

## Social Cost of Carbon (SCC) under Different Socioeconomic Development Patterns

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The social cost of carbon (SCC) is an important economic concept used to measure the economic cost caused by an additional ton of carbon dioxide (CO<sub>2</sub>) emissions or its equivalent. Nordhaus (2011) defines it as “the change in the discounted value of the utility of consumption denominated in terms of current consumption per unit of additional emissions”. There are a wide range of uncertainties regarding the social cost of carbon. However, the focus is usually placed on limited sources of uncertainty in the socioeconomic or physical climate aspects for existing studies. Using a stochastic version of the Simple Climate Model for Optimization (SCM4OPT) (Su et al., 2017; 2018), this study aims to estimate the SCC under different socioeconomic development patterns.

A preliminary output for this study can be seen in Figure 1. First, different socioeconomic development levels represented by the 5 SSP scenarios cause a wide range of SCC in future. In 2020, the lowest SCC can be found in SSP 1 with a mean value of about 62 USD(2005)/tCO<sub>2</sub>, and the highest can be found in SSP 5 with 71 USD(2005)/tCO<sub>2</sub>. However, by the end of this century, the SCC of SSP 1 increases to about 448 USD(2005)/tCO<sub>2</sub>, while SCC for SSP5 is up to 973 USD(2005)/tCO<sub>2</sub>. On the other hand, uncertainties resulting from human current understanding of climate system also cause a large uncertainty regarding SCC, as shown in the area for each SSP scenario. For example, a range of 315-686 USD(2005)/tCO<sub>2</sub> is found in 2100 regarding SSP 1, and 743-1530 USD(2005)/tCO<sub>2</sub> for SSP 5. Both socioeconomic assumptions and biophysical climate system can cause a wide range of uncertainties with respect to the SCC. A comprehensive consideration of the SCC uncertainties exist in various sources is important in the assessment of climate change policy.

This is an ongoing study and following two issues also need to be considered in future: 1) Current biophysical uncertainties in SCM4OPT are represented by a relative old version of model comparison of GCM simulations and we will update them based on CMIP6; 2) We will make a sensitivity analysis to distinguish the impacts resulting from different specific sources.

**Figure 1: Social cost of carbon under uncertainty.** The ranges between the lower and upper areas show the likely probabilities (i.e., the 17th and 83rd percentiles).

### References

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Keywords: Social cost of carbon, Climate change, SSP scenarios, SCM4OPT

