**ESU22001 Climate Science**

**Practical 1**

**Daisyworld**

**Aim**

The Daisyworld model is a sandbox that allows us to explore interactions between the biosphere and a planet’s climate. This practical will allow you to explore how variations in physical climate can affect the biosphere and the other way around. While Daisyworld is a simple model and could not be used for real-world forecasting what it can do is provide a way to play around and understand what’s going on in a way that a more complicated model cannot.

Workflow

Go to <https://drive.mathworks.com/sharing/362d885f-28f9-410d-ab5d-7d6db4f68855> then add the folder to your MATLAB Drive add the folder to your files: click the  **Add to my Files** button and select **Copy Folder**. MATLAB Drive adds the folder to your files and opens the **Files** view. You must be logged in with your MathWorks account to add a shared folder to your files. If you now go to the MATLAB Online window you should be able to see the files on the left hand side.

The files in the folder are: a documentation file called Documentation\_ESU22001.mx, the Daisyworld model daisyworld.m and a .m file associated with each task. You will also find a paper putting the Daisyworld model into context and discussing its limitations.

You can open all these files in the MATLAB editor. Task 1 invites you to explore the model itself – you can do this by reading the documentation and looking at the daisyworld.m file. Take your time over this task and make sure you understand what’s going on.

Each of the tasks 2-4 has an associated .m script. Open the file and run it by pressing the big green arrow at the top of the editor or F5 on your keyboard. Each script sets the parameters, calls daisyworld.m and produces some figures. You can save the figures for future use as .jpeg or .png files from the Figure tab along the top > Save as… then choose your desired file format.

**Practical tasks**

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| **Task 1: Understanding the Daisyworld model** |
| What are the input variables? What are the output variables? What are their units? |
| **Task 2: Effect of solar radiation on the biosphere and temperature** |
| How do the populations of black and white daisies vary with solar radiation? |
| Why is there a peak? |
| Why do white and black daisies vary differently? |
| What happens if you change the optimum growth temperature? |
| What happens if you change the albedo values? |
| **Task 3: Effect of daisy properties on the environment** |
| How does global temperature vary as you change the albedo of the daisies? |
| What happens if you change the optimum growth temperature? |
| What happens if you change the solar radiation? |
| **Task 4: The greenhouse effect** |
| What happens to the daisy populations as the amount of 'greenhouse gases' emitted increases? |
| What happens to the global temperature as the emission increases and why? |
| What if you change the capacity of the daisies to take up GHGs? |
| What if you change their albedo? |