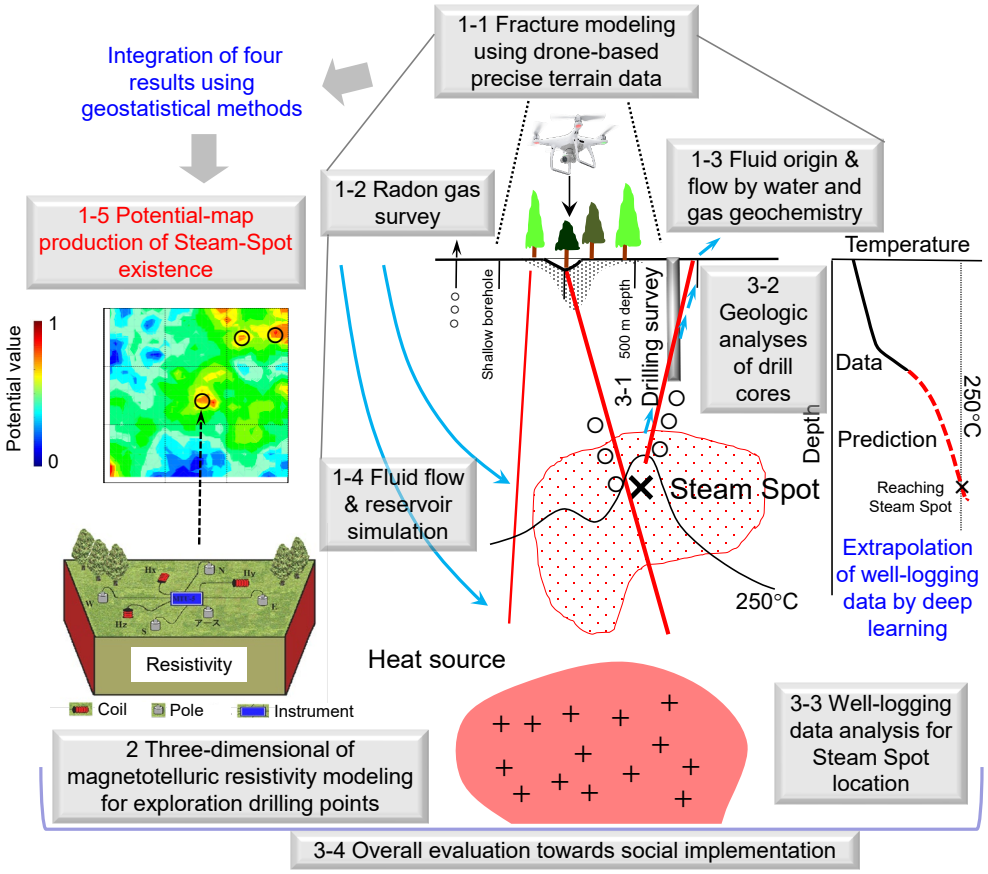
aXis BAGUS Project

Accuracy Improvement and Demonstration by Boring Survey of Steam-Spot Detection Technology for Locating Drilling Sites of Geothermal Production Wells



The SATREPS BAGUS project (JPMJSA1401) has been developed to the JST aXis project and with a new name, aXis BAGUS project. One of the most blessed point of the new project is that we can confirm effectiveness and accuracy of the methods for Steam-Spot detection developed by the SATREPS project through an actual drilling survey. For large decrease of carbon dioxide emission, utilization promotion of geothermal power is needed. The new project aims to develop technologies for locating accurately suitable portion, Steam Spot, to drilling of production well for geothermal power generation from the ground surface by a combination of remote sensing, geochemistry, mineralogy, and numerical simulation. The Patuha geothermal field, West Java, Indonesia is selected as a study area, and the research is advanced by collaboration with the ITB team including ITB, PT Geo Dipa Energi (GDE), CMCGR and other collaborators. Research contents include 3D fracture modeling using high-precision topographic data, radon concentration measurement at many shallow drilling points, estimations of reservoir temperature and fluid origin by water and gas geochemistry, simulation for fluid flow and specification of liquid or vapor rich zones, and potential-map production of Steam-Spot existence by integrating these results using geostatistical methods. Exploration drilling sites are narrowed at two based on subsurface resistivity distribution by electromagnetic survey at high potential zones. The existence potential of Steam Spot is verified through temperature, pressure, and mineralogical data obtained by the drillings down to about 500 m depth. Social implementation of the research result will contribute to large increase of geothermal power generation by reducing resource-exploration cost.

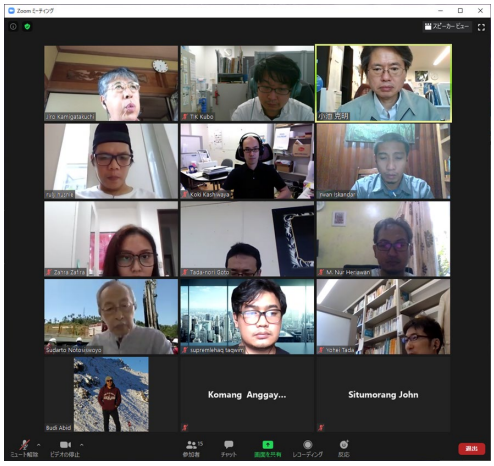
Because the inflection spread of covid-19 has continued from the official start of the aXis BAGUS project, the Kyoto Univ. (KU) team has still been unable to visit ITB and the Patuha. Even though this situation, owing to the great effort and sincere collaboration of the ITB team, this project has been advanced as outlined below. Online meetings using Zoom have been hold in almost every month to conform the research progress; present the research results from both teams; discuss the results, research plans and schedules; find solutions to solve problems; exchange information about the effects of covid-19, etc.

Outline of Research Progress

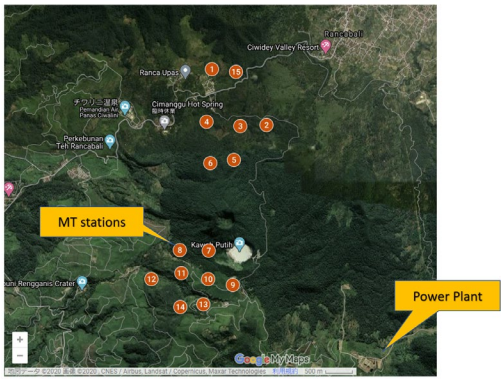
ITB team has been continuously carrying out the research despite some restrictions. ITB has come to an agreement with GDE to allow ITB researchers to enter the Patuha site for field research anytime. On August 6th, 2020, ITB and GDE team had a coordination meeting in the CMCGR office and visited their workshop to check the drilling machine and equipment to be used for the survey at Patuha. On October 28th-29th, 2020, ITB team conducted a TEM (Transient Electromagnetic) survey at the candidate sites of temperature core hole (TCH) drilling. The target of this survey is to obtain the images of subsurface structures which may contribute to a permeability zone of hot fluids flow. In order to facilitate ITB team in the field research, KU team provided a drone and another RAD7 machine and the two instruments arrived at ITB in the last November.

ITB team have implemented the radon survey from July 2020 using 18 monitoring wells. The new RAD7 was in January 2021. Relatively high radon concentration was observed in the northern part of Patuha with the hot/warm springs where high fracture density zones are estimated from a digital elevation model. These results suggest the presence of permeable fractures that connect the geothermal reservoir and near surface. We can regard the northern part of Patuha as one of the highest potential areas for TCH drilling.

ITB team had collected 11 hot water samples and one meteoric water sample in Patuha. They completed successfully all of the geochemical measurements by themselves using by the installed equipment during JPMJSA1401. Both KU and ITB teams discussed and estimated temperatures of the hot waters in their aquifers in Patuha. KU team also continued to examine the geochemical data measured by JPMJSA1401 and estimated fluid flow regime in this area considering time scale of fluid circulation. In addition, the clarification of 3D resistivity structure in Patuha has been tried by the magnetotelluric (MT) sounding and transient electromagnetic (TEM) survey and the inversion analysis of these data.



Online meeting in June 2020.



Site distribution of MT survey.

TEM survey in October 2020.

Construction of radon measurement well and radon survey.