## 4.4 Statistical Summaries

Statistical summaries for selected variables at all sites where those variables were measured are given in this section. The statistics reported for each variable at each site are the number of observations, maximum, 90th percentile, 75th percentile, median or 50th percentile, mean, and the minimum. Every table has the sites sorted in descending order by the mean value; thus, the first site listed in each table has the highest mean concentration during the WHITEX study period for the variable reported.

Table 4.3 has summaries of extinction and scattering ($km^{-1}$) for the three major sites (Page, Hopi, and Canyonlands), as well as scattering at Bullfrog. Extinction and Scattering were gathered on a six hour time schedule beginning January 3 allowing a maximum of 185 observations. In the case of extinction, fewer than the maximum number of observations were reported as clouds obscured the transmissometer sight path during inclement weather. As previously noted, many extinction observations were missing at Hopi and Canyonlands during the high sulfate episode in mid-February. However, Page, being at a lower elevation, was least affected by the weather and extinction was measured during the episode. Hopi was most affected by the weather and reports only 137 extinction observations.

The highest extinction of 0.12 $km^{-1}$ was reported at Page during the major mid-February episode when the other sites (Hopi and Canyonlands) were obscured by clouds. The peak value of scattering for all sights was .14 $km^{-1}$ and occurred at Bullfrog during the major mid-February episode. For extinction, Page has the highest values for all statistics reported. Bullfrog is highest in all categories for scattering. In either case (extinction or scattering), Page is followed by Canyonlands then Hopi.

Table 4.3: Scattering ($km^{-1}$) at Hopi, Page, Canyonlands, and Bullfrog and extinction ($km^{-1}$) at Hopi, Page, and Canyonlands.

(a) SCATTERING ($km^{-1}$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| BULLFROG | 185 | 0.0152 | 0.1440 | 0.0367 | 0.0290 | 0.0250 | 0.0207 | 0.0115 |
| PAGE | 185 | 0.0080 | 0.0600 | 0.0350 | 0.0260 | 0.0230 | 0.0210 | 0.0108 |
| CANYONLANDS | 185 | 0.0057 | 0.0390 | 0.0295 | 0.0238 | 0.0206 | 0.0195 | 0.0113 |
| HOPI POINT | 169 | 0.0040 | 0.0400 | 0.0215 | 0.0186 | 0.0162 | 0.0153 | 0.0109 |

(b) EXTINCTION ($km^{-1}$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 173 | 0.0180 | 0.1200 | 0.0380 | 0.0310 | 0.0280 | 0.0255 | 0.0115 |
| CANYONLANDS | 165 | 0.0064 | 0.0470 | 0.0348 | 0.0297 | 0.0264 | 0.0258 | 0.0150 |
| HOPI POINT | 137 | 0.0040 | 0.0300 | 0.0223 | 0.0182 | 0.0161 | 0.0148 | 0.0093 |

Table 4.4 has summaries for fine particle mass and the primary constituents of fine particle mass (sulfates, nitrates, organic carbon, elemental carbon, and fine soil). IMPROVE Fine mass was measured on a 12 hour cycle starting at 0800 and 1400 hours for a possible maximum of 92

samples. The maximum number of IMPROVE samples reported occurred at Page with 83 samples; however, no data exist at Cisco after February 3 and only 44 IMPROVE samples are reported there. SFU data are on a 24 hour cycle beginning at 0800 hours at Wupatki, Navajo, and Bryce Canyon.

The data at Meadview were derived from SCISAS data that were on a 24 hour cycle with a start time of 0000 hours. For simplicity, the original data have been analyzed for this section. At Meadview, nitrates and fine mass were measured on a daily basis, there are no nitrate data after Julian day 32. The elemental and carbon data were measured once every three days for a possible maximum of 16 data points. Fine soil was calculated from the elemental data yielding 16 data points.

The values reported here for fine mass are gravimetric and have blank filter values subtracted from them yielding negative minimum values for some sites. Similarly, although not gravimetric, the other species are blank corrected causing negative minimum values and percentile values at some sites.

Wupatki reports the highest maximum and mean values for fine mass of 22.4 $\mu g/m^3$ and 5.29 $\mu g/m^3$, respectively. Based on mean values, Page ranks fifth behind Wupatki, Cisco, Green River, and Mexican Hat. Hopi has the lowest mean concentration of fine mass. The other statistics, except minimums, roughly follow the mean values in descending order; the exceptions to this would be at Canyonlands which has an unusually low maximum and 90th percentile for it ranking, and Bryce Canyon which has an unusually high maximum and 90th percentile.

Sulfate ion mass was measured on a 6 hour schedule with a maximum of 167 values reported at Hopi. Page has the least with 133 values reported. The highest mean sulfate readings were reported at Page with a mean value of 0.996 $\mu g/m^3$. However, the maximum sulfate reading occurred at Bullfrog with a value of 4.27 $\mu g/m^3$. The other statistics followed the ranking according to mean values with Hopi reporting the lowest values.

Nitrate was measured at 6 sites (the three major sites, Bullfrog, Meadview and Bryce Canyon). Meadview and Bryce Canyon nitrate are SCISAS values on a 12 hour schedule giving 85 samples at Bryce Canyon. The remaining sites have IMPROVE values reported which were sampled on a 24 hour schedule yielding a minimum of 40 values at Page and a maximum of 42 values for Bullfrog and Hopi.

Based on mean concentrations of nitrate, Page is fourth in line after Meadview, Bryce Canyon, and Canyonlands with a mean concentration of .238 $\mu g/m^3$. Meadview reported the highest maximum and mean concentrations of 1.1289 $\mu g/m^3$ and 0.6454 $\mu g/m^3$, respectively. All other statistics follow roughly the same order as determined by mean values with Hopi being lowest for all statistics.

Organic and light absorbing carbon was measured at the same 6 sites as nitrates. SCISAS values are reported at Meadview and Bryce Canyon and the other sites report IMPROVE values. Based on mean values, Page has the highest concentrations of both organic and light absorbing carbon with values of 0.995 $\mu g/m^3$ and 0.52 $\mu g/m^3$, respectively. Hopi has the lowest mean concentration of organic carbon with a value of 0.077 $\mu g/m^3$ and Bryce Canyon has the lowest light absorbing carbon mean concentration of 0.033 $\mu g/m^3$. All statistics, with the exception of minimums, follow the ranking determined determined by mean values.

Fine soil concentrations at all 13 sites are calculated from concentrations of aluminum, silicon, potassium, calcium, titanium, and iron assuming they exist as oxides. IMPROVE data are on a 12 hour schedule, and the SFU and SCISAS data are on a 24 hour schedule. Mexican Hat has the highest mean concentration of fine soil, reporting 0.3644 $\mu g/m^3$. Hopi is close to the bottom with a mean concentration of 0.232 $\mu g/m^3$. The lowest mean concentration was at Hite at 0.1891 $\mu g/m^3$.

Fine soil is unique in that none of its other statistics follow the ranking based on mean concentrations. For example, Mexican Hat, which has the highest mean concentration, reports a maximum

of 1.30 $\mu g/m^3$. Monticello, which is sixth in line based on mean values, has the highest maximum concentration with 1.93 $\mu g/m^3$ being reported.

Sulfate data are reported at only four sites: Page, Hopi, Canyonlands and Bullfrog. Assuming that elemental sulfur exits as sulfate it is interesting to examine sulfur concentrations at all sites by scaling the sulfate values to the element sulfur. Table 4.5 has statistics for elemental sulfur for all sites. The number of observations is largest for the four sulfate sites where sulfate was measured on a 6 hour schedule. The remaining sites are either 12 hour IMPROVE or 24 hour SCISAS or SFU data.

Green River has the highest mean sulfur concentration of $.345\mu g/m^3$ while Page is a close second with a mean of $.332\mu g/m^3$. In terms of maximum sulfur values, Bullfrog is highest with $4.74\mu g/m^3$ and Page is again a close second with $4.27\mu g/m^3$. The site with the least sulfur is Bryce Canyon with a mean concentration of 0.113 $\mu g/m^3$. The maximum and minimum values do not follow the rankings based on mean concentrations. For example, Bullfrog, which has the highest maximum, has the sixth highest mean, and the highest minimum belongs to Meadview which is second to last in mean concentrations. The remaining statistics, with minor exceptions, follow the rankings based on mean concentrations.

Table 4.4: Statistical summary of fine particulate mass ($\mu g/m^3$), and the constituents of fine mass ($\mu g/m^3$) during the WHITEX study period.

(a) FINE PARTICLE MASS ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| WUPATKI | 43 | 4.5103 | 22.4 | 10.76 | 6.2000 | 5.2954 | 4.0000 | 0.0000 |
| CISCO | 44 | 2.6443 | 11.116 | 8.7898 | 6.7691 | 5.1343 | 5.2468 | -.5947 |
| GREEN RIVER | 81 | 2.0408 | 11.186 | 6.8245 | 5.6811 | 4.3887 | 4.3482 | 0.5213 |
| MEXICAN HAT | 71 | 2.0798 | 8.8410 | 6.8860 | 5.9643 | 4.2306 | 4.4589 | 0.7964 |
| PAGE | 83 | 1.7460 | 8.9800 | 6.2670 | 4.9260 | 3.9800 | 3.9122 | 1.0043 |
| CANYONLANDS | 82 | 1.2313 | 5.6330 | 4.3188 | 3.7419 | 2.8363 | 2.9051 | 0.0646 |
| BULLFROG | 82 | 1.3368 | 8.9360 | 3.8889 | 3.4319 | 2.5685 | 2.4335 | 0.2026 |
| NAVAJO | 42 | 1.1014 | 6.2000 | 3.9700 | 3.2250 | 2.5667 | 2.5000 | 0.7000 |
| BRYCE CANYON | 39 | 1.9704 | 9.2410 | 6.0840 | 2.5640 | 2.3084 | 1.7350 | 0.3000 |
| HITE | 80 | 1.4212 | 6.5716 | 4.2099 | 3.0205 | 2.1586 | 2.0208 | -1.399 |
| MONTICELLO | 72 | 1.3119 | 5.5522 | 3.8829 | 3.1929 | 2.1477 | 2.0709 | -.7794 |
| MEADVIEW | 49 | 0.7150 | 3.5555 | 2.5679 | 2.1109 | 1.6848 | 1.6364 | 0.3886 |
| HOPI POINT | 82 | 1.2060 | 5.2600 | 3.1859 | 2.4430 | 1.5762 | 1.5554 | -.8829 |

(b) SULFATE ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 133 | 0.8170 | 4.2700 | 2.2210 | 1.1400 | 0.9960 | 0.8556 | 0.0472 |
| BULLFROG | 166 | 0.6101 | 4.7450 | 1.2923 | 1.0147 | 0.7967 | 0.6690 | 0.0315 |
| CANYONLANDS | 163 | 0.3644 | 1.8880 | 1.2676 | 0.9445 | 0.7271 | 0.6835 | 0.0427 |
| HOPI POINT | 167 | 0.4020 | 1.9600 | 1.0493 | 0.7123 | 0.4956 | 0.3635 | -.0097 |

(c) NITRATE ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| MEADVIEW | 29 | 0.2468 | 1.1289 | 0.8111 | 0.6469 | 0.4711 | 0.4556 | 0.1552 |
| BRYCE CANYON | 85 | 0.2473 | 1.1240 | 0.7720 | 0.6185 | 0.4153 | 0.3331 | 0.0669 |
| CANYONLANDS | 41 | 0.1645 | 0.7430 | 0.5399 | 0.3540 | 0.2556 | 0.2374 | 0.0318 |
| PAGE | 40 | 0.1800 | 0.8900 | 0.4580 | 0.2940 | 0.2380 | 0.2054 | 0.0221 |
| BULLFROG | 42 | 0.0895 | 0.3810 | 0.2608 | 0.1684 | 0.1172 | 0.0956 | -.0218 |
| HOPI POINT | 42 | 0.1200 | 0.5000 | 0.1929 | 0.1089 | 0.0938 | 0.0588 | -.0122 |

Table 4.6 has summaries of $CD_4$ concentrations at the eight $CD_4$ receptors using fully scaled $CD_4$ at Hopi and Page. As discussed earlier, the fully scaled $CD_4$ data at Page are time averaged to 12 hour data yielding fewer data points than the unscaled $CD_4$ data set. Averaging to 12 hour data at Page puts the scaled $CD_4$ on the same time frame that will be used in subsequent analysis. At the satellite sites samples were collected over extended time periods, on the order of four days, yielding very few data points.

The mean fully scaled $CD_4$ concentration at Page of 0.00587 ppt, is highest for all sites; Hopi has the second highest mean concentration of fully scaled $CD_4$ of 0.00293 ppt. All statistics, other than minimums, followed the rankings based on mean values except for Green River. Maximum and 90th percentile values at Green River seem to be out of line; but, only 3 samples were obtained at the Green River monitoring site. Minimum values do not seem to be associated with any particular site. Page, which has the highest mean, and the highest maximum, also has the lowest minimum value of 0.00 ppt. Hopi has the second highest minimum of 0.00034 ppt, and Hite has the highest minimum of 0.00037 ppt.

Statistical summaries of selenium, arsenic, copper, lead, zinc, and bromine are given in Table 4.7. The data values are either IMPROVE (12 hour) with a maximum of 83 data points, or SCISAS (24 hour) giving a maximum of 42 data points. At Hopi Point, 24 hour SCISAS selenium data dissagregated to 12 hour data, as discussed earlier, are described. Page has the highest mean concentrations of selenium ($1.13 ng/m^3$) and bromine ($1.24 ng/m^3$) for the 13 sites listed. However, Page is fifth in line for mean concentrations of arsenic and zinc, third in line for copper, and seventh in line for lead. The minimum values are almost uniformly zero across all sites and for some elements, such as lead and selenium, many median values are zero.

Summaries of other elements measured during the WHITEX study period are give in Table 4.8. Of the six elements summarized iron ( indicative of soil) nickel and potassium were significant across all sites, the other three elements, strontium, rubidium, and zirconium were below detection limits almost all the time for all sites.

Table 4.4: Statistical summary of fine particulate mass ($\mu g/m^3$), and the constituents of fine mass ($\mu g/m^3$) during the WHITEX study period (continued).

(d) ORGANIC CARBON ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 82 | 0.5900 | 3.0300 | 1.6340 | 1.2630 | 0.9550 | 0.8922 | -.2577 |
| CANYONLANDS | 83 | 0.4419 | 2.3780 | 0.9997 | 0.7339 | 0.4439 | 0.4299 | -.3183 |
| BULLFROG | 84 | 0.7854 | 5.7690 | 0.7289 | 0.5051 | 0.3921 | 0.2445 | -.3431 |
| MEADVIEW | 15 | 0.1511 | 0.6341 | 0.5668 | 0.3712 | 0.2738 | 0.2692 | 0.0701 |
| BRYCE CANYON | 85 | 0.1274 | 0.6310 | 0.4500 | 0.3842 | 0.2695 | 0.2419 | 0.0961 |
| HOPI POINT | 84 | 0.2720 | 1.2200 | 0.2928 | 0.2242 | 0.0771 | 0.0708 | -.4923 |

(e) ELEMENTAL CARBON ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 82 | 0.3600 | 2.1000 | 0.9140 | 0.6980 | 0.5020 | 0.4584 | -.0677 |
| BULLFROG | 84 | 0.2912 | 1.9200 | 0.7013 | 0.4285 | 0.3491 | 0.2950 | -.0562 |
| CANYONLANDS | 83 | 0.1973 | 0.8110 | 0.5131 | 0.4258 | 0.2870 | 0.2721 | -.1206 |
| HOPI POINT | 84 | 0.1250 | 0.7000 | 0.3002 | 0.2272 | 0.1644 | 0.1595 | -.0868 |
| MEADVIEW | 45 | 0.0244 | 0.1082 | 0.0717 | 0.0433 | 0.0375 | 0.0298 | 0.0078 |
| BRYCE CANYON | 85 | 0.0162 | 0.0750 | 0.0570 | 0.0433 | 0.0329 | 0.0277 | 0.0134 |

(f) SOIL ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| MEXICAN HAT | 71 | 0.2458 | 1.3008 | 0.6458 | 0.4934 | 0.3644 | 0.2928 | 0.0488 |
| MEADVIEW | 16 | 0.2277 | 0.8407 | 0.7824 | 0.5601 | 0.3604 | 0.2863 | 0.1147 |
| WUPATKI | 41 | 0.2477 | 1.1166 | 0.6876 | 0.4165 | 0.3360 | 0.2327 | 0.0526 |
| NAVAJO | 42 | 0.3331 | 1.6082 | 0.5757 | 0.3696 | 0.3011 | 0.1975 | 0.0158 |
| GREEN RIVER | 81 | 0.1575 | 0.7514 | 0.5573 | 0.3978 | 0.2987 | 0.2615 | 0.0726 |
| MONTICELLO | 72 | 0.3226 | 1.9253 | 0.4636 | 0.3173 | 0.2908 | 0.2041 | 0.0140 |
| PAGE | 71 | 0.1380 | 0.6500 | 0.4910 | 0.3750 | 0.2870 | 0.2728 | 0.0472 |
| CISCO | 44 | 0.1835 | 0.8645 | 0.6429 | 0.2661 | 0.2725 | 0.2111 | 0.0537 |
| BRYCE CANYON | 39 | 0.2950 | 1.7560 | 0.4880 | 0.2856 | 0.2468 | 0.1463 | 0.0459 |
| CANYONLANDS | 81 | 0.1663 | 0.9640 | 0.4684 | 0.2371 | 0.2319 | 0.1778 | 0.0885 |
| HOPI POINT | 81 | 0.1620 | 0.8500 | 0.4572 | 0.2872 | 0.2319 | 0.1676 | 0.0714 |
| BULLFROG | 82 | 0.1316 | 0.8060 | 0.3599 | 0.2230 | 0.2020 | 0.1707 | 0.0635 |
| HITE | 80 | 0.1687 | 0.8724 | 0.4816 | 0.2027 | 0.1891 | 0.1378 | 0.0083 |

Table 4.5: Statistical summary of elemental sulfur concentrations ($\mu g/m^3$) during the WHITEX study period.

ELEMENTAL SULFUR ($\mu g/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| GREEN RIVER | 81 | 0.1913 | 1.0960 | 0.5786 | 0.4217 | 0.3451 | 0.3141 | 0.0398 |
| PAGE | 133 | 0.2723 | 4.2724 | 0.7403 | 0.3801 | 0.3320 | 0.2852 | 0.0157 |
| CISCO | 44 | 0.1243 | 0.5759 | 0.4868 | 0.3811 | 0.3031 | 0.2847 | 0.0297 |
| MEXICAN HAT | 71 | 0.1421 | 0.6048 | 0.4602 | 0.3732 | 0.2920 | 0.3016 | 0.0169 |
| HITE | 80 | 0.1840 | 1.0732 | 0.4655 | 0.3676 | 0.2826 | 0.2599 | 0.0216 |
| BULLFROG | 166 | 0.2034 | 4.7449 | 0.4308 | 0.3382 | 0.2656 | 0.2230 | 0.0105 |
| CANYONLANDS | 163 | 0.1215 | 1.8883 | 0.4225 | 0.3149 | 0.2424 | 0.2278 | 0.0142 |
| MONTICELLO | 72 | 0.1559 | 0.8355 | 0.3870 | 0.3274 | 0.2421 | 0.2020 | 0.0336 |
| WUPATKI | 43 | 0.1331 | 0.7264 | 0.3779 | 0.2792 | 0.2238 | 0.2343 | 0.0000 |
| NAVAJO | 42 | 0.0981 | 0.4774 | 0.3025 | 0.2360 | 0.1662 | 0.1416 | 0.0197 |
| HOPI POINT | 167 | 0.1341 | 1.9556 | 0.3498 | 0.2374 | 0.1652 | 0.1212 | −.0032 |
| MEADVIEW | 16 | 0.0860 | 0.3067 | 0.2815 | 0.2466 | 0.1589 | 0.1461 | 0.0405 |
| BRYCE CANYON | 39 | 0.0699 | 0.2805 | 0.2276 | 0.1592 | 0.1125 | 0.1061 | 0.0053 |

Table 4.6: Statistical summary of $CD_4$ (ppt) at eight receptor sites using fully scaled $CD_4$ at Page and Hopi.

$CD_4$ (ppt)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 32 | .00803 | .04328 | .01066 | .00781 | .00587 | .00421 | .00000 |
| HOPI POINT | 36 | .00192 | .01051 | .00470 | .00388 | .00293 | .00285 | .00034 |
| HITE | 2 | .00171 | .00279 | .00279 | .00279 | .00158 | .00158 | .00037 |
| BULLFROG | 20 | .00102 | .00288 | .00275 | .00207 | .00101 | .00077 | .00009 |
| GREEN RIVER | 3 | .00040 | .00093 | .00093 | .00093 | .00053 | .00053 | .00013 |
| CANYONLANDS | 20 | .00057 | .00253 | .00111 | .00050 | .00045 | .00023 | .00009 |
| MEXICAN HAT | 4 | .00040 | .00095 | .00095 | .00087 | .00046 | .00041 | .00008 |
| MONTICELLO | 3 | .00020 | .00049 | .00049 | .00049 | .00029 | .00028 | .00009 |

Table 4.7: Statistical summary of concentrations for the trace elements selenium, arsenic, copper, lead, zinc, and bromine ($ng/m^3$).

(a) SELENIUM ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 83 | 1.1400 | 5.3000 | 2.5400 | 1.7300 | 1.1300 | 0.8200 | 0.0000 |
| CISCO | 44 | 0.5200 | 2.1000 | 1.3400 | 0.6600 | 0.4100 | 0.2600 | 0.0000 |
| MEXICAN HAT | 71 | 0.5900 | 2.3200 | 1.2800 | 0.7800 | 0.4000 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 0.6100 | 2.6000 | 1.3600 | 0.6600 | 0.3700 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.4100 | 1.8300 | 0.8100 | 0.5400 | 0.3400 | 0.2800 | 0.0000 |
| WUPATKI | 43 | 0.4800 | 2.0000 | 1.1000 | 0.5000 | 0.2700 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.2600 | 0.9100 | 0.5600 | 0.3300 | 0.1700 | 0.0000 | 0.0000 |
| HOPI POINT | 82 | 0.1200 | 0.6000 | 0.3200 | 0.2200 | 0.1600 | 0.1500 | 0.0000 |
| HITE | 80 | 0.2500 | 0.9300 | 0.5700 | 0.2500 | 0.1400 | 0.0000 | 0.0000 |
| MONTICELLO | 72 | 0.2500 | 1.0300 | 0.5500 | 0.0000 | 0.1300 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 0.2700 | 1.1000 | 0.6700 | 0.0000 | 0.1100 | 0.0000 | 0.0000 |
| MEADVIEW | 15 | 0.1179 | 0.3416 | 0.3219 | 0.1230 | 0.0907 | 0.0947 | -.0540 |
| BRYCE CANYON | 39 | 0.1600 | 0.8000 | 0.2000 | 0.0000 | 0.0500 | 0.0000 | 0.0000 |

(b) ARSENIC ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| CISCO | 44 | 0.9100 | 3.5000 | 1.8600 | 1.4600 | 0.8300 | 0.6800 | 0.0000 |
| GREEN RIVER | 81 | 0.7200 | 3.1000 | 1.8200 | 1.3300 | 0.7800 | 0.7700 | 0.0000 |
| MONTICELLO | 72 | 0.8600 | 3.2100 | 2.0100 | 0.9600 | 0.6000 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 0.6400 | 2.7600 | 1.3900 | 0.9900 | 0.5300 | 0.3100 | 0.0000 |
| PAGE | 83 | 0.5200 | 2.2000 | 1.1500 | 0.8300 | 0.5200 | 0.4600 | 0.0000 |
| WUPATKI | 43 | 0.6100 | 2.0000 | 1.5000 | 0.9000 | 0.4900 | 0.2000 | 0.0000 |
| BULLFROG | 82 | 0.4000 | 1.9300 | 0.8800 | 0.6100 | 0.3600 | 0.2800 | 0.0000 |
| HOPI POINT | 81 | 0.7100 | 3.8000 | 1.2800 | 0.3900 | 0.3300 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.3000 | 1.1500 | 0.7200 | 0.5600 | 0.3200 | 0.3000 | 0.0000 |
| NAVAJO | 42 | 0.5400 | 2.0000 | 1.2100 | 0.4000 | 0.3000 | 0.0000 | 0.0000 |
| MEADVIEW | 15 | 0.5438 | 1.8700 | 1.531 | 0.1265 | 0.2389 | 0.1053 | −.0050 |
| HITE | 80 | 0.3800 | 2.0300 | 0.6500 | 0.4300 | 0.2100 | 0.0000 | 0.0000 |
| BRYCE CANYON | 39 | 0.1200 | 0.5000 | 0.0000 | 0.0000 | 0.0300 | 0.0000 | 0.0000 |

Table 4.7: Statistical summary of concentrations for trace elements selenium, arsenic, copper, lead, zinc, and bromine (continued).

(c) COPPER ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| BRYCE CANYON | 39 | 6.6200 | 41.6 | 2.5000 | 1.4000 | 1.9200 | 0.8000 | 0.0000 |
| WUPATKI | 43 | 0.9000 | 4.6000 | 2.1000 | 1.5000 | 1.0400 | 0.8000 | 0.0000 |
| MEADVIEW | 14 | 1.318 | 4.5250 | 3.942 | 1.1200 | 1.0100 | 0.5305 | 0.0372 |
| PAGE | 83 | 0.4400 | 2.6000 | 0.9800 | 0.6500 | 0.4700 | 0.3500 | 0.0000 |
| HOPI POINT | 81 | 0.6900 | 4.9000 | 0.8200 | 0.4600 | 0.3800 | 0.1900 | 0.0000 |
| MONTICELLO | 72 | 0.6500 | 3.5500 | 0.8600 | 0.4000 | 0.3500 | 0.0900 | 0.0000 |
| NAVAJO | 42 | 0.4000 | 1.9000 | 0.8400 | 0.3300 | 0.2800 | 0.2000 | 0.0000 |
| GREEN RIVER | 81 | 0.3100 | 1.6000 | 0.6700 | 0.4000 | 0.2300 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.9300 | 8.4800 | 0.2800 | 0.1800 | 0.2100 | 0.0400 | 0.0000 |
| CISCO | 44 | 0.3200 | 1.5000 | 0.4000 | 0.3300 | 0.2000 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 0.2800 | 1.2900 | 0.5700 | 0.3300 | 0.1900 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.1600 | 0.7600 | 0.3300 | 0.2000 | 0.1200 | 0.0700 | 0.0000 |
| HITE | 80 | 0.1500 | 0.5700 | 0.3500 | 0.1300 | 0.0800 | 0.0000 | 0.0000 |

(d) LEAD ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| CISCO | 44 | 2.5000 | 9.5000 | 5.6900 | 2.9300 | 1.4900 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 3.2500 | 24.77 | 3.7300 | 1.9100 | 1.3700 | 0.0000 | 0.0000 |
| MEADVIEW | 48 | 0.9700 | 3.3700 | 3.3000 | 1.7700 | 1.3100 | 0.9400 | -.0030 |
| MONTICELLO | 72 | 2.3600 | 12 | 4.9800 | 1.2300 | 1.2500 | 0.0000 | 0.0000 |
| BRYCE CANYON | 39 | 1.2300 | 3.5000 | 2.9000 | 2.2000 | 1.1000 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 1.7800 | 6.6000 | 4.4400 | 1.9100 | 1.0400 | 0.0000 | 0.0000 |
| PAGE | 83 | 1.7200 | 7.1000 | 3.5800 | 1.5900 | 0.9800 | 0.0000 | 0.0000 |
| HOPI POINT | 81 | 1.9100 | 12.2 | 1.9100 | 1.3200 | 0.9700 | 0.0000 | 0.0000 |
| WUPATKI | 43 | 1.3800 | 5.1000 | 3.2000 | 1.0000 | 0.7000 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 1.1100 | 4.6000 | 2.0100 | 0.8500 | 0.5600 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.6600 | 3.6600 | 0.9600 | 0.0000 | 0.2600 | 0.0000 | 0.0000 |
| HITE | 80 | 0.6000 | 2.4100 | 1.1400 | 0.0000 | 0.2400 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.7200 | 4.5600 | 0.9300 | 0.0000 | 0.2200 | 0.0000 | 0.0000 |

Table 4.7: Statistical summary of concentrations for trace elements selenium, arsenic, copper, lead, zinc, and bromine (continued).

(e) ZINC ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| GREEN RIVER | 81 | 1.7800 | 13 | 4.2400 | 3.0400 | 2.5200 | 2.4100 | 0.0000 |
| BRYCE CANYON | 39 | 4.2200 | 26.8 | 4.4000 | 2.3000 | 2.3700 | 1.5000 | 0.0000 |
| CISCO | 44 | 1.3700 | 8.2000 | 3.9600 | 2.7400 | 2.3600 | 2.1700 | 0.0000 |
| WUPATKI | 43 | 2.6000 | 17.9 | 3.2000 | 2.5000 | 2.1700 | 1.9000 | 0.0000 |
| PAGE | 83 | 1.1600 | 5.9000 | 3.5700 | 2.3200 | 1.7900 | 1.4900 | 0.0000 |
| MEXICAN HAT | 71 | 0.8600 | 4.1200 | 2.4700 | 1.7900 | 1.3400 | 1.2200 | 0.0000 |
| MONTICELLO | 72 | 0.8700 | 4.2700 | 2.5300 | 1.6600 | 1.3000 | 1.2000 | 0.0000 |
| NAVAJO | 42 | 1.7000 | 10.7 | 2.6700 | 1.4000 | 1.2100 | 0.7000 | 0.0000 |
| BULLFROG | 82 | 0.9500 | 5.4900 | 2.1600 | 1.3600 | 1.1500 | 0.9700 | 0.0000 |
| HITE | 80 | 0.9800 | 5.6600 | 2.4200 | 1.3400 | 1.1100 | 0.9600 | 0.0000 |
| HOPI POINT | 81 | 0.9800 | 5.4000 | 2.1600 | 1.2800 | 1.0100 | 0.7200 | 0.0000 |
| MEADVIEW | 6 | 0.9872 | 2.2670 | 2.2670 | 2.1010 | 0.9551 | 0.6265 | −.0130 |
| CANYONLANDS | 82 | 0.5500 | 2.4500 | 1.6800 | 1.2700 | 0.9200 | 0.8700 | 0.0000 |

(f) BROMINE ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| PAGE | 83 | 0.8600 | 3.5000 | 2.3900 | 1.8700 | 1.2400 | 1.3500 | 0.0000 |
| MEADVIEW | 48 | 0.7090 | 2.6400 | 2.5000 | 1.4100 | 1.1600 | 1.0600 | 0.2120 |
| GREEN RIVER | 81 | 1.0400 | 3.5000 | 2.6900 | 1.8600 | 1.1000 | 1.0100 | 0.0000 |
| CISCO | 44 | 1.0200 | 3.7000 | 2.6000 | 1.6700 | 1.0200 | 1.0100 | 0.0000 |
| MEXICAN HAT | 71 | 0.7900 | 3.4700 | 1.9500 | 1.4900 | 0.9100 | 0.9800 | 0.0000 |
| CANYONLANDS | 82 | 0.6100 | 2.1700 | 1.5400 | 1.2700 | 0.7600 | 0.7200 | 0.0000 |
| WUPATKI | 43 | 0.8000 | 2.8000 | 1.8000 | 1.3000 | 0.7300 | 0.6000 | 0.0000 |
| BULLFROG | 82 | 0.6100 | 1.8700 | 1.5700 | 1.1900 | 0.7200 | 0.7700 | 0.0000 |
| HITE | 80 | 0.6800 | 2.6500 | 1.6700 | 1.1700 | 0.6400 | 0.5100 | 0.0000 |
| MONTICELLO | 72 | 0.7500 | 2.4600 | 1.8700 | 1.2800 | 0.6400 | 0.4300 | 0.0000 |
| HOPI POINT | 81 | 0.6000 | 2.9000 | 1.3400 | 0.9300 | 0.6100 | 0.5200 | 0.0000 |
| BRYCE CANYON | 39 | 0.6600 | 2.9000 | 1.2000 | 0.8000 | 0.3900 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 0.4100 | 1.1000 | 1.0000 | 0.7000 | 0.3400 | 0.0000 | 0.0000 |

Table 4.8: Statistical summary of concentrations of iron, nickel, potassium, strontium, rubidium, and zirconium ($\mu g/m^3$).

(a) IRON ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| GREEN RIVER | 81 | 17.66 | 81.9 | 57.07 | 38.67 | 28.53 | 24.61 | 7.1600 |
| WUPATKI | 43 | 13.54 | 61.6 | 35.6 | 23.4 | 18.12 | 13.4 | 0.0000 |
| CISCO | 44 | 11.98 | 67.6 | 35.14 | 17 | 16.67 | 13.06 | 3.6500 |
| PAGE | 83 | 9.0300 | 46.6 | 27.62 | 20.6 | 15.28 | 13.48 | 1.4500 |
| BRYCE CANYON | 39 | 17.05 | 97.3 | 32.4 | 17.3 | 14.68 | 9.3000 | 2.3000 |
| NAVAJO | 42 | 13.86 | 70.2 | 27.6 | 19.73 | 14.52 | 9.5500 | 2.1000 |
| MEXICAN HAT | 71 | 8.9800 | 52.03 | 25.03 | 19.72 | 14.46 | 12.65 | 0.0000 |
| MONTICELLO | 72 | 15.1 | 89.98 | 26.5 | 14.68 | 14.27 | 10.41 | 1.5100 |
| HOPI POINT | 81 | 9.6200 | 46.8 | 25.26 | 16.13 | 12 | 9.0800 | 0.6300 |
| HITE | 80 | 8.3500 | 41.13 | 26.36 | 12.48 | 10.16 | 7.2300 | 1.1000 |
| MEADVIEW | 16 | 6.5530 | 24.37 | 23.06 | 11.2 | 9.5130 | 7.0019 | 2.7340 |
| CANYONLANDS | 82 | 8.0600 | 40.99 | 21.54 | 10.14 | 9.3800 | 6.7300 | 1.8700 |
| BULLFROG | 82 | 7.2400 | 40.27 | 19.18 | 9.6100 | 8.7500 | 6.5900 | 1.4800 |

(b) NICKEL ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| CISCO | 44 | 7.8100 | 46.9 | 7.8600 | 1.6300 | 2.7600 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 2.4900 | 16.3 | 3.5000 | 0.8000 | 1.0900 | 0.2100 | 0.0000 |
| MONTICELLO | 72 | 2.2300 | 14.55 | 2.5200 | 0.6900 | 1.0100 | 0.3200 | 0.0000 |
| MEXICAN HAT | 71 | 0.8700 | 4.3700 | 1.8100 | 0.4900 | 0.4500 | 0.0000 | 0.0000 |
| HITE | 80 | 0.9000 | 6.5600 | 0.9100 | 0.4400 | 0.4000 | 0.0000 | 0.0000 |
| BRYCE CANYON | 39 | 0.3400 | 1.2000 | 0.7000 | 0.3000 | 0.1700 | 0.0000 | 0.0000 |
| MEADVIEW | 14 | 0.1656 | 0.6354 | 0.4710 | 0.1750 | 0.1450 | 0.1240 | −.0180 |
| NAVAJO | 42 | 0.2200 | 1.0000 | 0.5000 | 0.3000 | 0.1400 | 0.0000 | 0.0000 |
| WUPATKI | 43 | 0.2200 | 0.7000 | 0.6000 | 0.0000 | 0.1100 | 0.0000 | 0.0000 |

(c) POTASSIUM ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| CISCO | 44 | 16.03 | 74.6 | 42.92 | 33.37 | 25.2 | 23.28 | 0.0000 |
| GREEN RIVER | 81 | 11.29 | 43.3 | 28.06 | 23.31 | 15.19 | 15.55 | 0.0000 |
| BRYCE CANYON | 39 | 13.88 | 81.7 | 27.4 | 14.8 | 14.58 | 10.4 | 2.2000 |
| MEXICAN HAT | 71 | 11.77 | 62.11 | 26.04 | 20.47 | 14.05 | 12.98 | 0.0000 |
| MONTICELLO | 72 | 13.43 | 71.55 | 28.39 | 15.77 | 13.06 | 9.0000 | 0.0000 |
| WUPATKI | 43 | 12.48 | 45.8 | 33.8 | 14.8 | 11.22 | 8.5000 | 0.0000 |
| MEADVIEW | 16 | 6.4340 | 24.68 | 23.52 | 12.61 | 9.7600 | 7.7590 | 2.3970 |
| HITE | 80 | 6.9500 | 28.85 | 17.2 | 10.79 | 7.9200 | 6.2800 | 0.0000 |
| NAVAJO | 42 | 8.2400 | 33.8 | 20.23 | 8.6500 | 6.5800 | 5.6500 | 0.0000 |

Table 4.8: Statistical summary of concentrations of iron, nickel, potassium, strontium, rubidium, and zirconium (continued).

(d) RUBIDIUM ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| MEADVIEW | 15 | 0.0960 | 0.3500 | 0.287 | 0.2340 | 0.1410 | 0.1170 | 0.0000 |
| BRYCE CANYON | 39 | 0.2200 | 0.9000 | 0.5000 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| HITE | 80 | 0.1100 | 0.5300 | 0.0000 | 0.0000 | 0.0300 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.0500 | 0.2700 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 0.0900 | 0.6000 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| HOPI POINT | 81 | 0.0400 | 0.3000 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 0.0700 | 0.5500 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| MONTICELLO | 72 | 0.0500 | 0.4200 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| CISCO | 44 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 0.0300 | 0.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| PAGE | 83 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| WUPATKI | 43 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

(e) STRONTIUM ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| MEADVIEW | 13 | 0.2460 | 0.8520 | 0.733 | 0.4580 | 0.2880 | 0.2580 | -.0050 |
| BRYCE CANYON | 39 | 0.3600 | 1.5000 | 0.9000 | 0.0000 | 0.1500 | 0.0000 | 0.0000 |
| HOPI POINT | 81 | 0.1400 | 0.6000 | 0.3300 | 0.0000 | 0.0600 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 0.1700 | 0.7000 | 0.3400 | 0.0000 | 0.0600 | 0.0000 | 0.0000 |
| WUPATKI | 43 | 0.2100 | 0.9000 | 0.2000 | 0.0000 | 0.0600 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 0.1300 | 0.6500 | 0.3200 | 0.0000 | 0.0500 | 0.0000 | 0.0000 |
| MONTICELLO | 72 | 0.1800 | 1.0700 | 0.2200 | 0.0000 | 0.0500 | 0.0000 | 0.0000 |
| PAGE | 83 | 0.1300 | 0.6000 | 0.2500 | 0.0000 | 0.0500 | 0.0000 | 0.0000 |
| HITE | 80 | 0.1400 | 0.6500 | 0.0000 | 0.0000 | 0.0400 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.0900 | 0.5200 | 0.1100 | 0.0000 | 0.0300 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.0600 | 0.3300 | 0.0000 | 0.0000 | 0.0200 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 0.0700 | 0.5000 | 0.0000 | 0.0000 | 0.0100 | 0.0000 | 0.0000 |
| CISCO | 44 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Table 4.8: Statistical summary of concentrations of iron, nickel, potassium, strontium, rubidium, and zirconium (continued).

(f) ZIRCONIUM ($ng/m^3$)

| SITE | NO. of OBS | STD DEV | MAX | 90th PRCNTL | 75th PRCNTL | MEAN | MED | MIN |
|---|---|---|---|---|---|---|---|---|
| WUPATKI | 43 | 0.3100 | 1.4000 | 0.7000 | 0.0000 | 0.1200 | 0.0000 | 0.0000 |
| HITE | 80 | 0.2600 | 1.0600 | 0.5900 | 0.0000 | 0.1100 | 0.0000 | 0.0000 |
| NAVAJO | 42 | 0.2400 | 0.9000 | 0.6000 | 0.0000 | 0.1000 | 0.0000 | 0.0000 |
| HOPI POINT | 81 | 0.1700 | 0.5000 | 0.3900 | 0.0000 | 0.0900 | 0.0000 | 0.0000 |
| MONTICELLO | 72 | 0.2000 | 0.8300 | 0.4600 | 0.0000 | 0.0800 | 0.0000 | 0.0000 |
| PAGE | 83 | 0.1700 | 0.6000 | 0.3900 | 0.0000 | 0.0800 | 0.0000 | 0.0000 |
| BRYCE CANYON | 39 | 0.2700 | 1.1000 | 0.0000 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| BULLFROG | 82 | 0.1700 | 0.8200 | 0.4000 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| CANYONLANDS | 82 | 0.1600 | 0.7500 | 0.3500 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| GREEN RIVER | 81 | 0.2300 | 1.1000 | 0.4700 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| MEXICAN HAT | 71 | 0.2300 | 1.0700 | 0.3400 | 0.0000 | 0.0700 | 0.0000 | 0.0000 |
| CISCO | 44 | 0.2100 | 0.9000 | 0.2800 | 0.0000 | 0.0600 | 0.0000 | 0.0000 |
| MEADVIEW | 13 | 0.5620 | 0.3890 | 0.3890 | 0.1640 | −.4070 | −.5410 | −.9340 |

Relative humidity apparently plays an important role in the conversion of $SO_2$ to sulfates; when the relative humidity is high many conversion processes are either triggered or accelerated causing non-linear relationships between predictor variables and sulfate concentrations. One mathematical way of treating this non-linearity is to multiply predictor variables by the relative humidity. Table 4.9 has the statistical summaries of three tracers multiplied by relative humidity; the tracers are $CD_4$, selenium, and arsenic.

## 4.5 Temporal History of Meteorological Data

Figures 4.18 through 4.21 shows the temporal history of extinction, scattering, temperature, relative humidity, wind speed, and wind direction for the three major sites (Canyonlands, Page, and Hopi) and Bullfrog. At Page (Figure 4.18), the meteorological aspects of the episode are evident. The episode begins on JD=41; the winds for several days preceding are light and variable, and the wind directions show a clear diurnal pattern alternating between north at day and south at night, indicating stagnant conditions. The episode is triggered by a dramatic change in the relative humidity; on day 41 through day 44 the relative humidity stays consistently in the range of 85% - 98%, whereas before the episode the humidity is around 35% - 45%. High humidity affects visibility in two ways: first, sulfate production is enhanced; and secondly, the deliquescence point for sulfate aerosol is around 70%. During the episode the amplitude of the diurnal variation of temperature is clearly dampened. Termination of the episode is indicated by a dramatic increase in wind speed, loss of the diurnal wind pattern, and a sudden drop in humidity to around 30% on JD=45.

The other three sites (Figures 4.19 - 4.21) show similar regimes during the episode. However, two of these sites, Hopi and Canyonlands, experience many periods of high relative humidity. Table 4.10 lists the days that precipitation was recorded at the Grand Canyon NOAA weather monitoring station, these days coincide with the times that the transmissometer data are missing at Hopi. Nevertheless, at Hopi, the high relative humidity times are accompanied by increases in scattering.