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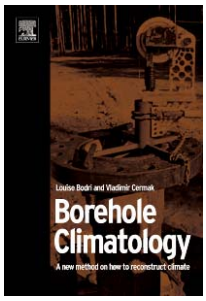
Borehole Climatology *– A New Method on How to Reconstruct Climate*, by Louise Bodri and Vladimir Cermak, 2007. Elsevier, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. Hardback, x + 335 pages. Price EUR 160.00, GBP 110.00, USD 195.00. ISBN 978-0-08-045320-0.



Louise Bodri and Vladimir Cermak deserve major credit for accepting the challenge to write an introductory borehole geophysics/geothermal paleoclimatology textbook. Their title "Borehole Climatology" is not very informative and suggests a wider scope than the contents make true. In fact, the book focuses on one aspect of borehole climatology/paleoclimatology that is related to the forcing of surface temperatures: the response of the underground temperature to surface temperatures, and the resulting possibility of reconstructing fluctuations in surface temperatures during the past from present transients in borehole temperatures with depth.

This is the first comprehensive book devoted entirely to the subject, although shorter reviews of borehole geothermal climatology have been published before (a.o. Pollack and Huang 2000; Majorowicz et al. 2004). Somehow these works were missed by the authors and are absent in their reference list. On the other hand, other (original) works by the above authors are cited correctly. Another point of criticism is that the book, although pretending to provide a review, refers predominantly to work by the authors themselves, carried out in the Czech Republic, Cuba, Kamchatka Eastern Canada and other places. I would say that this focus makes the book out of balance.

Bodri and Cermak have gone through a large number of research publications on the subject, up till 2006, so the book is well up-to-date. It is obviously that the book has been prepared quite recently, so that it is now as "hot" as possible.

The book is well organized. The preface is followed by four major blocks covering, respectively: "Background and history of the problem" (Chapter 1), "Climate change and subsurface temperature" (Chapter 2),"Ground temperature histories: evidence of changing climate" (Chapter 3) and "Subsurface temperature monitoring: present-day temperatures change and its variability" (Chapter 4). These are followed by a summary ("Conclusions and perspectives of future progress").

Chapter 1 briefly reviews the paleoclimatological reconstructions as based on surface observatory data and proxies. There is a part (1.3) devoted to a review of borehole-temperature paleoclimatology. This is extended (and sometimes repeated) in the following chapters, particularly in Chapter 3.

Chapter 2 is a very good review of the method, inversion techniques and the method's limitations. I find the comparison of the methods and Table 3 very useful. A very large part of this chapter focuses on "Ground-Air Temperature" coupling and on the effects of various environmental changes. These changes affect temperature vs. depth and inversion of temperature logs. The subsurface temperature regime can be biased by water-flow effects, land clearing, forest fires, snow cover, ground-freezing effects and other factors, so that the inversion of such temperature logs can result in a "non-climatic" ground-surface history. Existing borehole-temperature databases lack information on the environmental conditions of the wells and their

topographical position. The inversion of large amount of such well logs can give some average ground-temperature histories (GSTH), but these can be skewed by biases working one way. It is positive that the book points out these problems. It also well describes biases due to tightly constrained inversions resulting in so-called “spaghetti GSTH”.

Chapter 3 gives a good review of GSTH reconstructions from around the world (continental). It divides them into 3 groups depending on the duration of the reconstructed history as related to well-temperature depths. Shallow logs (100 m or so) show only decades to about a century of the surface-temperature history, while deeper wells (several kilometers deep) – like the wells of the deep-drilling projects – provide the glacial-to-Holocene part of the history. There is a short part in Chapter 3 on super-deep holes like KTB or the Kola well. The Kola well is the deepest well on Earth, being 13 km deep. The paleoclimatic reconstructions from these holes are difficult, however, due to various geological reasons; it is fairly disappointing not to see any surface histories derived from these deep temperature logs in this textbook.

Chapter 4 is devoted to the description of the ongoing work of subsurface-temperature monitoring. It describes one of the most important aspects of the borehole method, dealing with the question of whether we can relate reconstructions of the paleoclimate based on subsurface temperature logs to surface-temperature change despite several disturbing factors related to changes snow cover, snow packing, soil moisture, land cover , etc.? The book answers this question in part: the work done shows fairly good long-term coupling between subsurface-temperature changes and surface-temperature forcing.

To summarize, Louis Bodri and Vladimir Cermak’s book is an outstanding work that I strongly recommend to each library, and that I advise each geography, geology and geophysics student to read. The book is at such a high scientific level that it should also be read by researchers working in paleoclimatic reconstructions using proxies. Borehole-temperature paleoclimatology GSTH reconstructions challenge some of the other reconstructions like the famous “hockey stick” surface-temperature history. This fairly new method and its limitations should therefore be understood by climatologists.

References

Majorowicz, J., Safanda, J. and Skinner, W., 2004. Past surface temperature changes as derived from continental temperature logs ***S*** Canadian and some global examples of application of a new tool in climate change studies, in Dmowska, R., ed., Advances in Geophysics (Elsevier, Amsterdam), v. 47, p. 113-174.

Pollack, H.N. and Huang, S., 2000, Climate reconstruction from subsurface temperatures”: Annual Reviews of Earth and Planetary Sciences, v. 28, p. 339-365.

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