14	0.10	-0.02	0.04	0.97
Eigenvalues	34.6	8.1	2.8	2.0	1.9	1.1	1.1	
% of Variance	61.9	14.4	5.1	3.5	3.5	2.0	1.9	
Cumulative %	61.9	76.2	81.3	84.8	88.3	90.3	92.3	

TABLE SI-10A

Bishkek PM10	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	PM10	Dust Oxide
Na	1.0000											
Mg	0.7671	1.0000										
Al	0.7299	0.9658	1.0000									
K	0.7200	0.8961	0.9297	1.0000								
Ca	0.7045	0.9767	0.9165	0.8195	1.0000							
Sc	0.7525	0.9353	0.9810	0.9391	0.8545	1.0000						
Ti	0.6669	0.9482	0.9685	0.9420	0.9197	0.9340	1.0000					
Mn	0.6856	0.9309	0.9564	0.9794	0.8665	0.9538	0.9714	1.0000				
Fe	0.6585	0.9551	0.9639	0.9283	0.9371	0.9181	0.9945	0.9591	1.0000			
Rb	0.7135	0.9089	0.9455	0.9852	0.8297	0.9614	0.9320	0.9775	0.9169	1.0000		
PM10	0.6680	0.8289	0.8568	0.9073	0.7768	0.8600	0.8589	0.8959	0.8435	0.9107	1.0000	
Dust Oxide	0.7439	0.9831	0.9952	0.9326	0.9471	0.9679	0.9780	0.9598	0.9777	0.9424	0.8612	1.0000

TABLE SI-10B

Bishkek Coarse	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	Coarse PM	Dust Oxide
Na	1.0000											
Mg	0.7874	1.0000										
Al	0.7405	0.9607	1.0000									
K	0.7147	0.9007	0.9250	1.0000								
Ca	0.6952	0.9588	0.8934	0.8295	1.0000							
Sc	0.7442	0.8971	0.9519	0.8923	0.7607	1.0000						
Ti	0.6593	0.9246	0.9439	0.9600	0.9068	0.8614	1.0000					
Mn	0.6744	0.9187	0.9389	0.9844	0.8528	0.9018	0.9736	1.0000				
Fe	0.6508	0.9296	0.9366	0.9431	0.9324	0.8296	0.9915	0.9540	1.0000			
Rb	0.7195	0.9296	0.9581	0.9837	0.8446	0.9387	0.9517	0.9815	0.9326	1.0000		
Coarse PM	0.6323	0.8012	0.7974	0.8565	0.7441	0.7580	0.8148	0.8558	0.7987	0.8492	1.0000	
Dust Oxide	0.7528	0.9799	0.9921	0.9372	0.9376	0.9228	0.9649	0.9498	0.9646	0.9593	0.8126	1.0000

TABLE SI-10C

Bishkek PM2.5	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	PM2.5	Dust Oxide
Na	1.0000											
Mg	0.7340	1.0000										
Al	0.8078	0.9615	1.0000									
K	0.9053	0.7875	0.8775	1.0000								
Ca	0.7768	0.9890	0.9484	0.8029	1.0000							
Sc	0.7923	0.9647	0.9805	0.8545	0.9587	1.0000						
Ti	0.8388	0.9457	0.9862	0.8956	0.9433	0.9650	1.0000					
Mn	0.8811	0.8997	0.9626	0.9514	0.9063	0.9417	0.9757	1.0000				
Fe	0.8507	0.9448	0.9879	0.9068	0.9421	0.9645	0.9961	0.9808	1.0000			
Rb	0.8938	0.7751	0.8630	0.9798	0.8021	0.8473	0.8864	0.9494	0.9016	1.0000		
PM2.5	0.5103	0.6613	0.6660	0.6110	0.6475	0.6788	0.6510	0.6147	0.6374	0.5600	1.0000	
Dust Oxide	0.8325	0.9657	0.9978	0.8947	0.9596	0.9817	0.9902	0.9717	0.9925	0.8822	0.6665	1.0000

TABLE SI-11A												
Lidar PM10	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	PM10	Dust Oxide
Na	1.0000											
Mg	0.9836	1.0000										
Al	0.9751	0.9974	1.0000									
K	0.9712	0.9824	0.9812	1.0000								
Ca	0.9793	0.9961	0.9943	0.9800	1.0000							
Sc	0.9749	0.9964	0.9956	0.9857	0.9922	1.0000						
Ti	0.9655	0.9872	0.9876	0.9945	0.9883	0.9883	1.0000					
Mn	0.9715	0.9882	0.9860	0.9957	0.9890	0.9902	0.9980	1.0000				
Fe	0.9734	0.9936	0.9950	0.9908	0.9949	0.9931	0.9963	0.9955	1.0000			
Rb	0.9869	0.9967	0.9956	0.9892	0.9946	0.9929	0.9907	0.9919	0.9961	1.0000		
PM10	0.9426	0.9616	0.9576	0.9762	0.9563	0.9665	0.9724	0.9776	0.9676	0.9653	1.0000	
Dust Oxide	0.9791	0.9983	0.9995	0.9855	0.9964	0.9964	0.9909	0.9902	0.9971	0.9976	0.9618	1.0000

TABLE SI-11B												
Lidar Coarse	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	Coarse PM	Dust Oxide
Na	1.0000											
Mg	0.9167	1.0000										
Al	0.8999	0.9947	1.0000									
K	0.8834	0.9643	0.9682	1.0000								
Ca	0.8839	0.9837	0.9824	0.9663	1.0000							
Sc	0.9173	0.9918	0.9884	0.9660	0.9729	1.0000						
Ti	0.8546	0.9669	0.9709	0.9898	0.9740	0.9643	1.0000					
Mn	0.8722	0.9697	0.9698	0.9923	0.9790	0.9696	0.9965	1.0000				
Fe	0.8791	0.9819	0.9863	0.9855	0.9903	0.9766	0.9911	0.9920	1.0000			
Rb	0.8953	0.9879	0.9902	0.9795	0.9924	0.9755	0.9814	0.9838	0.9941	1.0000		
Coarse PM	0.8516	0.9390	0.9382	0.9589	0.9558	0.9352	0.9600	0.9685	0.9632	0.9565	1.0000	
Dust Oxide	0.9067	0.9956	0.9987	0.9762	0.9886	0.9895	0.9779	0.9788	0.9919	0.9945	0.9485	1.0000

TABLE SI-11C												
Lidar PM2.5	Na	Mg	Al	K	Ca	Sc	Ti	Mn	Fe	Rb	PM2.5	DUST Oxide
Na	1.0000											
Mg	0.7959	1.0000										
Al	0.8045	0.9988	1.0000									
K	0.7000	0.9606	0.9560	1.0000								
Ca	0.8092	0.9965	0.9977	0.9511	1.0000							
Sc	0.7973	0.9981	0.9989	0.9544	0.9959	1.0000						
Ti	0.7411	0.9885	0.9837	0.9824	0.9810	0.9832	1.0000					
Mn	0.7363	0.9865	0.9809	0.9843	0.9783	0.9809	0.9987	1.0000				
Fe	0.7726	0.9974	0.9955	0.9720	0.9928	0.9948	0.9951	0.9932	1.0000			
Rb	0.7490	0.9903	0.9858	0.9873	0.9819	0.9855	0.9966	0.9973	0.9946	1.0000		
PM2.5	0.5649	0.8627	0.8566	0.9230	0.8543	0.8543	0.9060	0.9135	0.8845	0.9001	1.0000	
DUST Oxide	0.8157	0.9987	0.9995	0.9591	0.9978	0.9981	0.9849	0.9824	0.9957	0.9872	0.8594	1.0000