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Editorial

Impacts of land use change on climate

The US National Research Council (NRC, 2005) recommended the expansion of the climate change issue to include land use and land-cover processes as an important climate forcing. These processes have not been a major component of past Intergovernmental Panel on Climate Change (IPCC) reports. The NRC report states that beyond the change in mean atmospheric composition caused by increasing greenhouse gases, landscape variations may have important local, regional and potentially global climatic implications. In some cases, the climate response to land use and land-cover change may even exceed the contribution from increasing greenhouse gases. 'Improving societally relevant projections of regional climate impacts will require a better understanding of the magnitudes of regional forcings and the associated climate responses.' The International Geosphere Biosphere Programme (IGBP) and the Global Energy and Water Cycle Experiment (GEWEX) have also identified the importance of understanding the climate response to land use and land-cover change. As we move forward to the Fifth Assessment Report of the IPCC, there is growing impetus to address this aspect of anthropogenic impacts on the planet's environment. As a matter of fact, the CMIP5 suite of climate simulations that will be run for this report assessment (http://cmip-pcmdi.llnl.gov/cmip5/) now includes a new forcing dataset: the changes in land–surface areas used for agriculture, grazing activities, forestry, etc.

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This special issue is inspired by a recent •NSF-sponsored workshop titled 'Detecting the Atmospheric Response to the Changing Face of the Earth: A Focus on Human-Caused Regional Climate Forcings, Land-Cover/Land Use Change, and Data Monitoring' that was held in Boulder, Colorado, USA in August 2007. Workshop presentations are available online from the National Center for Atmospheric Research (NCAR) Joint Office for Science Support (JOSS; http://www.joss.ucar.edu/joss_psg/meetings/Meetings_2007/Detecting/Index.html), and an overview of workshop conclusions is presented by Mahmood *et al*. (2010). Presenters from this workshop and other interested researchers have contributed articles for two special issues. In addition to this special issue of the *International Journal of Climatology*, there is also a special issue of *Boundary Layer Meteorology* (Niyogi *et al*., 2009) focusing on the effects of land use and land-cover change on fluxes to the atmosphere, and subsequent impacts on weather and climate at the synoptic scales and the mesoscale.

This special issue introduces a number of the studies presented at the Boulder workshop. Most of the studies examine regional impacts of land surface states on climate (Costa and Pires, 2010; Fall *et al*., 2010a, 2010b; Ge, 2010; Kishtawal *et al*., 2010; Mishra *et al*., 2010; Moore *et al*., 2010; Petchprayoon *et al*., 2010; Sertel *et al*., 2010; Takahashi *et al*., 2010; Tokairin *et al*., 2010; Xiao *et al*., 2010). However, several studies take a global perspective of land-cover consequences (Anantharaj *et al*., 2010; Kvalevåg *et al*., 2010; Lawrence and Chase, 2010; Strengers *et al*., 2010). Hibbard *et al*. (2010) sums up with a position paper on recommended future directions for research.

Both observational and modelling studies are presented in this study. The observational studies use *in situ* climate data (Petchprayoon *et al*., 2010; Xiao *et al*., 2010), satellite measurements (Ge, 2010; Kishtawal *et al*., 2010) and data from regional reanalyses (Fall *et al*., 2010a, 2010b). The modelling studies use regional atmospheric models (Moore *et al*., 2010; Sertel *et al*., 2010; Takahashi *et al*., 2010; Tokairin *et al*., 2010; Xiao *et al*., 2010), global climate models (Anantharaj *et al*., 2010; Costa and Pires, 2010; Kvalevåg *et al*., 2010; Lawrence and Chase, 2010; Strengers *et al*., 2010) and one uses a land surface model run offline (Mishra *et al*., 2010).

Several studies focus on the impact of urbanization on climate change. Kishtawal *et al*. (2010) look at the evidence of urbanization on precipitation trends and the occurrence of extreme rainfall events over India. Petchprayoon *et al*. (2010) search for evidence that increased runoff and flooding in the Yom River Basin of Thailand is connected to changes in land use, particularly the spread of urban areas. Sertel *et al*. (2010) find evidence that inaccurate specification of land cover in the default configuration of the Weather Research and Forecast (WRF) model, and in particular, poor representation of the extent of urban areas, impairs the simulation of surface temperature as compared to station reports. Tokairin *et al*. (2010) use a mesoscale model to examine the effects of urbanization on circulation over the island of Java, Indonesia.

Other studies examine the consequences of regional vegetation change on climate. Costa and Pires (2010) model the precipitation response to future deforestation scenarios over South America, considering not only the tropical forests but also the cerrado to the south. Mishra *et al*. (2010) look at historic, current and future land use effects on surface fluxes over Wisconsin in offline simulations with the Variable Infiltration Capacity (VIC) land surface model driven by meteorological output from IPCC climate models. Ge (2010) examines the effect of agriculture, specifically the cultivation of winter wheat,