MOUNTAIN ENVIRONMENTAL MANAGEMENT

Discussion Paper Series

Computer-based Climatological Maps for High Mountain Areas

**New Methods and Their Application,
with Examples from the Himalayas**

Klaus Hormann

MEM Series No. 12

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International Centre for Integrated Mountain Development

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COMPUTER-BASED CLIMATOLOGICAL MAPS FOR HIGH MOUNTAIN AREAS

NEW METHODS AND THEIR APPLICATION, WITH EXAMPLES FROM THE HIMALAYAS

Klaus Hormann

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Klaus Hormann is a Professor of Geography at the Department of Geography of Kiel University (Germany). He started his academic career as a geomorphologist, publishing articles and books mainly on fluvial geomorphology and morphometry. After an eight-month field study in Nepal (1971/72), the main result of which was a classification and explanation of river terraces in Central Nepal, his studies focussed more and more upon the application of morphometric methods for high mountain areas and, in particular, upon the influence of mountain topography on spatial climatic and hydrologic differentiation. Since 1987 he has been engaged in climatic model and runoff model computation for hydropower development purposes in Northern Pakistan's high mountain areas.

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Acknowledgements

The intention of this publication is to produce a true discussion paper on special methods of constructing climatological maps for high mountain areas and their application; and not to provide a general review of all existing methods in this domain. It was the idea of Professor S.R. Chalise of ICIMOD that information about my actual methods should be made available in the English language. I would like to express my thanks to Professor Chalise, not only for this idea but also for the discussions engaged in during my visit to Kathmandu in March 1994. I am grateful to ICIMOD for publishing this work.

As I have been working on spatial climatological regression model computation methods for high mountain areas for about 20 years, the list of persons and institutions I have to thank for their support would be quite long and never complete. Therefore, on this occasion, I shall concentrate my thanks on Mr. H. Kuntz in Lahore (Pakistan), the Project Manager of the WAPDA/GTZ and SHYDO/GTZ hydropower development projects, for his support to my work in the Hindu Kush-Himalayan Region over the last six years. This support not only provided the means for extensive digitisation work, field work, and system development but also gave me the opportunity to work on hydropower development questions as an insider, with much better access to the required data and a more intense involvement in the questions of practical application than I would have obtained with pure academic study.

Dr. Klaus Hormann
Professor
Geographisches Institut der
Universitaet Kiel
Olshausenstr. 40
D 24098 Kiel,
Germany

Preface

Extreme variations in climate, even within short distances and between adjacent watersheds, are more of a rule than an exception in the mountainous areas of the Hindu Kush-Himalayan Region. Although such variations in climate can be seen to be closely linked to the variations in topographical features, the exact relationship between changes in climatic parameters with topographical parameters is not easy to establish. The problem becomes further complicated as data availability on climatic parameters is extremely limited for higher elevations in the Hindu Kush-Himalayas. Furthermore, operational costs of meteorological and hydrological stations, in these highly inaccessible mountains, are also very high. This imposes severe restrictions on developing a denser network of hydrometeorological stations in these mountains in the near future, as economic and development imperatives of the countries of this region will severely limit funds to develop such networks.

However, adequate understanding of climate and its variations is a fundamental necessity for planning sustainable mountain development and for the management of natural resources. Considering the high potential of development of water and biological resources in the Hindu Kush-Himalayas, the need for improving our knowledge on the temperature, precipitation, and hydrological regimes of climatically diverse regions of the Hindu Kush-Himalayan mountains cannot be overemphasised.

Recent developments in computer-based methods, which use existing climatic data to generate new data for mountain areas without observation stations, provide some hope to fill the data gap, and facilitate a better understanding of the climatic and hydrological regimes of the Hindu Kush-Himalayas, despite the limitations of the technique and complications imposed by the topographical variations of these high mountain areas. In this context, the new methods developed by Prof. Klaus Hormann in producing computer-based climatological maps for high mountain areas and demonstrating their applications in the planning of hydropower development, which are based on his work in Nepal and Pakistan spanning over the last two decades, are extremely interesting. Application of knowledge for sustainable development of natural resources of the Hindu Kush-Himalayas being of prime concern to ICIMOD, it is hoped that this publication will help promote further discussions on this topic and contribute towards further refinement and operationalisation of these new methods and techniques.

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