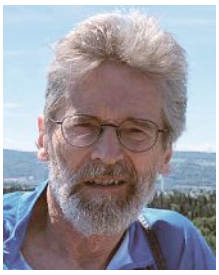
Editorial

Prof. Claudia Mohr



Prof. em.
Urs Baltensperger

The idea for this special issue was created during the Spring Meeting 2023 of the Swiss Chemical Society at the University of Zurich on 14th April 2023, which had the Chemistry and Physics of the Atmosphere as its theme. In view of the scope of *CHIMIA* and the limited space in a special issue we focus here on the chemistry of the atmosphere, *i.e.* the investigation of chemical species and their reactions in the atmosphere. Other research activities such as atmospheric physics or climate-related research on greenhouse gases (also active fields in Switzerland) are not included here.

Atmospheric chemistry was not considered an independent research discipline until about half a century ago, but rather included in meteorology (a good example is the famous ozone data series from Arosa). Since then, an active atmospheric chemistry community has developed in many Higher Education institutions in Switzerland, with players in Basel, Bern, Dübendorf, Fribourg, Lausanne, Sion, Villigen, and Zürich. These groups perform research either on gases or aerosols (liquid or solid particles suspended in the atmosphere). They investigate the abundance and distribution of such gaseous or aerosol-borne species, their chemical reactions and transformation, their sources, and sinks, as well as their impact on ecosystems, climate, and health, in several cases at the international forefront of the science in this field.

While not all relevant players were able to contribute to this special issue, we are still happy to present a series of articles as a showcase of state-of-the-art research on *Atmospheric Chemistry in Switzerland*.

Our special issue includes the following articles:

Urs Baltensperger presents a history of atmospheric chemistry, starting with the early recognition of adverse health effects of air pollution, showing how the development of the measurement technology follows the recognition of the relevance of individual species in the atmosphere and *vice versa*, and describing the atmospheric chemistry developments for the various institutions in Switzerland active in this field.

Christoph Hueglin and colleagues present the history of the NABEL network (Nationales Beobachtungsnetz für Luftfremdstoffe, a federal network of air quality stations in Switzerland), which exemplifies the relevance of reliable, long-term air quality monitoring, and also the importance of such monitoring for air pollution control at both national and international levels.

Claudia Mohr and ***Martin Gysel-Beer*** highlight the chemical complexity of the atmosphere, especially of atmospheric aerosols, and demonstrate that chemistry has a decisive role in determining their impact on the environment, especially on climate and human health. They also stress the importance of long-term research infrastructures for a better understanding of the evolution of the chemistry of the atmosphere.

Markus Kalberer and colleagues argue that additional variables beyond the mere mass of particulate matter are needed in epidemiological studies, as mass is not able to reflect the complexity of atmospheric aerosols, with its thousands of different components with highly varying toxicity, and present the oxidative potential as one possibility to complement mass measurements.

Imad El-Haddad and colleagues present an overview on particle formation from gaseous precursors. This is highly relevant for climate, as more than 50% of the cloud condensation nuclei (particles that are able to form cloud droplets) are produced in this way (*i.e.* not by direct emission of particles to the atmosphere). They show how highly interesting atmospheric chemistry is performed by an international collaboration at CERN, in the so-called CLOUD chamber.

Julia Schmale and coworkers present research from the Arctic coast, where anthropogenic and natural emissions either directly, or *via* secondary aerosol formation, along with the strongly varying atmospheric conditions (polar night and polar day), result in a complex atmospheric chemistry system, which undergoes rapid changes in the context of climate change.

Markus Ammann and coworkers describe the multiphase chemistry in the atmosphere, focusing on reactions that would not occur in the gas phase alone. They describe the role of water, which can be present as ice or as liquid water in aqueous aerosols or highly diluted cloud droplets, and provide examples of the reactions of key species, such as halogens, reactive nitrogen, and organics, within aerosol particles and at condensed phase–air interfaces.

Athanasios Nenes and colleagues present an example of their expertise on thermodynamic modeling of aerosol composition. They calculate pH and liquid water content from the measured aerosol chemical composition and use this information to understand the sensitivity of aerosol mass to the availability of ammonia and nitric acid (which are two major aerosol precursors). Aerosol pH also influences aerosol toxicity (through *e.g.* solubilization of Fe, Cu and other metals).

Christof Ammann and ***Alex Valach*** report on the sources and sinks of ammonia, an important atmospheric pollutant due to its contribution to secondary inorganic aerosol formation and its deposition and impacts on vulnerable ecosystems. Agriculture is by far the largest source for ammonia globally and in Switzerland. In contrast to other pollutants such as nitrogen oxides there has been a moderate reduction in ammonia emissions in the last decades.

We hope with this special issue to convey a bit of the fascination of this interdisciplinary topic, which consists of, besides chemistry, also physics, biology, and medicine to name a few other disciplines.

The CHIMIA Editorial is very grateful to Prof. Claudia Mohr and Prof. em. Urs Baltensperger for their great efforts in organizing this issue on *Atmospheric Chemistry in Switzerland,* highlighting some of the important research and analysis being performed in Switzerland. Cover image created by ChatGPT, prompts: Image where the sky fills most of the scene, with a thin layer of Earth's surface showing settlements, traffic, emissions, and faint natural landscapes. The hazy, dusty sky captures the atmosphere of human impact on the environment.