

Aerosol Measurements at South Pole: Impact of Local Contamination

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Aerosol measurements have been conducted at the South Pole Atmospheric Baseline Observatory (SPO) by NOAA/GMD continuously since 1974. Aerosol measurements made in the station's Clean Air Sector (CAS) show the lowest aerosol concentrations routinely measured at the earth's surface. Some of the early measurements were, however, influenced by the local sources and these data were removed from the clean data archive. In these cases, wind sector screening is vital; without this, single short-term events can dominate a parameter's average. Fortunately, contamination in the CAS is thought to be rare since local sources tend to be downwind of the measurements due to the predominant air flow pattern.

In this study, we asked to what extent human activity may have influenced the aerosol measurements in recent years. In the 2000's, two large construction projects occurred that brought additional people and increased local pollution to SPO. These were the construction of the New South Pole Station (1999-2007) and the development of the IceCube Solar Neutrino Observatory (2005-2010). Additionally, there were individual events that had the potential to skew long-term trends if not properly identified as local pollution and removed from the clean data archive (e.g., the demolition of the Old Pole Station in December 2010).

Markers of human activity over the years at South Pole have been analyzed and compared with the long-term aerosol record (Figure 1). These markers include metrics such as station population, number of cargo flights, and station fuel consumption. The human activity markers peak in the period 2005.5-2007, shown by the 'MAX' bar on the upper panel. There is no corresponding bump in the long-term aerosol records during this period (particle number concentration is shown) as might be expected if increased local pollution was contaminating the measurements. The trend line is very slightly increasing over this period but over the longer term is flat. From comparisons such as these we conclude that increased activity at SPO during the mid-2000's did not appreciably affect the aerosol measurements being made there. Additional analysis showed discrete events that did contaminate the CAS for extended periods of time. These events were relatively rare, however, and were removed from the clean data archive so as not to affect the long-term trends.

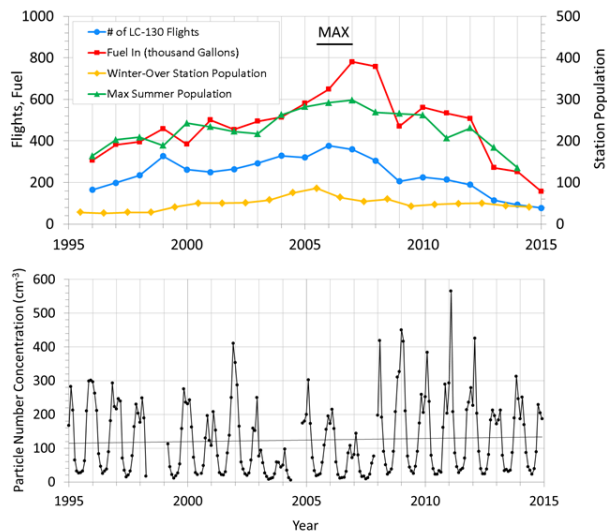


Figure 1. Times series of human activity markers and aerosol particle concentration measurements at SPO over the last 20 years.