

Integrated Research Program for Advancing Climate Models - B: national research program in Japan on earth system modeling

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The Integrated Research Program for Advancing Climate Models, or TOUGOU (abbreviation taken from its Japanese name), is a national project for projection of global change. Its aim to provide information for adaptation and mitigation, based on scientific evaluation of changes including those in extreme events and carbon cycle. The project was launched in April, 2017. While the entire program deals with a wide range of physical aspects and consequent impacts of climate change, Theme B (TOUGOU-B) focuses on the development of a state-of-the-art earth system model incorporating biogeochemical processes, such as sophisticated carbon and nitrogen cycles, as well as its application to exploring future socio-economic pathways of climate change mitigation. MIROC-ESM, an earth system model (ESM) developed under TOUGOU-B (and the previous SOUSEI-B) has been significantly improved since the 5th phase of coupled model intercomparison project (CMIP5), and is starting to be run for CMIP6 with the hope that the results contribute to the next IPCC Assessment Report due in 2021. New features of the latest version of MIROC-ESM are, among others, incorporation of nitrogen cycle for the terrestrial biosphere, explicit iron and phosphate cycle, nutrient deposition to the ocean via atmosphere, and nutrient transport by rivers from land to ocean. Besides further model improvements such as incorporation of methane dynamics, TOUGOU-B' s scope includes: interactions among water resource, land-use and ecosystem (nexus); integration of socio-economics and earth system to evaluate the effect of interactions between human society and climate change; development of a sophisticated scheme for probabilistic assessment of the temperature increase quantified with climate sensitivity and transient climate response to CO₂ emissions (TCRE), both of which are important for estimating mitigation costs; development of a model coupler that facilitates switching sub-models on and off. Preliminary results from the program will be introduced in the presentation.