Advances of Atmospheric Aerosol Research in Austria

Compendium prepared by the Clean Air Commission of the Austrian Academy of Sciences

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Introduction

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1. Foreword

Atmospheric aerosol research has a long tradition in Austria. Milestones of the early work are described in the volume “History of Aerosol Science” by Preining and Davis (2000). The more recent advances are covered in this compendium, which illustrates the scientific work performed at Austrian research institutions and field sites in the past decades. No single institution emerged in Austria devoted exclusively to atmospheric aerosol research. However several groups are very actively pursuing innovative work in the field with high reputation. A focal point and stimulating panel for the atmospheric aerosol research was the Clean Air Commission (Kommission für Reinhaltung der Luft, KRL) of the Austrian Academy of Sciences. The real reward of the KRL was the support of the interdisciplinary cooperation among scientists from different fields of aerosol research including aerosol physics, aerosol chemistry, epidemiology, forestry and agriculture, ecology, environmental technology, meteorology, and applied air pollution research. The research work in the field of atmospheric aerosols triggered and coordinated by the KRL as well as related activities at Austrian research sites is highlighted in this compendium. The purpose of this portrayal is to foster future joint aerosol research activities in Austria and internationally and to demonstrate the need of academic support to maintain and convey working groups devoted to aerosol research.

The role of the KRL as a platform for scientific exchange has also been used to compile this overview. While KLR members formed the core of the team of authors, the coverage of this work extends beyond and also describes relevant work performed in Austria in general, providing an overview on activities representing some hundred scientific publications over the last decade.

Instead of focusing all activities regarding atmospheric aerosols on a single institution, Austrian scientists developed a well-established network of researchers at different universities and scientific institutions, who have a long record of intense collaboration and significant international impact. This compendium is proof of the competence and complementarity of the research performed. The individual, self-standing contributions reflect very different aspects of atmospheric aerosols which together provide a coherent total like that of a “virtual institute of aerosol science”.

The literature sections to each of the chapters indicate the Austrian contributions by identifying authors with Austrian affiliation in bold type.

The volume starts out with an overview on assessing the release of aerosols to the atmosphere in general (Winiwarter, pp. 8 ff) and continues describing approaches for emission abatement (Höflinger, pp. 21 ff) based on theoretic foundations, specific for "fugitive" dust sources. The next chapters deal with methodological development of measuring aerosols, first of all regarding the distinct physical parameters (Hitzenberger, pp. 30 ff) but also concerning optical and chemical characteristics (Hitzenberger and Bauer, pp. 38 ff) followed by the distinctive properties of bioaerosols (Bauer, pp. 53 ff).

Two sections present efforts to unravel specific atmospheric processes associated with aerosol – its scavenging behaviour (Kasper-Giebl, pp. 64 ff) and its response to air mass changes (Berner, pp. 71 f). Modelling aerosol transport and dispersion along wind fields and thus assigning shares of PM load to source sectors is presented by Sturm et al. (pp. 74 ff) while Puxbaum (pp. 89 ff) concludes from atmospheric measurements to the sources directly via source apportionment.

The next papers focus on health effects. Neuberger (pp. 108 ff) describes studies that link aerosol exposure and human health impacts (epidemiology), while Haluza (pp. 121 ff) reviews the Austrian toxicological studies. Integrating health effects, atmospheric dispersion and formation with emission and emission abatement modelling into a single policy tool is performed in integrated assessment modelling (Amann, pp. 126 ff). At a global application also climate effects of aerosols are considered. Finally, an overview of a major overarching study is presented, performed under KRL's coordination, which already in the past demonstrated the level of working collaboration (Hauck, pp. 135 ff). An outlook containing aspects for future research potentials and needs (Winiwarter, pp. 141 ff) concludes this compendium.

The overall scheme in this volume thus covers, for aerosols, the entire fate of trace compounds in the atmosphere, from their release in form of emissions via dispersion and transformation towards removal processes, but furthermore including the response of substrates, specifically regarding human health. While the respective processes characterize the change of atmospheric conditions, exactly the conditions in form of atmospheric concentrations can be observed directly. Some of the processes are influencable by humans and thus responsive to policy actions (emissions), others are given naturally (specifically the dispersion processes) nevertheless decisively influence the impacts in combination and simultaneously.

For this reason, emissions and ambient air concentrations need to be assessed independently to provide an appropriate description of an air quality situation. An adequate description has been provided in terms of a budget considerations and a budget approach, on global scale, in a separate activity of the KRL. The respective contribution on aerosol budgets has been outlined by Jaenicke (2005). The fact that this work derived from a KRL sponsored activity again points to their central role in the Austrian aerosol science.

2. Literature

Preining, O., Davis, E. J., (eds.), 2000. **History of Aerosol Science.** Austrian Academy of Sciences, Vienna.

Jaenicke, R., 2005. Global aerosols. Chapter 8 in: **Hantel M.** (Ed.), 2005: Observed Global Climate, Landolt-Börnstein New Series (Group V: Geophysics), 6, pp. 8-1 – 8-9, Springer, Berlin.

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