利用長期天氣展望與其不確定性之流量超越機率推估—以石門水庫入流量為例

Exceedance Probability of Streamflow Based on CWB's Long-Term Weather Outlook and Weather Outlook Uncertainty: A Case Study of inflow of Shimen Reservoir

國立台灣大學生物環境系統工程學系

博士生	副教授
黃群展	許少瑜
Qun-Zhan Huang	Shao-Yiu Hsu

摘　要

中央氣象局(CWB)的天氣預報產品提供近未來天氣情境之可能性。在研究文獻中，此產品被用來推估未來水文條件，如河川流量之超越機率。過去研究多直接採用預報提供之機率，然而這些提供未來天氣(降雨、溫度)類別之可能性的天氣預報產品，如季天氣展望、月天氣展望，本身隱含不確定性。因此天氣類別發生的可能性應基於當下天氣展望以及過往歷史資訊進行修正，即推估已知 CWB 天氣展望時天氣類別之後驗機率。本研究利用邏輯迴歸(logistic regression)線性分類法計算以之月天氣展望下天氣類別之後驗機率。基於此後驗機率，我們以相同比例生成各類別天氣時間序列(隨機模擬)，接著投入水文模式中獲得模擬流量，將模擬流量排序後得到河川流量之超越機率。因此，本研究提出天氣預報產品新的應用方式，並以月天氣展望與石門水庫入流量超越機率推估為研究案例。其結果顯示(a)月天氣展望所提供之類別可能性與類別發生頻率正相關但並不相同；(b) 線性分類法之天氣類別命中率平均受訓練資料長度(52 周至 205 周)影響並不顯著。

關鍵詞：長期天氣預報，河川流量超越機率，邏輯迴歸，天氣類別之後驗機率

Abstract

Central Weather Bureau (CWB) of Taiwan provides weather forecast products that predict possible near future weather scenarios and had been used to evaluate future hydrological conditions, such as the exceedance probability streamflow in literature. Previous studies usually directly adept the probability provided by these weather products; however, these products, e.g. "long-term weather outlook", which indicates the likelihood of categories

of future long-term weather (precipitation and temperature) have inherent uncertainty. Therefore, the probabilities of future weather categories should be modified based on historical information. In other words, the posterior probability of each category that is conditional on the CWB's weather outlook should be estimated. In this study, we applied a linear method for classification called logistic regression to predict the likelihood of future weather categories based on the given CWB's weather outlook. According to the posterior probabilities, we generated the number of the time-series weather data belong each category in the same ratio. We obtained the exceedance streamflow probability by applying the weather series in a hydrological model and ranking the simulation results. Therefore, we provide a novel application for original weather forecast products, and also demonstrated an example with Shimen Reservoir's inflow and the CWB's monthly weather outlooks. The case study results show that (a) the likelihood of a category indicated by the outlook was proportional to the frequency of the category occurring, but not the same. (b) The hitting rate of the classification was not obviously influenced by the lengths (52-205 weeks) of training data.

Keywords: Long-Term Weather Outlook，Exceedance Probability of Streamflow，logistic regression，posterior probability of weather categories