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Abstract Title: Predictive mapping of fluoride levels in groundwater in Central Benin (Western Africa) using a geostatistical approach

Authors: Joël Tossou[1,2,3], Thomas Hermans[1,4], Philippe Orban[1], Moussa Boukari[3], Serge Brouyère[1]

[1] Hydrogeology & Environmental Geology, Urban & Environmental Engineering, University of Liège, Sart-Tilman, Belgium

[2] General Directorate for Water, Ministry for Mines, Energy and Water, Cotonou, Benin

[3] Applied Hydrology Laboratory, University of Abomey-Calavi, Abomey-Calavi, Benin

[4] Department of Geology, University of Gent, Gent, Belgium

Corresponding author's e-mail : serge.brouyere@uliege.be (ou Joël ou Phil?)

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Groundwater of the crystalline aquifers of central Benin (Département des Collines) are characterized by elevated fluoride concentrations of up to 7 mg/L, whereas the standard recommended by WHO is 1.5 mg/L. Consumption of these waters with high fluoride content impacts human health, the population of the region being effectively largely affected by dental fluorosis. Recent hydrogeochemical investigations on groundwater from the crystalline aquifers coupled to geochemical, petrological and mineralogical investigations on rock samples collected in the area of interest have revealed that the origin of these anomalous fluoride levels is geogenic with a strong contribution of ferromagnesian minerals, mainly biotite.

Using the results obtained on collected samples, together with regional information on geology, a double cartography exercise was performed on the scale of the Department of the Hills in order to obtain (1) a map of estimation of fluoride concentrations in the groundwater by ordinary kriging and (ii) a probability map of exceeding the WHO guideline value (1.5 mg / L) of fluoride in water by Indicator Kriging. In addition to the cartography itself, the analysis of the spatial structure of the data (fluoride content of the groundwater) through the calculation of the variograms shows that there is a strong link between these and the dominant geological structures, confirming the geogenic origin of fluoride.

The map produced using these geostatistical procedures will serve as a support for decision makers and resource managers to make the right choice of drinking water catchment areas to avoid, at least to minimize the risk of high levels of fluoride in abstracted groundwaters.