

Preface

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The Flexible Global Ocean-Atmosphere-Land System Model (FGOALS) is a coupled climate model that allows researchers to conduct fundamental research into the Earth's past, present, near-term and long-term future climate states. FGOALS couples the ocean, atmosphere, land, and sea ice through a coupler that coordinates the component models and passes the exchange of energy, momentum, and water among them. The first version of the model, FGOALS1, was released in 2004 as a new version of the Global Ocean-Atmosphere-Land System Model (GOALS), which has been developed by LASG/IAP since the early 1990s. FGOALS1 has been applied to comparative model calculations in the context of CMIP3, as well as a variety of scientific studies that support the implementation of many Chinese research projects. The second version of the model, FGOALS2, was released in 2009, and its experiments as part of CMIP5 have been conducted in support of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The output from the FGOALS CMIP5 runs is available to the international climate research community via the Earth System Grid gateway at LASG/IAP: <http://esg.lasg.ac.cn>.

FGOALS2 has two versions, FGOALS-s2 and FGOALS-g2, which share the same coupling framework, ocean and land components, but adopt different atmospheric and sea ice components. Although the development of FGOALS2 is based at LASG/IAP, it is a cooperative effort among several Chinese research centers/institutions. The First Institute of Oceanography, State Oceanic Administration, has contributed to the setup of the coupler used in these two versions. The Center of Earth System Science (CESS), Tsinghua University, has devoted itself to the code optimization of FGOALS-g2. More than half of the FGOALS-g2 CMIP5 experiments were performed on the supercomputer at CESS. The State Key Laboratory of Atmospheric Boundary Physics and Atmospheric Chemistry (LAPC), Institute of Atmospheric Physics, has been dedicated to the ocean carbon cycle module of FGOALS-s2. The School of Atmospheric Sciences, Nanjing University, has long been involved in the assessment of the model. The Supercomputing Center of the Institute of Atmospheric Physics and Supercomputing Center of the Chinese Academy of Sciences, have provided most of the computer resources for the FGOALS CMIP5 experiments.

This special issue is mainly focused on the results from FGOALS: there are four introductory papers and 26 papers documenting various aspects of the model. Of these, 17 of the papers evaluate the performances of the two versions of FGOALS in terms of climate phenomena and their variability across many time scales; the remaining nine compare FGOALS to other CMIP5/CMIP3 models.

The study of climate system models needs long-term and common efforts. After more than five years' development of the new FGOALS version, improvements can be seen in many aspects. Nevertheless, we also still find limitations and biases in the current version. This special issue documents both the strengths and weaknesses of the FGOALS CMIP5 experiments and provides a useful reference for the future development and improvement of the FGOALS model.

Coordinated by the Chinese Academy of Sciences, the Earth System Model of the Chinese Academy of Sciences is in progress at the Institute of Atmospheric Physics. Many laboratories and research centers inside and outside the IAP, including LASG/IAP, have been involved in the efforts. The FGOALS team should continue to make contributions. It is hoped that these cooperative efforts will provide a powerful Earth system modeling platform available for use by the scientific community in the near future.

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