Constructing the Apparent Geological Model by Fusing Surface Resistivity Survey and Borehole Record – A Case Study of Choushuichi Alluvial Fan

Jui-Pin Tsai[1] Ping-Yu Chang[2,*] Tian-Chyi Jim Yeh[3] Liang Cheng Chang[4]

[1] Assistant Professor, Department of Earth Science, National Cheng Kung University, No.1, University Road, Tainan City 701, Taiwan (R.O.C)
[2] Associate Professor, Department of Earth Science, National Central University, No.300, Jhongda Rd., Taoyuan County 32001, Taiwan (R.O.C.). E-mail: pingyuc@ncu.edu.tw
[3] Professor, Department of Hydrology and Water Resources, University of Arizona, 1133 E. James E. Rogers Way, 214 Harshbarger Bldg 11, Tucson, Arizona, USA
[4] Professor, Department of the Civil Eng., National Chiao-Tung University, No. 1001, University Road, Hsinchu 30010, Taiwan (R.O.C.)

Abstract

In this study we constructed an apparent geological model with resistivity data from surface resistivity surveys. We developed a data fusion approach by integrating dense electrical resistivity measurements collected with the Schlumberger arrays and wellbore logs. The approach includes an optimization algorithm and a geostatistic interpolation method. We first generated an apparent formation factor model from the surface resistivity measurements and groundwater resistivity records with an inverse distance method. And then convert the model into the geology model with the optimized judgment criteria from the algorithms relating the apparent formation factors to the borehole geology. We also employed a non-parametric bootstrap method to analyze the uncertainty of the predicted sediment types. The results show that the predictions of clay, gravel, and sand are accurate. Overall, the model is capable of capturing the spatial features of the sediment types. More importantly, the approach can be arranged in a self-updated sequence, allowing adjustments to the model to accommodate newly collected core records or geophysical data. Therefore, we conclude that the approach is able to provide a more detailed apparent geological model for use in future groundwater simulation and can benefit multi-discipline

studies.