5.4.3 Nitrates

The scattering efficiency of nitrates is not well known, but according to Tang et al.[12] it should be between approximately 1.1 and 7.0 m^2/g at low relative humidities depending on the particle size distribution. The lowest efficiency corresponds to a highly polydisperse size distribution ($\sigma_g = 2.0$) and the highest efficiency corresponds to a monodisperse size distribution ($\sigma_g = 1.01$) assuming a mass median diameter of 0.98 μm which is based on measurements of Los Angeles aerosols. If the WHITEX nitrate particles actually had a smaller mean diameter, for example if they were similar in size to the sulfate particles, then the scattering efficiency would be higher. Results of the regression analyses indicate that this may be true. The RH corrected scattering efficiencies when b_{ext} is the dependent variable are 5.5±1.5 at Hopi Point, 2.4±1.2 at Canyonlands, and 3.2±1.0 m^2/g for all sites combined. The result for Page was negative, and also not statistically significant.

Most of the nitrate scattering efficiencies estimated by the MLR analyses (see Table 5.26) were statistically significant, and physically reasonable. However, when the regressions were done using b_{scat} as the dependent variable, the results were higher than expected. No RH correction was used when b_{scat} was the dependent variable, but these results indicate that perhaps the nephelometer does not completely dry the particles and that some RH correction is needed. 60% RH may also be too high to use as "low" RH. Similar results were seen for sulfates.

When literature scattering efficiencies are used, the percents of fine particle scattering due to nitrates are 5±0% at Page, 9±1% at Canyonlands, 6±1% at Hopi Point with minimum organics, and 5±0% at Hopi Point with maximum organics. When the MLR efficiency is used, the scattering due to nitrates are 17±1% at Page, 26±2% at Canyonlands, and 16±2% at Hopi Point with both maximum and minimum organics.

5.4.4 Fine Soil Dust

All fine soil regression coefficients except two were statistically insignificant (see Table 5.27). The significant estimates for the scattering efficiency of fine soil dust were 4.4±2.1 and 5.5±2.5 m^2/g. These are more than 3 times greater than the consensus efficiency of 1.3 m^2/g.

Using the literature scattering efficiency, the percentages of fine particle scattering due to fine soil are 2±0% at Page, 3±0% at Canyonlands, 5±1% at Hopi Point with minimum organics, and 4±1% at Hopi Point with maximum organics.. Using the MLR efficiency, the percentages of fine scattering due to fine soil are 3±1 at Page, 4±1 at Canyonlands, 6±1 at Hopi Point with minimum organics, and 5±1% at Hopi Point with maximum organics.

5.5 Time Variations in the Light Extinction Budget

5.5.1 Extinction budgets for Individual Time Periods

Time plots of 12-hour averaged measured and reconstructed scattering and absorption coefficients are shown in Figures 5.22, 5.23, 5.24, and 5.25 and in Tables 5.28-5.35. The scattering and absorption efficiencies used are the consensus literature values. Extinction due to missing particulate or NO_2 data was set to zero unless the missing value was sulfate. If sulfate was missing, then the time period was deleted. Missing data should not cause serious underestimation of the reconstructed extinction since with the exception of NO_2 at all sites and coarse mass at Canyonlands, there were very few missing data.

Table 5.26: Summary of multiple linear regression analyses used to determine nitrate scattering efficiency for 0% RH. Results are in m^2/g.

Site	RH Subgroup	Dependent Variable	†Result for Minimum Organics	†Result for Maximum Organics
Page	All	b_{ext}	*-1.1±2.1	
Page	All	b_{scat}	6.2±2.5	
Page	Low	b_{ext}	*1.6±5.2	
Page	Low	b_{scat}	*3.7±4.7	
Cany	All	b_{ext}	2.4±1.2	
Cany	All	b_{scat}	10.8±1.5	
Cany	Low	b_{ext}	7.4±2.2	
Cany	Low	b_{scat}	9.8±2.1	
Hopi	All	b_{ext}	5.5±1.5	5.7±1.5
Hopi	All	b_{scat}	8.2±1.4	8.2±1.4
Hopi	Low	b_{ext}	8.7±4.0	9.2±4.1
Hopi	Low	b_{scat}	7.8±2.3	7.8±2.3
All	All	b_{ext}	3.2±1.0	3.2±1.0
All	All	b_{scat}	9.0±0.9	9.2±0.9
All	Low	b_{ext}	12.7±1.9	12.7±1.9
All	Low	b_{scat}	10.2±1.2	10.5±1.2

* These values are statistically insignificant ($t > 0.05$).

The independent variables used for each MLR were sulfates, organics, nitrates, absorbing carbon, and coarse mass when the dependent variable was b_{ext}. When the dependent variable was b_{scat}, total carbon was used rather than organics and absorbing carbon.

†When b_{ext} was the dependent variable and all relative humidities were included, sulfates and nitrates were multiplied by the modified Tang relative humidity functions. No RH correction was applied to the other three cases for each site.

When the site is "All" no coarse data were included in the analysis since this would eliminate all Canyonlands data.

Table 5.27: Summary of multiple linear regression analyses used to determine fine soil scattering efficiency. Results are in m^2/g.

Site	RH Subgroup	Dependent Variable	Result for Minimum Organics	Result for Maximum Organics
Page	All	b_{ext}	*4.0±7.0	
Page	All	b_{scat}	*-5.1±3.7	
Page	Low	b_{ext}	*6.2±6.8	
Page	Low	b_{scat}	*-5.2±6.1	
Cany	All	b_{ext}	*1.3±3.3	
Cany	All	b_{scat}	*-1.3±1.7	
Cany	Low	b_{ext}	*0.0±2.3	
Cany	Low	b_{scat}	*-1.2±2.2	
Hopi	All	b_{ext}	4.4±2.1	4.4±2.1
Hopi	All	b_{scat}	*1.7±1.2	*1.6±1.2
Hopi	Low	b_{ext}	5.5±2.5	5.5±2.5
Hopi	Low	b_{scat}	*1.1±1.4	*1.0±1.4
All	All	b_{ext}	*1.5±2.5	*1.3±2.6
All	All	b_{scat}	*-1.5±1.1	*-1.6±1.1
All	Low	b_{ext}	*3.0±2.0	*2.5±2.0
All	Low	b_{scat}	*-1.2±1.2	*-1.3±1.3

*These values are statistically insignificant ($t > 0.05$).
The independent variables used for each MLR were sulfates, organics, nitrates, absorbing carbon, and coarse mass when the dependent variable was b_{ext}. When the dependent variable was b_{scat}, total carbon was used rather than organics and absorbing carbon.

When b_{ext} was the dependent variable and all relative humidities were included, sulfates and nitrates were multiplied by the modified Tang relative humidity functions. No RH correction was applied to the other three cases for each site.

When the site is "All" no coarse mass is included in the regression since this would eliminate all Canyonlands data.

Table 5.28: Extinction coefficients (Km^{-1}) due to each chemical species at Page. The total and measured extinction do not include Rayleigh scattering.

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil	NO2
7.3	. ± .	0.01820 ± 0.00289	0.00975 ± 0.00175	0.00024 ± 0.00013	0.00506 ± 0.00173	0.00173 ± 0.00149	0.00064 ± 0.00024	0.00014 ± 0.00002	0.00061 ± 0.00006
7.8	0.01890 ± 0.00292	0.02057 ± 0.00314	0.01025 ± 0.00185	0.00018 ± 0.00015	0.00726 ± 0.00194	0.00186 ± 0.00161	0.00034 ± 0.00011	0.00009 ± 0.00001	0.00059 ± 0.00006
8.3	0.01865 ± 0.00289	0.02604 ± 0.00253	0.00557 ± 0.00061	0.00031 ± 0.00020	0.01344 ± 0.00200	0.00577 ± 0.00141	0.00020 ± 0.00005	0.00018 ± 0.00002	0.00057 ± 0.00006
8.8	0.01855 ± 0.00288	0.00601 ± 0.00058	0.00491 ± 0.00052	0.00031 ± 0.00023	. ± .	. ± .	0.00025 ± 0.00005	. ± .	0.00054 ± 0.00006
9.3	0.01985 ± 0.00302	0.02795 ± 0.00260	0.00568 ± 0.00061	0.00083 ± 0.00039	0.01146 ± 0.00192	0.00831 ± 0.00159	0.00031 ± 0.00005	0.00021 ± 0.00002	0.00114 ± 0.00012
9.8	0.02510 ± 0.00354	0.02324 ± 0.00233	0.00623 ± 0.00068	-0.00008 ± 0.00030	0.00905 ± 0.00169	0.00612 ± 0.00141	0.00052 ± 0.00007	0.00031 ± 0.00004	0.00108 ± 0.00011
10.3	0.01920 ± 0.00295	0.02164 ± 0.00228	0.00431 ± 0.00046	0.00073 ± 0.00030	0.00902 ± 0.00169	0.00624 ± 0.00142	0.00034 ± 0.00005	0.00016 ± 0.00002	0.00084 ± 0.00009
10.8	0.01910 ± 0.00294	0.01701 ± 0.00209	0.00593 ± 0.00065	0.00157 ± 0.00039	0.00414 ± 0.00146	0.00274 ± 0.00128	0.00043 ± 0.00007	0.00067 ± 0.00007	0.00154 ± 0.00016
11.3	0.01870 ± 0.00290	0.01475 ± 0.00203	0.00452 ± 0.00048	0.00112 ± 0.00032	0.00490 ± 0.00147	0.00282 ± 0.00127	0.00035 ± 0.00005	. ± .	0.00104 ± 0.00011
11.8	0.02120 ± 0.00315	0.01771 ± 0.00213	0.00503 ± 0.00055	0.00060 ± 0.00027	0.00625 ± 0.00155	0.00411 ± 0.00132	0.00043 ± 0.00007	0.00025 ± 0.00003	0.00104 ± 0.00011
12.3	0.01820 ± 0.00285	0.01817 ± 0.00212	0.00499 ± 0.00054	0.00085 ± 0.00030	0.00705 ± 0.00157	0.00314 ± 0.00128	0.00036 ± 0.00005	0.00053 ± 0.00006	0.00126 ± 0.00013
12.8	0.02415 ± 0.00344	0.02104 ± 0.00219	0.00810 ± 0.00089	0.00083 ± 0.00034	0.00546 ± 0.00148	0.00395 ± 0.00129	0.00069 ± 0.00009	0.00038 ± 0.00004	0.00163 ± 0.00017
13.3	0.02530 ± 0.00356	0.02812 ± 0.00245	0.00727 ± 0.00079	0.00206 ± 0.00052	0.00998 ± 0.00176	0.00577 ± 0.00140	0.00101 ± 0.00012	0.00034 ± 0.00004	0.00169 ± 0.00017
14.3	0.01970 ± 0.00300	0.02354 ± 0.00227	0.00491 ± 0.00052	0.00365 ± 0.00065	0.00684 ± 0.00158	0.00539 ± 0.00138	0.00051 ± 0.00007	0.00041 ± 0.00004	0.00183 ± 0.00019
14.8	0.02260 ± 0.00329	0.02404 ± 0.00227	0.00544 ± 0.00059	0.00091 ± 0.00037	0.00763 ± 0.00160	0.00705 ± 0.00144	0.00085 ± 0.00011	0.00044 ± 0.00005	0.00171 ± 0.00018
15.3	0.01515 ± 0.00255	0.02489 ± 0.00222	0.00506 ± 0.00055	0.00125 ± 0.00034	0.00909 ± 0.00163	0.00629 ± 0.00135	0.00175 ± 0.00020	0.00034 ± 0.00004	0.00111 ± 0.00011
15.8	. ± .	0.02510 ± 0.00256	0.01386 ± 0.00170	0.00113 ± 0.00039	0.00307 ± 0.00137	0.00271 ± 0.00123	0.00283 ± 0.00035	0.00041 ± 0.00005	0.00109 ± 0.00011
16.8	0.03280 ± 0.00431	0.01503 ± 0.00222	0.01057 ± 0.00137	0.00056 ± 0.00027	0.00000 ± 0.00127	0.00099 ± 0.00114	0.00151 ± 0.00020	0.00053 ± 0.00006	0.00086 ± 0.00009
19.8	0.01205 ± 0.00223	0.00624 ± 0.00185	0.00329 ± 0.00035	0.00088 ± 0.00024	0.00000 ± 0.00134	0.00075 ± 0.00120	0.00022 ± 0.00004	0.00026 ± 0.00003	0.00084 ± 0.00009
20.3	0.01120 ± 0.00215	0.01169 ± 0.00190	0.00220 ± 0.00024	0.00145 ± 0.00029	0.00316 ± 0.00139	0.00199 ± 0.00122	0.00013 ± 0.00003	0.00047 ± 0.00005	0.00229 ± 0.00023
21.3	0.01005 ± 0.00204	0.01406 ± 0.00199	0.00326 ± 0.00035	0.00151 ± 0.00035	0.00348 ± 0.00143	0.00272 ± 0.00127	0.00031 ± 0.00005	0.00043 ± 0.00005	0.00235 ± 0.00024
21.8	0.01535 ± 0.00257	0.01974 ± 0.00201	0.00543 ± 0.00061	0.00116 ± 0.00032	0.00453 ± 0.00138	0.00443 ± 0.00124	0.00055 ± 0.00008	0.00047 ± 0.00005	0.00316 ± 0.00032
23.3	0.01800 ± 0.00283	0.02358 ± 0.00228	0.00788 ± 0.00087	0.00091 ± 0.00039	0.00523 ± 0.00150	0.00660 ± 0.00142	0.00065 ± 0.00008	0.00049 ± 0.00005	0.00182 ± 0.00019
23.8	0.02060 ± 0.00309	0.03085 ± 0.00268	0.01414 ± 0.00163	0.00094 ± 0.00041	0.00518 ± 0.00148	0.00704 ± 0.00144	0.00100 ± 0.00013	0.00048 ± 0.00005	0.00207 ± 0.00021
24.3	0.01925 ± 0.00295	0.02100 ± 0.00214	0.00757 ± 0.00083	. ± .	0.00516 ± 0.00144	0.00575 ± 0.00133	0.00056 ± 0.00007	0.00041 ± 0.00004	0.00155 ± 0.00016
24.8	0.01705 ± 0.00273	0.02125 ± 0.00213	0.00670 ± 0.00074	0.00101 ± 0.00033	0.00470 ± 0.00141	0.00657 ± 0.00137	0.00070 ± 0.00010	0.00032 ± 0.00003	0.00124 ± 0.00013
25.3	0.01585 ± 0.00262	0.01971 ± 0.00206	0.00353 ± 0.00039	0.00112 ± 0.00034	0.00640 ± 0.00146	0.00669 ± 0.00135	0.00050 ± 0.00007	0.00033 ± 0.00004	0.00113 ± 0.00012
25.8	0.01770 ± 0.00280	0.01866 ± 0.00204	0.00481 ± 0.00056	0.00098 ± 0.00031	0.00422 ± 0.00138	0.00628 ± 0.00134	0.00087 ± 0.00011	0.00032 ± 0.00003	0.00118 ± 0.00012
26.3	0.01375 ± 0.00240	0.02125 ± 0.00210	0.00357 ± 0.00039	0.00129 ± 0.00035	0.00700 ± 0.00150	0.00680 ± 0.00137	0.00073 ± 0.00009	0.00043 ± 0.00005	0.00143 ± 0.00015
26.8	0.01860 ± 0.00289	0.02786 ± 0.00232	0.00506 ± 0.00057	0.00113 ± 0.00039	0.00713 ± 0.00148	0.01101 ± 0.00162	0.00163 ± 0.00020	0.00037 ± 0.00004	0.00154 ± 0.00016
27.3	0.01780 ± 0.00281	0.02951 ± 0.00274	0.00385 ± 0.00043	0.00178 ± 0.00043	0.00469 ± 0.00167	0.01418 ± 0.00205	0.00298 ± 0.00035	0.00049 ± 0.00005	0.00155 ± 0.00016
27.8	0.02600 ± 0.00363	0.05054 ± 0.00336	0.00716 ± 0.00079	0.00181 ± 0.00056	0.01697 ± 0.00220	0.01892 ± 0.00230	0.00342 ± 0.00040	0.00047 ± 0.00005	0.00180 ± 0.00018
28.3	0.02695 ± 0.00372	0.02253 ± 0.00221	0.00327 ± 0.00036	0.00376 ± 0.00068	0.00597 ± 0.00151	0.00666 ± 0.00141	0.00103 ± 0.00013	0.00074 ± 0.00008	0.00110 ± 0.00011
28.8	0.00650 ± 0.00168	0.01175 ± 0.00195	0.00147 ± 0.00017	0.00091 ± 0.00022	0.00000 ± 0.00131	0.00764 ± 0.00142	0.00051 ± 0.00007	0.00018 ± 0.00002	0.00104 ± 0.00011

Table 5.28: Extinction coefficients (Km^{-1}) due to each chemical species at Page. The total and measured extinction do not include Rayleigh scattering (continued from previous page).

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil	NO2
29.3	0.00395 ± 0.00142	0.00276 ± 0.00178	0.00063 ± 0.00008	0.00075 ± 0.00015	0.00000 ± 0.00132	0.00021 ± 0.00118	0.00020 ± 0.00004	0.00016 ± 0.00002	0.00081 ± 0.00008
29.8	0.00625 ± 0.00165	0.01184 ± 0.00189	0.00100 ± 0.00012	0.00140 ± 0.00027	0.00402 ± 0.00138	0.00426 ± 0.00126	0.00023 ± 0.00005	0.00012 ± 0.00001	0.00080 ± 0.00008
30.3	0.00600 ± 0.00163	0.00940 ± 0.00186	0.00125 ± 0.00015	0.00124 ± 0.00023	0.00278 ± 0.00137	0.00237 ± 0.00122	0.00057 ± 0.00008	0.00017 ± 0.00002	0.00102 ± 0.00011
30.8	0.01570 ± 0.00260	0.01873 ± 0.00228	0.00564 ± 0.00120	0.00070 ± 0.00024	0.00491 ± 0.00142	0.00415 ± 0.00125	0.00163 ± 0.00036	0.00034 ± 0.00004	0.00136 ± 0.00014
31.3	0.01480 ± 0.00251	0.01550 ± 0.00201	0.00643 ± 0.00072	0.00064 ± 0.00025	0.00337 ± 0.00139	0.00241 ± 0.00122	0.00116 ± 0.00015	0.00043 ± 0.00005	0.00105 ± 0.00011
31.8	0.01830 ± 0.00286	0.02016 ± 0.00211	0.00544 ± 0.00066	0.00059 ± 0.00029	0.00606 ± 0.00146	0.00563 ± 0.00132	0.00114 ± 0.00014	0.00047 ± 0.00005	0.00082 ± 0.00009
32.3	0.01495 ± 0.00253	0.01721 ± 0.00199	0.00378 ± 0.00042	0.00085 ± 0.00033	0.00574 ± 0.00144	0.00418 ± 0.00125	0.00081 ± 0.00010	0.00068 ± 0.00007	0.00117 ± 0.00012
32.8	0.01345 ± 0.00238	0.02228 ± 0.00216	0.00570 ± 0.00070	0.00097 ± 0.00033	0.00718 ± 0.00152	0.00520 ± 0.00130	0.00146 ± 0.00019	0.00057 ± 0.00006	0.00120 ± 0.00012
33.3	0.01645 ± 0.00267	0.02214 ± 0.00215	0.00520 ± 0.00058	0.00088 ± 0.00039	0.00744 ± 0.00154	0.00500 ± 0.00130	0.00152 ± 0.00018	0.00072 ± 0.00008	0.00138 ± 0.00014
33.8	0.02220 ± 0.00325	0.03467 ± 0.00256	0.00882 ± 0.00098	0.00095 ± 0.00046	0.01147 ± 0.00175	0.00916 ± 0.00149	0.00209 ± 0.00025	0.00068 ± 0.00007	0.00152 ± 0.00016
34.3	0.01935 ± 0.00296	0.02867 ± 0.00237	0.00658 ± 0.00073	0.00106 ± 0.00046	0.00917 ± 0.00164	0.00824 ± 0.00146	0.00134 ± 0.00016	0.00082 ± 0.00009	0.00146 ± 0.00015
34.8	. ± .	0.02319 ± 0.00293	0.01253 ± 0.00223	0.00051 ± 0.00028	0.00425 ± 0.00140	0.00285 ± 0.00122	0.00169 ± 0.00025	0.00062 ± 0.00006	0.00075 ± 0.00008
35.3	0.00860 ± 0.00189	0.01856 ± 0.00202	0.00636 ± 0.00070	0.00045 ± 0.00024	0.00529 ± 0.00141	0.00404 ± 0.00123	0.00081 ± 0.00011	0.00046 ± 0.00005	0.00115 ± 0.00012
35.8	0.00885 ± 0.00191	0.00670 ± 0.00184	0.00382 ± 0.00042	0.00047 ± 0.00021	0.00000 ± 0.00131	0.00220 ± 0.00119	. ± .	0.00021 ± 0.00002	. ± .
36.3	0.00660 ± 0.00169	0.00873 ± 0.00183	0.00169 ± 0.00018	0.00049 ± 0.00019	0.00426 ± 0.00138	0.00212 ± 0.00118	. ± .	0.00017 ± 0.00002	. ± .
36.8	0.00720 ± 0.00175	0.01431 ± 0.00196	0.00206 ± 0.00023	0.00036 ± 0.00021	0.00596 ± 0.00143	0.00572 ± 0.00130	. ± .	0.00021 ± 0.00002	. ± .
37.3	0.00565 ± 0.00160	0.00234 ± 0.00174	0.00138 ± 0.00015	. ± .	0.00000 ± 0.00129	0.00071 ± 0.00116	. ± .	0.00024 ± 0.00003	. ± .
37.8	0.00450 ± 0.00148	0.00183 ± 0.00018	0.00162 ± 0.00018	. ± .	. ± .	. ± .	. ± .	0.00021 ± 0.00002	. ± .
38.3	0.00515 ± 0.00154	0.00887 ± 0.00185	0.00208 ± 0.00022	. ± .	0.00414 ± 0.00139	0.00233 ± 0.00120	0.00010 ± 0.00003	0.00022 ± 0.00002	. ± .
38.8	0.00485 ± 0.00151	0.00589 ± 0.00185	0.00300 ± 0.00033	. ± .	0.00000 ± 0.00134	0.00232 ± 0.00122	0.00015 ± 0.00004	0.00023 ± 0.00002	. ± .
39.3	0.00620 ± 0.00165	0.00897 ± 0.00188	0.00236 ± 0.00025	. ± .	0.00415 ± 0.00141	0.00207 ± 0.00122	0.00016 ± 0.00004	0.00023 ± 0.00002	. ± .
39.8	0.00860 ± 0.00189	0.01650 ± 0.00201	0.00389 ± 0.00042	. ± .	0.00789 ± 0.00153	0.00418 ± 0.00123	0.00027 ± 0.00005	0.00027 ± 0.00003	. ± .
40.3	0.00955 ± 0.00199	0.01270 ± 0.00194	0.00360 ± 0.00038	0.00123 ± 0.00032	0.00426 ± 0.00141	0.00301 ± 0.00124	0.00027 ± 0.00004	0.00035 ± 0.00004	. ± .
40.8	0.01310 ± 0.00234	0.01989 ± 0.00208	0.00632 ± 0.00069	0.00122 ± 0.00036	0.00517 ± 0.00140	0.00618 ± 0.00132	0.00047 ± 0.00007	0.00053 ± 0.00005	. ± .
41.3	0.02210 ± 0.00324	0.03392 ± 0.00473	0.02467 ± 0.00434	0.00031 ± 0.00030	0.00402 ± 0.00139	0.00297 ± 0.00122	0.00148 ± 0.00024	0.00046 ± 0.00005	. ± .
41.8	0.06325 ± 0.00736	0.07716 ± 0.01164	0.05742 ± 0.01142	0.00121 ± 0.00055	0.00607 ± 0.00145	0.00984 ± 0.00155	0.00208 ± 0.00054	0.00055 ± 0.00006	. ± .
42.3	0.05895 ± 0.00693	0.05517 ± 0.00699	0.03999 ± 0.00667	0.00143 ± 0.00052	0.00731 ± 0.00156	0.00481 ± 0.00132	0.00111 ± 0.00018	0.00053 ± 0.00006	. ± .
42.8	0.07355 ± 0.00839	0.07127 ± 0.00993	0.05204 ± 0.00967	0.00071 ± 0.00046	0.00825 ± 0.00156	0.00821 ± 0.00144	0.00184 ± 0.00053	0.00023 ± 0.00002	. ± .
43.3	0.06150 ± 0.00718	0.04624 ± 0.00664	0.03730 ± 0.00634	0.00035 ± 0.00042	0.00427 ± 0.00143	0.00315 ± 0.00125	0.00086 ± 0.00014	0.00030 ± 0.00003	. ± .
43.8	0.07175 ± 0.00820	0.08180 ± 0.01229	0.06916 ± 0.01211	-0.00014 ± 0.00052	0.00543 ± 0.00143	0.00518 ± 0.00129	0.00188 ± 0.00061	0.00028 ± 0.00003	. ± .
44.3	0.08970 ± 0.01000	0.08336 ± 0.01060	0.05605 ± 0.01028	0.00078 ± 0.00050	0.01438 ± 0.00197	0.01070 ± 0.00160	0.00106 ± 0.00017	0.00039 ± 0.00004	. ± .
44.8	0.03790 ± 0.00482	0.02045 ± 0.00238	0.01261 ± 0.00155	0.00079 ± 0.00035	0.00366 ± 0.00133	0.00243 ± 0.00117	0.00065 ± 0.00010	0.00031 ± 0.00003	. ± .
45.3	0.00230 ± 0.00126	0.00096 ± 0.00171	0.00020 ± 0.00004	0.00118 ± 0.00019	0.00000 ± 0.00126	-0.00061 ± 0.00113	0.00007 ± 0.00002	0.00014 ± 0.00002	. ± .
45.8	0.00280 ± 0.00131	0.00157 ± 0.00167	0.00028 ± 0.00003	0.00035 ± 0.00012	0.00000 ± 0.00124	0.00087 ± 0.00111	0.00002 ± 0.00003	0.00006 ± 0.00001	. ± .
46.3	0.00410 ± 0.00144	0.00347 ± 0.00181	0.00081 ± 0.00009	0.00065 ± 0.00015	0.00000 ± 0.00134	0.00159 ± 0.00121	0.00013 ± 0.00004	0.00028 ± 0.00003	. ± .
46.8	0.00420 ± 0.00145	0.00385 ± 0.00183	0.00303 ± 0.00050	0.00041 ± 0.00014	0.00000 ± 0.00131	-0.00019 ± 0.00117	0.00026 ± 0.00008	0.00033 ± 0.00004	. ± .
47.3	0.00480 ± 0.00151	0.00299 ± 0.00181	0.00276 ± 0.00031	0.00017 ± 0.00014	0.00000 ± 0.00133	0.00000 ± 0.00119	0.00006 ± 0.00004	. ± .	. ± .
47.8	0.00350 ± 0.00138	0.00102 ± 0.00177	0.00116 ± 0.00013	0.00012 ± 0.00010	0.00000 ± 0.00131	-0.00043 ± 0.00118	0.00004 ± 0.00003	0.00014 ± 0.00002	. ± .
48.3	0.00380 ± 0.00141	0.00737 ± 0.00180	0.00150 ± 0.00016	0.00034 ± 0.00015	0.00285 ± 0.00134	0.00251 ± 0.00119	0.00004 ± 0.00002	0.00013 ± 0.00002	. ± .
48.8	0.00620 ± 0.00165	0.01806 ± 0.00225	0.00125 ± 0.00014	0.00034 ± 0.00014	0.01280 ± 0.00187	0.00353 ± 0.00123	. ± .	0.00015 ± 0.00002	. ± .
Mean	0.01908 ± 0.00041	0.02140 ± 0.00041	0.00901 ± 0.00034	0.00092 ± 0.00004	0.00528 ± 0.00018	0.00461 ± 0.00016	0.00083 ± 0.00002	0.00036 ± 0.00001	0.00130 ± 0.00002
Frac	0.89148 ± 0.02552	1.00000 ± 0.02714	0.42118 ± 0.01766	0.04286 ± 0.00213	0.24669 ± 0.00955	0.21555 ± 0.00848	0.03901 ± 0.00128	0.01673 ± 0.00040	0.06040 ± 0.00151

Table 5.29: Fraction of non-Rayleigh extinction due to each chemical species at Page.

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil	NO2
7.3	1.000± 0.225	0.536± 0.128	0.013± 0.007	0.279± 0.105	0.095± 0.083	0.035± 0.014	0.008± 0.002	0.034± 0.006
7.8	1.000± 0.216	0.498± 0.118	0.009± 0.007	0.353± 0.109	0.090± 0.079	0.017± 0.006	0.004± 0.001	0.029± 0.005
8.3	1.000± 0.137	0.214± 0.031	0.012± 0.008	0.516± 0.092	0.222± 0.058	0.008± 0.002	0.007± 0.001	0.022± 0.003
8.8	1.000± 0.136	0.817± 0.117	0.052± 0.039	. ± .	. ± .	0.042± 0.009	. ± .	0.090± 0.013
9.3	1.000± 0.132	0.203± 0.029	0.030± 0.014	0.410± 0.079	0.297± 0.063	0.011± 0.002	0.008± 0.001	0.041± 0.006
9.8	1.000± 0.142	0.268± 0.040	-0.003± 0.013	0.389± 0.083	0.263± 0.066	0.022± 0.004	0.013± 0.002	0.046± 0.007
10.3	1.000± 0.149	0.199± 0.030	0.034± 0.014	0.417± 0.090	0.288± 0.072	0.016± 0.003	0.007± 0.001	0.039± 0.006
10.8	1.000± 0.174	0.349± 0.057	0.092± 0.026	0.243± 0.091	0.161± 0.078	0.025± 0.005	0.039± 0.006	0.091± 0.015
11.3	1.000± 0.195	0.306± 0.053	0.076± 0.024	0.332± 0.110	0.191± 0.090	0.024± 0.005	. ± .	0.071± 0.012
11.8	1.000± 0.170	0.284± 0.046	0.034± 0.016	0.353± 0.097	0.232± 0.080	0.024± 0.005	0.014± 0.002	0.059± 0.009
12.3	1.000± 0.165	0.275± 0.044	0.047± 0.017	0.388± 0.098	0.173± 0.073	0.020± 0.004	0.029± 0.005	0.069± 0.011
12.8	1.000± 0.147	0.385± 0.058	0.039± 0.017	0.260± 0.075	0.188± 0.064	0.033± 0.005	0.018± 0.003	0.077± 0.011
13.3	1.000± 0.123	0.259± 0.036	0.073± 0.020	0.355± 0.070	0.205± 0.053	0.036± 0.005	0.012± 0.002	0.060± 0.008
14.3	1.000± 0.136	0.209± 0.030	0.155± 0.031	0.291± 0.073	0.229± 0.063	0.022± 0.004	0.017± 0.002	0.078± 0.011
14.8	1.000± 0.134	0.226± 0.033	0.038± 0.016	0.317± 0.073	0.293± 0.066	0.035± 0.006	0.018± 0.003	0.071± 0.010
15.3	1.000± 0.126	0.203± 0.029	0.050± 0.014	0.365± 0.073	0.253± 0.059	0.070± 0.010	0.014± 0.002	0.045± 0.006
15.8	1.000± 0.144	0.552± 0.088	0.045± 0.016	0.122± 0.056	0.108± 0.050	0.113± 0.018	0.016± 0.003	0.043± 0.006
16.8	1.000± 0.209	0.703± 0.138	0.037± 0.019	0.000± 0.084	0.066± 0.076	0.100± 0.020	0.035± 0.007	0.057± 0.010
19.8	1.000± 0.419	0.527± 0.166	0.141± 0.057	0.000± 0.215	0.120± 0.196	0.035± 0.012	0.042± 0.013	0.135± 0.042
20.3	1.000± 0.230	0.188± 0.037	0.124± 0.032	0.270± 0.127	0.170± 0.108	0.011± 0.003	0.040± 0.008	0.196± 0.037
21.3	1.000± 0.200	0.232± 0.041	0.107± 0.029	0.248± 0.108	0.193± 0.094	0.022± 0.005	0.031± 0.006	0.167± 0.029
21.8	1.000± 0.144	0.275± 0.042	0.059± 0.017	0.229± 0.074	0.224± 0.067	0.028± 0.005	0.024± 0.004	0.160± 0.023
23.3	1.000± 0.137	0.334± 0.049	0.039± 0.017	0.222± 0.067	0.280± 0.066	0.028± 0.004	0.021± 0.003	0.077± 0.011
23.8	1.000± 0.123	0.458± 0.066	0.030± 0.014	0.168± 0.050	0.228± 0.051	0.032± 0.005	0.016± 0.002	0.067± 0.009
24.3	1.000± 0.144	0.360± 0.054	. ± .	0.246± 0.073	0.274± 0.069	0.027± 0.004	0.020± 0.003	0.074± 0.011
24.8	1.000± 0.142	0.315± 0.047	0.048± 0.016	0.221± 0.070	0.309± 0.072	0.033± 0.006	0.015± 0.002	0.058± 0.008
25.3	1.000± 0.148	0.179± 0.027	0.057± 0.018	0.325± 0.081	0.339± 0.077	0.025± 0.004	0.017± 0.003	0.057± 0.009
25.8	1.000± 0.155	0.258± 0.041	0.053± 0.018	0.226± 0.078	0.337± 0.081	0.047± 0.008	0.017± 0.002	0.063± 0.009
26.3	1.000± 0.140	0.168± 0.025	0.061± 0.018	0.329± 0.078	0.320± 0.072	0.034± 0.005	0.020± 0.003	0.067± 0.010
26.8	1.000± 0.118	0.182± 0.025	0.041± 0.014	0.256± 0.057	0.395± 0.067	0.059± 0.009	0.013± 0.002	0.055± 0.007
27.3	1.000± 0.131	0.130± 0.019	0.060± 0.016	0.159± 0.058	0.481± 0.083	0.101± 0.015	0.017± 0.002	0.053± 0.007
27.8	1.000± 0.094	0.142± 0.018	0.036± 0.011	0.336± 0.049	0.374± 0.052	0.068± 0.009	0.009± 0.001	0.036± 0.004
28.3	1.000± 0.139	0.145± 0.021	0.167± 0.034	0.265± 0.072	0.296± 0.069	0.046± 0.007	0.033± 0.005	0.049± 0.007
28.8	1.000± 0.235	0.125± 0.025	0.077± 0.023	0.000± 0.111	0.650± 0.162	0.043± 0.009	0.015± 0.003	0.089± 0.017

Table 5.29: Fraction of non-Rayleigh extinction due to each chemical species at Page (continued from previous page).

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil	NO2
29.3	1.000± 0.912	0.228± 0.150	0.272± 0.183	0.000± 0.478	0.076± 0.430	0.072± 0.049	0.058± 0.038	0.293± 0.191
29.8	1.000± 0.226	0.084± 0.017	0.118± 0.030	0.340± 0.129	0.360± 0.121	0.019± 0.005	0.010± 0.002	0.068± 0.013
30.3	1.000± 0.280	0.133± 0.031	0.132± 0.036	0.296± 0.157	0.252± 0.139	0.061± 0.015	0.018± 0.004	0.109± 0.024
30.8	1.000± 0.172	0.301± 0.074	0.037± 0.014	0.262± 0.082	0.222± 0.072	0.087± 0.022	0.018± 0.003	0.073± 0.012
31.3	1.000± 0.183	0.415± 0.071	0.041± 0.017	0.217± 0.094	0.155± 0.081	0.075± 0.014	0.028± 0.005	0.068± 0.011
31.8	1.000± 0.148	0.270± 0.043	0.029± 0.015	0.301± 0.079	0.279± 0.072	0.057± 0.009	0.023± 0.003	0.041± 0.006
32.3	1.000± 0.164	0.220± 0.035	0.049± 0.020	0.334± 0.092	0.243± 0.078	0.047± 0.008	0.040± 0.006	0.068± 0.011
32.8	1.000± 0.137	0.256± 0.040	0.044± 0.015	0.322± 0.075	0.233± 0.063	0.066± 0.011	0.026± 0.004	0.054± 0.008
33.3	1.000± 0.137	0.235± 0.035	0.040± 0.018	0.336± 0.077	0.226± 0.063	0.069± 0.011	0.033± 0.005	0.062± 0.009
33.8	1.000± 0.104	0.254± 0.034	0.027± 0.013	0.331± 0.056	0.264± 0.047	0.060± 0.008	0.019± 0.002	0.044± 0.006
34.3	1.000± 0.117	0.230± 0.032	0.037± 0.016	0.320± 0.063	0.287± 0.056	0.047± 0.007	0.029± 0.004	0.051± 0.007
34.8	1.000± 0.179	0.540± 0.118	0.022± 0.012	0.183± 0.065	0.123± 0.055	0.073± 0.014	0.027± 0.004	0.032± 0.005
35.3	1.000± 0.154	0.343± 0.053	0.024± 0.013	0.285± 0.082	0.218± 0.070	0.044± 0.008	0.025± 0.004	0.062± 0.009
35.8	1.000± 0.388	0.570± 0.169	0.070± 0.037	0.000± 0.196	0.328± 0.199	. ± .	0.031± 0.009	. ± .
36.3	1.000± 0.296	0.194± 0.046	0.056± 0.025	0.488± 0.188	0.243± 0.144	. ± .	0.019± 0.005	. ± .
36.8	1.000± 0.194	0.144± 0.025	0.025± 0.015	0.416± 0.115	0.400± 0.106	. ± .	0.015± 0.002	. ± .
37.3	1.000± 1.052	0.590± 0.443	. ± .	0.000± 0.551	0.303± 0.545	. ± .	0.103± 0.077	. ± .
37.8	1.000± 0.139	0.885± 0.131	. ± .	. ± .	. ± .	. ± .	0.115± 0.016	. ± .
38.3	1.000± 0.295	0.234± 0.055	. ± .	0.467± 0.184	0.263± 0.146	0.011± 0.004	0.025± 0.006	. ± .
38.8	1.000± 0.460	0.527± 0.181	. ± .	0.000± 0.236	0.408± 0.252	0.026± 0.011	0.040± 0.014	. ± .
39.3	1.000± 0.296	0.263± 0.062	. ± .	0.463± 0.185	0.231± 0.144	0.018± 0.006	0.026± 0.006	. ± .
39.8	1.000± 0.172	0.236± 0.038	. ± .	0.478± 0.110	0.253± 0.081	0.016± 0.004	0.016± 0.003	. ± .
40.3	1.000± 0.216	0.283± 0.053	0.097± 0.029	0.335± 0.122	0.237± 0.104	0.021± 0.005	0.028± 0.005	. ± .
40.8	1.000± 0.148	0.318± 0.048	0.061± 0.019	0.260± 0.075	0.311± 0.074	0.024± 0.004	0.027± 0.004	. ± .
41.3	1.000± 0.197	0.727± 0.163	0.009± 0.009	0.119± 0.044	0.088± 0.038	0.044± 0.009	0.014± 0.002	. ± .
41.8	1.000± 0.213	0.744± 0.186	0.016± 0.008	0.079± 0.022	0.128± 0.028	0.027± 0.008	0.007± 0.001	. ± .
42.3	1.000± 0.179	0.725± 0.152	0.026± 0.010	0.132± 0.033	0.087± 0.026	0.020± 0.004	0.010± 0.002	. ± .
42.8	1.000± 0.197	0.730± 0.170	0.010± 0.007	0.116± 0.027	0.115± 0.026	0.026± 0.008	0.003± 0.001	. ± .
43.3	1.000± 0.203	0.807± 0.179	0.008± 0.009	0.092± 0.034	0.068± 0.029	0.019± 0.004	0.006± 0.001	. ± .
43.8	1.000± 0.212	0.845± 0.195	-0.002± 0.006	0.066± 0.020	0.063± 0.018	0.023± 0.008	0.003± 0.001	. ± .
44.3	1.000± 0.180	0.672± 0.150	0.009± 0.006	0.173± 0.032	0.128± 0.025	0.013± 0.003	0.005± 0.001	. ± .
44.8	1.000± 0.165	0.617± 0.104	0.039± 0.018	0.179± 0.068	0.119± 0.059	0.032± 0.006	0.015± 0.002	. ± .
45.3	1.000± 2.468	0.204± 0.358	1.204± 2.110	0.000± 1.286	-0.622± 1.584	0.071± 0.126	0.143± 0.250	. ± .
45.8	1.000± 1.504	0.178± 0.191	0.223± 0.249	0.000± 0.790	0.554± 0.920	0.013± 0.023	0.038± 0.041	. ± .
46.3	1.000± 0.738	0.233± 0.124	0.187± 0.107	0.000± 0.386	0.458± 0.423	0.037± 0.023	0.081± 0.043	. ± .
46.8	1.000± 0.672	0.787± 0.396	0.106± 0.062	0.000± 0.340	-0.049± 0.305	0.068± 0.038	0.086± 0.042	. ± .
47.3	1.000± 0.856	0.923± 0.568	0.057± 0.058	0.000± 0.445	0.000± 0.398	0.020± 0.018	. ± .	. ± .
47.8	1.000± 2.454	1.137± 1.978	0.118± 0.226	0.000± 1.284	-0.422± 1.369	0.039± 0.074	0.137± 0.239	. ± .
48.3	1.000± 0.345	0.204± 0.054	0.046± 0.023	0.387± 0.205	0.341± 0.182	0.005± 0.003	0.018± 0.005	. ± .
48.8	1.000± 0.176	0.069± 0.012	0.019± 0.008	0.709± 0.136	0.195± 0.072	. ± .	0.008± 0.002	. ± .

Table 5.30: Extinction coefficients (Km^{-1}) due to each chemical species at Canyonlands. The total and measured extinction do not include Rayleigh scattering.

Date	Measured	Total	Sulfates	Organics	LAC	Nitrates	Fine Soil
7.3	0.02070 ± 0.00304	0.01647 ± 0.00289	0.00491 ± 0.00057	0.00564 ± 0.00211	0.00450 ± 0.00187	0.00143 ± 0.00018	. ± .
7.8	0.01230 ± 0.00220	0.02209 ± 0.00346	0.01523 ± 0.00287	0.00313 ± 0.00141	0.00206 ± 0.00124	0.00153 ± 0.00046	0.00015 ± 0.00002
8.3	0.01590 ± 0.00256	0.01687 ± 0.00217	0.00661 ± 0.00075	0.00446 ± 0.00149	0.00539 ± 0.00139	0.00022 ± 0.00006	0.00019 ± 0.00002
8.8	0.01745 ± 0.00271	0.00860 ± 0.00200	0.00684 ± 0.00076	0.00000 ± 0.00137	0.00137 ± 0.00123	0.00024 ± 0.00005	0.00016 ± 0.00002
9.3	0.01765 ± 0.00273	0.00734 ± 0.00189	0.00525 ± 0.00056	0.00000 ± 0.00134	0.00129 ± 0.00120	0.00055 ± 0.00007	0.00025 ± 0.00003
9.8	0.02650 ± 0.00362	0.01716 ± 0.00213	0.00894 ± 0.00100	0.00283 ± 0.00138	0.00390 ± 0.00127	0.00130 ± 0.00016	0.00019 ± 0.00002
10.3	0.03030 ± 0.00400	0.01748 ± 0.00207	0.00584 ± 0.00062	0.00575 ± 0.00148	0.00428 ± 0.00129	0.00143 ± 0.00017	0.00018 ± 0.00002
10.8	0.02550 ± 0.00352	0.01571 ± 0.00203	0.00609 ± 0.00066	0.00411 ± 0.00143	0.00332 ± 0.00126	0.00200 ± 0.00023	0.00019 ± 0.00002
11.3	0.02320 ± 0.00329	0.01511 ± 0.00209	0.00364 ± 0.00039	0.00801 ± 0.00161	0.00244 ± 0.00126	0.00082 ± 0.00010	0.00020 ± 0.00002
11.8	0.01865 ± 0.00284	0.01427 ± 0.00194	0.00456 ± 0.00050	0.00502 ± 0.00141	0.00370 ± 0.00123	0.00081 ± 0.00010	0.00018 ± 0.00002
12.3	0.01980 ± 0.00295	0.01551 ± 0.00210	0.00328 ± 0.00035	0.00598 ± 0.00154	0.00548 ± 0.00138	0.00043 ± 0.00006	0.00033 ± 0.00004
12.8	0.01815 ± 0.00279	0.01452 ± 0.00214	0.00645 ± 0.00071	0.00000 ± 0.00139	0.00730 ± 0.00146	0.00056 ± 0.00008	0.00021 ± 0.00002
13.3	0.01910 ± 0.00288	0.01321 ± 0.00196	0.00387 ± 0.00041	0.00453 ± 0.00143	0.00406 ± 0.00128	0.00051 ± 0.00007	0.00025 ± 0.00003
13.8	0.01805 ± 0.00278	0.01675 ± 0.00207	0.00386 ± 0.00041	0.00630 ± 0.00151	0.00574 ± 0.00136	0.00061 ± 0.00008	0.00025 ± 0.00003
14.3	0.02160 ± 0.00313	0.01328 ± 0.00199	0.00374 ± 0.00040	0.00450 ± 0.00145	0.00436 ± 0.00131	0.00046 ± 0.00006	0.00022 ± 0.00002
14.8	0.02565 ± 0.00354	0.01184 ± 0.00193	0.00422 ± 0.00045	0.00288 ± 0.00139	0.00372 ± 0.00127	0.00079 ± 0.00010	0.00022 ± 0.00002
15.3	0.03730 ± 0.00470	0.01689 ± 0.00220	0.00604 ± 0.00075	0.00391 ± 0.00151	0.00462 ± 0.00139	0.00189 ± 0.00025	0.00044 ± 0.00005
15.8	. ± .	0.02678 ± 0.00327	0.01171 ± 0.00241	0.00662 ± 0.00156	0.00414 ± 0.00132	0.00359 ± 0.00083	0.00071 ± 0.00007
16.3	0.02780 ± 0.00410	0.01690 ± 0.00311	0.01291 ± 0.00237	0.00000 ± 0.00148	0.00187 ± 0.00134	0.00140 ± 0.00021	0.00072 ± 0.00008
16.8	0.02270 ± 0.00359	0.00672 ± 0.00198	0.00569 ± 0.00063	0.00000 ± 0.00140	0.00032 ± 0.00125	0.00047 ± 0.00007	0.00023 ± 0.00002
17.3	0.01830 ± 0.00315	0.00571 ± 0.00188	0.00286 ± 0.00031	0.00000 ± 0.00137	0.00246 ± 0.00125	0.00015 ± 0.00004	0.00025 ± 0.00003
17.8	0.01065 ± 0.00238	0.00356 ± 0.00179	0.00163 ± 0.00018	0.00000 ± 0.00132	0.00162 ± 0.00119	0.00015 ± 0.00003	0.00016 ± 0.00002
18.3	0.01595 ± 0.00291	0.00577 ± 0.00194	0.00257 ± 0.00027	0.00000 ± 0.00142	0.00245 ± 0.00129	0.00053 ± 0.00007	0.00022 ± 0.00002
18.8	0.01505 ± 0.00283	0.01142 ± 0.00198	0.00413 ± 0.00046	0.00000 ± 0.00135	0.00625 ± 0.00137	0.00084 ± 0.00011	0.00021 ± 0.00003
19.3	. ± .	0.02082 ± 0.00259	0.00946 ± 0.00161	0.00465 ± 0.00148	0.00570 ± 0.00139	0.00085 ± 0.00014	0.00017 ± 0.00002
19.8	0.00955 ± 0.00228	0.00451 ± 0.00184	0.00253 ± 0.00028	0.00000 ± 0.00135	0.00154 ± 0.00122	0.00029 ± 0.00005	0.00016 ± 0.00002
20.3	0.01110 ± 0.00243	0.00339 ± 0.00184	0.00146 ± 0.00016	0.00000 ± 0.00136	0.00173 ± 0.00123	0.00003 ± 0.00003	0.00018 ± 0.00002
20.8	0.00635 ± 0.00196	0.00242 ± 0.00185	0.00183 ± 0.00020	0.00000 ± 0.00137	0.00036 ± 0.00123	0.00011 ± 0.00004	0.00011 ± 0.00001
21.3	0.01450 ± 0.00277	0.00444 ± 0.00185	0.00241 ± 0.00026	0.00000 ± 0.00136	0.00140 ± 0.00122	0.00048 ± 0.00006	0.00015 ± 0.00002
21.8	0.01425 ± 0.00274	0.00668 ± 0.00191	0.00366 ± 0.00040	0.00000 ± 0.00138	0.00194 ± 0.00125	0.00092 ± 0.00011	0.00015 ± 0.00002
22.3	0.01895 ± 0.00321	0.01832 ± 0.00213	0.00345 ± 0.00037	0.00645 ± 0.00153	0.00700 ± 0.00143	0.00125 ± 0.00015	0.00016 ± 0.00002
22.8	0.01755 ± 0.00308	0.01584 ± 0.00202	0.00558 ± 0.00062	0.00386 ± 0.00141	0.00462 ± 0.00130	0.00163 ± 0.00020	0.00015 ± 0.00002
23.3	0.02020 ± 0.00334	0.01308 ± 0.00197	0.00439 ± 0.00048	0.00356 ± 0.00141	0.00383 ± 0.00128	0.00110 ± 0.00014	0.00019 ± 0.00002
23.8	0.01670 ± 0.00299	0.01434 ± 0.00197	0.00520 ± 0.00057	0.00415 ± 0.00140	0.00382 ± 0.00126	0.00099 ± 0.00013	0.00018 ± 0.00002
24.3	0.01455 ± 0.00278	0.01270 ± 0.00198	0.00401 ± 0.00044	0.00441 ± 0.00144	0.00367 ± 0.00128	0.00045 ± 0.00006	0.00017 ± 0.00002
24.8	0.01320 ± 0.00264	0.00696 ± 0.00188	0.00425 ± 0.00046	0.00000 ± 0.00135	0.00213 ± 0.00122	0.00035 ± 0.00006	0.00022 ± 0.00003
25.3	0.01055 ± 0.00238	0.01107 ± 0.00194	0.00311 ± 0.00033	0.00290 ± 0.00139	0.00451 ± 0.00130	0.00027 ± 0.00005	0.00027 ± 0.00003
25.8	0.00925 ± 0.00224	0.00728 ± 0.00188	0.00349 ± 0.00038	0.00000 ± 0.00135	0.00311 ± 0.00125	0.00033 ± 0.00005	0.00034 ± 0.00004
26.3	0.01080 ± 0.00240	0.01332 ± 0.00211	0.00454 ± 0.00048	0.00437 ± 0.00153	0.00377 ± 0.00136	0.00043 ± 0.00006	0.00021 ± 0.00002
26.8	0.01500 ± 0.00282	0.01437 ± 0.00205	0.00700 ± 0.00078	0.00327 ± 0.00141	0.00322 ± 0.00127	0.00061 ± 0.00009	0.00026 ± 0.00003
27.3	0.01405 ± 0.00272	0.01504 ± 0.00213	0.00599 ± 0.00065	0.00534 ± 0.00154	0.00290 ± 0.00132	0.00045 ± 0.00006	0.00037 ± 0.00004
27.8	0.01370 ± 0.00269	0.00917 ± 0.00201	0.00465 ± 0.00052	0.00000 ± 0.00141	0.00406 ± 0.00133	. ± .	0.00046 ± 0.00005
28.8	0.00805 ± 0.00213	-0.00050 ± 0.00186	0.00042 ± 0.00006	0.00000 ± 0.00139	-0.00109 ± 0.00124	. ± .	0.00016 ± 0.00002

Table 5.30: Extinction coefficients (Km^{-1}) due to each chemical species at Canyonlands. The total and measured extinction do not include Rayleigh scattering (continued from previous page).

Date	Measured	Total	Sulfates	Organics	LAC	Nitrates	Fine Soil
29.3	0.00940 ± 0.00226	0.00034 ± 0.00180	0.00070 ± 0.00009	0.00000 ± 0.00134	-0.00049 ± 0.00120	0.00001 ± 0.00004	0.00012 ± 0.00001
29.8	0.01085 ± 0.00240	0.00308 ± 0.00181	0.00107 ± 0.00015	0.00000 ± 0.00134	0.00092 ± 0.00120	0.00097 ± 0.00014	0.00012 ± 0.00001
30.3	0.01760 ± 0.00308	0.00707 ± 0.00198	0.00131 ± 0.00016	0.00000 ± 0.00143	0.00423 ± 0.00135	0.00131 ± 0.00016	0.00022 ± 0.00002
30.8	0.01585 ± 0.00290	0.00464 ± 0.00187	0.00179 ± 0.00021	0.00000 ± 0.00138	0.00121 ± 0.00124	0.00143 ± 0.00018	0.00020 ± 0.00002
31.3	0.01770 ± 0.00309	0.00678 ± 0.00221	0.00329 ± 0.00036	0.00000 ± 0.00161	0.00233 ± 0.00146	0.00068 ± 0.00009	0.00048 ± 0.00005
31.8	0.01540 ± 0.00286	0.00690 ± 0.00188	0.00317 ± 0.00034	0.00000 ± 0.00136	0.00251 ± 0.00124	0.00048 ± 0.00007	0.00074 ± 0.00008
32.3	0.01255 ± 0.00258	0.00507 ± 0.00184	0.00248 ± 0.00026	0.00000 ± 0.00135	0.00162 ± 0.00122	0.00036 ± 0.00005	0.00061 ± 0.00006
32.8	0.00840 ± 0.00216	0.00561 ± 0.00184	0.00283 ± 0.00031	0.00000 ± 0.00134	0.00171 ± 0.00121	0.00045 ± 0.00007	0.00062 ± 0.00006
33.3	0.00970 ± 0.00229	0.00999 ± 0.00191	0.00310 ± 0.00034	0.00312 ± 0.00140	0.00226 ± 0.00124	0.00063 ± 0.00008	0.00088 ± 0.00009
33.8	0.01295 ± 0.00262	0.00681 ± 0.00187	0.00359 ± 0.00039	0.00000 ± 0.00136	0.00133 ± 0.00122	0.00077 ± 0.00010	0.00111 ± 0.00011
34.3	0.01190 ± 0.00251	0.00715 ± 0.00188	0.00278 ± 0.00031	0.00000 ± 0.00136	0.00229 ± 0.00124	0.00088 ± 0.00011	0.00120 ± 0.00012
34.8	0.01330 ± 0.00265	0.01874 ± 0.00304	0.01222 ± 0.00220	0.00000 ± 0.00135	0.00262 ± 0.00124	0.00340 ± 0.00101	0.00050 ± 0.00005
35.3	0.00780 ± 0.00210	0.00970 ± 0.00193	0.00545 ± 0.00072	0.00000 ± 0.00131	0.00280 ± 0.00121	0.00096 ± 0.00013	0.00048 ± 0.00005
35.8	0.00480 ± 0.00180	0.00374 ± 0.00179	0.00196 ± 0.00022	0.00000 ± 0.00132	0.00111 ± 0.00119	0.00049 ± 0.00007	0.00019 ± 0.00002
36.3	0.00505 ± 0.00183	0.00161 ± 0.00181	0.00138 ± 0.00015	0.00000 ± 0.00134	-0.00010 ± 0.00120	0.00017 ± 0.00003	0.00017 ± 0.00002
36.8	0.00650 ± 0.00197	0.00370 ± 0.00185	0.00153 ± 0.00016	0.00000 ± 0.00137	0.00160 ± 0.00123	0.00037 ± 0.00005	0.00019 ± 0.00002
37.3	0.00865 ± 0.00218	0.00435 ± 0.00177	0.00164 ± 0.00018	0.00000 ± 0.00131	0.00142 ± 0.00118	0.00103 ± 0.00012	0.00026 ± 0.00003
37.8	0.01385 ± 0.00270	0.00825 ± 0.00187	0.00234 ± 0.00025	0.00350 ± 0.00139	0.00072 ± 0.00120	0.00143 ± 0.00017	0.00026 ± 0.00003
38.3	0.01300 ± 0.00262	0.00936 ± 0.00187	0.00240 ± 0.00026	0.00385 ± 0.00139	0.00179 ± 0.00121	0.00108 ± 0.00013	0.00024 ± 0.00003
38.8	0.01110 ± 0.00243	0.00536 ± 0.00185	0.00310 ± 0.00034	0.00000 ± 0.00135	0.00096 ± 0.00121	0.00107 ± 0.00013	0.00023 ± 0.00003
39.3	0.01170 ± 0.00249	0.01042 ± 0.00190	0.00265 ± 0.00028	0.00363 ± 0.00141	0.00294 ± 0.00125	0.00088 ± 0.00011	0.00032 ± 0.00004
39.8	0.01200 ± 0.00252	0.01228 ± 0.00196	0.00310 ± 0.00034	0.00439 ± 0.00144	0.00377 ± 0.00128	0.00089 ± 0.00011	0.00014 ± 0.00002
40.3	0.01020 ± 0.00234	0.01288 ± 0.00193	0.00253 ± 0.00027	0.00554 ± 0.00144	0.00398 ± 0.00125	0.00062 ± 0.00008	0.00020 ± 0.00002
40.8	0.01155 ± 0.00247	0.00773 ± 0.00186	0.00310 ± 0.00034	0.00000 ± 0.00133	0.00375 ± 0.00125	0.00062 ± 0.00008	0.00026 ± 0.00003
41.3	0.01530 ± 0.00285	0.00915 ± 0.00191	0.00495 ± 0.00055	0.00000 ± 0.00134	0.00306 ± 0.00124	0.00080 ± 0.00011	0.00033 ± 0.00004
41.8	0.02250 ± 0.00357	0.01887 ± 0.00257	0.01063 ± 0.00176	0.00299 ± 0.00138	0.00402 ± 0.00127	0.00098 ± 0.00016	0.00025 ± 0.00003
42.3	0.02035 ± 0.00336	0.01560 ± 0.00204	0.00809 ± 0.00090	0.00450 ± 0.00139	0.00254 ± 0.00120	0.00023 ± 0.00005	0.00024 ± 0.00003
42.8	0.02365 ± 0.00368	0.01538 ± 0.00263	0.01355 ± 0.00187	0.00000 ± 0.00137	0.00129 ± 0.00123	0.00031 ± 0.00007	0.00023 ± 0.00002
43.3	0.02810 ± 0.00413	0.04468 ± 0.00512	0.02666 ± 0.00457	0.01332 ± 0.00193	0.00310 ± 0.00123	0.00136 ± 0.00024	0.00024 ± 0.00003
43.8	. ± .	0.07912 ± 0.02457	0.06943 ± 0.02439	0.00270 ± 0.00136	0.00162 ± 0.00120	0.00515 ± 0.00228	0.00022 ± 0.00002
44.3	. ± .	0.02176 ± 0.00367	0.01969 ± 0.00321	0.00000 ± 0.00132	0.00098 ± 0.00118	0.00084 ± 0.00014	0.00024 ± 0.00003
44.8	. ± .	0.01408 ± 0.00243	0.00762 ± 0.00156	0.00272 ± 0.00138	0.00248 ± 0.00124	0.00091 ± 0.00024	0.00035 ± 0.00004
45.3	0.00845 ± 0.00216	0.00017 ± 0.00183	0.00061 ± 0.00007	0.00000 ± 0.00136	-0.00100 ± 0.00122	0.00011 ± 0.00003	0.00044 ± 0.00005
45.8	0.00440 ± 0.00176	0.00160 ± 0.00183	0.00100 ± 0.00012	0.00000 ± 0.00136	0.00041 ± 0.00122	0.00007 ± 0.00004	0.00012 ± 0.00001
46.3	0.00370 ± 0.00169	0.00307 ± 0.00183	0.00075 ± 0.00009	0.00000 ± 0.00135	0.00203 ± 0.00123	0.00015 ± 0.00004	0.00014 ± 0.00002
46.8	. ± .	0.01349 ± 0.00479	0.01110 ± 0.00437	0.00000 ± 0.00135	0.00019 ± 0.00121	0.00205 ± 0.00073	0.00016 ± 0.00002
47.3	0.00830 ± 0.00215	0.00781 ± 0.00216	0.00768 ± 0.00118	0.00000 ± 0.00134	-0.00047 ± 0.00120	0.00061 ± 0.00018	. ± .
47.8	0.01360 ± 0.00268	0.01194 ± 0.00221	0.01064 ± 0.00118	0.00000 ± 0.00139	0.00077 ± 0.00124	0.00033 ± 0.00007	0.00021 ± 0.00002
48.3	0.01255 ± 0.00258	0.00671 ± 0.00181	0.00590 ± 0.00065	0.00000 ± 0.00126	0.00040 ± 0.00113	0.00024 ± 0.00004	0.00018 ± 0.00002
48.8	0.00890 ± 0.00221	0.00545 ± 0.00186	0.00439 ± 0.00048	0.00000 ± 0.00134	0.00087 ± 0.00120	. ± .	0.00019 ± 0.00002
Mean	0.01504 ± 0.00032	0.01161 ± 0.00038	0.00591 ± 0.00032	0.00201 ± 0.00016	0.00258 ± 0.00014	0.00085 ± 0.00004	0.00029 ± 0.00000
Frac	1.29549 ± 0.05081	1.00000 ± 0.04661	0.50900 ± 0.03215	0.17319 ± 0.01457	0.22252 ± 0.01408	0.07361 ± 0.00399	0.02494 ± 0.00090

Table 5.31: Fraction of non-Rayleigh extinction due to each chemical species at Canyonlands.

Date	Total	Sulfates	Organics	LAC	Nitrates	Fine Soil
7.3	1.000± 0.248	0.298± 0.063	0.342± 0.142	0.273± 0.123	0.087± 0.019	. ± .
7.8	1.000± 0.222	0.689± 0.169	0.142± 0.068	0.093± 0.058	0.069± 0.023	0.007± 0.001
8.3	1.000± 0.182	0.392± 0.067	0.264± 0.095	0.320± 0.092	0.013± 0.004	0.011± 0.002
8.8	1.000± 0.329	0.795± 0.205	0.000± 0.159	0.159± 0.148	0.028± 0.009	0.019± 0.005
9.3	1.000± 0.364	0.715± 0.199	0.000± 0.183	0.176± 0.170	0.075± 0.022	0.034± 0.010
9.8	1.000± 0.176	0.521± 0.087	0.165± 0.083	0.227± 0.079	0.076± 0.013	0.011± 0.002
10.3	1.000± 0.167	0.334± 0.053	0.329± 0.093	0.245± 0.079	0.082± 0.014	0.010± 0.002
10.8	1.000± 0.183	0.388± 0.065	0.262± 0.097	0.211± 0.085	0.127± 0.022	0.012± 0.002
11.3	1.000± 0.196	0.241± 0.042	0.530± 0.129	0.161± 0.086	0.054± 0.010	0.013± 0.002
11.8	1.000± 0.192	0.320± 0.056	0.352± 0.110	0.259± 0.093	0.057± 0.010	0.013± 0.002
12.3	1.000± 0.191	0.211± 0.036	0.386± 0.112	0.353± 0.101	0.028± 0.005	0.021± 0.004
12.8	1.000± 0.208	0.444± 0.082	0.000± 0.096	0.503± 0.125	0.039± 0.008	0.014± 0.003
13.3	1.000± 0.210	0.293± 0.053	0.343± 0.120	0.307± 0.107	0.039± 0.008	0.019± 0.004
13.8	1.000± 0.175	0.230± 0.038	0.376± 0.101	0.343± 0.092	0.036± 0.007	0.015± 0.003
14.3	1.000± 0.212	0.282± 0.052	0.339± 0.120	0.328± 0.110	0.035± 0.007	0.017± 0.003
14.8	1.000± 0.231	0.356± 0.069	0.243± 0.124	0.314± 0.119	0.067± 0.014	0.019± 0.003
15.3	1.000± 0.184	0.358± 0.064	0.231± 0.094	0.274± 0.090	0.112± 0.021	0.026± 0.005
15.8	1.000± 0.173	0.437± 0.105	0.247± 0.066	0.155± 0.053	0.134± 0.035	0.027± 0.004
16.3	1.000± 0.260	0.764± 0.199	0.000± 0.088	0.111± 0.082	0.083± 0.020	0.043± 0.009
16.8	1.000± 0.417	0.847± 0.267	0.000± 0.208	0.048± 0.187	0.070± 0.023	0.034± 0.011
17.3	1.000± 0.466	0.501± 0.174	0.000± 0.240	0.431± 0.261	0.026± 0.011	0.044± 0.015
17.8	1.000± 0.711	0.458± 0.236	0.000± 0.371	0.455± 0.405	0.042± 0.023	0.045± 0.023
18.3	1.000± 0.475	0.445± 0.157	0.000± 0.246	0.425± 0.265	0.092± 0.033	0.038± 0.013
18.8	1.000± 0.245	0.362± 0.075	0.000± 0.118	0.547± 0.153	0.074± 0.016	0.018± 0.004
19.3	1.000± 0.176	0.454± 0.096	0.223± 0.076	0.274± 0.075	0.041± 0.008	0.008± 0.001
19.8	1.000± 0.577	0.561± 0.237	0.000± 0.299	0.341± 0.304	0.064± 0.028	0.035± 0.015
20.3	1.000± 0.768	0.431± 0.238	0.000± 0.401	0.510± 0.456	0.009± 0.010	0.053± 0.029
20.8	1.000± 1.081	0.756± 0.584	0.000± 0.566	0.149± 0.521	0.045± 0.038	0.045± 0.035
21.3	1.000± 0.589	0.543± 0.234	0.000± 0.306	0.315± 0.305	0.108± 0.047	0.034± 0.015
21.8	1.000± 0.404	0.548± 0.168	0.000± 0.207	0.290± 0.205	0.138± 0.043	0.022± 0.007
22.3	1.000± 0.164	0.188± 0.030	0.352± 0.093	0.382± 0.090	0.068± 0.011	0.009± 0.001
22.8	1.000± 0.180	0.352± 0.060	0.244± 0.094	0.292± 0.090	0.103± 0.018	0.009± 0.002
23.3	1.000± 0.213	0.336± 0.062	0.272± 0.115	0.293± 0.107	0.084± 0.017	0.015± 0.003
23.8	1.000± 0.194	0.363± 0.064	0.289± 0.105	0.266± 0.095	0.069± 0.013	0.013± 0.002
24.3	1.000± 0.220	0.316± 0.060	0.347± 0.126	0.289± 0.110	0.035± 0.007	0.013± 0.003
24.8	1.000± 0.382	0.611± 0.178	0.000± 0.194	0.306± 0.194	0.050± 0.016	0.032± 0.010
25.3	1.000± 0.248	0.281± 0.058	0.262± 0.134	0.407± 0.137	0.024± 0.006	0.024± 0.005
25.8	1.000± 0.365	0.479± 0.134	0.000± 0.185	0.427± 0.204	0.045± 0.014	0.047± 0.013
26.3	1.000± 0.224	0.341± 0.065	0.328± 0.126	0.283± 0.112	0.032± 0.007	0.016± 0.003
26.8	1.000± 0.202	0.487± 0.088	0.228± 0.103	0.224± 0.094	0.042± 0.009	0.018± 0.003
27.3	1.000± 0.200	0.398± 0.071	0.355± 0.114	0.193± 0.092	0.030± 0.006	0.025± 0.004
27.8	1.000± 0.310	0.507± 0.125	0.000± 0.154	0.443± 0.175	. ± .	0.050± 0.012
28.8	1.000± 5.261	-0.840± 3.127	0.000± 2.780	2.180± 8.480	. ± .	-0.320± 1.191

Table 5.31: Fraction of non-Rayleigh extinction due to each chemical species at Canyonlands (continued from previous page).

Date	Total	Sulfates	Organics	LAC	Nitrates	Fine Soil
29.3	1.000± 7.487	2.059± 10.903	0.000± 3.941	-1.441± 8.407	0.029± 0.195	0.353± 1.869
29.8	1.000± 0.831	0.347± 0.210	0.000± 0.435	0.299± 0.427	0.315± 0.191	0.039± 0.023
30.3	1.000± 0.396	0.185± 0.057	0.000± 0.202	0.598± 0.254	0.185± 0.057	0.031± 0.009
30.8	1.000± 0.570	0.386± 0.162	0.000± 0.297	0.261± 0.287	0.308± 0.130	0.043± 0.018
31.3	1.000± 0.461	0.485± 0.167	0.000± 0.237	0.344± 0.243	0.100± 0.035	0.071± 0.024
31.8	1.000± 0.385	0.459± 0.135	0.000± 0.197	0.364± 0.205	0.070± 0.021	0.107± 0.031
32.3	1.000± 0.513	0.489± 0.185	0.000± 0.266	0.320± 0.267	0.071± 0.028	0.120± 0.045
32.8	1.000± 0.464	0.504± 0.174	0.000± 0.239	0.305± 0.238	0.080± 0.029	0.111 ± 0.038
33.3	1.000± 0.270	0.310± 0.068	0.312± 0.152	0.226± 0.131	0.063± 0.014	0.088 ± 0.019
33.8	1.000± 0.388	0.527± 0.156	0.000± 0.200	0.195± 0.187	0.113± 0.034	0.163 ± 0.048
34.3	1.000± 0.372	0.389± 0.111	0.000± 0.190	0.320± 0.193	0.123± 0.036	0.168 ± 0.047
34.8	1.000± 0.229	0.652± 0.158	0.000± 0.072	0.140± 0.070	0.181± 0.061	0.027 ± 0.005
35.3	1.000± 0.281	0.562± 0.134	0.000± 0.135	0.289± 0.137	0.099± 0.024	0.049 ± 0.011
35.8	1.000± 0.677	0.524± 0.258	0.000± 0.353	0.297± 0.348	0.131± 0.065	0.051 ± 0.025
36.3	1.000± 1.590	0.857± 0.968	0.000± 0.832	-0.062± 0.749	0.106± 0.120	0.106 ± 0.119
36.8	1.000± 0.707	0.414± 0.211	0.000± 0.370	0.432± 0.397	0.100± 0.052	0.051 ± 0.026
37.3	1.000± 0.575	0.377± 0.159	0.000± 0.301	0.326± 0.302	0.237± 0.100	0.060 ± 0.025
37.8	1.000± 0.321	0.284± 0.071	0.424± 0.194	0.087± 0.147	0.173± 0.044	0.032 ± 0.008
38.3	1.000± 0.283	0.256± 0.058	0.411± 0.170	0.191± 0.135	0.115± 0.027	0.026 ± 0.006
38.8	1.000± 0.488	0.578± 0.209	0.000± 0.252	0.179± 0.234	0.200± 0.073	0.043 ± 0.016
39.3	1.000± 0.258	0.254± 0.054	0.348± 0.149	0.282± 0.131	0.084± 0.019	0.031 ± 0.007
39.8	1.000± 0.226	0.252± 0.049	0.357± 0.130	0.307± 0.115	0.072± 0.015	0.011 ± 0.002
40.3	1.000± 0.212	0.196± 0.036	0.430± 0.129	0.309± 0.108	0.048± 0.010	0.016 ± 0.003
40.8	1.000± 0.340	0.401± 0.106	0.000± 0.172	0.485± 0.199	0.080± 0.022	0.034 ± 0.009
41.3	1.000± 0.295	0.541± 0.128	0.000± 0.146	0.334± 0.152	0.087± 0.022	0.036 ± 0.009
41.8	1.000± 0.193	0.563± 0.121	0.158± 0.076	0.213± 0.073	0.052± 0.011	0.013 ± 0.002
42.3	1.000± 0.185	0.519± 0.089	0.288± 0.097	0.163± 0.080	0.015± 0.004	0.015 ± 0.003
42.8	1.000± 0.242	0.881± 0.194	0.000± 0.089	0.084± 0.081	0.020± 0.006	0.015 ± 0.003
43.3	1.000± 0.162	0.597± 0.123	0.298± 0.055	0.069± 0.029	0.030± 0.006	0.005 ± 0.001
43.8	1.000± 0.439	0.878± 0.411	0.034± 0.020	0.020± 0.016	0.065± 0.035	0.003 ± 0.001
44.3	1.000± 0.239	0.905± 0.212	0.000± 0.061	0.045± 0.055	0.039± 0.009	0.011 ± 0.002
44.8	1.000± 0.244	0.541± 0.145	0.193± 0.104	0.176± 0.093	0.065± 0.020	0.025 ± 0.005
45.3	1.000± 15.224	3.588± 38.628	0.000± 8.000	-5.882± 63.727	0.647± 6.968	2.588 ±27.863
45.8	1.000± 1.618	0.625± 0.719	0.000± 0.850	0.256± 0.817	0.044± 0.056	0.075 ± 0.086
46.3	1.000± 0.843	0.244± 0.149	0.000± 0.440	0.661± 0.562	0.049± 0.032	0.046 ± 0.028
46.8	1.000± 0.502	0.823± 0.436	0.000± 0.100	0.014± 0.099	0.152± 0.076	0.012 ± 0.004
47.3	1.000± 0.391	0.983± 0.311	0.000± 0.172	-0.060± 0.155	0.078± 0.032	. ± .
47.8	1.000± 0.262	0.891± 0.192	0.000± 0.116	0.064± 0.105	0.028± 0.008	0.018 ± 0.004
48.3	1.000± 0.381	0.879± 0.256	0.000± 0.188	0.060± 0.169	0.036± 0.011	0.027 ± 0.008
48.8	1.000± 0.483	0.806± 0.289	0.000± 0.246	0.160± 0.227	. ± .	0.035 ± 0.012

Table 5.32: Extinction coefficients (Km^{-1}) due to each chemical species at Hopi Point when maximum organics are used. The total and measured extinction do not include Rayleigh scattering.

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
9.3	0.00530 ± 0.00148	0.00758 ± 0.00199	0.00322 ± 0.00034	0.00018 ± 0.00015	0.00206 ± 0.00146	0.00178 ± 0.00130	0.00018 ± 0.00003	0.00016 ± 0.00002
9.8	0.00495 ± 0.00145	0.00573 ± 0.00195	0.00246 ± 0.00026	0.00019 ± 0.00014	0.00143 ± 0.00144	0.00132 ± 0.00128	0.00017 ± 0.00003	0.00017 ± 0.00002
10.3	0.00600 ± 0.00155	0.00504 ± 0.00191	0.00159 ± 0.00017	0.00019 ± 0.00013	0.00141 ± 0.00141	0.00148 ± 0.00127	0.00010 ± 0.00003	0.00029 ± 0.00003
10.8	0.00450 ± 0.00140	0.00376 ± 0.00197	0.00196 ± 0.00021	0.00024 ± 0.00014	0.00145 ± 0.00146	-0.00015 ± 0.00130	0.00007 ± 0.00003	0.00019 ± 0.00002
11.3	0.00650 ± 0.00160	0.00585 ± 0.00187	0.00266 ± 0.00028	0.00026 ± 0.00014	0.00137 ± 0.00138	0.00123 ± 0.00123	0.00007 ± 0.00003	0.00027 ± 0.00003
11.8	0.00485 ± 0.00143	0.00542 ± 0.00190	0.00213 ± 0.00023	0.00020 ± 0.00012	0.00139 ± 0.00140	0.00149 ± 0.00125	0.00006 ± 0.00003	0.00014 ± 0.00002
12.3	0.00520 ± 0.00147	0.00419 ± 0.00193	0.00096 ± 0.00011	0.00017 ± 0.00010	0.00142 ± 0.00143	0.00148 ± 0.00128	0.00001 ± 0.00003	0.00015 ± 0.00002
12.8	0.00055 ± 0.00100	0.00577 ± 0.00194	0.00068 ± 0.00008	0.00017 ± 0.00010	0.00408 ± 0.00147	0.00069 ± 0.00126	0.00000 ± 0.00003	0.00014 ± 0.00002
13.3	0.00290 ± 0.00124	0.00328 ± 0.00184	0.00042 ± 0.00005	0.00017 ± 0.00010	0.00164 ± 0.00137	0.00090 ± 0.00122	0.00003 ± 0.00002	0.00013 ± 0.00002
13.8	0.00430 ± 0.00138	0.00537 ± 0.00196	0.00158 ± 0.00017	0.00028 ± 0.00015	0.00144 ± 0.00145	0.00170 ± 0.00130	0.00016 ± 0.00003	0.00022 ± 0.00002
14.3	0.01200 ± 0.00215	0.00812 ± 0.00196	0.00312 ± 0.00033	0.00034 ± 0.00018	0.00141 ± 0.00142	0.00218 ± 0.00128	0.00079 ± 0.00010	0.00028 ± 0.00003
14.8	0.01490 ± 0.00244	0.01966 ± 0.00222	0.00715 ± 0.00078	0.00074 ± 0.00026	0.00494 ± 0.00152	0.00522 ± 0.00138	0.00135 ± 0.00016	0.00026 ± 0.00003
15.3	0.01730 ± 0.00268	0.01238 ± 0.00213	0.00506 ± 0.00061	0.00094 ± 0.00030	0.00147 ± 0.00148	0.00302 ± 0.00135	0.00167 ± 0.00022	0.00022 ± 0.00002
15.8	. ± .	0.01674 ± 0.00274	0.01126 ± 0.00192	0.00086 ± 0.00030	0.00141 ± 0.00142	0.00066 ± 0.00126	0.00235 ± 0.00035	0.00020 ± 0.00002
16.3	. ± .	0.01724 ± 0.00236	0.01148 ± 0.00129	0.00082 ± 0.00030	0.00144 ± 0.00145	0.00168 ± 0.00130	0.00182 ± 0.00022	. ± .
16.8	. ± .	0.02341 ± 0.00298	0.01682 ± 0.00218	0.00075 ± 0.00025	0.00150 ± 0.00149	0.00218 ± 0.00134	0.00177 ± 0.00023	0.00038 ± 0.00004
17.3	0.00630 ± 0.00158	0.00742 ± 0.00198	0.00357 ± 0.00038	0.00071 ± 0.00023	0.00143 ± 0.00144	0.00113 ± 0.00129	0.00030 ± 0.00005	0.00029 ± 0.00003
17.8	0.00475 ± 0.00142	0.00460 ± 0.00192	0.00178 ± 0.00019	0.00047 ± 0.00016	0.00142 ± 0.00142	0.00067 ± 0.00127	0.00006 ± 0.00002	0.00020 ± 0.00002
18.3	0.00740 ± 0.00169	0.00363 ± 0.00187	0.00087 ± 0.00010	0.00035 ± 0.00012	0.00139 ± 0.00139	0.00085 ± 0.00124	0.00007 ± 0.00002	0.00011 ± 0.00001
18.8	0.00315 ± 0.00126	0.00405 ± 0.00194	0.00086 ± 0.00010	0.00033 ± 0.00012	0.00144 ± 0.00144	0.00117 ± 0.00129	0.00008 ± 0.00004	0.00017 ± 0.00002
19.3	0.00800 ± 0.00175	0.00515 ± 0.00190	0.00170 ± 0.00022	0.00031 ± 0.00011	0.00140 ± 0.00140	0.00143 ± 0.00126	0.00014 ± 0.00005	0.00017 ± 0.00002
19.8	. ± .	0.01825 ± 0.00366	0.01417 ± 0.00307	0.00053 ± 0.00017	0.00147 ± 0.00148	0.00163 ± 0.00132	0.00027 ± 0.00008	0.00018 ± 0.00002
20.3	0.00820 ± 0.00177	0.00661 ± 0.00195	0.00326 ± 0.00035	0.00064 ± 0.00019	0.00141 ± 0.00142	0.00085 ± 0.00127	0.00017 ± 0.00003	0.00027 ± 0.00003
20.8	0.00530 ± 0.00148	0.00594 ± 0.00189	0.00240 ± 0.00026	0.00053 ± 0.00016	0.00138 ± 0.00139	0.00129 ± 0.00124	0.00011 ± 0.00002	0.00023 ± 0.00002
21.3	0.00390 ± 0.00134	0.00457 ± 0.00188	0.00103 ± 0.00011	0.00046 ± 0.00014	0.00155 ± 0.00140	0.00134 ± 0.00125	0.00005 ± 0.00002	0.00015 ± 0.00002
21.8	0.00105 ± 0.00105	0.00325 ± 0.00187	0.00083 ± 0.00009	0.00033 ± 0.00011	0.00138 ± 0.00139	0.00053 ± 0.00124	0.00003 ± 0.00002	0.00015 ± 0.00002
22.3	0.00275 ± 0.00123	0.00393 ± 0.00186	0.00068 ± 0.00008	0.00026 ± 0.00010	0.00141 ± 0.00138	0.00144 ± 0.00124	0.00000 ± 0.00002	0.00014 ± 0.00002
22.8	0.00090 ± 0.00104	0.00360 ± 0.00192	0.00049 ± 0.00006	0.00039 ± 0.00013	0.00142 ± 0.00143	0.00113 ± 0.00127	0.00003 ± 0.00002	0.00014 ± 0.00002
23.3	0.00410 ± 0.00136	0.00521 ± 0.00188	0.00139 ± 0.00015	0.00045 ± 0.00014	0.00138 ± 0.00139	0.00166 ± 0.00125	0.00017 ± 0.00003	0.00016 ± 0.00002
23.8	. ± .	0.00714 ± 0.00192	0.00170 ± 0.00019	0.00058 ± 0.00015	0.00149 ± 0.00141	0.00274 ± 0.00128	0.00030 ± 0.00005	0.00033 ± 0.00004
24.3	0.00365 ± 0.00132	0.00448 ± 0.00187	0.00062 ± 0.00007	0.00063 ± 0.00016	0.00138 ± 0.00138	0.00158 ± 0.00124	0.00012 ± 0.00003	0.00015 ± 0.00002
24.8	0.00205 ± 0.00115	0.00504 ± 0.00187	0.00062 ± 0.00007	0.00058 ± 0.00014	0.00278 ± 0.00140	0.00081 ± 0.00123	0.00005 ± 0.00002	0.00019 ± 0.00002
25.3	0.00325 ± 0.00127	0.00234 ± 0.00185	0.00005 ± 0.00003	0.00055 ± 0.00012	0.00137 ± 0.00138	0.00001 ± 0.00123	0.00001 ± 0.00002	0.00036 ± 0.00004
25.8	0.00040 ± 0.00099	0.00249 ± 0.00183	0.00007 ± 0.00003	0.00039 ± 0.00011	0.00136 ± 0.00137	0.00046 ± 0.00122	0.00001 ± 0.00002	0.00020 ± 0.00002
26.3	0.00275 ± 0.00123	0.00451 ± 0.00185	0.00031 ± 0.00004	0.00030 ± 0.00010	0.00147 ± 0.00137	0.00221 ± 0.00124	0.00005 ± 0.00002	0.00016 ± 0.00002
26.8	0.00185 ± 0.00113	0.00425 ± 0.00186	0.00036 ± 0.00005	0.00041 ± 0.00012	0.00137 ± 0.00138	0.00192 ± 0.00124	0.00007 ± 0.00002	0.00013 ± 0.00001
27.3	0.00445 ± 0.00139	0.00408 ± 0.00186	0.00110 ± 0.00012	0.00045 ± 0.00014	0.00138 ± 0.00138	0.00075 ± 0.00123	0.00004 ± 0.00002	0.00036 ± 0.00004
27.8	0.00575 ± 0.00152	0.00748 ± 0.00188	0.00296 ± 0.00032	0.00081 ± 0.00019	0.00136 ± 0.00137	0.00175 ± 0.00123	0.00010 ± 0.00003	0.00050 ± 0.00005
28.3	0.00775 ± 0.00173	0.00756 ± 0.00190	0.00210 ± 0.00023	0.00099 ± 0.00022	0.00138 ± 0.00139	0.00231 ± 0.00126	0.00024 ± 0.00004	0.00054 ± 0.00006
28.8	0.00910 ± 0.00186	0.00893 ± 0.00195	0.00356 ± 0.00040	0.00124 ± 0.00025	0.00140 ± 0.00140	0.00196 ± 0.00126	0.00039 ± 0.00006	0.00039 ± 0.00004

Table 5.32: Extinction coefficients (Km^{-1}) due to each chemical species at Hopi Point when maximum organics are used. The total and measured extinction do not include Rayleigh scattering (continued from previous page).

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
29.3	0.01125 ± 0.00208	0.00673 ± 0.00186	0.00169 ± 0.00019	0.00135 ± 0.00027	0.00156 ± 0.00137	0.00135 ± 0.00122	0.00031 ± 0.00005	0.00047 ± 0.00005
29.8	0.00880 ± 0.00183	0.00777 ± 0.00189	0.00262 ± 0.00030	0.00131 ± 0.00026	0.00137 ± 0.00138	0.00150 ± 0.00123	0.00043 ± 0.00007	0.00055 ± 0.00006
30.3	0.00980 ± 0.00193	0.00752 ± 0.00192	0.00159 ± 0.00018	0.00127 ± 0.00026	0.00147 ± 0.00140	0.00228 ± 0.00127	0.00019 ± 0.00004	0.00071 ± 0.00008
30.8	. ± .	0.01997 ± 0.00390	0.01585 ± 0.00340	0.00093 ± 0.00023	0.00137 ± 0.00138	0.00025 ± 0.00122	0.00114 ± 0.00041	0.00043 ± 0.00005
31.3	0.01380 ± 0.00233	0.01655 ± 0.00274	0.01041 ± 0.00189	0.00076 ± 0.00022	0.00145 ± 0.00146	0.00205 ± 0.00132	0.00094 ± 0.00015	0.00093 ± 0.00010
31.8	0.00490 ± 0.00144	0.00670 ± 0.00192	0.00177 ± 0.00019	0.00064 ± 0.00017	0.00140 ± 0.00141	0.00191 ± 0.00127	0.00040 ± 0.00006	0.00058 ± 0.00006
32.3	0.00515 ± 0.00147	0.00475 ± 0.00190	0.00037 ± 0.00005	0.00058 ± 0.00015	0.00161 ± 0.00141	0.00139 ± 0.00126	0.00010 ± 0.00002	0.00070 ± 0.00007
32.8	0.00575 ± 0.00152	0.00308 ± 0.00186	0.00031 ± 0.00004	0.00073 ± 0.00017	0.00138 ± 0.00138	-0.00025 ± 0.00123	0.00006 ± 0.00002	0.00085 ± 0.00009
33.3	0.00980 ± 0.00193	0.00419 ± 0.00187	0.00040 ± 0.00005	0.00080 ± 0.00018	0.00138 ± 0.00139	0.00046 ± 0.00123	0.00008 ± 0.00002	0.00106 ± 0.00011
33.8	0.00515 ± 0.00147	0.00527 ± 0.00188	0.00064 ± 0.00007	0.00071 ± 0.00023	0.00151 ± 0.00139	0.00153 ± 0.00124	0.00011 ± 0.00003	0.00078 ± 0.00008
34.3	0.01300 ± 0.00225	0.00946 ± 0.00196	0.00504 ± 0.00053	0.00065 ± 0.00025	0.00139 ± 0.00139	0.00160 ± 0.00125	0.00014 ± 0.00003	0.00064 ± 0.00007
34.8	0.01200 ± 0.00215	0.02005 ± 0.00328	0.01644 ± 0.00267	0.00042 ± 0.00019	0.00179 ± 0.00142	0.00066 ± 0.00126	0.00046 ± 0.00014	0.00027 ± 0.00003
35.3	0.01750 ± 0.00270	0.02345 ± 0.00404	0.01883 ± 0.00355	0.00030 ± 0.00016	0.00141 ± 0.00141	0.00202 ± 0.00127	0.00055 ± 0.00019	0.00034 ± 0.00004
35.8	0.01140 ± 0.00209	0.00831 ± 0.00189	0.00510 ± 0.00057	0.00031 ± 0.00013	0.00133 ± 0.00134	0.00108 ± 0.00120	0.00019 ± 0.00005	0.00030 ± 0.00003
36.3	0.00570 ± 0.00152	0.00343 ± 0.00186	0.00088 ± 0.00010	0.00031 ± 0.00012	0.00138 ± 0.00138	0.00067 ± 0.00123	0.00002 ± 0.00002	0.00018 ± 0.00002
36.8	0.00355 ± 0.00130	0.00363 ± 0.00179	0.00062 ± 0.00007	0.00040 ± 0.00012	0.00133 ± 0.00133	0.00111 ± 0.00119	0.00000 ± 0.00002	0.00018 ± 0.00002
37.3	0.00550 ± 0.00150	0.00430 ± 0.00189	0.00097 ± 0.00011	0.00044 ± 0.00012	0.00140 ± 0.00141	0.00122 ± 0.00126	0.00003 ± 0.00002	0.00025 ± 0.00003
37.8	0.00300 ± 0.00125	0.00357 ± 0.00187	0.00093 ± 0.00010	0.00040 ± 0.00013	0.00139 ± 0.00139	0.00060 ± 0.00124	0.00003 ± 0.00002	0.00022 ± 0.00002
38.3	0.00590 ± 0.00154	0.00359 ± 0.00184	0.00112 ± 0.00012	0.00037 ± 0.00013	0.00136 ± 0.00137	0.00052 ± 0.00122	0.00001 ± 0.00002	0.00021 ± 0.00002
38.8	0.00320 ± 0.00127	0.00341 ± 0.00186	0.00089 ± 0.00010	0.00037 ± 0.00013	0.00137 ± 0.00138	0.00058 ± 0.00123	0.00001 ± 0.00002	0.00019 ± 0.00002
39.3	0.00625 ± 0.00158	0.00431 ± 0.00188	0.00104 ± 0.00011	0.00036 ± 0.00013	0.00139 ± 0.00140	0.00130 ± 0.00125	0.00002 ± 0.00002	0.00020 ± 0.00002
39.8	0.00590 ± 0.00154	0.00599 ± 0.00186	0.00197 ± 0.00021	0.00071 ± 0.00021	0.00136 ± 0.00137	0.00161 ± 0.00123	0.00006 ± 0.00003	0.00027 ± 0.00003
40.3	0.01075 ± 0.00203	0.00828 ± 0.00193	0.00282 ± 0.00030	0.00088 ± 0.00024	0.00139 ± 0.00140	0.00265 ± 0.00127	0.00010 ± 0.00002	0.00045 ± 0.00005
40.8	0.01185 ± 0.00213	0.01202 ± 0.00208	0.00693 ± 0.00084	0.00077 ± 0.00025	0.00139 ± 0.00140	0.00223 ± 0.00127	0.00029 ± 0.00006	0.00040 ± 0.00004
41.3	. ± .	0.01684 ± 0.00259	0.01107 ± 0.00176	0.00072 ± 0.00026	0.00139 ± 0.00139	0.00266 ± 0.00127	0.00051 ± 0.00009	0.00049 ± 0.00005
41.8	. ± .	0.03150 ± 0.00894	0.02525 ± 0.00869	0.00032 ± 0.00024	0.00137 ± 0.00137	0.00216 ± 0.00124	0.00220 ± 0.00098	0.00021 ± 0.00002
42.3	. ± .	0.02630 ± 0.00404	0.01949 ± 0.00355	0.00011 ± 0.00023	0.00253 ± 0.00140	0.00381 ± 0.00129	0.00037 ± 0.00008	. ± .
42.8	. ± .	0.07547 ± 0.02731	0.07070 ± 0.02723	0.00013 ± 0.00022	0.00138 ± 0.00139	0.00115 ± 0.00124	0.00195 ± 0.00060	0.00015 ± 0.00002
43.3	0.01280 ± 0.00223	0.01551 ± 0.00236	0.01058 ± 0.00139	0.00014 ± 0.00021	0.00139 ± 0.00140	0.00284 ± 0.00128	0.00032 ± 0.00006	0.00023 ± 0.00003
43.8	0.01250 ± 0.00220	0.01090 ± 0.00201	0.00666 ± 0.00074	0.00013 ± 0.00018	0.00138 ± 0.00138	0.00215 ± 0.00125	0.00036 ± 0.00007	0.00022 ± 0.00002
44.3	0.01475 ± 0.00242	0.00733 ± 0.00187	0.00226 ± 0.00025	0.00013 ± 0.00017	0.00135 ± 0.00136	0.00305 ± 0.00125	0.00037 ± 0.00006	0.00018 ± 0.00002
44.8	. ± .	0.00691 ± 0.00198	0.00271 ± 0.00062	0.00008 ± 0.00012	0.00138 ± 0.00139	0.00175 ± 0.00125	0.00066 ± 0.00014	0.00032 ± 0.00003
45.3	0.00575 ± 0.00152	0.00164 ± 0.00192	0.00021 ± 0.00005	0.00005 ± 0.00010	0.00143 ± 0.00144	-0.00017 ± 0.00127	0.00003 ± 0.00003	0.00010 ± 0.00001
45.8	0.00050 ± 0.00100	0.00157 ± 0.00191	0.00009 ± 0.00003	0.00020 ± 0.00010	0.00141 ± 0.00142	-0.00022 ± 0.00126	0.00000 ± 0.00002	0.00009 ± 0.00001
46.3	0.00750 ± 0.00170	0.00493 ± 0.00193	0.00040 ± 0.00006	0.00026 ± 0.00010	0.00142 ± 0.00143	0.00251 ± 0.00129	0.00019 ± 0.00003	0.00014 ± 0.00002
46.8	0.00600 ± 0.00155	0.00619 ± 0.00195	0.00187 ± 0.00033	0.00056 ± 0.00013	0.00142 ± 0.00142	0.00147 ± 0.00127	0.00047 ± 0.00009	0.00041 ± 0.00004
47.3	0.00280 ± 0.00123	0.00341 ± 0.00193	0.00151 ± 0.00017	0.00071 ± 0.00015	0.00142 ± 0.00143	-0.00032 ± 0.00127	0.00010 ± 0.00004	. ± .
47.8	0.00485 ± 0.00143	0.00306 ± 0.00190	0.00036 ± 0.00006	0.00032 ± 0.00011	0.00141 ± 0.00142	0.00085 ± 0.00126	0.00003 ± 0.00003	0.00009 ± 0.00001
48.3	0.00675 ± 0.00163	0.00181 ± 0.00189	0.00094 ± 0.00010	0.00012 ± 0.00009	0.00140 ± 0.00141	-0.00078 ± 0.00125	0.00000 ± 0.00002	0.00012 ± 0.00001
48.8	0.00405 ± 0.00136	0.00298 ± 0.00192	0.00132 ± 0.00015	0.00023 ± 0.00012	0.00142 ± 0.00143	-0.00015 ± 0.00127	. ± .	0.00016 ± 0.00002
Mean	0.00658 ± 0.00020	0.00871 ± 0.00043	0.004671± 0.00037	0.00049 ± 0.00002	0.00153 ± 0.00016	0.00140 ± 0.00014	0.000338± 0.00002	0.00030± 0.00000
Frac	0.75583 ± 0.04381	1.00000 ± 0.06986	0.536334± 0.05044	0.05622 ± 0.00359	0.17620 ± 0.02004	0.16012 ± 0.01800	0.038792± 0.00281	0.03421± 0.00176

Table 5.33: Fraction of non-Rayleigh light extinction due to each chemical species at Hopi Point when maximum organics are used.

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
9.3	1.000± 0.371	0.425± 0.120	0.024± 0.021	0.272± 0.205	0.235± 0.182	0.024± 0.007	0.021± 0.006
9.8	1.000± 0.481	0.429± 0.153	0.033± 0.027	0.250± 0.265	0.230± 0.237	0.030± 0.011	0.030± 0.011
10.3	1.000± 0.536	0.315± 0.124	0.038± 0.029	0.280± 0.299	0.294± 0.275	0.020± 0.010	0.058± 0.023
10.8	1.000± 0.741	0.521± 0.279	0.064± 0.050	0.386± 0.438	-0.040± 0.346	0.019± 0.013	0.051± 0.027
11.3	1.000± 0.452	0.455± 0.153	0.044± 0.028	0.234± 0.247	0.210± 0.221	0.012± 0.006	0.046± 0.016
11.8	1.000± 0.496	0.393± 0.144	0.037± 0.026	0.256± 0.274	0.275± 0.250	0.011± 0.007	0.026± 0.010
12.3	1.000± 0.651	0.229± 0.109	0.041± 0.030	0.339± 0.375	0.353± 0.346	0.002± 0.007	0.036± 0.017
12.8	1.000± 0.475	0.118± 0.042	0.029± 0.020	0.707± 0.348	0.120± 0.222	0.000± 0.005	0.024± 0.009
13.3	1.000± 0.793	0.128± 0.073	0.052± 0.042	0.500± 0.503	0.274± 0.403	0.009± 0.008	0.040± 0.023
13.8	1.000± 0.516	0.294± 0.112	0.052± 0.034	0.268± 0.287	0.317± 0.268	0.030± 0.012	0.041± 0.015
14.3	1.000± 0.341	0.384± 0.101	0.042± 0.024	0.174± 0.180	0.268± 0.170	0.097± 0.027	0.034± 0.009
14.8	1.000± 0.160	0.364± 0.057	0.038± 0.014	0.251± 0.082	0.266± 0.076	0.069± 0.011	0.013± 0.002
15.3	1.000± 0.243	0.409± 0.086	0.076± 0.028	0.119± 0.121	0.244± 0.117	0.135± 0.029	0.018± 0.003
15.8	1.000± 0.231	0.673± 0.159	0.051± 0.020	0.084± 0.086	0.039± 0.076	0.140± 0.031	0.012± 0.002
16.3	1.000± 0.194	0.666± 0.118	0.048± 0.019	0.084± 0.085	0.097± 0.077	0.106± 0.019	. ± .
16.8	1.000± 0.180	0.718± 0.131	0.032± 0.011	0.064± 0.064	0.093± 0.058	0.076± 0.014	0.016± 0.003
17.3	1.000± 0.377	0.481± 0.138	0.096± 0.040	0.193± 0.201	0.152± 0.179	0.040± 0.013	0.039± 0.011
17.8	1.000± 0.590	0.387± 0.167	0.102± 0.055	0.309± 0.335	0.146± 0.283	0.013± 0.007	0.043± 0.019
18.3	1.000± 0.729	0.240± 0.127	0.096± 0.060	0.383± 0.431	0.234± 0.362	0.019± 0.011	0.030± 0.016
18.8	1.000± 0.677	0.212± 0.105	0.081± 0.049	0.356± 0.394	0.289± 0.347	0.020± 0.014	0.042± 0.021
19.3	1.000± 0.522	0.330± 0.129	0.060± 0.031	0.272± 0.290	0.278± 0.265	0.027± 0.014	0.033± 0.013
19.8	1.000± 0.284	0.776± 0.229	0.029± 0.011	0.081± 0.083	0.089± 0.075	0.015± 0.005	0.010± 0.002
20.3	1.000± 0.417	0.493± 0.155	0.097± 0.041	0.213± 0.224	0.129± 0.196	0.026± 0.009	0.041± 0.013
20.8	1.000± 0.450	0.404± 0.136	0.089± 0.039	0.232± 0.245	0.217± 0.220	0.019± 0.007	0.039± 0.013
21.3	1.000± 0.582	0.225± 0.096	0.101± 0.052	0.339± 0.337	0.293± 0.299	0.011± 0.006	0.033± 0.014
21.8	1.000± 0.814	0.255± 0.150	0.102± 0.068	0.425± 0.493	0.163± 0.393	0.009± 0.008	0.046± 0.027
22.3	1.000± 0.669	0.173± 0.084	0.066± 0.040	0.359± 0.390	0.366± 0.360	0.000± 0.005	0.036± 0.018
22.8	1.000± 0.754	0.136± 0.074	0.108± 0.068	0.394± 0.449	0.314± 0.390	0.008± 0.007	0.039± 0.021
23.3	1.000± 0.510	0.267± 0.100	0.086± 0.041	0.265± 0.283	0.319± 0.266	0.033± 0.013	0.031± 0.012
23.8	1.000± 0.380	0.238± 0.069	0.081± 0.030	0.209± 0.205	0.384± 0.207	0.042± 0.013	0.046± 0.014
24.3	1.000± 0.590	0.138± 0.060	0.141± 0.069	0.308± 0.334	0.353± 0.313	0.027± 0.013	0.033± 0.015
24.8	1.000± 0.525	0.123± 0.048	0.115± 0.051	0.552± 0.345	0.161± 0.251	0.010± 0.005	0.038± 0.015
25.3	1.000± 1.118	0.021± 0.021	0.235± 0.193	0.585± 0.750	0.004± 0.526	0.004± 0.009	0.154± 0.123
25.8	1.000± 1.039	0.028± 0.024	0.157± 0.123	0.546± 0.681	0.185± 0.508	0.004± 0.009	0.080± 0.060
26.3	1.000± 0.580	0.069± 0.030	0.067± 0.035	0.326± 0.332	0.490± 0.341	0.011± 0.006	0.035± 0.015
26.8	1.000± 0.619	0.085± 0.039	0.096± 0.051	0.322± 0.354	0.452± 0.352	0.016± 0.009	0.031± 0.014
27.3	1.000± 0.645	0.270± 0.126	0.110± 0.061	0.338± 0.372	0.184± 0.313	0.010± 0.007	0.088± 0.041
27.8	1.000± 0.355	0.396± 0.108	0.108± 0.037	0.182± 0.189	0.234± 0.175	0.013± 0.005	0.067± 0.018
28.3	1.000± 0.355	0.278± 0.076	0.131± 0.044	0.183± 0.189	0.306± 0.184	0.032± 0.010	0.071± 0.020
28.8	1.000± 0.309	0.399± 0.098	0.139± 0.041	0.157± 0.160	0.219± 0.149	0.044± 0.012	0.044± 0.011

Table 5.33: Fraction of non-Rayleigh light extinction due to each chemical species at Hopi Point when maximum organics are used (continued from previous page).

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
29.3	1.000± 0.391	0.251± 0.075	0.201± 0.068	0.232± 0.213	0.201± 0.190	0.046± 0.015	0.070± 0.021
29.8	1.000± 0.344	0.337± 0.091	0.169± 0.053	0.176± 0.183	0.193± 0.165	0.055± 0.016	0.071± 0.019
30.3	1.000± 0.361	0.211± 0.059	0.169± 0.055	0.195± 0.193	0.303± 0.186	0.025± 0.008	0.094± 0.026
30.8	1.000± 0.276	0.794± 0.230	0.047± 0.015	0.069± 0.070	0.013± 0.061	0.057± 0.023	0.022± 0.005
31.3	1.000± 0.234	0.629± 0.155	0.046± 0.015	0.088± 0.089	0.124± 0.082	0.057± 0.013	0.056± 0.011
31.8	1.000± 0.405	0.264± 0.081	0.096± 0.037	0.209± 0.219	0.285± 0.206	0.060± 0.019	0.087± 0.026
32.3	1.000± 0.566	0.078± 0.033	0.122± 0.058	0.339± 0.326	0.293± 0.290	0.021± 0.009	0.147± 0.061
32.8	1.000± 0.854	0.101± 0.062	0.237± 0.153	0.448± 0.523	-0.081± 0.402	0.019± 0.013	0.276± 0.169
33.3	1.000± 0.631	0.095± 0.044	0.191± 0.095	0.329± 0.363	0.110± 0.298	0.019± 0.010	0.253± 0.116
33.8	1.000± 0.505	0.121± 0.045	0.135± 0.065	0.287± 0.283	0.290± 0.257	0.021± 0.009	0.148± 0.055
34.3	1.000± 0.293	0.533± 0.124	0.069± 0.030	0.147± 0.150	0.169± 0.137	0.015± 0.004	0.068± 0.016
34.8	1.000± 0.231	0.820± 0.189	0.021± 0.010	0.089± 0.072	0.033± 0.063	0.023± 0.008	0.013± 0.003
35.3	1.000± 0.244	0.803± 0.205	0.013± 0.007	0.060± 0.061	0.086± 0.056	0.023± 0.009	0.014± 0.003
35.8	1.000± 0.322	0.614± 0.156	0.037± 0.018	0.160± 0.165	0.130± 0.147	0.023± 0.008	0.036± 0.009
36.3	1.000± 0.767	0.257± 0.142	0.090± 0.060	0.402± 0.458	0.195± 0.374	0.006± 0.007	0.052± 0.029
36.8	1.000± 0.697	0.171± 0.086	0.110± 0.064	0.366± 0.409	0.306± 0.361	0.000± 0.006	0.050± 0.025
37.3	1.000± 0.622	0.226± 0.102	0.102± 0.053	0.326± 0.358	0.284± 0.318	0.007± 0.006	0.058± 0.026
37.8	1.000± 0.741	0.261± 0.139	0.112± 0.069	0.389± 0.440	0.168± 0.358	0.008± 0.007	0.062± 0.033
38.3	1.000± 0.725	0.312± 0.163	0.103± 0.064	0.379± 0.428	0.145± 0.348	0.003± 0.006	0.058± 0.030
38.8	1.000± 0.771	0.261± 0.145	0.109± 0.070	0.402± 0.460	0.170± 0.372	0.003± 0.006	0.056± 0.031
39.3	1.000± 0.617	0.241± 0.108	0.084± 0.047	0.323± 0.354	0.302± 0.318	0.005± 0.005	0.046± 0.021
39.8	1.000± 0.439	0.329± 0.108	0.119± 0.051	0.227± 0.239	0.269± 0.222	0.010± 0.006	0.045± 0.015
40.3	1.000± 0.330	0.341± 0.087	0.106± 0.038	0.168± 0.174	0.320± 0.171	0.012± 0.004	0.054± 0.014
40.8	1.000± 0.245	0.577± 0.122	0.064± 0.024	0.116± 0.118	0.186± 0.110	0.024± 0.007	0.033± 0.007
41.3	1.000± 0.218	0.657± 0.145	0.043± 0.017	0.083± 0.084	0.158± 0.079	0.030± 0.007	0.029± 0.005
41.8	1.000± 0.401	0.802± 0.358	0.010± 0.008	0.043± 0.045	0.069± 0.044	0.070± 0.037	0.007± 0.002
42.3	1.000± 0.217	0.741± 0.177	0.004± 0.009	0.096± 0.055	0.145± 0.054	0.014± 0.004	. ± .
42.8	1.000± 0.512	0.937± 0.495	0.002± 0.003	0.018± 0.020	0.015± 0.017	0.026± 0.012	0.002± 0.001
43.3	1.000± 0.215	0.682± 0.137	0.009± 0.014	0.090± 0.091	0.183± 0.087	0.021± 0.005	0.015± 0.003
43.8	1.000± 0.261	0.611± 0.132	0.012± 0.017	0.127± 0.129	0.197± 0.120	0.033± 0.009	0.020± 0.004
44.3	1.000± 0.361	0.308± 0.086	0.018± 0.024	0.184± 0.191	0.416± 0.201	0.050± 0.015	0.025± 0.007
44.8	1.000± 0.405	0.392± 0.144	0.012± 0.018	0.200± 0.209	0.253± 0.195	0.096± 0.034	0.046± 0.014
45.3	1.000± 1.656	0.128± 0.153	0.030± 0.071	0.872± 1.346	-0.104± 0.784	0.018± 0.028	0.061± 0.072
45.8	1.000± 1.720	0.057± 0.072	0.127± 0.168	0.898± 1.418	-0.140± 0.820	0.000± 0.013	0.057± 0.070
46.3	1.000± 0.554	0.081± 0.034	0.053± 0.029	0.288± 0.311	0.509± 0.329	0.039± 0.016	0.028± 0.012
46.8	1.000± 0.446	0.302± 0.109	0.090± 0.035	0.229± 0.241	0.237± 0.218	0.076± 0.028	0.066± 0.022
47.3	1.000± 0.800	0.443± 0.256	0.208± 0.126	0.416± 0.481	-0.094± 0.376	0.029± 0.020	. ± .
47.8	1.000± 0.878	0.118± 0.076	0.105± 0.074	0.461± 0.545	0.278± 0.446	0.010± 0.012	0.029± 0.019
48.3	1.000± 1.477	0.519± 0.545	0.066± 0.085	0.773± 1.122	-0.431± 0.824	0.000± 0.011	0.066± 0.069
48.8	1.000± 0.911	0.443± 0.290	0.077± 0.064	0.477± 0.570	-0.050± 0.427	. ± .	0.054± 0.035

Table 5.34: Extinction coefficients (Km^{-1}) due to each chemical species at Hopi Point when minimum organics are used. The total and measured extinction do not include Rayleigh scattering.

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
9.3	0.00530± 0.00148	0.00552 ± 0.00198	0.00322 ± 0.00034	0.00018 ± 0.00015	0.00000 ± 0.00145	0.00178 ± 0.00130	0.00018 ± 0.00003	0.00016 ± 0.00002
9.8	0.00495± 0.00145	0.00430 ± 0.00194	0.00246 ± 0.00026	0.00019 ± 0.00014	0.00000 ± 0.00143	0.00132 ± 0.00128	0.00017 ± 0.00003	0.00017 ± 0.00002
10.3	0.00600± 0.00155	0.00364 ± 0.00190	0.00159 ± 0.00017	0.00019 ± 0.00013	0.00000 ± 0.00141	0.00148 ± 0.00127	0.00010 ± 0.00003	0.00029 ± 0.00003
10.8	0.00450± 0.00140	0.00231 ± 0.00196	0.00196 ± 0.00021	0.00024 ± 0.00014	0.00000 ± 0.00145	-0.00015 ± 0.00130	0.00007 ± 0.00003	0.00019 ± 0.00002
11.3	0.00650± 0.00160	0.00448 ± 0.00187	0.00266 ± 0.00028	0.00026 ± 0.00014	0.00000 ± 0.00137	0.00123 ± 0.00123	0.00007 ± 0.00003	0.00027 ± 0.00003
11.8	0.00485± 0.00143	0.00403 ± 0.00189	0.00213 ± 0.00023	0.00020 ± 0.00012	0.00000 ± 0.00139	0.00149 ± 0.00125	0.00006 ± 0.00003	0.00014 ± 0.00002
12.3	0.00520± 0.00147	0.00277 ± 0.00192	0.00096 ± 0.00011	0.00017 ± 0.00010	0.00000 ± 0.00142	0.00148 ± 0.00128	0.00001 ± 0.00003	0.00015 ± 0.00002
12.8	0.00055± 0.00100	0.00577 ± 0.00194	0.00068 ± 0.00008	0.00017 ± 0.00010	0.00408 ± 0.00147	0.00069 ± 0.00126	0.00000 ± 0.00003	0.00014 ± 0.00002
13.3	0.00290± 0.00124	0.00164 ± 0.00183	0.00042 ± 0.00005	0.00017 ± 0.00010	0.00000 ± 0.00136	0.00090 ± 0.00122	0.00003 ± 0.00002	0.00013 ± 0.00002
13.8	0.00430± 0.00138	0.00393 ± 0.00195	0.00158 ± 0.00017	0.00028 ± 0.00015	0.00000 ± 0.00144	0.00170 ± 0.00130	0.00016 ± 0.00003	0.00022 ± 0.00002
14.3	0.01200± 0.00215	0.00670 ± 0.00195	0.00312 ± 0.00033	0.00034 ± 0.00018	0.00000 ± 0.00141	0.00218 ± 0.00128	0.00079 ± 0.00010	0.00028 ± 0.00003
14.8	0.01490± 0.00244	0.01966 ± 0.00222	0.00715 ± 0.00078	0.00074 ± 0.00026	0.00494 ± 0.00152	0.00522 ± 0.00138	0.00135 ± 0.00016	0.00026 ± 0.00003
15.3	0.01730± 0.00268	0.01091 ± 0.00212	0.00506 ± 0.00061	0.00094 ± 0.00030	0.00000 ± 0.00147	0.00302 ± 0.00135	0.00167 ± 0.00022	0.00022 ± 0.00002
15.8	. ± .	0.01533 ± 0.00273	0.01126 ± 0.00192	0.00086 ± 0.00030	0.00000 ± 0.00141	0.00066 ± 0.00126	0.00235 ± 0.00035	0.00020 ± 0.00002
16.3	. ± .	0.01580 ± 0.00236	0.01148 ± 0.00129	0.00082 ± 0.00030	0.00000 ± 0.00144	0.00168 ± 0.00130	0.00182 ± 0.00022	. ± .
16.8	. ± .	0.02191 ± 0.00298	0.01682 ± 0.00218	0.00075 ± 0.00025	0.00000 ± 0.00148	0.00218 ± 0.00134	0.00177 ± 0.00023	0.00038 ± 0.00004
17.3	0.00630± 0.00158	0.00599 ± 0.00198	0.00357 ± 0.00038	0.00071 ± 0.00023	0.00000 ± 0.00143	0.00113 ± 0.00129	0.00030 ± 0.00005	0.00029 ± 0.00003
17.8	0.00475± 0.00142	0.00318 ± 0.00192	0.00178 ± 0.00019	0.00047 ± 0.00016	0.00000 ± 0.00142	0.00067 ± 0.00127	0.00006 ± 0.00002	0.00020 ± 0.00002
18.3	0.00740± 0.00169	0.00225 ± 0.00187	0.00087 ± 0.00010	0.00035 ± 0.00012	0.00000 ± 0.00139	0.00085 ± 0.00124	0.00007 ± 0.00002	0.00011 ± 0.00001
18.8	0.00315± 0.00126	0.00261 ± 0.00194	0.00086 ± 0.00010	0.00033 ± 0.00012	0.00000 ± 0.00144	0.00117 ± 0.00129	0.00008 ± 0.00004	0.00017 ± 0.00002
19.3	0.00800± 0.00175	0.00375 ± 0.00190	0.00170 ± 0.00022	0.00031 ± 0.00011	0.00000 ± 0.00140	0.00143 ± 0.00126	0.00014 ± 0.00005	0.00017 ± 0.00002
19.8	. ± .	0.01678 ± 0.00366	0.01417 ± 0.00307	0.00053 ± 0.00017	0.00000 ± 0.00147	0.00163 ± 0.00132	0.00027 ± 0.00008	0.00018 ± 0.00002
20.3	0.00820± 0.00177	0.00520 ± 0.00194	0.00326 ± 0.00035	0.00064 ± 0.00019	0.00000 ± 0.00141	0.00085 ± 0.00127	0.00017 ± 0.00003	0.00027 ± 0.00003
20.8	0.00530± 0.00148	0.00455 ± 0.00188	0.00240 ± 0.00026	0.00053 ± 0.00016	0.00000 ± 0.00138	0.00129 ± 0.00124	0.00011 ± 0.00002	0.00023 ± 0.00002
21.3	0.00390± 0.00134	0.00303 ± 0.00187	0.00103 ± 0.00011	0.00046 ± 0.00014	0.00000 ± 0.00139	0.00134 ± 0.00125	0.00005 ± 0.00002	0.00015 ± 0.00002
21.8	0.00105± 0.00105	0.00187 ± 0.00186	0.00083 ± 0.00009	0.00033 ± 0.00011	0.00000 ± 0.00138	0.00053 ± 0.00124	0.00003 ± 0.00002	0.00015 ± 0.00002
22.3	0.00275± 0.00123	0.00252 ± 0.00186	0.00068 ± 0.00008	0.00026 ± 0.00010	0.00000 ± 0.00138	0.00144 ± 0.00124	0.00000 ± 0.00002	0.00014 ± 0.00002
22.8	0.00090± 0.00104	0.00219 ± 0.00191	0.00049 ± 0.00006	0.00039 ± 0.00013	0.00000 ± 0.00142	0.00113 ± 0.00127	0.00003 ± 0.00002	0.00014 ± 0.00002
23.3	0.00410± 0.00136	0.00383 ± 0.00187	0.00139 ± 0.00015	0.00045 ± 0.00014	0.00000 ± 0.00138	0.00166 ± 0.00125	0.00017 ± 0.00003	0.00016 ± 0.00002
23.8	. ± .	0.00565 ± 0.00192	0.00170 ± 0.00019	0.00058 ± 0.00015	0.00000 ± 0.00140	0.00274 ± 0.00128	0.00030 ± 0.00005	0.00033 ± 0.00004
24.3	0.00365± 0.00132	0.00311 ± 0.00186	0.00062 ± 0.00007	0.00063 ± 0.00016	0.00000 ± 0.00138	0.00158 ± 0.00124	0.00012 ± 0.00003	0.00015 ± 0.00002
24.8	0.00205± 0.00115	0.00504 ± 0.00187	0.00062 ± 0.00007	0.00058 ± 0.00014	0.00278 ± 0.00140	0.00081 ± 0.00123	0.00005 ± 0.00002	0.00019 ± 0.00002
25.3	0.00325± 0.00127	0.00097 ± 0.00184	0.00005 ± 0.00003	0.00055 ± 0.00012	0.00000 ± 0.00137	0.00001 ± 0.00123	0.00001 ± 0.00002	0.00036 ± 0.00004
25.8	0.00040± 0.00099	0.00113 ± 0.00183	0.00007 ± 0.00003	0.00039 ± 0.00011	0.00000 ± 0.00136	0.00046 ± 0.00122	0.00001 ± 0.00002	0.00020 ± 0.00002
26.3	0.00275± 0.00123	0.00304 ± 0.00185	0.00031 ± 0.00004	0.00030 ± 0.00010	0.00000 ± 0.00137	0.00221 ± 0.00124	0.00005 ± 0.00002	0.00016 ± 0.00002
26.8	0.00185± 0.00113	0.00288 ± 0.00186	0.00036 ± 0.00005	0.00041 ± 0.00012	0.00000 ± 0.00137	0.00192 ± 0.00124	0.00007 ± 0.00002	0.00013 ± 0.00001
27.3	0.00445± 0.00139	0.00270 ± 0.00186	0.00110 ± 0.00012	0.00045 ± 0.00014	0.00000 ± 0.00138	0.00075 ± 0.00123	0.00004 ± 0.00002	0.00036 ± 0.00004
27.8	0.00575± 0.00152	0.00612 ± 0.00187	0.00296 ± 0.00032	0.00081 ± 0.00019	0.00000 ± 0.00136	0.00175 ± 0.00123	0.00010 ± 0.00003	0.00050 ± 0.00005

Table 5.34: Extinction coefficients (Km^{-1}) due to each chemical species at Hopi Point when minimum organics are used. The total and measured extinction do not include Rayleigh scattering (continued from previous page).

Date	Measured	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
28.3	0.00775± 0.00173	0.00618 ± 0.00190	0.00210 ± 0.00023	0.00099 ± 0.00022	0.00000 ± 0.00138	0.00231 ± 0.00126	0.00024 ± 0.00004	0.00054 ± 0.00006
28.8	0.00910± 0.00186	0.00754 ± 0.00194	0.00356 ± 0.00040	0.00124 ± 0.00025	0.00000 ± 0.00140	0.00196 ± 0.00126	0.00039 ± 0.00006	0.00039 ± 0.00004
29.3	0.01125± 0.00208	0.00517 ± 0.00186	0.00169 ± 0.00019	0.00135 ± 0.00027	0.00000 ± 0.00136	0.00135 ± 0.00122	0.00031 ± 0.00005	0.00047 ± 0.00005
29.8	0.00880± 0.00183	0.00640 ± 0.00189	0.00262 ± 0.00030	0.00131 ± 0.00026	0.00000 ± 0.00137	0.00150 ± 0.00123	0.00043 ± 0.00007	0.00055 ± 0.00006
30.3	0.00980± 0.00193	0.00605 ± 0.00191	0.00159 ± 0.00018	0.00127 ± 0.00026	0.00000 ± 0.00139	0.00228 ± 0.00127	0.00019 ± 0.00004	0.00071 ± 0.00008
30.8	. ± .	0.01860 ± 0.00390	0.01585 ± 0.00340	0.00093 ± 0.00023	0.00000 ± 0.00137	0.00025 ± 0.00122	0.00114 ± 0.00041	0.00043 ± 0.00005
31.3	0.01380± 0.00233	0.01510 ± 0.00274	0.01041 ± 0.00189	0.00076 ± 0.00022	0.00000 ± 0.00145	0.00205 ± 0.00132	0.00094 ± 0.00015	0.00093 ± 0.00010
31.8	0.00490± 0.00144	0.00530 ± 0.00191	0.00177 ± 0.00019	0.00064 ± 0.00017	0.00000 ± 0.00140	0.00191 ± 0.00127	0.00040 ± 0.00006	0.00058 ± 0.00006
32.3	0.00515± 0.00147	0.00314 ± 0.00189	0.00037 ± 0.00005	0.00058 ± 0.00015	0.00000 ± 0.00140	0.00139 ± 0.00126	0.00010 ± 0.00002	0.00070 ± 0.00007
32.8	0.00575± 0.00152	0.00170 ± 0.00186	0.00031 ± 0.00004	0.00073 ± 0.00017	0.00000 ± 0.00138	-0.00025 ± 0.00123	0.00006 ± 0.00002	0.00085 ± 0.00009
33.3	0.00980± 0.00193	0.00281 ± 0.00187	0.00040 ± 0.00005	0.00080 ± 0.00018	0.00000 ± 0.00138	0.00046 ± 0.00123	0.00008 ± 0.00002	0.00106 ± 0.00011
33.8	0.00515± 0.00147	0.00376 ± 0.00187	0.00064 ± 0.00007	0.00071 ± 0.00023	0.00000 ± 0.00138	0.00153 ± 0.00124	0.00011 ± 0.00003	0.00078 ± 0.00008
34.3	0.01300± 0.00225	0.00807 ± 0.00196	0.00504 ± 0.00053	0.00065 ± 0.00025	0.00000 ± 0.00139	0.00160 ± 0.00125	0.00014 ± 0.00003	0.00064 ± 0.00007
34.8	0.01200± 0.00215	0.01825 ± 0.00328	0.01644 ± 0.00267	0.00042 ± 0.00019	0.00000 ± 0.00141	0.00066 ± 0.00126	0.00046 ± 0.00014	0.00027 ± 0.00003
35.3	0.01750± 0.00270	0.02204 ± 0.00403	0.01883 ± 0.00355	0.00030 ± 0.00016	0.00000 ± 0.00141	0.00202 ± 0.00127	0.00055 ± 0.00019	0.00034 ± 0.00004
35.8	0.01140± 0.00209	0.00698 ± 0.00189	0.00510 ± 0.00057	0.00031 ± 0.00013	0.00000 ± 0.00133	0.00108 ± 0.00120	0.00019 ± 0.00005	0.00030 ± 0.00003
36.3	0.00570± 0.00152	0.00206 ± 0.00185	0.00088 ± 0.00010	0.00031 ± 0.00012	0.00000 ± 0.00138	0.00067 ± 0.00123	0.00002 ± 0.00002	0.00018 ± 0.00002
36.8	0.00355± 0.00130	0.00230 ± 0.00179	0.00062 ± 0.00007	0.00040 ± 0.00012	0.00000 ± 0.00133	0.00111 ± 0.00119	0.00000 ± 0.00002	0.00018 ± 0.00002
37.3	0.00550± 0.00150	0.00290 ± 0.00189	0.00097 ± 0.00011	0.00044 ± 0.00012	0.00000 ± 0.00140	0.00122 ± 0.00126	0.00003 ± 0.00002	0.00025 ± 0.00003
37.8	0.00300± 0.00125	0.00218 ± 0.00187	0.00093 ± 0.00010	0.00040 ± 0.00013	0.00000 ± 0.00139	0.00060 ± 0.00124	0.00003 ± 0.00002	0.00022 ± 0.00002
38.3	0.00590± 0.00154	0.00223 ± 0.00183	0.00112 ± 0.00012	0.00037 ± 0.00013	0.00000 ± 0.00136	0.00052 ± 0.00122	0.00001 ± 0.00002	0.00021 ± 0.00002
38.8	0.00320± 0.00127	0.00204 ± 0.00185	0.00089 ± 0.00010	0.00037 ± 0.00013	0.00000 ± 0.00137	0.00058 ± 0.00123	0.00001 ± 0.00002	0.00019 ± 0.00002
39.3	0.00625± 0.00158	0.00292 ± 0.00188	0.00104 ± 0.00011	0.00036 ± 0.00013	0.00000 ± 0.00139	0.00130 ± 0.00125	0.00002 ± 0.00002	0.00020 ± 0.00002
39.8	0.00590± 0.00154	0.00463 ± 0.00186	0.00197 ± 0.00021	0.00071 ± 0.00021	0.00000 ± 0.00136	0.00161 ± 0.00123	0.00006 ± 0.00003	0.00027 ± 0.00003
40.3	0.01075± 0.00203	0.00689 ± 0.00192	0.00282 ± 0.00030	0.00088 ± 0.00024	0.00000 ± 0.00139	0.00265 ± 0.00127	0.00010 ± 0.00002	0.00045 ± 0.00005
40.8	0.01185± 0.00213	0.01063 ± 0.00208	0.00693 ± 0.00084	0.00077 ± 0.00025	0.00000 ± 0.00139	0.00223 ± 0.00127	0.00029 ± 0.00006	0.00040 ± 0.00004
41.3	. ± .	0.01545 ± 0.00259	0.01107 ± 0.00176	0.00072 ± 0.00026	0.00000 ± 0.00139	0.00266 ± 0.00127	0.00051 ± 0.00009	0.00049 ± 0.00005
41.8	. ± .	0.03013 ± 0.00894	0.02525 ± 0.00869	0.00032 ± 0.00024	0.00000 ± 0.00137	0.00216 ± 0.00124	0.00220 ± 0.00098	0.00021 ± 0.00002
42.3	. ± .	0.02377 ± 0.00403	0.01949 ± 0.00355	0.00011 ± 0.00023	0.00000 ± 0.00137	0.00381 ± 0.00129	0.00037 ± 0.00008	. ± .
42.8	. ± .	0.07409 ± 0.02731	0.07070 ± 0.02723	0.00013 ± 0.00022	0.00000 ± 0.00138	0.00115 ± 0.00124	0.00195 ± 0.00060	0.00015 ± 0.00002
43.3	0.01280± 0.00223	0.01412 ± 0.00235	0.01058 ± 0.00139	0.00014 ± 0.00021	0.00000 ± 0.00139	0.00284 ± 0.00128	0.00032 ± 0.00006	0.00023 ± 0.00003
43.8	0.01250± 0.00220	0.00953 ± 0.00201	0.00666 ± 0.00074	0.00013 ± 0.00018	0.00000 ± 0.00138	0.00215 ± 0.00125	0.00036 ± 0.00007	0.00022 ± 0.00002
44.3	0.01475± 0.00242	0.00598 ± 0.00186	0.00226 ± 0.00025	0.00013 ± 0.00017	0.00000 ± 0.00135	0.00305 ± 0.00125	0.00037 ± 0.00006	0.00018 ± 0.00002
44.8	. ± .	0.00553 ± 0.00197	0.00271 ± 0.00062	0.00008 ± 0.00012	0.00000 ± 0.00138	0.00175 ± 0.00125	0.00066 ± 0.00014	0.00032 ± 0.00003
45.3	0.00575± 0.00152	0.00021 ± 0.00192	0.00021 ± 0.00005	0.00005 ± 0.00010	0.00000 ± 0.00143	-0.00017 ± 0.00127	0.00003 ± 0.00003	0.00010 ± 0.00001
45.8	0.00050± 0.00100	0.00015 ± 0.00190	0.00009 ± 0.00003	0.00020 ± 0.00010	0.00000 ± 0.00142	-0.00022 ± 0.00126	0.00000 ± 0.00002	0.00009 ± 0.00001
46.3	0.00750± 0.00170	0.00351 ± 0.00192	0.00040 ± 0.00006	0.00026 ± 0.00010	0.00000 ± 0.00142	0.00251 ± 0.00129	0.00019 ± 0.00003	0.00014 ± 0.00002
46.8	0.00600± 0.00155	0.00477 ± 0.00194	0.00187 ± 0.00033	0.00056 ± 0.00013	0.00000 ± 0.00142	0.00147 ± 0.00127	0.00047 ± 0.00009	0.00041 ± 0.00004
47.3	0.00280± 0.00123	0.00199 ± 0.00192	0.00151 ± 0.00017	0.00071 ± 0.00015	0.00000 ± 0.00142	-0.00032 ± 0.00127	0.00010 ± 0.00004	. ± .
47.8	0.00485± 0.00143	0.00165 ± 0.00190	0.00036 ± 0.00006	0.00032 ± 0.00011	0.00000 ± 0.00141	0.00085 ± 0.00126	0.00003 ± 0.00003	0.00009 ± 0.00001
48.3	0.00675± 0.00163	0.00041 ± 0.00188	0.00094 ± 0.00010	0.00012 ± 0.00009	0.00000 ± 0.00140	-0.00078 ± 0.00125	0.00000 ± 0.00002	0.00012 ± 0.00001
48.8	0.00405± 0.00136	0.00156 ± 0.00192	0.00132 ± 0.00015	0.00023 ± 0.00012	0.00000 ± 0.00142	-0.00015 ± 0.00127	0.00000 ± .	0.00016 ± 0.00002
Mean	0.00658± 0.00020	0.00732 ± 0.00043	0.004671± 0.00037	0.00049 ± 0.00002	0.00015 ± 0.00016	0.00139 ± 0.00014	0.00034 ± 0.00002	0.00030 ± 0.00000
Frac	0.89894± 0.05941	1.00000 ± 0.08304	0.637886± 0.06332	0.06687 ± 0.00477	0.02014 ± 0.02140	0.19044 ± 0.02225	0.04614 ± 0.00365	0.04069 ± 0.00246

Table 5.35: Fraction of non-Rayleigh extinction due to each chemical species at Hopi Point when minimum organics are used.

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
9.3	1.000± 0.507	0.583± 0.218	0.033± 0.030	0.000± 0.263	0.322± 0.262	0.033± 0.013	0.029± 0.011
9.8	1.000± 0.638	0.572± 0.265	0.044± 0.038	0.000± 0.333	0.307± 0.328	0.040± 0.019	0.040± 0.018
10.3	1.000± 0.738	0.437± 0.233	0.052± 0.045	0.000± 0.387	0.407± 0.408	0.027± 0.017	0.080± 0.042
10.8	1.000± 1.200	0.848± 0.726	0.104± 0.107	0.000± 0.628	-0.065± 0.565	0.030± 0.029	0.082± 0.070
11.3	1.000± 0.590	0.594± 0.256	0.058± 0.040	0.000± 0.306	0.275± 0.298	0.016± 0.009	0.060± 0.026
11.8	1.000± 0.663	0.529± 0.254	0.050± 0.038	0.000± 0.345	0.370± 0.355	0.015± 0.010	0.035± 0.017
12.3	1.000± 0.980	0.347± 0.243	0.061± 0.056	0.000± 0.513	0.534± 0.592	0.004± 0.011	0.054± 0.038
12.8	1.000± 0.475	0.118± 0.042	0.029± 0.020	0.707± 0.348	0.120± 0.222	0.000± 0.005	0.024± 0.009
13.3	1.000± 1.578	0.256± 0.287	0.104± 0.131	0.000± 0.829	0.549± 0.964	0.018± 0.024	0.079± 0.089
13.8	1.000± 0.702	0.402± 0.204	0.071± 0.052	0.000± 0.366	0.433± 0.394	0.041± 0.022	0.056± 0.028
14.3	1.000± 0.412	0.466± 0.144	0.051± 0.031	0.000± 0.210	0.325± 0.213	0.118± 0.037	0.042± 0.013
14.8	1.000± 0.160	0.364± 0.057	0.038± 0.014	0.251± 0.082	0.266± 0.076	0.069± 0.011	0.013± 0.002
15.3	1.000± 0.275	0.464± 0.106	0.086± 0.032	0.000± 0.135	0.277± 0.135	0.153± 0.036	0.020± 0.004
15.8	1.000± 0.252	0.735± 0.181	0.056± 0.022	0.000± 0.092	0.043± 0.083	0.153± 0.036	0.013± 0.003
16.3	1.000± 0.211	0.727± 0.136	0.052± 0.021	0.000± 0.091	0.106± 0.084	0.115± 0.022	. ± .
16.8	1.000± 0.192	0.768± 0.144	0.034± 0.012	0.000± 0.068	0.099± 0.063	0.081± 0.015	0.017± 0.003
17.3	1.000± 0.467	0.596± 0.207	0.119± 0.055	0.000± 0.239	0.189± 0.224	0.050± 0.019	0.048± 0.017
17.8	1.000± 0.854	0.560± 0.343	0.148± 0.102	0.000± 0.447	0.211± 0.419	0.019± 0.013	0.063± 0.038
18.3	1.000± 1.175	0.387± 0.324	0.156± 0.140	0.000± 0.618	0.378± 0.634	0.031± 0.027	0.049± 0.041
18.8	1.000± 1.051	0.330± 0.248	0.126± 0.105	0.000± 0.552	0.448± 0.596	0.031± 0.027	0.065± 0.049
19.3	1.000± 0.717	0.453± 0.237	0.083± 0.051	0.000± 0.373	0.381± 0.388	0.037± 0.023	0.045± 0.024
19.8	1.000± 0.308	0.844± 0.260	0.032± 0.012	0.000± 0.088	0.097± 0.081	0.016± 0.006	0.011± 0.003
20.3	1.000± 0.528	0.627± 0.243	0.123± 0.059	0.000± 0.271	0.163± 0.252	0.033± 0.013	0.052± 0.020
20.8	1.000± 0.584	0.527± 0.225	0.116± 0.060	0.000± 0.303	0.284± 0.297	0.024± 0.011	0.051± 0.021
21.3	1.000± 0.873	0.340± 0.213	0.152± 0.104	0.000± 0.459	0.442± 0.495	0.017± 0.012	0.050± 0.031
21.8	1.000± 1.407	0.444± 0.444	0.176± 0.185	0.000± 0.738	0.283± 0.721	0.016± 0.019	0.080± 0.080
22.3	1.000± 1.044	0.270± 0.202	0.103± 0.086	0.000± 0.548	0.571± 0.648	0.000± 0.008	0.056± 0.042
22.8	1.000± 1.233	0.224± 0.197	0.178± 0.166	0.000± 0.648	0.516± 0.734	0.014± 0.015	0.064± 0.056
23.3	1.000± 0.690	0.363± 0.181	0.117± 0.068	0.000± 0.360	0.433± 0.389	0.044± 0.023	0.042± 0.021
23.8	1.000± 0.481	0.301± 0.108	0.103± 0.044	0.000± 0.248	0.485± 0.280	0.053± 0.020	0.058± 0.021
24.3	1.000± 0.846	0.199± 0.121	0.203± 0.132	0.000± 0.444	0.508± 0.501	0.039± 0.025	0.048± 0.030
24.8	1.000± 0.525	0.123± 0.048	0.115± 0.051	0.552± 0.345	0.161± 0.251	0.010± 0.005	0.038± 0.015
25.3	1.000± 2.683	0.052± 0.103	0.567± 1.083	0.000± 1.412	0.010± 1.268	0.010± 0.028	0.371± 0.705
25.8	1.000± 2.290	0.062± 0.104	0.345± 0.567	0.000± 1.204	0.407± 1.265	0.009± 0.023	0.177± 0.287
26.3	1.000± 0.861	0.102± 0.063	0.099± 0.068	0.000± 0.451	0.727± 0.602	0.016± 0.012	0.053± 0.033
26.8	1.000± 0.913	0.125± 0.083	0.142± 0.101	0.000± 0.476	0.667± 0.609	0.024± 0.017	0.045± 0.029
27.3	1.000± 0.974	0.407± 0.284	0.167± 0.126	0.000± 0.511	0.278± 0.494	0.015± 0.013	0.133± 0.093
27.8	1.000± 0.432	0.484± 0.157	0.132± 0.051	0.000± 0.222	0.286± 0.219	0.016± 0.007	0.082± 0.026

Table 5.35: Fraction of non-Rayleigh extinction due to each chemical species at Hopi Point when minimum organics are used (continued from previous page).

Date	Total	Sulfates	Coarse	Organics	LAC	Nitrates	Fine Soil
28.3	1.000± 0.435	0.340± 0.111	0.160± 0.061	0.000± 0.223	0.374± 0.234	0.039± 0.014	0.087± 0.029
28.8	1.000± 0.364	0.472± 0.133	0.164± 0.054	0.000± 0.186	0.260± 0.180	0.052± 0.016	0.052± 0.014
29.3	1.000± 0.509	0.327± 0.123	0.261± 0.107	0.000± 0.263	0.261± 0.254	0.060± 0.024	0.091± 0.034
29.8	1.000± 0.418	0.409± 0.130	0.205± 0.073	0.000± 0.214	0.234± 0.204	0.067± 0.023	0.086± 0.027
30.3	1.000± 0.446	0.263± 0.088	0.210± 0.079	0.000± 0.230	0.377± 0.241	0.031± 0.012	0.117± 0.039
30.8	1.000± 0.297	0.852± 0.256	0.050± 0.016	0.000± 0.074	0.013± 0.066	0.061± 0.026	0.023± 0.006
31.3	1.000± 0.257	0.689± 0.177	0.050± 0.017	0.000± 0.096	0.136± 0.091	0.062± 0.015	0.062± 0.013
31.8	1.000± 0.510	0.334± 0.126	0.121± 0.054	0.000± 0.264	0.360± 0.273	0.075± 0.029	0.109± 0.041
32.3	1.000± 0.851	0.118± 0.073	0.185± 0.121	0.000± 0.446	0.443± 0.482	0.032± 0.020	0.223± 0.136
32.8	1.000± 1.547	0.182± 0.201	0.429± 0.480	0.000± 0.812	-0.147± 0.741	0.035± 0.040	0.500± 0.550
33.3	1.000± 0.941	0.142± 0.096	0.285± 0.200	0.000± 0.491	0.164± 0.451	0.028± 0.020	0.377± 0.254
33.8	1.000± 0.703	0.170± 0.087	0.189± 0.112	0.000± 0.367	0.407± 0.387	0.029± 0.017	0.207± 0.105
34.3	1.000± 0.343	0.625± 0.165	0.081± 0.037	0.000± 0.172	0.198± 0.162	0.017± 0.006	0.079± 0.021
34.8	1.000± 0.254	0.901± 0.218	0.023± 0.011	0.000± 0.077	0.036± 0.069	0.025± 0.009	0.015± 0.003
35.3	1.000± 0.259	0.854± 0.224	0.014± 0.008	0.000± 0.064	0.092± 0.060	0.025± 0.010	0.015± 0.003
35.8	1.000± 0.383	0.731± 0.214	0.044± 0.022	0.000± 0.191	0.155± 0.177	0.027± 0.010	0.043± 0.012
36.3	1.000± 1.270	0.427± 0.387	0.150± 0.147	0.000± 0.670	0.325± 0.665	0.010± 0.013	0.087± 0.079
36.8	1.000± 1.101	0.270± 0.212	0.174± 0.145	0.000± 0.578	0.483± 0.639	0.000± 0.009	0.078± 0.062
37.3	1.000± 0.922	0.334± 0.221	0.152± 0.107	0.000± 0.483	0.421± 0.514	0.010± 0.010	0.086± 0.057
37.8	1.000± 1.213	0.427± 0.369	0.183± 0.168	0.000± 0.638	0.275± 0.616	0.014± 0.015	0.101± 0.087
38.3	1.000± 1.161	0.502± 0.416	0.166± 0.148	0.000± 0.610	0.233± 0.580	0.004± 0.010	0.094± 0.078
38.8	1.000± 1.282	0.436± 0.399	0.181± 0.176	0.000± 0.672	0.284± 0.656	0.005± 0.011	0.093± 0.085
39.3	1.000± 0.911	0.356± 0.232	0.123± 0.091	0.000± 0.476	0.445± 0.515	0.007± 0.008	0.068± 0.045
39.8	1.000± 0.568	0.425± 0.177	0.153± 0.077	0.000± 0.294	0.348± 0.300	0.013± 0.008	0.058± 0.024
40.3	1.000± 0.394	0.409± 0.122	0.128± 0.050	0.000± 0.202	0.385± 0.213	0.015± 0.005	0.065± 0.020
40.8	1.000± 0.277	0.652± 0.150	0.072± 0.027	0.000± 0.131	0.210± 0.126	0.027± 0.008	0.038± 0.008
41.3	1.000± 0.237	0.717± 0.166	0.047± 0.019	0.000± 0.090	0.172± 0.087	0.033± 0.008	0.032± 0.006
41.8	1.000± 0.420	0.838± 0.381	0.011± 0.009	0.000± 0.045	0.072± 0.046	0.073± 0.039	0.007± 0.002
42.3	1.000± 0.240	0.820± 0.204	0.005± 0.010	0.000± 0.058	0.160± 0.061	0.016± 0.004	. ± .
42.8	1.000± 0.521	0.954± 0.509	0.002± 0.003	0.000± 0.019	0.016± 0.018	0.026± 0.013	0.002± 0.001
43.3	1.000± 0.235	0.749± 0.159	0.010± 0.015	0.000± 0.098	0.201± 0.097	0.023± 0.006	0.016± 0.003
43.8	1.000± 0.298	0.699± 0.167	0.014± 0.019	0.000± 0.145	0.226± 0.140	0.038± 0.011	0.023± 0.005
44.3	1.000± 0.440	0.378± 0.125	0.022± 0.029	0.000± 0.226	0.510± 0.262	0.062± 0.022	0.030± 0.010
44.8	1.000± 0.504	0.490± 0.207	0.014± 0.022	0.000± 0.250	0.316± 0.253	0.119± 0.049	0.058± 0.021
45.3	1.000± 12.930	1.000± 9.146	0.238± 2.228	0.000± 6.810	-0.810± 9.558	0.143± 1.314	0.476± 4.354
45.8	1.000± 17.913	0.600± 7.603	1.333± 16.902	0.000± 9.467	-1.467± 20.389	0.000± 0.133	0.600± 7.600
46.3	1.000± 0.774	0.114± 0.065	0.074± 0.050	0.000± 0.405	0.715± 0.537	0.054± 0.031	0.040± 0.023
46.8	1.000± 0.575	0.392± 0.174	0.117± 0.055	0.000± 0.298	0.308± 0.294	0.099± 0.044	0.086± 0.036
47.3	1.000± 1.364	0.759± 0.737	0.357± 0.352	0.000± 0.714	-0.161± 0.657	0.050± 0.052	. ± .
47.8	1.000± 1.628	0.218± 0.254	0.194± 0.233	0.000± 0.855	0.515± 0.967	0.018± 0.028	0.055± 0.063
48.3	1.000± 6.485	2.293± 10.516	0.293± 1.360	0.000± 3.415	-1.902± 9.241	0.000± 0.049	0.293± 1.342
48.8	1.000± 1.741	0.846± 1.046	0.147± 0.197	0.000± 0.910	-0.096± 0.823	. ± .	0.103± 0.127

At all three sites, it can be seen that scattering by fine sulfates dominates when the extinction coefficient is high. When the extinction coefficient is below average, sulfate scattering is still important, but scattering by organics and absorption due to elemental carbon are also often large fractions of the total extinction. This is especially true for Page.

5.5.2 Budgets on Extreme Extinction Days

The maximum 24-hour averaged measured extinction at Page was 0.0769 Km^{-1}. This occurred on Julian day 43 (Feb. 12). The minimum measured extinction at Page occurred 2 days later on Julian day 45 (Feb 14) when it was 0.0129 Km^{-1}. These days were also near the extremes of the reconstructed extinction values at Hopi Point and Canyonlands. Although Julian day 42 (Feb 11) is used as the high extinction day at Hopi Point since the extinction at Hopi Point was higher on that day than on Feb 12. A summary of the extinction budgets for these two days is shown in Table 5.36. On Feb. 12 (Feb 11 at Hopi Point), light extinction was dominated by scattering due to fine sulfates at all three sites. In contrast, Feb 14 was a near-Rayleigh day at all sites, with Rayleigh scattering accounting for 89±14%, 92±16%, and 98±18% of the light extinction at Page, Canyonlands, and Hopi Point, respectively. The pie charts in Figures 5.26, 5.27, 5.28, and 5.29 illustrate these budgets. The relative sizes of the pies are proportional to the measured light extinction.

5.6 Comparison to Previous Studies at Grand Canyon

WHITEX extinction budgets are similar to the results of at least two previous studies which have reported light extinction budgets for Grand Canyon National Park (Hopi Point) (Malm, et al.[5] and Malm and Johnson[7]). Scattering by fine ammonium sulfate was found to be the dominant factor in the non-Rayleigh light extinction budget in all three studies even though WHITEX was during the winter, another study was for summertime data, and the third included data for a full two year time period. During WHITEX, the percent of the non-Rayleigh scattering at Hopi Point due to fine sulfates was 68%. Malm et al. found that 47–48% of the scattering during a two week period in August 1984 was due to fine sulfates and Malm and Johnson attributed 63% of the scattering during two years from December 1979 to November 1981 to fine sulfates.

5.7 Summary

The findings of this chapter are summarized below:

- The nephelometer underestimates the actual scattering coefficient by as much as a factor of three when the relative humidity is very high (> 90%). However there is evidence that it does not dry the particles completely.
- TOR light absorbing carbon measurements appear to be slightly too high and TMO concentrations are too low, but the TOR values are closer to what is expected based on the optical measurements.
- The largest fraction of mean non-Rayleigh extinction at Page, Canyonlands, and Hopi Point is scattering by fine sulfates. The two next largest fractions are absorption by light absorbing carbon and scattering by organics, with organics being more important at Page and particle absorption more important at Canyonlands and Hopi Point. (See Figure 5.3.)