



AIR POLLUTION METEOROLOGY

Richard S. Scorer

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“Talking of education, people have now-a-days” (said he) “got a strange opinion that every thing should be taught by lectures. Now, I cannot see that lectures can do so much good as reading the books from which the lectures are taken. I know nothing that can be best taught by lectures, except where experiments are to be shewn. You may teach chymistry by lectures – you might teach making of shoes by lectures!”

James Boswell: *Life of Samuel Johnson*, 1766

Dedicated to my wife Margaret: *sine qua non*

ABOUT OUR AUTHOR

Richard Scorer gained an open scholarship to Repton School, and another to Cambridge University in Mathematics where he gained the title of Wrangler for Part II Mathematics examination. He obtained his PhD at Cambridge for a doctoral thesis on Atmospheric Waves which answered a problem posed by an earlier air crash in North Wales. He moved to Imperial College, London where he has since been Lecturer in Meteorology, Reader in Applied Mathematics, and Professor of Theoretical Mechanics; and is currently Emeritus Professor.

The following catalogue of academic appointments and public service makes impressive reading:

Founding member of the journal *Atmospheric Environment*; Fellow of the Royal Society of Health; Fellow of the Institute of Mathematics and its Applications; Fellow of the Royal Aeronautical Society; Honorary Member and former Chairman of the National Society for Clean Air and Environmental Protection (NSCA); Honorary Member of the Czechoslovak Meteorological Society; Member of the American Association for the Advancement of Science; Fellow of the Royal Meteorological Society; Former President and Honorary Member of the Royal Meteorological Society; Advisor on environmental research to the Central Electricity Research Laboratory; Member and former Committee Chairman of the Technical Committee of the UK Clean Air Council; Member of the Farm and Food Society; Conservator of Wimbledon Common.

Since retiring, Professor Scorer has spent more time on the new technology of satellite imagery of clouds. He has written many books on meteorology and aerodynamics which are all leaders in the field, especially for the understanding of cloud mechanisms in the atmosphere. He has travelled widely all over the world, lately in the Galapagos Islands; Spitsbergen, Iceland, Greenland; South Georgia and the Arctic Peninsula, as well as examining the far North during his satellite studies, and has always been very aware of the ecological and environmental forces at work on all life forms on Earth. These travels have acutely impressed upon the author the magnitude of the human influence on the welfare of other species and flora of the world, and their influence on us.

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Author's Preface

Meteorology is a study of how Nature produces such a glorious variety of weather and its advance gradually makes forecasting possible. We have come to regard the atmosphere as a fluid and understanding it requires making mathematical models which must obey the laws of fluid mechanics and physics. Professor David Brunt used to say that the air is basically water vapour diluted with large amounts of oxygen and nitrogen which changed very little while the water vapour condensed into clouds which collected most of the pollution and precipitated it in rain, snow, hail, and thereby produced the continual display of beautiful, severe and very varied weather.

Today the various gases which complete a roll-call of vast chemical variety, while all the different parts of the atmosphere transform them from primary to secondary pollution which then plays tricks with sunshine and radiations far away in the ultra-violet and infra red. So we are interested already in the consequences that will follow the release of pollution into the weather systems which will come tomorrow and beyond.

We start by describing what this pollution is, for it is mostly the result of burning fossil fuel and great industries manufacture all sorts of chemicals which react with sunshine over a very wide range of temperatures. We already have many books describing the clouds and storms in the process of routine weather forecasting using a wide range of mathematical models made possible by modern computers which can carry and process the millions of observations which we feed into them.

As we do this the scientific problems of physics and chemistry are multiplied. They are thrown around by the mechanics of the fluid atmosphere and the radiation from the sun. We may hope, or even assume, that it is merely a question of processing the observations through suitable computers to obtain a prediction of tomorrow's pollution display. But we have to face that any such forecast must follow, not precede, the forecast of the weather. And we know that the weather can drift apart from the forecast often by tomorrow. So do we need to take the laws of physics literally and in details?

To explore these possibilities we study the kind of meteorology which air pollution tells us about, and how it may be transformed.

This book records how the subject has changed and is changing, in the hope that the mistakes of the (recent) past will not be followed again.

The terminology of meteorology becomes so familiar over the years that it seems simple to an old hand. Therefore this time I have included a technical dictionary, which is more than an enlarged glossary; it supplements many aspects of the earlier chapters, and it should be helpful to budding

meteorologists, and I hope it helps them to get more from what they can see with their otherwise unaided eyes.

Everyone concerned with air pollution thinks, or even knows, that it is dispersed by turbulence; but what is turbulence? Read on

Acknowledgement

I am deeply indebted to my daughter Beatrice who salvaged the text from my old computer when it gave up, and compiled the camera-ready copy for this book from heaps of text, slides and photographs. I am very grateful to her for taking on this task while also preparing to move to work in Uganda, and for completing it before leaving the country!

Any remaining errors are my responsibility.

R.S.Scorer
Raynes Park
2002

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