EGU22-10310
https://doi.org/10.5194/egusphere-egu22-10310
EGU General Assembly 2022

Environmental Module of the Integrated Assessment Model WILIAM

Tomás Calheiros[1], Tiago Lourenço[2], Margarita Mediavilla[3], Noelia Alonso[4], Tiziano Distefano[5], and Iván Ramos-Diez[6]

[1]FCiências.ID, Universidade de Lisboa, Lisboa, Portugal (tlmenezes@fc.ul.pt)
[2]FCiências.ID, Universidade de Lisboa, Lisboa, Portugal (tcapela@fc.ul.pt)
[3]Escuela de Ingenierías Industriales, Universidad de Valladolid, Valladolid, Spain (marga@EII.UVA.ES)
[4]CARTIF, Universidad de Valladolid, Valladolid, Spain (noefer@cartif.es)
[5]Dipartimento di Economia e Management, Università di Pisa, Pisa, Italy (tiziano.distefano@ec.unipi.it)
[6]CARTIF, Universidad de Valladolid, Valladolid, Spain (ivaram@cartif.es)

The main objective of LOCOMOTION research is to increase the robustness, transparency, accessibility, usability and reliability of the MEDEAS set of the Integrated Assessment Models (IAMs), developing a new set of nested models. This structure allows for flexibly testing, improving and expanding each module without impairing the robustness of the models. One of the purposes is also to expand the geographical coverage and detail by creating a new multi-regional world model with 9 global regions and integrating the 27 EU countries.

The new approach includes an Environmental module covering the Land and Water modules and also a climate module. This module has been split into several submodules which are structured as: Diets, Water, Land management, Land Products Availability, Climate, Land Use and Land-Use Change and Forestry (LULUCF) and agriculture emissions. The six submodules related to Land (Forests, Wood Production, Croplands, Yields, Grasslands and Land Uses) calculate the availability of land products from forests and agricultural lands. In the land module, also agriculture and LULUCF emissions are endogenously calculated.

The water module is divided in two parts: demand and availability. The demand includes the use of water by economic sectors and households on the base of the water intensity. The water availability is defined at the country scale and depends on the volume of freshwater net of the share that must be kept ensuring basic environmental services and functions.

The climate module in WILIAM is divided in different parts. The first includes the links with the other modules: energy, industry, agriculture and LULUCF emissions, where the greenhouse gas (GHG) emissions not calculated endogenously are consistent with the RCP scenarios (Representative Concentration Pathways). Other important element of this module is Climate, which includes modelling of GHG cycles, climate variables and climate change impacts. The first computes the cycle of each GHG separately and the interactions between cycles, including carbon, methane and nitrous oxide.

The modelling of climate variables intends to calculate the total radiative forcing of each gas and

their contribution to the global temperature change. The main outputs of the climate module are the total radiative forcing, the mean global temperature change (Capellán-Pérez et al., 2017), the sea level rise and the ocean acidification. Climate change impacts modelling includes the regionalization of climate variables at each climate zone to model impacts considering the heterogeneity of climate in different areas of the Earth, the modelling of impacts on forests (on Net Primary Productivity), on water availability, and in crop yields.

Preliminary results indicate, for example, that land for forest and irrigated crops will decrease in the all climate zones and future scenarios, for 2050. In climate module, temperature change will be larger in polar than in tropical climates.

References: Capellán-Pérez, I., De Blas, I., Nieto, J., Castro, C., Miguel, L.J., Mediavilla, M., Carpintero, Ó., Rodrigo, P., Frechoso, F., Cáceres, S., 2017. EU Framework Program for Research and Innovation actions (H2020 LCE-21-2015) Guiding European Policy toward a low-carbon economy . Modelling sustainable Energy system Development under Environmental And Socioeconomic constraints. Medeas-Ue 1, 1–254.