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Mapping of interconnection of climate risks

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Anthropogenic climate change possibly causes various impacts on human society and ecosystem. Here, we call possible damages or benefits caused by the future climate change as “climate risks”. Many climate risks are closely interconnected with each other by direct cause-effect relationship. In this study, the major climate risks are comprehensively summarized based on the survey of studies in the literature using IPCC AR5 etc, and their cause-effect relationship are visualized by a “network diagram”. This research is conducted by the collaboration between the experts of various fields, such as water, energy, agriculture, health, society, and eco-system under the project called ICA-RUS (Integrated Climate Assessment – Risks, Uncertainties and Society).

First, the climate risks are classified into 9 categories (water, energy, food, health, disaster, industry, society, ecosystem, and tipping elements). Second, researchers of these fields in our project survey the research articles, and pick up items of climate risks, and possible cause-effect relationship between the risk items. A long list of the climate risks is summarized into $\sim$130, and that of possible cause-effect relationship between the risk items is summarized into $\sim$300, because the network diagram would be illegible if the number of the risk items and cause-effect relationship is too large. Here, we only consider the risks that could occur if climate mitigation policies are not conducted. Finally, the chain of climate risks is visualized by creating a “network diagram” based on a network graph theory (Fruchtman & Reingold algorithm).

Through the analysis of network diagram, we find that climate risks at various sectors are closely related. For example, the decrease in the precipitation under the global climate change possibly causes the decrease in river runoff and the decrease in soil moisture, which causes the changes in crop production. The changes in crop production can have an impact on society by changing the food price or food supply. Changes in river runoff can also make an impact on the hydropower efficiency. Comprehensive pictures of climate risks and their interconnections are clearly shown in a straightforward manner by the network diagram. We will have a discussion how our results can be helpful for our society to recognize the climate risk.