CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The design of a water resource system inevitably depends on the predictation of likely flows over the economic life of the system. Reliance on historical records only has been criticized because it is not likely to be repeated in the future and it provides only one sample of possible futures and is insufficient to measure the uncertainty in system response that is assignable to variability in hydrology. Synthesized streamflows have become an important tool to the planner of a water resource system because, when used in conjunction with computer simulation, they allow the planner to evaluate proposed system designs more thoroughly and in a more statistically sophisticated manner than was possible with previously available methods. The generation of hydrologic data does not add information to the observed record. But taking into account the stochastic nature of hydrologic data is a more efficient use of the data than the traditional techniques based on the observed historic sequence. "Synthetic flows or stochastic data do not improve poor records but merely improve the quality of designs made with whatever records are available." (Fiering and Jackson, 1971, p.24.)

1.2 STATEMENT OF THE PROBLEM

It is possible to state that most of water resources projects always rely on historical records. Then, an important aspect in the design or planning of water resources system is the availability of historical data such as streamflow records, rainfall records. It is widely expected that the longer the record available yields the

better planning or design. For example, the brevity of existing streamflow records almost always impairs the precision of the final designs of river-basin developments that are analyzed by simulation techniques. However, in practice data available are usually too short to be used. In order to have longer length of records, one must extend the existing data. This can be achieved by streamflow generation schemes.

Sometimes, though a long historical record is available a large number of sequences resembling that historical one are required in, for example, simulation and optimization techniques in order to obtain several comparable results. Another important consideration is that even with a record as long as, say, 50 or 100 years, it may still lack some critical information such as low or high flows-inherent in the statistical population of river flows. If the most severe droughts or floods on record are not representative of the statistical population, it is obvious that the design will become distorted.

It would be most desirable then to have a record that is long enough to represent conditions as they will be during the project life as if the historical record acts. Generally speaking, it has to resemble the historical record in terms of some statistical parameters and, when applied to actual work, would yield the same result as the historical record.

To have such the record, some methods of extrapolating the existing one must be devised. This may be overcome due to the existence of the hydrologic data generation techniques. This study attemts to present some important models for the generation of streamflows at one particular site, termed as "single-site generation".

1.3 OBJECTIVE OF THESIS

1. To apply the various models to generate streamflows for a

set of Northern Thailand streams and compare the performance of the model.

2. The application computer program for each of the discussed models is developed for practical use.

1.4 SCOPE OF THE STUDY

There are serveral models that exist at present for generating streamflow data. They can be broadly classified into two groups, namely, the short memory models and long memory models. Markov and ARMA models belong to the first group while the fractional Gaussian noises and broken line processes belong to the second. The Markov model has been widely used in the past because it is simple, easy to apply and well documented. The main criticism against its use is that it does not produce drought sequences severer than those observed in the historic record and it fails to preserve the Hurst phenomenon. Fast fractional Gaussian noise model and broken line process have been developed to model the Hurst coefficient explicitly. However, because of the degree of complexity and the relatively large requirement of computer time, they have not been widely used by the hydrologists. Hence as part of this thesis it became necessary to develop these models fully for practical application and test them with actual data. In this thesis, seven monthly streamflow generation models are Thomas-Fiering model, Two-Tier model, Disaggregation model, method of fragments, First Spolia Chander model, Second Spolia Chander model and Sen model, included some modifications. The process of generation can be broadly classified into two stages. Annual data is used initially and then monthly data at a latter stage.

The primary objective of this study is the assessment of single-site streamflow generation models. Thus, no attempt is made to justify all the statistics by application of an appropriate statistical test; only the synthethic and historical sequences are

tabulated to establish the compatibility of various statistics by visual inspectation. In this study 1000 years of data are generated for each river in each of the models.

1.5 LAYOUT OF THESIS

The work carried out in this thesis is shown schematically in Fig. (1.1). Chapter one consists of introduction, statement of the problem, objective of thesis, scope of the study and layout of thesis. Chapter two deal with the literature review in synthetic hydrology. Chapter three gives the list of data rivers, map used in this thesis and their historical annual parameters used in model comparison. The generation of annual flows is deat with in chapter four and five. In chapter four, short memory annual flow models is described and applied to actual streamflow data using autoregressive (AR) model and autoregressive moving average (ARMA) model, including some modifications. Chapter five, long memory annual flow models is described and applied to actual streamflow data using fast fractional Gaussian noise (ffGn) and the broken line (BL) process, which are modified to generate skew flows. Chapter six deals with the generation of monthly flows and the application to actual data. The conclusions and recommendations obtained from the study are given in chapter seven.

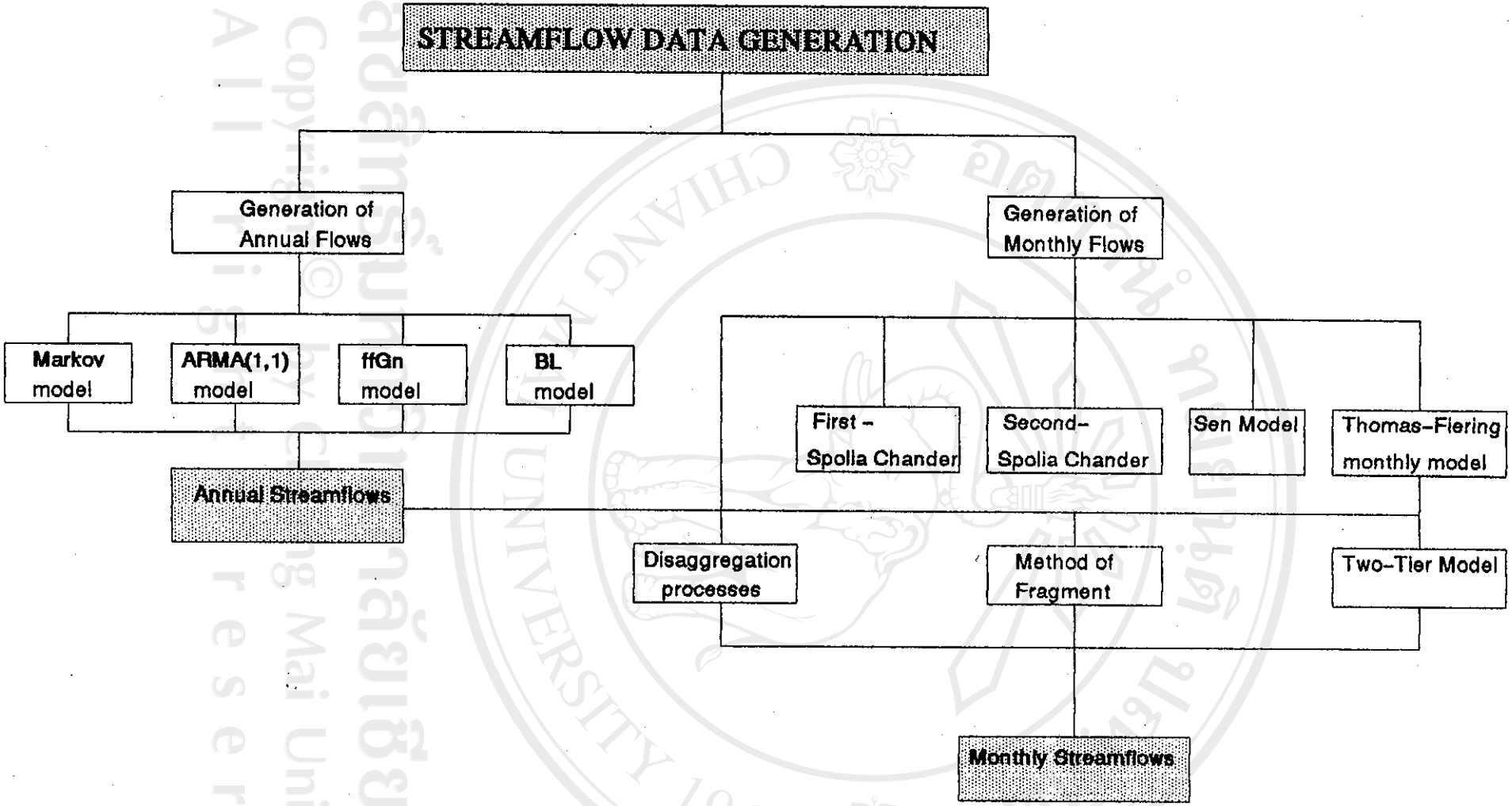

FIGURE 1.1 ANNUAL AND MONTHLY FLOW GENERATION MODELS