



Thermal anomalies, paleoclimatic diffusive and advective phenomena: example of the Anglo-Paris Basin

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This work is the first quantification of the combined impact of diffusive and advective paleoclimatic phenomena to explain the weak vertical thermal flux anomaly in the upper part of the Anglo-Paris intracratonic sedimentary basin. The aim of the research is to understand the mechanisms at the origin of the thermal flux anomaly at the level of the Meso-Cenozoic sediment pile. Based on a temperature profile representative of the basin, transient thermo-hydraulic simulations were performed along a representative vertical cross section of about 400 kilometers within the Lower Cretaceous multi-layer aquifer. Three paleoclimatic scenarios are the combination of two paleotemperature climatic forcings and two hydrodynamic regimes, one of them taking into account the interruption of the recharge linked to permafrost development.

The simulation results clearly show the transient nature of the basin's thermal regime. Then, for the reference well, the majority of the thermal flux anomaly can be explained by advective and paleoclimatic mechanisms with a decrease in geothermal flux simulated up to a little over 30 mW/m², depending on the scenarios. Decrease in heat flux because of basin scale subsurface flows in the Lower Cretaceous is around 15 mW/m², with a mean value for groundwater recharge, whereas estimations could be twice as high.