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Borehole climatology: principles, achievements and prospects

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World climate has been always undergoing significant changes in the past, however, at present, we witness a pronounced global warming, which seems even to accelerate. The global warming is manifested by increasing mean surface air temperature. Surface temperature-time variations propagate downward and impart certain temperature 'signature" to the shallow rock strata. The analysis of the subsurface (borehole) temperature-depth profiles and inferences about surface temperature histories proved to be a useful tool of the paleoclimate reconstruction. The "borehole climatology" thus suitably links up the knowledge gained from the instrumental long-term air temperature records with a number of proxy methods. Unlike the proxies borehole data provides direct past temperature assessment and can extend the areal range to regions poorly covered with meteorological observations.

The presentation briefly introduces the method and its basic principles together with their advantages and disadvantages. Recent major achievements will be demonstrated on suitable examples, such as (i) comparison of slightly different methods of analysis, (ii) selected sets of paleoclimate reconstructions from several specific regions and definite time periods, (iii) compilations of uniform borehole temperature data sets, and (iv) discussion on various processes that may mask or disqualify the results (terrain effect, rain and snow cover, vegetation cover and its changes, soil properties and hydrogeology). Special attention will be paid to the high-resolution subsurface temperature-time monitoring within and below the penetration depth of the seasonal temperature variations as an indicator of the magnitude of the present-day warming rate and the possibility to distinguish between the natural and man-made (anthropogenic) component

of the global warming.