CST-323: Introduction to Earth System Modelling
CAP-465: Modelling and Simulation of Earth Systems
Exercise I: Water in the Dam

A small note about exercises: Each exercise describes a model in a way that could be written in a scientific paper. It means that not all the details are presented in the description. It is up to the student to decide how they will be implemented.

In the year of 1950, a given city has 100,000 inhabitants. A dam with a capacity of 5,000,000,000m³ of water produces hydroelectric energy for the whole city. In the region, two rainy seasons take place in each year. In the first season, the rains add 2,000,000,000m³ of water to the dam, while in the second they add 1,500,000,000m³. In the beginning of 1950, the dam is full and each inhabitant consumes on average 10kWh of energy per month. Each kWh of energy requires 100m³ of water to be produced. The consumption of energy increases an average of 5% per inhabitant each year.

Develop a model to investigate future scenarios for the dam. For each of the scenarios below, how long will it take until the dam is not able to provide all the energy required by the city?
1) If nothing else happens.
2) If the turbines would require only 80m³ of water to generate 1kWh.
3) If the consumption growth falls by half.
4) If the overall rain falls by half from 1970 onwards.
5) If the scenarios (2), (3), and (4) take place.