

Exploring Impacts of Land-Cover Conversion on Regional Convective Heavy Rain Events in Metropolitan Areas in Taiwan

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The heavy rainfall is recognized as one of the most frequent and widespread severe weather events in many regions. In the recent years, the intensity and frequency of heavy rainfalls and the consequent hazards (e.g. urban flooding, flash floods, landslides, and so on) are becoming major environmental issues over different temporal and spatial scales. Many studies regarding the long-term statistics of rainfall events found that in many regions, the characteristics of heavy rainfall events are underlying significant variations and strongly affecting the regional water cycles and microclimate. Among these factors, the conversions of land-use/land-cover (LULC) is drawing much more attentions because the changes in LULC directly lead to the variations in thermodynamical and mechanical properties of the different land surface types, and further alter the triggering patterns of the consequent convective heavy rainfall events.

In this study, we used a series of analysis to quantify how the conversion of LULC and urbanization process influence the properties of convective heavy rainfall events in the Taipei metropolitan area in northern Taiwan. First, we used analytical slab model to capture the triggering of convectively rainfall events by simply using the surface observation. Second, we applied the long-term statistics to quantify the trends of convective rainfall events and the results showed that the frequency of convective rainfall events is increasing in the past decades in Taipei. Finally, we used a mesoscale numerical weather forecast model to simulate the physical properties of the convective heavy rainfall events under different historical land use compositions, and the results showed that the patterns are highly correlated with the LULC in Taipei.

Keywords: Convective rainfall, Land cover change, Urbanization, Surface energy budget