Geophysical Research Abstracts, Vol. 8, 09101, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09101
© European Geosciences Union 2006

Self-Potential Method for Characterizing Streaming Flows in the Saturated and Vadose Zones: State of the Art and Illustration on the Monitoring of La Soutte (Vosges, France)

P. Sailhac, M. Béhaegel and G. Marquis

Institut de Physique du Globe de Strasbourg - UMR 7516 -5, rue René Descartes, 67084 Strasbourg Cedex - (pascal.sailhac@eost.u-strasbg.fr)

First we will briefly review SP interpretation techniques developed to allow for the monitoring of water fluxes during pumping, infiltration or seepage. Primary we consider interpretation techniques that are based upon Green function decompositions and can be used for flows in the saturated zone (e.g. wavelets, COP tomography, and iso-α line). Classical application of theses techniques is underlined by the assumption of a constant electrical conductivity medium that involves uncertainty and bias in quantitative flow parameter estimates. For instance, the diffusive effect of a conductive shallow layer tends to increase the apparent depth of an underground flow source. Instead, one can use Green functions of a tabular medium. We also consider the more complex case of the unsaturated zone, in which the hydraulic and electric conductivities are depending on the water content. Different soil models and experiments can be used for the monitoring of the infiltration and the characterisation of the soil hydraulic parameters.

Then we will show applications to SP data from the hydrogeophysical monitoring experiment at La Soutte (Vosges, France). The site is a small catchment area of fractured granites and volcanic rocks, covered by clayey and peaty soils; there are small perched aquifers located within the first meters of the underground. Since November 2004, a set up of 40 unpolarizable electrodes is used for a continuous-time monitoring of SP. The quality of this data set is considered, by comparison to meteorological data from a weather station, to magnetic data from a nearby magnetic observatory, and to lightning events from spherics. Finally using hydraulic and electric modelling, we discuss the resulting near surface flow models for each season.