Prologue

Ten years ago the publishing house De Gruyter asked me to write a book titled *Luft* (Air), which was published in 2003. *Paul Crutzen* said that it was written in the wrong language. It was written in German, my mother tongue. I took it as a compliment that they wanted me to reach more international readers. My first thank you goes to De Gruyter, who offered me the opportunity to write *another* book on *air* in English about 3 years ago. The German book *Air* belongs to a planned series on water, air, and soil (the last one has not been written yet), which means that there were certain restrictions and wishes that came from the editor. However, for this new book I had absolute freedom to choose my own content; therefore, I would like to express a second thank you to De Gruyter. The only wish from the editor was that this book should contribute to the discussion on *climate change*.

This new book is not a (revised) translation of *Air* – I have only used a few fundamental issues such as physicochemistry and basic air chemistry, which has become fundamental knowledge in any textbook. I am a chemist; my original background is physical chemistry, but for 35 years I have been dealing with air chemistry (and air pollution studies). Chemistry is the science of matter, and matter distributes and cycles through nature.

The climate system is a part of this, and the atmosphere is another part. The Earth's climate system provides a habitable zone. I agree with those scientists who argue that human beings, as a part of nature, have altered the "natural system" to such an extent that we are now unable to reverse the present system back to a preindustrial or even prehuman state. Nevertheless, the key question at present is how to maintain the functioning of our climate system in such a way that enables the sustainable survival of humans. We can state that humans have become a global force in chemical evolution with respect to climate change by interrupting naturally evolved biogeochemical cycles. However, humans also have all the capacities to turn the "chemical revolution" into a sustainable chemical evolution.

An understanding of how the climate system works is provided by the *natural* sciences (physics, chemistry, and biology). This book focuses on the chemistry of the climate system, but differentiating precisely between physics and chemistry makes absolutely no sense when trying to understand that system. However, without an understanding of biological laws – and we could probably include social laws here as well, considering that the biosphere was long ago transformed into the noosphere – we will neither understand climate change nor find solutions to *climate control*. Maybe this book will provoke people by bridging state-of-the-art textbook knowledge with ideas or opinions beyond "pure" chemistry. Without a paradigm change in the next two to three decades (for example, carbon dioxide cycling), we will have little chance to control climate.

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My knowledge is limited; therefore, specialists will find gaps and missing pieces in my book. A few weeks ago, I attended a lecture by Professor Norimichi Takenaka (Japan), who studied the decomposition of ammonium nitrite in drying dew droplets by the formation of N_2 – a disproportioning and fascinating pathway for atmospheric NH_3 and NO_x. Unfortunately, I did not know about this reaction, even though it was already known in the nineteenth century, and it is a key example of interfacial chemistry, which is a focus of my book and has been a special interest of mine in the last few years after having studied multiphase chemistry for many years. I believe that interfaces (or heterogeneous systems) at certain places in natureprovide special conditions for chemical reactions and therefore result in the turnover of matter. Our knowledge about what happens in atmospheric multiphase chemistry, despite much progress over the last two decades, remains limited (I hope that some of that knowledge is summarized in this book). However, interfacial chemistry may be more important (and almost more interesting) for controlling the climate system at the interfaces between the atmosphere and the Earth's surface, including, for example, natural waters, soils, plants, and microorganisms.

Special thanks go to Professor Volker A. Mohnen, to whom I owe important scientific suggestions over the last 20 years, including the impulse to write this book.

Finally, I would like to thank my coworkers who accepted my frequent absence at the institute throughout the last 2 years (and who kept things running smoothly); I wrote this book in my office at my home in Berlin (day and night, weekdays and weekends – special thanks go to my wife Ursula and my family), surrounded by hundreds of books on the chemistry (but also the history, physics, and biology) of the *climate system* published in the last 200 years (and a few older ones). This book, to my knowledge, is the first ever to be titled *Chemistry of the Climate System*, and I hope – no, I am sure – that it will not be the last. It stands between "special" and "generic"; it is part textbook, part monograph (and might even appear to be an ecopamphlet). Hence, the book is recommended to any and all who like nature and chemistry or who want to learn more about climate system chemistry.

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