Resistivity monitoring for dam safety inspection in Korea

In-ky Cho[1], Ki-Seog Kim[2], Hwan-Ho Yong[3], Myeong-Jong Yi[4]

(1) Division of Geology and Geophysics,Kangwon National Univ.,Chuncheon, Korea
(2) Heesong Geotek Co., Ltd., Sungnam, Korea
(3) Korea Rural Community Corporation, Naju, Korea
(4) Korea Institute of Geoscience and Mineral Resources, Daejeon, Korea

keywords: Resistivity monitoring, embankment dam, leakage detection, inversion

Resistivity monitoring has been applied to wide range of engineering and environmental problems with the help of automatic/rapid data acquisition, data communication and effective interpretation software. Especially, the resistivity monitoring at embankment dams can provide helpful information about leakage zones. However, significant challenges still remain in data acquisition system, noise suppression and time-lapse inversion for more detailed and quantitative interpretation.

There are 18,000 reservoir dams in Korea. More than 16 % of them are reported to undergo leakage problems and need to be repaired. For the leakage detection, we devised a resistivity monitoring system and installed the system at 9 test dam sites as shown in Figure 1. The resistivity data set automatically collected every 6 hours is stored to the data base via internet. Because the system is linked to the earthquake observation system, it automatically measures a resistivity data set after a significant shock and the influence of earthquake can be evaluated immediately.

The interpretation of collected resistivity monitoring data is divided into two steps. First, time series of resistivity data is filtered to suppress a spike type noise and then median filtering is applied to remove the high frequency noise caused by diurnal variation, assuming that resistivity value does not change abruptly with time. Next, the filtered time series are resampled at equally spaced but sparse time step. Then time-lapse inversion is performed for the resampled data sets. In the inversion process, the standard deviation of each time-series is used for data weighting. Furthermore, the regularization parameters between data misfits and model constraints are adjusted automatically by comparing their norms at a current iteration.

A:Goseong
B:Yongin
C:Jincheon
D:Boryeong
E:Sangju
F:Geumsan
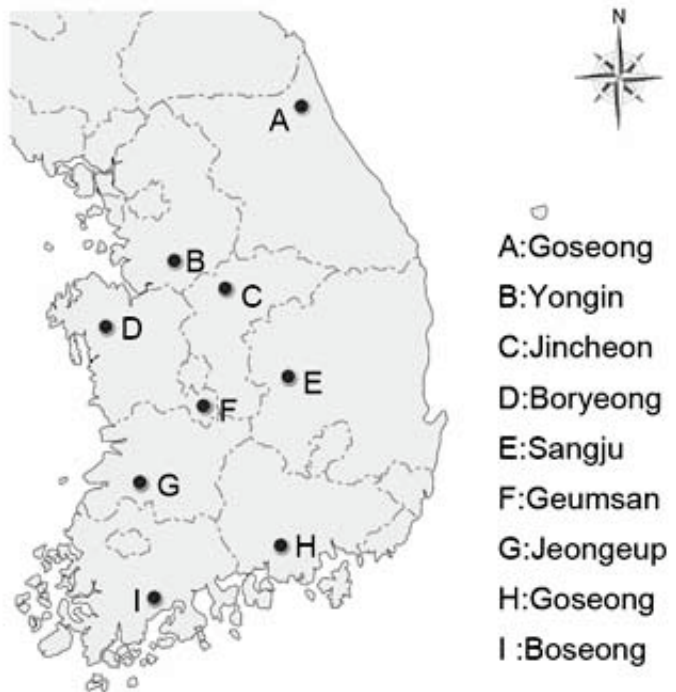G:Jeongeup
H:Goseong
I :Boseong

Figure: Location map of reservoir dams installed with automatic resistivity monitoring system in Korea.