台灣大地震預警期的另一項曙光

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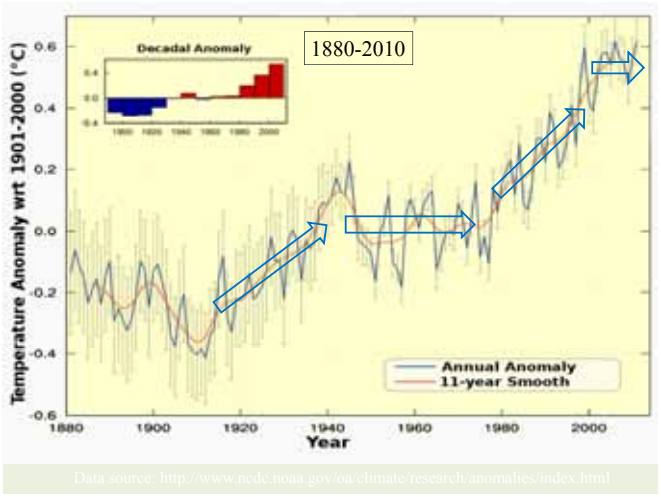
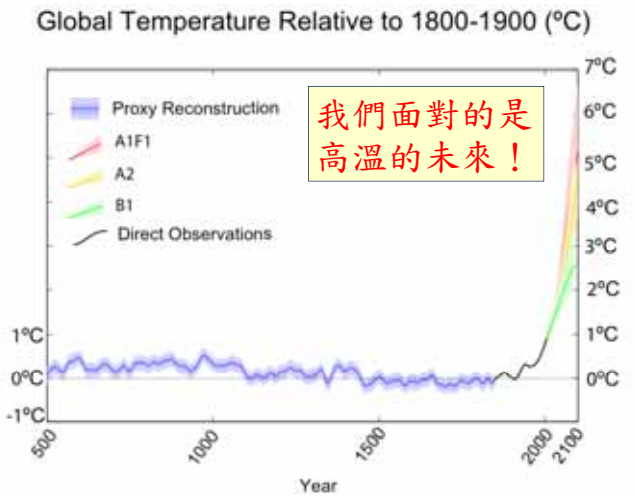
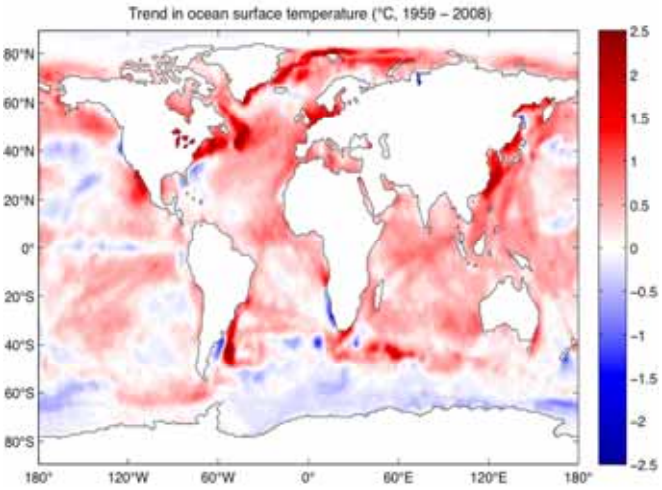
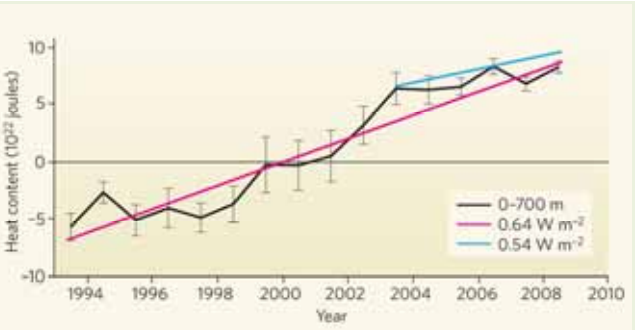
[3]國立中正大學地震學研究所



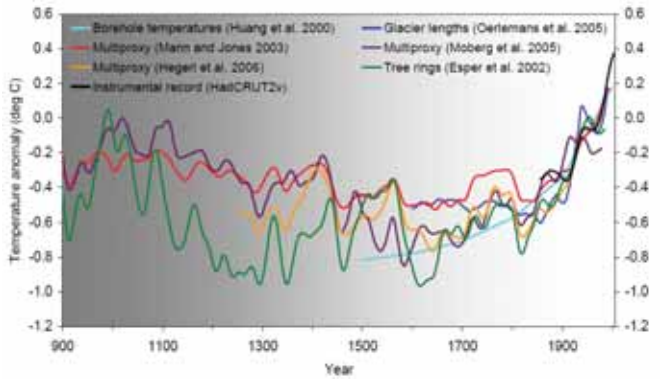
Data source: http://www.ncdc.noaa.gov/oa/climate/research/anomalies/index.html







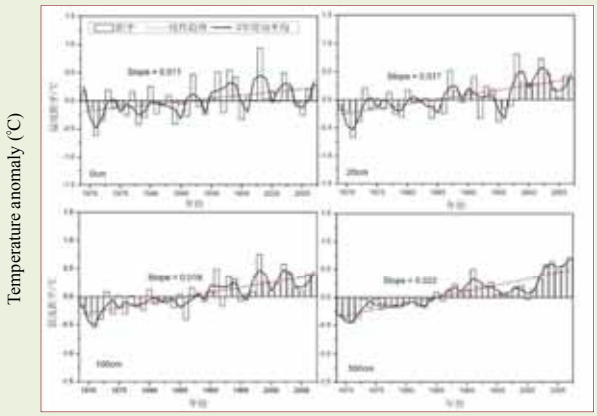
The warming ocean is revealed by changes in heat content from 1993 to 2008, shown by the black line with error bars, sampled the ocean to 700 m depth and gives an average warming trend of 0.64 W m^{-2} (red line). The data available from Argo floats since 2003 enable an estimate to 2,000 m depth (blue line). (Nature 465: 304, 2010)

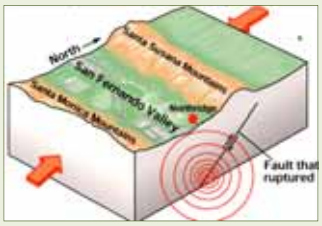


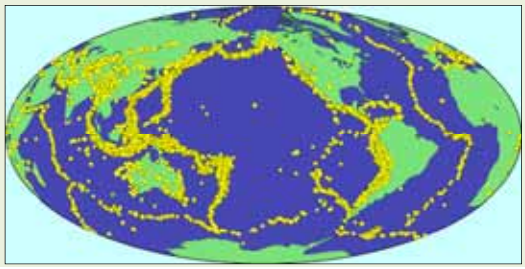
Comparison of selected reconstructions to instrumental record. The figure is taken from National Research Council (2006, Figure S1).

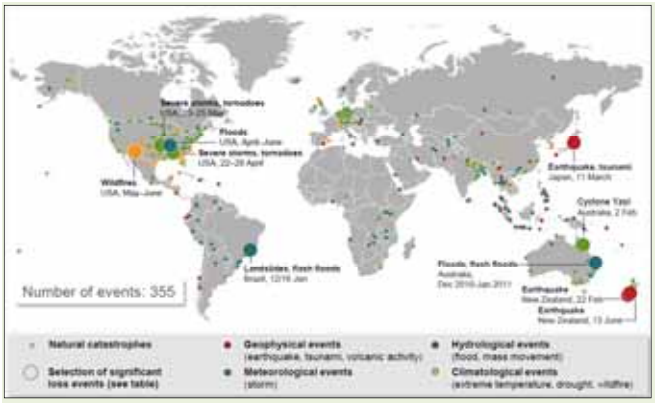
Soil Temperatures, 1969-2007

8-station（成功、恒春、花蓮、嘉義、台東、台中、新竹、宜蘭）average

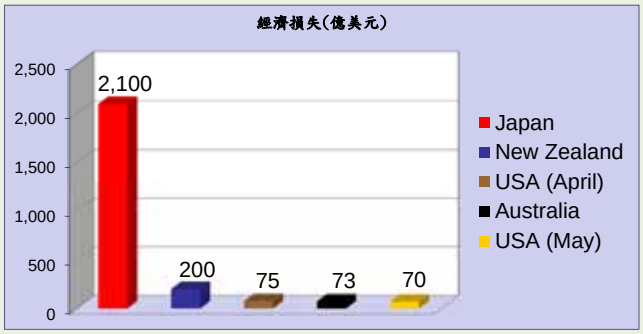




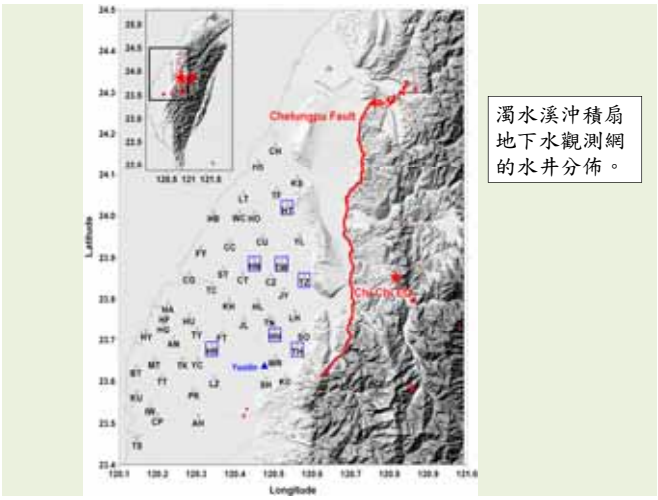




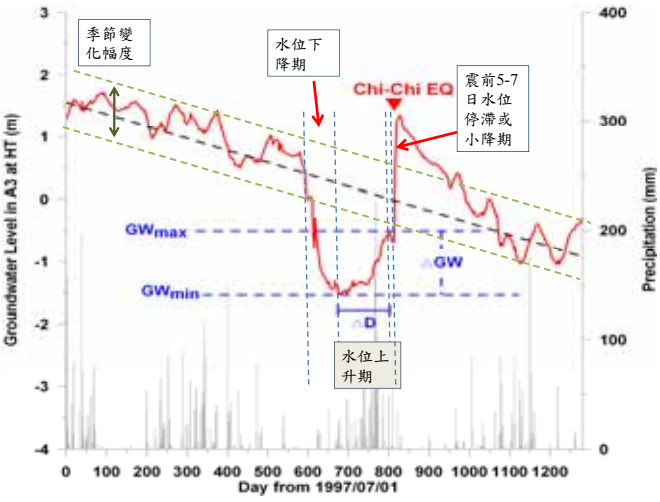
Natural loss events January – June 2011 (source: 2011 Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE)

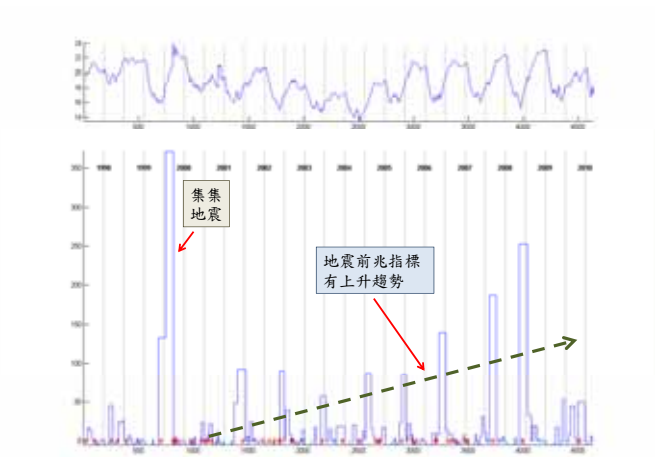


2011年上半年，全球天然災害造成的經濟損失便達2650億美元（約台幣7兆6千多億元），創下史上新高紀錄。全球天然災害造成的經濟損失，以311日本大地震和海嘯的2100億美元最高，其次是今年二月的紐西蘭基督城大地震，約損失200億美元。第三名是美國東南部的龍捲風災害，損失約75億美元；澳大利亞西南部去年十二月至今年一月間洪水為患，損失也高達73億美元。光是今年前半年的全球天然災害經濟損失，便已超越2005年一整年締造的2220億美元舊紀錄。



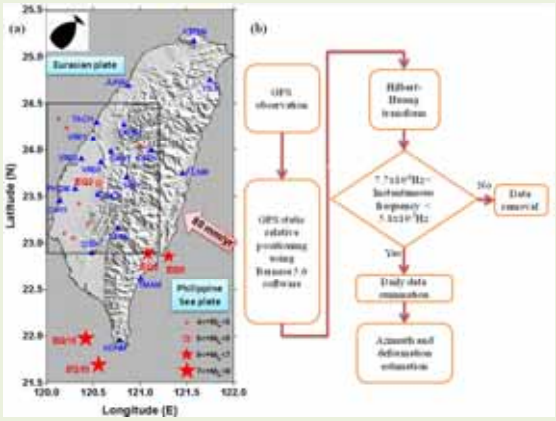
濁水溪沖積扇地下水觀測網的水井分佈。



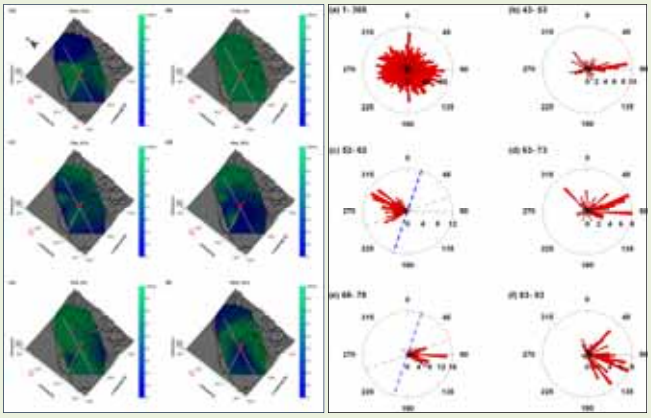


虎溪站(含水層三，觀四井)自1997年7月至2010年12月的水位紀錄與地震前兆指標的關係。

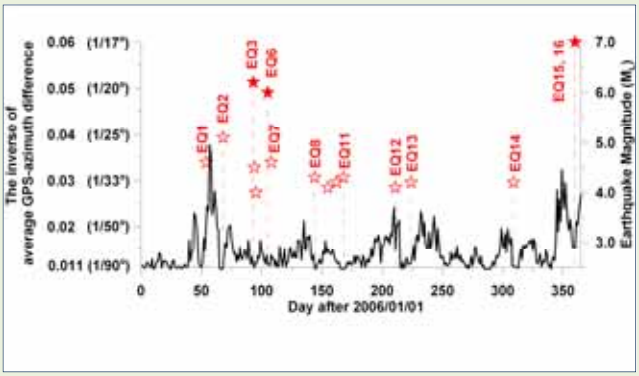
Data Analyses

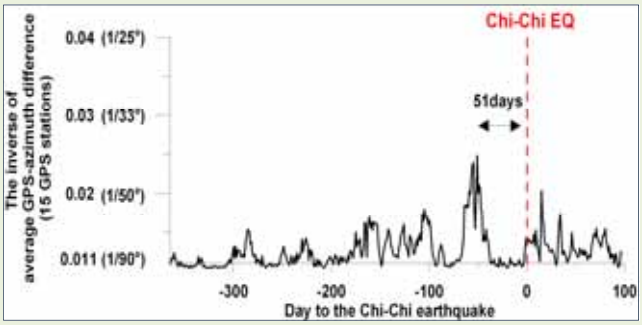


The GPS horizontal azimuths v.s. 雲林古坑地震 (2006-3-9; M_L=5.1)



The inverse of average GPS-azimuth difference in 2006

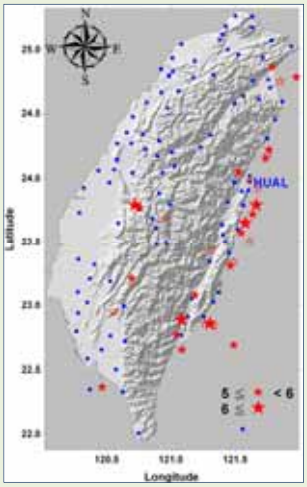




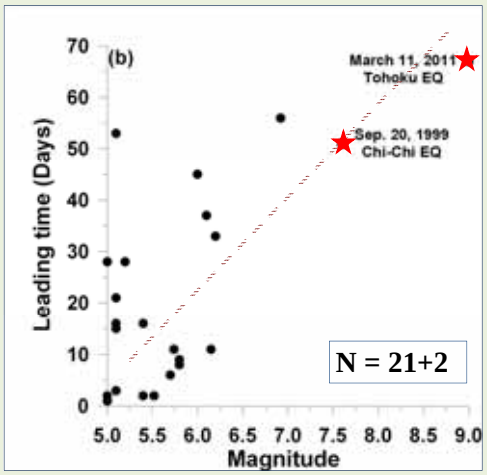
2006-2009

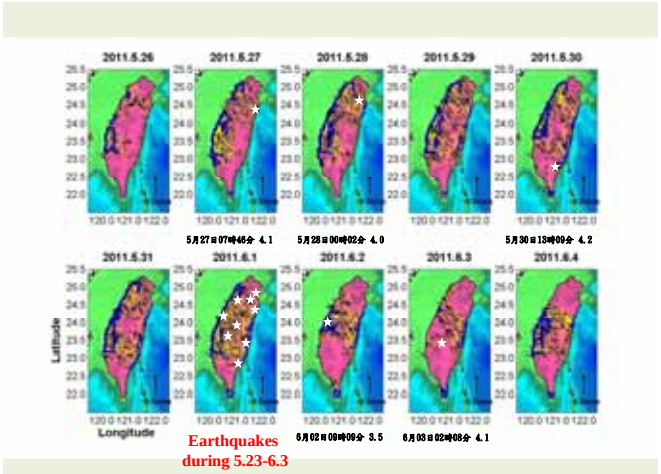
GPS = 99 stations

Earthquakes = 32

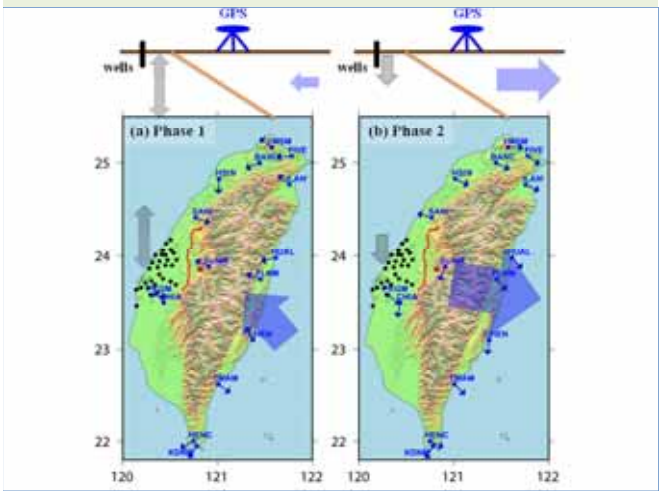


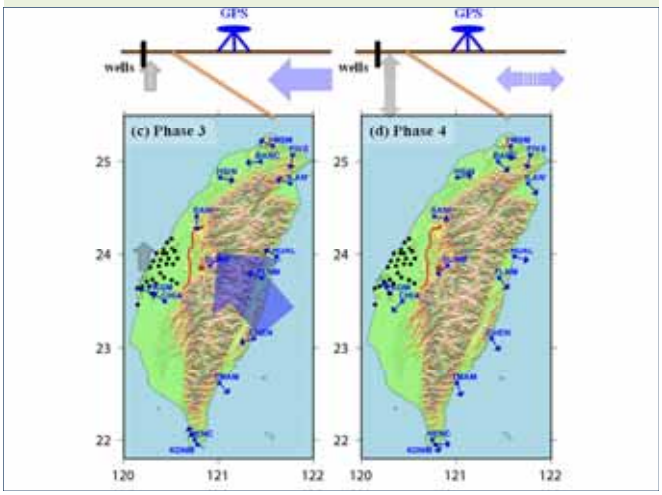
21/32 = 66%



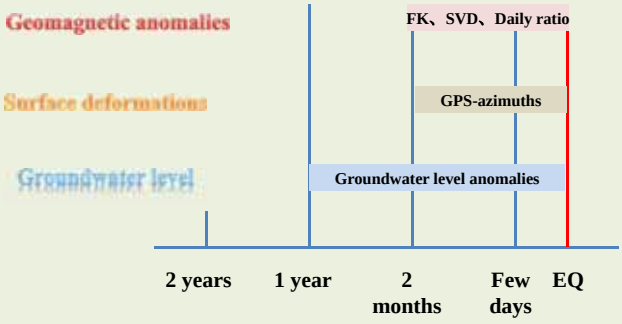


Earthquakes during 5.23-6.3





Summarization



- 台灣獨特的地質背景及密佈的觀測系統(GPS、地震儀、地下水位、地磁)提供一個絕佳的機會，讓我們深入了解地震發生前、後的地表及地下變形歷程，以及孕震的機制。
- 透過多重前兆指標(GPS、地震儀、地下水位、地磁)的交叉驗證，台灣有機會在未來幾年內，建立地震預警系統，將地震預警的時間提前到一個月以上，對知災、防災、避災、救災都會有重要的助益。
- 目前發展中的多重前兆指標預警系統，並不需要建立額外的觀測站，只需要將現有的觀測數據，進一步發揮潛在的功能即可。