# Integrated analysis of air pollution in central West Antarctica

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Recent meteorological observations reveal an increase in annual temperature between 1958 and 2010 by 2.4±1.2 °C per year in central West Antarctica. Antarctica is one of the fastest-warming regions globally and the origin of these higher warming rates remains uncertain. Atmospheric aerosols can absorb or reflect solar radiation and their contributions to these affects (as well as the particle's ability to nucleate ice and clouds) are influenced by its composition. Specifically, a number of studies have indicated that organic aerosol plays an important role in both the direct as well as the indirect aerosol forcing. However, because there is an uncertainty of at least of a factor of 3 related to this forcing (IPCC, 2013), further studies are essential. Typically, one of the mechanisms for aerosol aging is coating via condensation of organic components (secondary organic aerosols-SOA), produced via gas phase chemistry, onto particulates.

Figure 1 illustrates the first glimpse of a paradigm for examining aerosol processing based on a global distribution of secondary aerosol sources. From Figure 1, an interesting pattern of organic matter in three distinct environments is obtained: the Amazon Forest (intensive biosphere-atmosphere interaction) with high organic and low inorganic; San Francisco Bay (sea salt particles mix with anthropogenic pollutants) and central Antarctica (fresh and aged marine aerosol with little organic carbon). Inorganic components in the San Francisco Bay and Antarctica arise from sea salt aerosol (the primary types of aerosol at these locations) while the source of inorganics in the Amazon is currently under debate. Laskin et al. found that sea salt aerosol may react with SOA, leaving behind particles depleted in chloride and enriched in the corresponding organic salts. These reactions change their hygroscopicity and alter their heterogeneous reactions and nucleation activity. In the Antarctica sample, one striking observation was the lack of carbon coating. However, in retrospect, given the lack of carbon sources (plants and industry), this may be expected. Understanding the differences between how particles in "carbon-rich" versus "carbon-poor" environments will enhance model predictions on how climate change affects aerosol processing, which further affects melting of the Antarctica Ice Sheet.

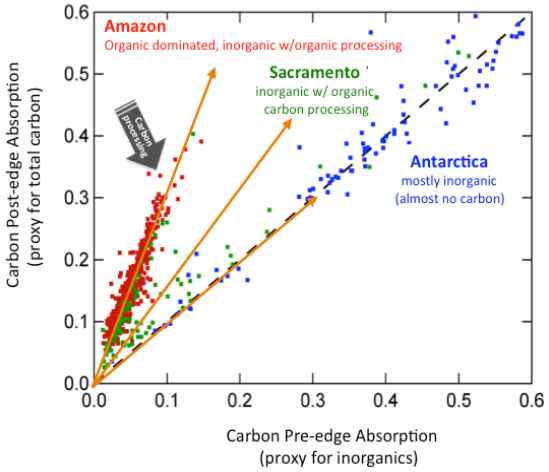


**Figure 1.** The signature of organic aerosol from three distinct environments: Amazon Forest, San Francisco Bay and central Antarctica. Plot of post edge-Pre edge (320 eV-280 eV) intensity is used to quantify carbon. However, because aerosol inorganic components (Na, K, Ca, etc.) are relatively well known, the carbon pre-edge can also be used to estimate the inorganic component. Hence, this plot illustrates the amount of carbon relative to the amount of inorganic present.