

The relationship between velocity model and density model in Taiwan's midline and South line by using gravity data

利用重力資料討論台灣中線及南線速度模型  
與密度模型的關係

Chung-Ying Han, Horng-Yuan Yen

Speaker: Chung-Ying Han

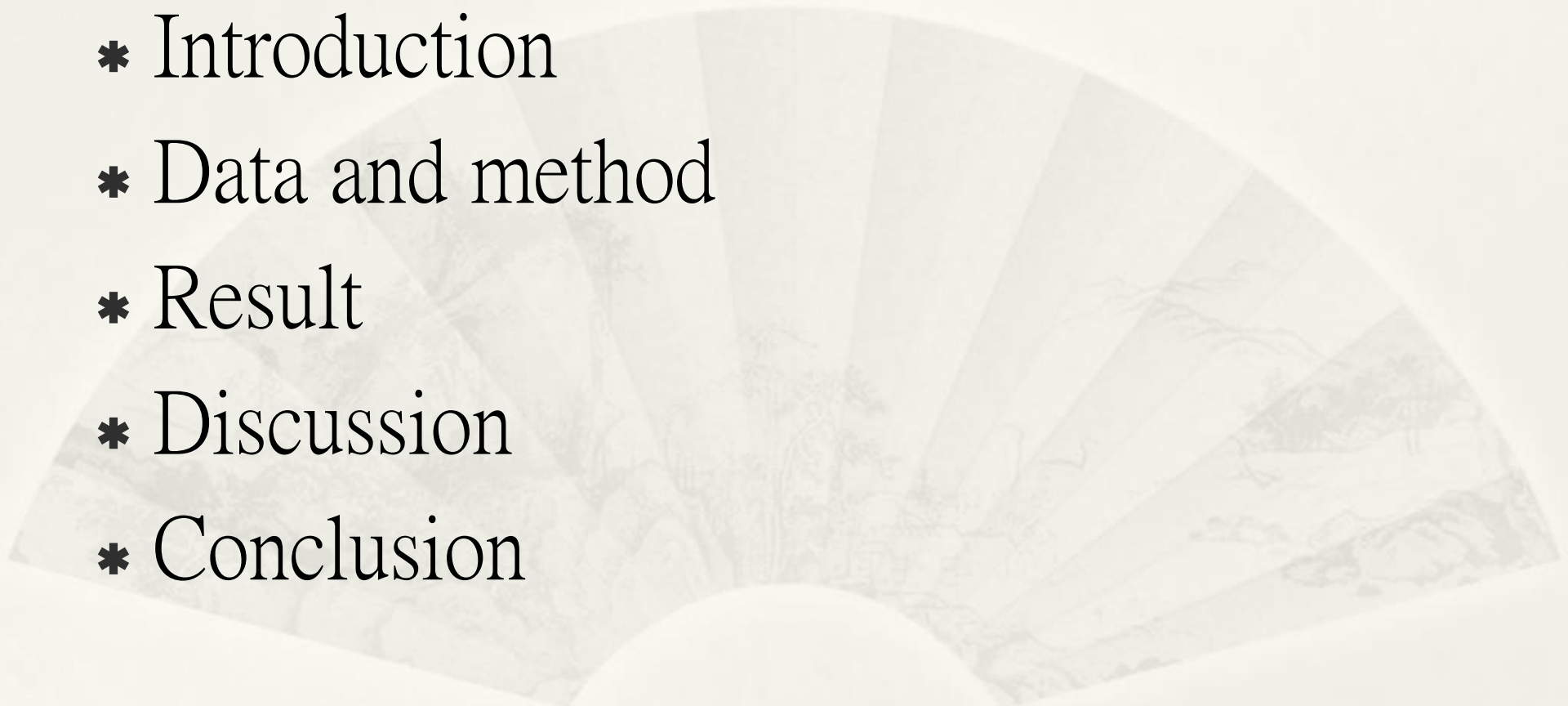
# References

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- \* Hao Kuo-Chen, Francis T. Wu, and Steven W. Roecker ,2012. Three-dimensional P velocity structures of the lithosphere beneath Taiwan from the analysis of TAIGER and related seismic data sets, Journal of Geophysical Research, VOL. 117, B06306, doi:10.1029/2011JB009108.
- \* Mahir Isik , Hakkı Senel , 2009. 3D gravity modeling of Buyuk Menderes basin in Western Anatolia using parabolic density function. Journal of Asian Earth Sciences 34 , 317 – 325.
- \* V. Chakravarthia, N. Sundararajan ,2004. Automatic 3-D gravity modeling of sedimentary basins with density contrast varying parabolically with depth. Computers & Geosciences 30 , 601 – 607.

# Outline

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- \* Introduction
  - \* Data and method
  - \* Result
  - \* Discussion
  - \* Conclusion
- 

# Introduction

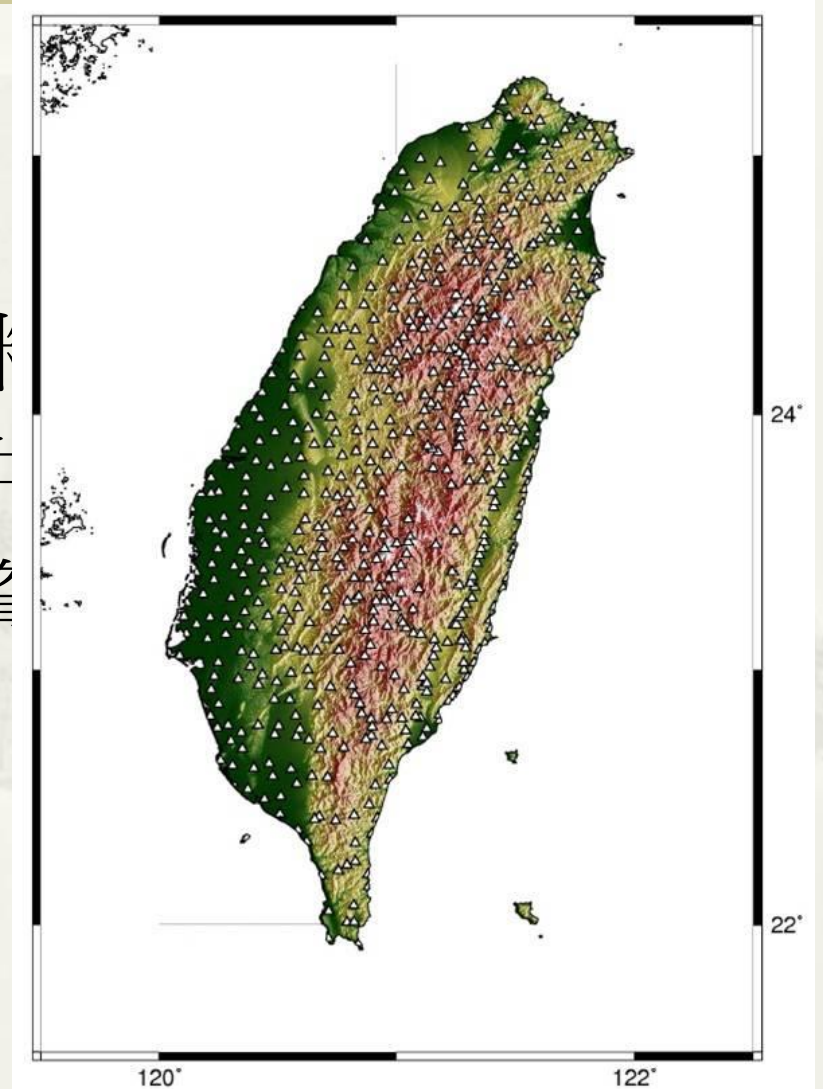
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- \* 速度構造與密度構造很難得到一個一致性
- \* 近年來許多計畫的資料使前人有做出台灣地區或是跨海峽的速度模型
- \* 使用重力資料來檢驗速度模型是否符合重力觀測

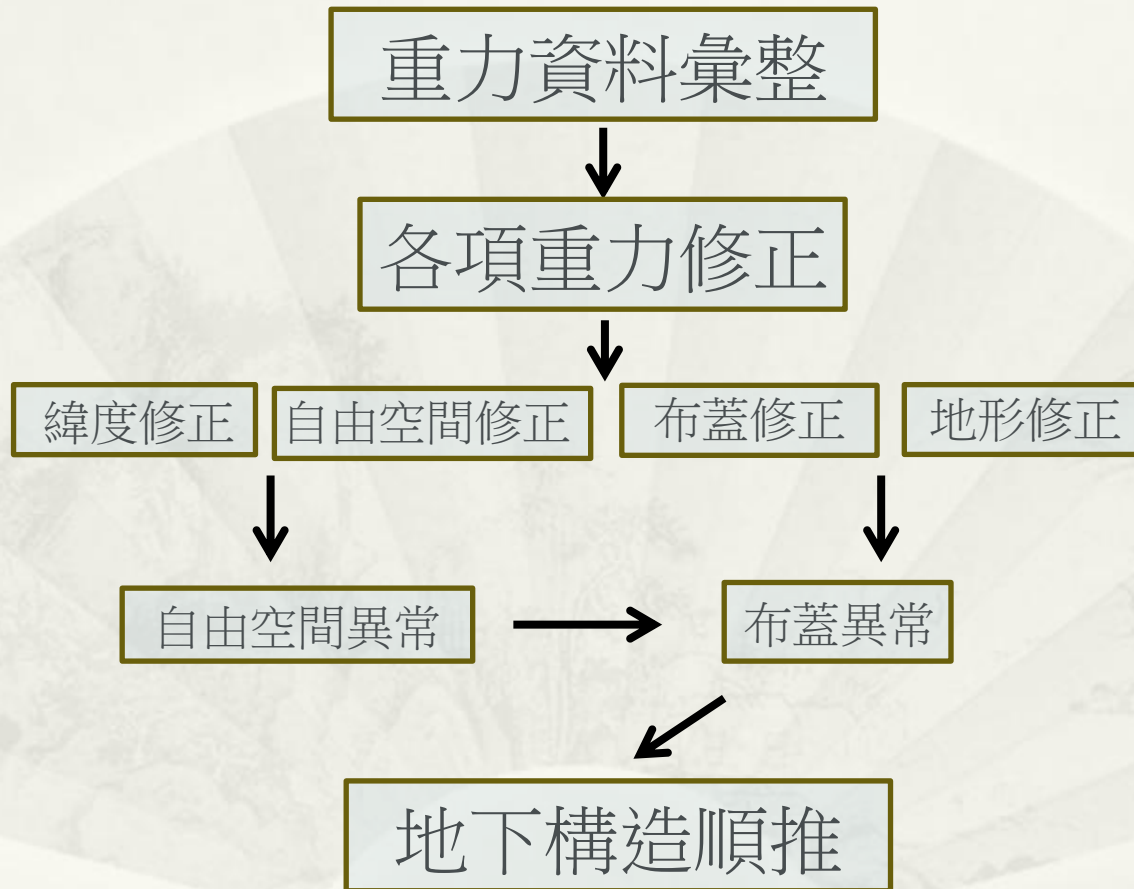
# Data and method

## \* 重力資料

1. 陸上重力資料
2. 中國石油公司 重力資料
3. DNSC 丹麥國家測量中
4. NGDC 美國地球物理資

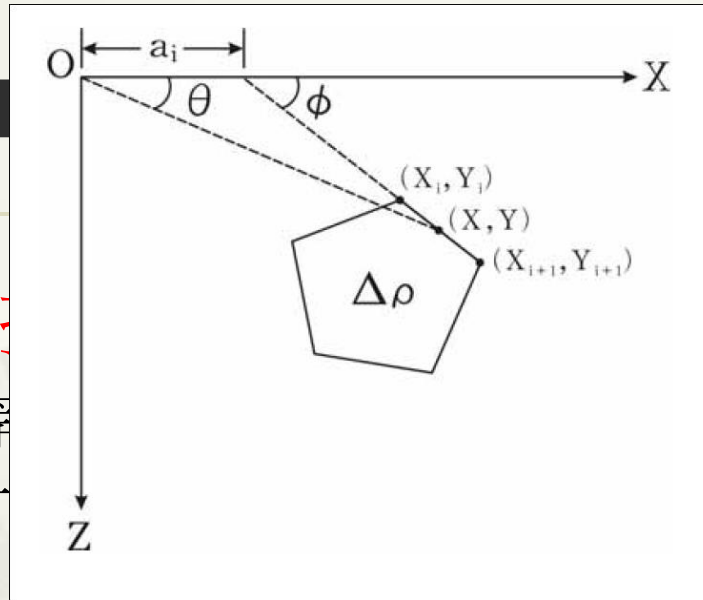


# Data and method



# Data and

- \* 地下構造順...  
採用Talwani等  
重力值公式，來計



之二維空間理論  
映的理論重力值。

$$\Delta g = 2G\Delta\rho_i \sum_{i=1}^n W_i$$

$$W_i = a_i \sin \phi_i \cos \phi_i \{ (\theta_i - \theta_{i+1}) + \tan \phi_i \ln \left[ \frac{\cos \theta_i (\tan \theta_i - \tan \phi_i)}{\cos \theta_{i+1} (\tan \theta_{i+1} - \tan \phi_i)} \right] \}$$

(Talwani et al., 1959)

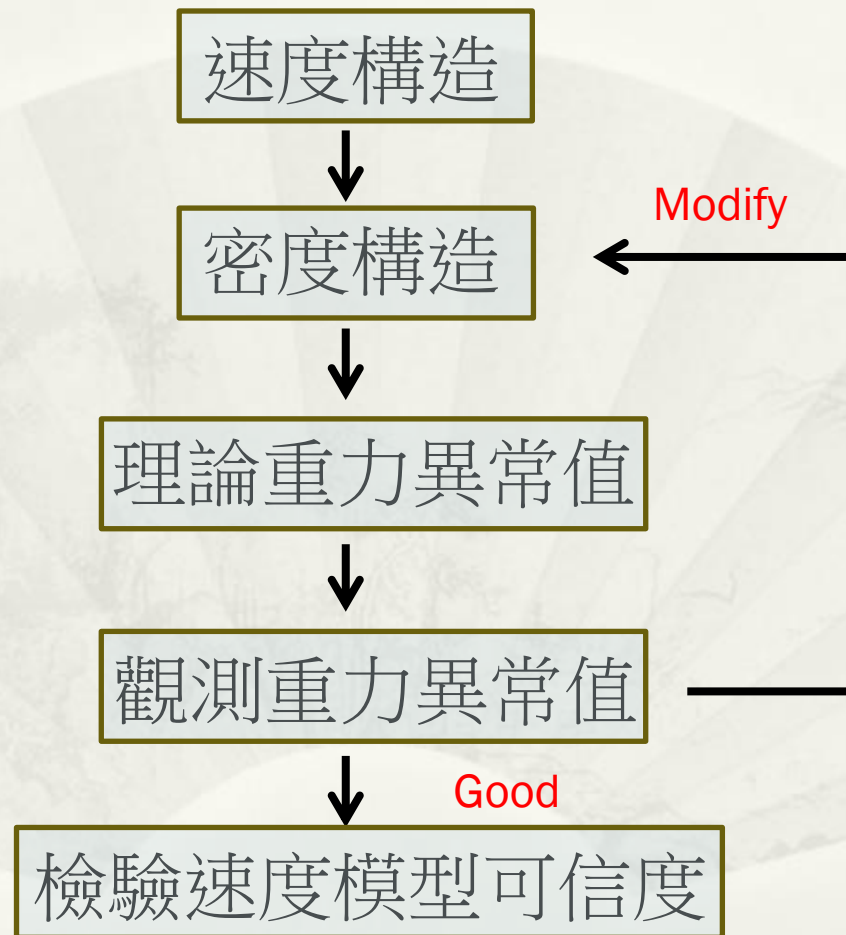
重力效應總和:

$$\sum_{k=1}^m \Delta g_j (\Delta \rho_k)$$

其中

$$\Delta g_j (\Delta \rho_k) = 2G\Delta\rho_k \sum_{i=1}^n W_i$$

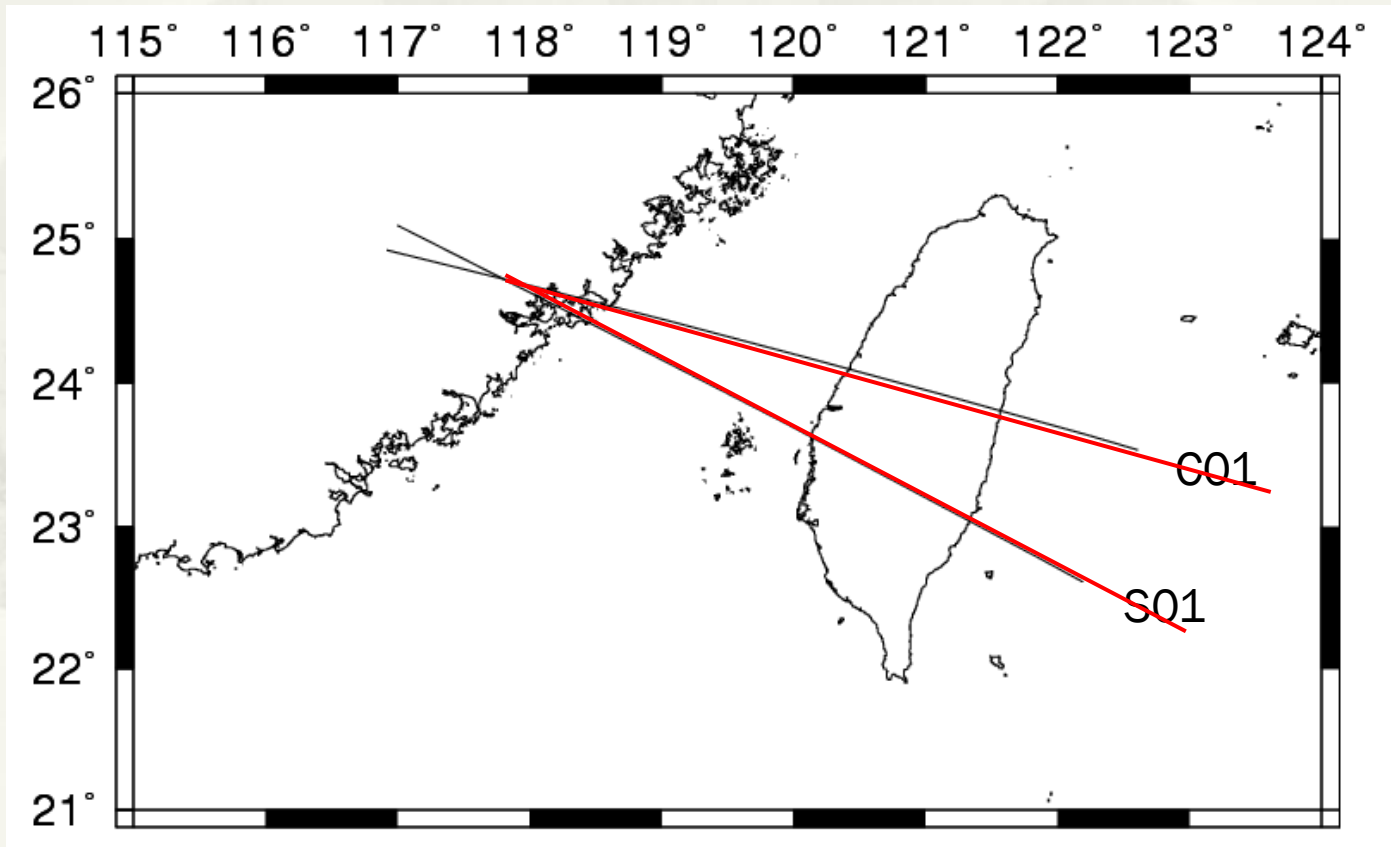
# Data and method





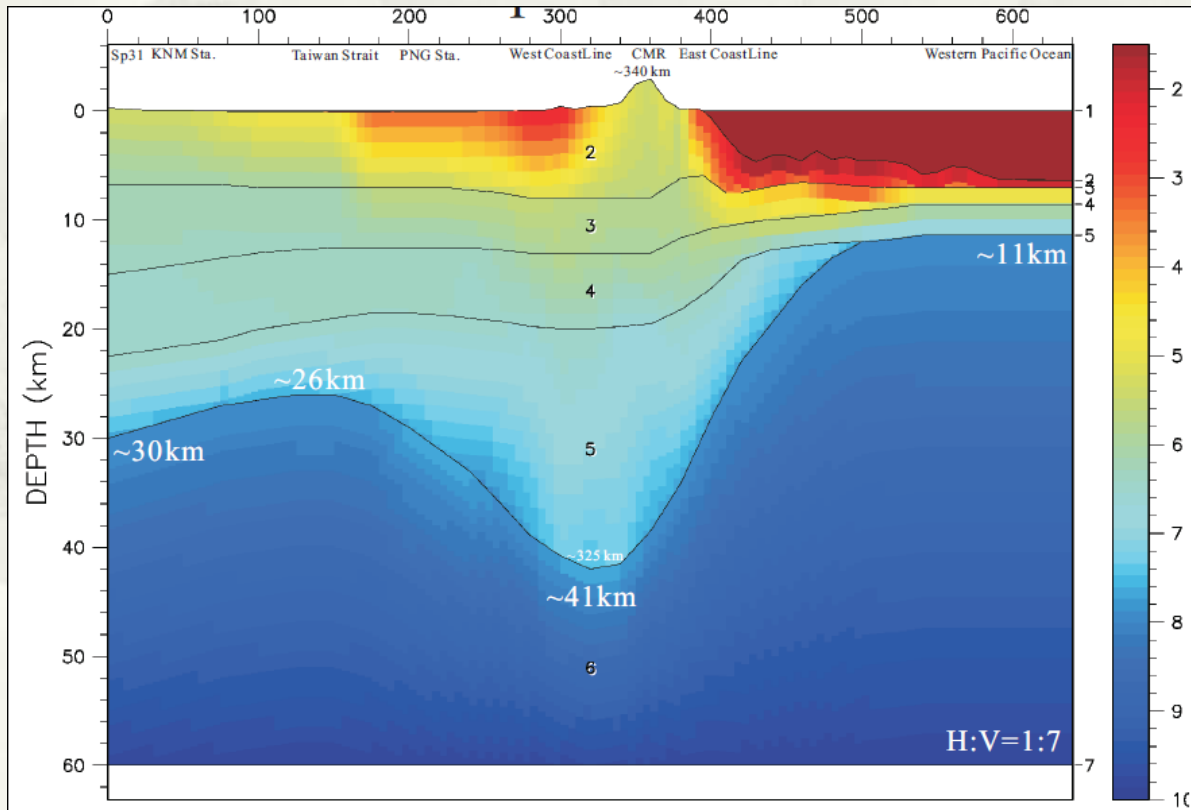
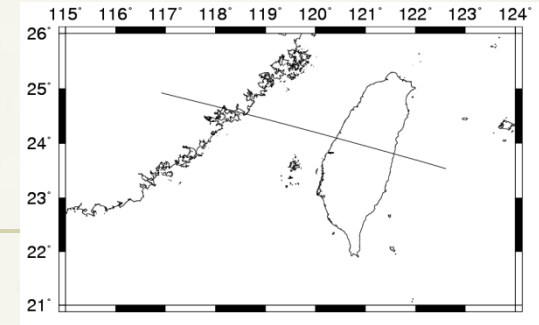
# Data and method

## \* 本研究測線位置



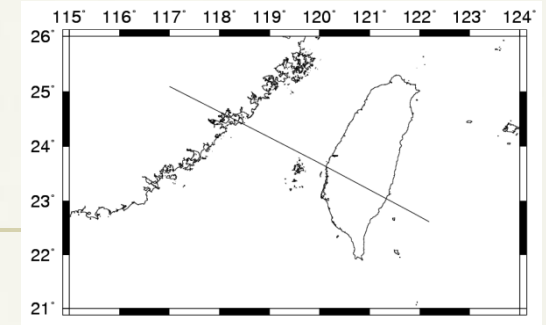
# Data and method

- \* 速度模型(取自Yao-wen Kuo, 2011)

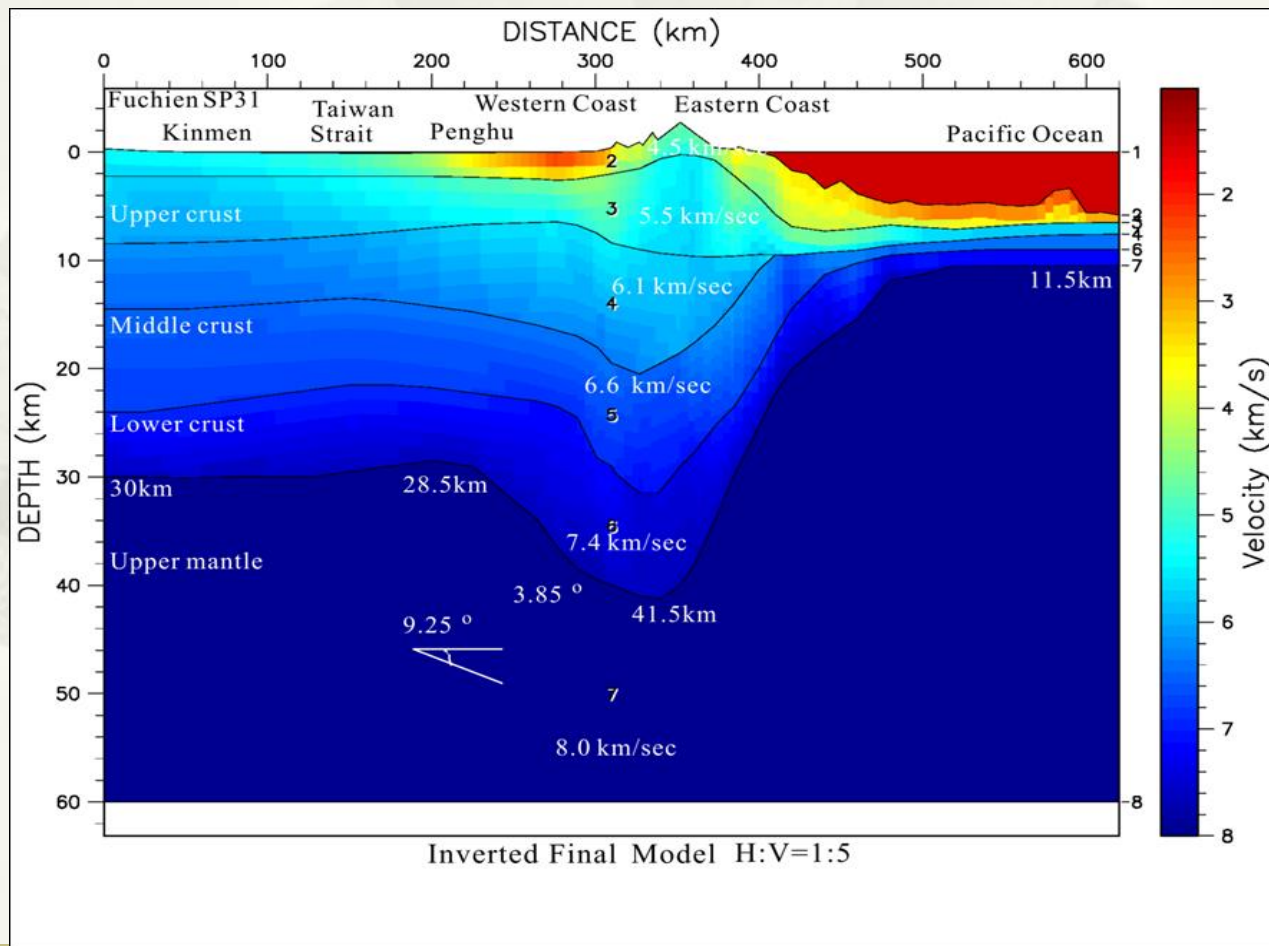


中線(C01)

# Data and method



- \* 速度模型(取自Yao-wen Kuo, 2011)

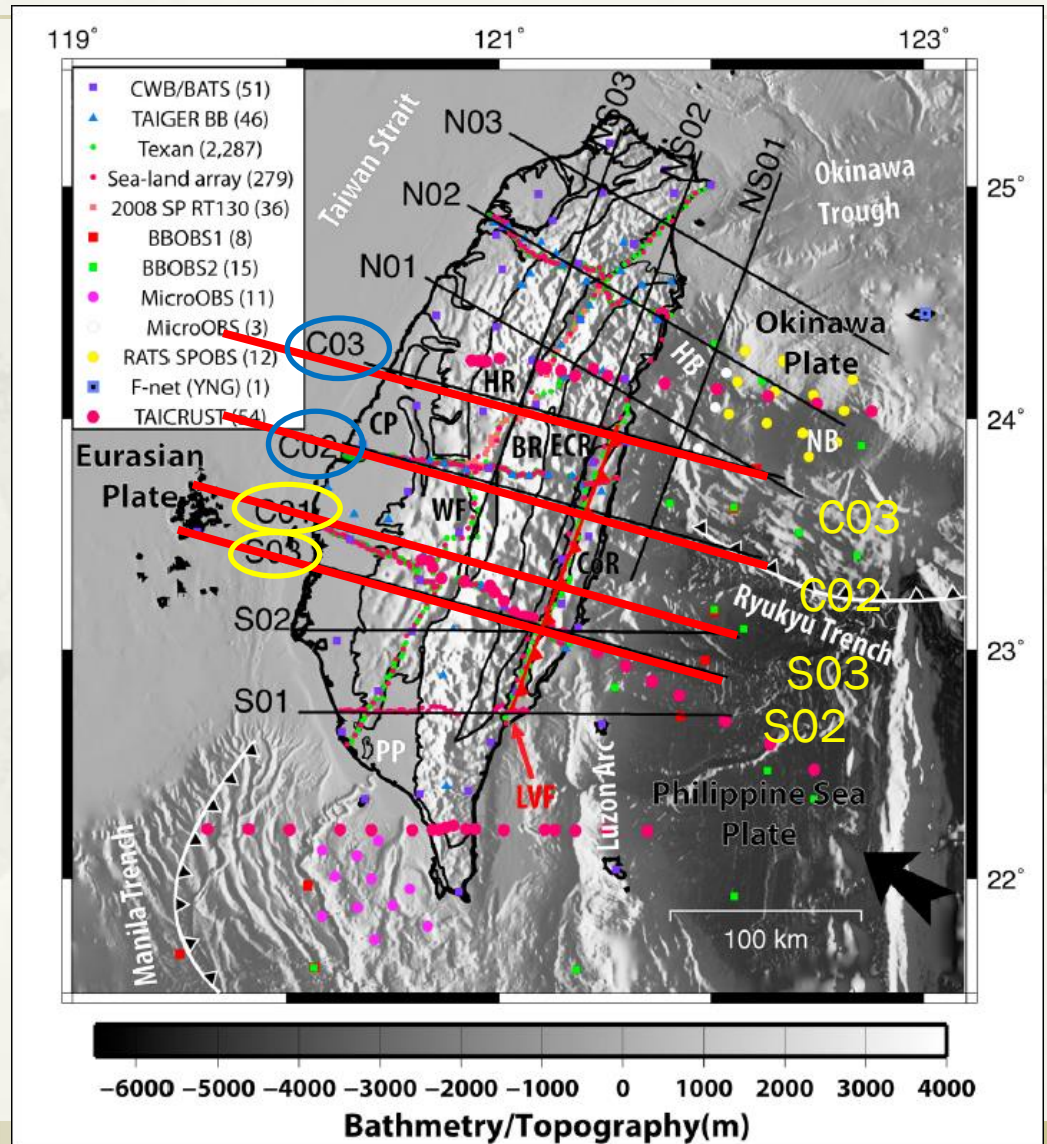


南線(S01)

# Data and method

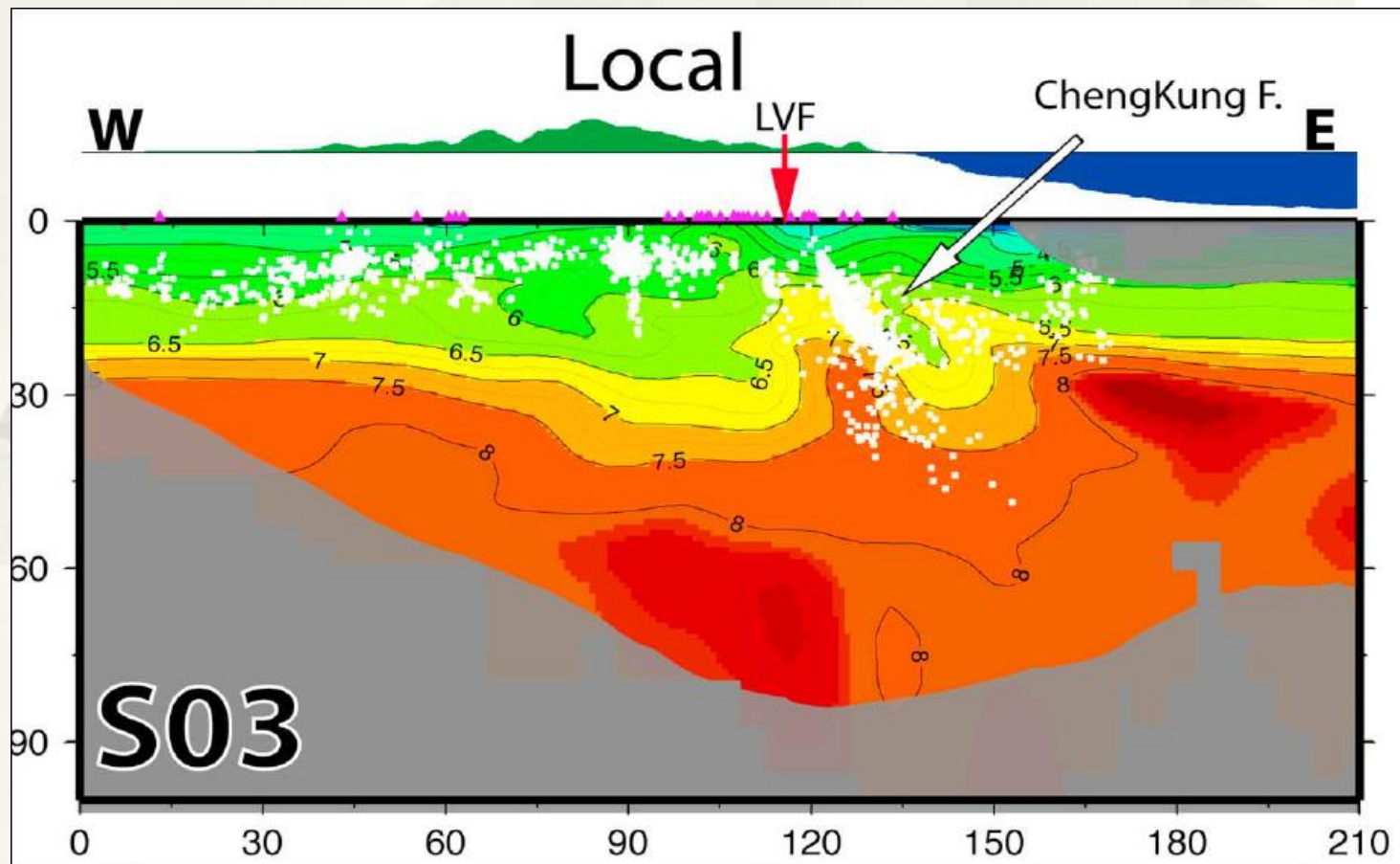
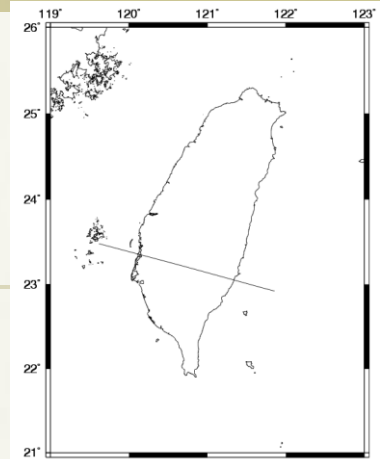
## \* 速度模型

(取自Hao Kuo-Chen, 2012)



# Data and method

- \* 速度模型(取自Hao Kuo-Chen, 2012)

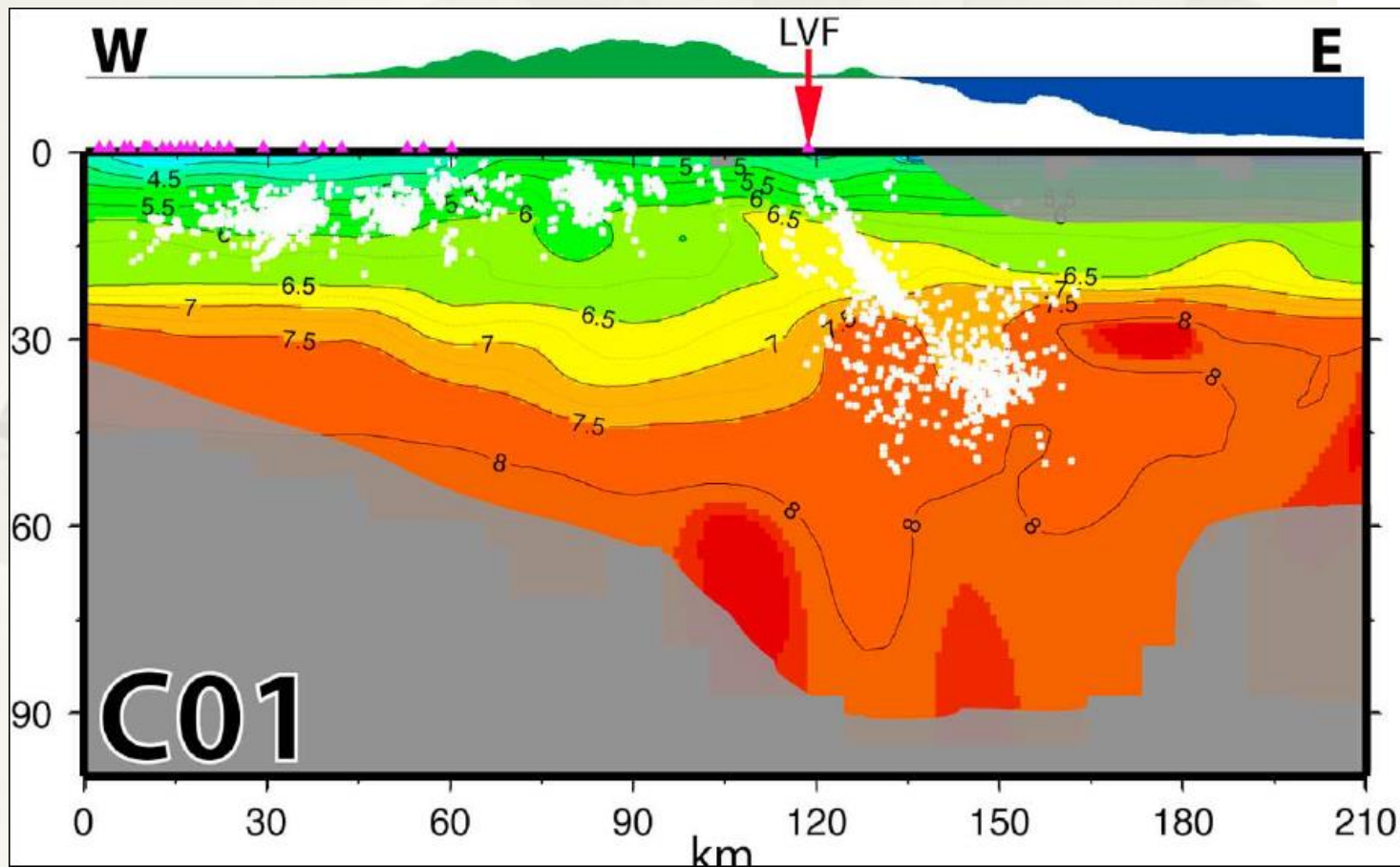
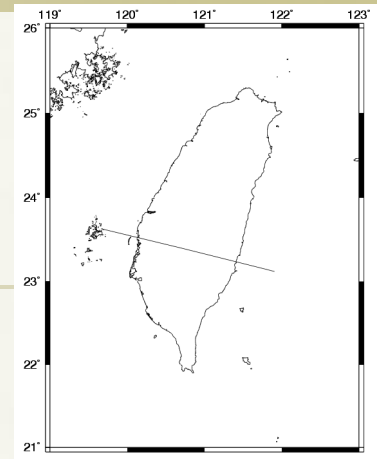


S02



# Data and method

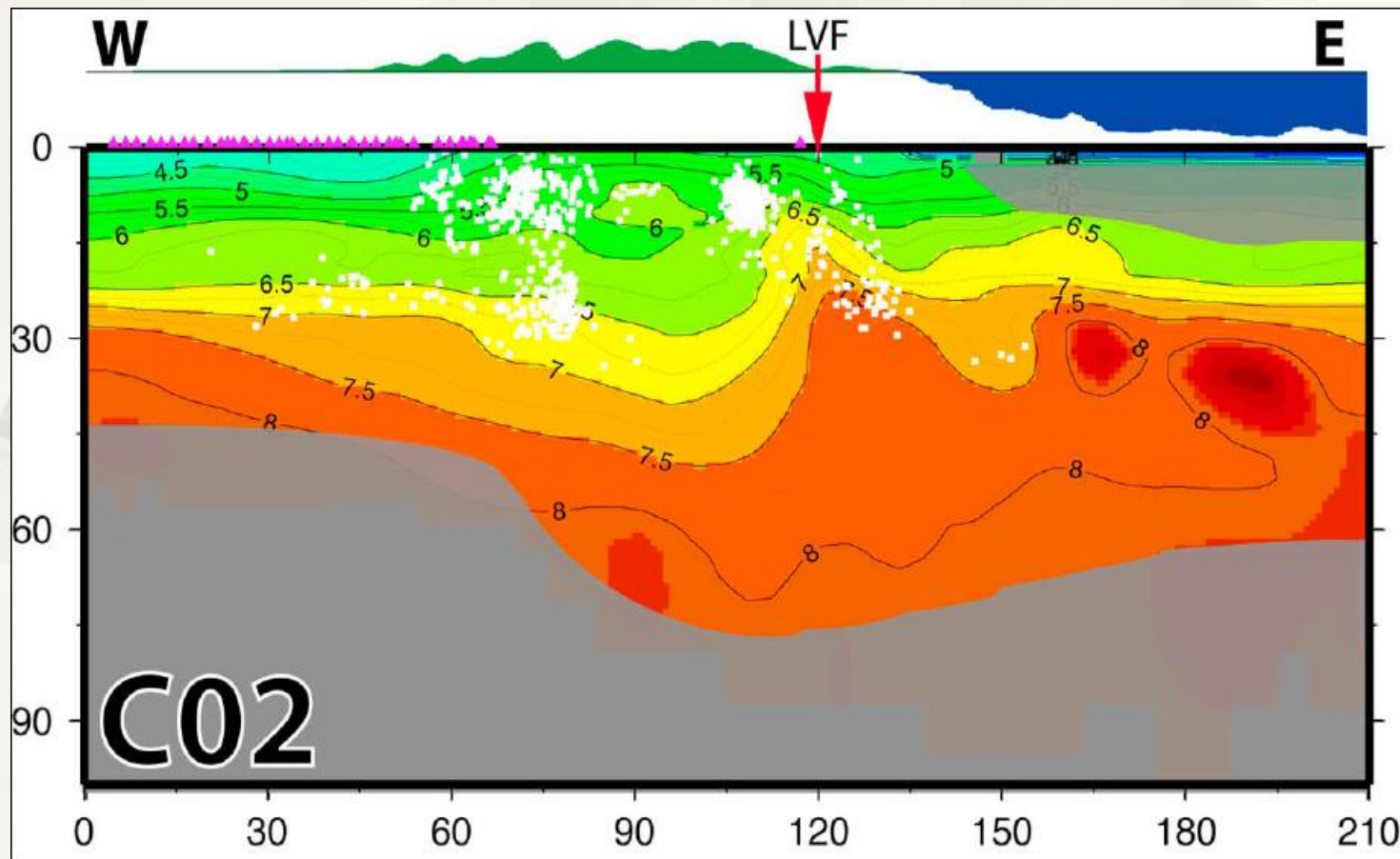
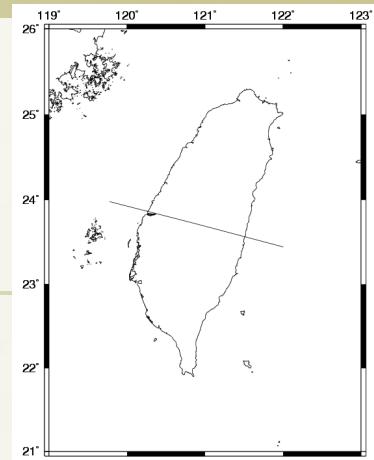
\* 速度模型(取自Hao Kuo-Chen, 2012)



S03

# Data and method

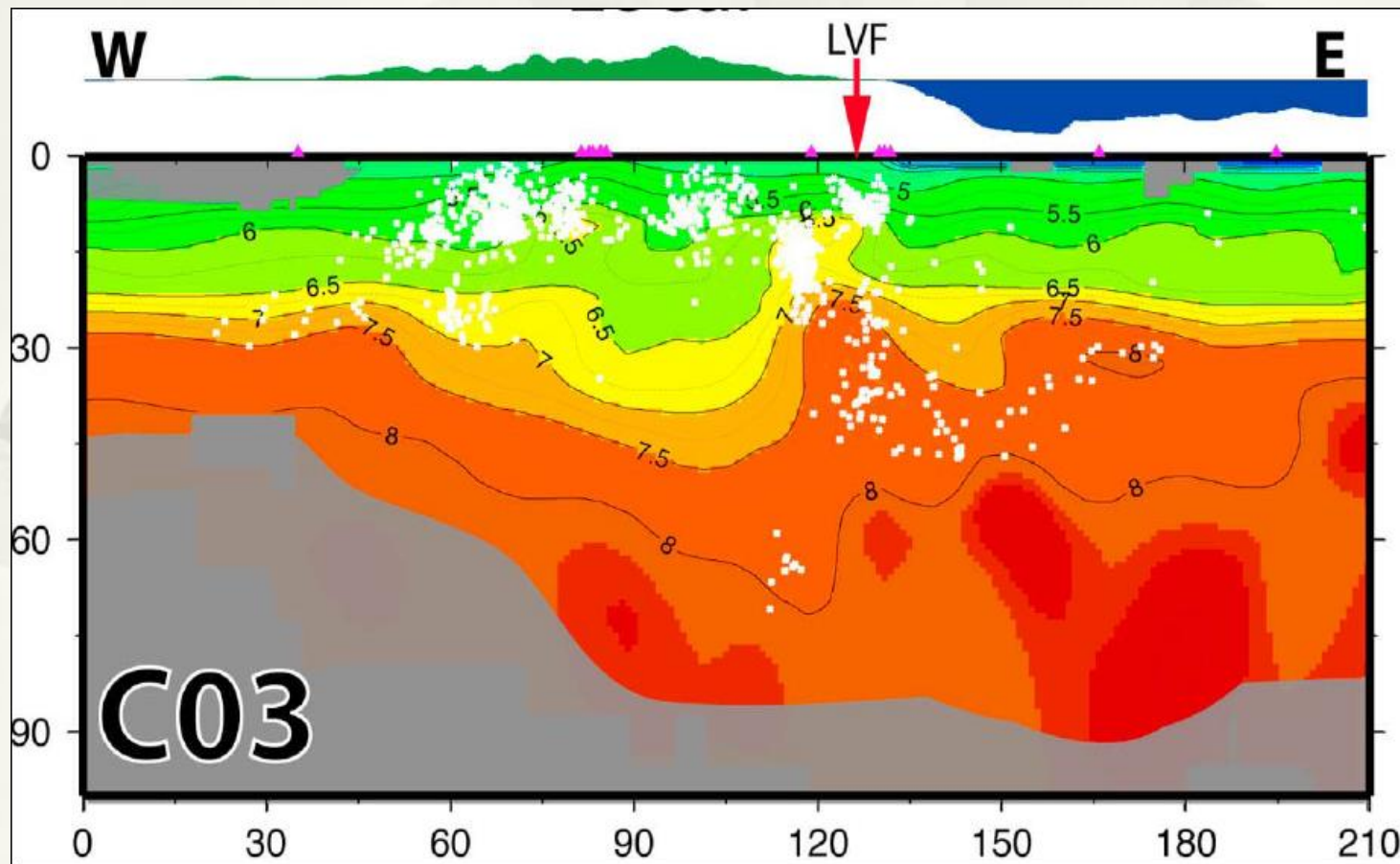
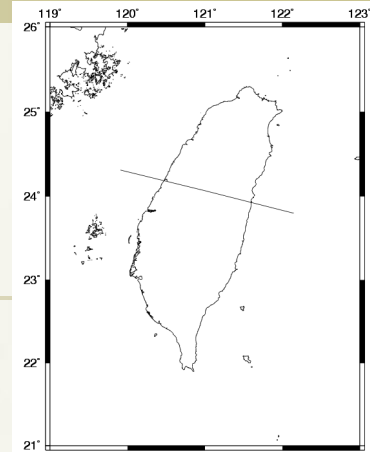
\* 速度模型(取自Hao Kuo-Chen, 2012)



C02

# Data and method

- \* 速度模型(取自Hao Kuo-Chen, 2012)



C03



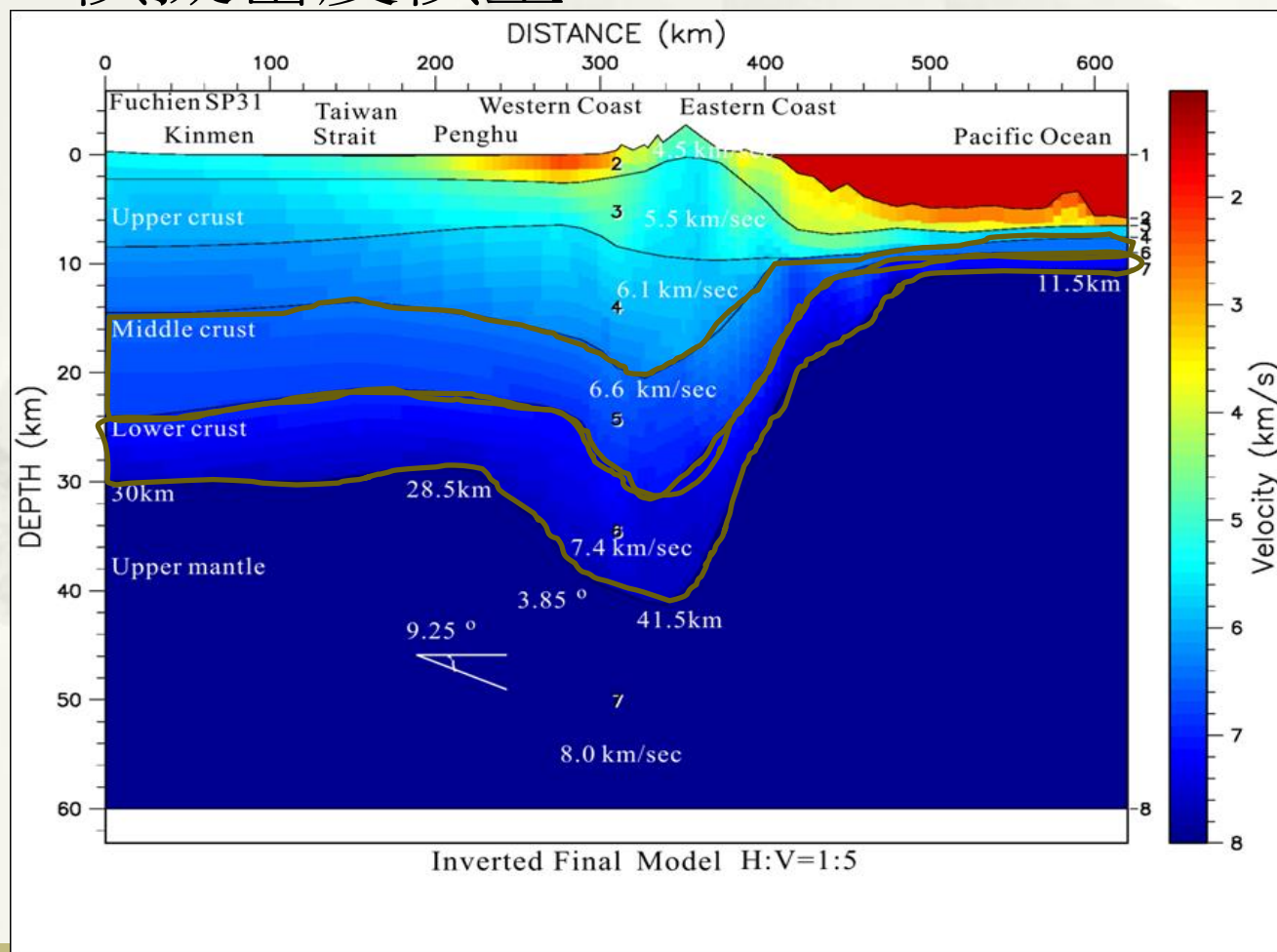
# Data and method

統計經驗公式（鈴木次郎，1980）

$$\rho = a + b V_p$$

$\rho$ 為地層密度； $V_p$ 為P波速度；  
 $a, b$ 為根據統計經驗所得之係數，其中 $a=0.8, b=0.3$ 。

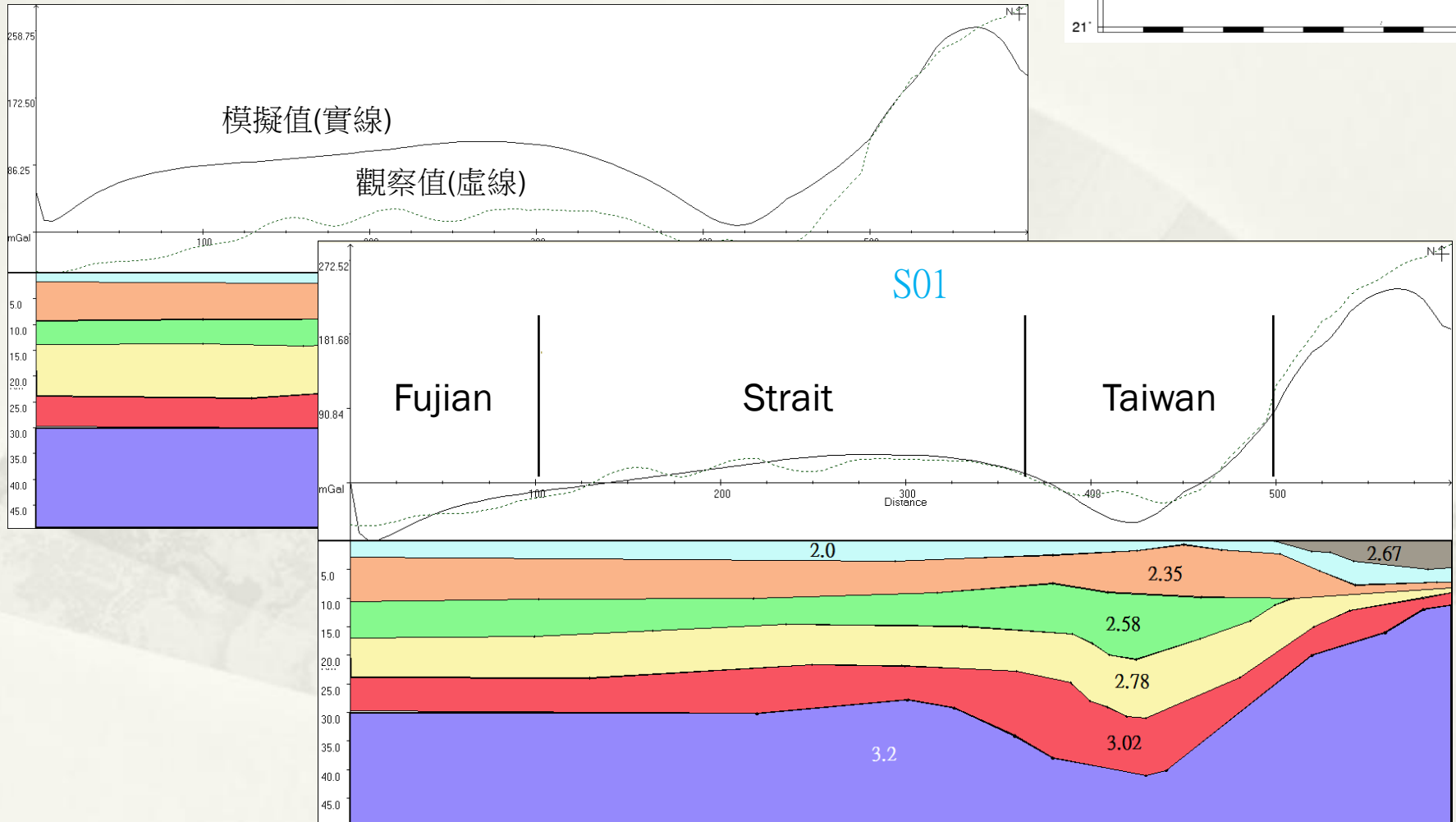
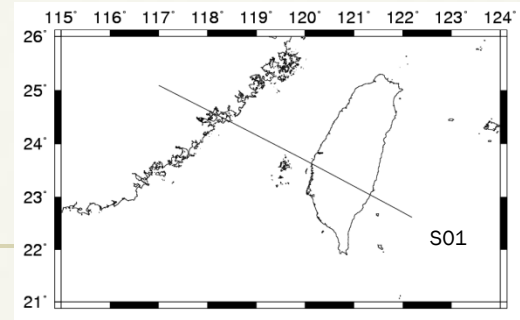
## \* 模擬密度模型



$$6.6 * 0.3 + 0.8 = 2.78$$

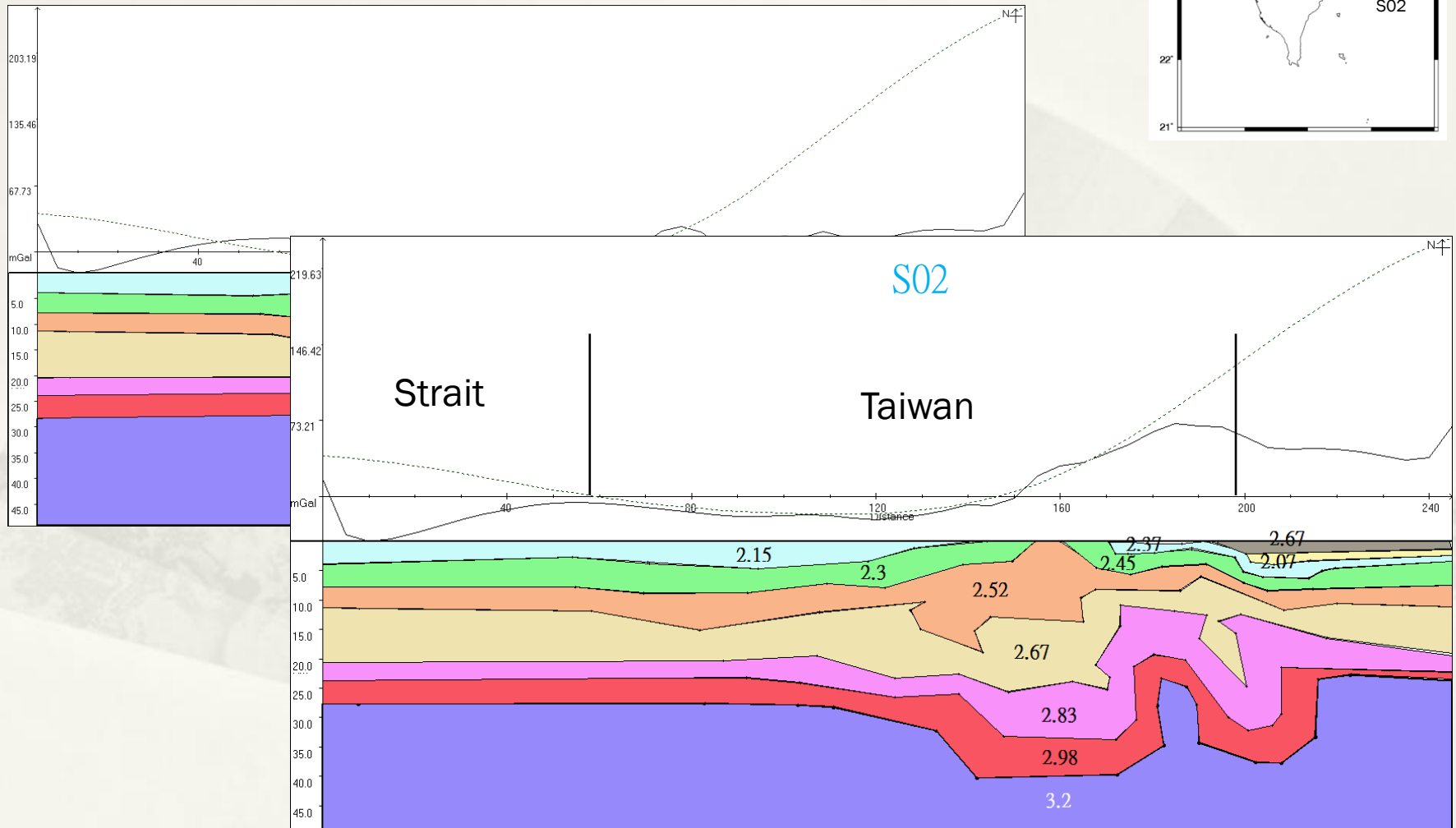
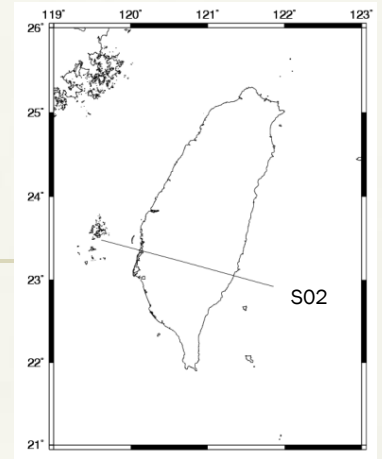
$$7.4 * 0.3 + 0.8 = 3.02$$

# Result



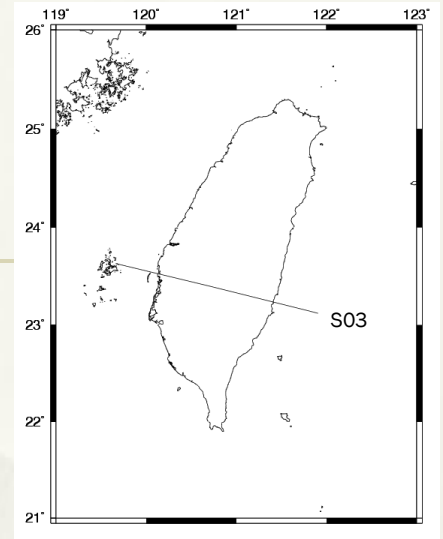
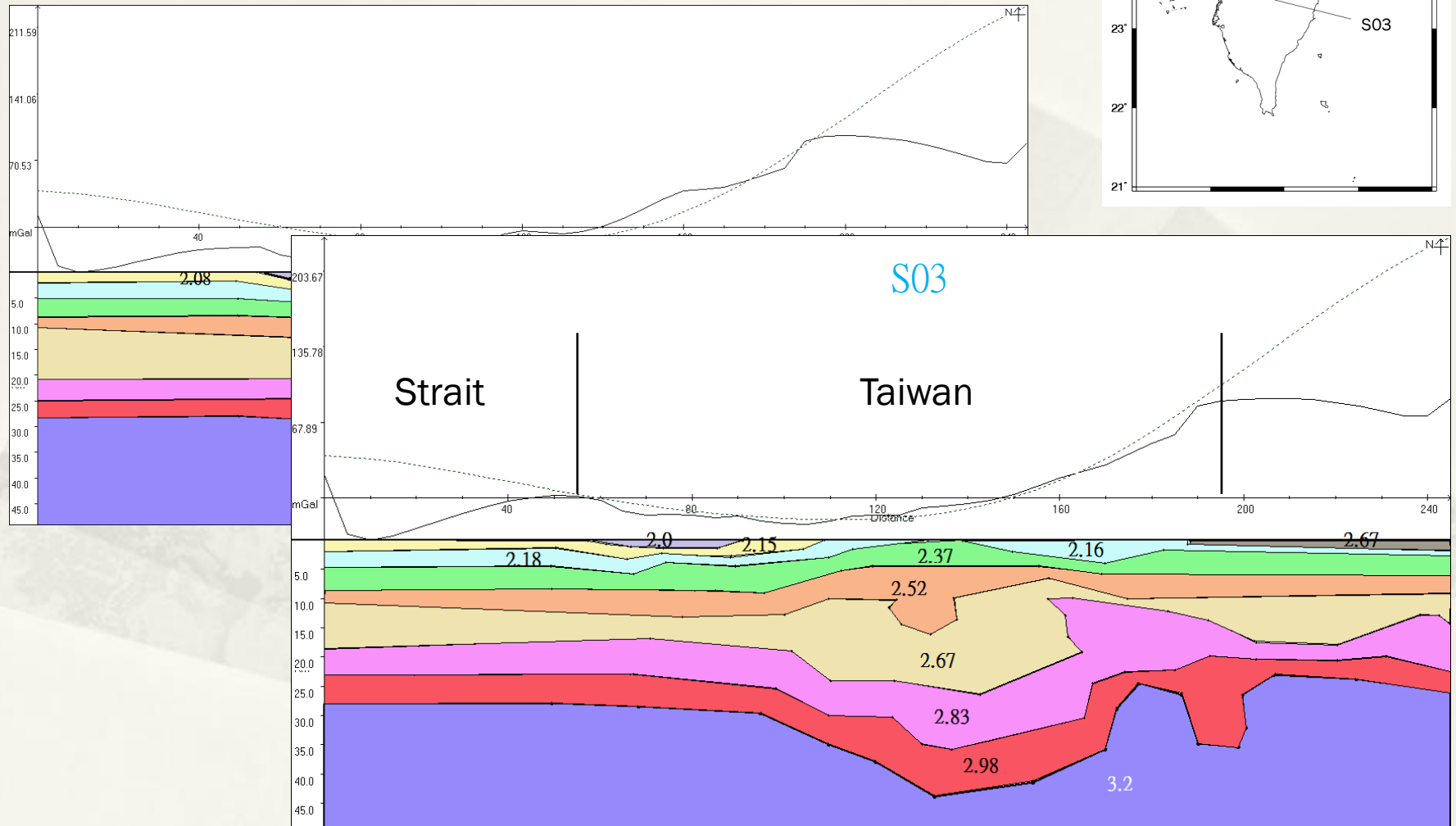
(修改自Yao-wen Kuo, 2011)

# Result



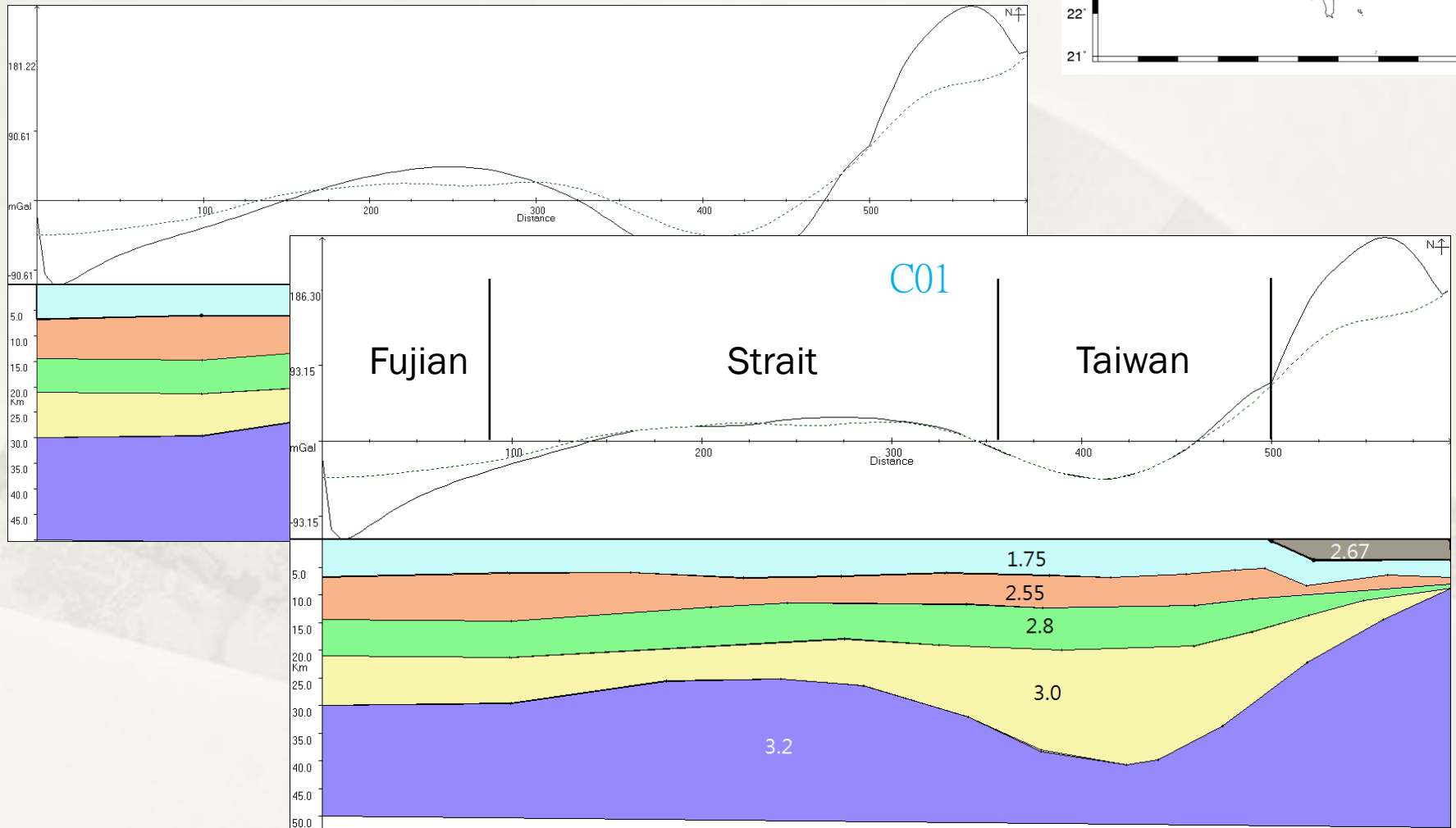
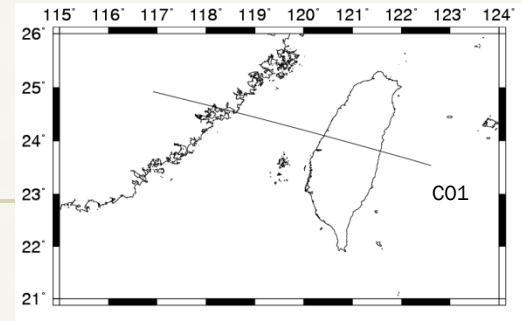
(修改自Hao Kuo-Chen, 2012)

# Result



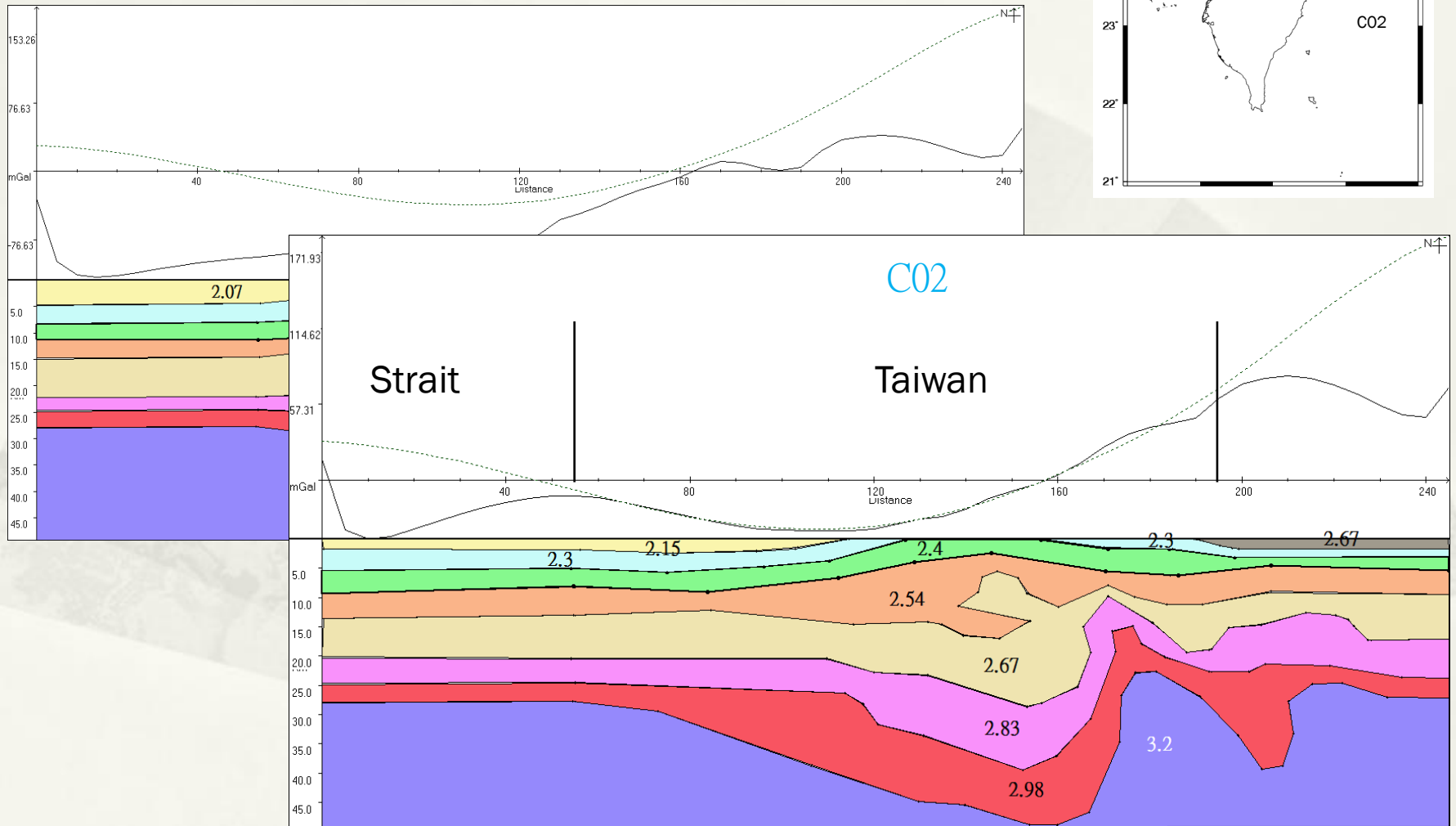
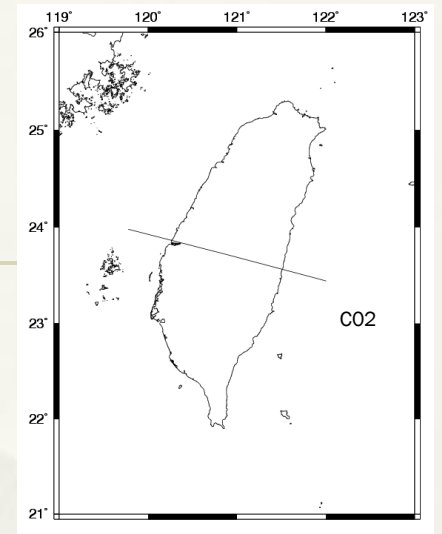
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# Result



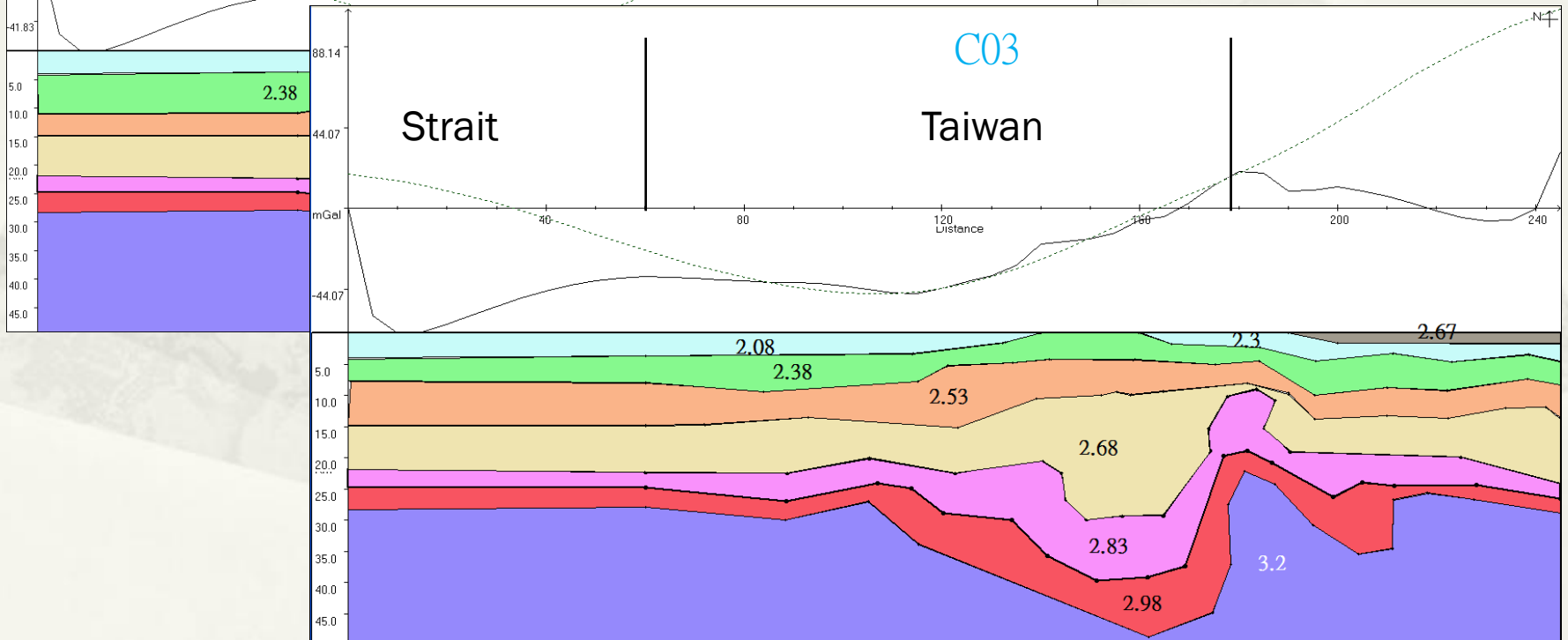
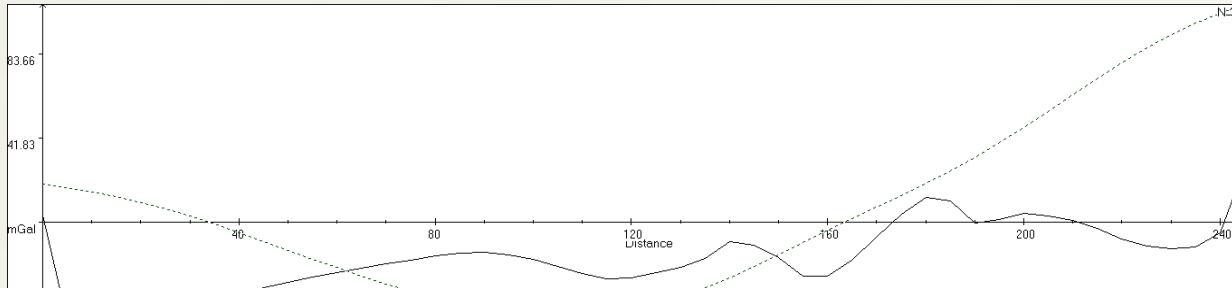
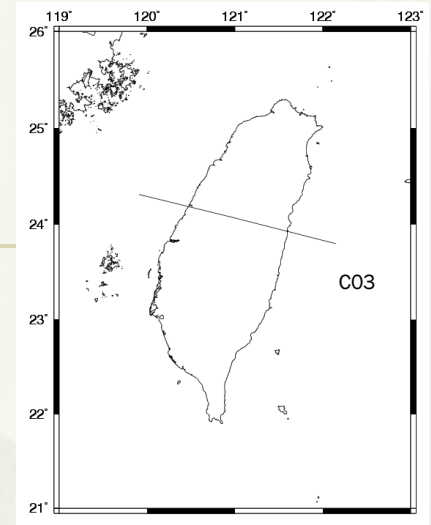
(修改自Yao-wen Kuo, 2011)

# Result



(修改自Hao Kuo-Chen, 2012)

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(修改自 Hao Kuo-Chen, 2012)

# 統計經驗公式（鈴木次郎，1980）

$$\rho = a + b V_p$$

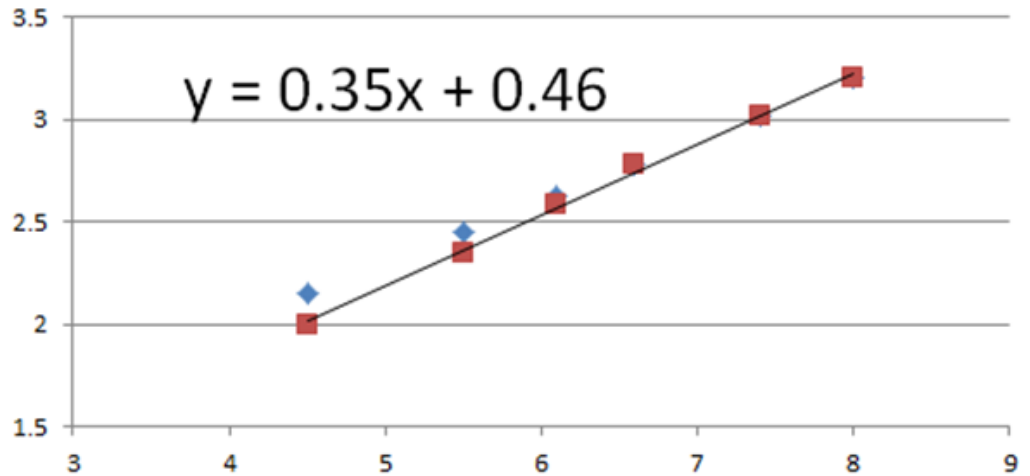
$\rho$ 為地層密度； $V_p$ 為P波速度；

$a, b$ 為根據統計經驗所得之係數，其中 $a = 0.8, b = 0.3$ 。

## Discussion

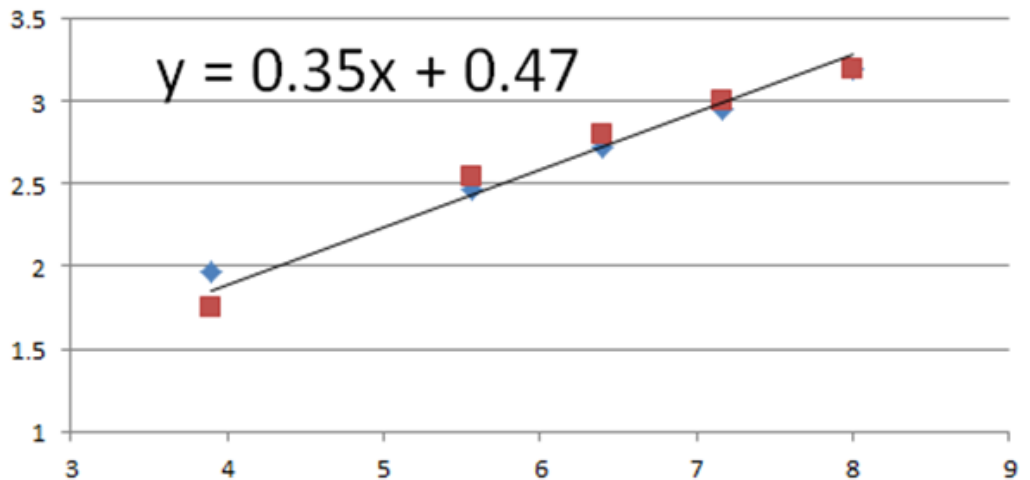
S01

原始速度	原始密度	調整後密度
8	3.2	3.2
7.4	3.02	3.02
6.6	2.78	2.78
6.1	2.63	2.58
5.5	2.45	2.35
4.5	2.15	2



C01

原始速度	原始密度	調整後密度
8	3.2	3.2
7.17	2.95	3
6.4	2.72	2.8
5.57	2.47	2.55
3.9	1.97	1.75

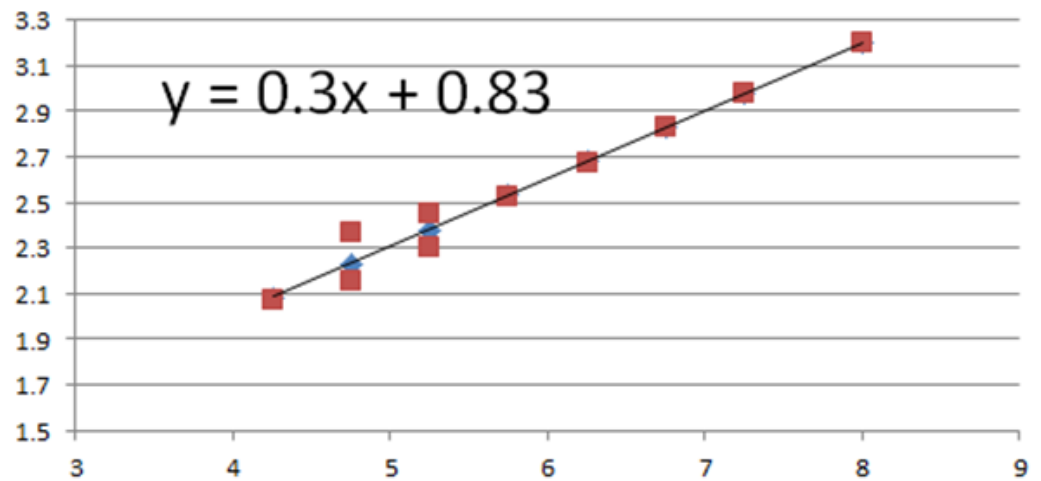




# Discussion

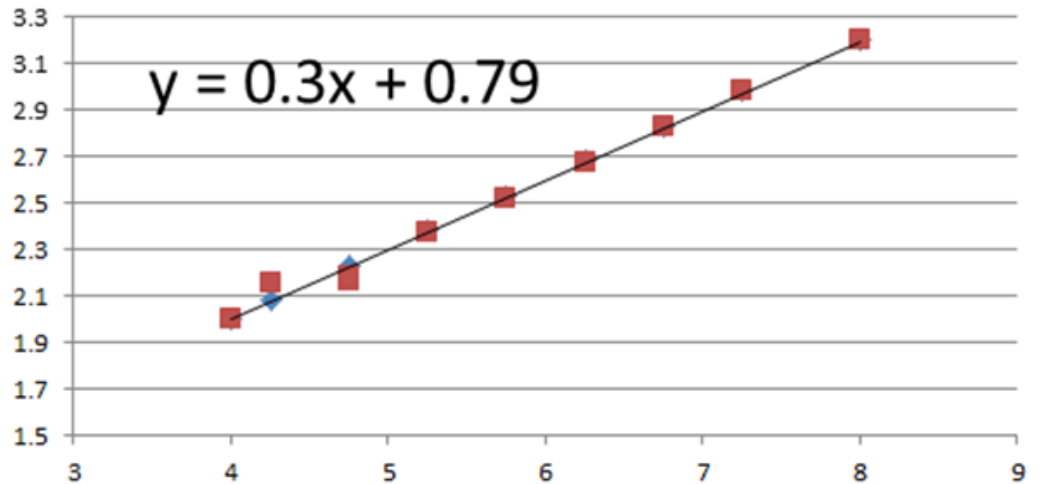
S02

原始速度	原始密度	調整後密度
8	3.2	3.2
7.25	2.98	2.98
6.75	2.83	2.83
6.25	2.68	2.67
5.75	2.53	2.52
5.25	2.38	2.45
5.25	2.38	2.3
4.75	2.23	2.37
4.75	2.23	2.15
4.25	2.08	2.07



S03

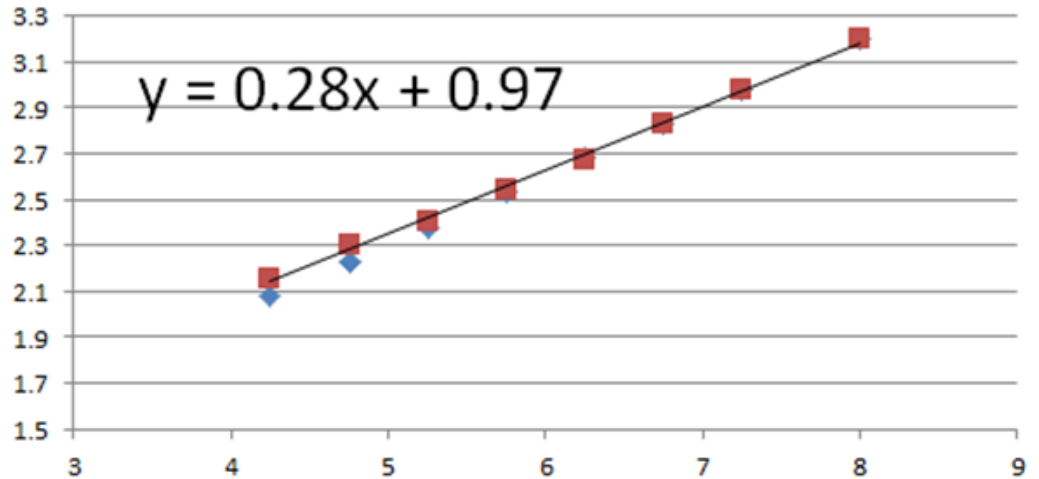
原始速度	原始密度	調整後密度
8	3.2	3.2
7.25	2.98	2.98
6.75	2.83	2.83
6.25	2.68	2.67
5.75	2.53	2.52
5.25	2.38	2.37
4.75	2.23	2.16
4.75	2.23	2.18
4.25	2.08	2.15
4	2	2



# Discussion

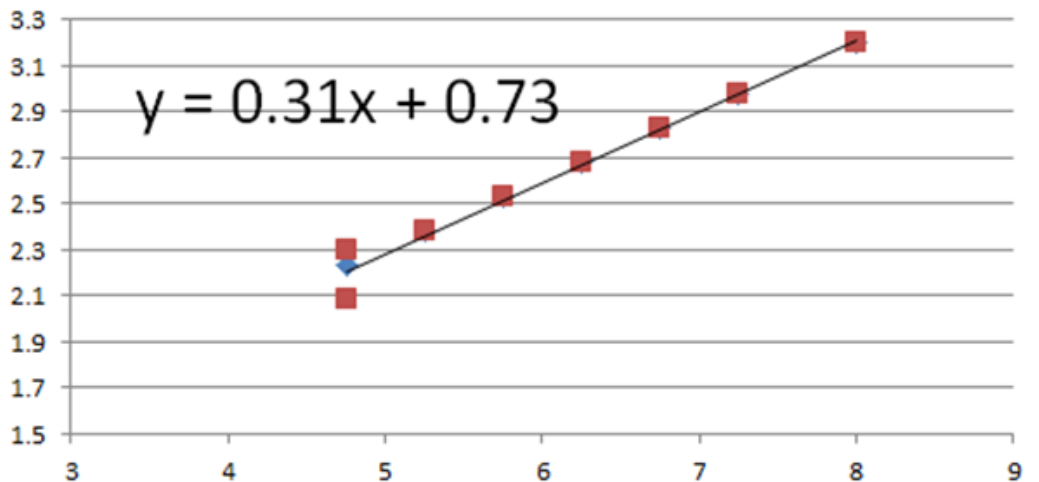
C02

原始速度	原始密度	調整後密度
8	3.2	3.2
7.25	2.98	2.98
6.75	2.83	2.83
6.25	2.68	2.67
5.75	2.53	2.54
5.25	2.38	2.4
4.75	2.23	2.3
4.75	2.23	2.3
4.25	2.08	2.15



C03

原始速度	原始密度	調整後密度
8	3.2	3.2
7.25	2.98	2.98
6.75	2.83	2.83
6.25	2.68	2.68
5.75	2.53	2.53
5.25	2.38	2.38
4.75	2.23	2.3
4.75	2.23	2.08



# Discussion

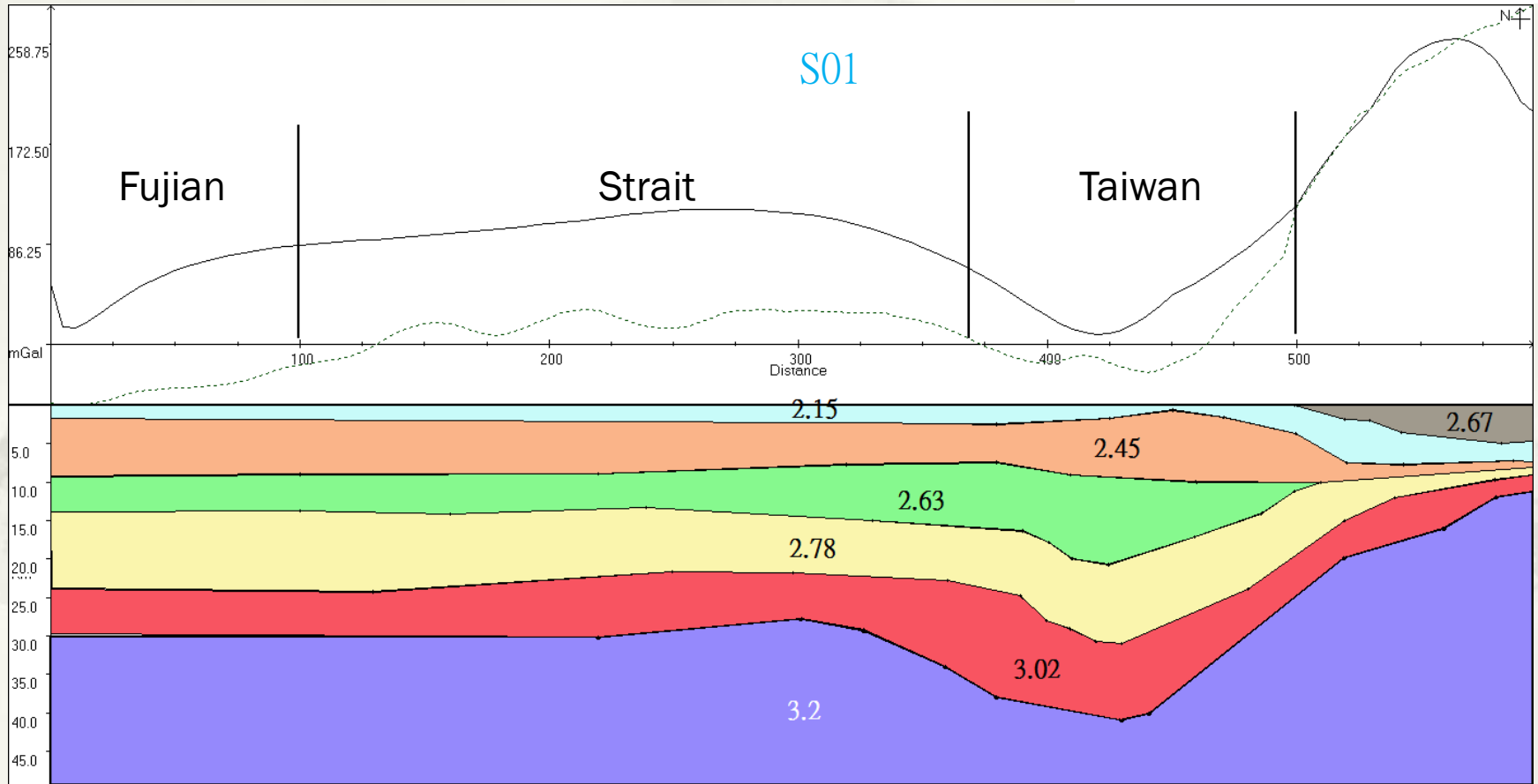
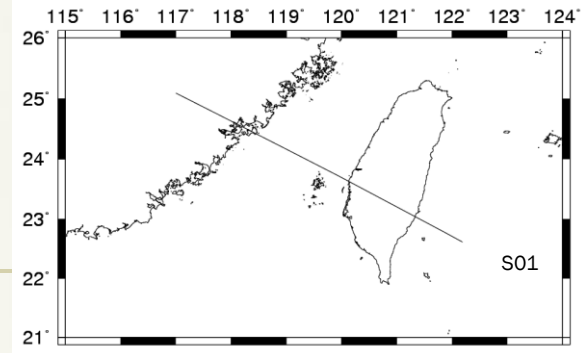
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- \* 比較原始中線南線密度模型



# Discussion

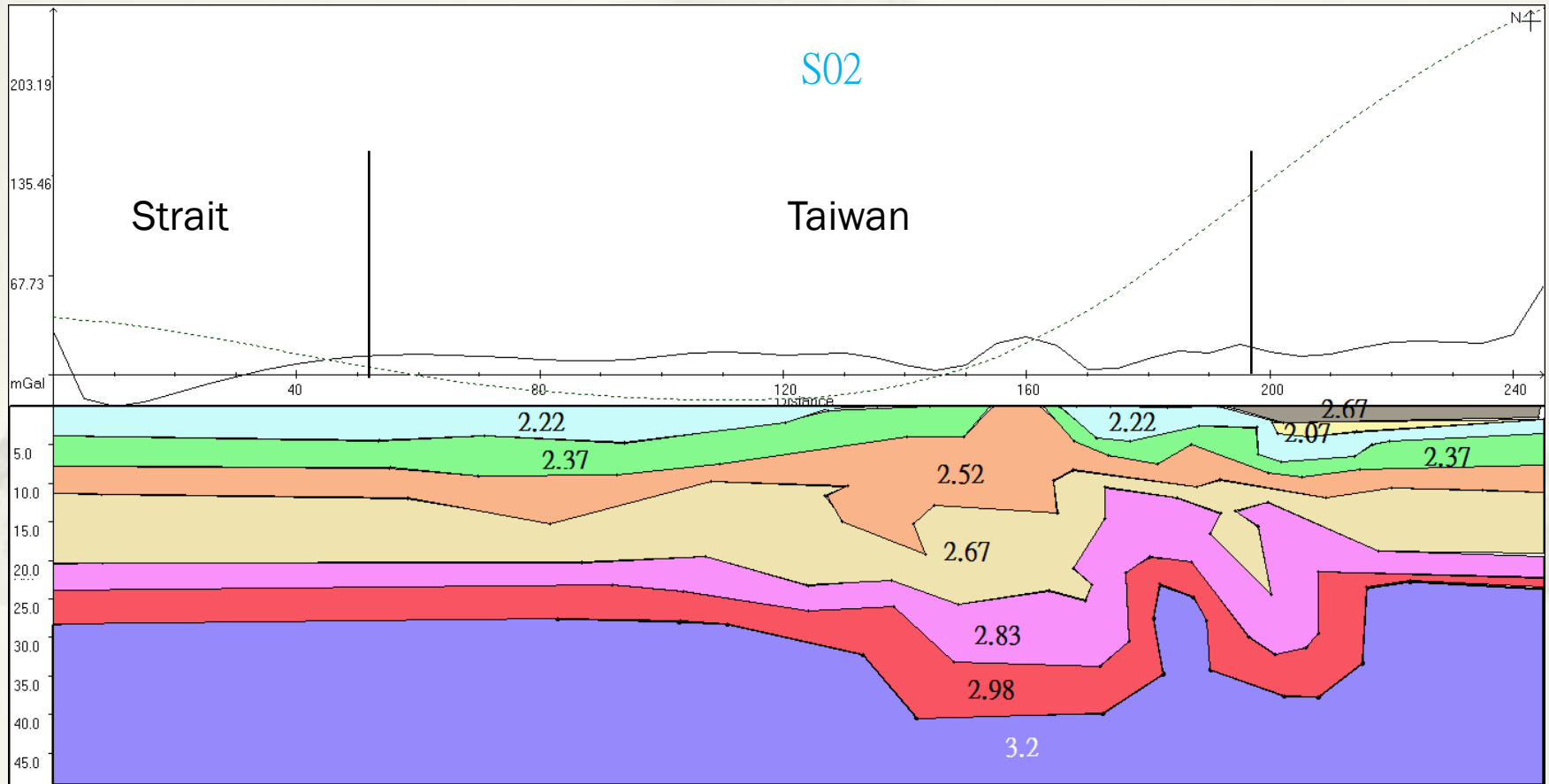
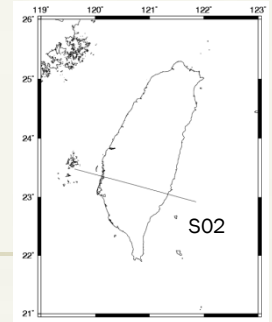
南線



(修改自Yao-wen Kuo, 2011)

# Discussion

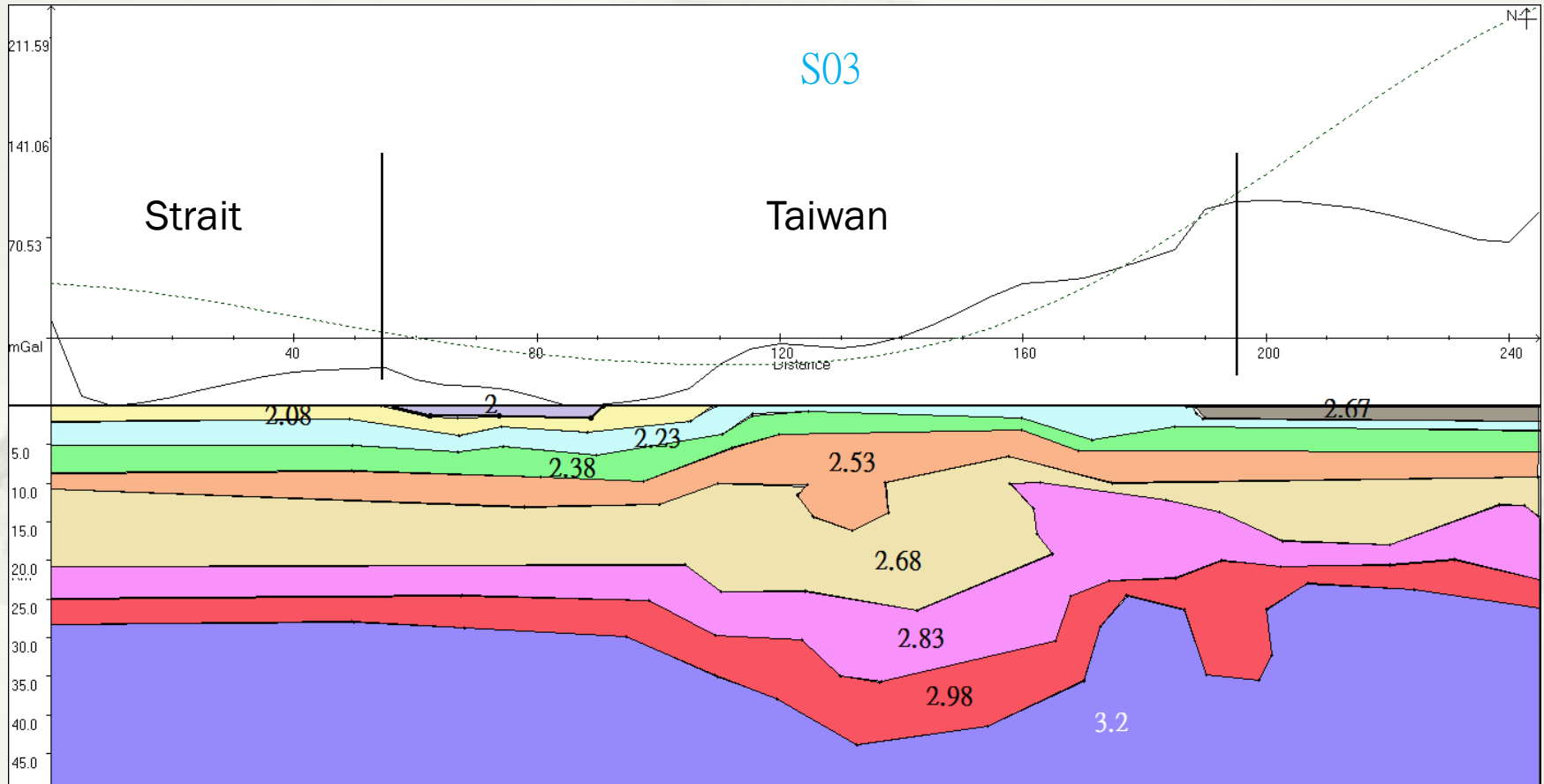
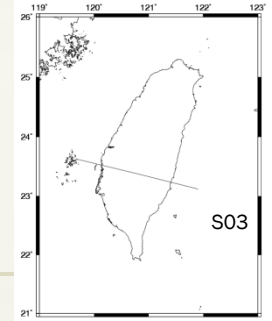
南線



(修改自 Hao Kuo-Chen, 2012)

# Discussion

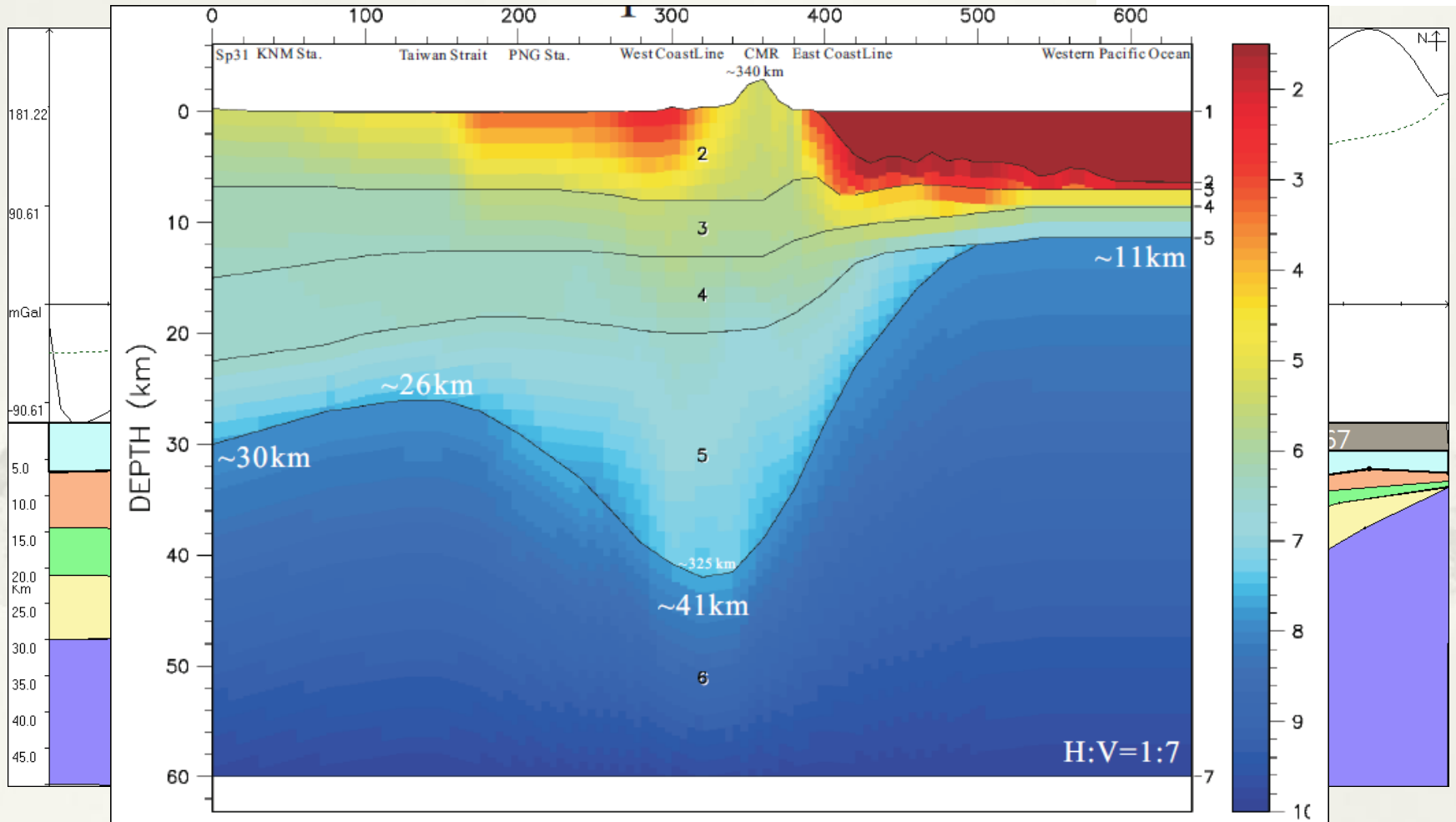
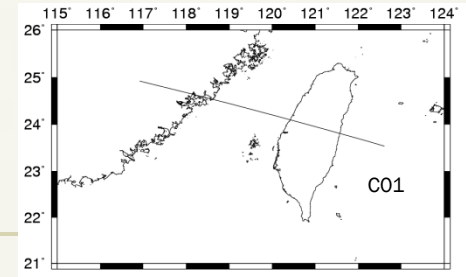
南線



(修改自 Hao Kuo-Chen, 2012)

# Discussion

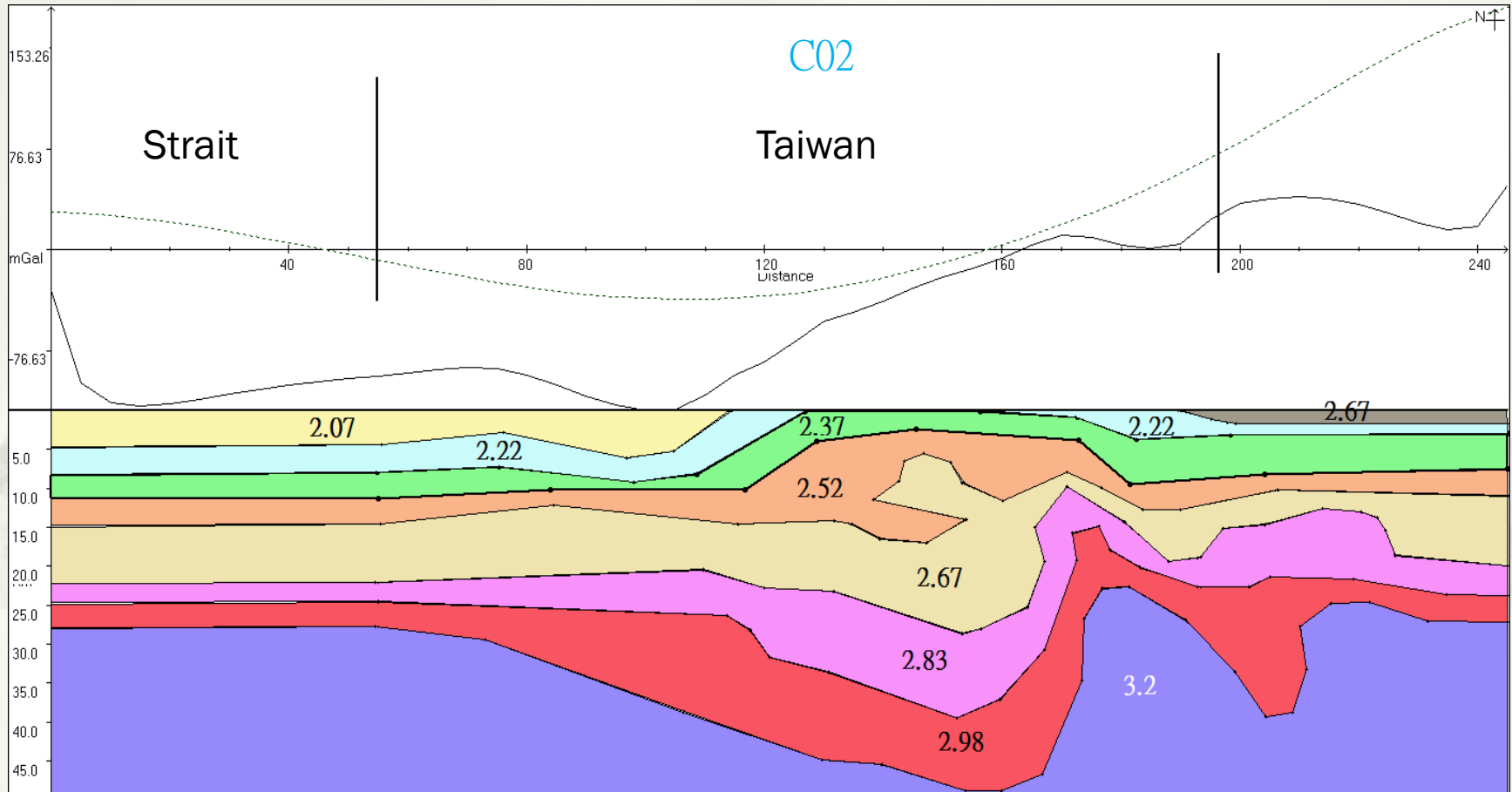
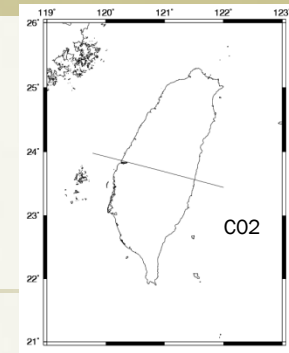
中線



(修改自 Yao-wen Kuo, 2011)

# Discussion

中線

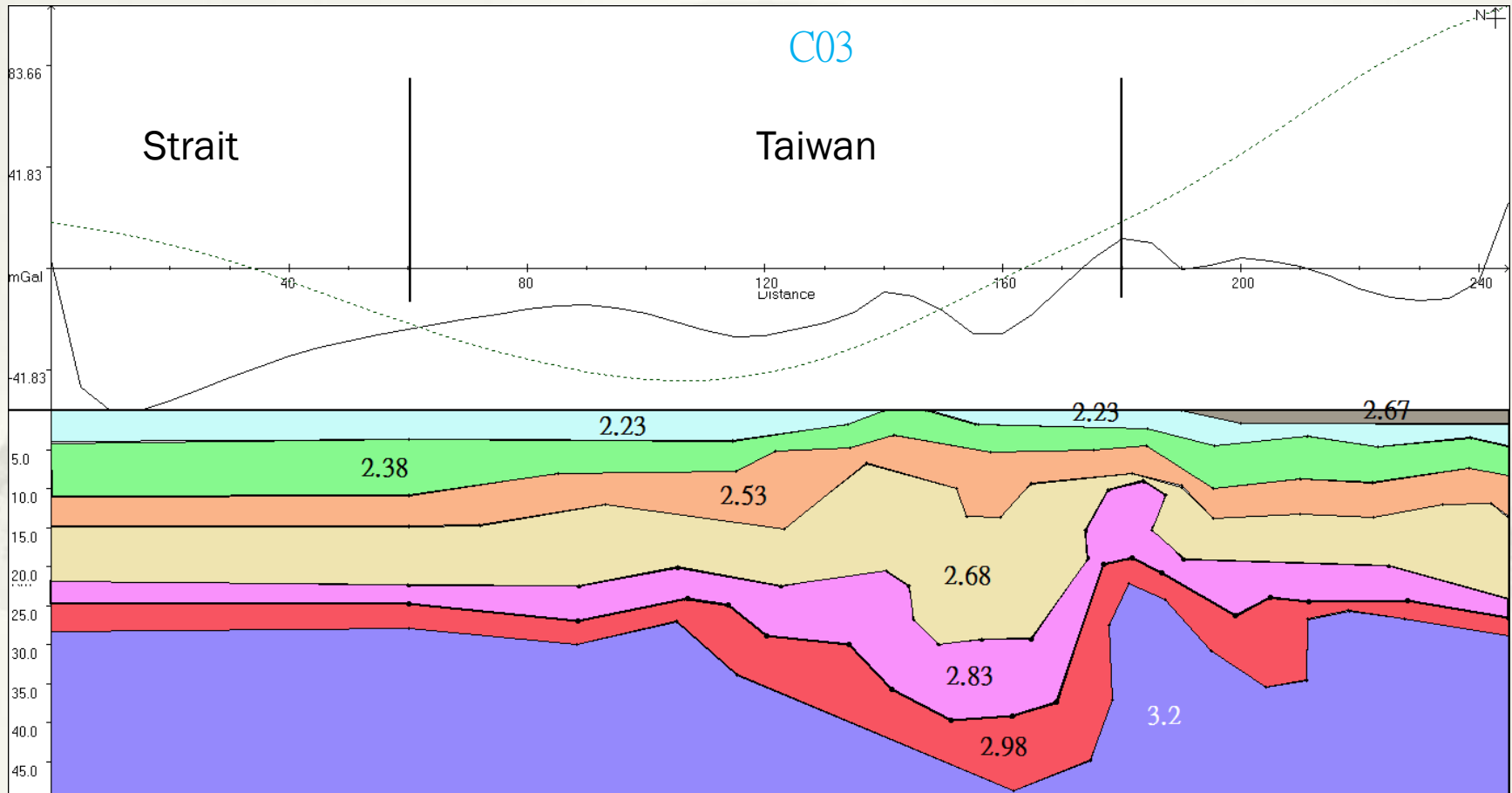
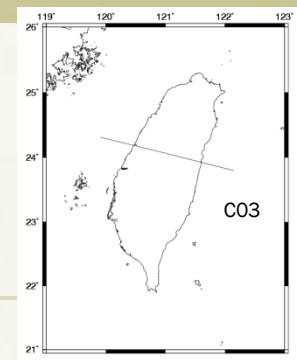


(修改自 Hao Kuo-Chen, 2012)



# Discussion

中線



(修改自 Hao Kuo-Chen, 2012)

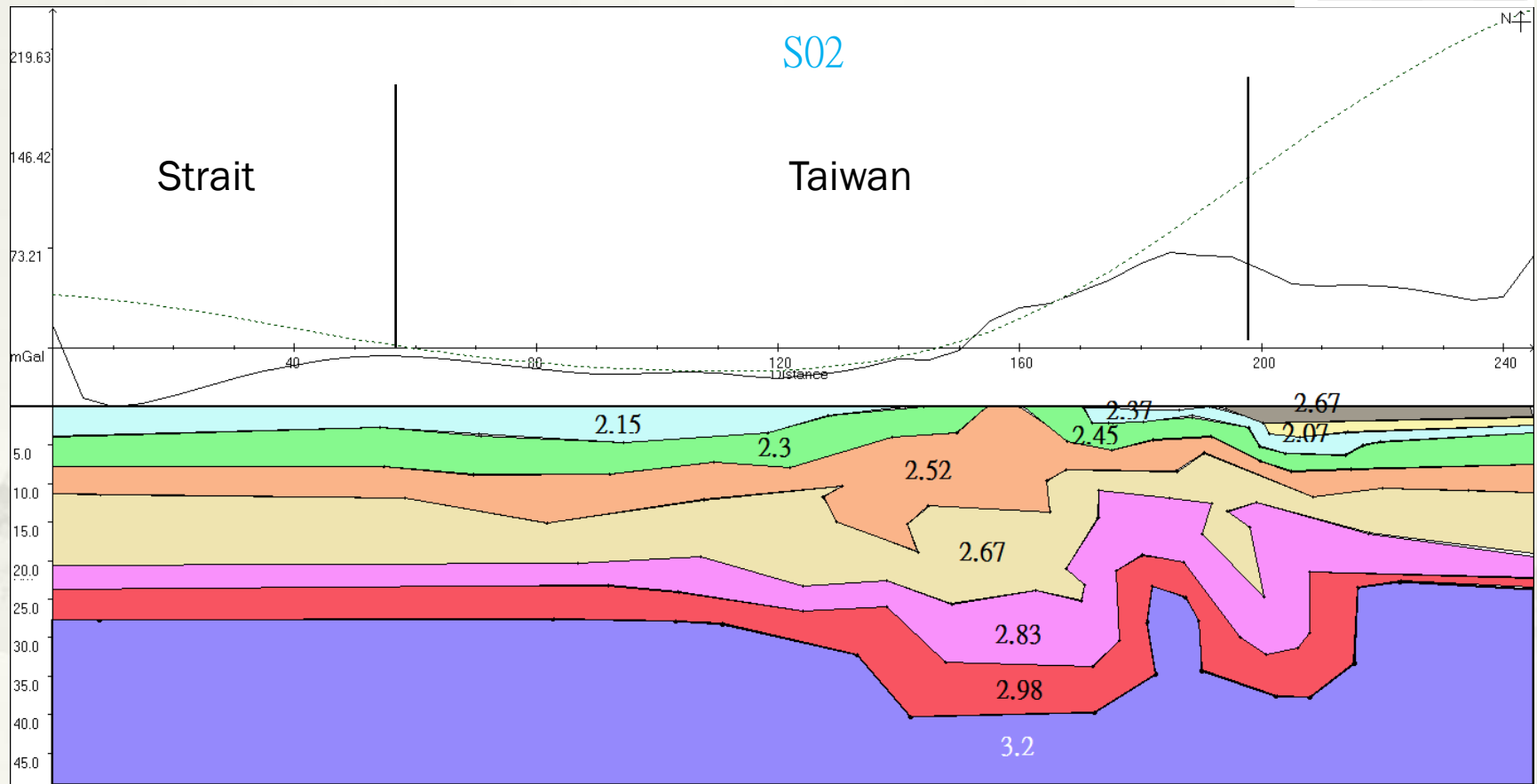
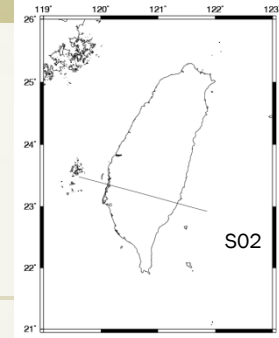
# Discussion

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- \* 討論調整後模型的結果

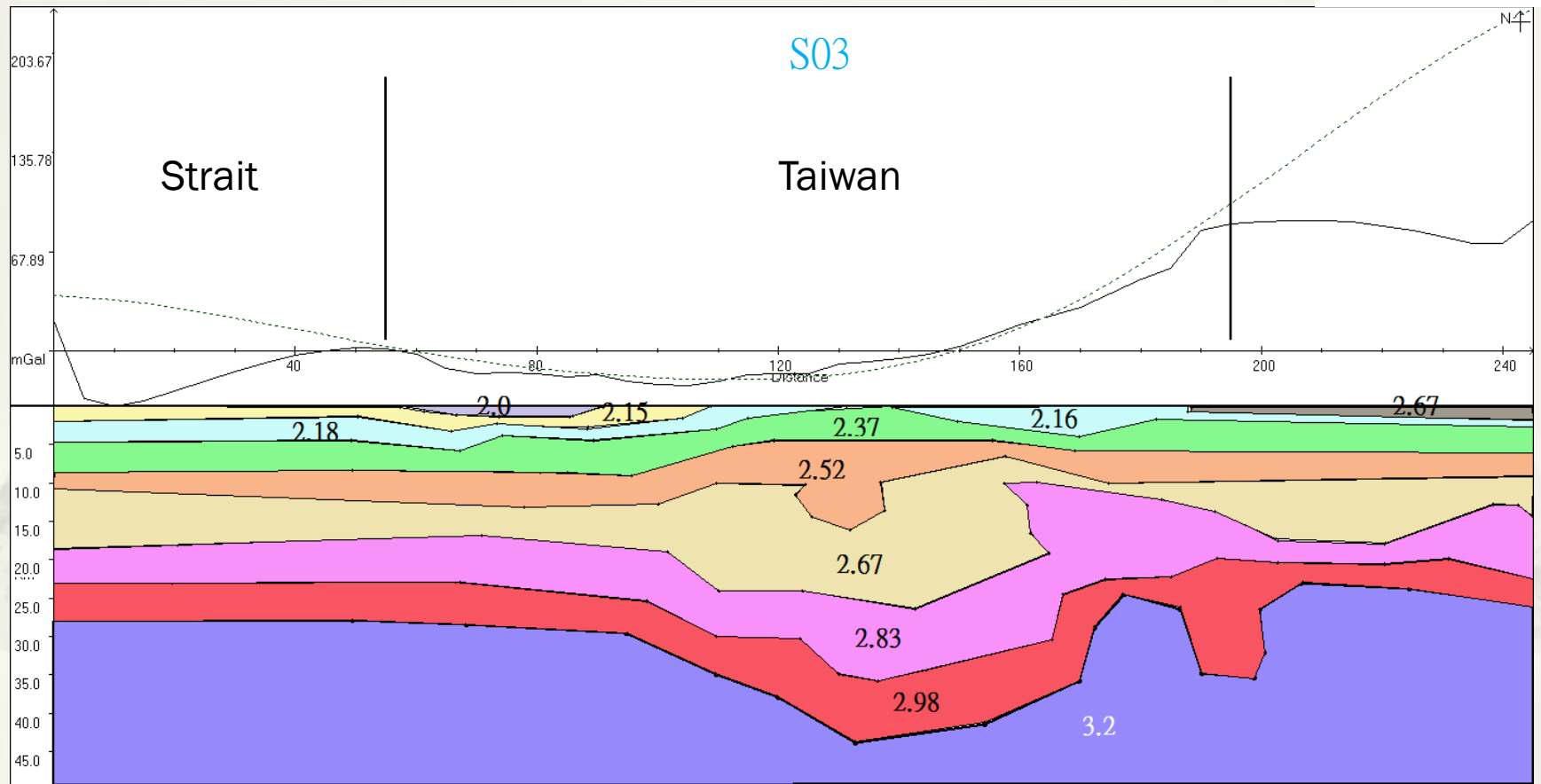
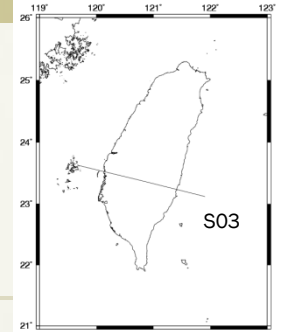


# Discussion



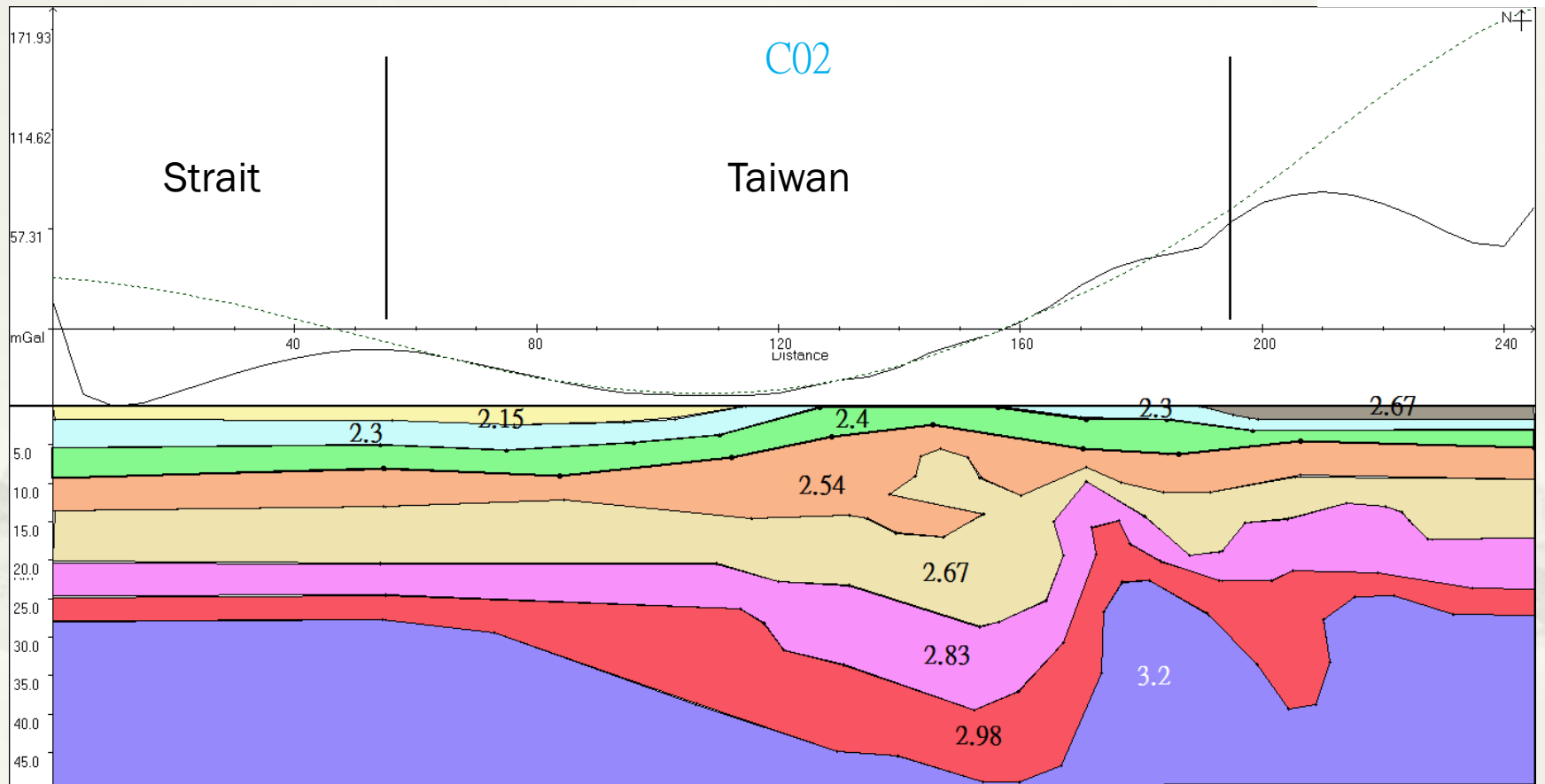
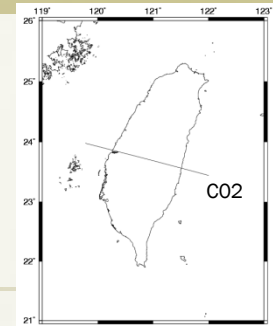
(修改自 Hao Kuo-Chen, 2012)

# Discussion



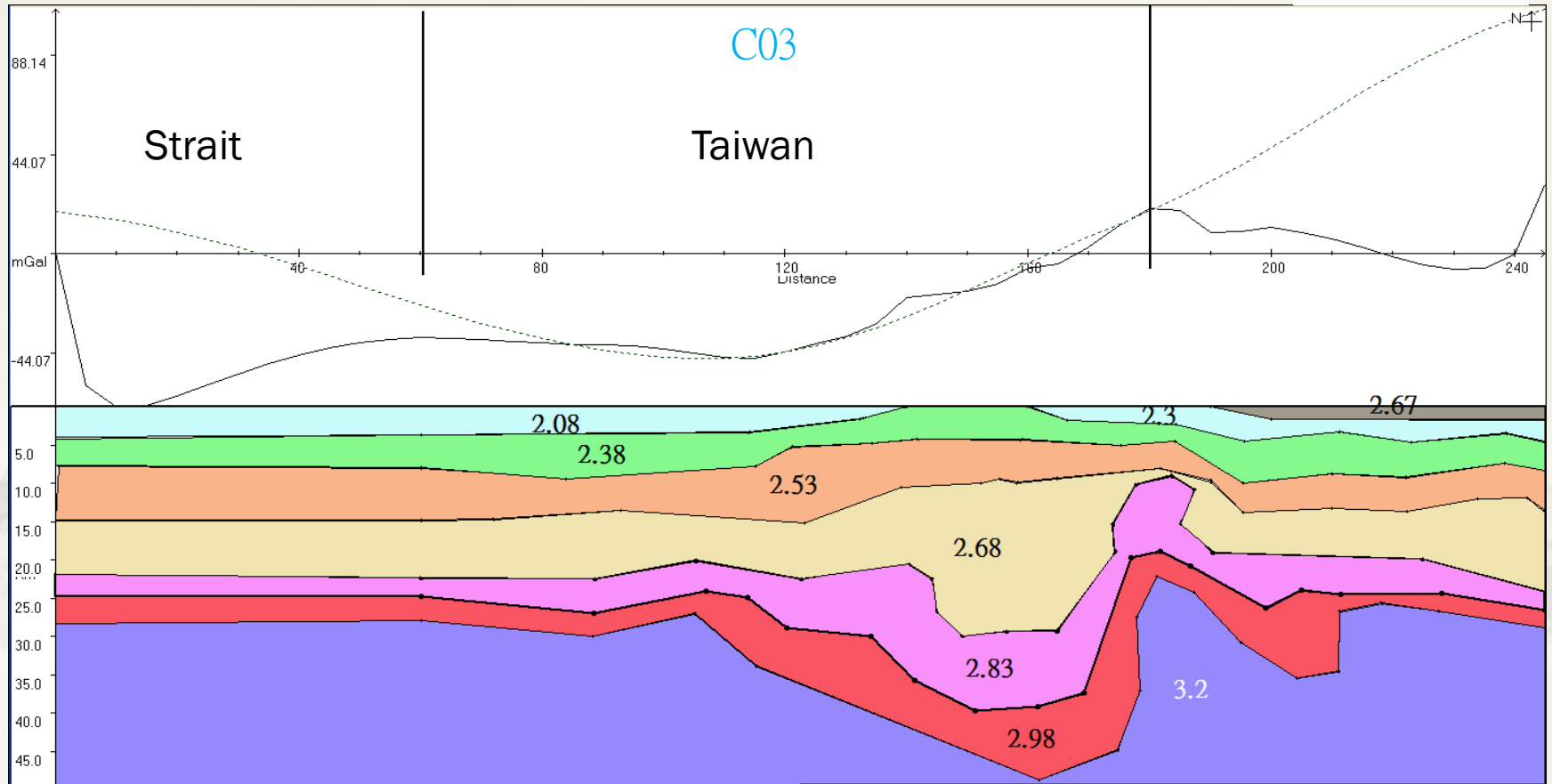
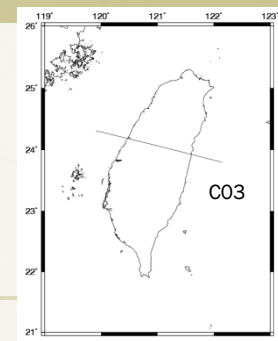
(修改自Hao Kuo-Chen, 2012)

# Discussion



(修改自Hao Kuo-Chen, 2012)

# Discussion



(修改自 Hao Kuo-Chen, 2012)

# Conclusion

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- \* 從相關式分析發現不同方式作的速度模型得到的速度轉密度相關式也會不同
- \* 比較調整前的密度模型可以初步猜測模型和重力觀測的符合情形
- \* 比較調整後的密度模型與該區地質狀況初步認為S02，S03，C02，C03東部的淺層速度都低估了

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**THE END**