

國立臺北大學自然資源與環境管理研究所

102 學年度第二學期『環境災害與風險管理』

課程講義 (8)：風險評估數學概要與極值統計學

Introduction to Mathematics for Risk Analysis and Statistics of Extremes

<http://statisticaloutsourcingservices.com/Outlier2.pdf>

A Review of Statistical Outlier Methods

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.135.3825&rep=rep1&type=pdf>

Statistics of extremes in hydrology

<http://ind.ntou.edu.tw/~klee/hydrology/CH.9.pdf> 水文統計與頻率分析

<http://web.iitd.ac.in/~chahar/Courses/CEL251/ROUTING.pdf> Flood and Flood Routing

● INTRODUCTION

- Acceptable Risk, Probability of Exceedance, and Extremes
- Outlier vs. Extremes; Outlier Test (Woodside and Kocurek, 1997)
 - ⇒ Method based on Inter-Quartile Range: $IQR = Q_3 - Q_1$; $Q_1 - 1.5IQR$ $[Q_3 + 1.5IQR]$
 - ⇒ Grubbs' T Test; Dixon's Outlier Test; Youden's Rank Test for Laboratories
- Extreme Event Analysis and Extreme Value Theory

● FUNDAMENTAL STATISTICS RELATED TO RISK

- Mode, Mean, Median and Range; Higher Order Moments
- Outliers vs. Extremes; Risk, Safety and Reliability
- Normal Distribution and 6-Sigma => Standard Deviation, Normality => Log-Normal
- Value at Risk (VaR): Originally VaR was intended to measure the risks in derivatives markets. Currently VaR is widely applied in financial institutions to measure all kinds of financial risks

● STATISTICS OF EXTREMES

- What are Extreme Value Statistics (<http://www.assessment.ucar.edu/toolkit/index.html>)

Extreme value statistics are used primarily to quantify the stochastic behavior of a process at unusually large (or small) values. Particularly, such analyses usually require estimation of the probability of events that are more extreme than any previously observed. Many fields have begun to use extreme value theory and some have been using it for a very long time including meteorology, hydrology, finance and ocean wave modeling.
- Statistical Distribution
 - ⇒ Gaussian Family: Normal and Log-Normal
 - ⇒ Extreme Type I: Gumbel Distribution
 - ⇒ Extreme Type III: Weibul Distribution
 - ⇒ Pearson Type III and Log-Pearson Type III
- Some Generic Approaches
 - ⇒ Weibul Plotting Position
 - ⇒ Q-Q Plot (Normality Test)
- Flood and Flooding Routing: Return Period vs. Design Flood
- Software Packages: [Palisade @Risk](#), [Oracle Crystal Ball](#)

