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TELLUS

Foreword

Atmospheric aerosols have been shown to have substantial effects on ecosystems, human health and climate. Deposition of particle bound nitrogen dominates the total deposition of nitrogen of ecosystems, which exceeds of the critical limits for deposited nitrogen species and causes eutrofication of the ecosystem. The health effect caused by exposure to anthropogenic particles has been estimated to cause about 270 000 premature deaths per year in the EU. Particles affect the climate by scattering (reflecting) radiation back to space and indirectly by changing cloud albedo. The present estimate of the global climate forcing caused by anthropogenic particles is about -1.2 Wm^{-2}, which can be compared to the climate forcing caused by the anthropogenic CO_2 of $+1.6$ Wm^{-2}. However, the uncertainty in the estimate of the aerosol forcing is quite large, and this uncertainty propagates into the uncertainty in climate projections. To address these problems, there is a need for substantial improvement in the understanding of natural as well as anthropogenic sources, formation of new particles and ageing of existing particles in the atmosphere, interactions between particles and gases and interactions with and effects on clouds.

The observations of new particle formation over the boreal forest initiated an intense set of field experiments involving several Nordic groups. These experiments showed that the atmosphere over the Nordic countries provides a most interesting scene for atmospheric aerosol studies, producing important knowledge of general interest. This, together with a broad concept for studying processes from atomic to regional and global scales, including laboratory and modelling studies, formed the base for biosphere–atmosphere–cloud–climate interactions (BACCI), which started in January 2003 as one of four Nordic Centers of Excellence supported by Nordic Council of Ministers. Under the leadership of Prof. Markku Kulmala, the goals were set very high, not only in terms of publication standards and rates, but also in developing new research groups to extend the Nordic activities and excel together on an international scene. The main purpose was to establish substantial new knowledge on the aerosol life cycle. The progress and achievements of BACCI are presented in the overview article by Kulmala et al. in this issue.

The concept of Nordic Centers of Excellence has proven to be most useful, not only to boost the research within a specific area, but also in supporting Nordic scientists in establishing large research programs. BACCI has been instrumental in starting projects such as the infrastructure project European Super-sites for Atmospheric Aerosol Research (EUSAAR) and European Integrated project on Aerosol Cloud Climate and Air Quality Interactions (EUCAARI) within the EU FP6 framework. In EUSAAR, the Nordic concept on long-term monitoring of key aerosol components has been transferred to a European scale. The major goal of EUCAARI is to deliver the next generation of air quality and climate models, which, to a major part, is built on the same research structure as within BACCI.

With this special issue and a following issue, a selection of publications from different activities within BACCI will give a taste of the research accomplished within BACCI, and with that, the formal activities in BACCI will end.

Hans-Christen Hansson, Guest Editor
Department of Applied Environmental Science
Stockholm University
Stockholm, Sweden

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