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Thermal log analysis for recognition of ground surface temperature change and water movements

M. Verdoya, P. Chiozzi, and V. Pasquale

Dipartimento per lo Studio del Territorio e delle Sue Risorse, Settore di Geofisica, Università di Genova, Viale Benedetto XV 5, 16132 Genoa, Italy

Abstract. A joint analysis of surface air temperature series recorded at meteorological stations and temperature-depth profiles logged in nearby boreholes was performed to estimate conditions existing prior to the beginning of the instrumental record in central-northern Italy. The adopted method considers conductive and advective heat transport in a layered medium and provides simultaneous estimates of the pre-observational temperatures and the Darcy velocities. The reconstruction of the ground surface temperature history using a generalised least-squares inversion method was performed for boreholes where hydrological disturbances to measured temperature logs were proved negligible. Both methods revealed generally coherent climatic changes in the whole investigated area. Climatic conditions were generally warm and comparable with the reference period 1960–1990. The absence of the Little Ice Age seems to be a generic feature of the climate in central-northern Italy. Climate change of the 19th century was generally insignificant with well-balanced periods of cold and warmth. The investigated area became significantly colder only at the end of the 19th century. Cooling culminated around 1950 when it was replaced by rapid warming. Recent warming was not inferred only for one of the investigated holes.

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