

## Highlighted results from the latest MIROC-based ESM and activities of TOUGOU-B

\*Michio Kawamiya<sup>1</sup>, Kaoru Tachiiri<sup>1</sup>, Tomohiro Hajima<sup>1</sup>, Tokuta Yokohata<sup>2</sup>, Junichi Tsutsui<sup>4</sup>, Takashi Arakawa<sup>3</sup>, Takahiro Inoue<sup>1</sup>

1. Japan Agency for Marine-Earth Science and Technology, 2. National Institute for Environmental Studies, 3. Research Organization for Information Science and Technology, 4. Central Research Institute of Electric Power Industry

Team MIROC, consisting of leading climate modeling institutes in Japan, developed a new version of the Model for Interdisciplinary Research on Climate, Earth System for Long-term simulations (MIROC-ES2L), an Earth system model (ESM) using a state-of-the-art climate model as the physical core. This model embeds a terrestrial biogeochemical component with explicit carbon–nitrogen interaction to account for soil nutrient control on plant growth and the land carbon sink. The model's ocean biogeochemical component is largely updated to simulate biogeochemical cycles of carbon, nitrogen, phosphorus, iron, and oxygen such that oceanic primary productivity can be controlled by multiple nutrient limitations. The ocean nitrogen cycle is coupled with the land component via river discharge processes, and external inputs of iron from atmospheric deposition are considered. Comparison of a historical simulation with observation studies showed the model could reproduce reasonable historical changes in climate, the carbon cycle, and other biogeochemical variables together with reasonable spatial patterns of distribution of the present-day condition. It is our hope that the ESM could help further understanding of climate–biogeochemical interaction mechanisms, projection of future environmental changes, and exploration of our future options regarding sustainable development by evolving the processes of climate, biogeochemistry, and human activities in a holistic and interactive manner.

Keywords: Earth System Model, Climate Change, IPCC, CMIP, Carbon Cycle, Nitrogen Cycle