

# Interactions between Taiwan's Land-Use/Cover Change and Regional Atmospheric and Hydro-Meteorological Modeling and Large-Scale Climate Variability

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## ● BACKGROUND & OBJECTIVES

Over the past few decades, Taiwan has been experiencing rapid and significant land use/cover change (LUCC) that interacts with regional land and atmosphere thereby becoming part of a driving force for the entire Earth System. According to the Global Land Project (GLP, 2005) Science Plan and Implementation Strategy, the interactions among LUCC, regional atmosphere, and large-scale climate variability have been deemed a very important research direction. For instance:

Issue 1.3 (GLP): in order to understand how the atmospheric dimension of global change affects ecosystem structure and thus to LUCC, one should analyze

- The effect of climate and atmospheric composition changes on ecosystems.
- Impact of seasonality and inter-annual variability of extreme climate events on terrestrial systems and disturbance regime.
- Impact of changes in land and water management or land use on atmospheric composition and climate.

Issue 2.1 (GLP): the examination of the feedbacks to the Earth System from LUCC should also be conducted on multiple fronts, including

- Critical Earth System feedbacks.
- Relationships in space and time affecting ecosystem feedbacks.

Thus, our intention is to tailor this research project to shed light on various interactions between Taiwan's LUCC and the earth system. Key physical elements and their routes of interactions with Taiwan's LUCC emphasized in this research project are illustrated in Figure 2. Our investigation will be surrounding all these elements to discover their empirical relationships and underlying mechanism using broad-spectrum statistical and modeling analyses, respectively.

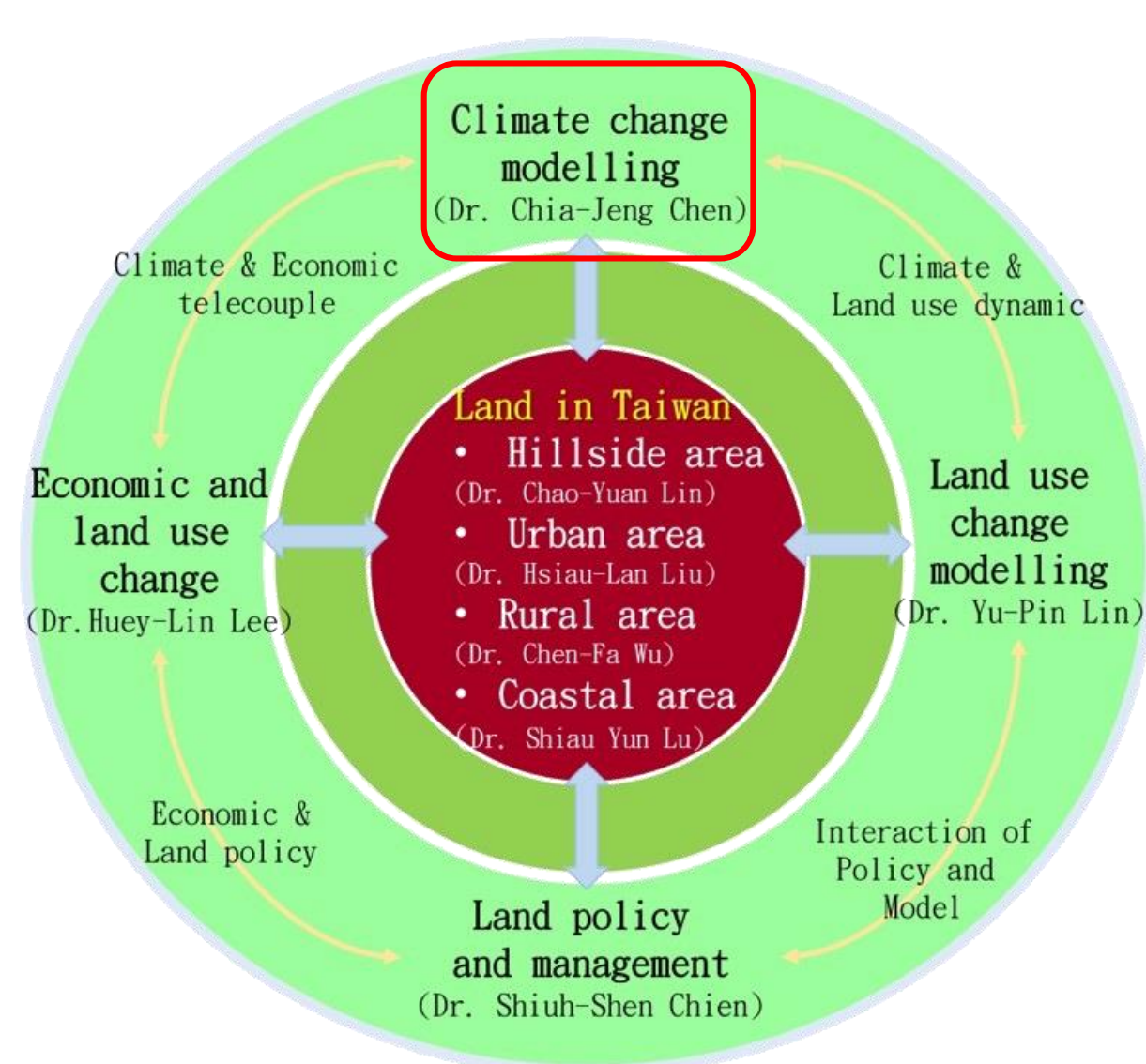


Figure 1. Schematic of the Land Resources Core Project – Modeling dynamic changes and mechanisms of land systems; highlighted is this sub-project.

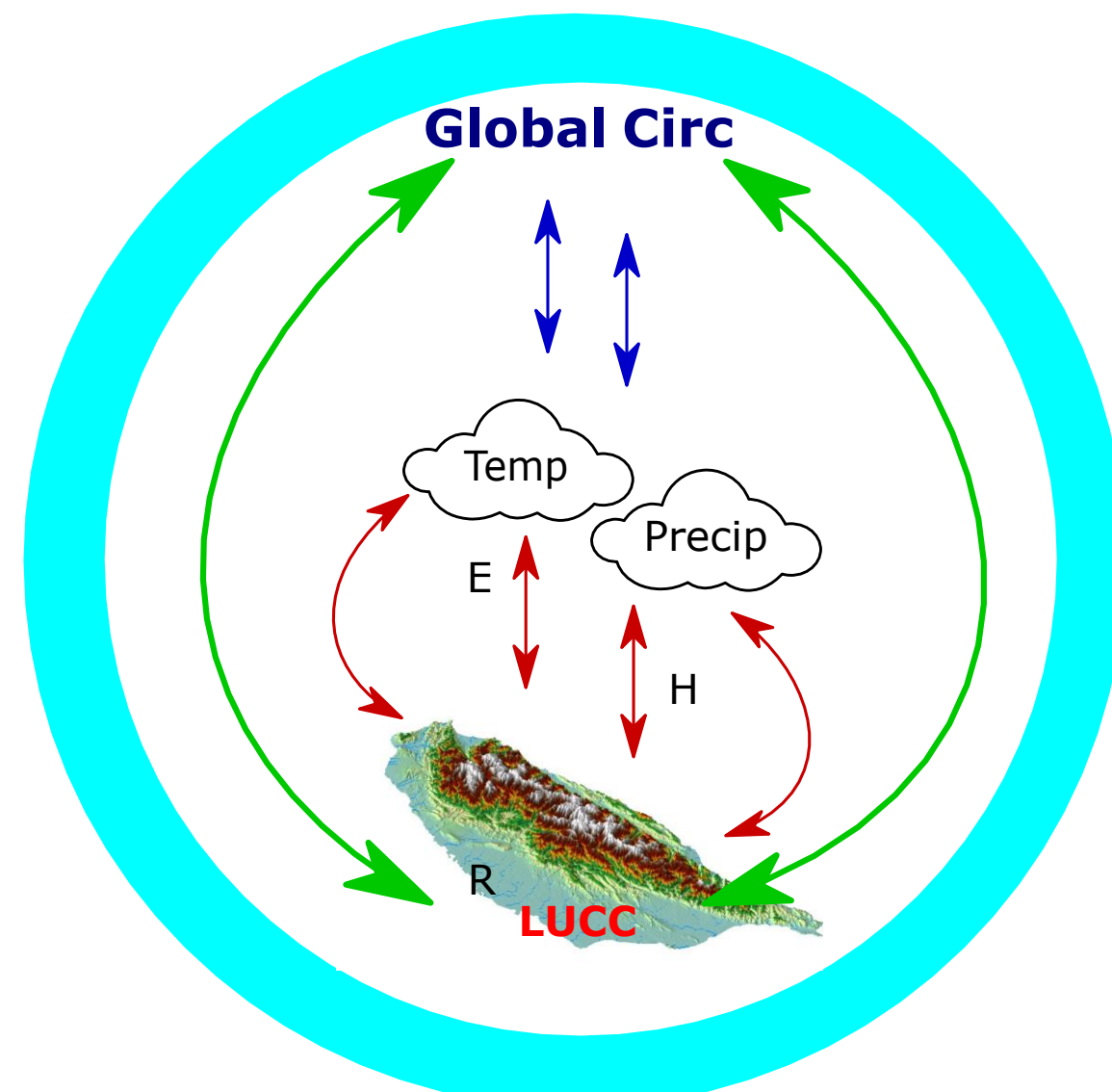


Figure 2. Illustration of physical elements and their routes of interactions with LUCC, where Temp and Precip (temperature and precipitation) stand for local/regional climates, E and H (latent and sensible heat; red arrows) for land surface fluxes, R for river runoff, and blue and green arrows for teleconnections with global circulation patterns.

## ● DATA SETS

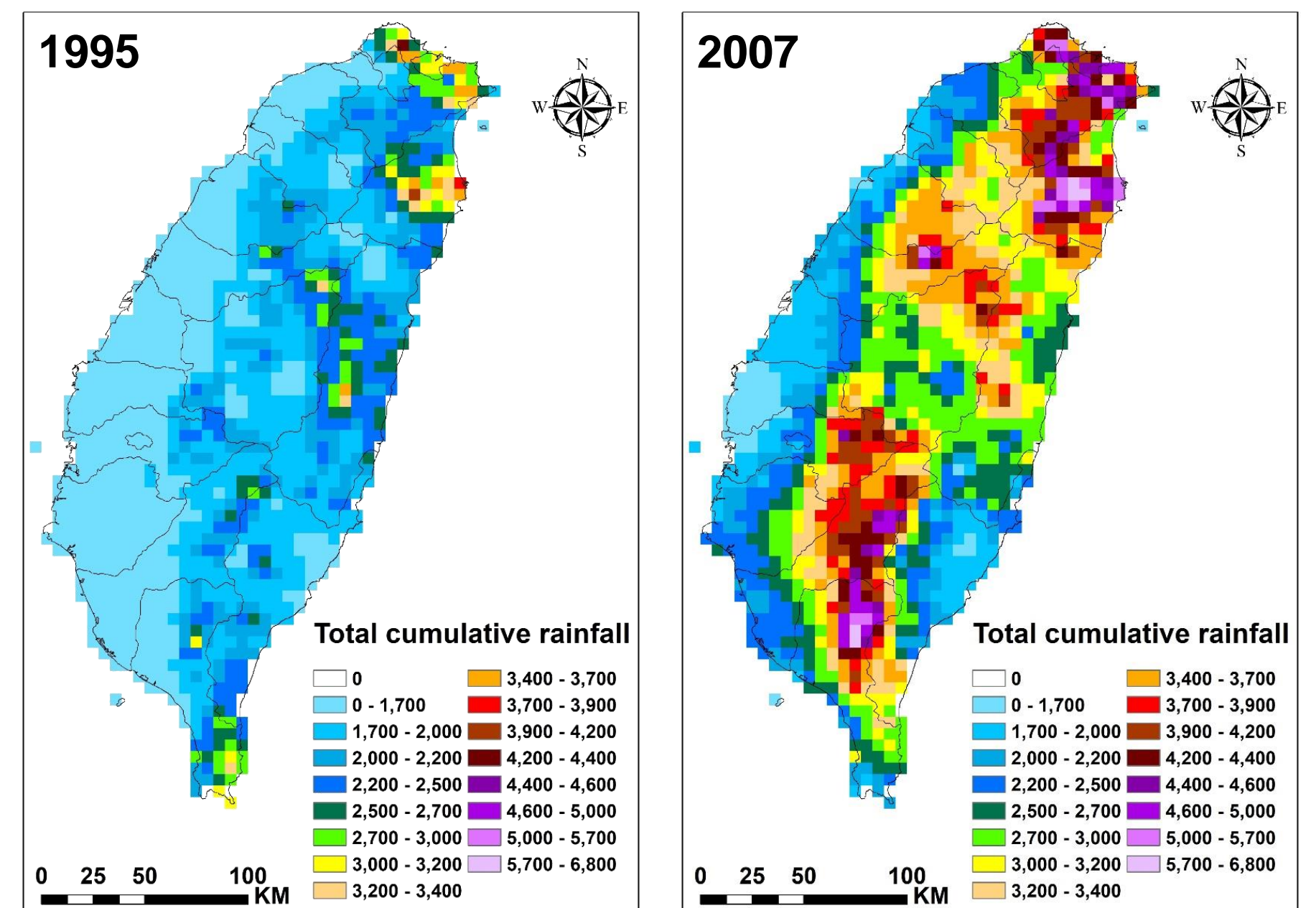


Figure 3. TCCIP data sharing with other sub-projects.

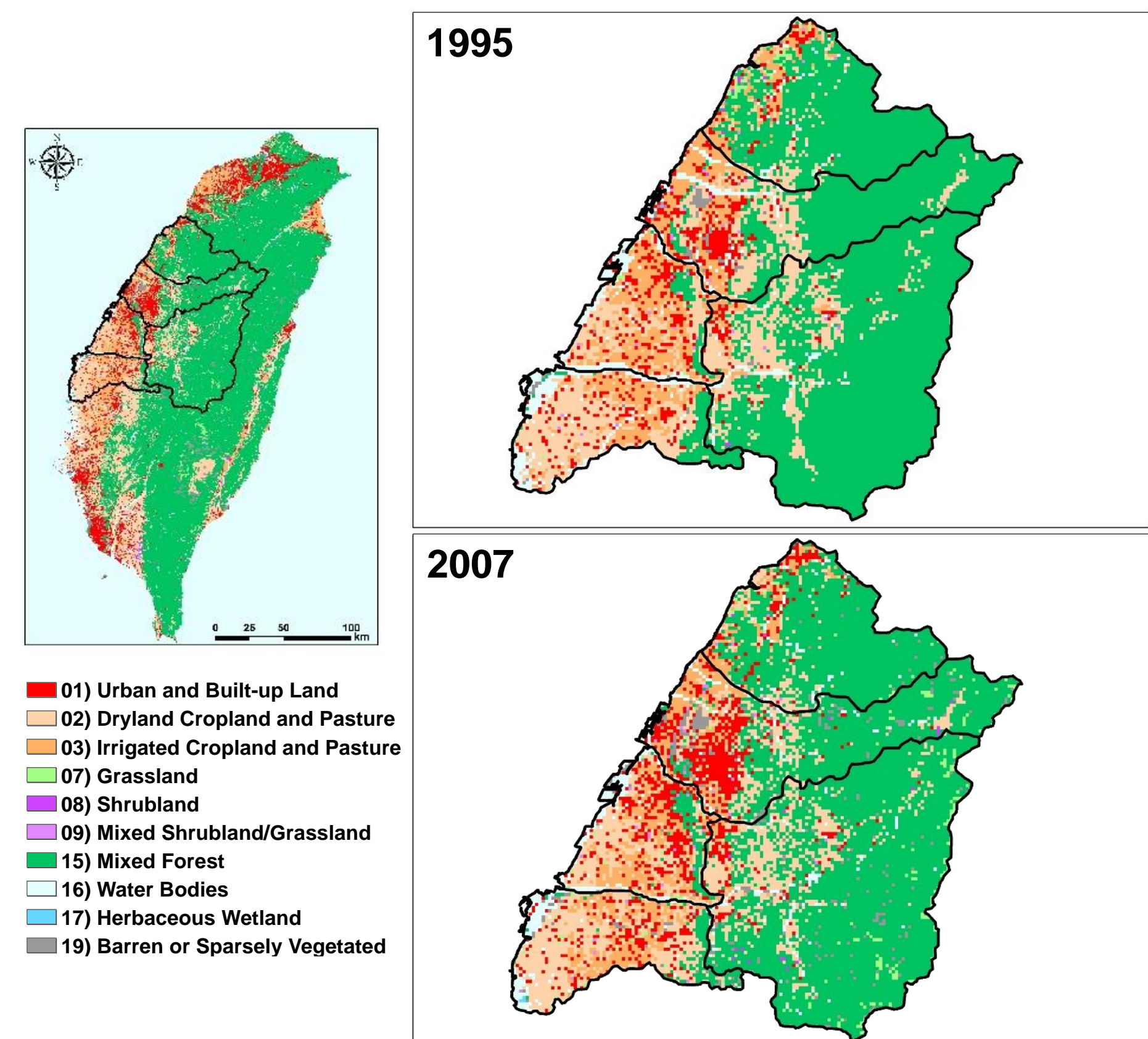


Figure 4. NLSC landuse/cover data of central Taiwan

## ● PRELIMINARY RESULTS

“Realistic” simulations that reflect land use/cover change in central Taiwan can induce **reduction** in latent heat (LH) and specific humidity (Q), **increase** in sensible heat (SH) and 2m temperature (T), and **enhanced** precipitation patterns.

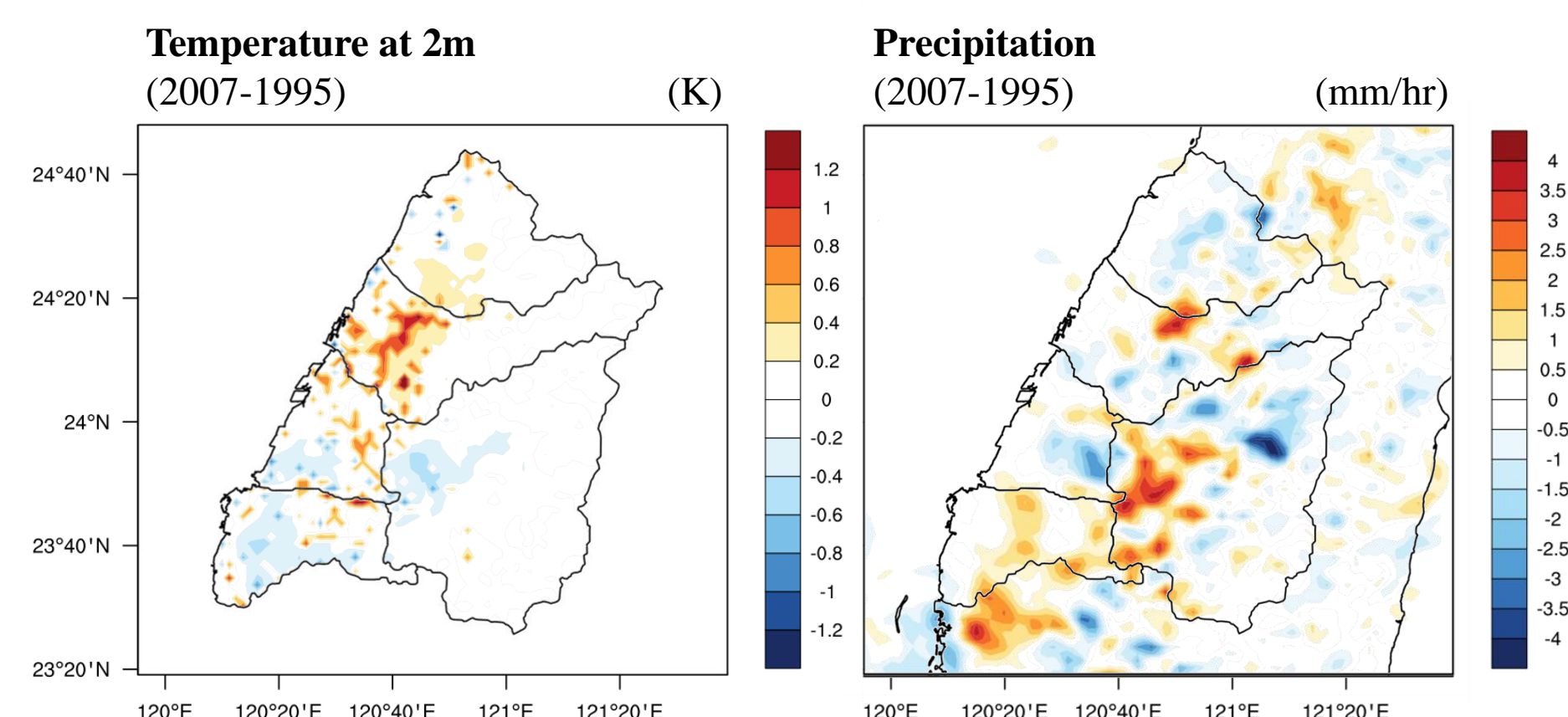


Figure 5. LUCC-induced changes in temperature and precipitation.