Preface

The lower atmosphere, known as the troposphere, contains a large concentration of minute airborne particles, which together with the gas surrounding them are referred to as atmospheric aerosols. Some aerosols get emitted directly from sources like biomass burning, ocean wave action, dessert storms, and human activities, and others are formed in the atmosphere through gas phase chemistry that leads to particle nucleation and growth. The combination of air pollution and climate change is worsening air quality through higher concentrations of ground-level ozone and inhalable fine and ultrafine particles. Hence, research in atmospheric chemistry in the era of climate change demands innovative and integrated approaches to thinking at multiple scales, all phases of matter, and at the interface of different phases of matter.

The latest Intergovernmental Panel on Climate Change (IPCC) report released in summer 2021 associated higher certainties with humans' role in causing climate change, with no region in the world being spared from experiencing its impacts in terms of more intense and frequent weather extremes, wildfires, flooding, and drought. Atmospheric and climate models are developed based on data about atmospheric composition and dynamics. These models are validated by reproducing historical data from field measurements, and also incorporate bulk and interfacial reaction rates and mechanisms per available literature. However, aerosols' representation in these models is still far from complete. This is because aerosol physicochemical properties change during their atmospheric residence time, which can last up to two weeks.

The STEM book *Atmospheric Aerosol Chemistry: State of the Science* outlines major research findings to date in aerosol chemistry and advances in analytical tools used in laboratory settings for studying their surface and bulk reactivity. These processes take place at the surface of the particles/droplets or within the aerosol condensed phase. This book is organized into five main chapters that start with a general introduction in Chapter 1. "Instrumentation for measuring aerosols physical and chemical properties" is the focus of Chapter 2 followed by "Physical properties of aerosols" in Chapter 3. Chapters 4 and 5 highlight specific examples on "Interfacial aerosol chemistry" and "Bulk aqueous phase chemistry relevant to cloud droplets", respectively. Each chapter cites references closely related to the topics presented which gives the reader the opportunity to further explore a given concept or reaction at a much deeper level.

The writing of this book came at a time when exciting research questions enabled by advances in instrumentations were taking place among atmospheric chemistry research groups around the world. I hope this book would serve as the starting point for early career researchers eager to learn about atmospheric aerosols and pursue further research opportunities to advance this branch of knowledge. I am grateful to all the students, colleagues, and senior researchers whom I met in person, worked with,

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or read their papers for their dedication and enthusiasm in applying fundamental chemistry concepts to atmospheric aerosol research. The science you produced inspired me to choose this field of study, and I am confident it will inspire many generations to come.

Hind A. Al-Abadleh, Ph.D