Preface

An Introduction to the KIHZ Project

The description of the climate system and the quantification of its natural variability and dynamics is essential to assess an ongoing anthropogenic climate change and to validate climate and biogeochemical models to allow for reliable projections into the future. Because the spatio-temporal coverage of direct meteorological observations is rather limited, high-resolution and absolutely dated climate archives represent the only key to a quantification of seasonal to millenial climate variations in the past. Furthermore, climate models provide insights into the major processes and causes relevant for climate variability on these time scales.

Both approaches represent one side of the same medal, however melting both sides down to one combined effort is often hampered by obstacles defined by the different nature of the approaches. For instance, General Circulation Models (GCMs) per se deal with spatially resolved data representing real climate variables in the model world (such as temperature or precipitation) with each model run reflecting one possible realization of climate history under given boundary conditions. In contrast, the records of natural climate archives are influenced by climate variations as they took place in reality, however, are often representative of local climate conditions only. Moreover, the climate information deduced from natural archives is in nearly all cases based on climate proxies, whose relationship to real climate variables, the so called transfer function, has to be established beforehand.

In order to bridge the gap between climate models and archives and to join these different aspects within the German climate research community, the project "Climate in historical times" (KIHZ) has been initiated in 1998 by geoscientists and climate modelers from five German National Research Centers, members of the Helmholtz association (HGF), as depicted in the inner ring in Fig. 1. Those starting members contributed lake sediments, tree rings, polar ice cores and climate information from permafrost regions as well

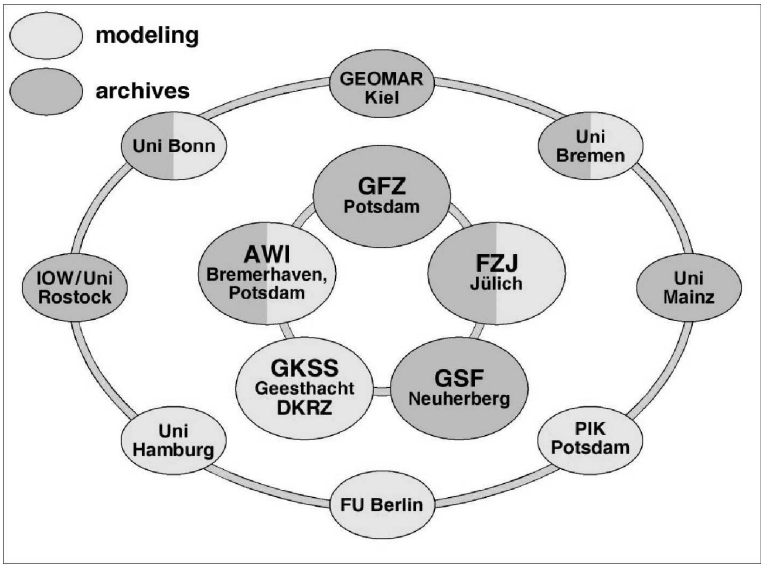

Fig. 1. Structure of the KIHZ project listing all participants. The inner ring summarizes the founding HGF institutes while the outer ring shows the complementary university and Leibniz Association institutes. Dark grey circles indicate institutes contributing natural climate archives, light grey circles indicate climate modeling groups.

as GCMs, high-resolution regional atmospheric models and models of intermediate complexity to KIHZ. In the year 2000, nine additional groups from German universities and institutes from the Leibniz association joined KIHZ (outer ring in Fig. 1) adding further competence e.g. on marine sediments, corals, lake sediments as well as on solar variations, coupled circulation models and earth climate system models of intermediate complexity.

Starting from joined meetings presenting the disciplinary work done prior to and within KIHZ, a very fruitful discussion took place between the diverse groups which did not only result in a common language and a better understanding of the different approaches but also in cross-disciplinary working groups attempting to fill the gaps between climate archives and models. Among others by upscaling studies, relating local climate proxy data to large scale teleconnection patterns using meteorological data and multivariate time series analysis, by improving transfer functions based on empirical and experimental evidence, by aiding the interpretation of climate records using climate models to identify processes relevant for the observed climate variations or by splicing climate reconstructions from climate archives into circulation models using nudging techniques.

The results of these projects are summarized in this volume which is a spin off of the final KIHZ meeting held in Wilhelmshaven in September 2001.

The volume is divided into two parts. Part I provides an overview of the basics of the climate system and its dynamics and of the tools used for climate reconstruction, i.e. natural climate archives and climate models. In Part II individual results achieved during the KIHZ project in the last 5 years are presented which are aimed "Towards a synthesis of Holocene proxy data and climate models".

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