**Conceptual Model - Causes of Haze in Breton Wilderness Area (BRET1)**

Regional sulfate and sulfate transported from north of the site together with the stagnation meteorology conditions during the extended summer are likely responsible for most of the regional haze in the Breton wilderness area. Mobile emissions from the city of New Orleans and southern Mississippi may also contribute significantly to the regional haze in Breton Island.

As shown in Figure 1, Breton Wilderness Area consists of 5,000 + acres on Breton Island, part of the Chandeleur Barrier Island chain located off the Mississippi River Delta of southern Louisiana. Ground cover is low sandy beaches on the Gulf of Mexico side, falling off on the mainland side into ponds, inlets, and salt-water marshes. The IMPROVE site representing Breton Wilderness Area is BRET1, located at the southeastern extreme of the Mississippi Delta, about 80 km (50 mi) south-southwest of the Wilderness, with Gulf Coast waters between. Based on all the valid aerosol measurements during 2001-2004 in Breton NWR, the average $PM_{2.5}$ mass concentration is 8.2 $\mu g/m^3$, and the average total light extinction coefficient ($B_{ext}$) is 77.8 $Mm^{-1}$ (Visual Range ~ 62 Km; Deciview ~ 20). The contributions of the major aerosol components to Breton haze are particulate sulfate 58.1%, nitrate 7.7%, organic matter (OMC) 7.9%, elemental carbon (light absorbing carbon, LAC) 4.0%, fine soil 1.0%, sea salt 1.8%, and coarse mass (CM) 5.3%.

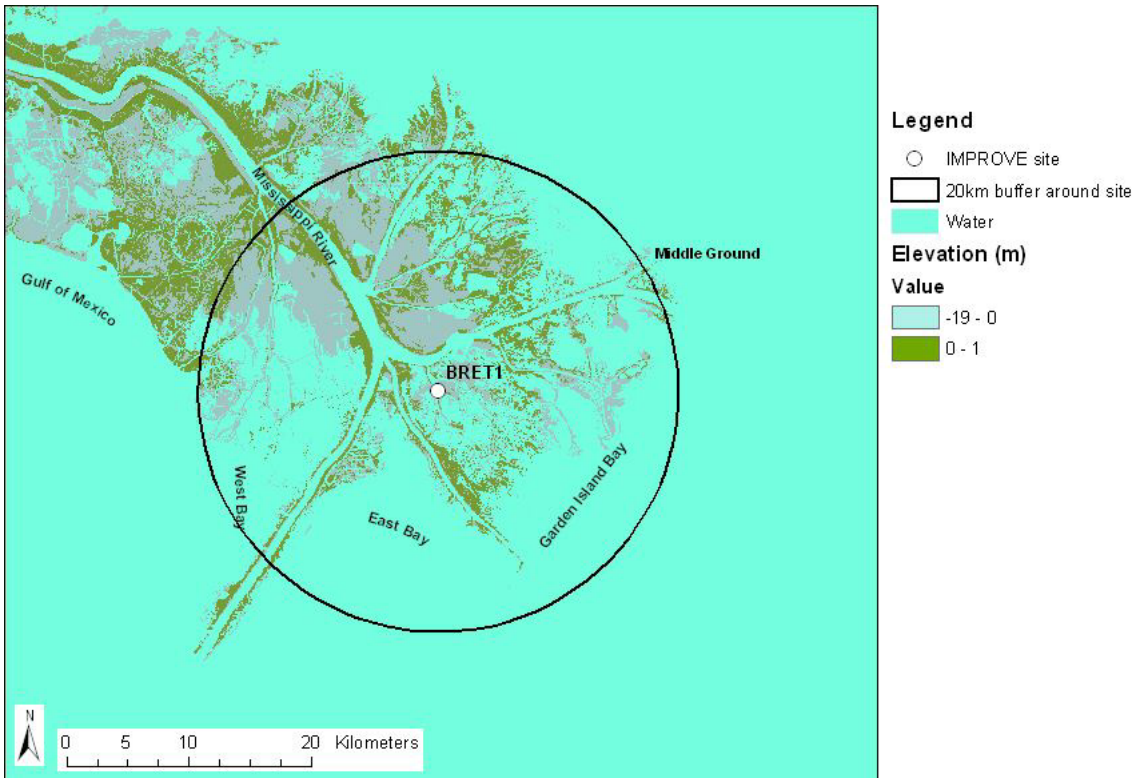

Figure 1. Terrain and land features surrounding the Breton Wilderness sampling site

Sulfate is the largest aerosol contributor to light extinction during the 20% worst days, with a contribution of ~ 68%. Figure 2 suggests that the highest occurrence of the 20% worst days happened in September, in which ~ 50% of the sampling days are the 20% haziest days at Breton. September is the month with most frequent flow from the north and northeast, over areas rich in SO2 emissions. As shown in Figure 3, in the 20% worst visibility days, sulfate is the largest aerosol contributor to haze with a contribution from ~50% in the winter to ~80% in the summer. Nitrate and OMC each contributes about 10-20% to light extinction in the 20% worst days during the winter and early spring. Figure 4 indicates that the air transport patterns are quite different for 20% best and 20% worst days. During the 20% best days, air usually comes from southeast of the site. While during the 20% worst haze days, air most frequently comes from the north.

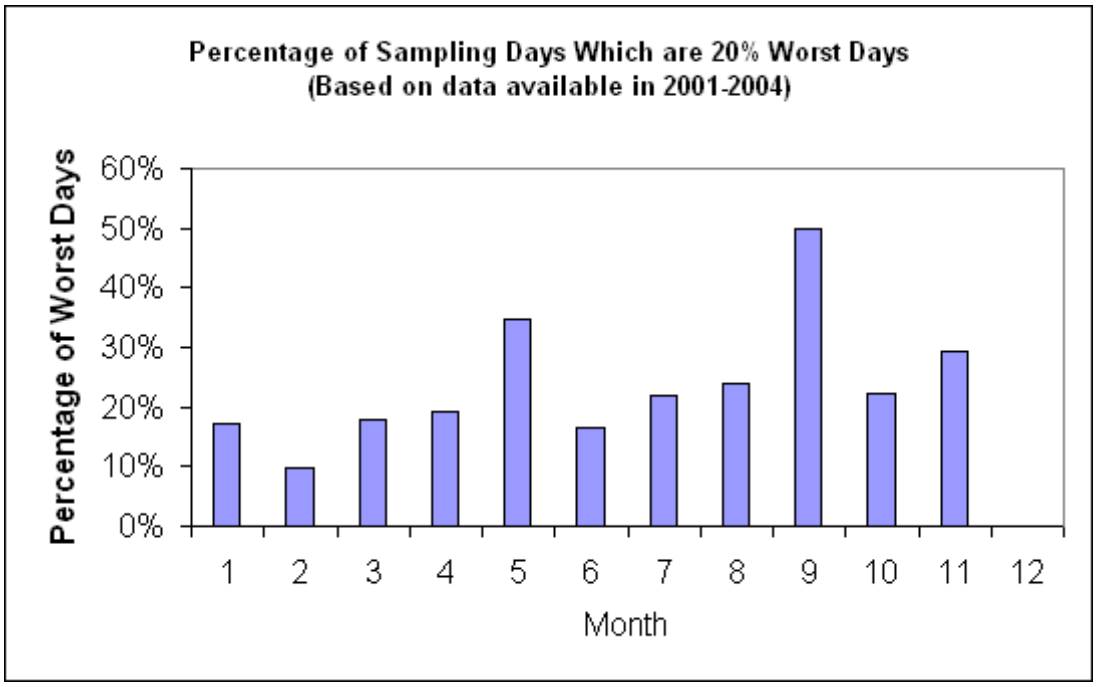


Figure 2. Percentage of sampling days that are 20% worst days in each month (Based on data available in 2001-2004)

Based on the PMF receptor modeling, seven source factors are identified for BRET1. Figure 5 illustrates the contribution of each PMF resolved source factor to $PM_{2.5}$ mass at the site. Sulfate-rich secondary aerosol is the biggest contributor, followed by mobile source emissions. Difference maps of the PMF factor score weighted and un-weighted residence times (Figure 6) suggest that secondary sulfate mostly comes from the surrounding areas including southern Louisiana and Mississippi and the Texas Gulf Coast as well as transports from the north of the site, while mobile emissions are mostly from southern Louisiana and Mississippi including major urban areas such as New Orleans. Industrial sources in the region include those associated with the petroleum industry including offshore drilling and refineries in southern Louisiana (Baton Rouge) and the Texas Gulf Coast, 300 to 400 km (200 – 250 mi) west.

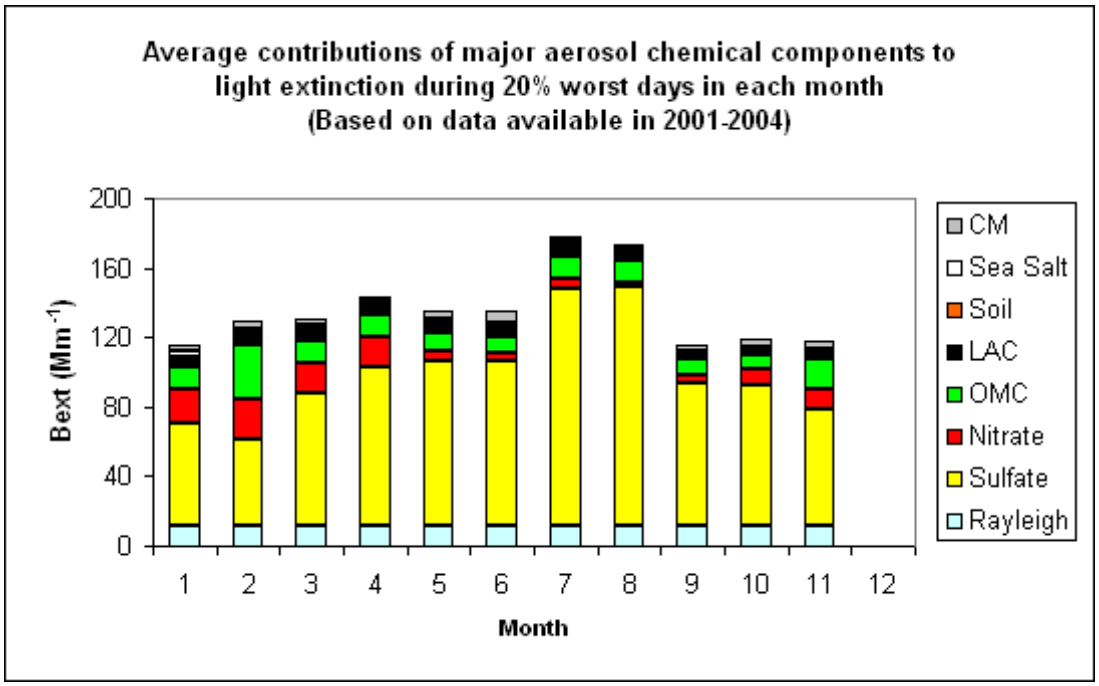


Figure 3. Average contributions of major aerosol chemical components to light extinction during 20% worst days in each month (Based on data available in 2001-2004)

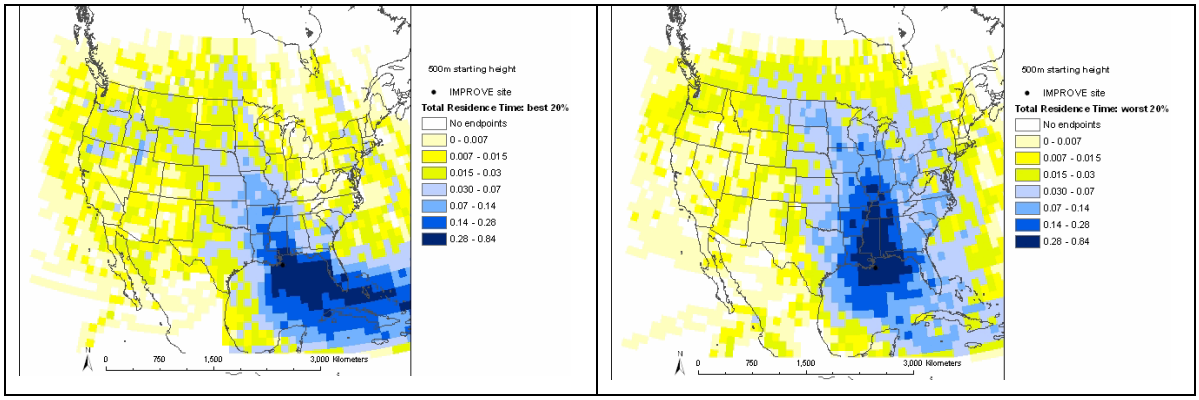


Figure 4. Normalized residence time for 20% best (left) and 20% worst (right) days (based on data from 2001-2004, air mostly transported from the blue area under the given sampling days)

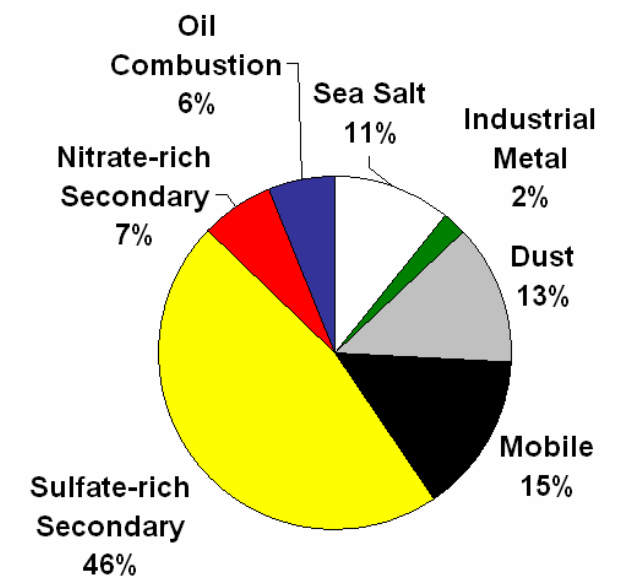


Figure 5. Average contributions of PMF resolved source factors to PM2.5 mass concentration.

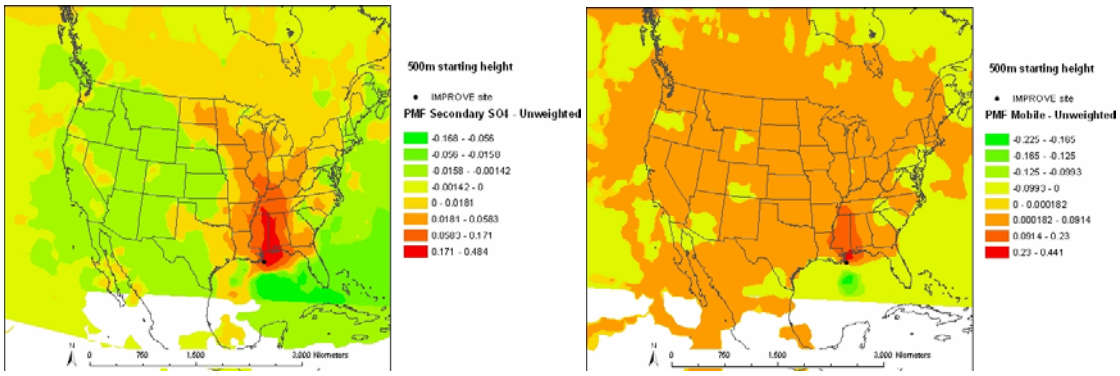


Figure 6. Difference maps of the PMF source factor (Sulfate-rich secondary source factor on the left and mobile source factor on the right) weighted and un-weighted residence times.

Because of the small diurnal temperature range of water and its aerodynamically smooth surface, mixing heights over water are relatively low with respect to those over land, with much less diurnal variation, and cycles that may during certain seasons be unrelated to and out of phase with the overland cycle. These features result in a potential for significant plume trapping effects at BRET1 and Breton Wilderness. Regionally, aerosol accumulation is more likely to occur during persistent subsidence inversion conditions associated with buildup and stagnation associated with synoptic high pressure ridges. Long-term data have shown the Gulf Coast region to be subject to frequent regional stagnation episodes. In the central Gulf Coast, stagnation conditions were found to exist 5 to 10 % of the time, mostly during extended summer (May-October), with the onset of the stagnation period occurring earlier (around May) in the Gulf Coast region than in southwestern states. So, regional $SO_2$ emissions together with the stagnation meteorology

conditions during the extended summer are most likely responsible for much of the regional haze in the Breton wilderness area.