Preliminary Conceptual Model - Causes of Haze in Guadalupe Mountains National Park (GUMO1)

Sulfate from the southeastern United States and from point sources in the northeastern Mexico in the summer, as well as dust from western Texas and Mexico border, and southeastern Texas in the spring are the major causes of haze at the Guadalupe Mountains National Park.

The Guadalupe Mountains IMPROVE monitoring site is located 8 km (5 mi) southeast of Guadalupe Peak. The monitoring site is technically outside of the Class I area (Guadalupe Mountains National Park) at an elevation of 1,674 m (5,492 ft). The site is located near the top of the NW-SE oriented Delaware Mountain Range. It thus has good exposure to regional scale winds. The site may be influenced by wind blown dust from the dry lake (bare ground) in western Texas, as well as from the Mexican dry/barren region to the southwest. The average $PM_{2.5}$ mass concentration during the years 1997-2002 is 5.6 $\mu g/m^3$, and the average total light extinction coefficient (B_{ext}) is 35.7 Mm^{-1} (Visual Range ~ 109 Km; Deciview ~ 12.7). In average, sulfate is the largest contributor to haze, with a contribution of ~30%.

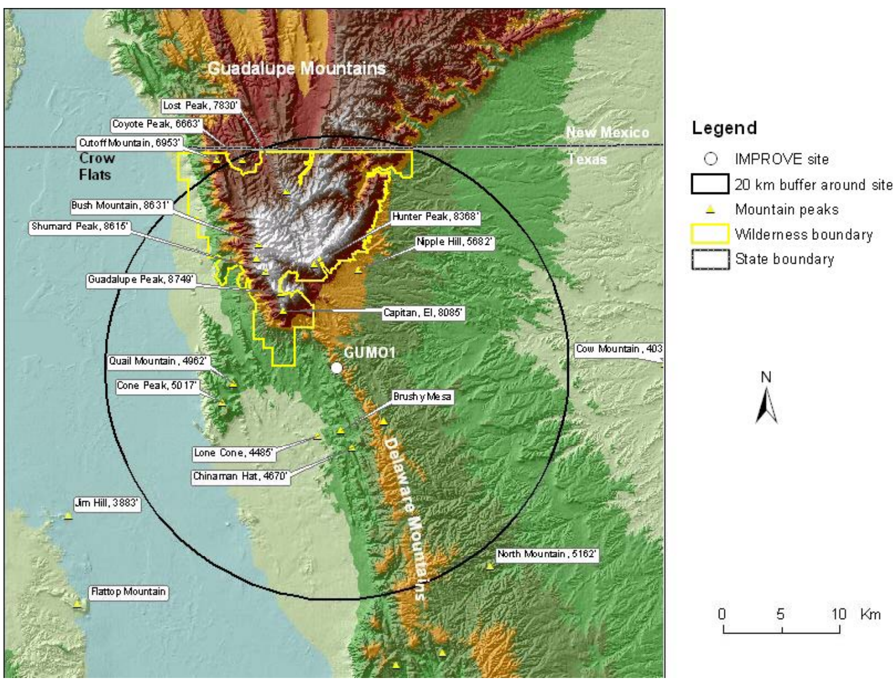

Figure 1. 20 Km terrain map

Figure 3 suggests that the highest occurrence of the 20% worst days happened in September, in which ~40% of the sampling days are the 20% haziest days at Guadalupe Mountains National Park. As shown in Figure 4, sulfate is the largest aerosol contributor to haze in the summer, with a contribution of 40-55% on the 20% worst days. In the spring, CM is the largest aerosol contributor to haze, and its contribution is about 30% on the worst days. Fine soil also contributes ~25% during the 20% worst days in March, which may due to relatively long-range transported dust.

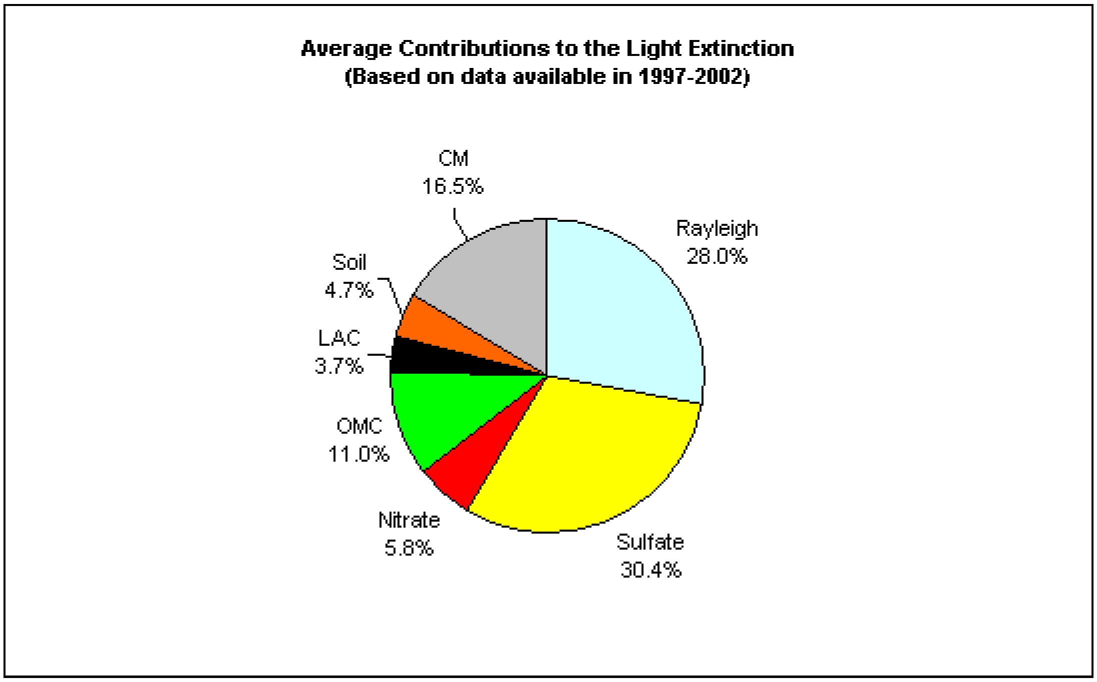

Figure 2. Average contributions of major aerosol chemical components to light extinction (Based on data available from 1997-2002)

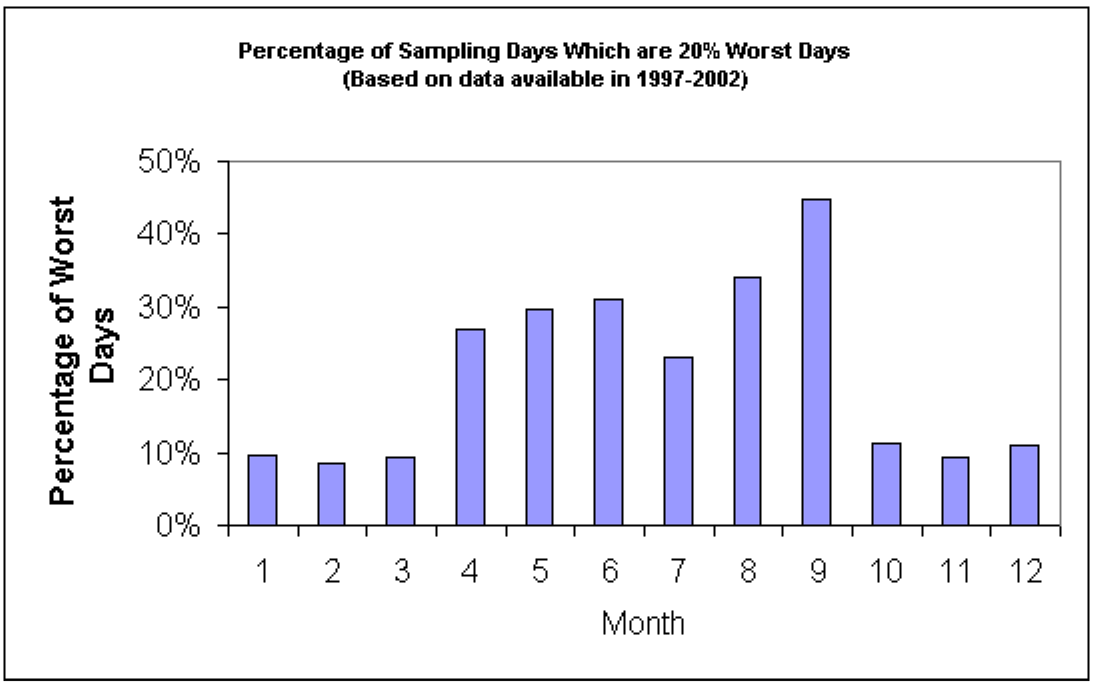

Figure 3. Percentage of sampling days that are 20% worst days in each month (Based on data available from 1997-2002)

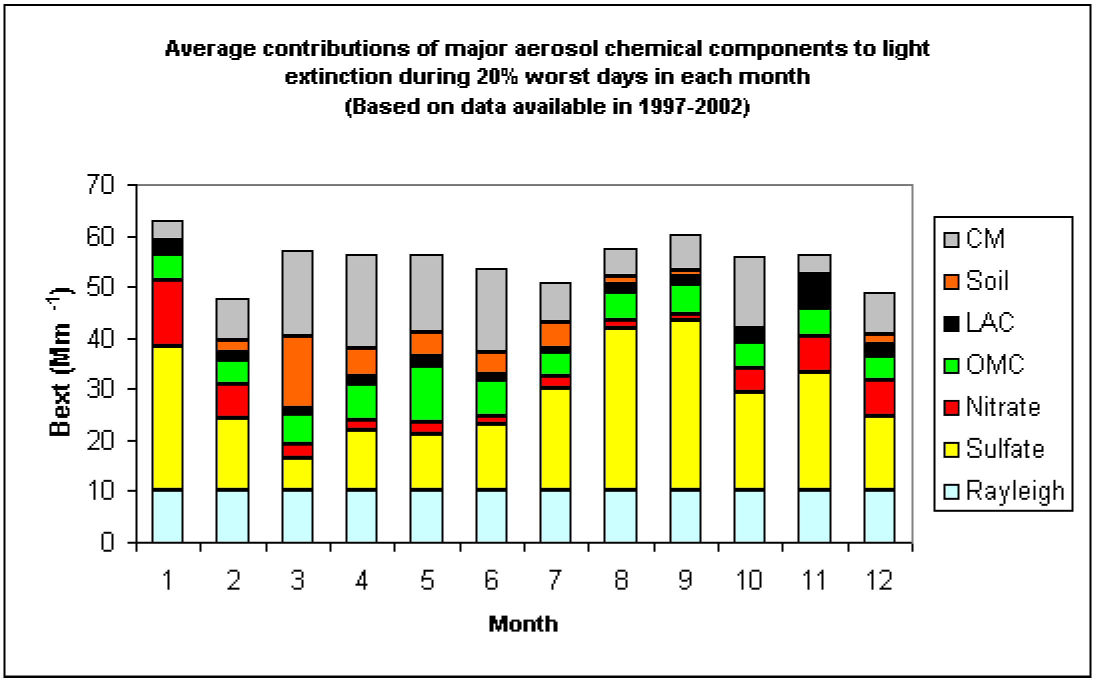

Figure 4. Average contributions of major aerosol chemical components to light extinction during 20% worst days in each month (Based on data available from 1997-2002)

Figure 5 shows main flow direction from the northwest in the cool season. Southeasterly flows from the Gulf of Mexico are dominant in the summer.

Dust is the major contributor to haze during the spring. Figure 6 suggests that dust is most likely transported from the western Texas and Mexico border, as well as southeastern Texas.

Sulfate is the largest contributor to aerosol light extinction in the summer. Figure 7 suggests that sulfate is mainly transported from the southeastern United States in the 20% highest sulfate days. There are some important point sources such as the Carbon I and II coal-fired Power Plants located in northern Mexico. These power plants are among the largest SO_2 point sources, and may contribute to the sulfate loadings at the GUMO1 year-round.

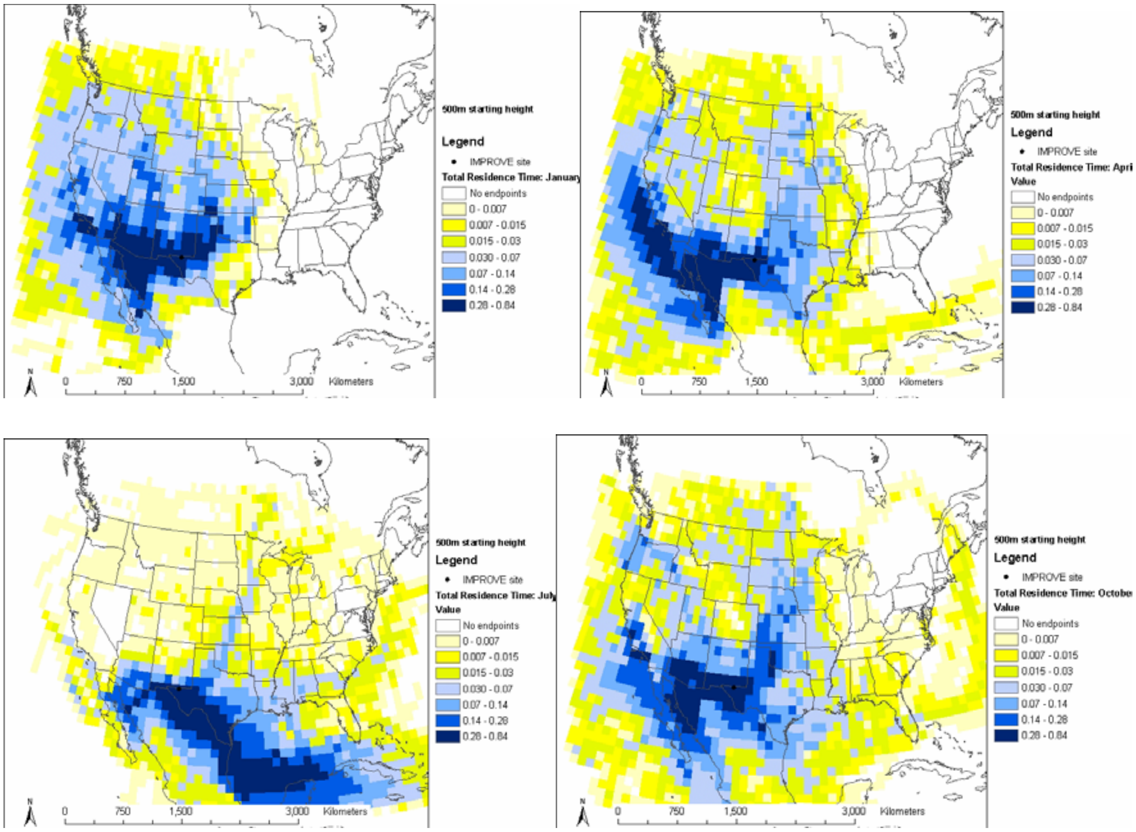

Figure 5. Normalized residence time in January (top left) and April (top right), July (bottom left) and October (bottom right) (based on data in 2000-2002)

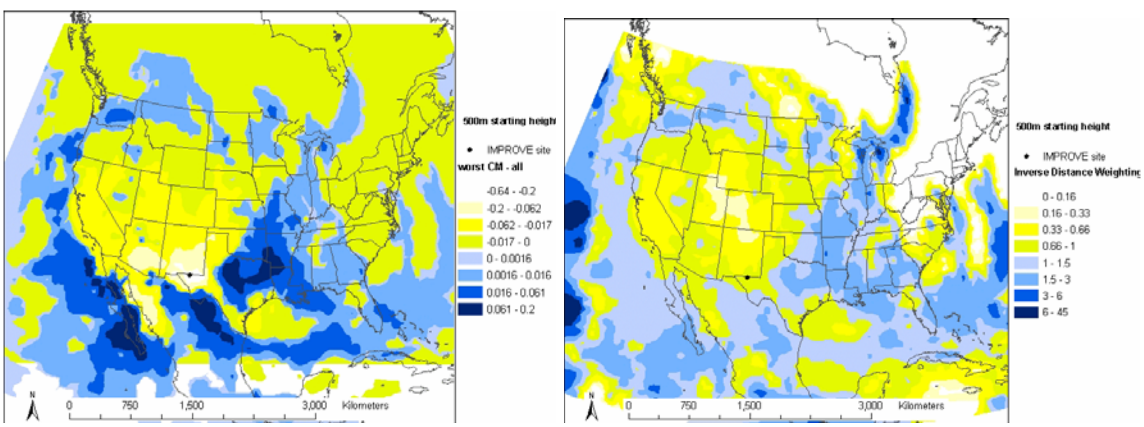

Figure 6. Difference (left) and ratio (right) of normalized residence time in 20% worst coarse mass days and all days in 2000-2002 (possible important source regions are shown up as blue in the maps)

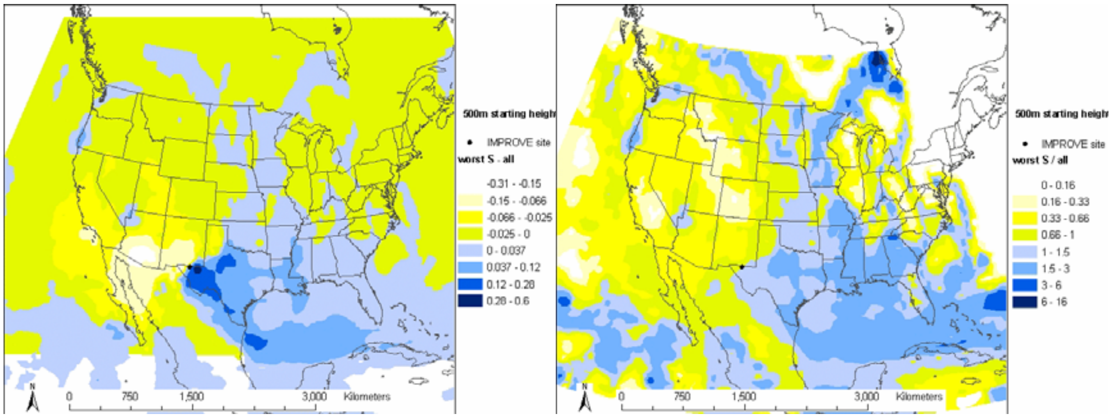

Figure 7. Difference (left) and ratio (right) of normalized residence time in 20% worst sulfate days and all days in 2000-2002 (possible important source regions are shown up as blue in the maps)