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Enhancing remote sensing research on global change to improve our understanding on Earth system processes

Global Change includes climate change and other environmental changes caused by the joint interaction among various layers of Earth. From the positive side, global change provides new opportunities to human and other living forms on Earth. In the meantime, it creates tremendous challenges and negative impact. At present, the negative impacts have reached all primary processes of the global ecosystem and every aspect of human society, especially causing degradation of the ecosystem. For instance, intensive deforestation causes decline of biodiversity; global warming causes sea level rise and increases the frequency of extreme weather and climate events (Yang et al., 2013). Changing the natural environment also considerably affects the socio-economic development of the entire world. Prompt and adequate response to challenges of global change is essential to realizing sustainable development of human society (Xu et al., 2013).

In order to address the above challenges, the international science community has created the World Climate Research Program, the International Geosphere-Biosphere Program, the Biological Diversity Program and the International Human Dimension Program on Global Environmental Change since the 1980s to intensify international collaboration and to improve research quality. Gradually, it has been realized that specialization in scientific research has considerable limits in solving complex problems. To understand and solve global environment change problems we must regard the Earth as a multi-scale nested system and integrate research achievements from all relevant disciplines. This is exactly the approach taken by the rapidly developing field of Earth system science.

The scope of study in Earth system science concentrate on the entire Earth as an integration of all interactions among the atmosphere, hydrosphere (including the cryosphere), biosphere, lithosphere, the mantle of Earth and the centrosphere, the near surface space as well as the anthroposphere. It has an emphasis specifically on the holistic structure, function and interaction among the various processes. At present, the frontier is on physical, chemical, and biological processes at the boundaries between various spheres and the trans-sphere processes and interactions, as well as the natural and socio-economic driving forces to the evolution of the Earth system. Specifically, these include the mechanism and predictability of changes of the climate system; atmospheric chemistry and its radiative and climate effect; the interactions among terrestrial ecosystem processes; the system dynamics of the ocean ecosystems and their biogeochemical processes; and the material exchange and flow of energy among land, sea and the atmosphere. In the meantime, more research attention is being turned to the impact of human activities to the Earth system, particularly the effect of human activities on ecosystem and global carbon cycling, global environment change and hydrological cycling, global environment change and the food system, impact of energy structure and policy adjustment on the environment, as well as management of global environmental change.

During the past 10 years, the international community further developed the Earth System Science Partnership, proposed the Future Earth initiative, and formed the Earth League. Targeting solving global environmental change issues, Earth system science has gradually consolidated the research connotation, scientific questions and methodology and research platform. The prominent characteristics of Earth system science approach is the integrated multi-scale and cross-disciplinary observation and simulation. From this aspect, satellite based remote sensing science and technology is one of the primary means to realize the multi-scale observation over the entire globe.

Since the 1960s, United States of America and other developed countries have been playing a leading role in using satellite remote sensing to observe the global atmosphere, ocean and land, so have they been dominating the corresponding data pro-

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cessing and information extraction field. In the past 5 years, China has launched a number of satellites including the environment and disaster monitoring satellite (HJ), ocean satellite (HY), meteorological satellite (FY), surveying and mapping satellite, and the high resolution satellite (GF). These has substantially improved the earth observation capability of China. In the future 5–10 years, more satellites with more specialized monitoring capabilities are being scheduled for launching. These efforts have placed China as the country with the fastest development of satellite remote sensing in the 21st century. As satellite remote sensing technology further develops, how can we organically combine satellite observation with modeling to facilitate global change studies is an important question facing the scientific community.

For the above reasons, in 2010, the Ministry of Science and Technology of China has launched a series of major projects including two projects in the High Technology Research and Development Program entitled "Research for Global Land Cover Mapping and Relevant Key Technologies", and "Research on the Production and Application of Data Products on Global Terrestrial Properties". Thereafter, the Ministry of Science and Technology of China also established a long-term key basic research program for global change studies. Through this program, the Chinese government has supported several dozen major basic science projects. As these projects progress, we are confident that remote sensing research in support of global change studies will be considerably enhanced. In order to reflect some of the research progresses on the use of remote sensing for global change studies, we decided to open this special theme in the journal. In this issue, we publish the first group of five papers on land cover mapping with remotely sensed data. Subsequently we will publish other research results centering around water and energy applications.

Xu G H, Ge Q S, Gong P, et al. 2013. Societal response to challenges of global change and human sustainable development. Chin Sci Bull, 58: 3161–3168
Yang J, Gong P, Fu R, et al. 2013. The role of satellite remote sensing in climate change studies. Nat Clim Change, 3: 875–883

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