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Surface heat flow of southern Israel based on new borehole data

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In the framework of the international DESIRE project new surface heat-flow values were determined at ten borehole locations in southern Israel. Maximum accessible depth for temperature borehole logging was 800 m. The section studied comprises sedimentary rocks of Aptian to Eocene age. Boreholes, in which new temperature logs were obtained, are well distributed across southern Israel allowing the observation of a regional heat-flow trend. New values of thermal conductivity, porosity and density, measured on drillcore and surface samples, formed the petrophysical database for the study. Thermal conductivity was measured under dry and water-saturated conditions for lithotypes and scaled up for geological formations. The new values are higher than most of the previously measured values, in particular for sandstones and siltstones, whose mean values are 5.0 and 2.9 W m^{-1} K^{-1}, respectively. Mean thermal conductivities of the most abundant lithotypes, which are dolomites and limestones, are on the order of 4.1 and 2.7 W m^{-1} K^{-1}, respectively. The total radiogenic heat production of the sedimentary cover, determined from gamma ray logs, varies slightly at regional scale providing a heat flow of < 4 mW m^{-2} for the sections above the Precambrian and Pan-African basement. Surface heat flow, calculated from continuous temperature logs using the interval method, ranges from 50−62 mW m^{-2} . The values plot in the upper half of previously determined values (40−60 mW m^{-2}) and are in accordance with values recently determined east of the Dead Sea Transform (DST) in Jordan. A weak trend of decreasing surface heat flow from the DST towards the Mediterranean Sea can be identified. This trend can be explained by regional changes in structure and mean composition of the lithosphere that are known from DESERT and DESIRE refraction seismic surveys and are quantified by a lithospheric 2D thermal model. Thus the thermal model provides a substantiated insight into the scale of heat-flow variations of the stable lithosphere in the greater DST area.