

A System Dynamics Approach to Global Warming

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Abstract

Predicting the effects of increased amount of CO₂ the atmosphere is the key to understanding the long term effects of global warming. This project intends to do just that utilizing Netlogo's System Dynamics Modeler. The First part of the project builds a convincing model of Earth's Ecosystem, including a built-in carbon cycle, and the second part of the project is makes the model relevant to the real world by calibrating and validating results from the model. With these two parts combined together, this project will be able to help people determine what consequences (if any) that an increased amount of CO₂ in the air can have on human population and our ecosystem.

Introduction

The issue of global warming has been one of the most talked about topics in recent years, as well as being one of the most controversial. An issue is that one of the main problems most people may have with the idea of global warming is that recent changes in global climate may not be man-induced; some people charge that the current increase in global temperature is part of a bigger Earth temperature cycle, while some ignore the recent temperature increases altogether. By building a convincing global warming model using System Dynamics, the results of this project will hopefully convince the global warming detractors of how serious the problem is.

Procedures and Methods

Current Software being used to model Global Warming is the System Dynamics Modeler in Netlogo. STELLA is also used in conjunction with the System Dynamics Modeler to validate Netlogo Models. The model uses set of equations and stocks to determine the results of the simulation using carbon cycle formulas.

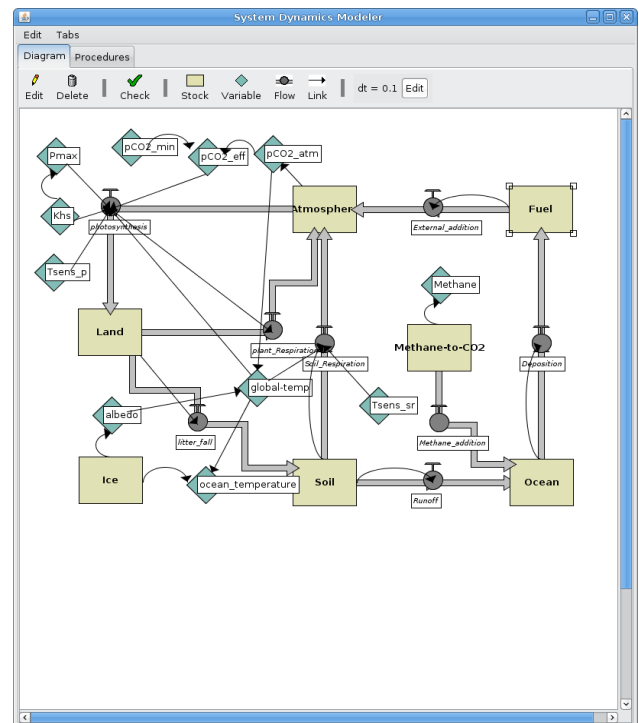


Figure 1. System Dynamics Model of the Global Warming Scenario

Figure 1 shows the diagram that is being used by Netlogo to calculate results. Methane/Ice were added as major factors.

Results

The model clearly shows a strong correlation between Earth's temperature and carbon dioxide levels in the air, as expected. What was surprising, however, is the fact that the model portrays possibility of a global warming process accelerating. The warming process is aided by melting ice, which will release fresh air into the salty ocean and reduce albedo, and methane in the ocean, which will be released once the ocean temperature reaches a certain level. While the results of this study is by no means perfect, it show clear advantage in reducing carbon output.