REAPPRAISE THE SOCIAL COST OF CARBON BASED ON THE FUND_HECTOR COUPLED MODEL

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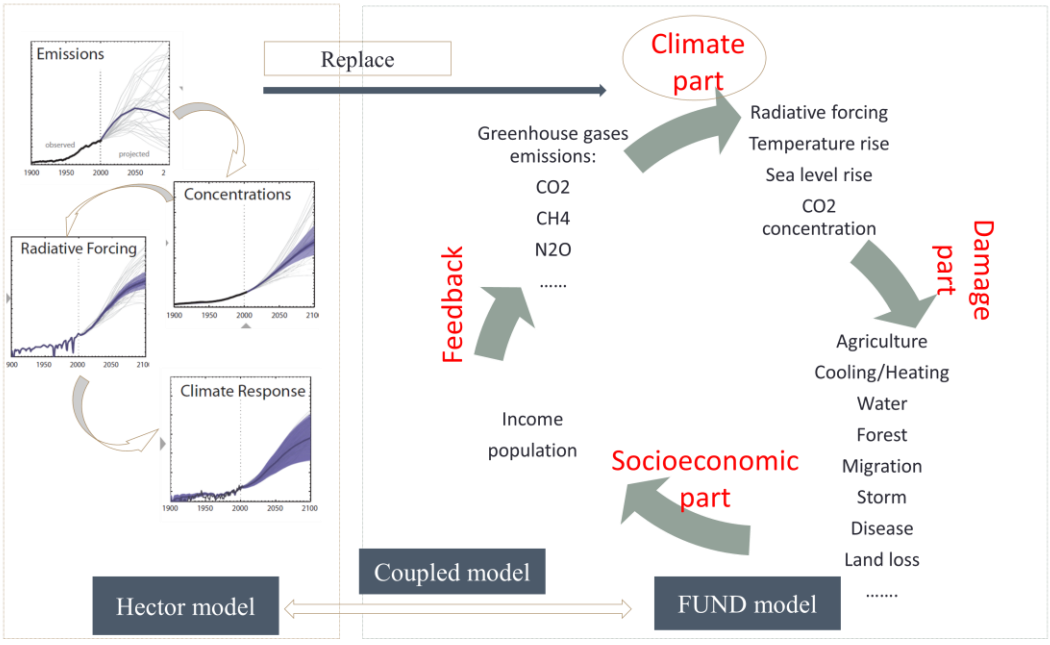
Overview

The social cost of carbon defines the economic loss caused by a unit of additional emission in a given year. Currently, FUND model is one of three models which has been used by US EPA to calculate the social cost of carbon, as well as the DICE and PAGE model. The components of the FUND model include the climate part, damage part and socioeconomic part, but the climate part of the FUND model is relative simple and may not reflect the modelling progress in climate science communities. In this context, we replace the climate part in the FUND model with the Hector model, which is is a simple open source global carbon-climate model developed by the PNNL to evaluate the climate response caused by GHG emissions. The result from the FUND_Hector coupled model shows a higher social cost of carbon compared with the original FUND model.

Methods

The method of this study is shown in Figure 1, the methods used by the FUND model to calculate the social cost of carbon is through simulating the climate response, economic and noneconomic damage regarding to the temperature increase projection from its climate part. In this study, we replace the original climate part with a more complex and accurate climate model Hector, and use the coupled model to reestimate the social cost of carbon.

Figure 1. The structure of the FUND_Hector coupled model

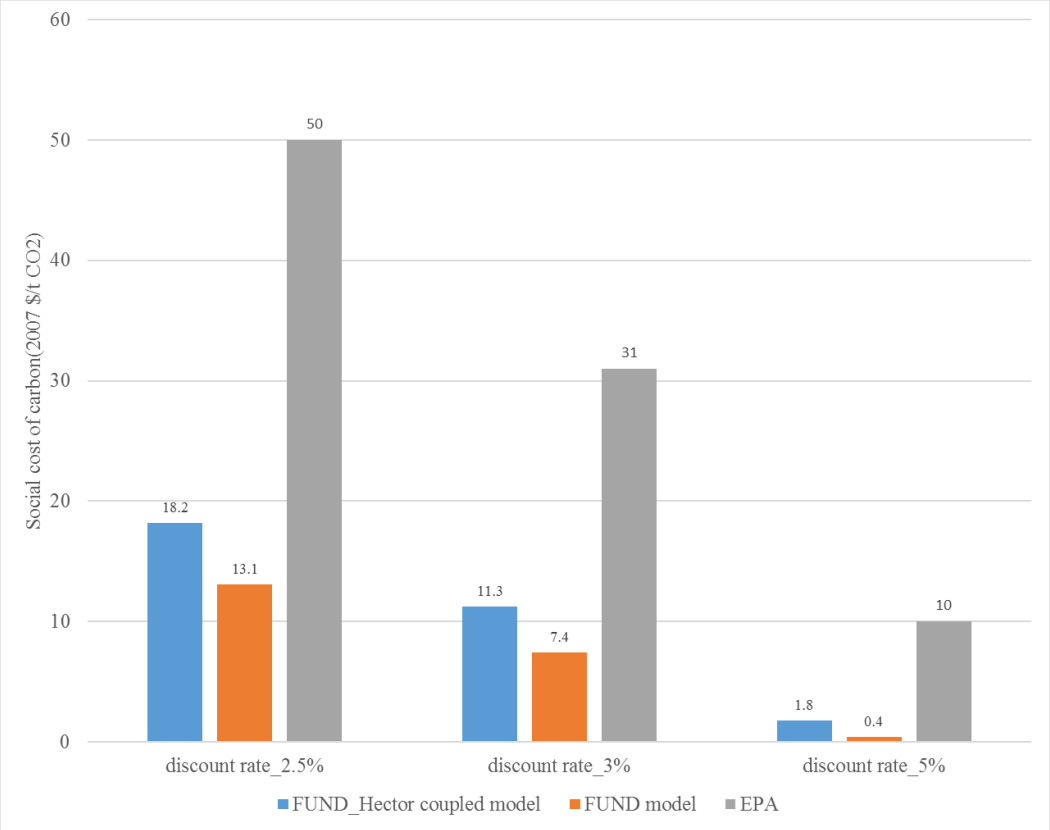


Results

The simulation results show that the climate part in the FUND model estimate a lower temperature rise range compared with the Hector model under RCP8.5. By replacing the climate part in the FUND model with the Hector model, we reestimate the SCC of year 2010 with the new coupled model shown in Figure 2. In the coupled model,

the SCC estimation is 11.3$ (2007 US dollars) under a 3% discount rate, while the SCC estimation by using the original FUND model is 7.4$ per ton CO2 under the same discount rate.

Figure2. Comparsion of social cost of carbon in year 2010 based on the coupled model, FUND model and EPA



Conclusions

This study introduces a simple carbon-climate model into the FUND model to reappraise the social cost of carbon, which brings a new insight in the evaluation of SC-CO2.The original FUND model estimate a lower SCC by about one third compared with the FUND_Hector coupled model. The difference of social cost of carbon between the FUND model and coupled model mainly comes from the different estimation on temperature rise. In the coupled model, a higher temperation increase leads to a higher marginal damage in agriculture sector and cooling sector.

References

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