Ph.D. Defense Announcement
Michael Cheeseman
Monday, December 6, at 10:00 a.m. MT

Michael Cheeseman
Ph.D. Defense

December 6, 2021
10:00 a.m. MT

Defense
ATS Large Classroom (101 ATS) or in Zoom (full meeting information below)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Jeffrey Pierce (Adviser)
Bonne Ford
Emily Fischer
Elizabeth Barnes
John Volckens (Mechanical Engineering)

THE AIR WE BREATHE: THE IMPORTANCE OF HIGH RESOLUTION AIR QUALITY PREDICTIONS

Ambient air pollution has significant health and economic impacts worldwide; and yet, even in the most developed countries, monitoring networks often lack the spatiotemporal density to adequately resolve air pollution gradients. Furthermore, though air pollution impacts the entire population, it can disproportionately impact the disadvantaged and vulnerable communities in society. Pollutants such as fine particulate matter ($PM_{2.5}$), nitrogen oxides (NO and NO_2), and ozone, which have a variety of anthropogenic and natural sources, have garnered the most research attention over the last few decades. Over half the world and over 80% of Americans live in urban areas, and yet many cities only have one or several air quality monitors, which limits our ability to adequately capture differences in exposure within cities and estimate the resulting health impacts. Improving sub-city air pollution estimates could improve epidemiological and health-impact studies in cities with heterogeneous distributions of $PM_{2.5}$, providing a better understanding of communities at-risk to urban air pollution. Biomass burning is a source of $PM_{2.5}$ air pollution that can impact both urban and rural areas, but quantifying the health impacts from biomass burning $PM_{2.5}$ can be even more difficult than from urban sources. Monitoring networks generally lack the spatial density needed to capture the heterogeneity of biomass burning smoke. Due to limitations of both urban and rural monitoring networks several techniques have been developed to supplement and enhance air pollution estimates. For example, satellite aerosol optical depth (AOD) can be used to fill spatial gaps but does not distinguish surface-level aerosols. Observations of smoke plume height (PH) may provide constraints on the vertical distribution of smoke and its impact on surface concentrations. Low-cost sensor networks have been rapidly expanding to provide higher density air pollution monitoring. Finally, both geophysical modeling, statistical techniques such as machine learning and data mining, and combinations of all of the aforementioned datasets have been increasingly used to enhance surface observations.

In this presentation, we explore several of these different datas sources and techniques for estimating air pollution and determining community exposure concentrations. First, I will give a brief overview of connections between smoke plume height, boundary layer dynamics, and the resulting relationship between $PM_{2.5}$ and AOD. Secondly, I present air quality measurements taken by the Citizen Enabled Aerosol Measurements for Satellites (CEAMS) citizen science campaign and the machine learning techniques we used to investigate drivers of urban air pollution. Finally, I discuss ongoing work investigating air pollution disparities at US public schools across racial/ethnic and poverty lines using high resolution $PM_{2.5}$ and NO_2 estimates.

Topic: Ph.D. Defense: Michael Cheeseman
Time: Dec 6, 2021 10:00 AM Mountain Time (US and Canada)

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