“Characterizing the Climate Impacts of Brown Carbon”

CARB Research Seminar for Contract # 13-330

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Announcements

- Additional information about the speakers as well as slides and other materials can be found at this link: https://ww3.arb.ca.gov/research/seminars/russell/russell.htm
- For those of you online, questions for the speakers can be sent to sierrarm@calepa.ca.gov
- For our in-person audience: "housekeeping" items

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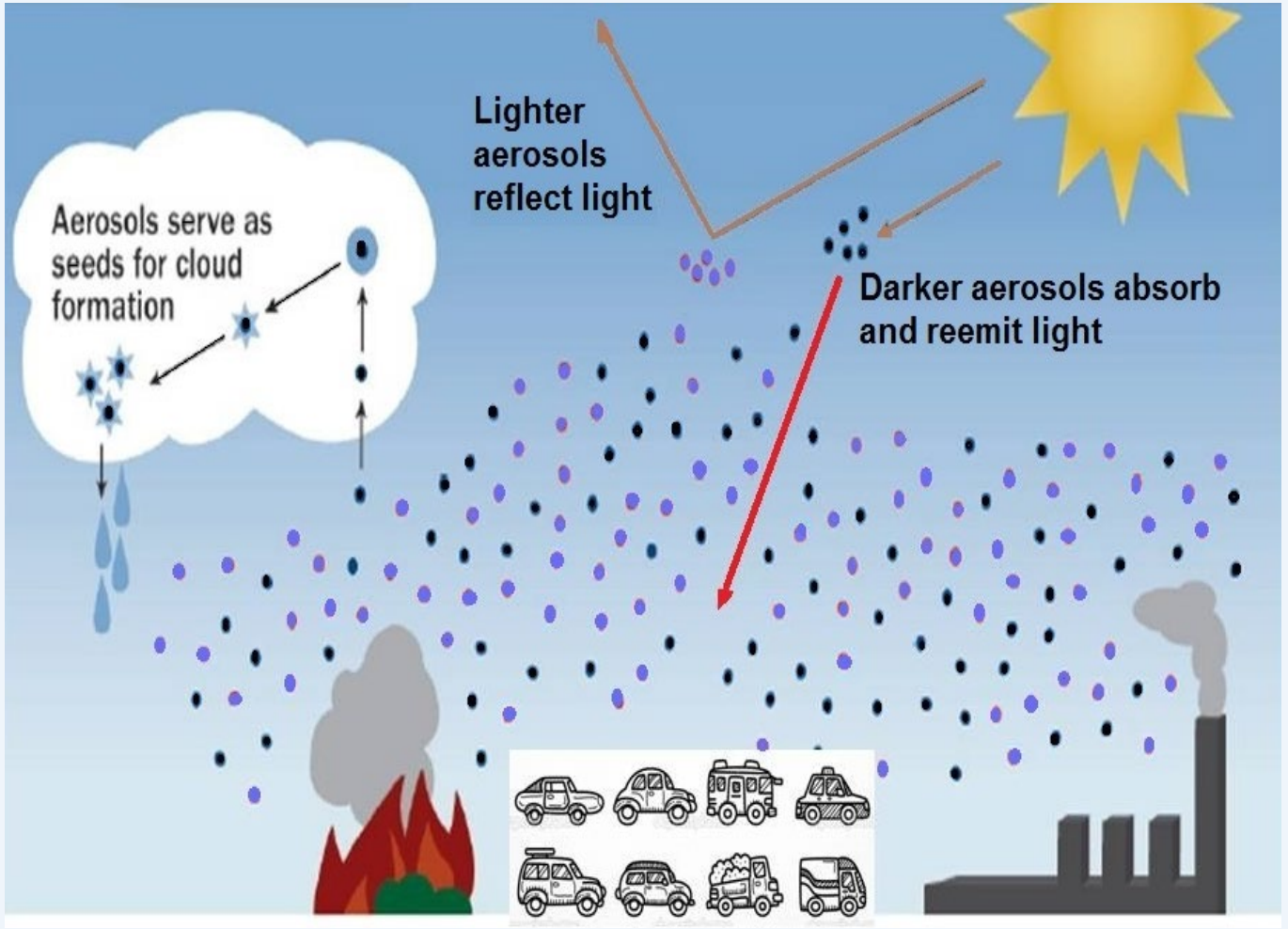
Aerosols: Tiny Particles — Major Climate Impact

Aerosols play an important role in Earth's overall energy balance:

- Scattering and absorbing incoming sunlight (direct effect)
  - Light absorbing particles (such as black carbon and brown carbon) influence climate by absorbing sunlight
- Modifying cloud properties (indirect effects)



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Black Carbon and the Regional Climate of California

Prior Research Contract: A Multi-Institutional Project

- The first such attempt to estimate the regional climate forcing of black carbon

Major Findings:

- BC emission reductions observed in California since the 1980s, as a result of air quality programs, are equivalent to reducing CO_2 emissions by 50 $MMTCO_2E$ annually (~12% of total 2016 CA GHG emissions of 429.4)
- If California's BC reduction from diesel can be replicated globally, the projected global warming for the coming decades can be mitigated by about 10 to 15%
- Solar absorption by brown carbon can be as much as 20% to 40% at visible wavelengths

Recommended Future Work:

- Quantify major brown carbon sources in key regions of California
- In view of the combined warming effects of brown carbon and black carbon, evaluate their climate impacts on regional and global climate

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Ramanathan et al: CARB Contract No. 08-323 https://www.arb.ca.gov/research/single-project.php?row_id=64841

Characterizing the Climate Impacts of Brown Carbon (BrC)

In 2013, through a multi-institution collaboration (UCSD, UCD, and Stanford University) CARB funded a research project to identify and characterize the contribution of BrC to climate forcing in California by:

(1) Providing fine particulate matter ($PM_{2.5}$) measurements that constrain the chemical concentrations and optical properties of burning activities,

(2) Quantifying the BrC organic components and the multi-wavelength absorption from burning emissions and from atmospheric formation of secondary components at two California locations, and

(3) Examining the globally and regionally-averaged climate response of BrC

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Today's Speakers

Speaker	Title and Organization	Research Topic
Dr. Lynn Russell	Professor of Atmospheric Chemistry at Scripps Institution of Oceanography, University of California at San Diego http://scrippsscholars.ucsd.edu/lmrussel	Aerosol particle chemistry, including the behavior of particles from both biogenic and combustion processes
Dr. Christopher Cappa	Professor of Civil and Environmental Engineering, University of California at Davis https://faculty.engineering.ucdavis.edu/cappa/	Laboratory and field measurements in pursuit of improving our understanding of the chemical, physical and optical properties of atmospheric aerosols
Dr. Michael Kleeman	Professor of Civil and Environmental Engineering, University of California at Davis https://faculty.engineering.ucdavis.edu/kleeman/	Measurements and modeling study of urban and regional air quality problems with an emphasis on the size and composition of atmospheric particles and gas-to-particle conversion processes

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