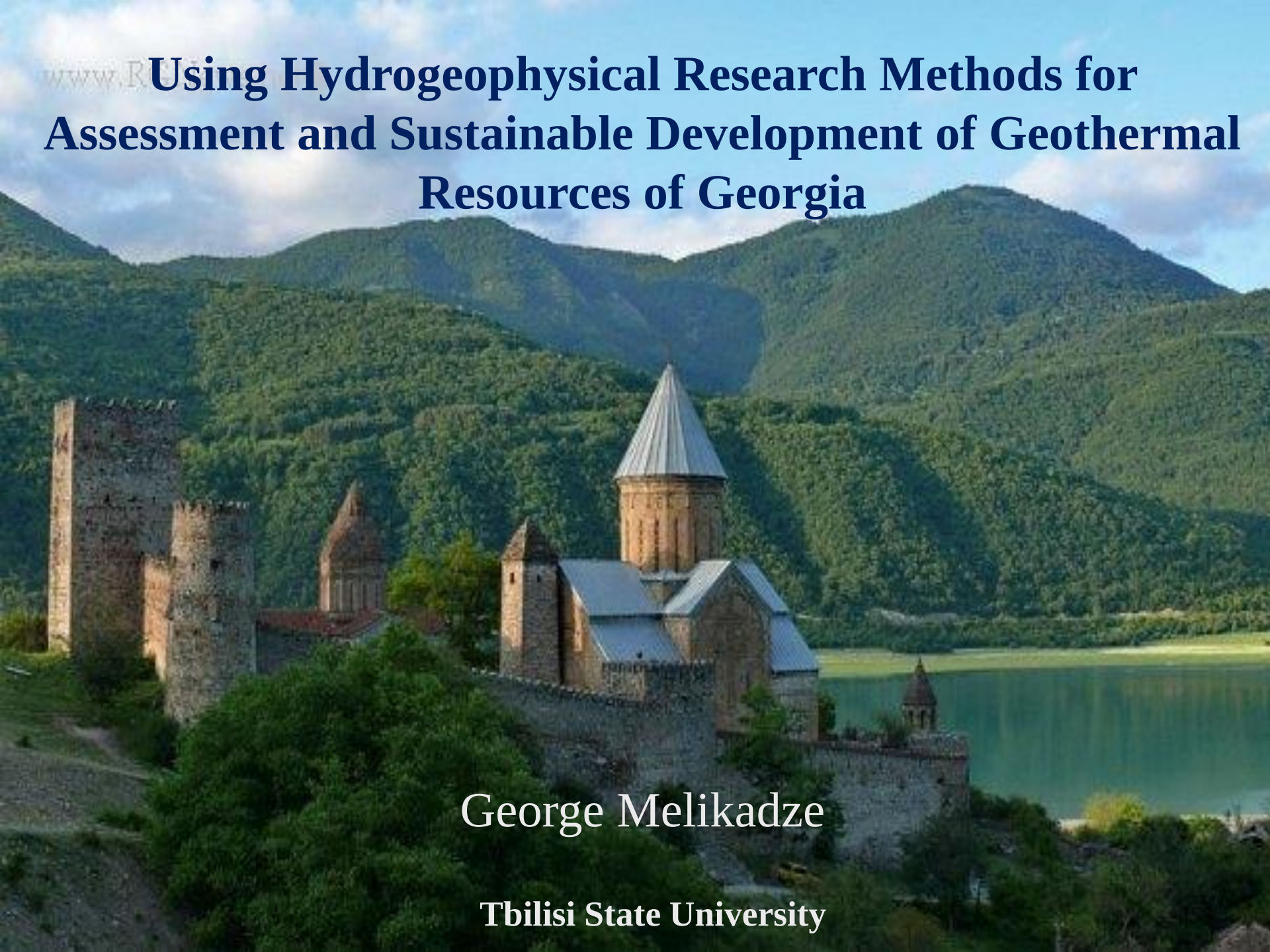




Using Hydrogeophysical Research Methods for Assessment and Sustainable Development of Geothermal Resources of Georgia

George Melikadze

Tbilisi State University

1998

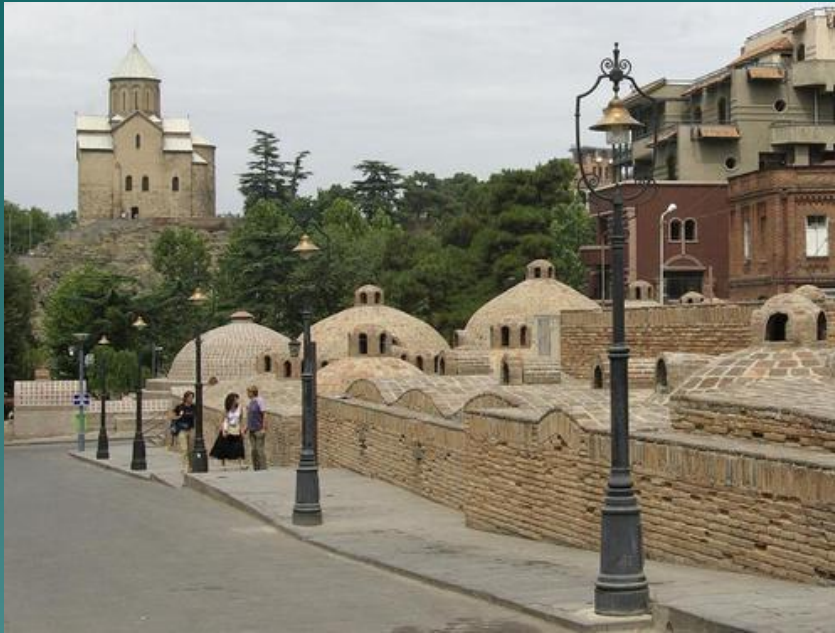


Most of the 50 geothermal wells in Georgia are of medium (500-1000 m) to moderate (2000-3000 m) depth and supply water at temperatures ranging from 40-60°C and 80-100°C.

Use	Installed Capacity ¹⁾ (MWt)	Annual Energy Use ²⁾ (TJ/yr = 10 ¹² J/yr)	Capacity Factor ³⁾
Individual Space Heating ⁴⁾	13.57	130	0.30
District Heating ⁴⁾	8.74	83	0.3
Air Conditioning (Cooling)			
Greenhouse Heating	20.27	192	0.3
Fish Farming			
Animal Farming			
Agricultural Drying ⁵⁾			
Industrial Process Heat ⁶⁾			
Snow Melting			
Bathing and Swimming ⁷⁾	30.81	290	0.3
Other Users (specify)			
Subtotal	73.39	695	0.3
Geothermal Heat Pumps	0.03	0.16	0.17
TOTAL	73.42	695.16	0.30

Georgia abounds in geothermal resources, concentrated in 44 deposits. According to preliminary estimations, their heat power is 420 megawatts, and elaboration of thermal energy is maximum 2.7 million megawatt/hour/year.

Thermal boreholes



Tbilisi

Kvaloni



Georgia has a high potential of geothermal resources, some have been in use since ancient times. The major areas of utilization are balneology resorts, local heating systems and greenhouses.

Nokalakevi



Sakarbedio

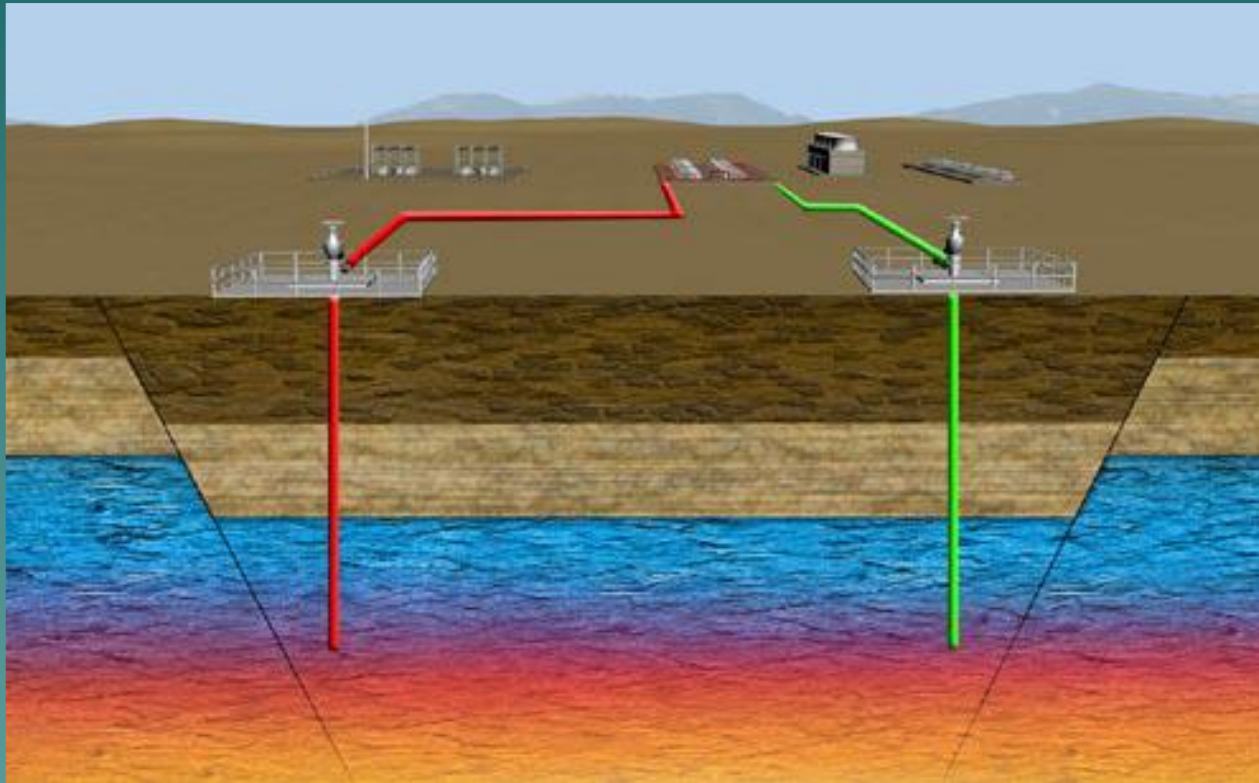


Zugdidi 2

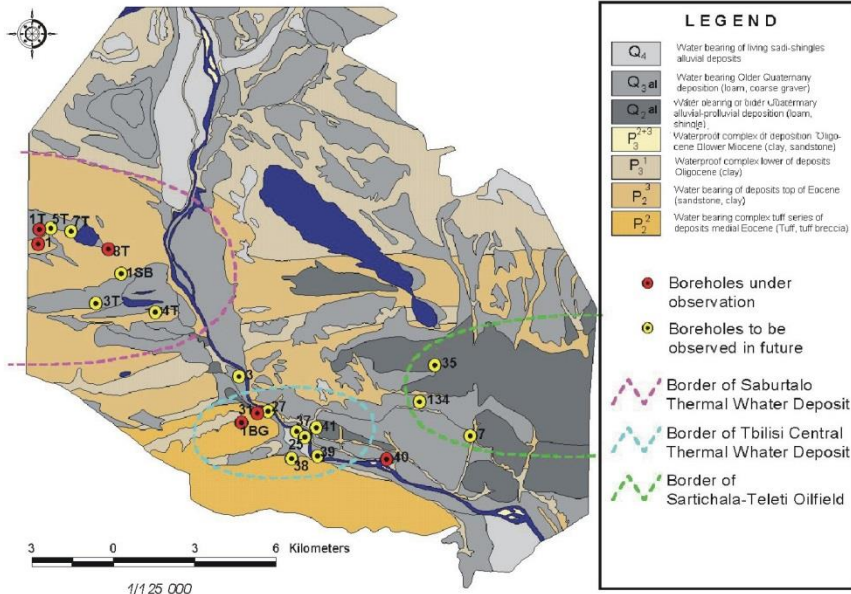


It also should be noted that part of these wells are non-operational. Today the amount of confirmed reserves does not correspond to reality for, under the current conditions of exploitation, well pressure and discharge rates are dropping. Therefore, a reassessment of the geothermal potential of Georgia is of major importance from the standpoint of economic development of the country based upon renewable, ecological cleaner energy source

Geothermal Circulation System



UNDP/GEF project “Georgia – Promoting the Use of Renewable Energy Resources for Local Energy Supply” (ID# 00034741)

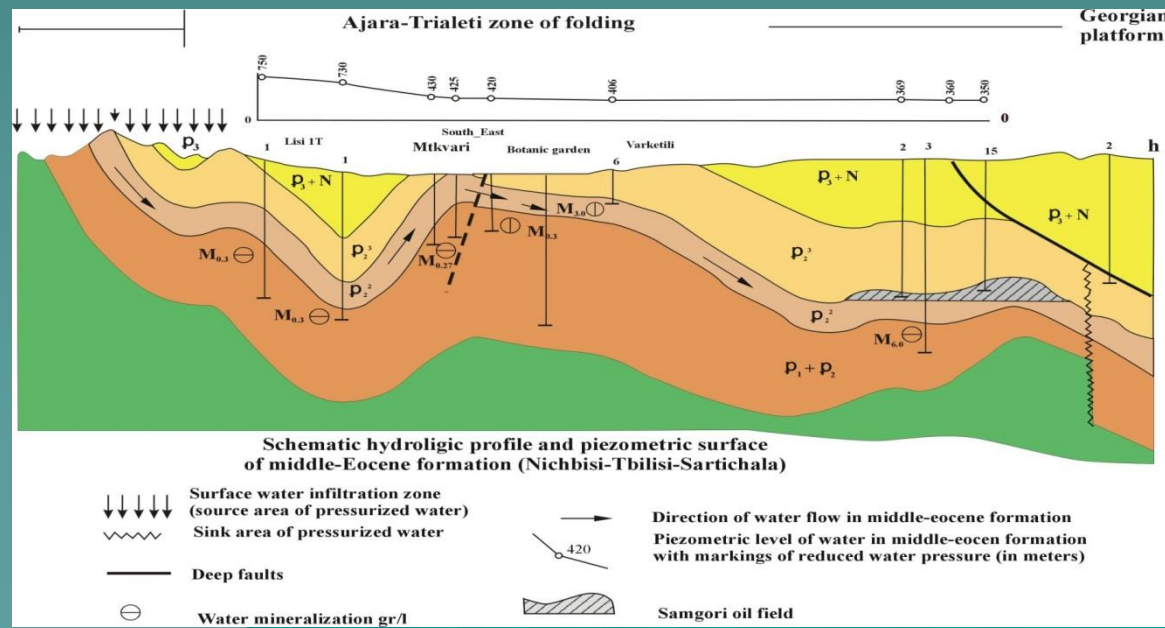


Tbilisi geothermal deposit

The thermal waters or “sulphur bathes” - therapeutic and spa
Lisi district- house heating
“Varketili” - Oil field

Geological cross-section of Tbilisi thermal deposits

Hydrodynamic relations between three sections



Repair of borehole head constructions and organization of monitoring



Borehole #4T



Borehole #5T



Monitoring equipments

Hydrodynamical and microtemperature monitoring



Determination of hydrodynamic parameters (hydraulic conductivity, transmissivity and storativity etc.)

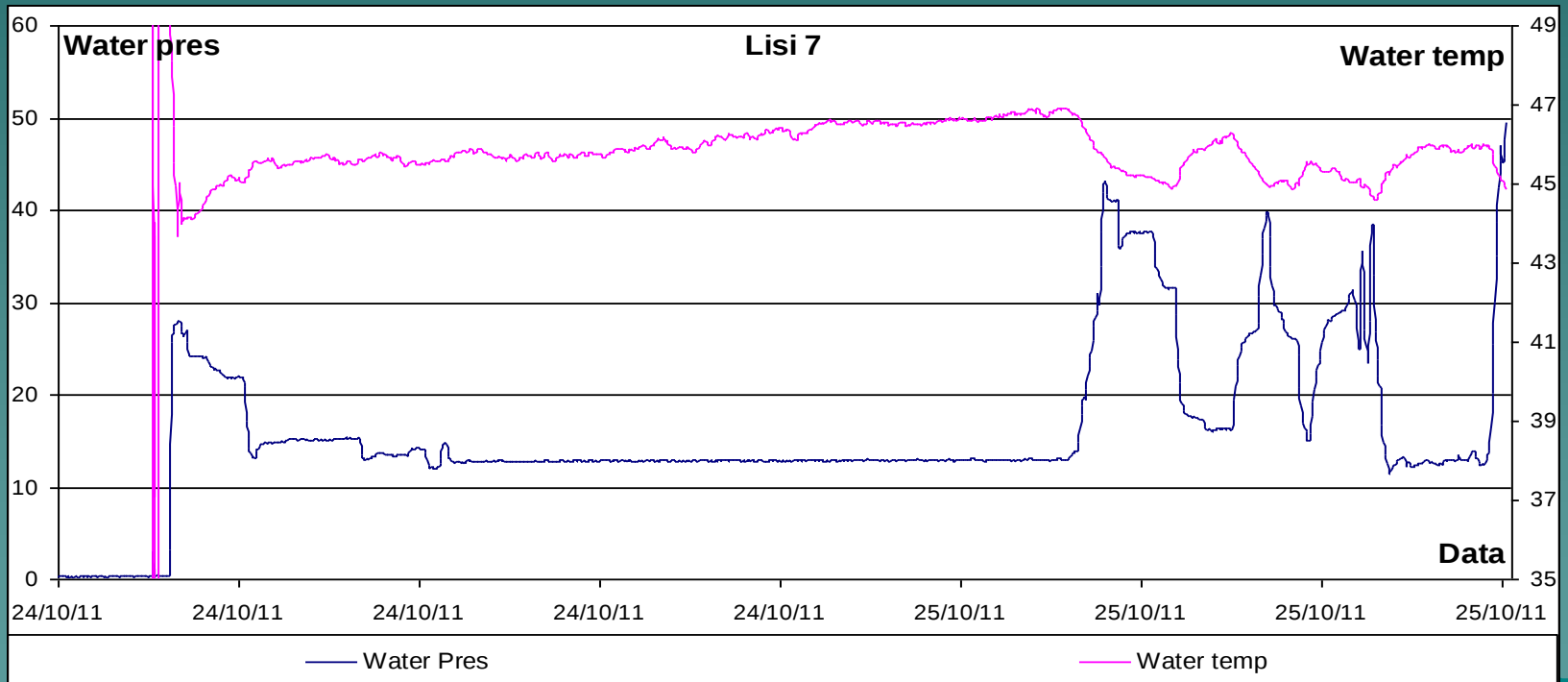


Slag-testing process on the boreholes #5
“Lisi” and #46 “Varketili”

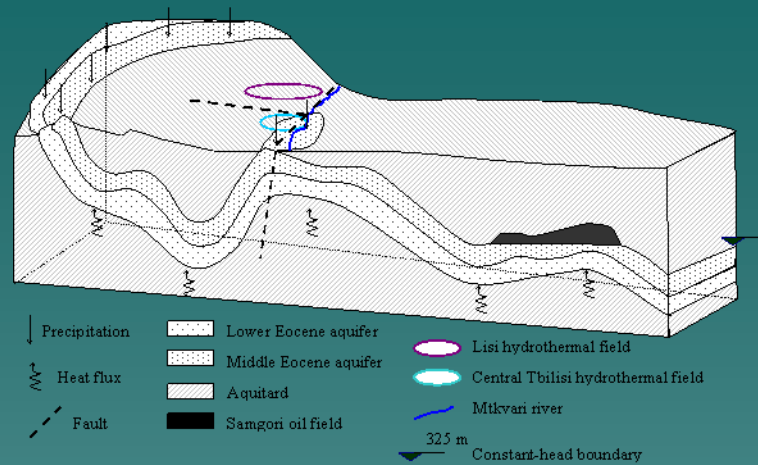
Reinjection process on the borehole #7 “Lisi”



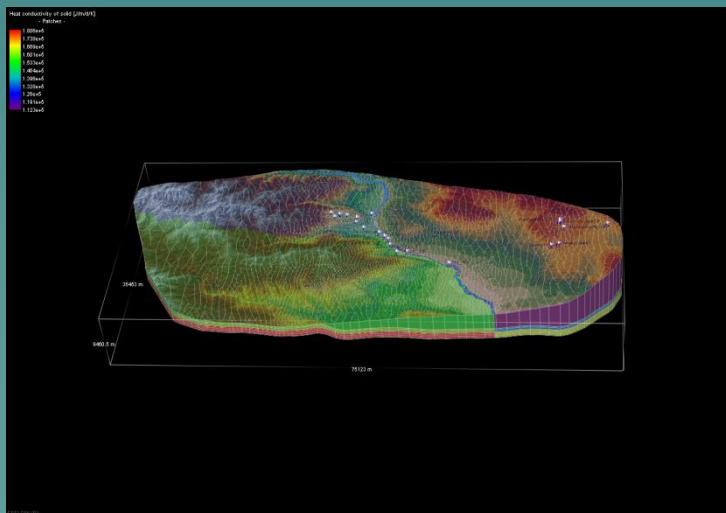
Variation of hydrodynamic parameters during reinjection on the borehole #7



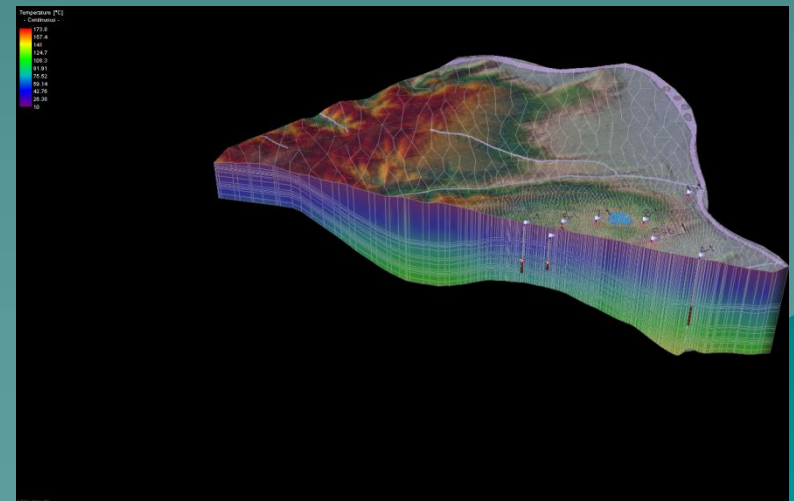
Conceptual model



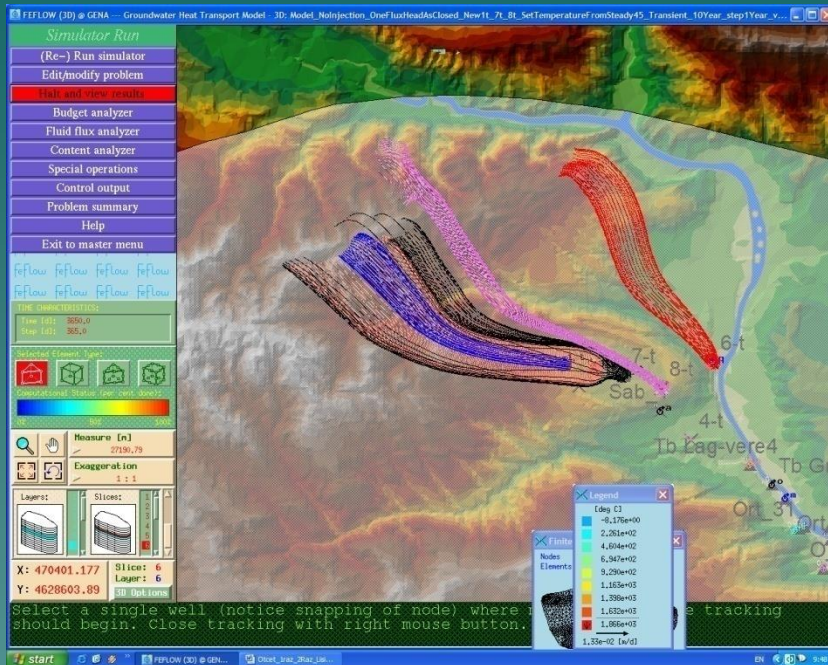
Hydraulic head



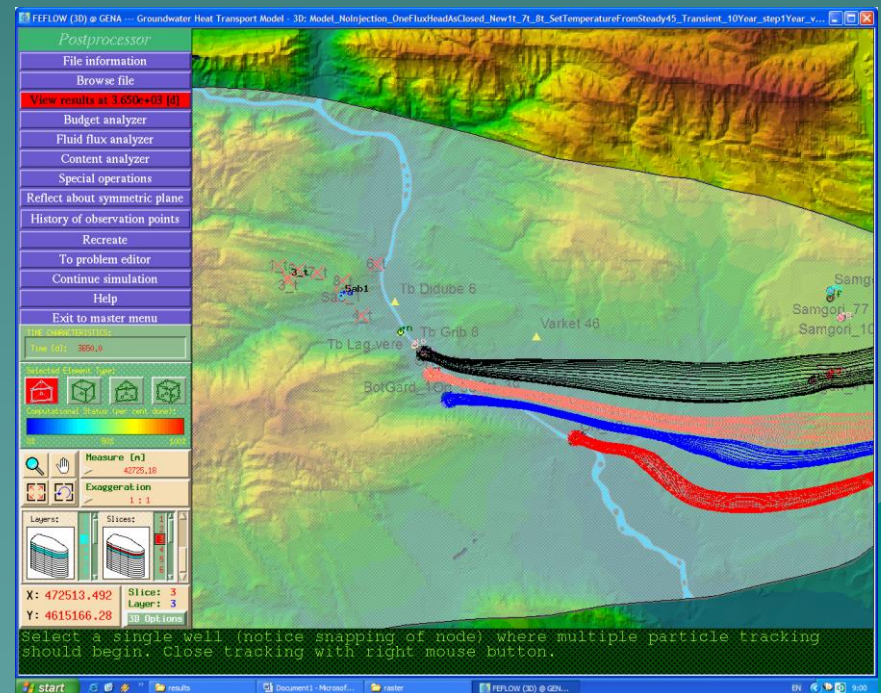
Heat flow



Numerical modeling

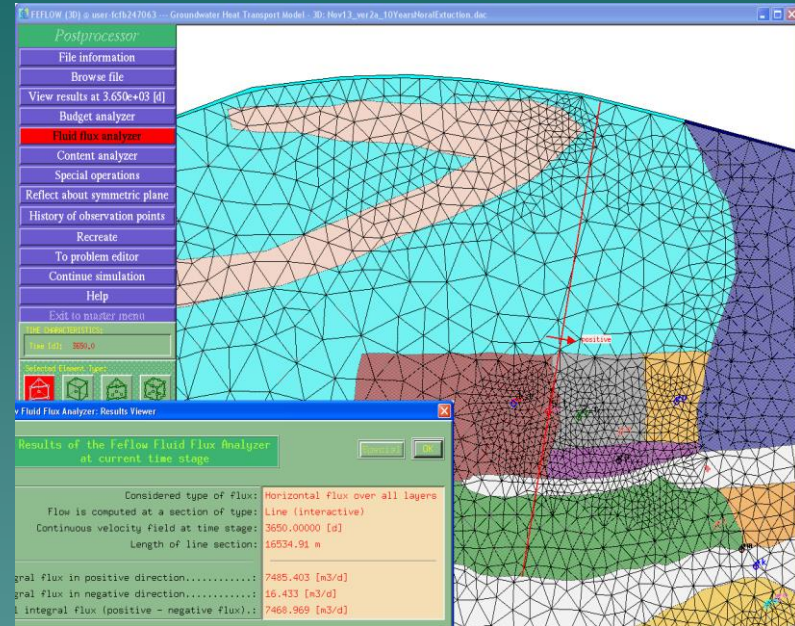
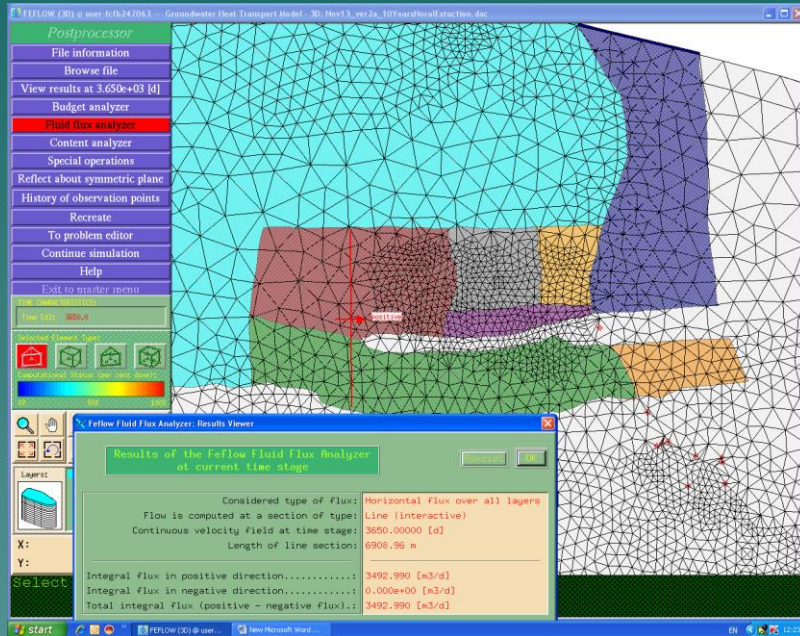


Water flow from recharge area



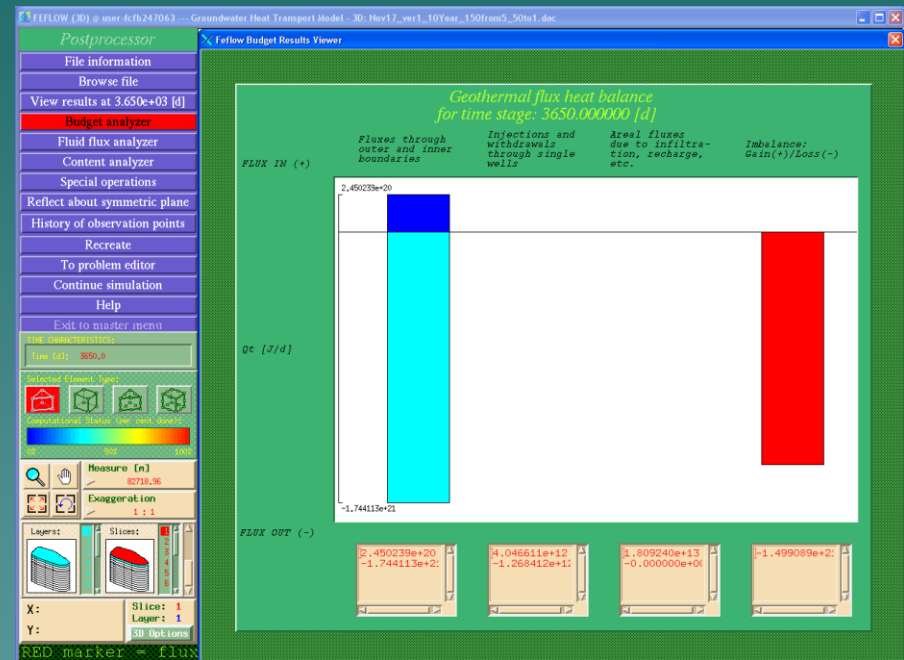
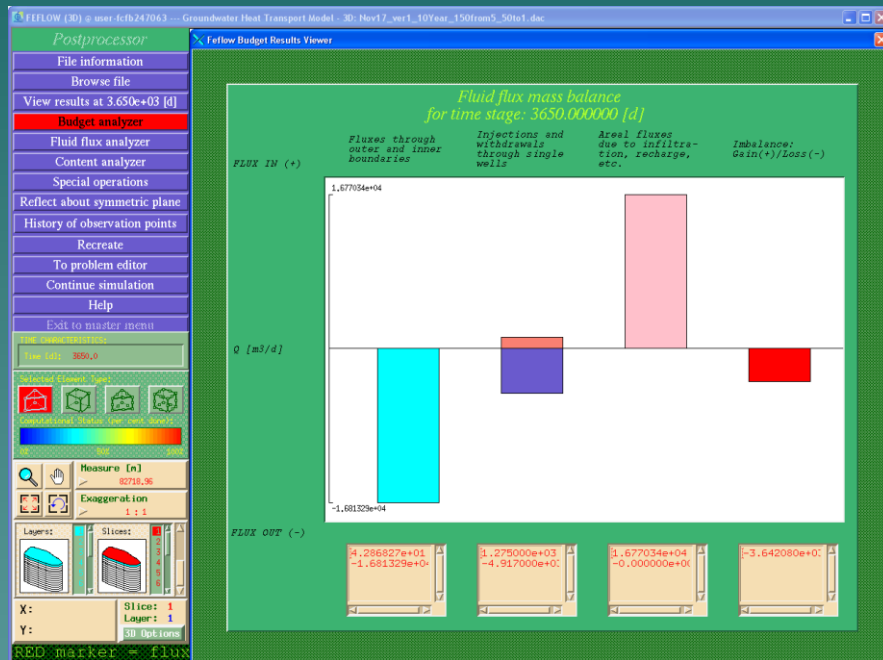
Water flow to discharge area

Model simulation calculation of discharge



Transmissivity of “Lisi” area (left- 3600 m³/day) and totally for North part ((right-7485 m³/day)

Water discharge (left) and energy (right) balance after 10 years

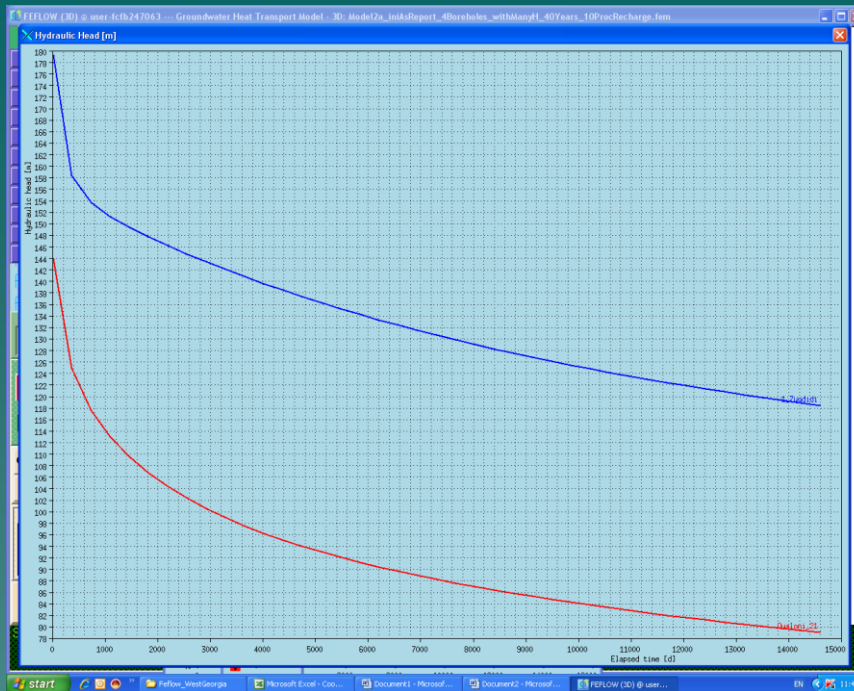


Reinjected water mass already totalled to 1275 m³/day in the water balance, while the energy disbalance was reduced to $-1.49 \cdot 10^{21}$ J/day

The numerical modeling of the thermal water flow showed that using GCS prolongs the exploitation period of the aquifer and Increase the number of users to 100 000

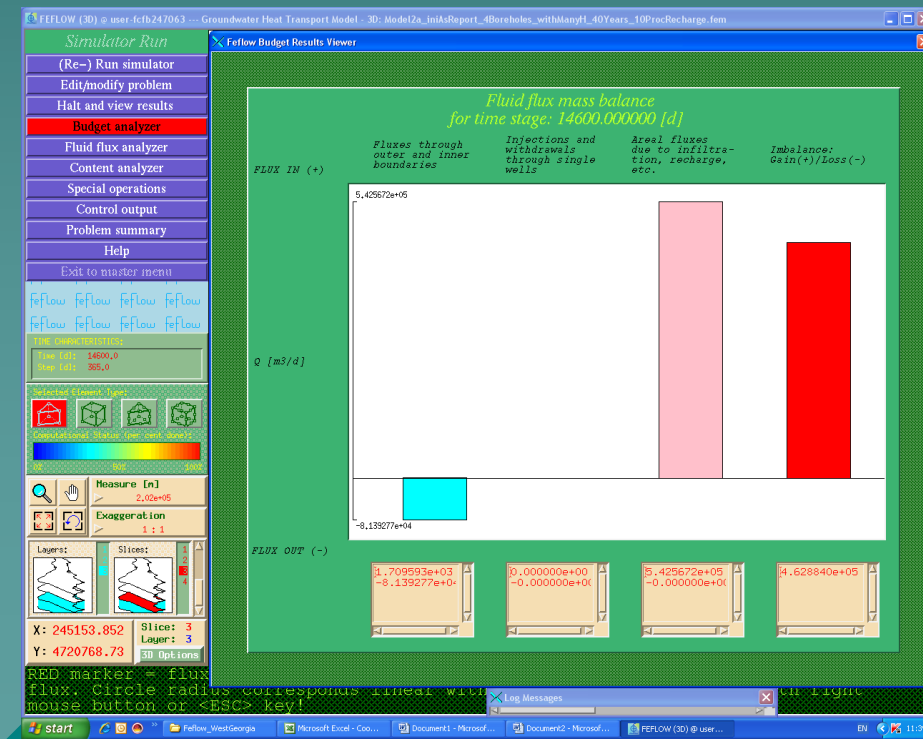
USAID project “Re-Assessment of Existing
Condition of the Geothermal Resources (West
Georgia) Establishment of the Rational
Exploitation Regime of Thermal Water Deposits
Rehabilitation of Tsaishi School Heat Supply
System Using Geothermal Energy”





Thermal water pressure drop in the Zugdidi and Kvaloni well during 35 years

Balance for today (after 35 exploitation)



Boreholes testing process

Borehole Menji #31



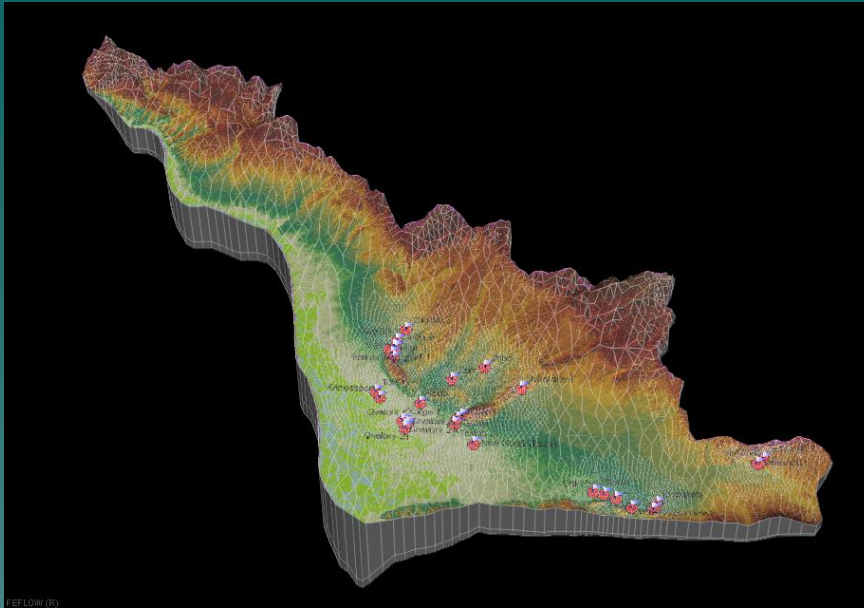
Zugdidi #1



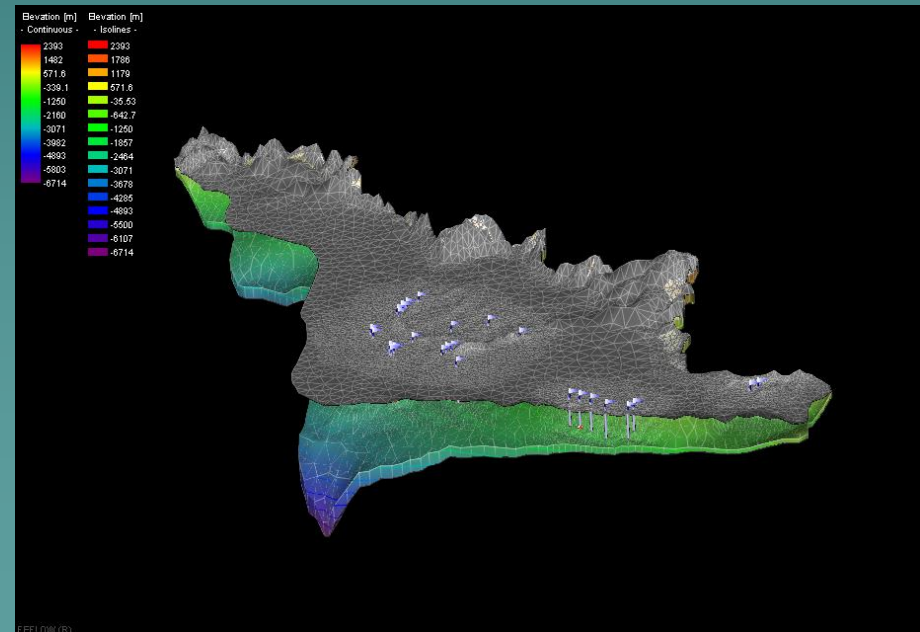
Tskvishi #1

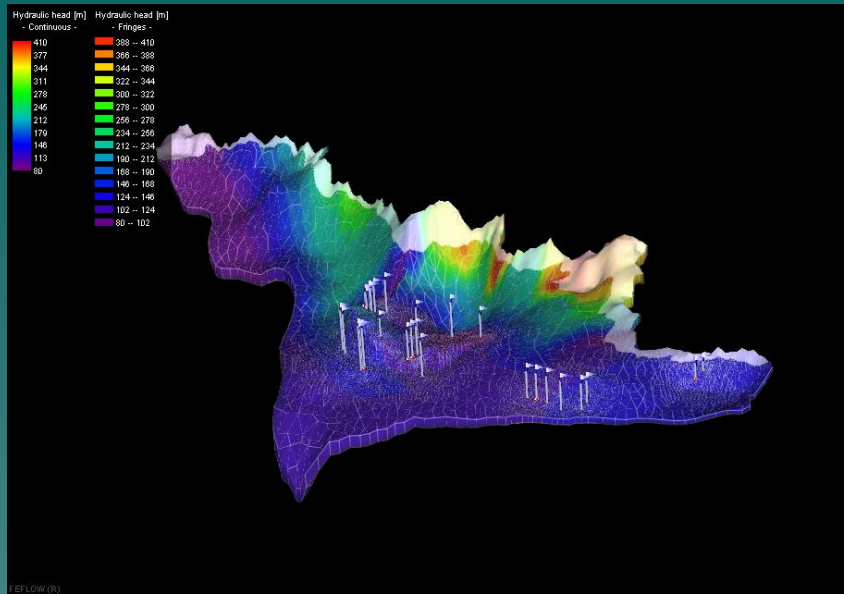


Conceptual model



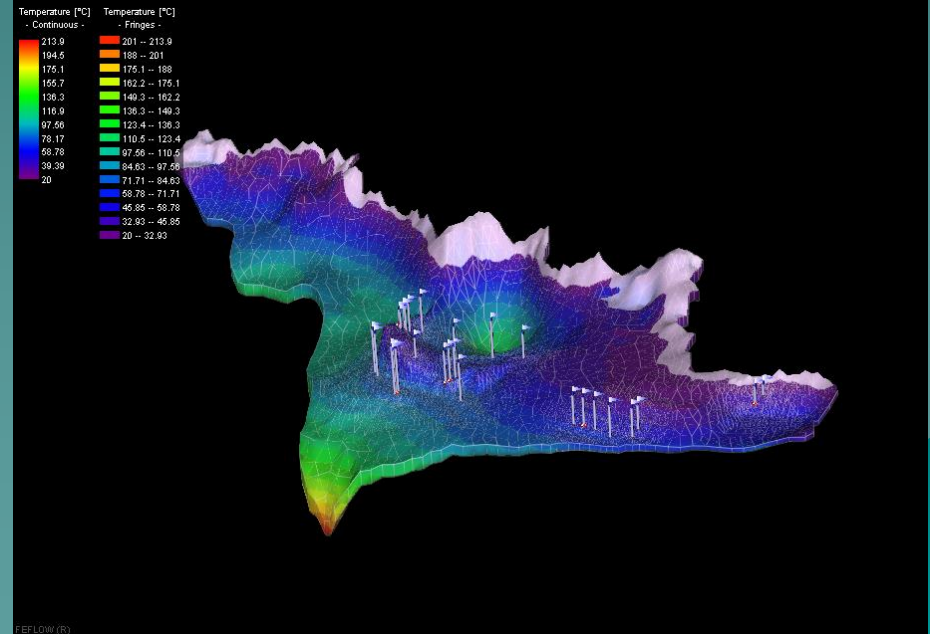
Borders of model





Hydraulic head

Heat flow



GCS testing process in West Georgia

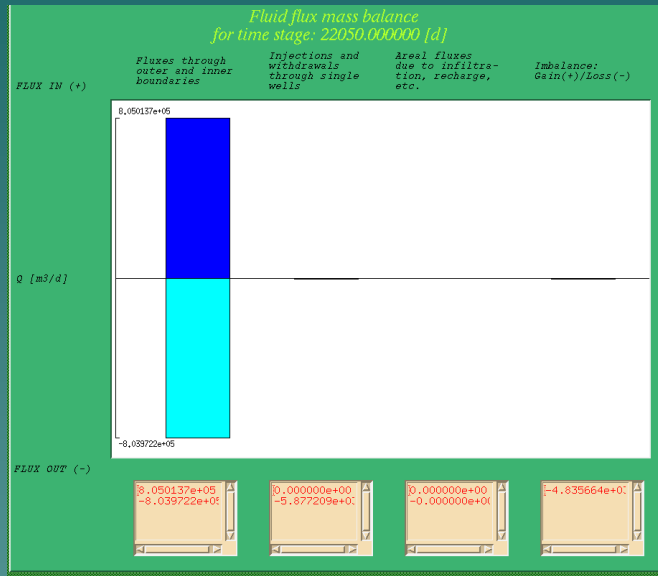


Tsaishi boreholes



Geothermal Circulation System

Balance after installation GCS





Thank your for attention