（様式５）(Style5)

学位論文全文に代わる要約
Extended Summary in Lieu of Dissertation

氏名： Chuan Zhang
Name

学位論文題目： Determination of Structures and Parameters of a Hydrological Model
Title of Dissertation （水循環モデルの構造とパラメータの決定に関する研究）

学位論文要旨：
Dissertation Summary

The objectives of this thesis are to apply different hydrological models (lumped model and semi-distributed model) in three forest catchments with different vegetation covers, and to provide a method for establishing an evapotranspiration sub-model in a field scale area. The thesis has been structured with an aim of presenting the research contributions within a framework of hydrological model and their application to understand effects of vegetation covers no hydrological and soil properties in different forest catchments. This dissertation is organized into six chapters.

Chapter 1 described the hydrological models based on model structural and spatial distribution.

Chapter 2 described the differences between theoretical and conceptual model for representation of some hydrological processes.

In Chapter 3, an hourly time step lumped conceptual model was applied to analyze the effects of forest type on soil physical properties and hydrological processes in two forest catchments with different forest types. To reduce the variable number of model parameters for the two catchments, the model parameter of outflow coefficients of ground water was determined by inspection of a hydrograph during the year in which annual rainfall was small; 1032mm and parameters of percolation rate were determined by an analysis of the storm water balance. The remaining parameters were calibrated by the Shuffled Complex Evolution (SCE) method using two years data.

In Chapter 4, a semi-distributed hydrological model, comprising two types of land use (forest and upland field), was applied to an upland field catchment to understand the integrated effects of reclamation on the hydrological cycle. Due to the difficulty of measurement of runoff from a forest area in the upland field catchment, another neighboring forest catchment was selected as a reference for determination of the model parameters of the forest area and comparison of a water balance with the upland field catchment. The model parameters, which were determined using the SCE method, were compared between the two catchments. In the upland field area, the ratio of actual evapotranspiration to potential evaporation was calculated using an evapotranspiration (*ET*) sub-model. In which, the model parameters of the *ET* sub-model are calibrated by rainfall-runoff data.

In Chapter 5, an additional approach for estimating actual evapotranspiration was conducted based on field measurement in a field scale experiment. In this field scale study, the total evapotranspiration and soil evaporation beneath the canopy were measured in a maize field using Bowen ratio energy balance method and micro-lysimeters, respectively; the variation of evapotranspiration and evaporation during maize growing stage were presented; the crop coefficient and soil evaporation coefficient were determined based on the actual measurements of evapotranspiration and soil evaporation; the relationships between leaf area index (LAI) and the crop

coefficient (K_c) and the ratio of soil evaporation (E_g) to actual evapotranspiration (ET_c) were obtained. From the results, the actual evapotranspiration can be estimated in a field by measurement of LAI.