

Peer Review of Group 13

Comprehension:

Group thirteen's group proposal pertains to the recovery of the Waitike geothermal reservoir near Rotorua, New Zealand. Following recovery of the reservoir due to a moratorium imposed on the borehole in 1986, the Rotorua regional council is currently considering different options brought to them by different stakeholders as to how to handle the reservoir into the future. Group thirteen's model of the situation could result in one of three outcomes in 2050: an unsustainable geothermal recovery rate, a higher than necessary recovery rate or a recovery rate approximately equal to the current rate. In either case predictions of future conditions will be made in order to offer a qualitative recommendation to RRC. They aim to model the situation by interpolating given data on extraction rates, water levels, and temperature and using these to determine the rate of refilling of the reservoir. With the knowledge that the supply of cold water into the reservoir is constant, they will be able to determine the proportion of hot water in, and thus the health of the reservoir.

Group thirteen has been given data on extraction rates and temperature dating back to 1950, and water levels back to 1985. Visualisation of the given data displayed a clear negative relationship between water level and extraction rate. Their model considers mass and temperature flow while assuming no other factor affects the temperature and pressure in the reservoir. Their model will consider two inflows and two outflows, formulated with constant for dynamic viscosity, permeability, and density.

Critical assessment:

Good inference of different stakeholders, especially on the tourism industry which is very prominent in the Rotorua region. Portrays the dynamic nature of the different stakeholders and the relationships between them well. Could be more explicit about the outcome of the resource consent. The insights that the model may give should also be more specifically described.

The main problem stated is that the geyser eruptions are disappearing or becoming less frequent. This is a good analogy for the health of the geothermal reservoir which is being modelled. When describing the model, each of the separate variables were mentioned. The variables that were mentioned are the total extraction rate, water level data/rate of refilling, and temperature, but it is not explicitly specified how this data can be used to track geyser eruptions. It can be inferred if you are knowledgeable on the topic, but for a stakeholder it may be difficult to follow and make that connection.

The graphs provide an excellent visualisation of the given data for the project. Legends, labels and axes are clear. There are thorough descriptions of where the graphs spike and why this may be. There is, however, no discussion of which data needs to be gained before our model can be produced.

The diagram constructed is clear and well-defined. However, the diagram is inconsistent with the ODE model of mass conservation as slow drainage is accounted for in the ODE, but it is omitted in the diagram. The ODE models are fundamentally derived from the conservation laws of mass and energy, but these physical processes are not explicitly stated in the assumptions.

Constructive feedback:

It may be helpful to note to be more specific about the outcome of the resource consent, such as who will benefit from this outcome. Also, it is recommended that group thirteen describes what insights they may gain from the model, and how the results of the model relate to the conclusions that can be drawn.

All the technical ideas were well explained, but it may be hard for a stakeholder to follow, because a lot of technical jargon is used. The use of technical jargon may distract the reader from easily comprehending the proposal. For example, in the how section, the purpose of the overall model is hard to decipher if you are not knowledgeable on the topic. This issue may be addressed by making simple changes like using bullet points. Proposals are designed to be understood by anyone, so it is advisable to use less technical jargon and more simple terms.

Information needs to be added about missing data. This includes information on the reservoir water level before the closure program began, which can be found in Scott's articles on the recovery of Rotorua geothermal fields. Re-injection rates (also required to model the mass flow) can be found in these articles as well.

The diagram could be improved by clearly labelling the flows of the reservoir. For example, the mass flow out of the reservoir needs to be labelled with both limited extraction and slow drainage. The underlying physics laws, such as Conservation law of Mass and Conservation law of Energy, also need to be explicitly stated as one of the assumptions made to formulate ODEs.