Geophysical Research Abstracts
Vol. 14, EGU2012-9678-1, 2012
EGU General Assembly 2012

A parametric model for geothermal potential assessment on a regional scale

D. E. Bruno (1), S. D'Arpa (1), N. Lopez (1), A. Galgaro (2), E. Destro (2), S. Chiesa (3), and V. F. Uricchio (1)

(1) CNR-Water Research Institute, V.le De Blasio 5, 70123 Bari, Italy (delia.bruno@ba.irsa.cnr.it), (2) Padova University-Geosciences Department, Via G. Gradenigo 6, 35131 Padova, Italy, (3) CNR-Dynamic of Environmental Processes Institute, Via Pasubio 5, 24044 Dalmine (BG), Italy

A geothermal potential assessment requires a contextual analysis of spatial and environmental features geographically represented through thematic maps. These informations, when implemented as part of a parametric model, can provide an useful framework for sustainable exploitation of geothermal resources. So, is necessary to consider hydrological, geological, geothermal and climate features, even integrating the existing territorial constraints. A methodology based on the use of indicators and indexes to value some parameters is proposed for Apulia, a region of southern Italy. The methodology allows to identify areas with different geothermal vocation according to two scenarios with different depths, providing two geothermal potential assessment charts: (1) map of shallow geothermal exchange (G) and (2) map of geothermal potential assessment (PG).

A set of four indicators is proposed: W (= groundWater), R (= Rock), F (=geothermal Flux) and C (= environmental Constraints). They summarize the trends of main parameters that characterize the exploitation of geothermal resource. The methodology is structured into 4 steps: (1) for each parameter, indexes are assigned through a standardization that processes all variables in a dimensionless numbers. The assigned indexes to each value are inversely proportional to the "goodness" (quantity, quality and status) of the parameter that contributes to the exploitation of geothermal resources and, consequently, to the weight attached to it; (2) the index values are classified into 4 weighed classes. The assigned weights describe the role of a class in the parameter definition; (3) the same procedure is performed on all parameters to obtain the indexes of the classes; (4) once the indicators W, R, F, C are defined and represented on thematic maps using unique indexes, apply the following algorithms:

Eq.1 Wg = [S (groundwater Speed) x C (hydraulic Conductivity) x D (Depth to water table) x I (Isophreatic) x Tw (Temperature in the well)]1/5

Eq.2 Rg = [L (Lithology) x P (Permeability) x Ct (thermal Conductivity) x So (Soil) x Tg (Temperature at ground level)]1/5

Eq.3 Fg = [DEM x Gt (temperature Gradient)]1/2

Eq.4 Cg = [Cl (landscape Constraint) x Pr (Planning requirements) x Ch (hydrogeological Constraint)]1/3

A final algorithm will be defined by the following expression:

Eq.5 G = (Rg x Wg x Fg x Cs)1/4

The values obtained are presented as specific indexes with an associated class of the area of region in which is possible build systems that exchange heat with the ground. Consistently with the approach undertaken to define the above steps, even in this last step, the larger index classes correspond with more critical areas, due to the absence or inability of the resource exploitation.

To define the geothermal potential, procedure is the same but the processing is slightly modified by:

Eq.6 Wp = [S (groundwater speed) x C (hydraulic Conductivity) x Iz (Isopiezics) x Tw (Temperature in the well)]1/4

Eq.7 Rp = [L (Lithology) x St (Structures) x P (Permeability) x Ct (thermal Conductivity) x (Ap) palaeo-geomorphology Aspects] 1/5

Then, the final algorithm is:

Eq.8 $PG = (Wp \times Rp \times Fp \times Cp)1/4$