ADVANCED STUDY WINTER SCHOOL ON ATMOSPHERIC SCIENCES. BLYDEPOORT, MPUMALANGA 1 - 11 JULY 1996

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1. INTRODUCTION

From the 1 to 11 July 1996, forty winter school participants and lecturers gathered at Blydepoort in Mpumalanga, South Africa to learn and teach about how their scientific disciplines can broaden other peoples' understanding of atmospheric processes. The knowledge exchanged provided participants with a broadened context for their own work. Putting the work of one's discipline in a broader context provides one with a better understanding of the relevance of one's work to the understanding of the global processes of biogeosphere-atmosphere interactions that occur on the planet we share and that scientists strive to understand.

2. WHAT WAS ACHIEVED AT THE WINTERSCHOOL?

The achievements of the winterschool can be classed in three broad categories.

2.1 Knowledge-building

The lectures taught participants about atmospheric process and about biogeosphere-atmosphere interactions, since an understanding of the atmosphere requires an understanding of the biogeosphere.

2.2 Capacity-building

The winterschool developed the scientific capacity of participants, since in addition to the lectures, participants were shown methods for practising science, be it through the use of computer simulation models or through a lecture on how to motivate for funding for research. This will benefit science in southern Africa, since the participants all work in the greater southern African region. The participants were postgraduate science students and scientists working in disciplines that encompass biogeospheric or atmospheric studies.

2.3 Communication-building

The winterschool created an opportunity for scientists from disparate disciplines and countries to meet one another, which will benefit the communication of scientific knowledge in southern Africa for years to come.

3. HOW WAS THIS ACHIEVED?

3.1 The Structure of the Winterschool

Lectures were given in the morning and evenings from 09:00-10:30, 11:00-12:30, then 17:00-18:30 and 19:30-21:00. Lectures and participants, lectured about work done in their disciplines and about their own work. This lecture structure was successful since:

a) a variety over the four lectures daily maintained interest among participants

b) three hours each afternoon could be used for computer sessions or for time to relax and interact with lecturers and participants

c) two postgraduate student participants presented lectures for their supervisors since the lecture topics fell within their research fields

d) other participants volunteered to spend 15 minutes each to talk about their own work. I was very pleased to have had the opportunity to give an introductory talk on the effects of elevated atmospheric carbon dioxide on plants, particularly on southern African savanna plants.

3.2 Disciplines and Lecturers

The table on the next page provides an idea of the scope of expertise amongst the lecturers. The six categories within which the topics fall are delimited for convenience, often one topic could fit into two or more categories (e.g. heterogeneous chemistry could fall under micro-, meso- and macro scale atmospheric processes).

3.2.1 Micro scale atmospheric processes

This category covered molecule and aerosol physics and chemistry. In Air Chemistry, molecule lifetime, reaction kinetics and the relative abundance of atmospheric gases was covered. In Aerosol Physics the sources of atmospheric aerosol, transport, removal, and sampling of aerosol were covered. Heterogeneous Chemistry covered the reactions that occur in clouds and how reactions amongst the different phases of matter are essential for cloud formation.

3.2.2 Meso scale atmospheric processes

Medium Range Meteorology covered the meteorology of the boundary layer of the earth's atmosphere. Weather Map Analysis covered terminology used, help with how to interpret a weather map, and where to get weather maps.

3.2.3 Macro scale atmospheric processes

Global Radiation Balance introduced participants to how to understand the role of the atmosphere in the earth's radiation budget. The proportional contributions of atmospheric gases to global warming were presented. The topic General Circulation gave participants an idea of the theories and

Table 1: List of categories and topics lecturers covered during the Atmospheric Sciences Winterschool. The institution and country each lecturer comes from, follows each name.

CATEGORY TOPICS	LECTURER AFFILIATION
Micro scale atmospheric process	
Air chemistry	Gunter Helas, Max Planck Institute, Germany
Aerosol physics	Harold Annegarn, University of the Witwatersrand, SA
Heterogeneous chemistry	Frank Dentener, Wageningen, The Netherlands
Meso scale atmospheric processes	
Medium range meteorology	Gerhard Held, ESKOM, SA
Weather map analysis	Gerhard Held, ESKOM, SA
Macro scale atmospheric processes	
Global radiation balance	Gunter Helas, Max Planck Institute, Germany
General Circulation	Rosanne Diab, University of Natal - Durban, SA
Computer modelling and data analysis	
Computer simulated dispersion modelling	Frank Dentener, Wageningen, The Netherlands
Computer aided aerosol data analysis	Harold Annegarn, University of the Witwatersrand, SA
Computer aided trospheric ozone data analysis	Gunter Helas, Max Planck Institute, Germany
Biogeosphere-atmosphere interactions	
Atmospheric Sulphur	Andy Andreae, Max Planck Institute, Germany
Basics of soil science	Mary Scholes, University of the Witwatersrand, SA
Biogenic Volatile Organic Carbon	Mary Scholes and her post-graduates student, Luanne Otter
Ecosystem theory	Bob Scholes, CSIR, SA
Ecosystem modelling	Bob Scholes, CSIR, SA
Vegetation fires	Gunter Helas and his post-graduate student, Lackson Marufu
Proposal writing	Danny Walmsley, SRK, SA

patterns in the circulation of the earth's atmosphere. Circulation types over southern Africa in different seasons, and how this affects transport of gases and aerosols in the atmosphere, were also covered.

3.2.4 Computer modelling and data analysis

Dispersion modelling using Gaussian plume models and photochemistry models of diurnal decay and regeneration of gases were available for participants to work with. The use of spreadsheets to analyse and interpret troposheric ozone and aerosol data was also demonstrated. The computer work focused on medium term, meso scale atmospheric processes rather than on longer term global modelling. Using meso scale models allowed participants to familiarise themselves with principles and practices of modelling using a more simple system than a larger scale model would require.

3.2.5 Biogeosphere-atmosphere interactions

The contribution of Atmospheric Sulphur to global climate change through climate forcing was discussed. Natural rather than anthropogenic sources of sulphur were discussed, although the contribution of sulphur from the oceans to the sulphur cycle is dominated by anthropogenic emissions. Other biogeochemical cycles were introduced, and the interrelatedness of the water, nitrogen and carbon cycles especially in terrestrial ecosystems was covered. The properties of ecosystem stability, resilience and scales of complexity were also explained in Ecosystem Theory. Ecosystem Models of water, carbon and nitrogen cycles were introduced and the biological controls at various points in the models were highlighted. Biogenic emissions from plants and soils, such as Volatile Organic Carbon emissions and nitrogen gas emissions respectively were explained once the soil as a biological medium had been explained in the lectures on the Basics of Soil Science. Pyrogenic gases and aerosols from Vegetation Fires in the veld and from cooking fires, were discussed.

3.2.6 Proposal writing

Practical hints for seeking and acquiring funding were presented. The procedure to follow in order to research, write, motivate and follow up on a good proposal were presented

3.3 Organisation of the winterschool

The course leaders, Gunter Helas and Harold Annegarn, must be congratulated for the well thought out progression in the lecture timetable. The lectures were on a high standard and the practical computer work complemented the theory in the lectures well. The daily schedule was well planned, and books were available for extra reading

during free time. The study fields of the participants was diverse, almost as diverse as their countries of origin. People working in atmospheric chemistry, cloud physics, aerosol science, meteorology, environmental aspects of mining, and ecology, participated. Participants came predominantly from the African sub continent whilst the lecturers were a mix of South African and European. This provided a stimulating diversity that the organisers must be pleased to have achieved.

4. A personal appraisal

As part of my MSc I am studying the effects of elevated atmospheric carbon dioxide (CO_2) on southern African savanna plants. By attending the winterschool I furthered my understanding of how plant-derived compounds contribute to atmospheric processes, and gained a better understanding of the scope of the field of atmospheric science. Besides learning from attending the lectures, the winterschool presented an opportunity to learn from interacting with people from different disciplines. Knowledge gained and contacts made during attendance of the winterschool can thus be used not only during the time I am studying for an MSc, but also during further research, such as towards a PhD and beyond. While the winterschool concentrated on atmospheric gases less stable and with a shorter lifetime than CO_2, the knowledge I gained about other atmospheric processes has built onto and expanded my understanding of the context of my work in global chemical cycles, atmospheric dynamics and climate change. It has been a very valuable experience.