Bounding the role of black carbon in climate: A scientific assessment

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Measurement and modeling studies have provided a range of estimates of climate warming due to light absorption by black carbon in the atmosphere and in surface snow and ice. This presentation describes an assessment paper that provides an evaluation of black-carbon climate forcing that is comprehensive in its inclusion of

all known and relevant processes and that is quantitative in providing best estimates and uncertainties of the main forcing terms: direct solar absorption, influence on liquid, mixed-phase, and ice clouds, and deposition on snow and ice. These effects are calculated with models, but, when possible, they are evaluated with both microphysical measurements and field observations. Direct radiative forcing alone does not capture important rapid adjustment mechanisms that contribute to forcing. A framework is established for quantifying climate forcings and their rapid responses and feedbacks. Sources that emit black carbon also emit other short- lived species that may either cool or warm climate. Net forcing is calculated for the principal effects of BC plus co-emissions, including cooling agents such as sulfur dioxide for source categories as well as for specific BC-rich sources within those categories. The uncertainties in net climate forcing from black-carbon-rich sources are substantial, largely due to lack of knowledge about cloud interactions with both black carbon and co-emitted organic carbon. This assessment, by evaluating the large number and complexity of the associated physical and radiative processes in black-carbon climate forcing, sets a baseline from which to improve future climate forcing estimates. In addition to describing the "Bounding BC" assessment paper this presentation will focus on the source of key uncertainties in forcing terms, including uncertainties that stem from model experiment design.