Development of a coupled Earth and socio-economic system model

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In ordinary future projections, link of Earth system model (ESM) and integrated assessment (or socio-economic) model (IAM) is one-way, where the greenhouse gas and land use scenarios developed by IAMs are input to ESM. However, a recent study indicated a possibility for human-carbon cycle feedback to be comparable in size (and opposite in sign) to climate-carbon cycle feedback. Thus, it is indicated that a two-way coupling of ESM and IAM could alter the pathway to meet the given climate (temperature) targets. To consider that, we first carried out a review work on climate-socioeconomic system feedback. By examining around 200 papers for eight sectors/processes (including land productivity (i.e., cropland and pasture), water resources, sea level rise and inundation, natural disasters, other ecosystem services, human health (i.e., labor productivity and disease/health), industry and related economic activities (i.e., energy, infrastructure, tourism and transportation, insurance, and finance), and migration and civil/international conflict), we concluded that land productivity, labor productivity, and energy system play most important roles (although we need to accumulate more studies for each sector to draw solid conclusions). Based on that we are developing a (loosely) coupled ESM-IAM model, by loosely coupling a coupled ESM and integrated land surface model, with a computational general equilibrium model.

Keywords: Earth system model, integrated assessment model, socio-economic model