

Grand Canyon (GRCA) 2016 Site Report

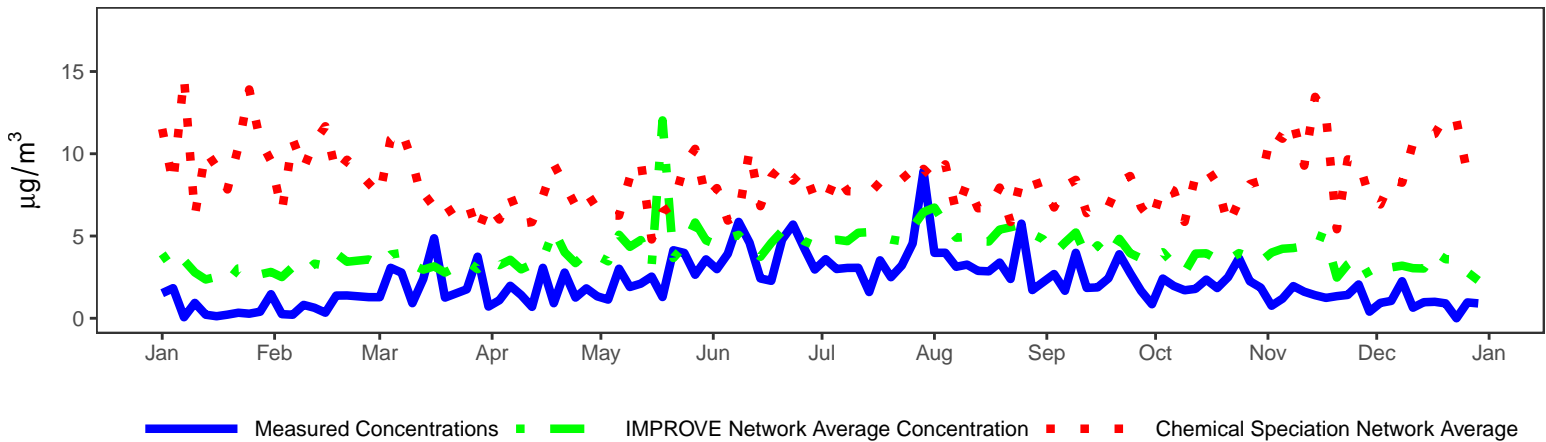
The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a long-term air pollution measurement program designed to document and track visibility in protected areas. IMPROVE samples and analyzes the haze particles that impair visibility so their sources can be identified and addressed.

Percent of Samples from GRCA Successfully Collected and Analyzed Per Year

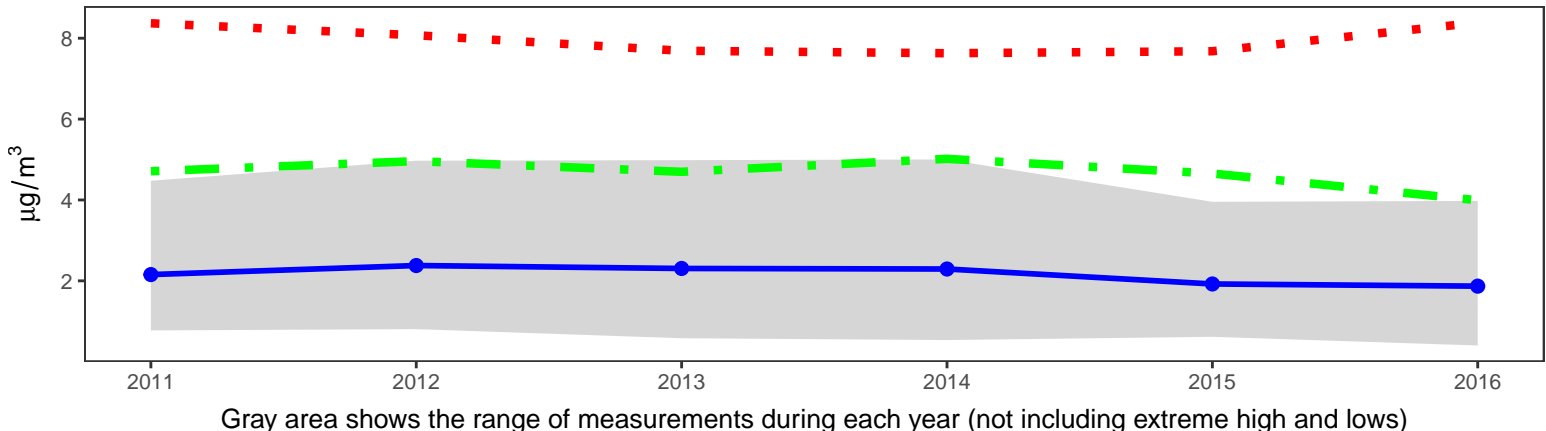
| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 95 | 90 | 100 | 88 | 80 | 98 | 99 | 94 | 95 | 95 | 95 | 100 | 100 | 97 | 98 | 95 | 97 |

In the plots below, mass concentrations measured at Grand Canyon give a sense of the seasonal trends of air quality in the area as well as show significant air quality events such as wildfires and dust storms. These are plotted alongside the average measurements across the IMPROVE network as well as its related Chemical Speciation Network (CSN). The CSN sites are located in urban areas where the populations are highest. In general, lower concentrations would suggest better visibility. The lower plot shows annual median concentrations with a gray shaded region to represent the 10th and 90th percentiles.

Daily Fine Particle Mass Concentrations in 2016



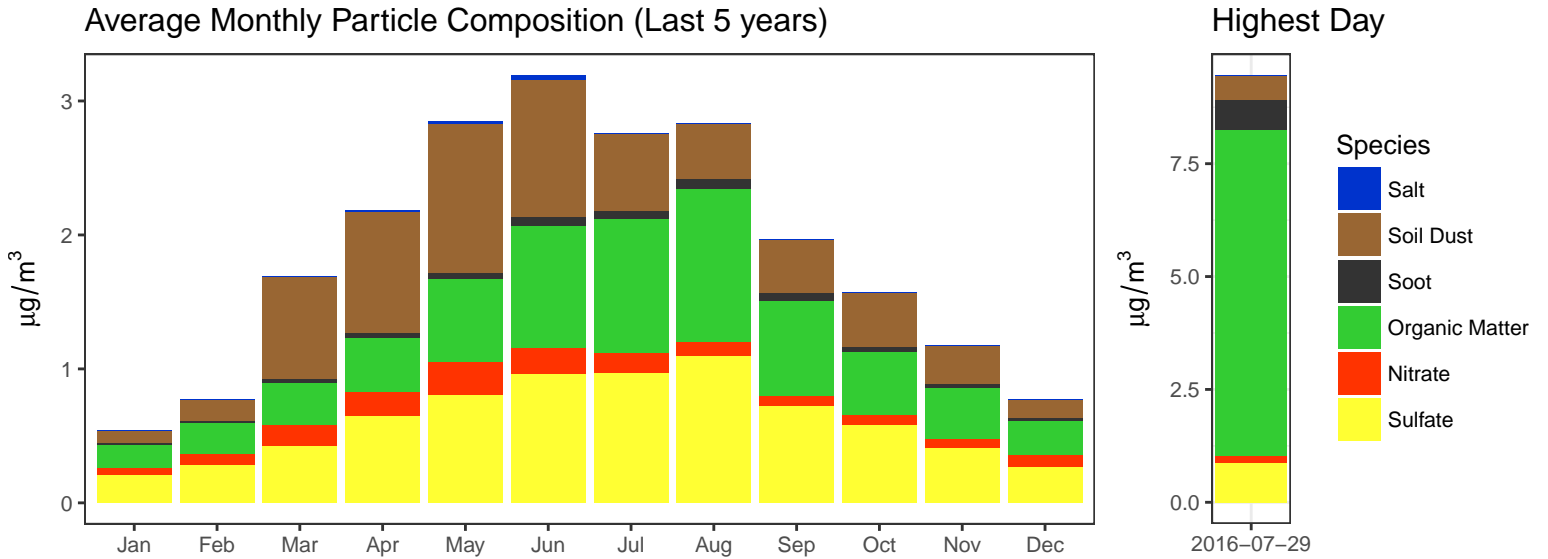
Trend in Fine Particle Mass Concentration Since 2000



More Information

To view and download IMPROVE data, you can visit: www3.epa.gov/airquality/airdata/
 The Univ. of California, Davis website with information about current research and publications: airquality.crocker.ucdavis.edu
 The Colorado State Univ. website with data resources, literature, and visibility overviews: vista.cira.colostate.edu/improve/
 The EPA website with guidance documents and background information: www3.epa.gov/ttnamti1/visdata.html
 Real-time air monitoring data for the United States: www.airnow.gov

The following plots summarize the chemical composition of particles collected at this site on a monthly average (left) and for the day with the highest measured mass during 2016 (right).



| Species | Natural Sources | Human-Made Sources |
|----------------|--------------------------------|---|
| Salt | Ocean spray, dry lakebeds | Chemical manufacturing, lake consumption |
| Soil Dust | Soil resuspension, dust storms | Construction, agriculture, deforestation, unpaved roads |
| Soot | Wildfires | Motor vehicles, wood burning, smoking |
| Organic Matter | Plants, animals, wildfires | Motor vehicles, cooking oils, household cleaners |
| Nitrate | Plants, animals | Fertilizer, stock yards, chemical manufacturing |
| Sulfate | Volcanism | Coal-fired power plants, chemical manufacturing |

The following map shows the average mass concentrations for both IMPROVE and the urban Chemical Speciation Network (CSN) sites in the region. The symbols indicate which network the sites are associated with. The color bar indicates the average annual mass concentration (micrograms per cubic meter) measured at each site in 2016.

