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Self potential method applied to salt-affected soils of Thailand

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Soil salinization in Northeast Thailand is caused by natural phenomenon (climate, rock salt deposit, saline groundwater) (Japakasetr and Workman 1981) as well as by human activities (wood cutting, water storage, groundwater pumping, etc) (Williamson et al., 1989). Salt-affected soils are formed as bare saline patches in low-land paddy soils under groundwater influence and are so called "Groundwater Associated Salinity" by Fitzpatrick (2005). High salinity level in rainfed rice fields depletes the annual crop yields (Yuvaniyama et al., 1996). Much research has been undertaken to survey salinity extent, to explain the causes and to recommend measures to be taken by the farmers. Recent works focused on the explanation of origin and how salts reach the ground surface, namely based on hydrogeological and geochemical data (Srisuk, 1994; Imaizumi and al., 2001). In a given rice farming area of Isaan region (Khon Kaen province, Phra Yun district, Ban Daeng site), French organization IRD and Land Development Department (LDD) from Thai Ministry of Agriculture and Cooperatives has carried out since three years a local field experiment (LFE) based on water and solute transfer monitoring at short-time steps within two meters soil depth and on the salt-affected soil rehabilitation using improved cultural practices (Saejiew, 2003). The paper summarizes a newly geophysical approach to identify the spatial distribution of saline patches at a watershed lowland scale.

The electrical spontaneous polarization method, so called self potential method (SP), is widely used for studying volcanic activity, tectonic phenomena as well as geophysical systems (oil or gas reservoirs, industrial sites such as underground waste deposits) (Perrier et al., 1997). SP method was performed around the LFE using 18 cm long non polarizing electrodes. The device consisted of an intermediate medium where a metal/metal-ion couple ($Pb/PbCl_2$) had a potential stabilized with a salt of the metal

ion having fixed concentration (saturated NaCl electrolyte). In field during the dry season, one electrode used as a reference potential was fixed in soil surface at a given location and another one was mobile. The potential difference of the dipole was measured using a high impedance voltmeter within a 1.5 ha area at each 5 m squared mesh and along two perpendicular transects at each 5 m step (250 m and 150 m).

SP values are ranged from -20 mV to +20 mV and mapped using Surfer™ software. The SP mapping is in accordance with a previous mapping of the bulk electrical conductivity performed in dry and rainy seasons using a Geonics™ device (EM38). Complementary geochemical and hydrological groundwater data (35 piezometers network) combined with geological (four 20 m rotary drilled boreholes) are used to explain the SP origin. We can conclude that SP method is full of promise in saline environment and can be used to assess the soil salinity degradation at a low cost.

Fitzpatrick, 2005. Hydro-pedologically based toposequence models as a powerful tool for managing salt-affected landscapes: case studies from geo-chemically variable saline environments. In International Salinity Forum “Managing Saline Soils and Water. Science, Technology, and Social Issues”, Riverside, California, USA, April 25-27, 2005.

Imaizumi M., Sukchan S., Wichaidit P., Srisuk K., Kaneko F., 2001. Hydrological and geochemical behavior of saline groundwater in Phra Yun, Northeast Thailand. JIRCAS Working Report 30, 7-14.

Japakasetr T., Workman D.R., 1981. Evaporite deposits of Northeast Thailand. American Assoc. of Petroleum Geologists, 179-187.

Perrier F.E., Petiau G., Clerc G., et al., 1997. A one-year systematic study of electrodes for long period measurements of the electric field in geophysical environments. J. Geomag. Geoelectr. 1677-1696.

Saejiew A., 2003. Evolution des sols de bas-fonds au Nord-est de la Thaïlande : étude des interactions entre sodisation et ferrolyse. Thèse ENSA Montpellier.

Srisuk K., 1994. Genetic characteristics of the groundwater regime in the Khon Kaen drainage basins, Northeast Thailand. Ph.D thesis, University of Alberta, 383 p.

Williamson D.R., Peck A.J., Turner J.V., Arunin S., 1989. Groundwater hydrology and salinity in a valley in Northeast Thailand. In: "Groundwater contamination". IAHS Publ., 185: 147-154.

Yuvaniyama A., Arunin S., Takai Y., 1996. Management of saline soil in the Northeast of Thailand. Thai J. Agric. Sci., 29, 1:1-10.