Assessment of linearity of climate-change impacts to global mean temperature

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Abstract

Because climate projections are conducted based on the limited number of published radiative forcing scenarios, analyzing climate-change impacts based on the other assumptions of radiative forcing is difficult. If we are able to derive impacts under the other assumptions from those under the published radiative forcing scenarios, the resulting information will be useful for decision making on climate stabilization targets. In this study, we assumed that the climate-change impacts under one of the four Representative Concentration Pathways (RCP) are unknown and those under the other RCP scenarios are known, and we derived the unknown impacts from the other two known impacts by linear interpolation using the global mean temperature (GMT) change of each RCP scenarios as a weighting factor. We assessed four climate-change impacts: (i) net primary production (NPP), (ii) biomass burning, (iii) erosion, and (iv) surface runoff. We found that NPP is the most adequate for linear interpolation, followed by biomass burning and erosion. Our analyses indicate that runoff is not suitable for linear interpolation. Both the change in NPP and the change in biomass burning are almost linear to GMT change. The increase in erosion tends to weaken as GMT increases. The change in runoff is not linear to GMT change. We also found that the relationship between changes in climate-change impacts and GMT change differs among the RCP scenarios.