

2024 NTNU Summer student internship

指導老師：陳卉瑄 (師大地球科學系)

林冠全 (AON 保險經紀人股份有限公司 協理)

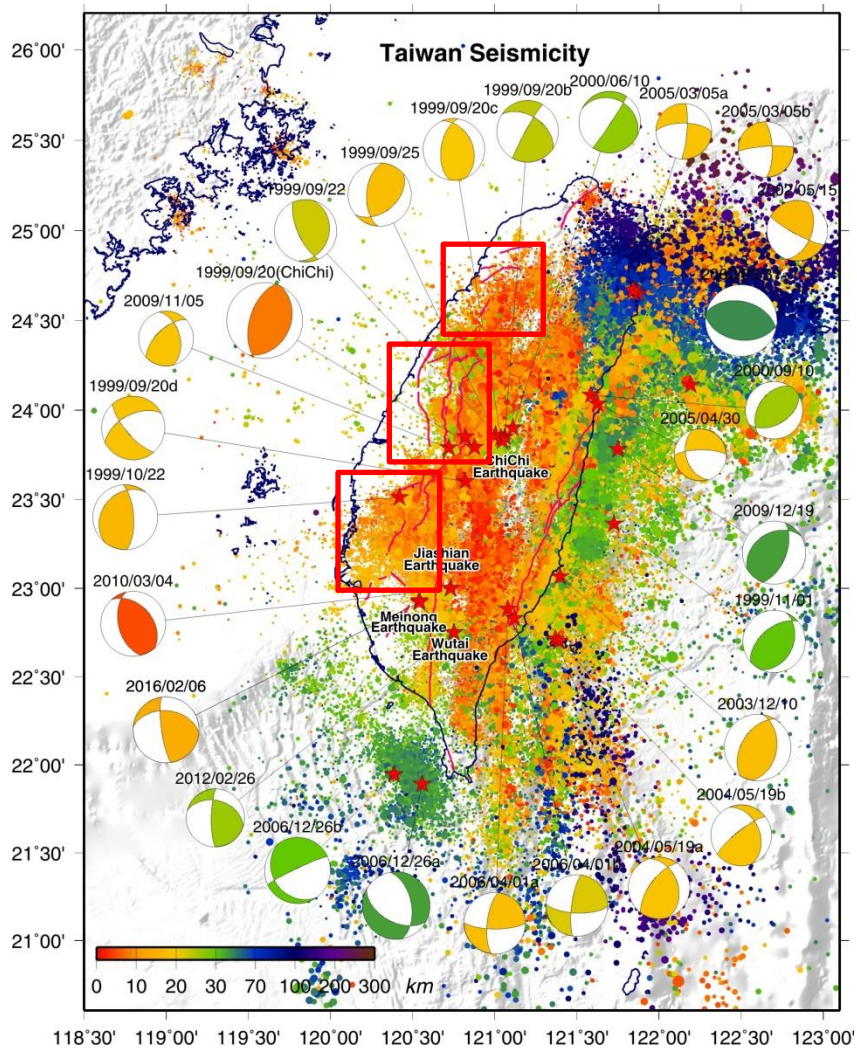
計畫主題：

地震活動對產業經濟活動之影響評估

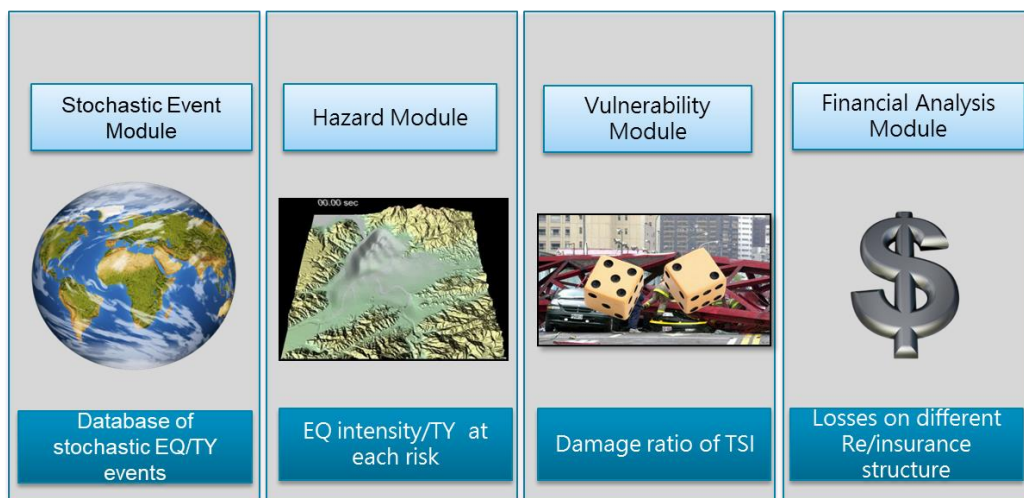
The impact of earthquakes on businesses

台灣的山脈主體為歐亞大陸板塊與菲律賓海板塊相互隱沒與聚合的結果，聚合邊界形成一系列的斷層，包含縱谷斷層和中央山脈斷層。聚合作用形成了山脈，易造成西部海岸平原受擠壓而隆起、產生許多活動斷層。這些活動構造在過去百年，造成了多起死亡人數近百人(或以上)之災害性地震：1906 年嘉義大地震(梅山斷層)、1935 年新竹台中地震(屯子腳斷層、獅潭斷層與神卓山斷層)、1941 年嘉義中埔地震(疑似盲斷層)、1946 年新化地震(新化斷層)、1951 年花東地震(米崙斷層、玉里斷層與池上斷層)、1964 年嘉義白河地震(疑似盲斷層)、1999 年集集地震(石岡斷層、車籠埔斷層與大尖山斷層)、2016 美濃地震(疑似盲斷層)。其中的集集地震規模為 7.3，造成 2471 人死亡，而保險損失為 5.58 億美元；2016 年美濃地震規模為 6.6，造成 117 人死亡，保險損失為 8.33 億美元。儘管其他天然災害如颱風、洪水、極端溫度事件亦會衝擊社會經濟發展，但在台灣，單一事件造成產業損失最嚴重的仍為地震。

隨著台灣產業的蓬勃發展，科學園區與科技產業的投資日益加大；而氣候變遷下的劇烈天氣事件更加頻繁和多變，了解天然災害對產業管理的發展是當今不可或缺的一項風險管理方式。而地震風險，是市場購買「巨災超額損失計畫」的承保和訂價之最重要驅動因素。對地震規模、發生時間、地點與活動斷層位置、分布與地表/結構物搖晃特性的瞭解，仍然是降低災害損失的最有效方法。台灣產業結構(農業、製造業、工業、金融保險業、半導體業、能源相關產業等)逐年因應世界趨勢而變，單一產業之地震風險為何？如何計算？而產業的總風險累積最大的區域又在哪裡？如何風險管理以協助組織降低損失？本暑期計劃將以台灣的地震風險計算和產業損失的風險管理為學習目標，期能利用歷史地震的危害度、暴露度和脆弱度之運算，配合現今之產業現況，進行風險評估和風險控制之初探研究。



圖一、台灣地震災害與產業聚落分布



圖二、巨災模型設計流程與模組。

The impact of earthquakes on businesses

The tectonic of Taiwan results from the collision between the Luzon Arc and the Chinese continental margin. In the northeastern part, the Philippine Sea plate subducts northwestward underneath the Eurasian plate along the Ryukyu Trench. In the southern part, the Eurasian plate oceanic lithosphere under the South China Sea subducts to the east beneath the Philippine Sea plate along the Manila trench. The major part of the island results from the strong convergence between the two plates with the main convergent boundary being along the Longitudinal Valley. The largest earthquake in the past century, Chi-Chi earthquake, it was the movement of the Chelungpu fault that registered 7.3 on the Richter scale in September of 1999, killed 2471 people. The final estimated insured loss was US\$ 558 million. 2016 Meinong earthquake (M_I=6.6; 03:57:26.1 Local Time; 22.92°N, 120.54°E; depth 14.6 km) is the largest event recorded in southwestern Taiwan in the last four decades. 117 persons were killed by this earthquake. The insured loss was US\$ 833 million. Although earthquake and typhoon/flood can give rise to significant catastrophe losses for Taiwan insurers, most agree that it is the earthquake that has the potential to cause the most severe catastrophe losses. Earthquake exposures are therefore the most significant driver of cover and pricing of the catastrophe excess of loss programmes purchased by the market. The largest accumulation of aggregate exposure for most companies is located in City of Taipei, HsinChu and Tainan, so it is these areas that are of particular focus in our study.