Introduction to CLEWs

Hands-on lecture 9: Climate Change and Greenhouse Gas Emissions

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Useful links:

1) Discussion forum for CLEWs
2) Results from this Hands-on

Pre-requisites:

1) Successful completion of all the activities under Hands-on lecture 8

Learning outcomes

By the end of this Hands-on, you will be able to:

1) Quantify the level of emissions from different fuel sources in a model setting
2) Compare the level of emissions from different sectors in a model setting
3) Interpret the extent of emissions in the CLEWs systems and their potential impact

Overview

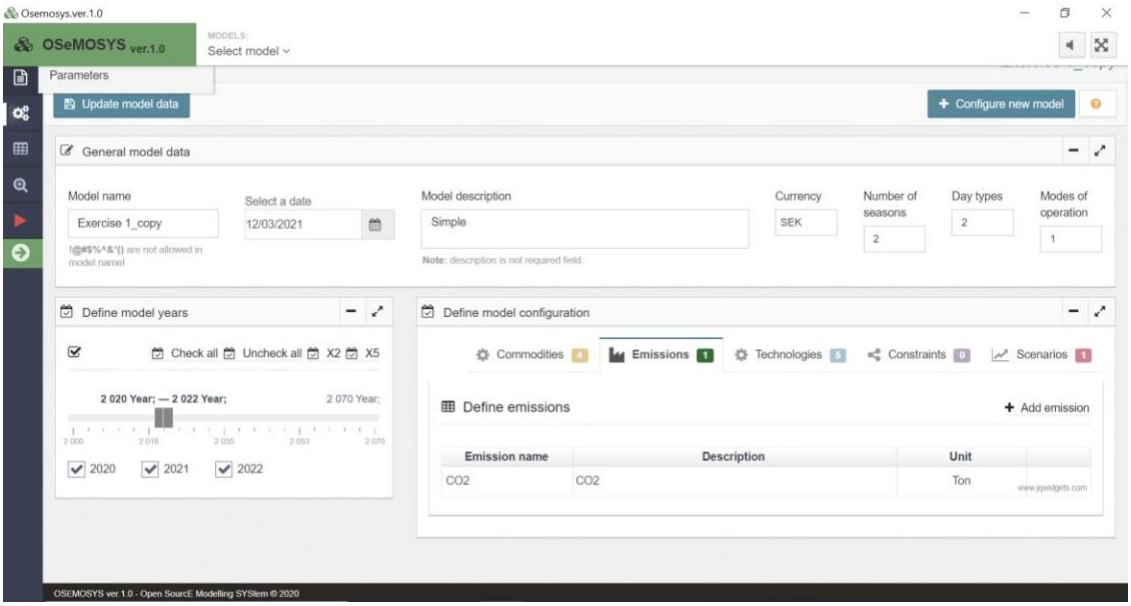
The previous activities were focused on building an integrated model of energy, water, and land use systems. The activities here focus on the representation of the fourth and final aspect of CLEWs: climate.

Activity 1 – Emissions from energy use

Before you start, copy the model from the previous Hands-on.

This activity will introduce emissions and the parameters that can be used to represent them. We will illustrate the concept by introducing only one type of emissions: CO2-equivalent (CO2eq). This is only an example. The user may define any type of emission for more advanced applications. E.g. in the future, if you wanted to insert other emission data for Methane, you could add another emission type called 'CH4' or 'Methane'.

To add the new emission type, choose your model and click on configure model tab. Find the tab '**EMISSION**'. There will be a default emission called CO2. You can rename it to '**CO2eq**'. Finally, click '**Save**'.



Now head to the technologies tab and under the column 'emissions' add CO2 for the technologies DEMAGRDSL, MINCOA, and MINGAS. This enables a new parameter to appear, called '**Emission Activity Ratio**'. Save before adding the data below for all years:

Technology	**Value**	**Parameter**
DEMAGRDSL	0.08 million tonnes of CO2eq	EmissionActivityRatio
DEMTRABIO	0.09 million tonnes of CO2eq	EmissionActivityRatio
MINGAS	0.06 million tonnes of CO2eq	EmissionActivityRatio
MINCOA	0.10 million tonnes of CO2eq	EmissionActivityRatio

Next, make sure that both the **parameters** '**AnnualEmissionLimit**' and '**ModelPeriodEmissionLimit**' are set to 9999 (which translates to having no constraint on emissions). NOTE: The **default value** can be updated to **9999** for both parameters as well.

Own reflection

Optional (no deliverable needed)

- Think of what types of emissions you have introduced in this exercise. Do you think more relevant ones could be introduced? Would it be important / worth it to introduce them?
- What insights can the emission accounting from such an optimization model give for coherent policy making? What policy processes can it inform?

Activity 2 – Emissions from land use

In this activity, land use emissions will be introduced. Kindly introduce data according to the table below.

Technology	**Value**	**Parameter**
LNDMAIHR	1 unit of activity produces 0.34 million tonnes of CO2eq	EmissionActivityRatio
LNDRICHR		
LNDMAIHI		
LNDRICHI		
LNDFOR	1 unit of activity absorbs 0.12 million tonnes of CO2eq	EmissionActivityRatio (negative value)

Note that the emissions produced by all the agricultural land are the same. The forest land, however, ***absorbs*** emissions (hence the negative emission coefficient). In this exercise, we do not introduce emissions related to land use changes. There are ways to introduce them, too, but we do not investigate them in this course.

When all the inputs are inserted, run the model and visualize the results.

Own reflection

Optional (no deliverable needed)

- Think of what new types of emissions you have introduced in this activity. What more relevant information do they give?
- Reflect on the extent of the land use emissions, compared to the energy related emissions.
- Are some emissions still not accounted for, in your opinion?