Global Impact Modeling in AIM

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From the early phase of the development, AIM had an impact assessment component which consisted of sector models for water resource, agriculture, human health and natural vegetation. The sector models were developed for impact projections at global scale with spatial resolution of 0.5^{o}x0.5^{o} [Harasawa *et al.*, 2003]. While the sector models have been progressed toward more realistic and precise representation of processes, they have also been practically used in various research projects with different objectives.

A notable recent effort for the model improvement is the participation to EU-WATCH project for making inter-comparison of global water resource models. Dr. Hanasaki has participated in the project since 2007 to submit simulation outputs of the water resource model H08 driven with shared input scenarios [Haddeland *et al.*, 2011]. Though H08 was originally developed as a kind of hydrological model, socio-economic aspects of the model are being reinforced through applications in several projects including “Project on Advanced Global Water Resource Assessment” funded by and conducted in NIES (2009.4-2012.3). Regarding the crop model, Dr. Masutomi, who moved from NIES to CESS in 2009, has been working on the model improvement through collaboration with crop modeling experts in National Institute for Agricultural Environment Studies [e.g. Masutomi *et al.*, 2010].

The global impact models in AIM were used to create country-by-country “Impact Functions” to be implemented into AIM/Impact[Policy]. AIM/Impact[Policy] is an integrated assessment tool for supporting policy analysis on long-term targets and has been developed in S-4 project (2005.4-2010.3) funded by the Ministry of Environment, Japan (MOE). The Impact Functions were created through numerous impact model simulations with synthetic scenarios like sensitivity analysis and spatial aggregation of the simulated results [Hijioka *et al.*, 2006]. With AIM/Impact[Policy] that is equipped with the Impact Functions, potential impacts of climate change on various sectors for each choice of climate policy like the upper limit of GHGs concentration can be examined and visualized easily. In order to contribute to the MOE-funded S-8 project (2010.4-2015.3), a successor project of S-4, Impact Functions with more explicit representation of adaptation are going to be developed. We are thinking that the Impact Function approach is also effective in linking CGE-type economic models with the impact models to create integrated scenarios of climate change.

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An important direction of the global impact modeling in AIM is the enhanced collaboration with climate modeling teams in Japan. For example, in Core Project 3 (CP3; 2006.4-2011.3) funded by and conducted in NIES, an integration of a climate model, impact models and terrestrial ecosystem models was set as one of objectives. The efforts to integrate models from different disciplines will be continued in a successor project of CP3 which will start in April 2011. In parallel, impact projections considering uncertainties in climate projections have been studied in MOE-funded S-5 project (2007.4-2012.3). In S-5 project, with the participation of sector experts in Japan, impacts of climate change on water resource, agriculture, human health, polar ice sheet, marine environment and terrestrial ecosystems have been analyzed with using multiple climate projections archived in CMIP3/PCMDI and the ranges of impact projections derived from climate projection uncertainties are investigated. The S-5 project also includes sub-themes on evaluation and downscaling of climate projections conducted mainly by climate modelers as well as the sub-themes on sector impacts analysis. Through the collaboration among the sub-themes, for example, an advanced study aiming at constraining uncertainty range of impact projections considering climate models' performance to reproduce historical observation has been conducted [Shiogama *et al.*, 2010].

As mentioned above, the global impact modeling in AIM has climbed over the fence of the original research project which aimed at the development of integrated assessment model, and is seeking possibility to obtain higher-level framework of analysis through collaboration with research teams from different disciplines. We believe that this research direction is consistent with the international trend which looks to the development of integrated socio-economic/climate scenarios and utilization of those scenarios in analyses of mitigation, adaptation and other issues [Moss *et al.*, 2010].

About research projects cited in text

S-4: Comprehensive assessment of climate change impacts to determine the dangerous level of global warming and to determine appropriate stabilization target of atmospheric GHG concentration [2005.4-2010.3; Leader: Prof. Nobuo Mimura in Ibaraki Univ.]

S-5: Integrated research on climate change scenarios to increase public awareness and contribute to the policy process [2007.4-2012.3; Leader: Prof. Akimasa Sumi in Univ. of Tokyo]

S-8: Comprehensive research on climate change impact assessment and adaptation policies [2010.4-2015.3; Leader: Prof. Nobuo Mimura in Ibaraki Univ.]

CP3: Assessment of climate risks based on integrated climate, impact, and land-use models [2006.4-2011.3; Leader: Dr. Seita Emori in NIES]

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