Geophysical Research Abstracts
Vol. 16, EGU2014-5431, 2014
EGU General Assembly 2014

The role of geostatistics in medical geology

Pierre Goovaerts
BioMedware, Inc, Ann Arbor, Michigan, USA (goovaerts@biomedware.com)

Since its development in the mining industry, geostatistics has emerged as the primary tool for spatial data analysis in various fields, ranging from earth and atmospheric sciences, to agriculture, soil science, remote sensing, and more recently environmental exposure assessment. In the last few years, these tools have been tailored to the field of medical geography or spatial epidemiology, which is concerned with the study of spatial patterns of disease incidence and mortality and the identification of potential "causes" of disease, such as environmental exposure, diet and unhealthy behaviors, economic or socio-demographic factors. On the other hand, medical geology is an emerging interdisciplinary scientific field studying the relationship between natural geological factors and their effects on human and animal health. This paper provides an introduction to the field of medical geology with an overview of geostatistical methods available for the analysis of geological and health data. Key concepts are illustrated using the mapping of groundwater arsenic concentrations across eleven Michigan counties and the exploration of its relationship to the incidence of prostate cancer at the township level.

Arsenic in drinking-water is a major problem and has received much attention because of the large human population exposed and the extremely high concentrations (e.g. 600 to 700 μg/L) recorded in many instances. Few studies have however assessed the risks associated with exposure to low levels of arsenic (say < 50 μg/L) most commonly found in drinking water in the United States. In the Michigan thumb region, arsenopyrite (up to 7% As by weight) has been identified in the bedrock of the Marshall Sandstone aquifer, one of the region's most productive aquifers. Epidemiologic studies have suggested a possible associationbetween exposure to inorganic arsenic and prostate cancer mortality, including a study of populations residing in Utah. The information available for the present ecological study (i.e. analysis of aggregated health outcomes) consist of: 1) 9,188 arsenic concentrations measured at 8,212 different private wells that were sampled between 1993 and 2002, 2) prostate cancer incidence recorded at the township level over the period 1985-2002, and 3) block-group population density that served as proxy for urbanization and use of regulated public water supply versus use of potentially contaminated private wells in rural areas.