**Building an observation and modelling framework to explore the eco-hydro-climatology in the montane forest of Taiwan**

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**Background and Problem Statement**

Chi-Lan montane forest, located at 1650 m above mean sea level in the northeastern Taiwan. Both frequent afternoon fog water and more than 3000 mm annual precipitation serve as plentiful water sources to Chi-Lan’s ecosystem both horizontally and vertically. However, the interactions between surface fluxes and atmosphere in such humid montane forests remain unclear. In this project, flux tower observations and land surface model simulations are utilized to investigate the carbon and water cycle. The surface carbon and water flux responses to the atmosphere may change under global warming, and thus, this well-instituted forest region can be used as a testbed to understand the change in montane forest under the climate changes.

The fog is usually formed at approximately noontime to the afternoon in Chi-Lan. The fog water plays an important role in supporting the fragile ecosystem and the local water cycle; however, accurate measurement of fog water interception in montane forest is challenging. Furthermore, the fog water source can be from the valley wind and the local evapotranspiration accumulates during the daytime. To what extent the climate changes and land use changes might alter its proportion is of great importance. We need both observational and modelling tools to decipher the coupled eco-hydro-climatology system in the montane forest. The study region of this collaborative project is yellow cypress (*Chamaecyparis obtusa* var*. formosana*) and Japanese cedar (*Cryptomeria japonica*) dominant montane forest over a 24,400 ha region on the Chi-Lan mountain area in northeastern Taiwan (23.98 N, 120.97 E). Mean air temperature and annual precipitation is 13°C and 4000 mm y-1. Elevations in this area range from 324 m to 2844 m asl. The geography of rugged terrain with the ocean nearby makes it subjected to the frequent occurrence of fog events due to orographic uplift. Several patches of old growth yellow cypress were cleared and regenerated or replaced with Japanese cedar in the 1960s. Broadleaf tree species were also recorded in the region such as *Dendropanax dentiger*, *Illicium anisatum*, *Machilus thunbergii* and *Lindera communis*.

This project is the first attempt to measured NPP and the fog-interception in Chi-Lan mountains. Also, we will explore the fog formation and its impacts on the earth system under climate change through direct measurements and numerical models simulations. In order to archive the goal, we propose two objectives in this project:

* An exhaustive regional assessment of carbon, water, and energy fluxes
* Explore the montane forest carbon, energy, and water cycle from land surface models

Through this project, an integrated eco-hydro-climate framework of observations and modeling will be built to evaluate the measurement of fog water interception and NPP in this montane forest and to explore how climate changes alter carbon, water, and energy cycles and how such alterations may impact the regional water resource.

The challenge and innovation of this project are the combined observations and modelling framework to study the interactions and feedback of ecology, hydrology, and climatology in this diverse ecosystem in Chi-Lan, which has not been explored thoroughly, especially under a changing climate system. This study provides the knowledge background and quantitative data to understand the carbon cycles, water cycles, energy budget, and flux patterns in low-latitude mountain forest ecosystem from watershed to regional scales.