Proceedings World Geothermal Congress 2010
Bali, Indonesia, 25-29 April 2010

Geothermal potential mapping in Korea using GIS data integration

Seung-Gyun Baek, Hyoung-Chan Kim and Jeongmin Park

KIGAM, 92, Gwahang-no, Yuseong, Daejeon, 305-350, Korea

sgbaek@pknu.ac.kr, khc@kigam.re.kr, min2000u@naver.com

Keywords: geothermal potential mapping, GIS data integration, frequency ratio model, heat flow, Korea

ABSTRACT

GIS data integration is applied for geothermal potential mapping in Korea. Several data sets, such as geological map, drainage map, lineament map, DEM, were collected as thematic maps for the integration. Frequency ratio model was applied to analyze the spatial relationship between the occurrences of high heat flow (> 70 ㎽/㎡) and the related-factors on thematic maps. The geothermal potential index was calculated by overlay of each factor's ratings on thematic maps, the indexes were mapped to represent geothermal potential. The success rate was calculated by test of geothermal potential map using the occurrences of high heat flow and high geothermal gradient.

1. INTRODUCTION

A geothermal exploration program is usually carried out on integrating and interpreting the results of geological, geochemical, geophysical and other surveys to identifying prospect areas (Noorollahi *et al*, 2007). Geographic Information System (GIS) can help to identify the prospect areas through a integrating the results and the thematic maps of different surveys (Bonham-Carter, 1994). Kim (2002, 2004a, b) studied the characteristics of geothermal resources of Korea by correlation analysis between geological structure and heat flow. These studies have tended to focus on the relationship between average of heat flow and geological time or lithology. Frequency ratio model, one of the probability models, was used to represent quantitatively the spatial relationship between the occurrence of higher heat flow or geothermal gradient and the related factors on thematic maps. The geothermal potential index was calculated by overlay of each factor's ratings on thematic maps, the indexes were mapped to represent geothermal potential.

2. DATA

Several data sets such as geological map, faults and lineament map, lineament density map, depth map of Mohorovicic discontinuity, drainage map, DEM, were used as the thematic maps in GIS integration. The measurement locations of heat flow (higher than 70 ㎽/㎡) were used as training sites in the analysis (figure 1). Geological thematic map was merged with 10 sheets of adjacent geological map scaled at 1:250,000 in ArcView shape format produced by KIGAM (figure 2). Faults and lineament map was made by extraction of linear features from geological map and satellite image. Lineament density map was generated by geostatistical interpolation with faults and lineament map (figure 3). The drainage map was made by extraction of the layers related river from the digital map scaled at 1:250,000. Digital Elevation Model (DEM) data in resolution of 50 meters was generated with the contour layers from many of digital map scaled at 1:25,000 (figure 5).

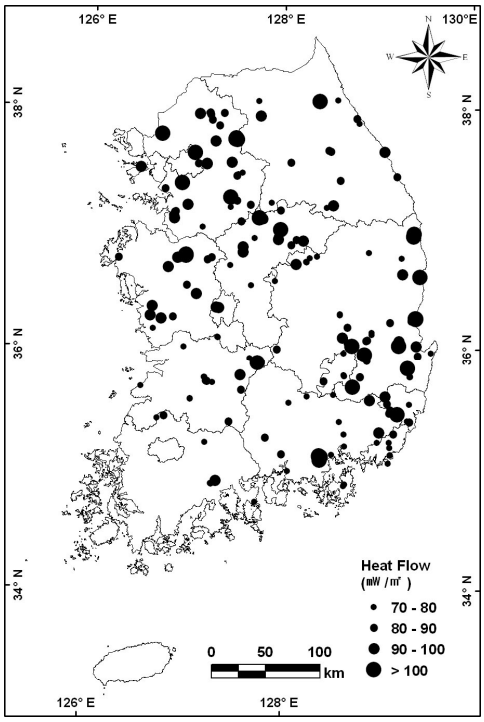

Figure 1: The location map of heat flow (higher than 70 ㎽/㎡).

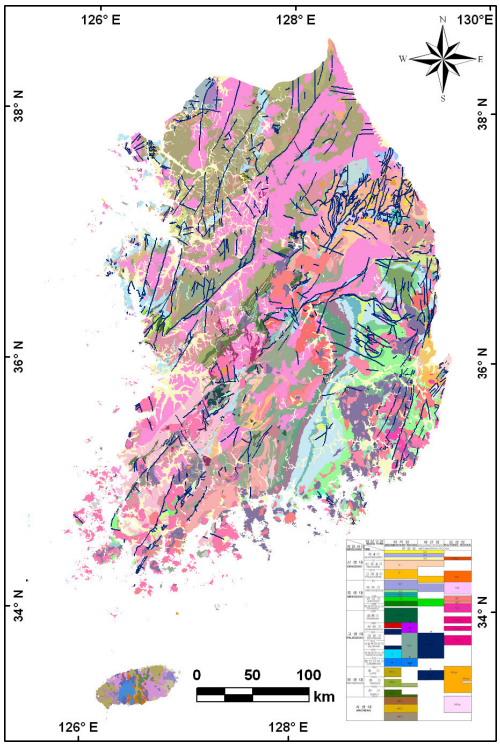

Figure 2: The geological map of Korea scaled at 1:250,000 by KIGAM.

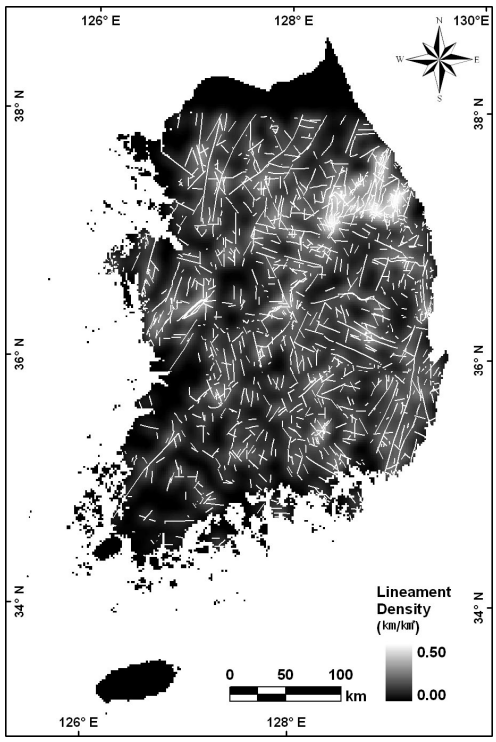

Figure 3: The map of distribution and density on faults and lineaments.

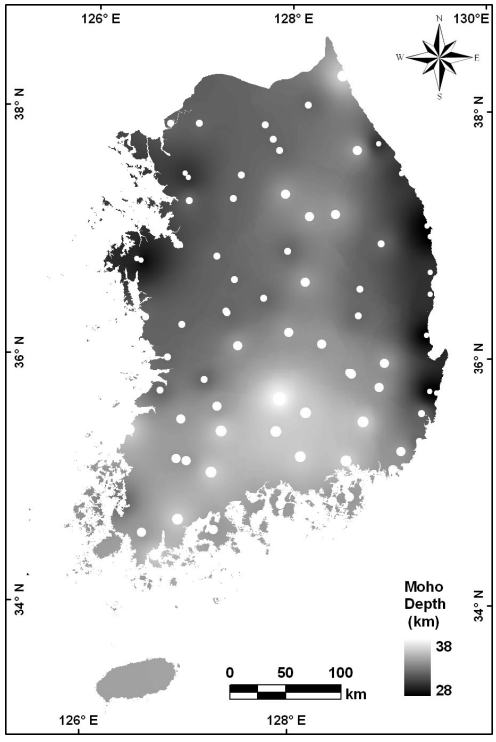

Figure 4: The depth map of Mohorovicic Discontinuity.

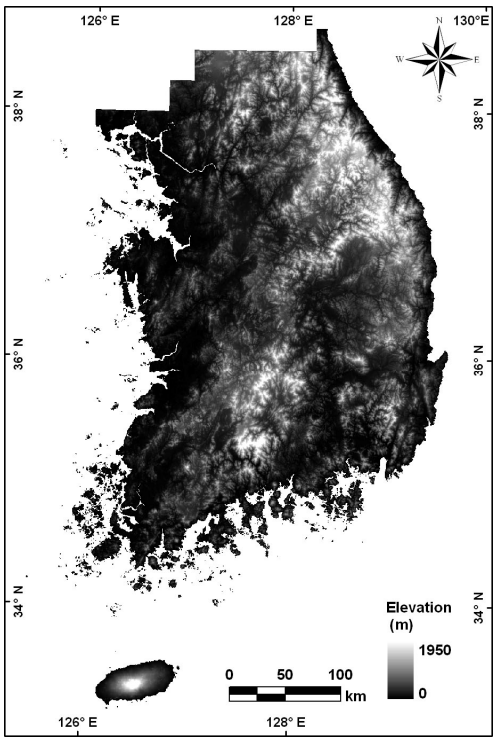

Figure 5: DEM of Korea in resolution of 100m.

3. METHODS

The spatial relationship between the locations of high heat flow (> 70 ㎽/㎡) and each related factors on thematic maps were analyzed using a frequency ratio model. The relationship was used as each factor's rating. The geothermal potential index was calculated by overlay of each factor's ratings on thematic maps, the indexes were mapped to represent geothermal potential. The geothermal potential map was tested using the occurrences of high heat flow or high geothermal gradient, and success rate was calculated.

ACKNOWLEGEMENT

This work is supported by KEMCO (Korea Energy Management Corporation) funding to KIGAM.

REFERENCES

Bonham-Carter, G.F.: Geographical Information systems for Geoscientists: Modeling with GIS, *Computer Methods in the Geosciences*, **13**, Pergamon, New York, USA, (1994), 398p.

Kim, H.C., Lee, S. and Song, M.Y.: Relationship analysis between lithology, geological time and geothermal gradient of South Korea, *Econ. Environ. Geol*., **35**, (2002), 163-170.

Kim, H.C., Lee, S. and Song, M.Y.: Geological characteristics and heat flow relationship in South Korea, *Econ. Environ. Geol*., **37**, (2004), 391-400.

Kim, H.C.: Interpretation of geothermal anomaly using heat flow and geological data in South Korea, *Ph.D. thesis*, Chungnam National University, KOREA (2004).

Noorollahi, Y., Itoi, R., Fujii, H. and Tanaka, T.: GIS integration model for geothermal exploration and well siting, *Geothermics*, **37**, (2008), 107-131.