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Results from repeated temperature measurements and from long-term temperature monitoring in borehole TGQC-1, south-central Portugal

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Since 1996 the borehole TGQC-1, south-central Portugal, has been used to study the climate variability in the region near the town of Evora. The borehole is 190 m deep and several temperature logs have been obtained there in different years. In 2005, a geothermal-climate change observatory has been installed in the borehole to include studies on air-ground coupling. Apparently, below 140 m, temperatures in the borehole are stable; at the surface, no vegetation and soil changes have occurred for periods longer than 100 years. The comparison of ground surface temperature reconstructions from temperature logs from the TGQC-1 borehole with the air temperatures time series of Lisbon weather station, about 100 km away from Evora, shows similar results, indicating a 0.6 °C per century temperature increase.

The long-term monitoring with 30 minute sampling interval of the air, soil and borehole temperatures in depths 2, 5, 10, 20, 50 and 100 cm and 1, 2.5, 5, 10, 20, 30 and 40 m, respectively, has been launched in May 2005. It provides data on the propagation of daily, seasonal and inter-annual surface temperature changes through the soil downward into the granite bedrock. The data obtained during the first two observational years were used to estimate the thermal diffusivity of soil and its seasonal variability down to 50 cm from the daily variations. The diffusivity of soil and bedrock between 50 cm and 10 m was estimated from the amplitude attenuation of the annual run. The diffusivity exhibits a gradual increase with depth, from values of 0.3 - 0.5 E-6 m2/s in the uppermost soil layer via 0.7 E-6 m2/s between 50 and 100 cm to 1.4 E-6 m2/s, 1.6

E-6 m2/s and 3.0 E-6 m2/s in the layers 1 - 2.5 m, 2.5 - 5 m and 5 - 10 m, respectively. Value of 3 E-6 m2/s obtained for the granite layer between 5 and 10 m seems to be too high for this rock type and it might indicate existence of a non-conductive component of the heat transfer in this layer.