Quantifying Population Exposure to Airborne Particulate Matter During Extreme Events in California due to Climate Change

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Supporting Information

Figure S1 shows the future change (%) in population-weighted annual average concentrations of $PM_{0.1}$ in the future (2047-53) compared to the present-day (2000-06) for California and the three air basins of interest. The population-weighted annual average concentration of $PM_{0.1}$ total mass was predicted to decrease by ~9% in California during future years (2047-53) relative to present years (2000-06) with the majority of this change occurring in the SoCAB (Fig. S1). Primary $PM_{0.1}$ source contributions to EC and OC concentrations decreased in the SV but increased in the SJV and SoCAB. Secondary

$PM_{0.1}$ component concentrations decreased in the SoCAB with mixed results in the SV and SJV.

Figure S2 shows the future change (%) in population-weighted annual average concentrations of PM_{10} in the future (2047-53) compared to the present-day (2000-06) for California and the three air basins of interest. Patterns for PM_{10} total mass, component species, trace metals, and contributions from different sources were similar to $PM_{2.5}$ patterns. PM_{10} total mass was predicted to decrease by ~3% in California in the future. Concentrations of EC, OC, S(VI), and N(-III) were predicted to decrease in the range between ~1-4%. Population-weighted concentrations of trace metals, and contributions from different sources were also predicted to decrease in the future by as much as ~3-6%.

Figure S4 illustrates the Generalized Pareto Distribution (GPD) fit to PM2.5 total mass concentrations in present and future climate. Basecase emissions inputs to both scenarios are identical. Concentration differences are caused by the direct effects of meteorology on the air pollution system.

Figure S5 displays the global climate change impact on 10-year return level for population-weighted 24-hour average $PM_{0.1}$ concentrations based on the Extreme Value Theorem (EVT). The plots show % difference between the future (2047-53) and present (2000-06) with vertical bars corresponding to 90% confidence interval for the 10-year return level estimates. Whenever the CI bars span zero, it implies that the predicted change in the future is not likely to be statistically significant.   . The 10-year return level of population-weighted 24-hour average $PM_{0.1}$ is generally going to decrease for total mass, and speciated $PM_{0.1}$ for California in future, although these are not likely to be statistically significant. Among the air basins of interest, only the SJV shows slight increase in 10-year return level values for difference sources, however, these changes are not statistically significant as the CI bars overlap zero. Figure S5 displays the climate effects on 10-year return level population-weighted 24-hr average PM_{10} concentrations during extreme events based on the EVT. 10-year return levels of 24-hr average population-weighted concentrations of PM_{10} total mass, chemical species except sulfate, trace metals and primary source contributions are predicted to increase in the future for the SJV and SoCAB. The 10-year return level population-weighted daily average total mass concentration of PM_{10} was predicted to increase by 19% in California, 15% in the SV, 13% in the SJV and only 1% in the SoCAB. Once again, the 90% confidence interval spans zero for the majority of these results relative to the inter-annual variability. The only statistically significant trends displayed in Fig. S5 are an increase in the 10-year return level population-weighted concentrations of primary diesel PM (state-wide).

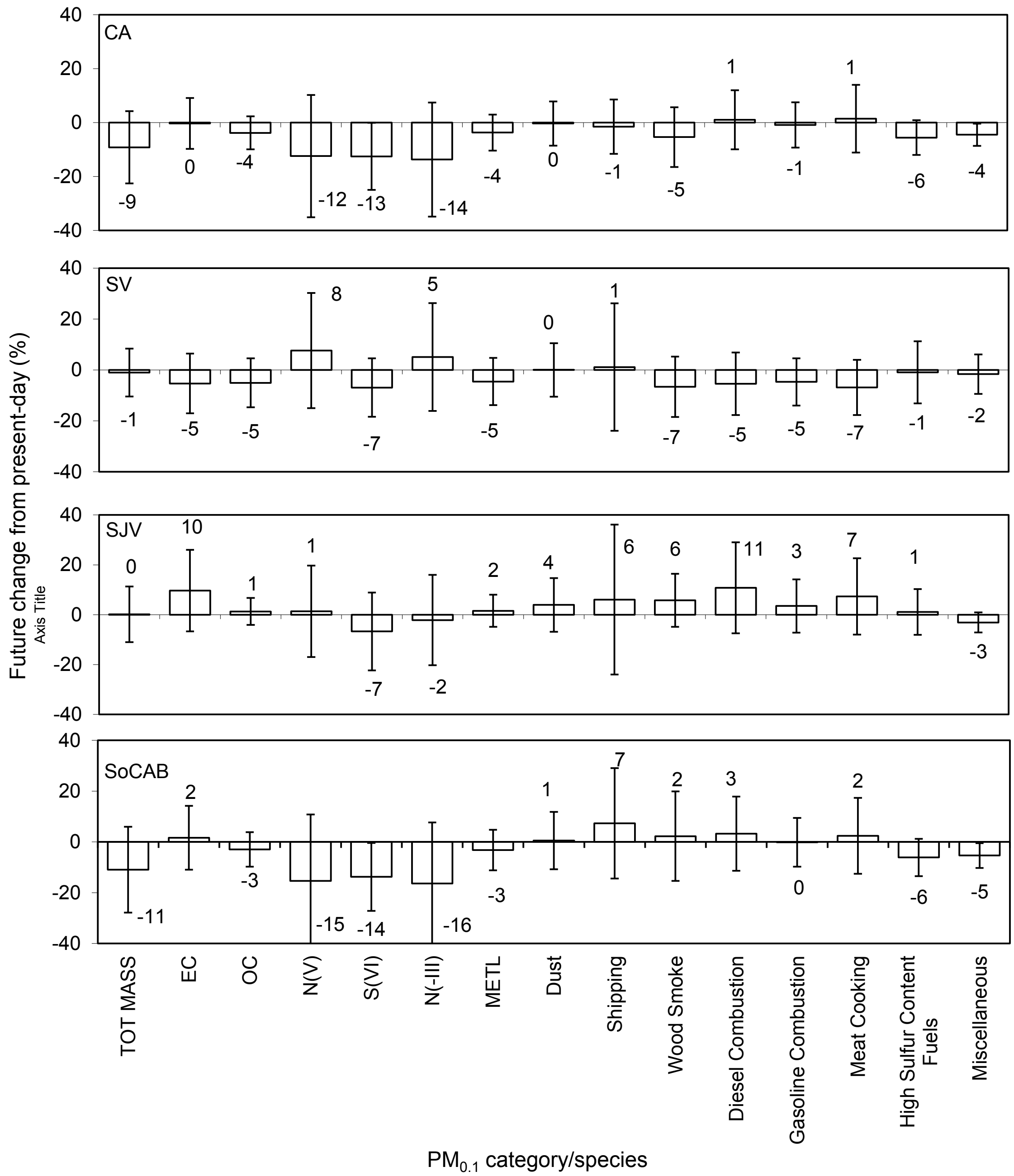


Fig. S1. Future (2047-53) change in population-weighted annual-average concentrations of $PM_{0.1}$ total mass, primary and secondary components, trace metal and source categories contributing to the total mass from present-day (2000-06). Panels (top-down) show California state-wide, Sacramento Valley (SV) air basin, San Joaquin Valley (SJV) air basin, and South Coast Air Basin (SoCAB) average results. The error bars represent the lower and upper limits of the 90% CI.

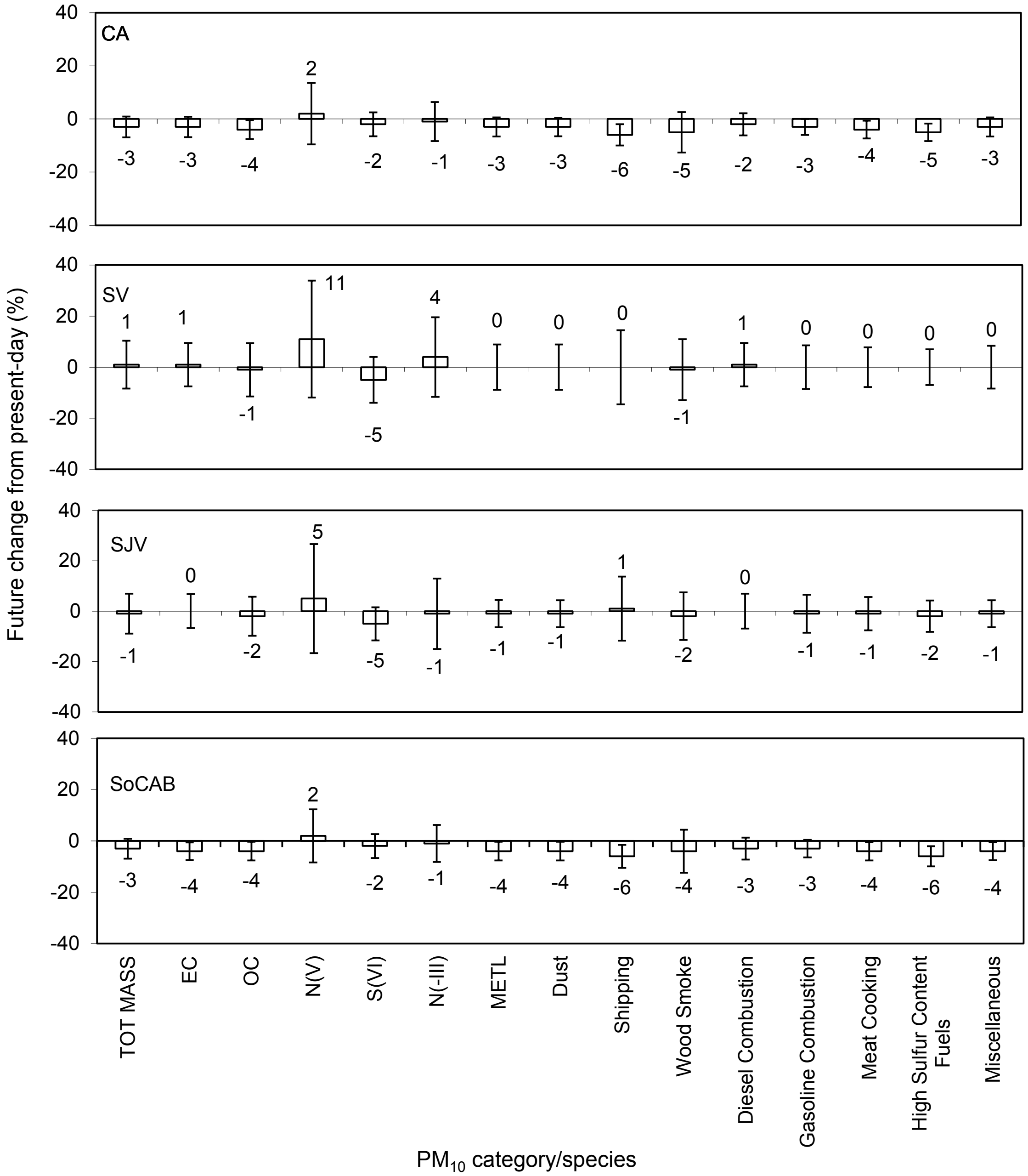
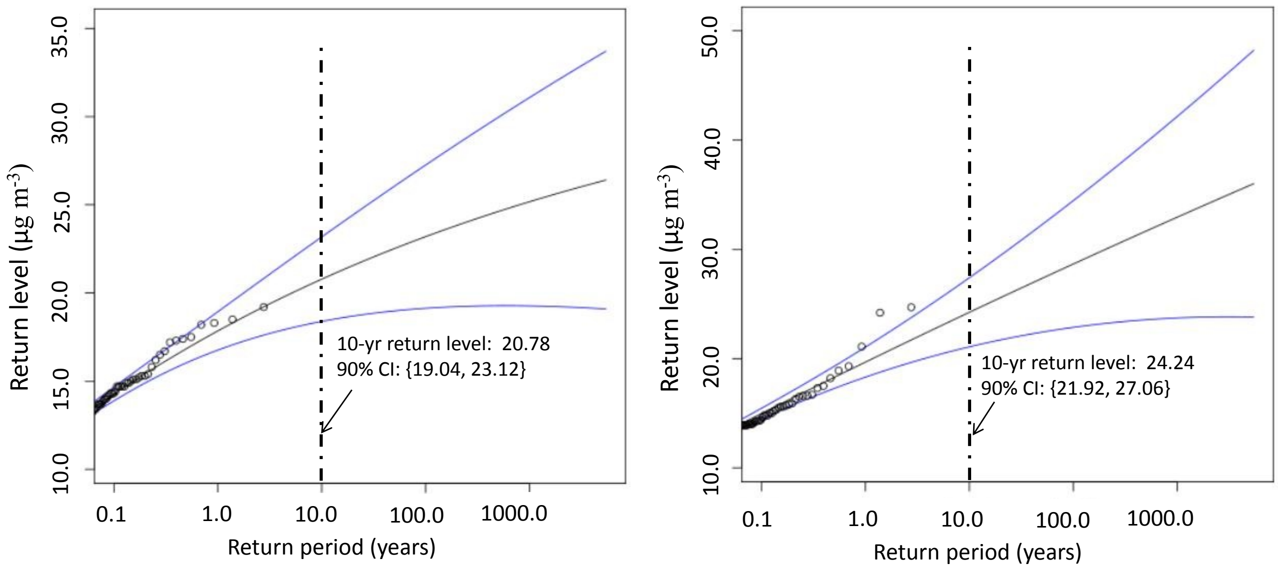


Fig. S2. Future (2047-53) change in population-weighted annual-average concentrations of PM_{10} total mass, primary and secondary components, trace metal and source categories contributing to the total mass from present-day (2000-06). Panels (top-down) show California state-wide average, Sacramento Valley (SV) air basin average, San Joaquin Valley (SJV) air basin average, and South Coast Air Basin (SoCAB) average results. The error bars represent the lower and upper limits of the 90% CI.



Present-day (2000-06) Future (2047-53)

Figure S3: Generalized Pareto Distribution (GPD) fit return level plots of $PM_{2.5}$ total mass for present-day (2000-06) and future (2047-53) in California based on the 75^{th} percentile and up daily average $PM_{2.5}$ mass (Fig. S3).

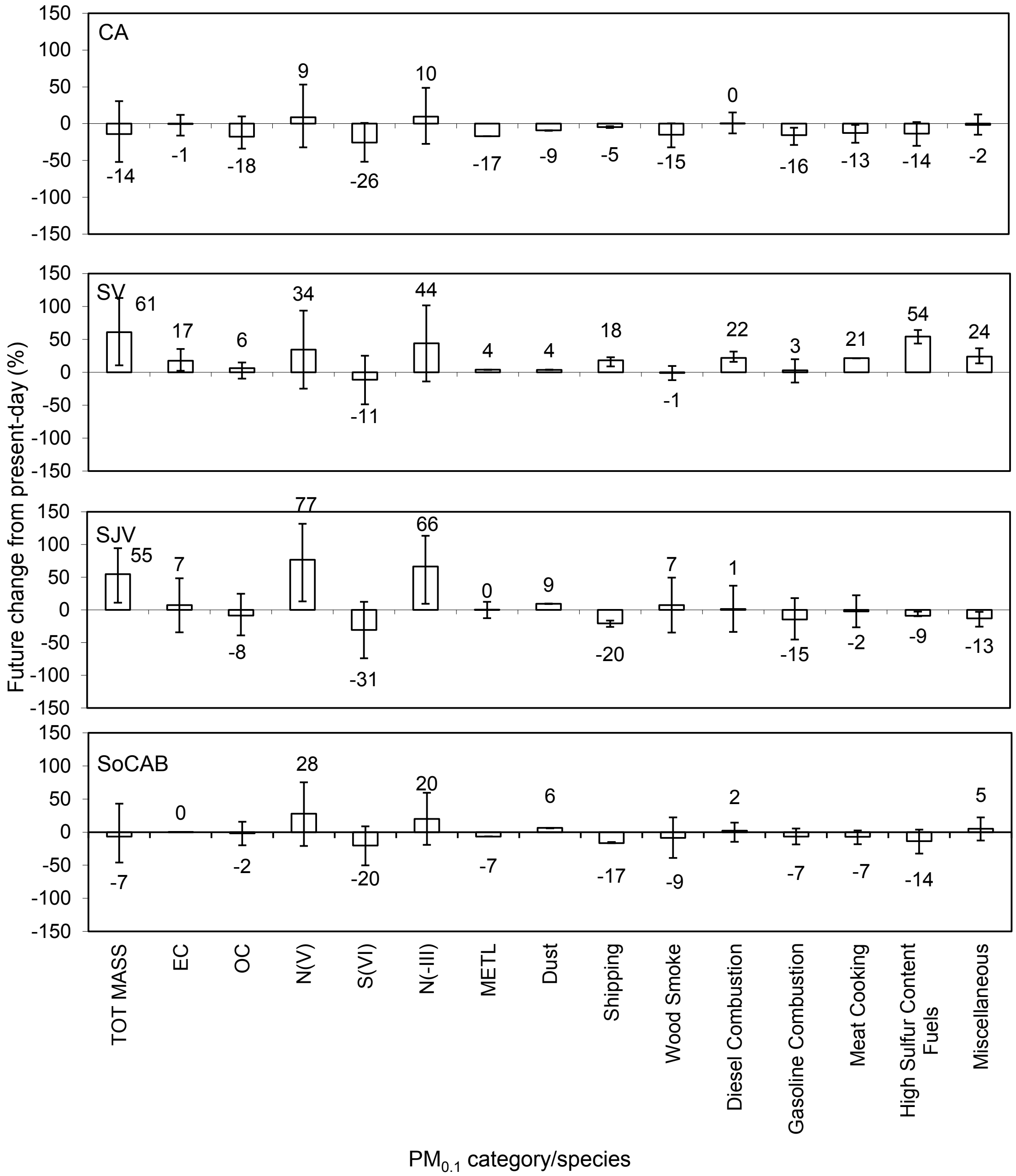


Fig. S4. Difference between the future (2047-53) and present-day (2000-2006) 10-year return level values of population-weighted $PM_{0.1}$ mass and species concentrations, and contributions to primary total mass concentrations from different sources for California (CA), Sacramento Valley (SV), San Joaquin Valley (SJV), and South Coast Air Basin (SoCAB) averages. Error bars represent the lower and upper limits of the 90% CI.

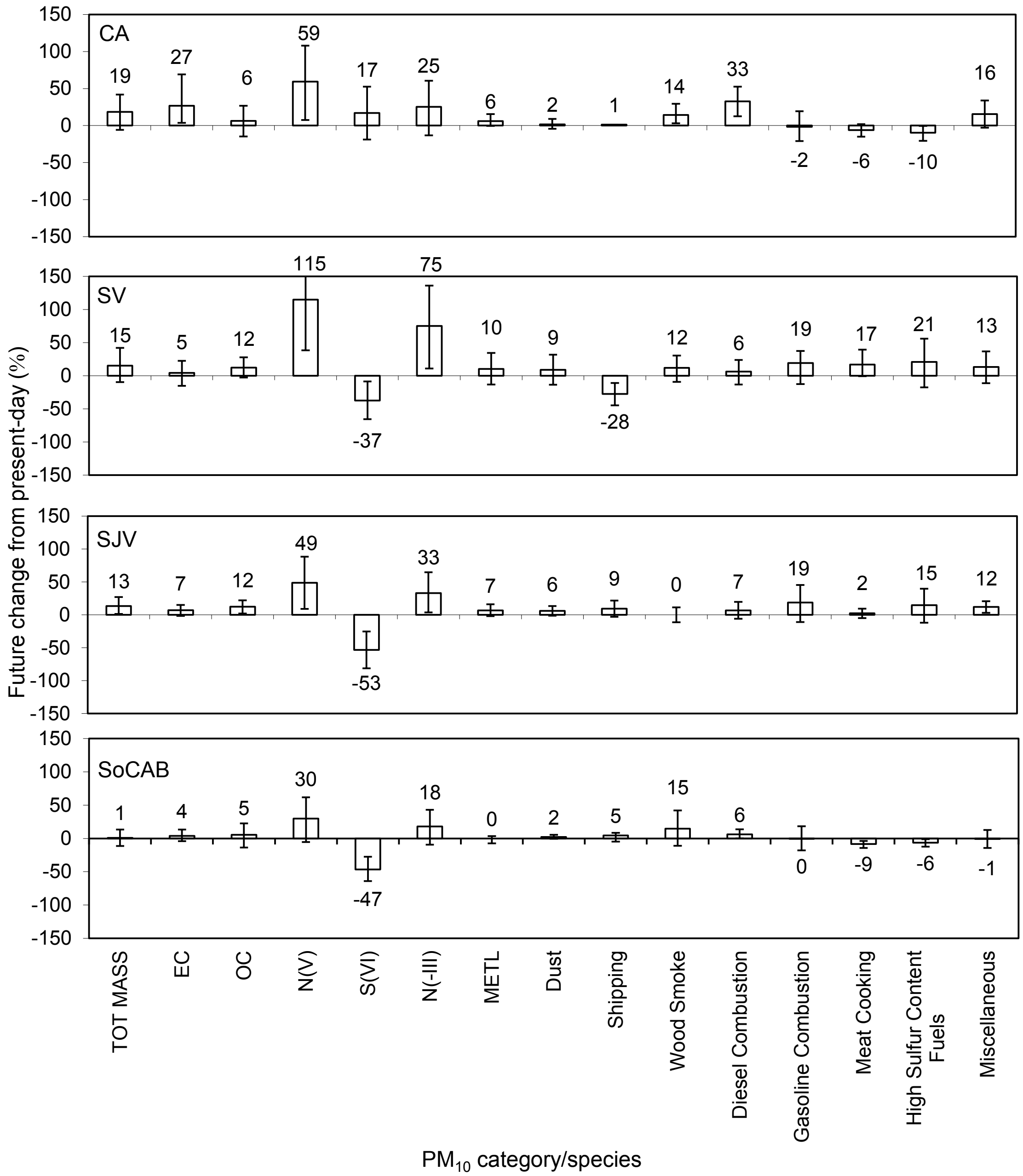


Fig. S5. Difference between the future (2047-53) and present-day (2000-2006) 10-year return level values of population-weighted PM_{10} mass and species concentrations, and contributions to primary total mass concentrations from different sources for California (CA), Sacramento Valley (SV), San Joaquin Valley (SJV), and South Coast Air Basin (SoCAB) averages. Error bars represent the lower and upper limits of the 90% CI.