Geophysical Research Abstracts
Vol. 14, EGU2012-1423, 2012
EGU General Assembly 2012
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Heat-Flow and Subsurface Temperature History in Eastern Senegal (West Africa)

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New temperature measurements from eight drill holes in the West African Craton reveal significant perturbations up to 100 meters below the alteration zone. These perturbations are mostly related to the recent global warming (1.5 °C since 1940) and to the circulations of water at the base of a 20-30 m thick alteration zone. The past ground surface temperatures inferred from boreholes are very consistent with the surface air temperatures recorded after 1940 in nearby meteorological stations, and do not show any significant change before 1900. Site effects are observed in the upper part of temperatures logs and are exclusively interpreted by the subsurface conditions, either the lower thermal conductivity and / or the circulation of water at the base of the alteration zone. In order to evaluate their importance at each borehole, we used a 1D finite differences model that includes both the temperature changes at the Earth surface and the heat transport by fluids: the eight temperature profiles can be well explained by models with the same surface temperature variations and the same basal heat flow, but with different characteristics of the heat transfers in the alteration zone. The basal heat flow estimated from these models ($31 \pm 1\ mWm^{-2}$) is consistent with that determined in the lowest portion of the deepest boreholes and confirms the previous measurements ($33 \pm 8\ mWm^{-2}$) in the southern part of the West African Craton (Leo Rise).