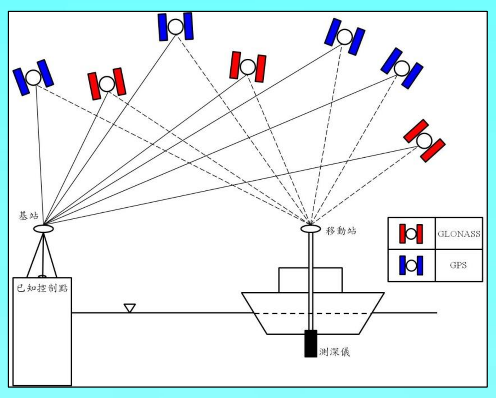
海洋地理資訊系統實驗室

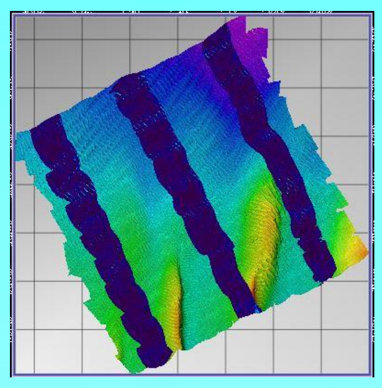
相關研究

• 以橢球高進行水深測量之探討

近年來發展出無驗潮水深測量的方法，需採用GNSS的橢球高，不需要觀測潮位，也可以避免觀測動態吃水及湧浪，可以降低一些傳統水深測量之誤差來源。無驗潮水深測量常用的衛星定位法包含：即時動態法、動態後處理(PPK)法、後處理精密單點定位(PPP)等，本研究探討發現後兩者之高程方向定位精度相當，而基站至移動站的距離各方法也有異，但仍需要注意部分資料有浮動解及所得的解高程精度不佳者；而傳統水深測量之潮汐改正需要特別注意潮位站及水深測區的潮時及潮位特性差異。無驗潮水深測量為以橢球面為參考的測量法，其所獲得的海底地形，也需要配合臺灣地區30”*30”網格的混合法大地起伏模式，轉換成以當地平均海水面為基準的水深，仍須考慮到區域性的大地起伏系統偏差量。最後再將上述轉換為正高系統的水深，與潮汐修正的傳統水深測量成果比較，兩者所獲得海底地形的較差絕對值99.9% 在20公分之內，兩者差異之原因可能來自該位置之大地起伏模式與系統差異值，另外缺乏較為精確之等潮區資訊造成潮汐延遲及潮汐振幅修正也是其中一項因子，而GNSS之橢球高觀測及計算的變動程度可能也會影響海底地形計算的結果。

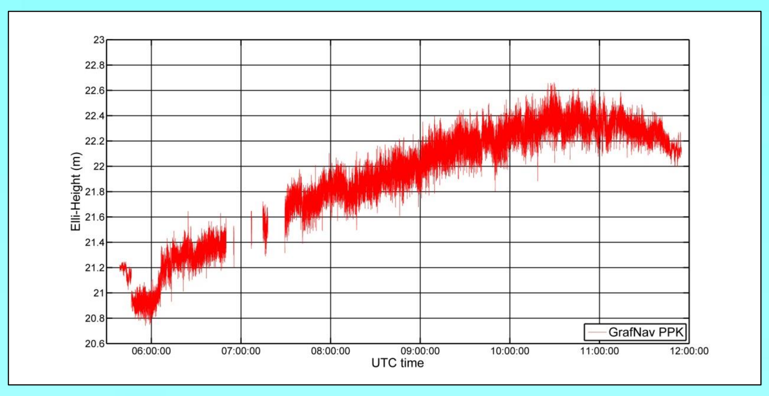


雙衛星系統動態差分定位原理



水深計算方法	傳統	無驗潮
檢核點數	5473402	5471688
誤差均值	-2.5cm	1.4cm
標準差	8.4cm	10.0cm
特等測深不符合點數	7005	7965
符合特等測深	符合	符合

交錯檢核之資料品質分析



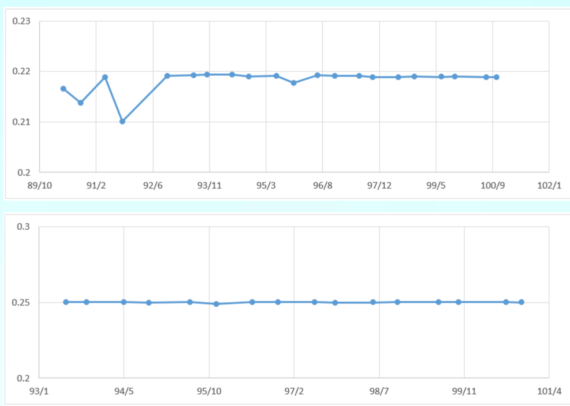
船載移動站解算橢球高時序列圖

無驗潮水深 - 潮位修正水深		
組距	網格數	百分比
0cm＜ 較差 ≦5cm	693376	56.089
5cm＜ 較差 ≦10cm	428296	34.646
10cm＜ 較差 ≦20cm	113333	9.168
20cm＜ 較差 ≦30cm	666	0.053
30cm＜ 較差 ≦40cm	344	0.028
40cm＜ 較差 ≦ 50cm	132	0.011
50cm＜ 較差 ≦100cm	58	0.003
總計	1236205	100

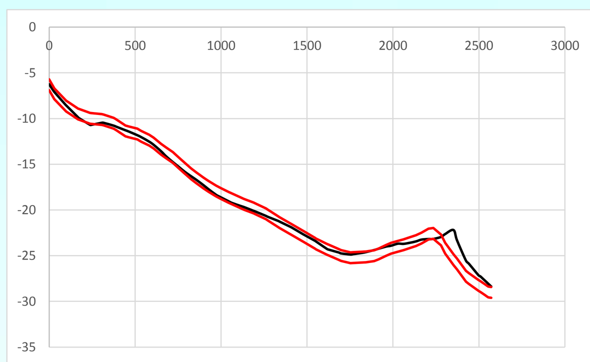
無驗潮與傳統之水深測量差異比較

• 臺北港附近海岸水深資料品管及地形變遷特性之研究—應用斷面迴歸與經驗正交函數分析

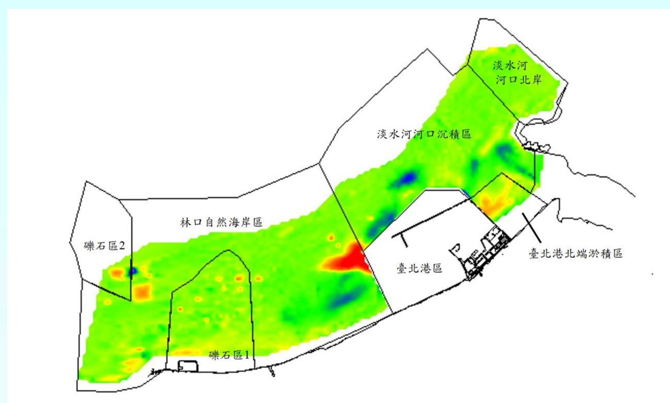
臺北港受建港施工之影響，許多文獻顯示淡水河、臺北港至林口海岸的海岸地形已產生變化，其中也發現有些水深測量資料有疑義，因此本研究利用斷面迴歸式及經驗正交函數分析探討水深資料品管，藉由迴歸品管範圍及經驗正交函數之時間EOF模態一皆可有效的進行水深資料品管。另外也應用侵淤圖、平均水深變化圖、土方變化圖、斷面變化圖及經驗正交函數探討臺北港附近海域之水深地形變遷，得知各分區區域主要的地形變異量位置與變異時間。本研究結果顯示：1. 90年至92年及95年的原始水深資料可能有疑義，2. 臺北港西堤西側受西堤興建影響，產生波浪反射掏刷影響，使地形產生變化，3. 臺北港附近海域於93年至100年主要地形變化位置為河口、臺北港周圍及林口外海，98年6月臺北港外廓防波堤外側產生隆起，應為受臺北港外廓防波堤興建之影響，之後便長期存在，4. 礫石區2在與林口自然海岸區之交界，水深約22公尺處，地形變化較大，造成此區變化甚大之原因應更進一步探討。本研究以更多面向的方式來得到地形變遷更多的資訊，由平均水深變化及土方量變化可以了解地形隨著時間的變化趨勢，由斷面套疊可得知詳細地理位置之地形變化，由侵淤圖及經驗正交函數分析則可以針對地形變異的時間及位置進行探討，藉由分區的方式也得到比整體分析更多的資訊，綜合以上方式則可以更完整的瞭解臺北港海岸變遷情形。

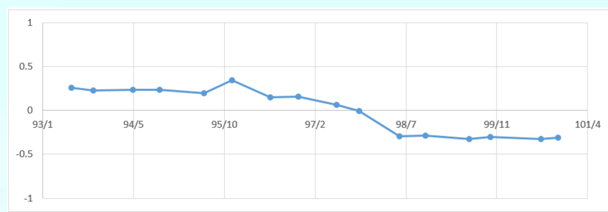


空間EOF模式一之資料品管



斷面均方根誤差之資料品管

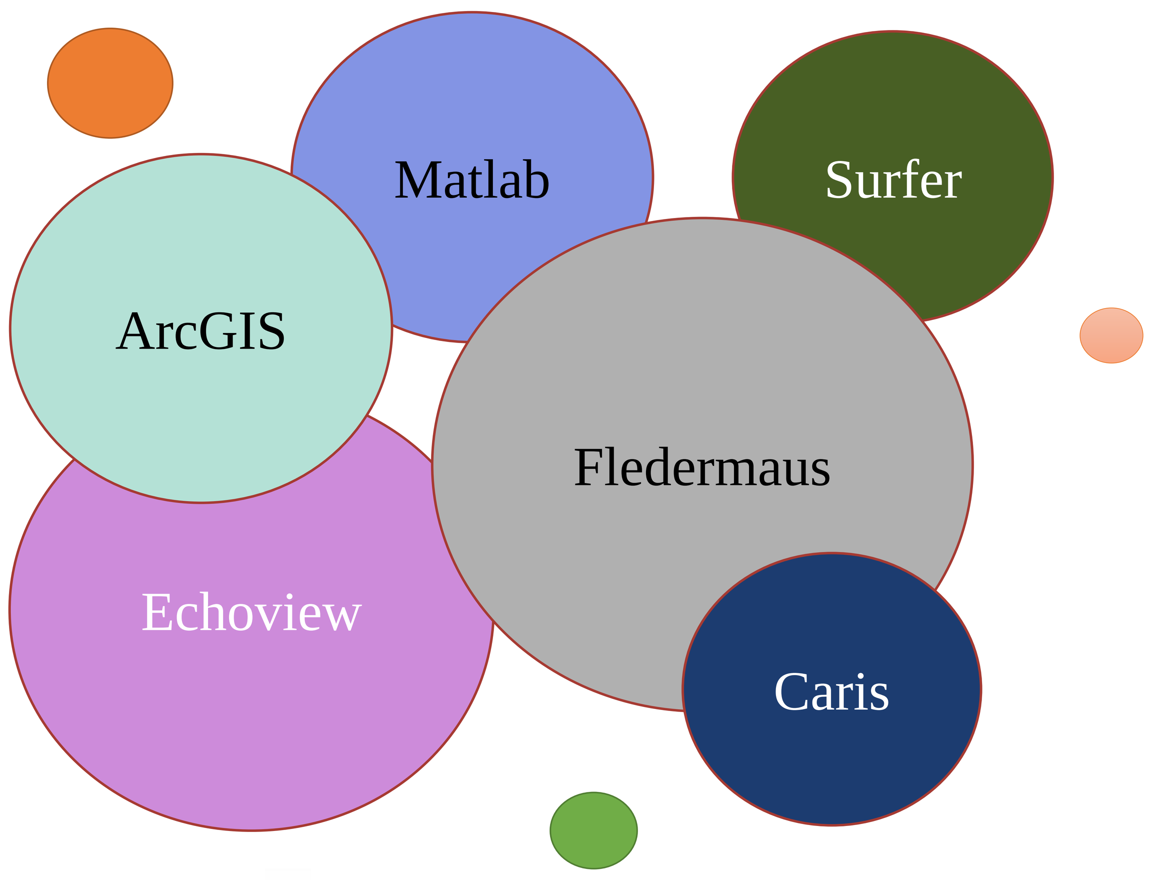




時間與空間EOF模式之地形變遷探討

資料蒐集

使用軟體

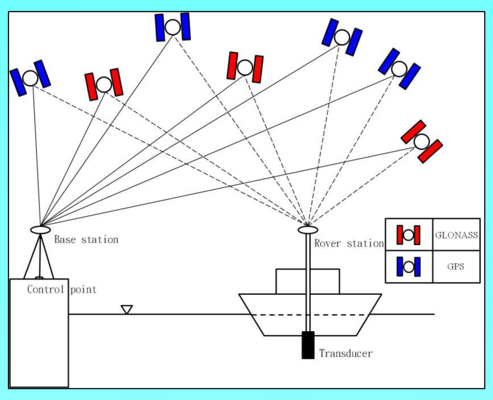


Marine Geographic Information Systems Lab.

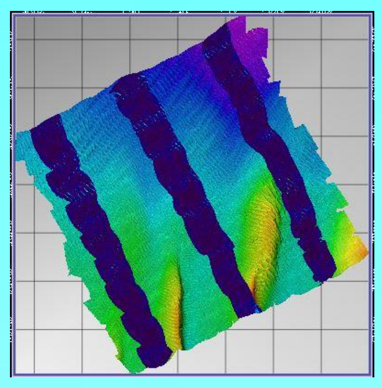
Research

• Study on the Ellipsoidally Referenced Bathymetric Survey

Recently, Bathymetric survey without tide observation can reduce some error sources from dynamic draft, heave and tide. GNSS high accurate positioning methods for bathymetric survey without tide observation include Real Time Kinematic (RTK), Post Processed Kinematic (PPK), and Post-Processed Precise Point Positioning (PPP). This study found that PPK and PPP have equivalent accuracy, and different positioning method have different effective distance between base station and mobile station. But it still need to be noticed that whether ellipsoid height is float solution or fixed solution. Traditional bathymetric survey also had been investigated on the tide correction difference by using different tidal stations. Bathymetric survey without tide observation is an Ellipsoidally Referenced Surveys (ERS). These ellipsoid-based bathymetry needs to use 2013 Taiwan Hybrid Undulation Model with grid resolution of 30”*30” to transfer water depth to the datum based on Mean Sea Level. Local undulation offset also needs to consider for this transformation. Then, water depth from traditional bathymetric survey with tide correction can be compared with bathymetric survey without tide observation. This study shows the percentage of data difference between two bathymetric survey methods which smaller than 20 cm is 99.9%. The reason cause the difference could be the geoid model and system deviation of geoid model. In addition, lagging of tide and tidal amplitude are also the factors due to lacking of good co-tidal zone information. As well as the variation of ellipsoid height could influence on bathymetric survey result.

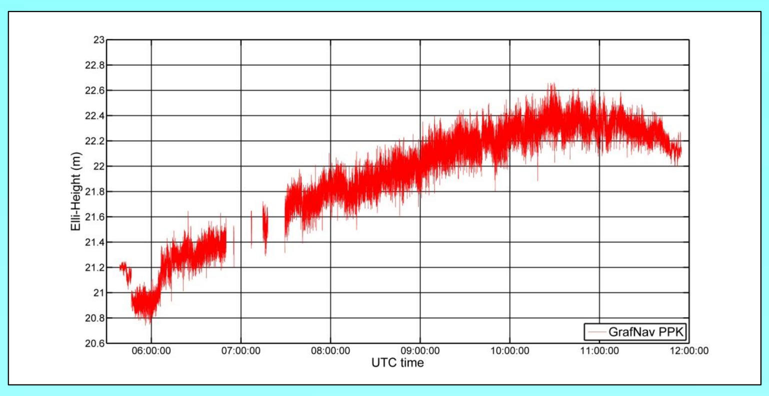


Differential GNSS (GPS+GLONASS)



Bathymetric survey method	Tradition	Without tidal observation
Number of points of comparison	5473402	5471688
Mean	-2.5cm	1.4cm
Standard devation	8.4cm	10.0cm
Number of rejected point in special order	7005	7965
Special order accepted	Yes	Yes

Cross check quality control



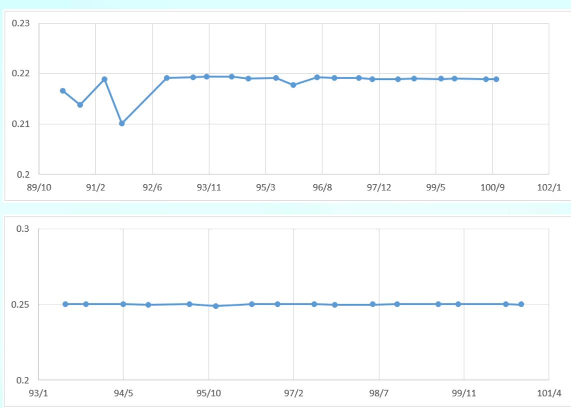
The GNSS ellipsoid Height time series on ship mounted rover station

The depth difference of two bathymetric survey methods		
Class interval	Number of grids	Percentage
0cm＜ d ≦5cm	693376	56.089
5cm＜ d ≦10cm	428296	34.646
10cm＜ d ≦20cm	113333	9.168
20cm＜ d ≦30cm	666	0.053
30cm＜ d ≦40cm	344	0.028
40cm＜ d ≦ 50cm	132	0.011
50cm＜ d ≦100cm	58	0.003
Total	1236205	100

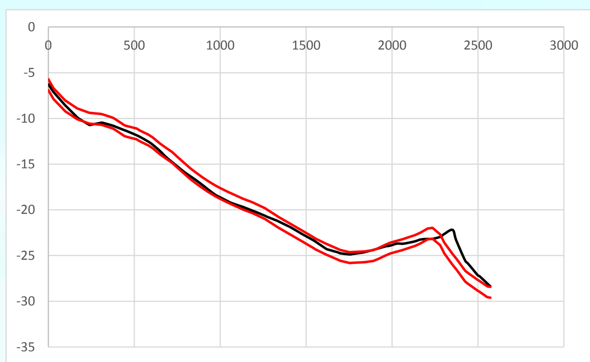
The differnce between two bathymetric survey methods

• Bathymetric data quality recheck and morphological changes in coastal area around Taipei Port - Application of profile regression and Empirical Orthogonal Function

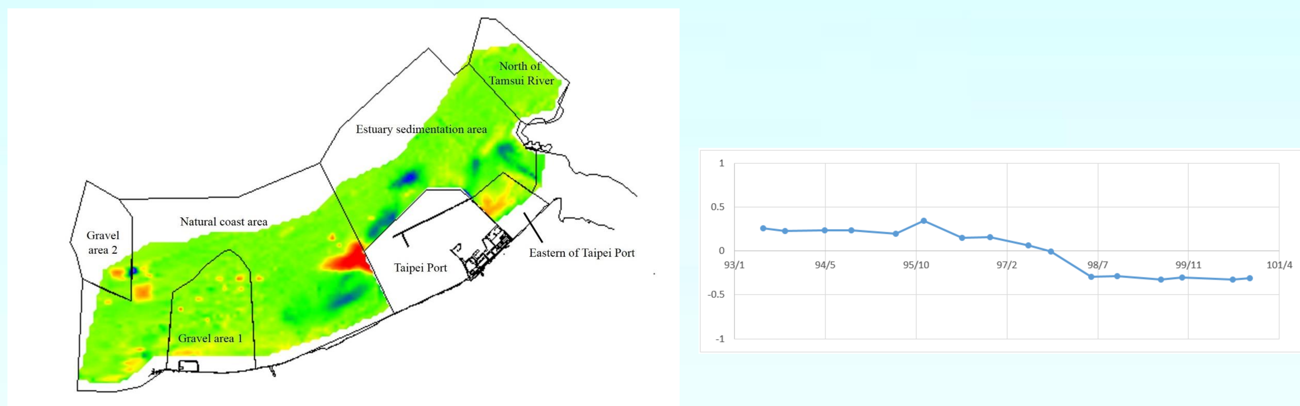
Many literatures revealed coastal morphology at Tanshui River, Taipei Port and coast of Linkou has changed, because of construction of Taipei Port. And literatures also can find that some doubt bathymetry data. Cause of some doubt bathymetric data, data are rechecked by recheck range of profile regression and Empirical Orthogonal Function (EOF) time mode 1. Erosional and depositional patterns, average change of depth, volume change, overlay of profile and EOF are also used to analyze coastal morphology. Integrate the results of the study. First, bathymetry data in the year 2001 to 2003 and 2006 are abnormal. Second, morphology changed at west of Taipei Port cause of waves. Third, morphology of gravel area 2 at the depth of about 22 meters changed significantly. It is consistent with the morphological uplift at northwest of Linkou Power Plant. What cause that is worthy to further investigate. Finally, affected by construction of breakwater, area at north of breakwater was uplift in June 2009. And that uplift was stay for a long time. The study get more morphological information with more ways. By changes of average depth chart and volume change analysis can roughly see the trends of morphological changes. By overlay of profile can see the changes more detailed on location. And by invade and silt picture and EOF can get more detailed information on time and space. Using separate zone to study also get more information. Based on the above approach, morphological changes can be more complete understand.



Data rechecked by spatial EOF mode 1



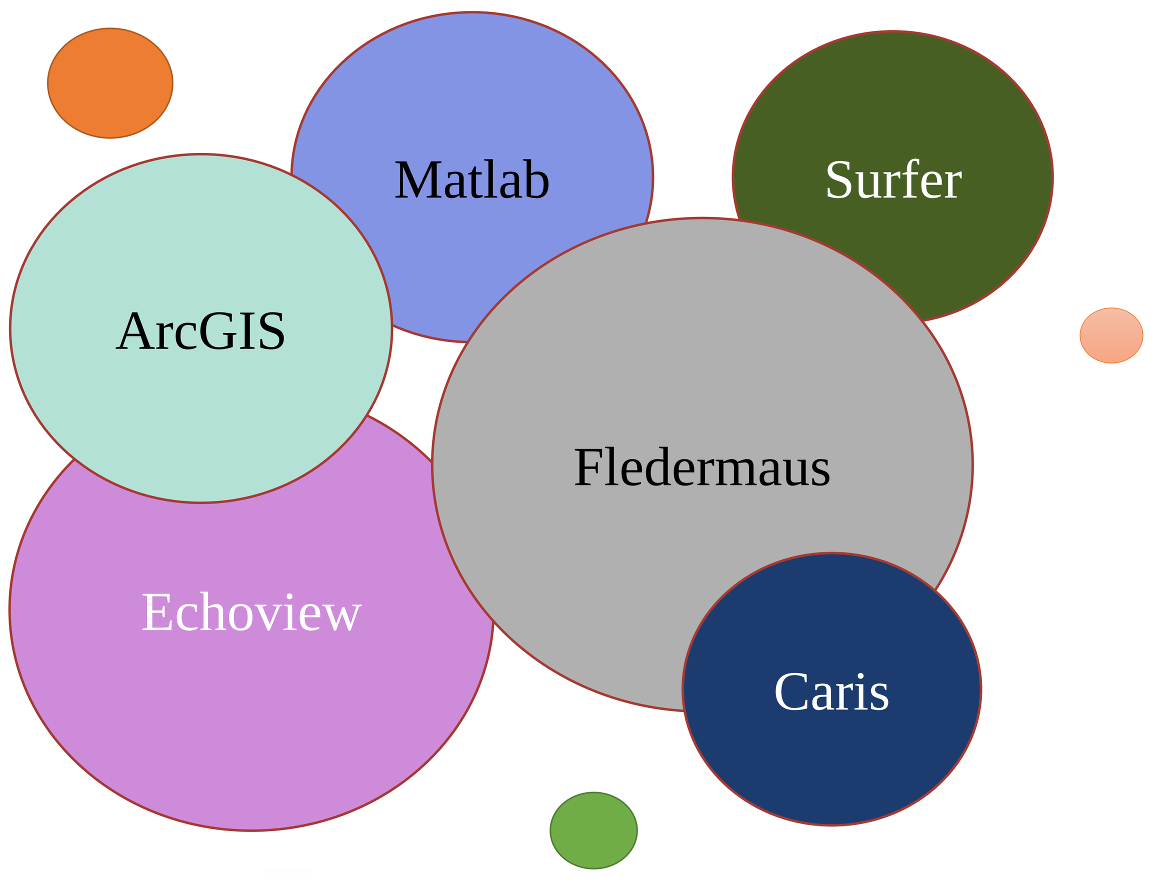
Profile data rechecked by RMSE



Morphological changes analyzed by EOF

Data Collection

Software



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