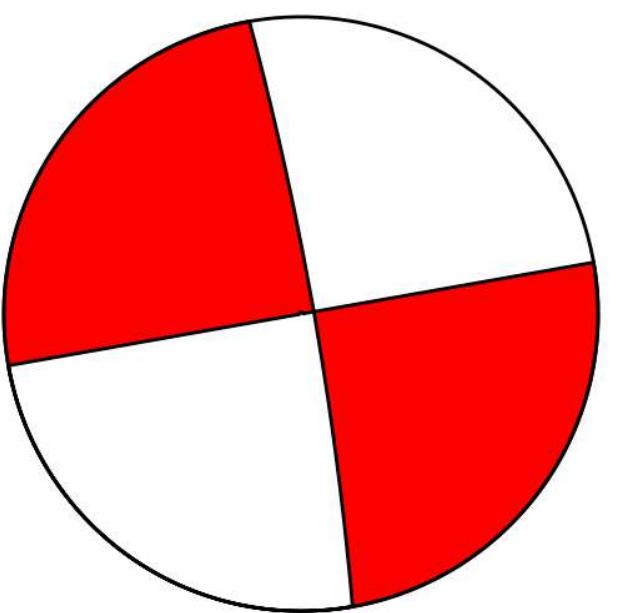


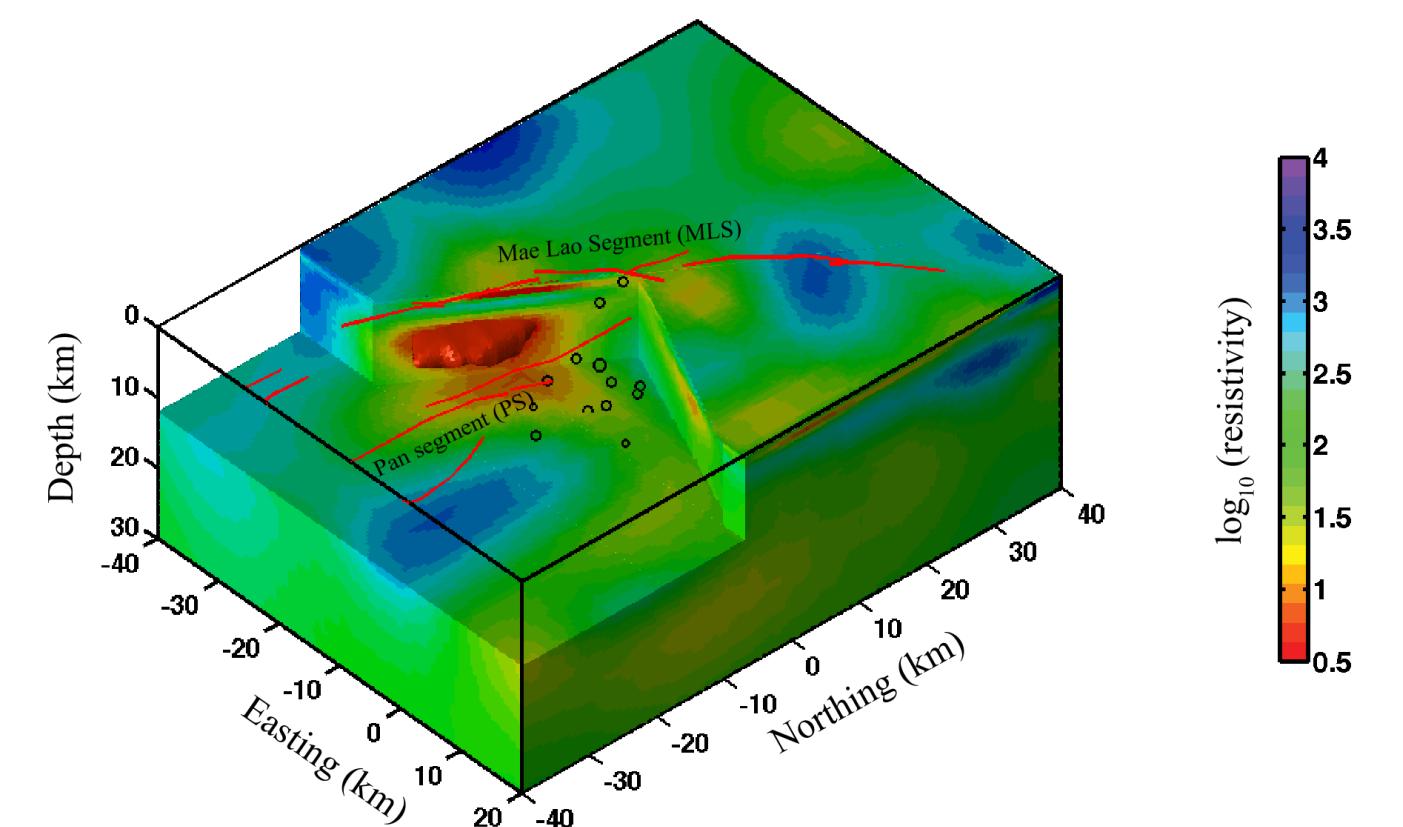


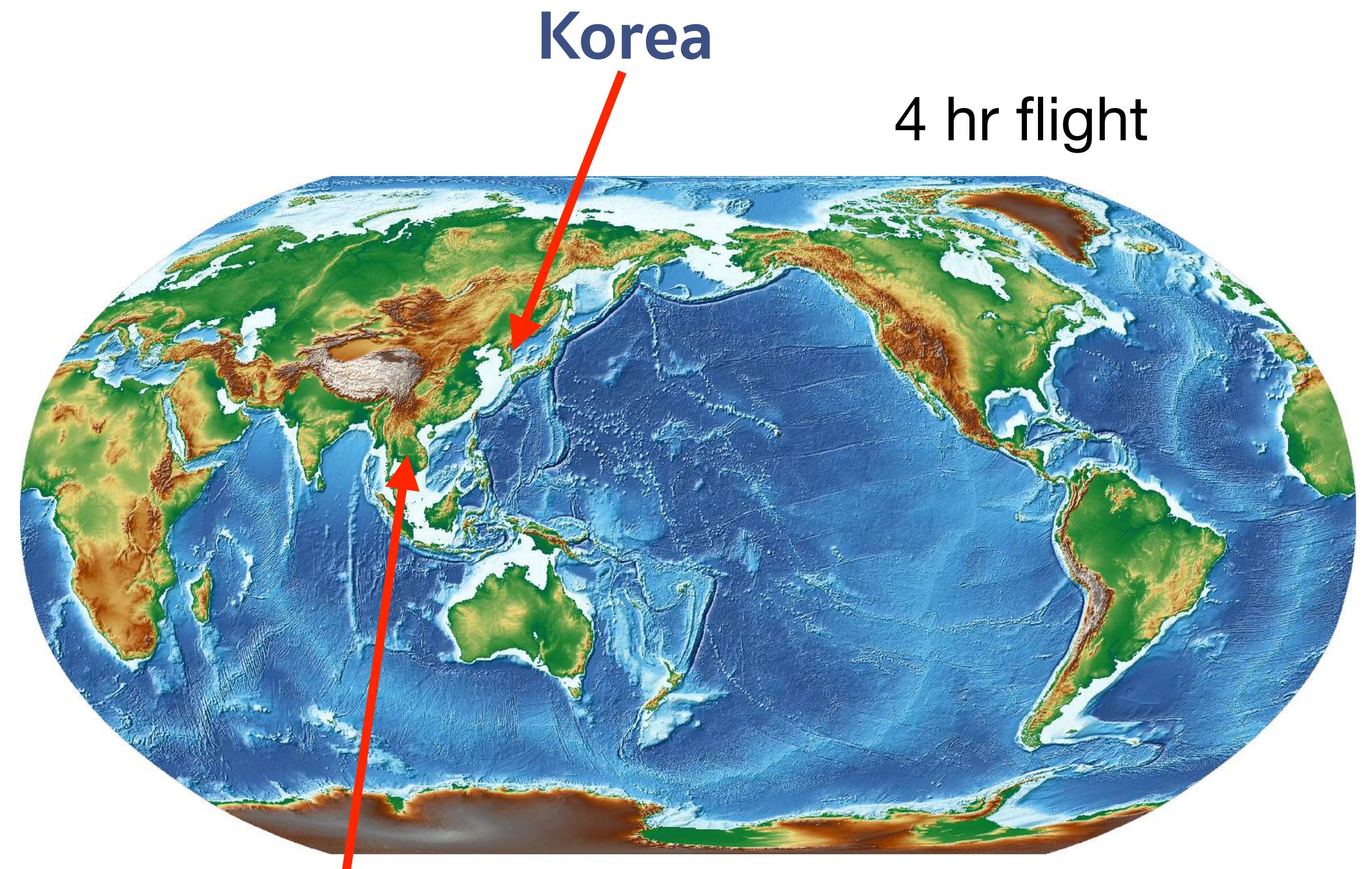
# Crustal Structure in Thailand

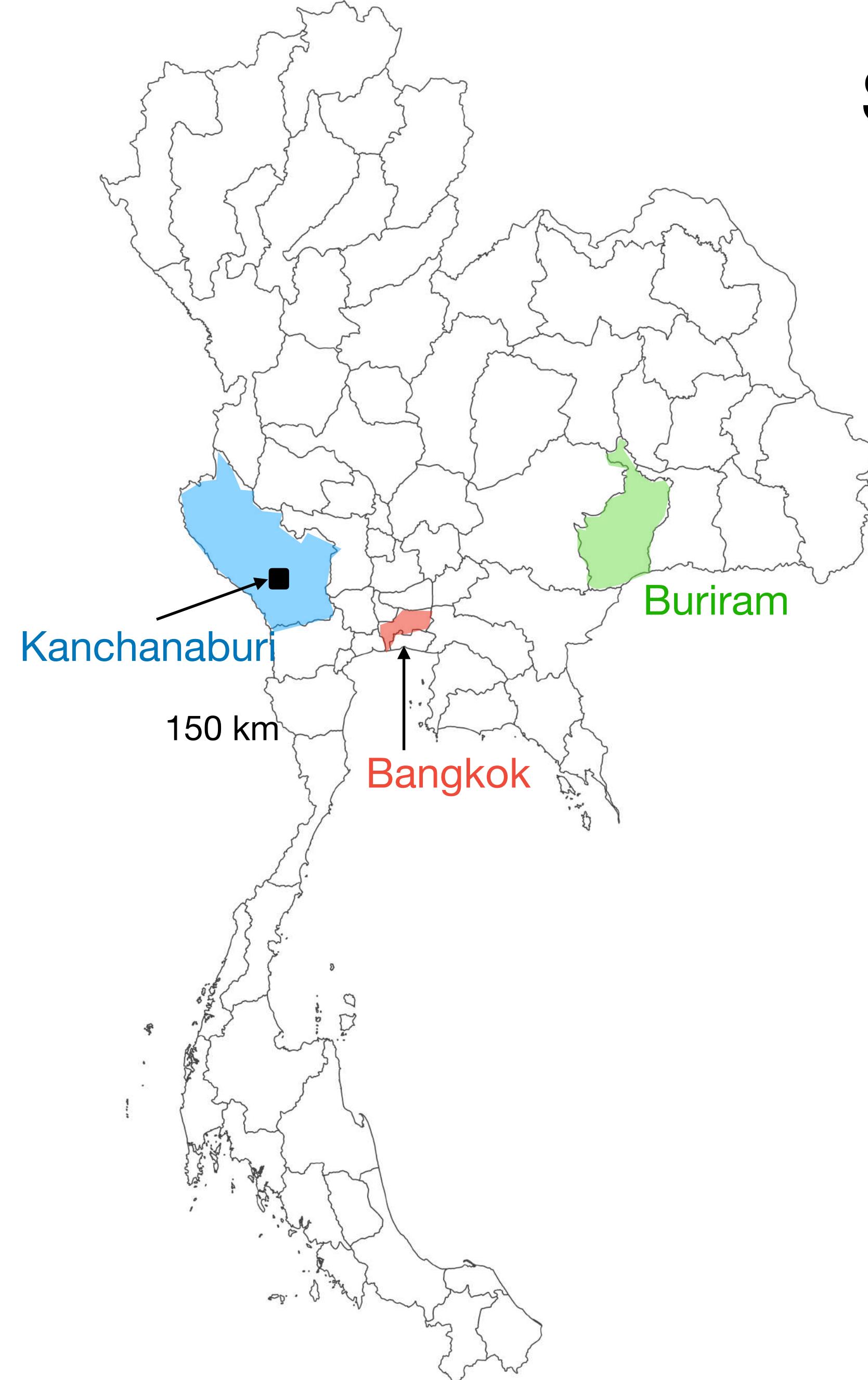
SIP2025



**Songkhun Boonchaisuk,**  
Mahidol University, Kanchanaburicampus  
[songkhun.boo@mahidol.edu](mailto:songkhun.boo@mahidol.edu)







# Songkhun Boonchaisuk (Job)

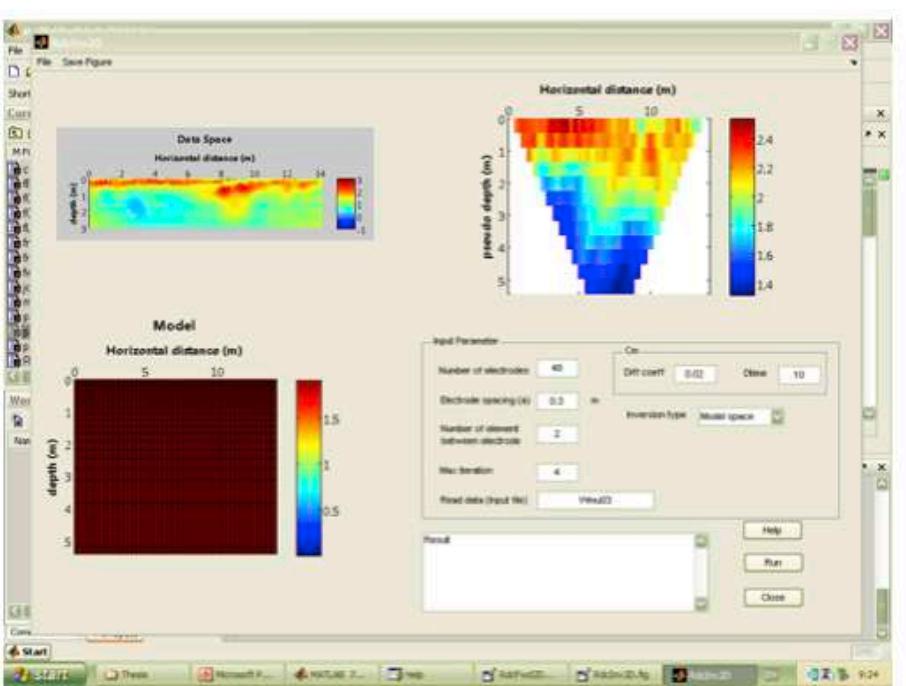
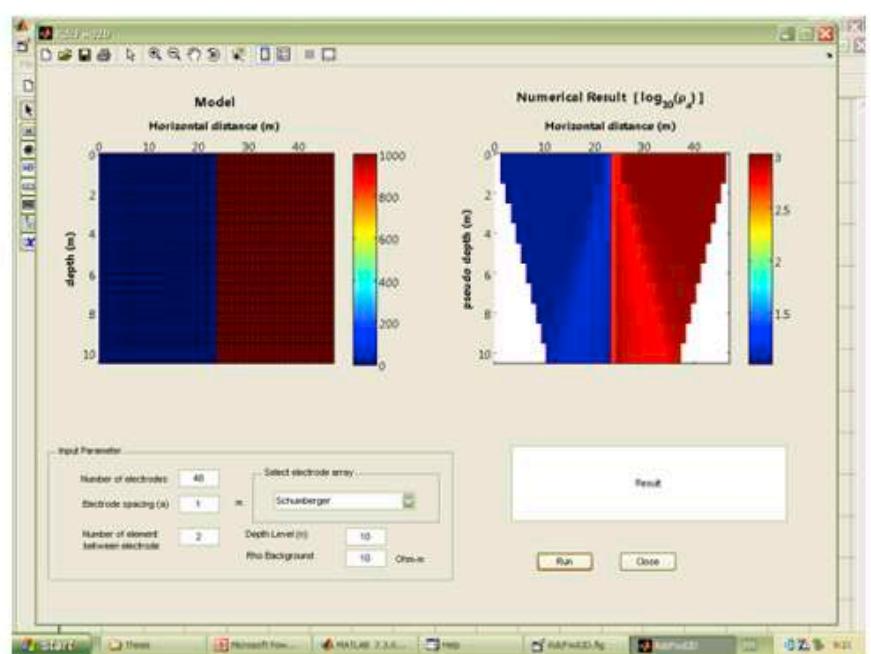
Geosciences  
Kanchanaburi  
Campus  
Mahidol University



Earthquake research center of Thailand

- 2007 M.Sc. (Physics) Mahidol University, Thailand
- 2013 Ph.D. (Physics) Mahidol University, Thailand
- Previous Work
- Work plan @ KIGAM

# 2D Resistivity Inversion Program Development

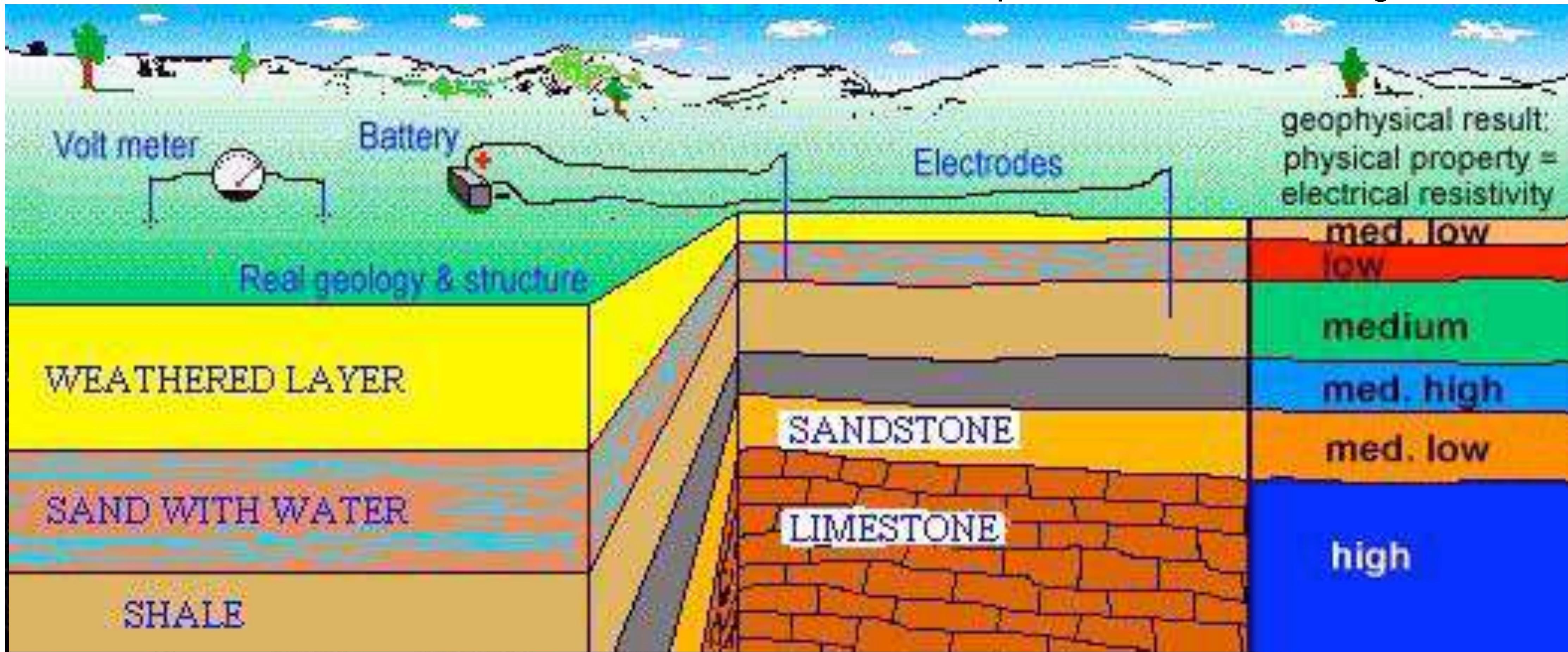


**Songkhun Boonchaisuk,  
Assoc. Prof. Dr. Weerachai Siripunvaraporn**

[songkhun.boo@mahidol.edu](mailto:songkhun.boo@mahidol.edu)

# Direct Current (DC) Resistivity

<http://www.eos.ubc.ca/ubcgif/>



# The goal of this work

---

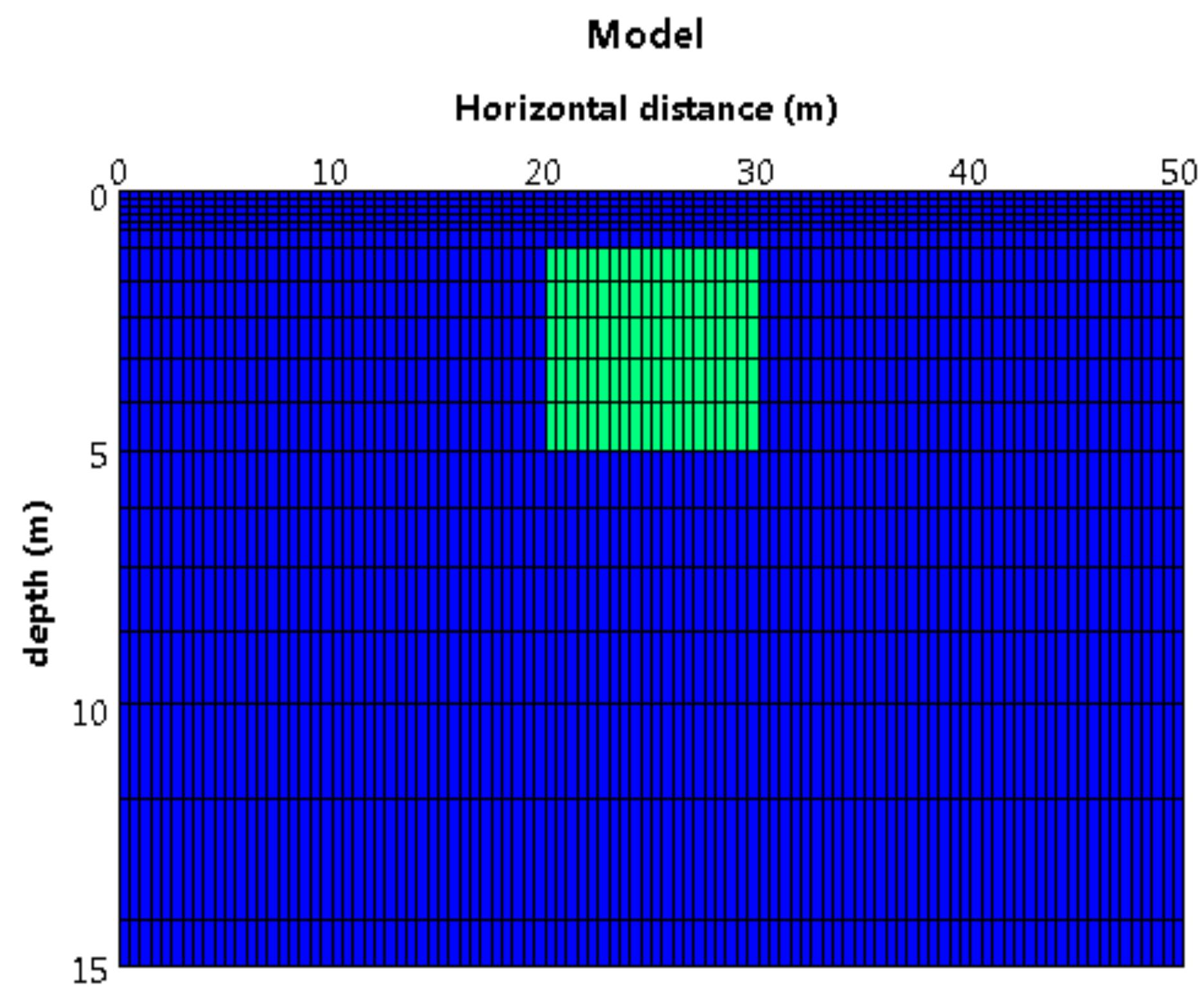
- Develop 2 inversion algorithms for DC resistivity: Both of them based on Occam's inversion
  - The model space method
    - (Constable et al. 1987 for 1-D resistivity and MT)
  - The data space method
    - (Siripunvaraporn and Egbert (2000) and Siripunvaraporn et al. (2005) for 2-D and 3-D MT)

## Occam's razor

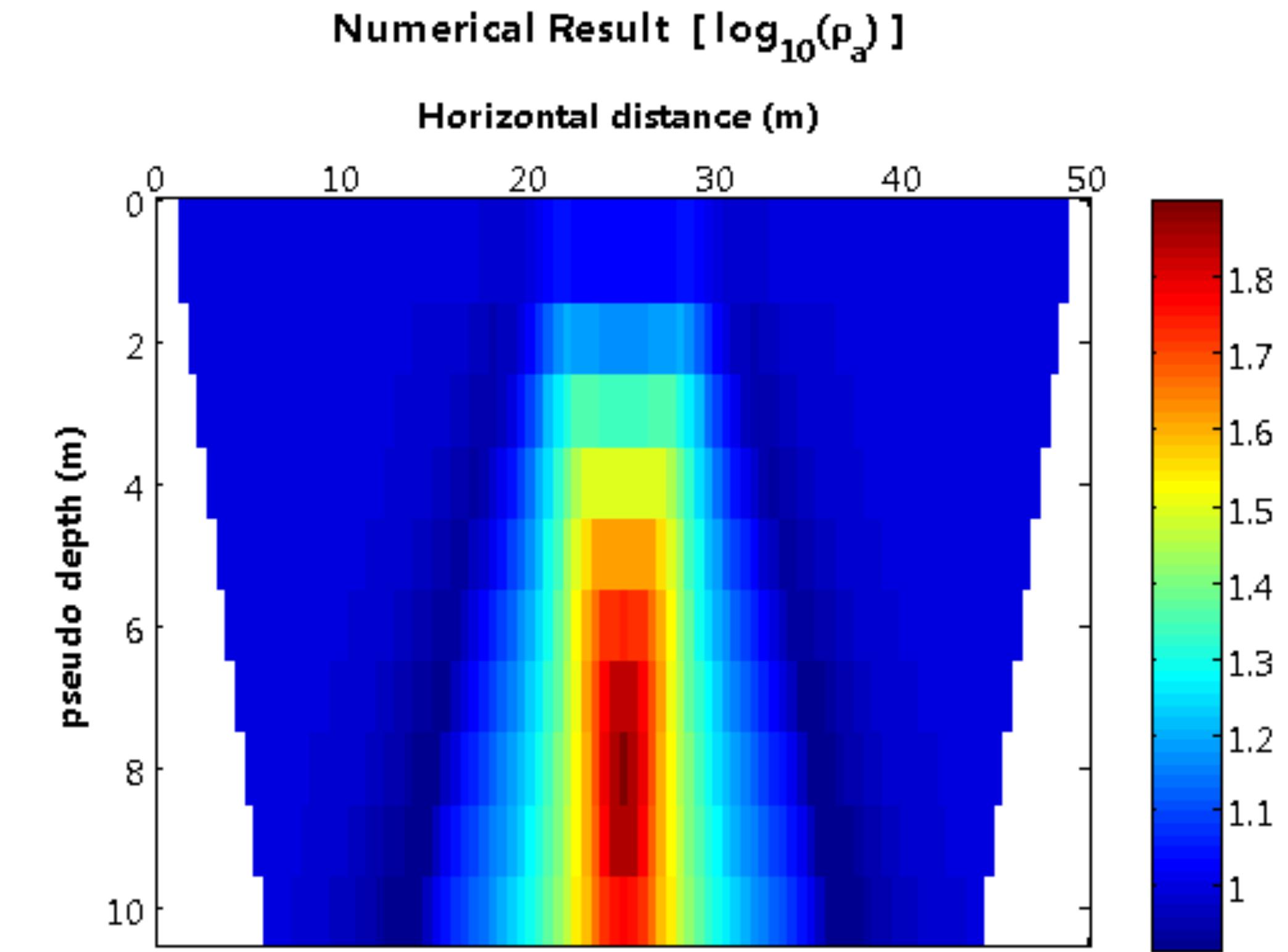
the principle in philosophy and science that assumptions introduced to explain a thing must not be multiplied beyond necessity, and hence the simplest of several hypotheses is always the best in accounting for unexplained facts.

# Forward modeling

e.g., RES2Dmod

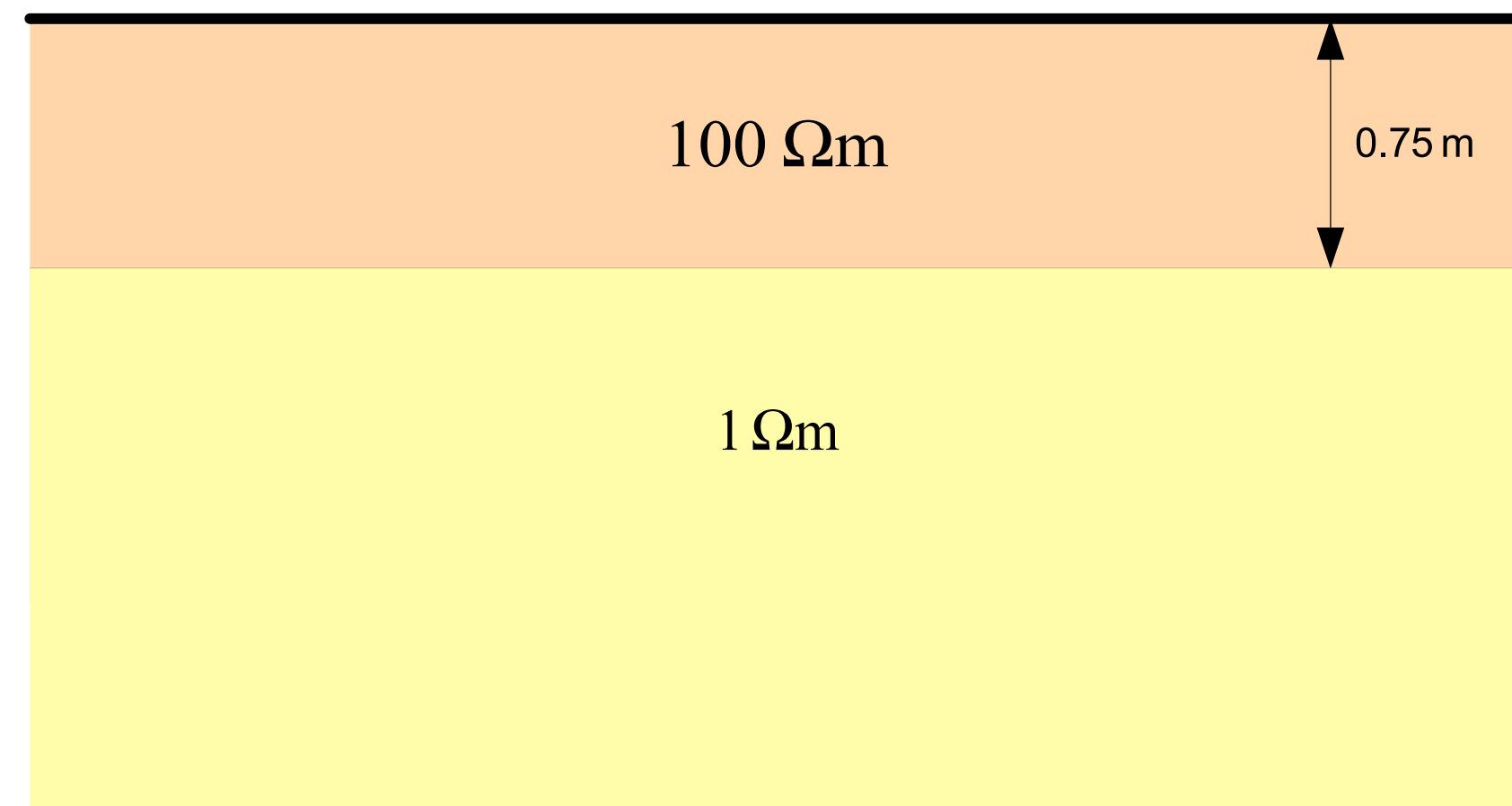


Calculation

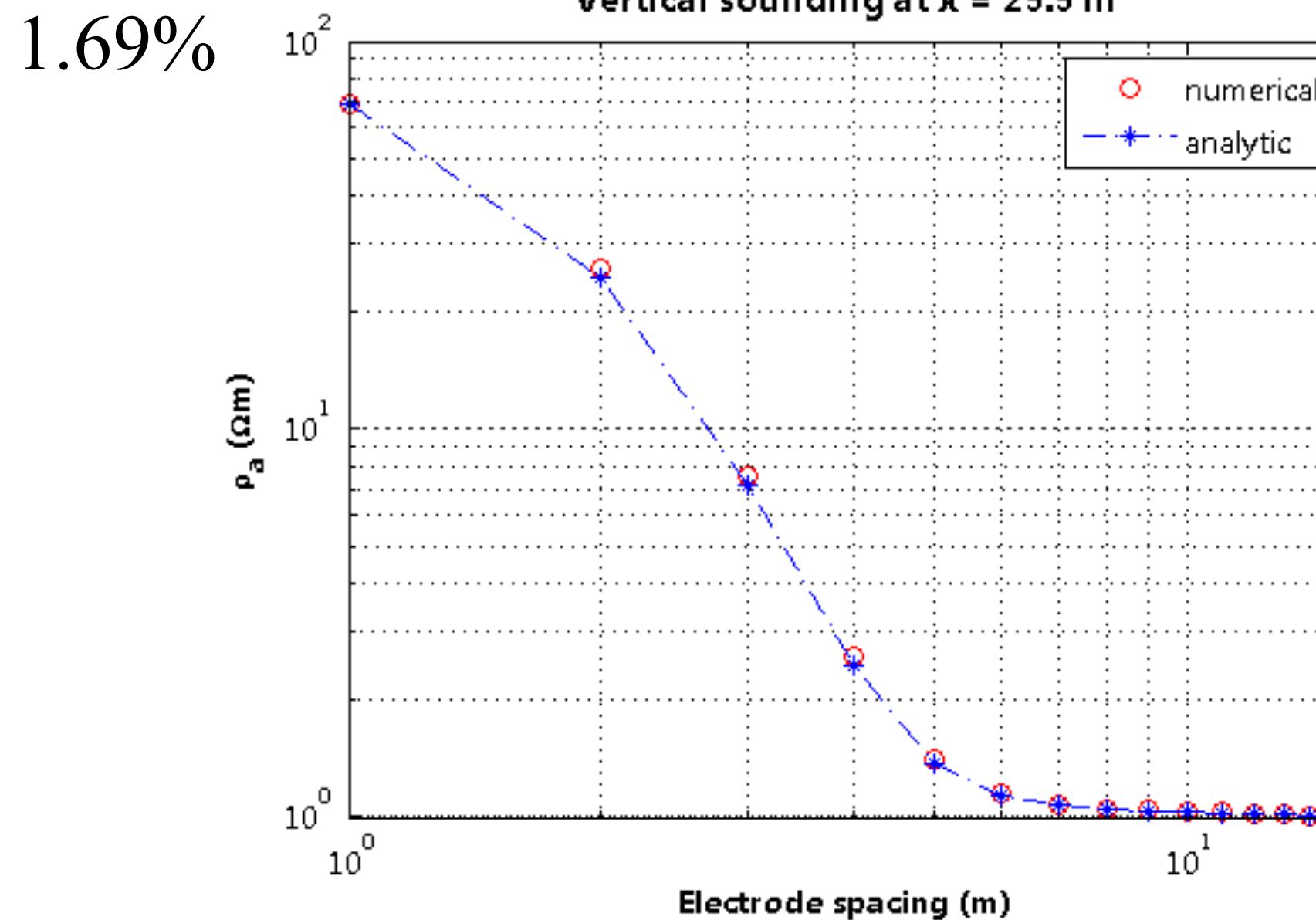


$$\nabla \cdot (\sigma \nabla \phi) = -I \delta(r - r_s)$$

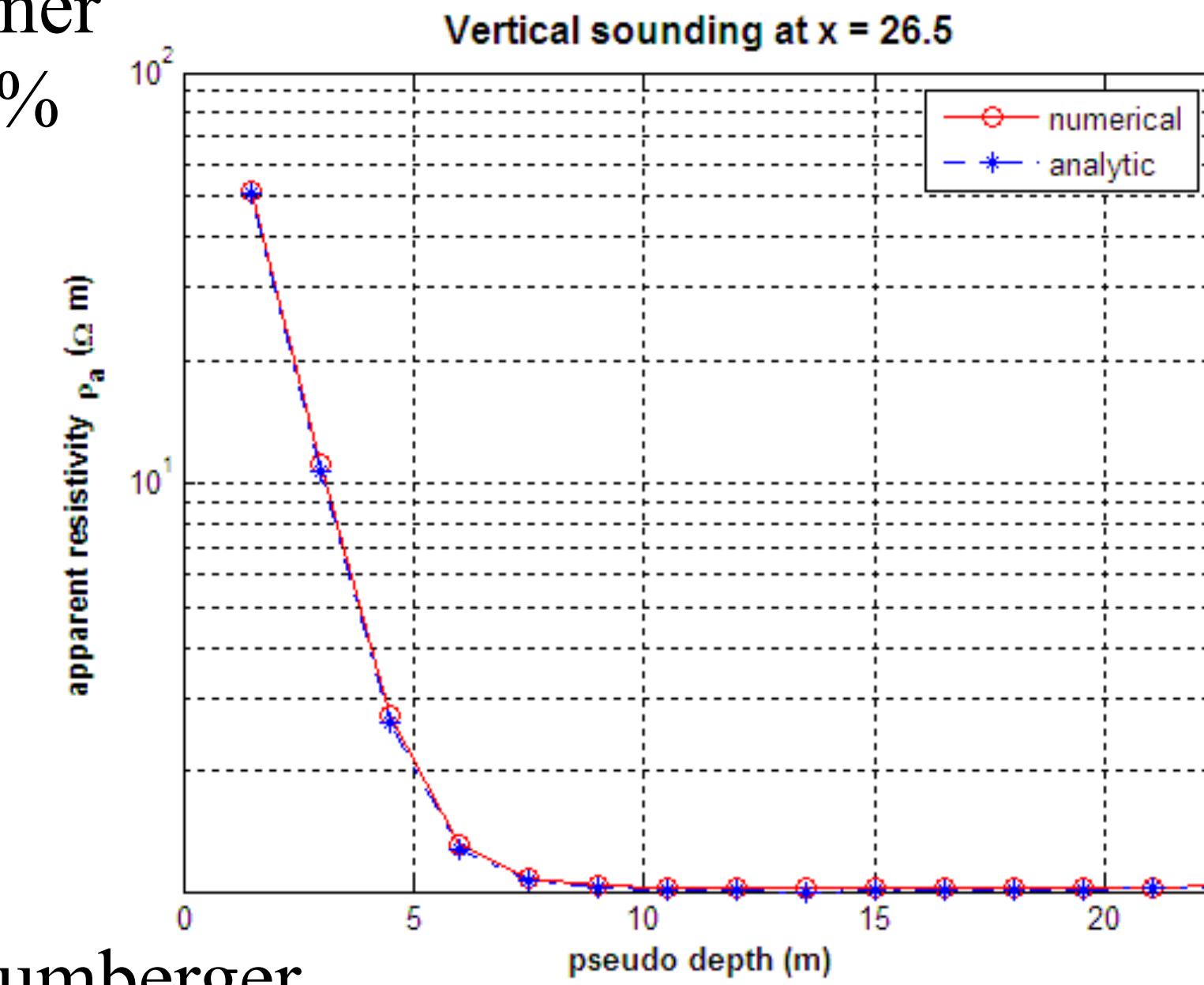
# Results for a two-layer model



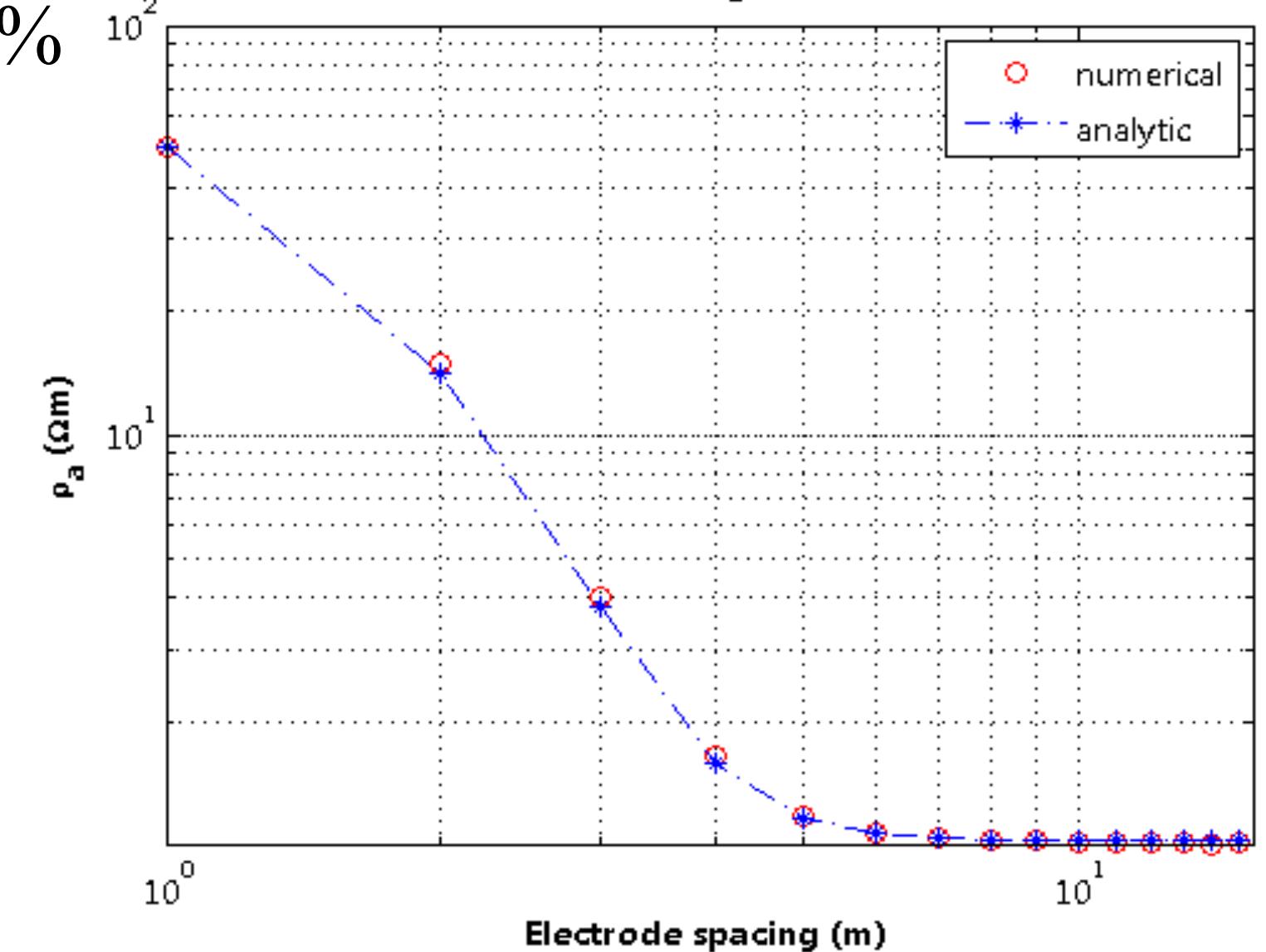
Dipole-dipole



Wenner  
2.29%

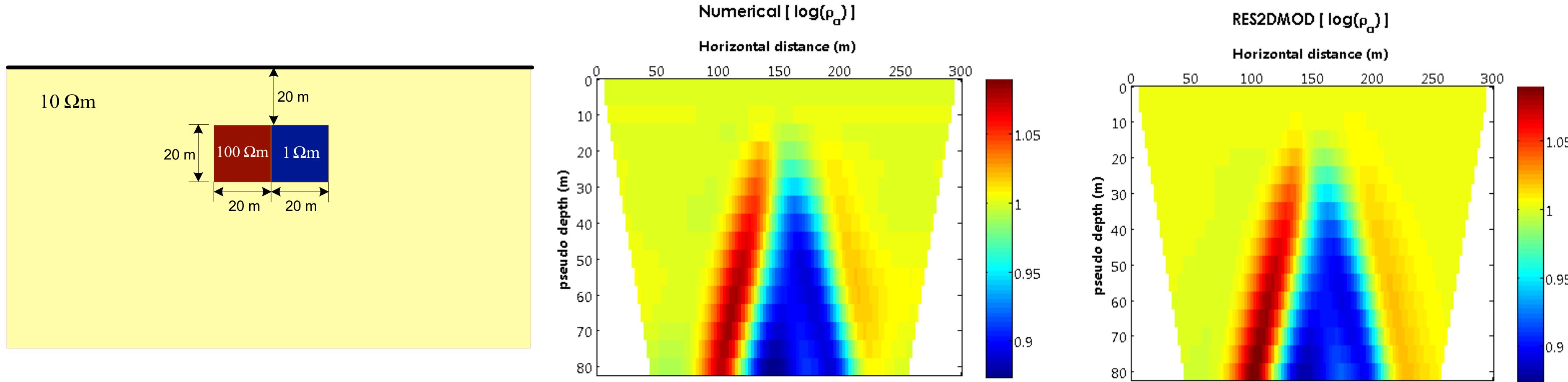


Schlumberger  
1.48%



# Pseudosection for dipole-dipole profile over two blocks model

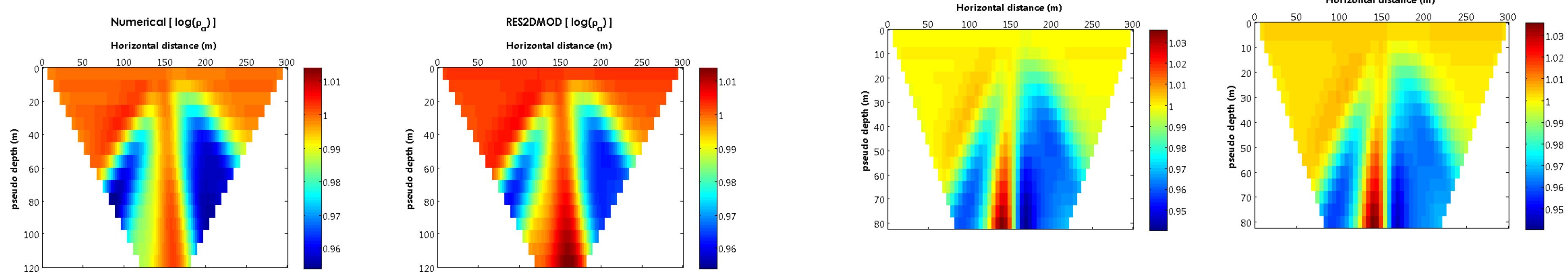
---



Dipole-dipole 0.65%

Schlumberger 0.49%

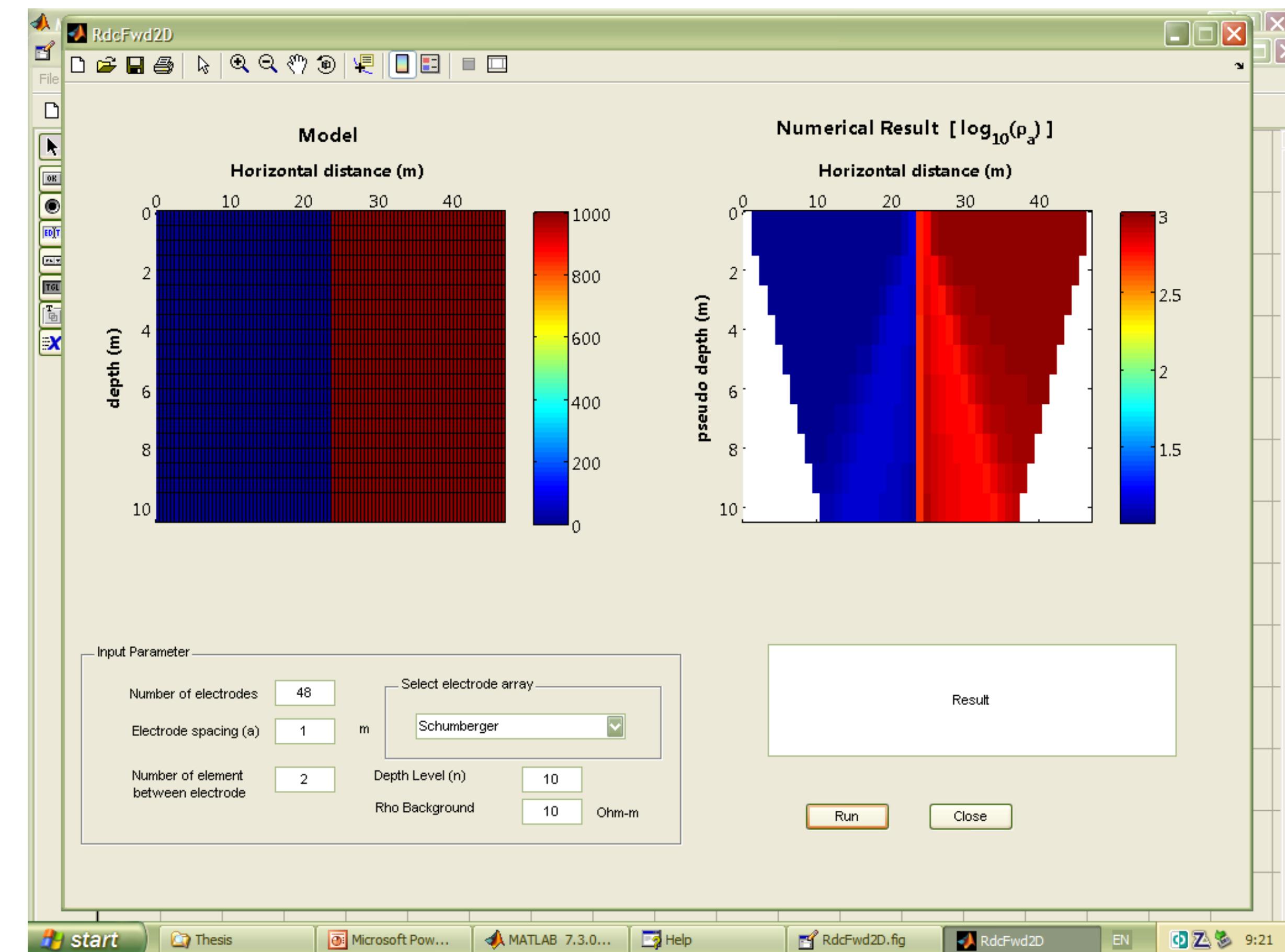
Wenner 1.02%



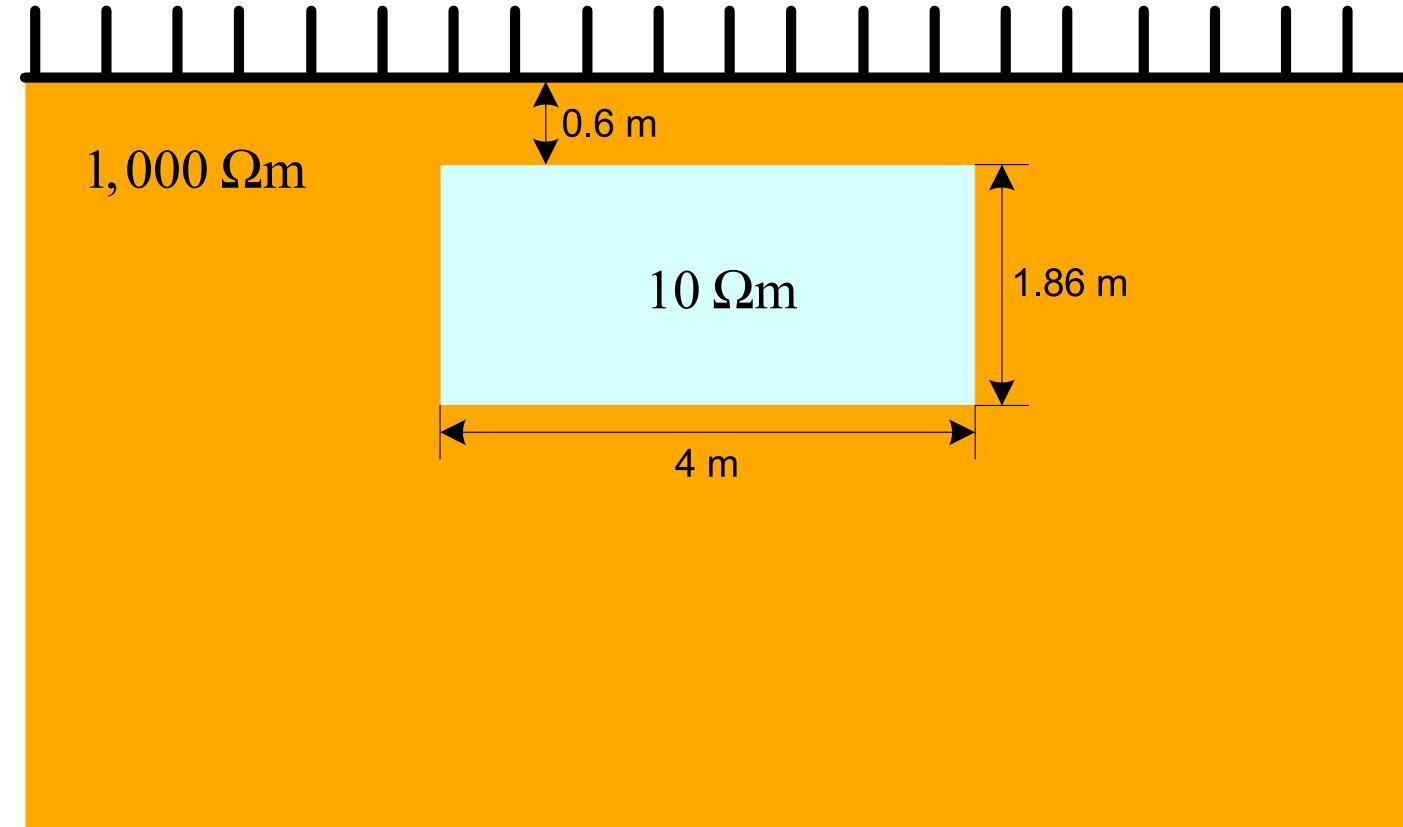
# Forward modeling

The numerical tests show that

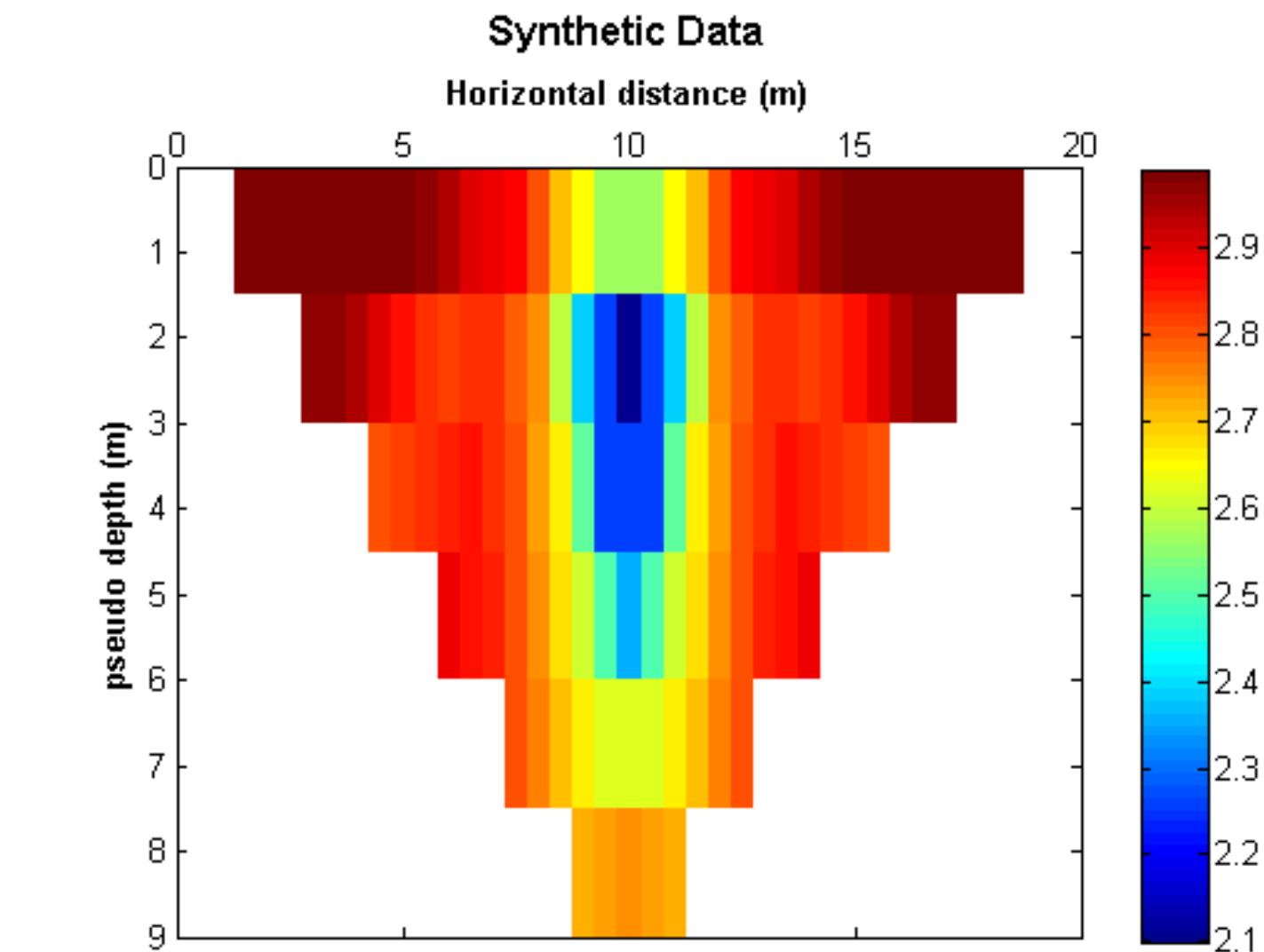
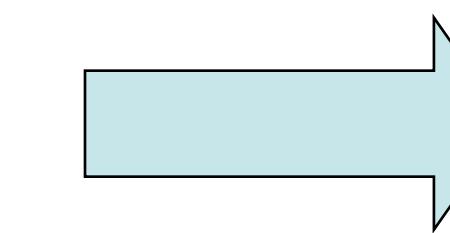
- Reliable
- Accurate



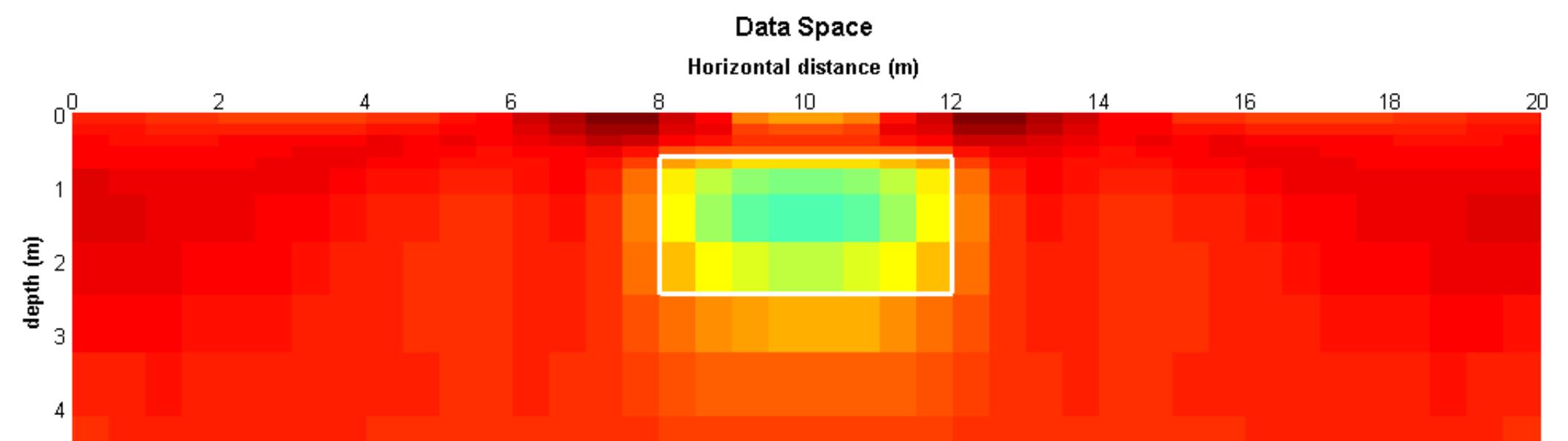
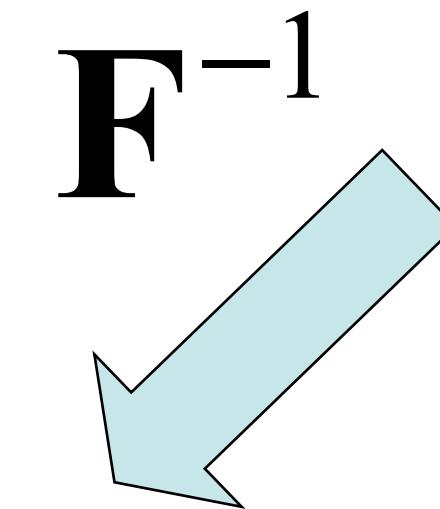
# What is the Inversion?



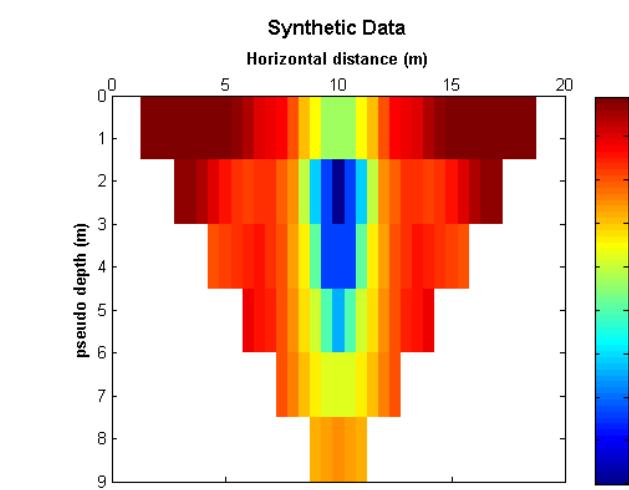
Forward



Inversion



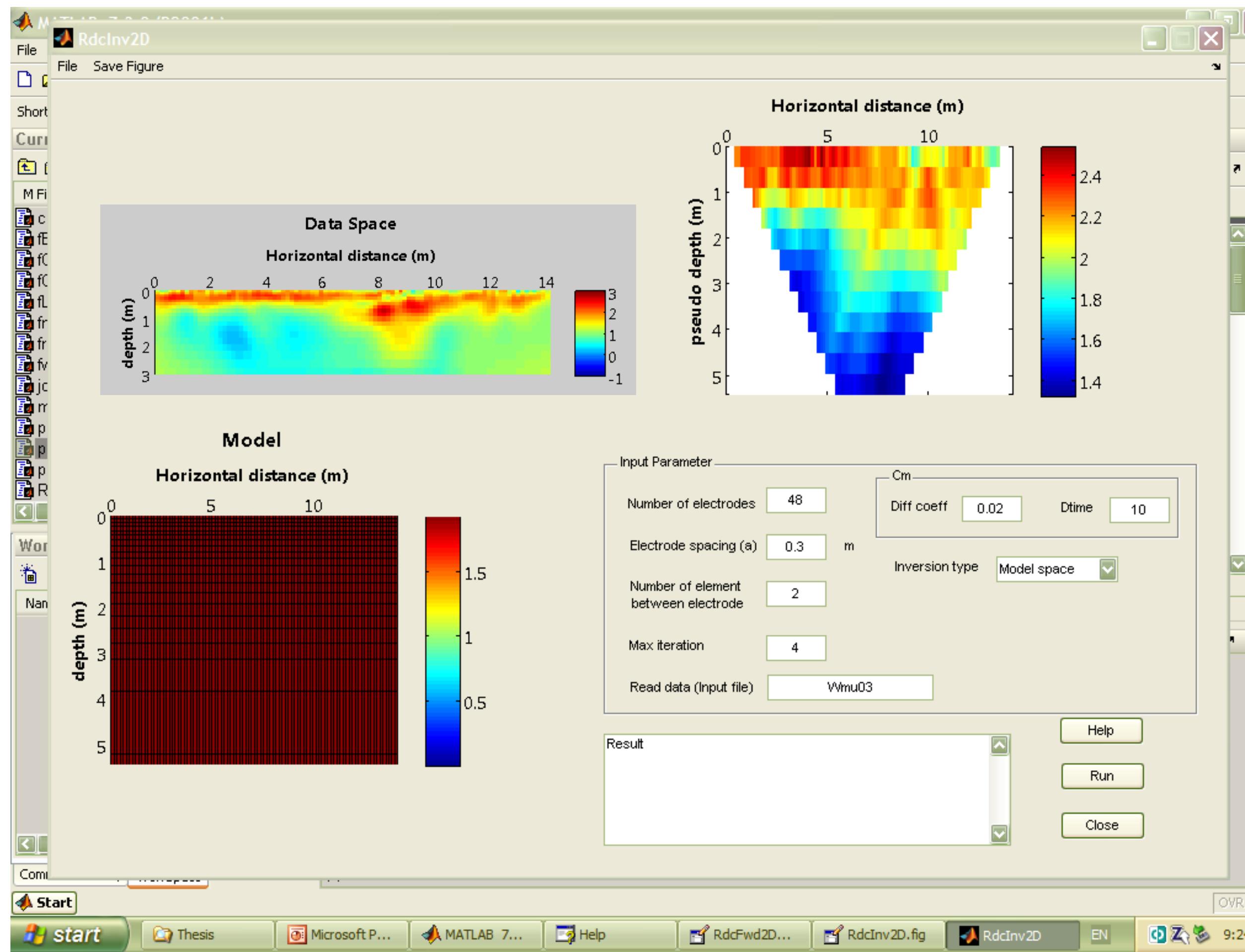
fit



response

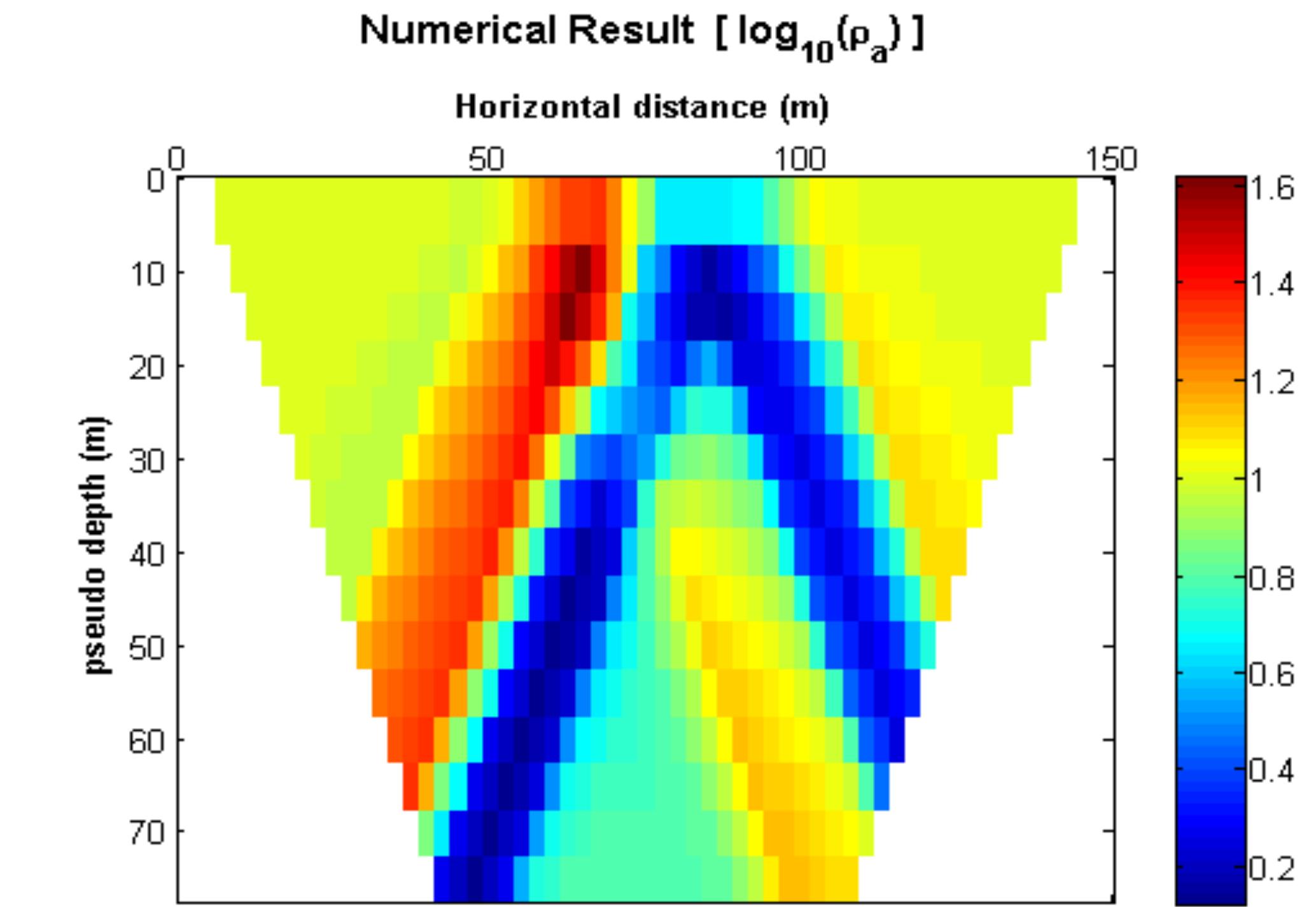
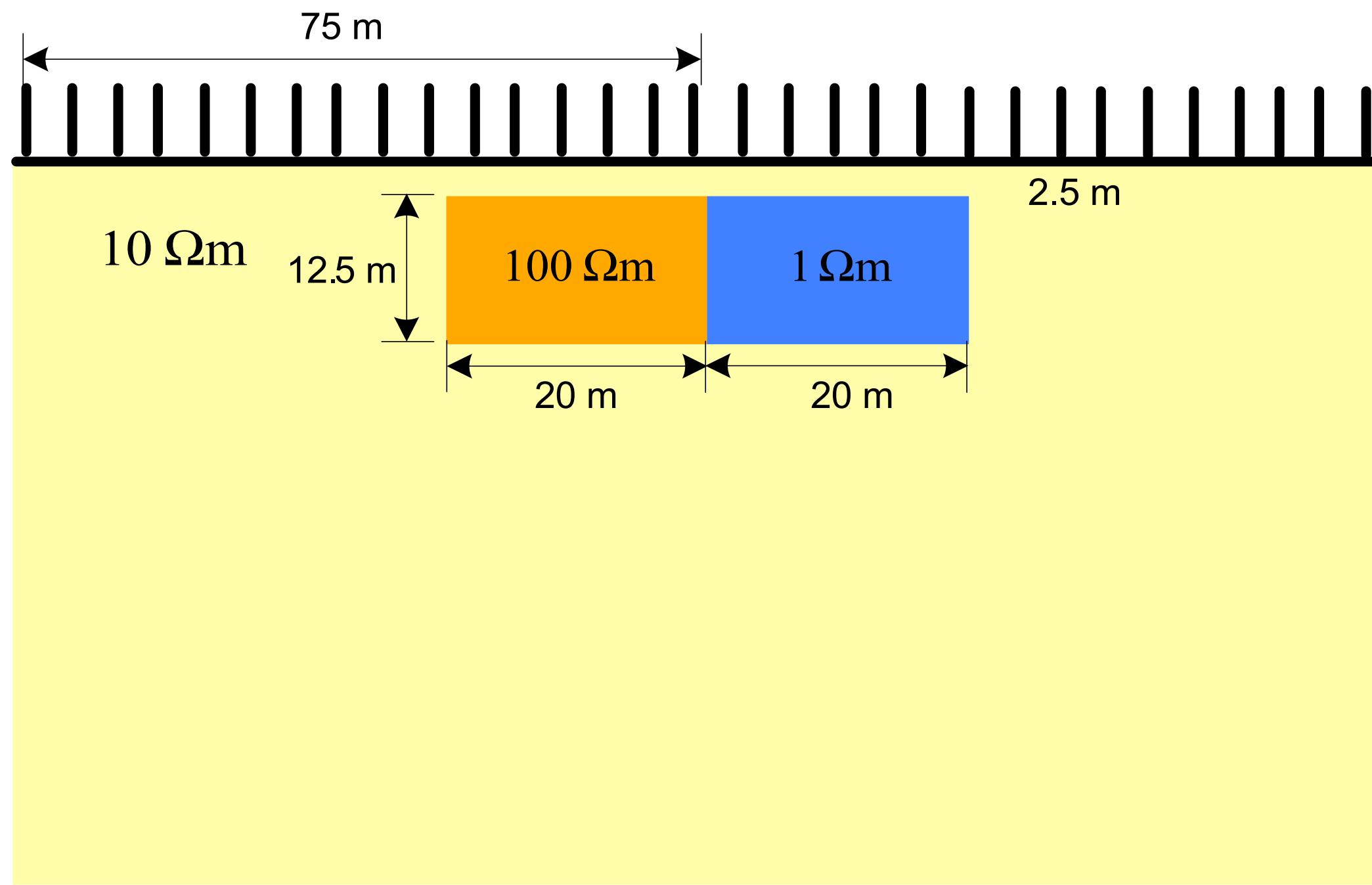
# Inversion

The codes of inversion are written with MATLAB



# Synthetic model and data

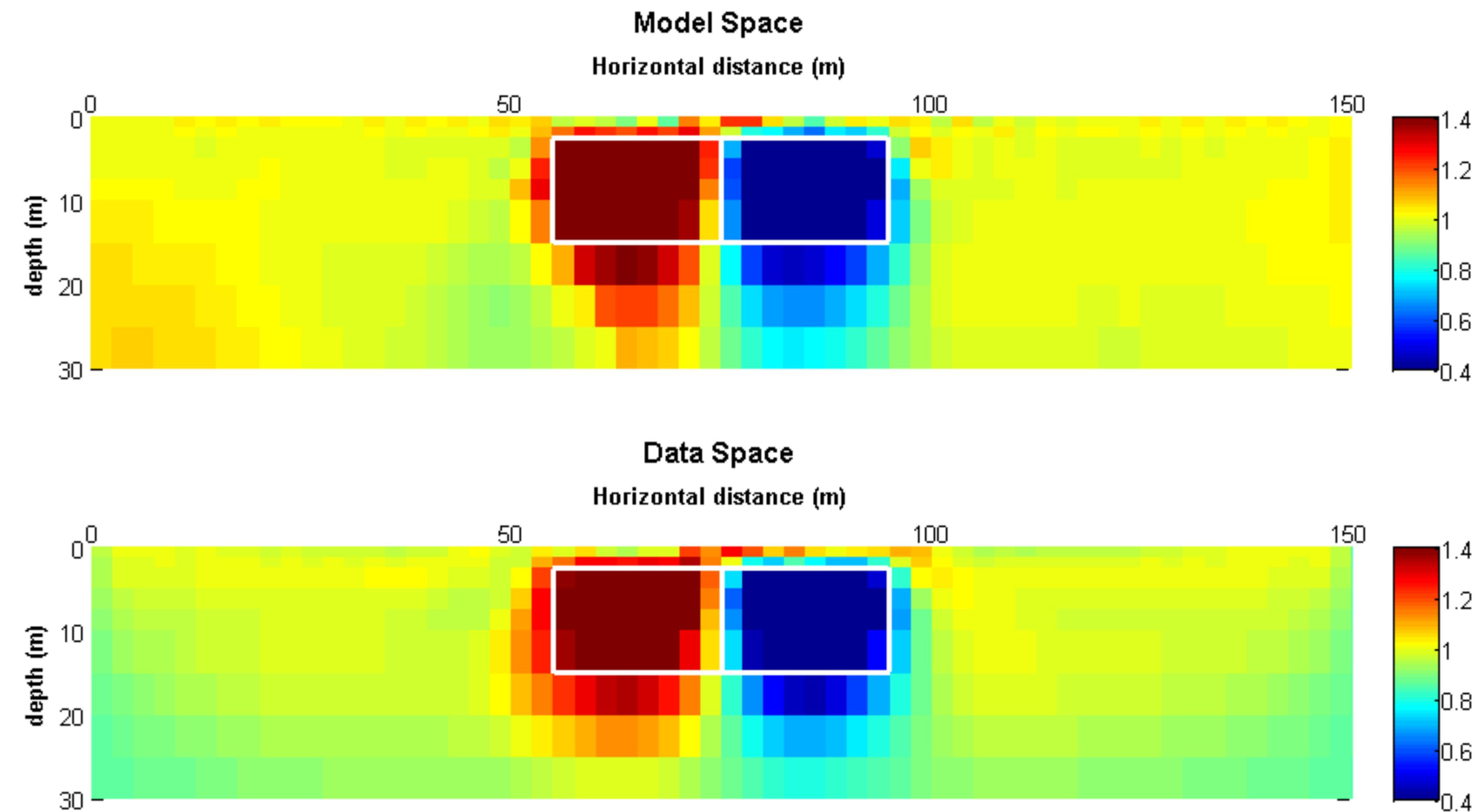
---



Dipole-dipole

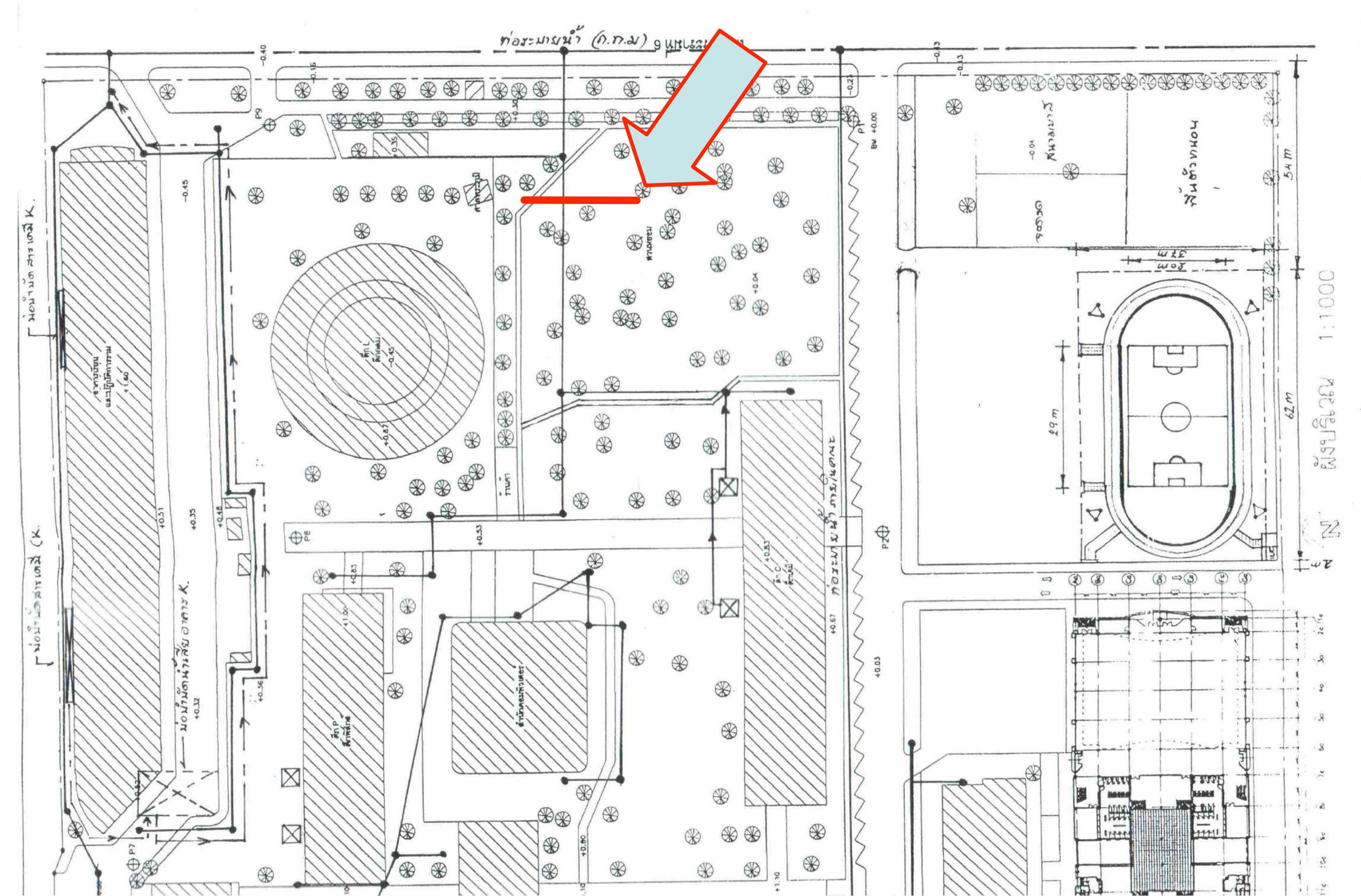
# Inverted models (dipole-dipole)

---



The white line indicates the two blocks

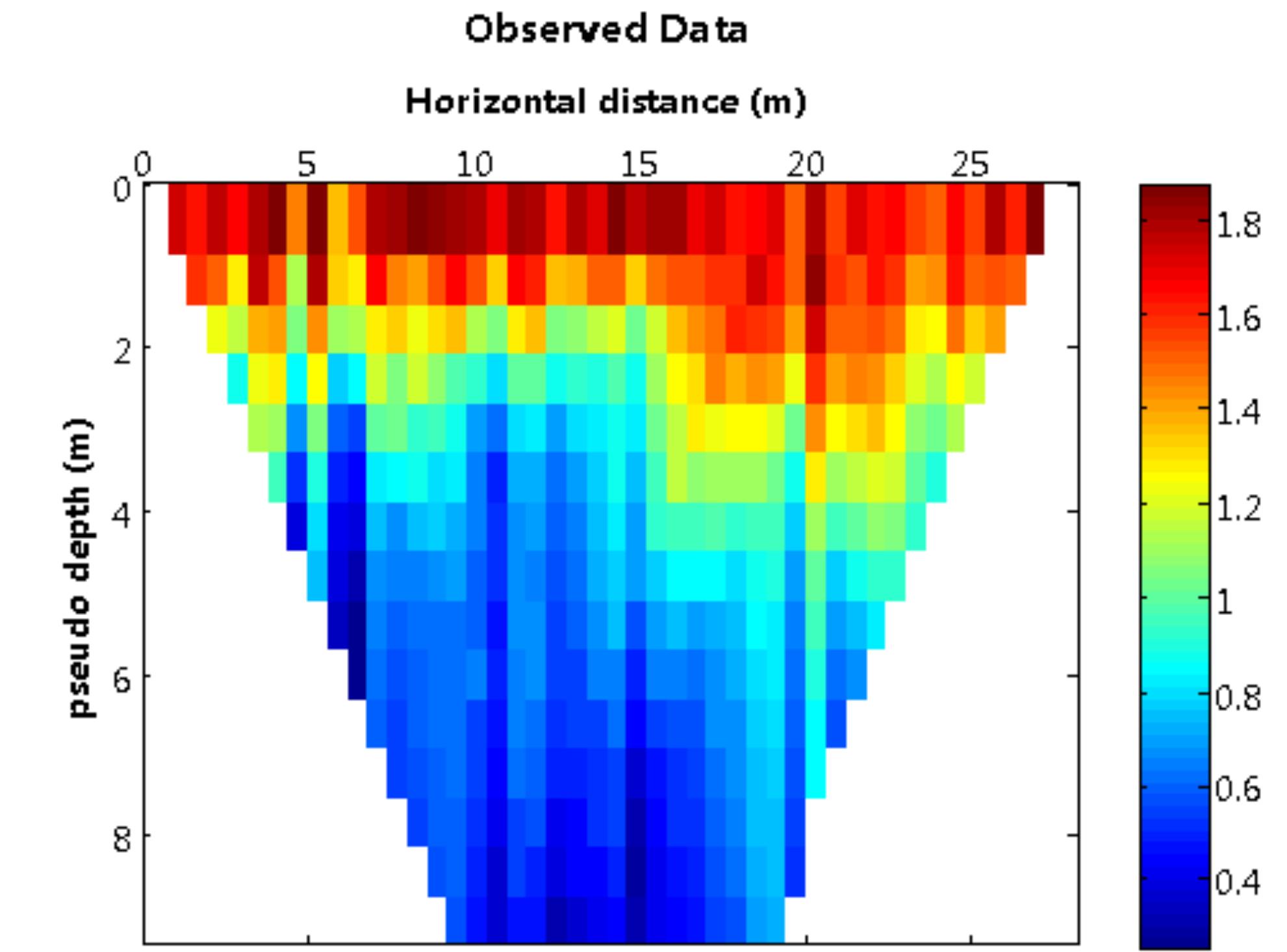
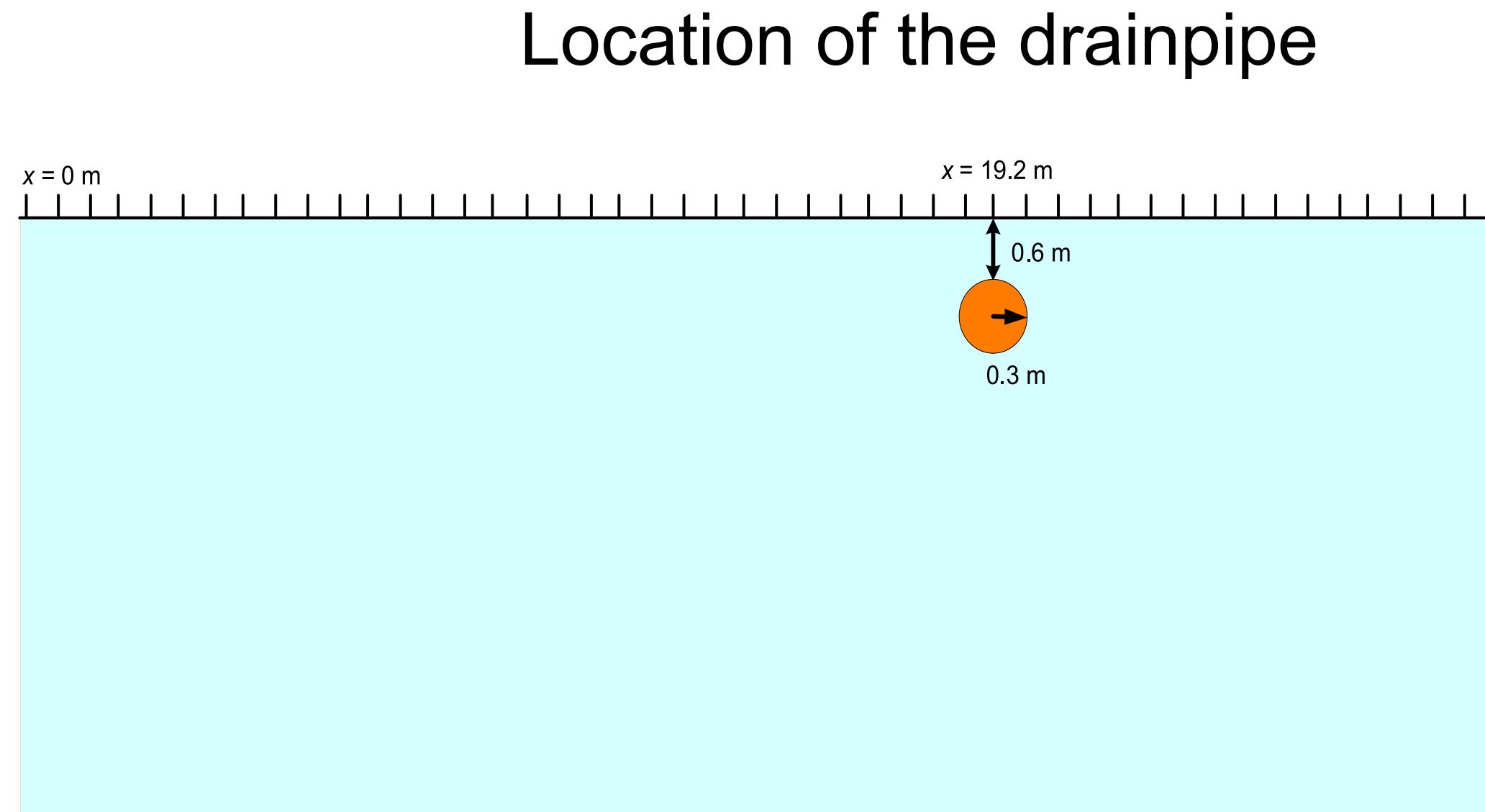
# Drainpipe map



Blue print: Fact of Science, Mahidol Univ.

# Real case tests

---

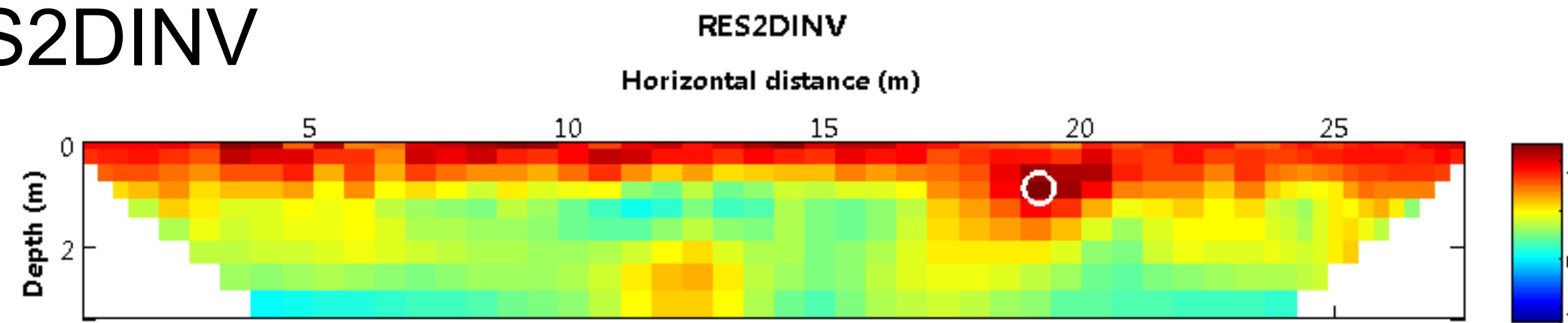


Compare the result with  
**RES2DINV**

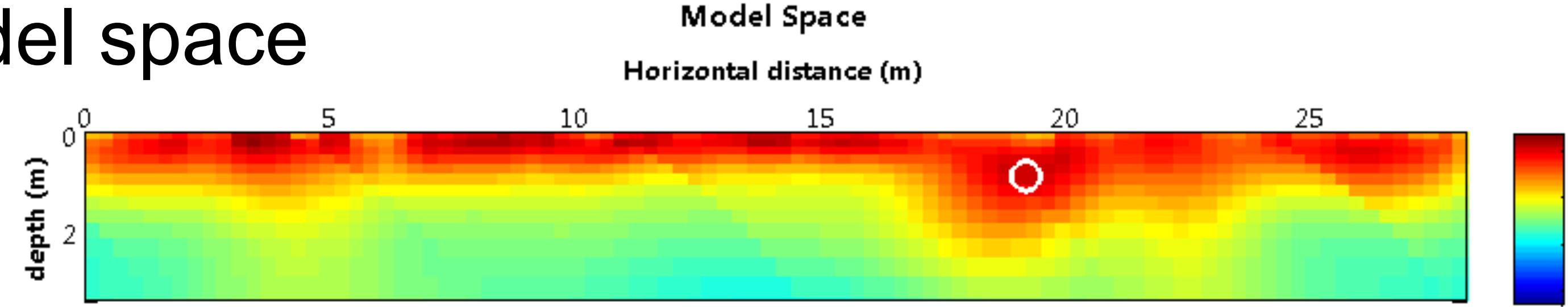
Schlumberger

# Inverted models (Schlumberger)

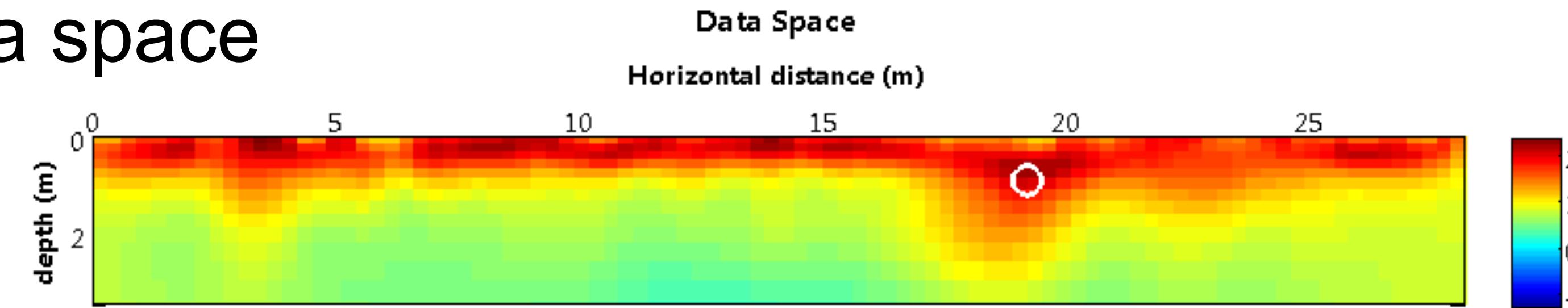
RES2DINV



Model space



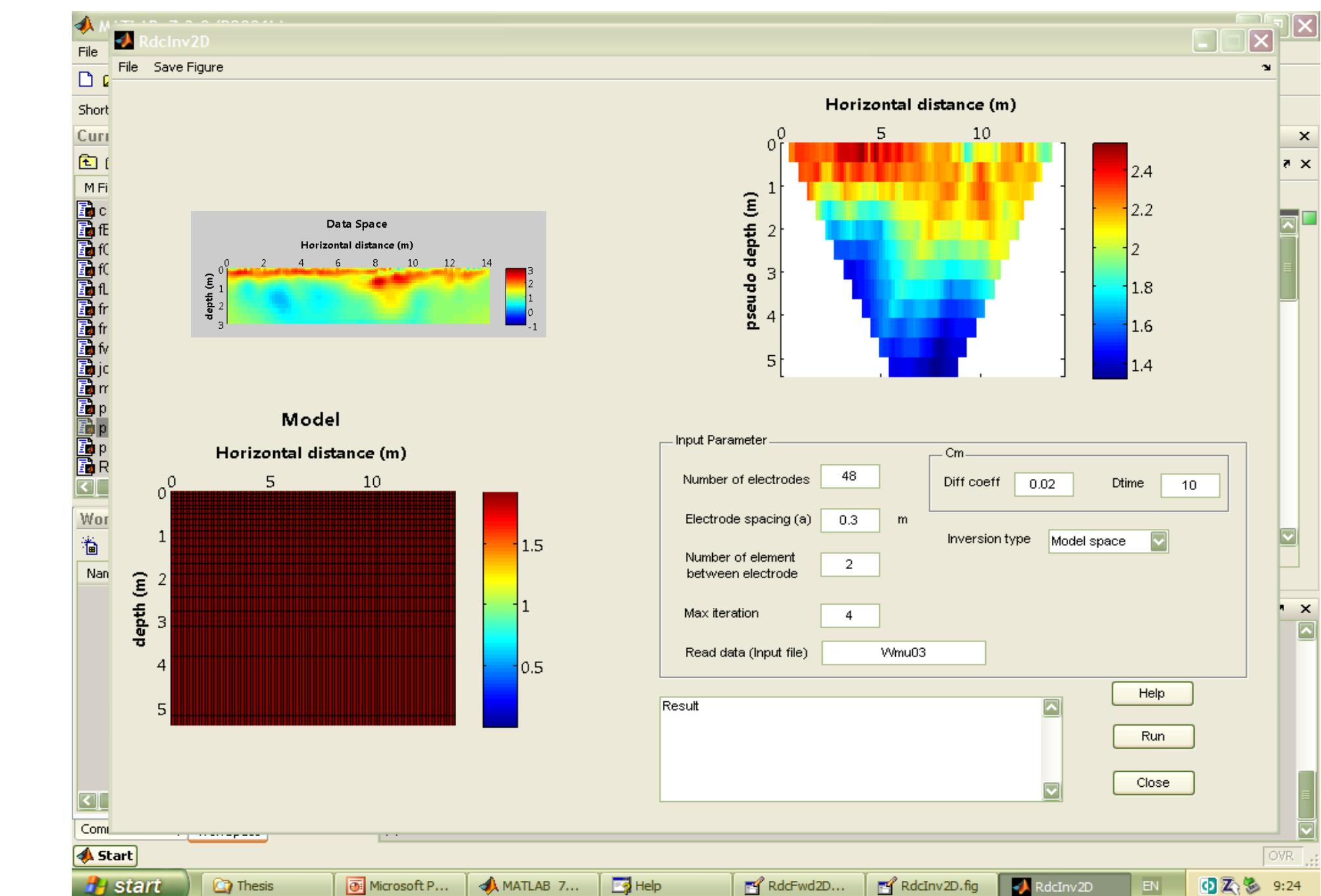
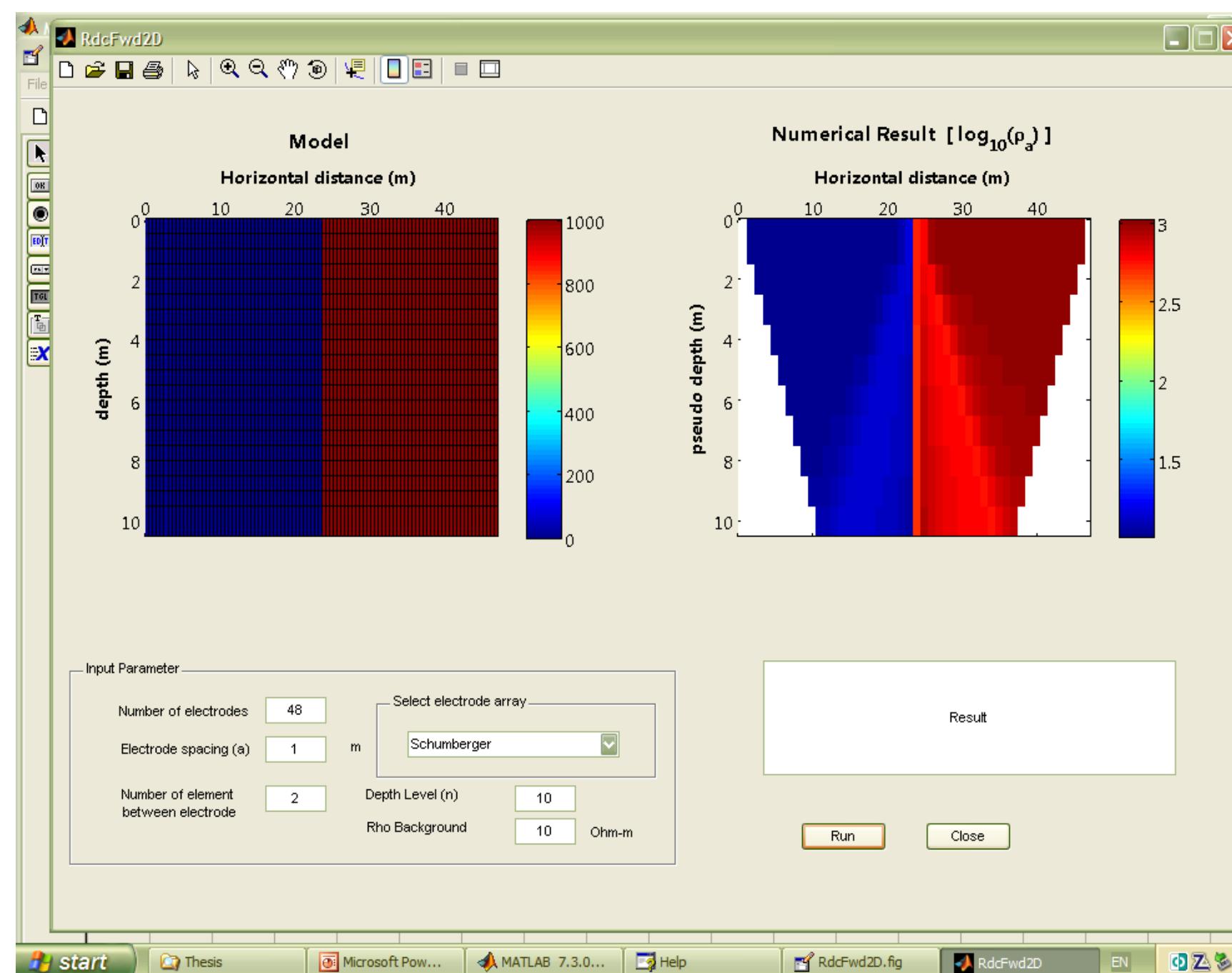
Data space



The white line indicates the circle drainpipe

# Output

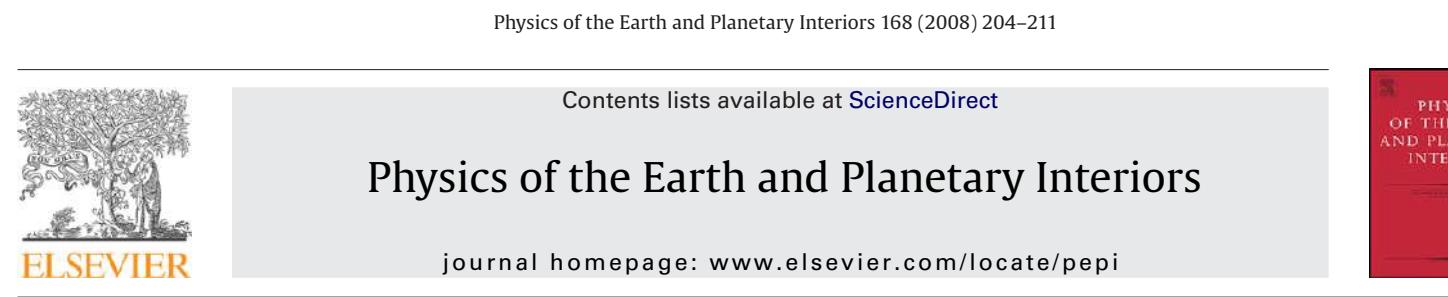
- The forward modeling program (880 Lines codes)
- The model space Occam's inversion (1200 Lines codes)
- The data space Occam's inversion (1300 Lines codes)



# Publication

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- Boonchaisuk, S., Vachiratienchai, C., Siripunvaraporn, W., *Two-dimensional direct current (DC) resistivity inversion: Data space Occam's approach*, Physics of the Earth and Planetary Interiors, 168 (2008), pp. 204-211



Two-dimensional direct current (DC) resistivity inversion: Data space  
Occam's approach

Songkhun Boonchaisuk, Chatchai Vachiratienchai, Weerachai Siripunvaraporn\*

Department of Physics, Faculty of Science, Mahidol University, Rama VI Road, Rachatawee, Bangkok 10400, Thailand

Impact factor 2.26

- Vachiratienchai, C., Boonchaisuk, S., Siripunvaraporn, W., (preparation), *A hybrid finite difference - finite element method to incorporate topography for 2D direct current (DC) resistivity modeling*

---

## Acknowledgement



## 3D DC resistivity inversion

## 2D DC resistivity inversion

-hybrid FD + FE

- time-lapse

- noisy data

**DGS-INV2DERT**





IP&DCR @ Ban nam  
Sang (Laos) 2009

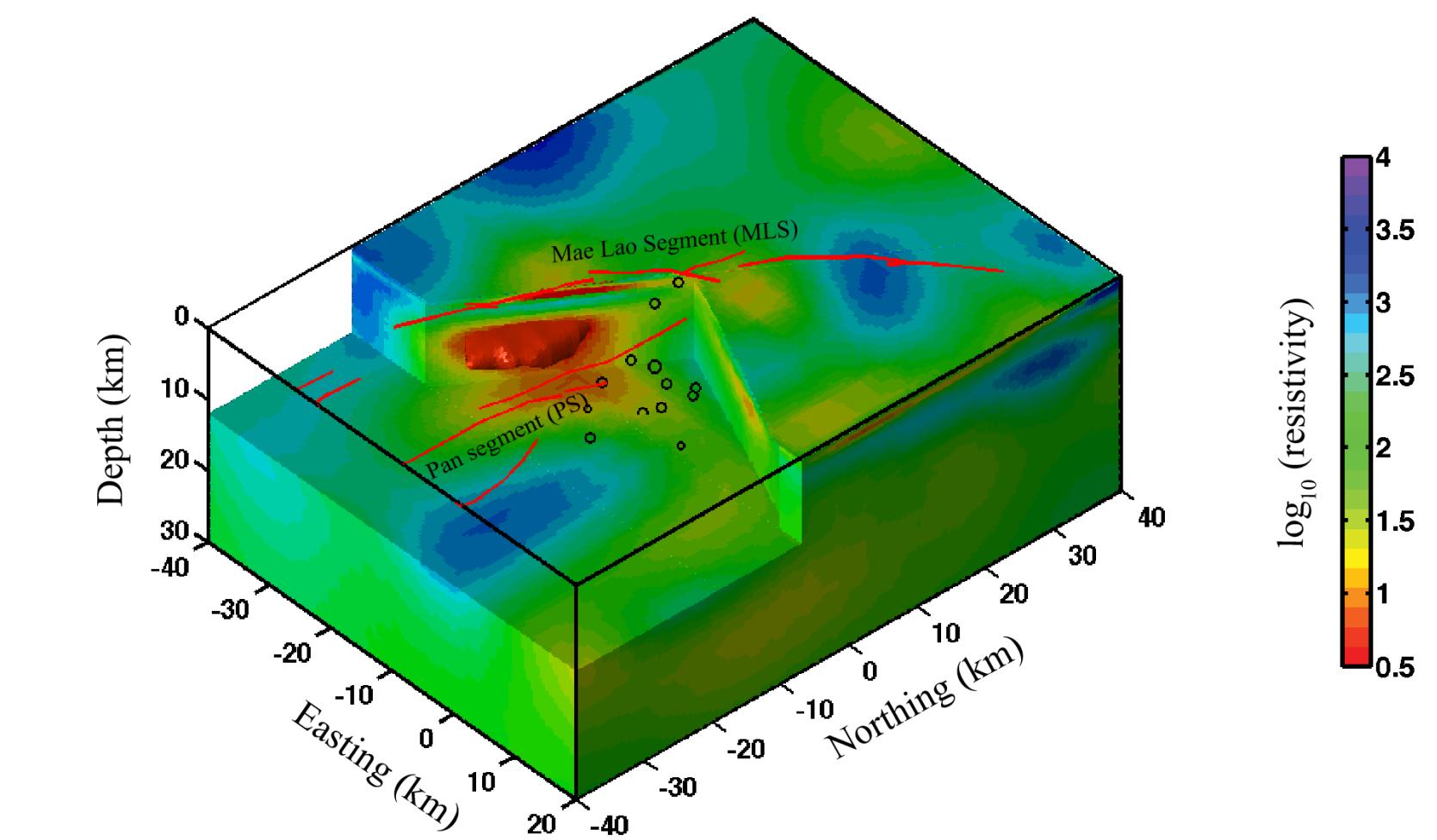


VES & 2D Geothermal @  
Hindad (Kanchanaburi) 2011

# Crustal Structure beneath Thailand by using Magnetotellurics (MT)

**Songkhun Boonchaisuk**, Suttipong Noisagool,  
Benjawut Piromphong, Puwis Amatyakul, Tawat Rung-Arunwan,  
Chatchai VachiratiENCHAI, Weerachai Siripunvaraporn  
Patchawee Nualkaew, Kung, Ploy, Toom, TaoHoo, Perth, P' Chai, James, ect.

[songkhun.boo@mahidol.edu](mailto:songkhun.boo@mahidol.edu)

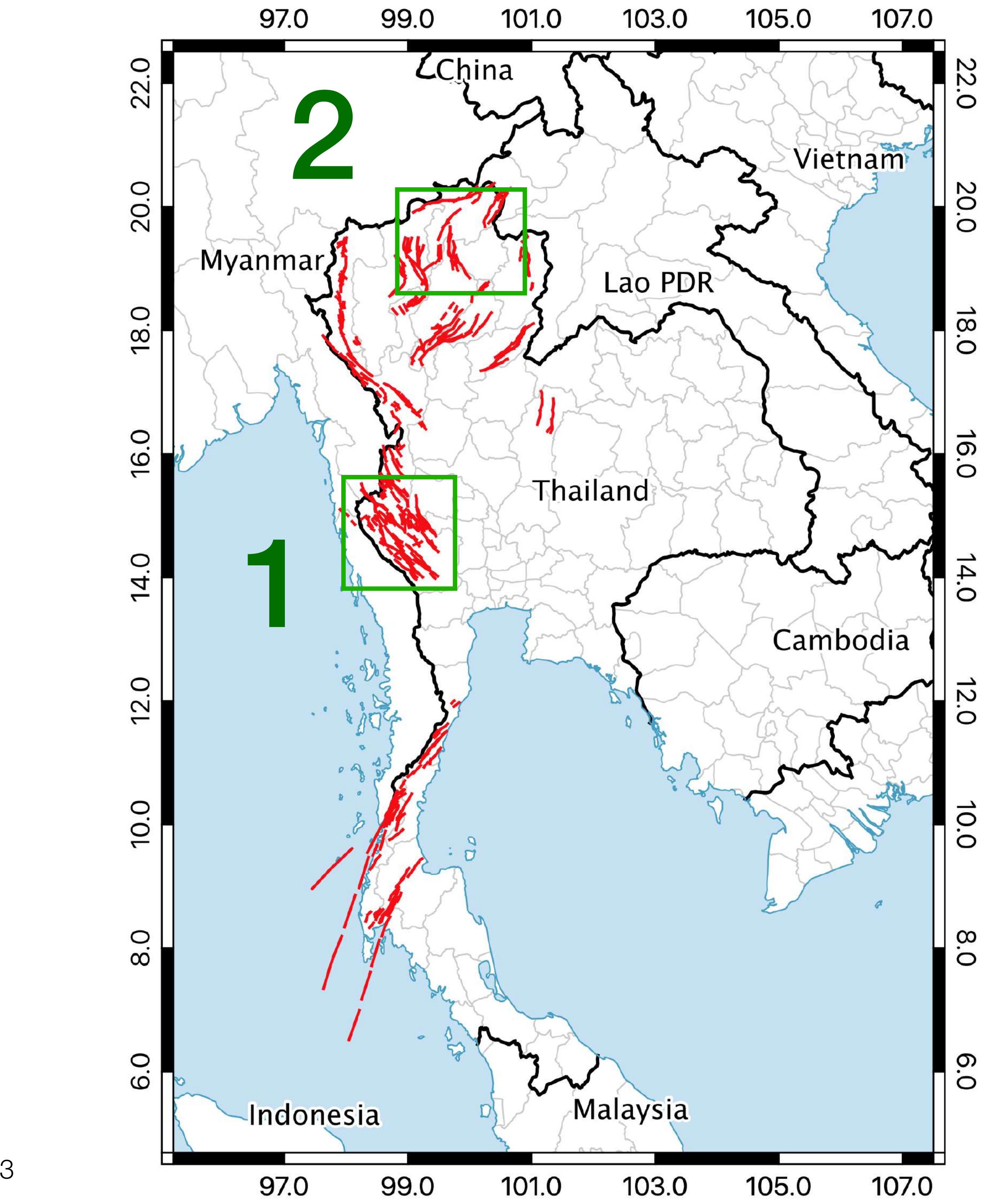


# **1 Kanchaburi**

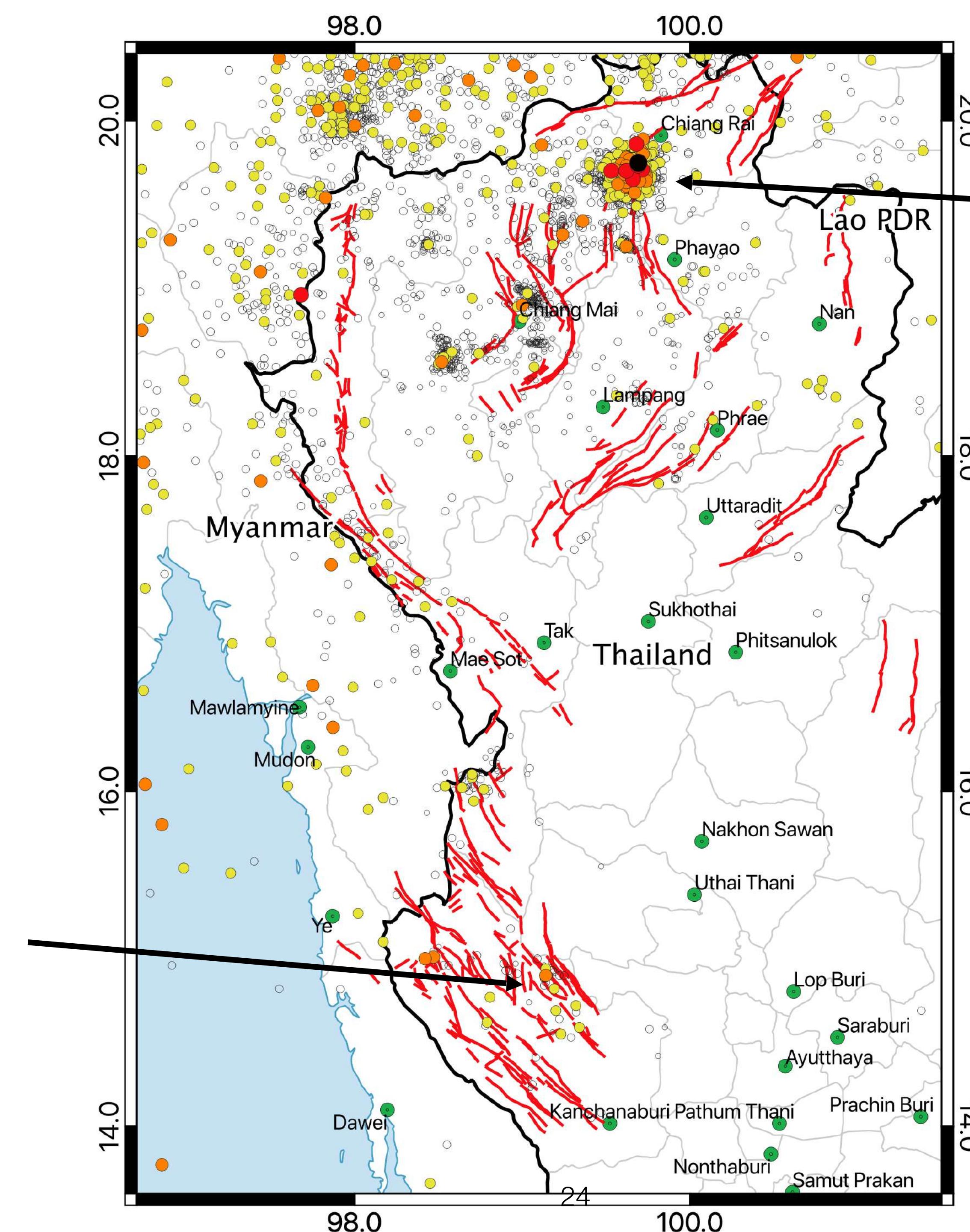
2009-2010

# **2 Chiang Rai**

2014-2015

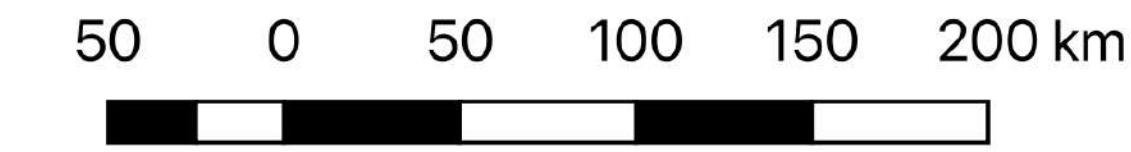


**5.9 M EQ  
1983  
? aftershocks**



**6.3 M Phan EQ  
2014  
> 1,000 aftershocks**

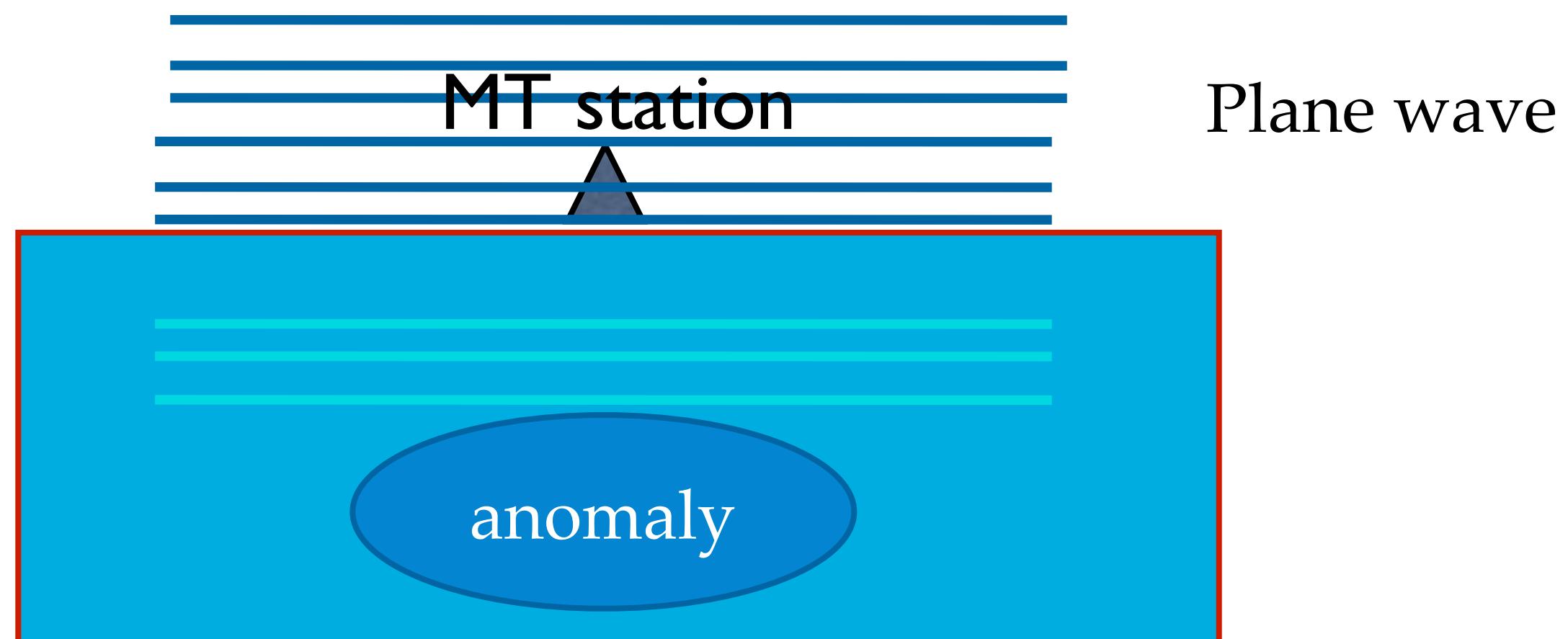
**Legend**  
Earthquake Magnitude  
• 0.6000 - 1.0000  
◦ 1.0000 - 2.0000  
○ 2.0000 - 3.0000  
● 3.0000 - 4.0000  
○ 4.0000 - 5.0000  
● 5.0000 - 6.0000  
● 6.0000 - 6.7000  
— Active fault



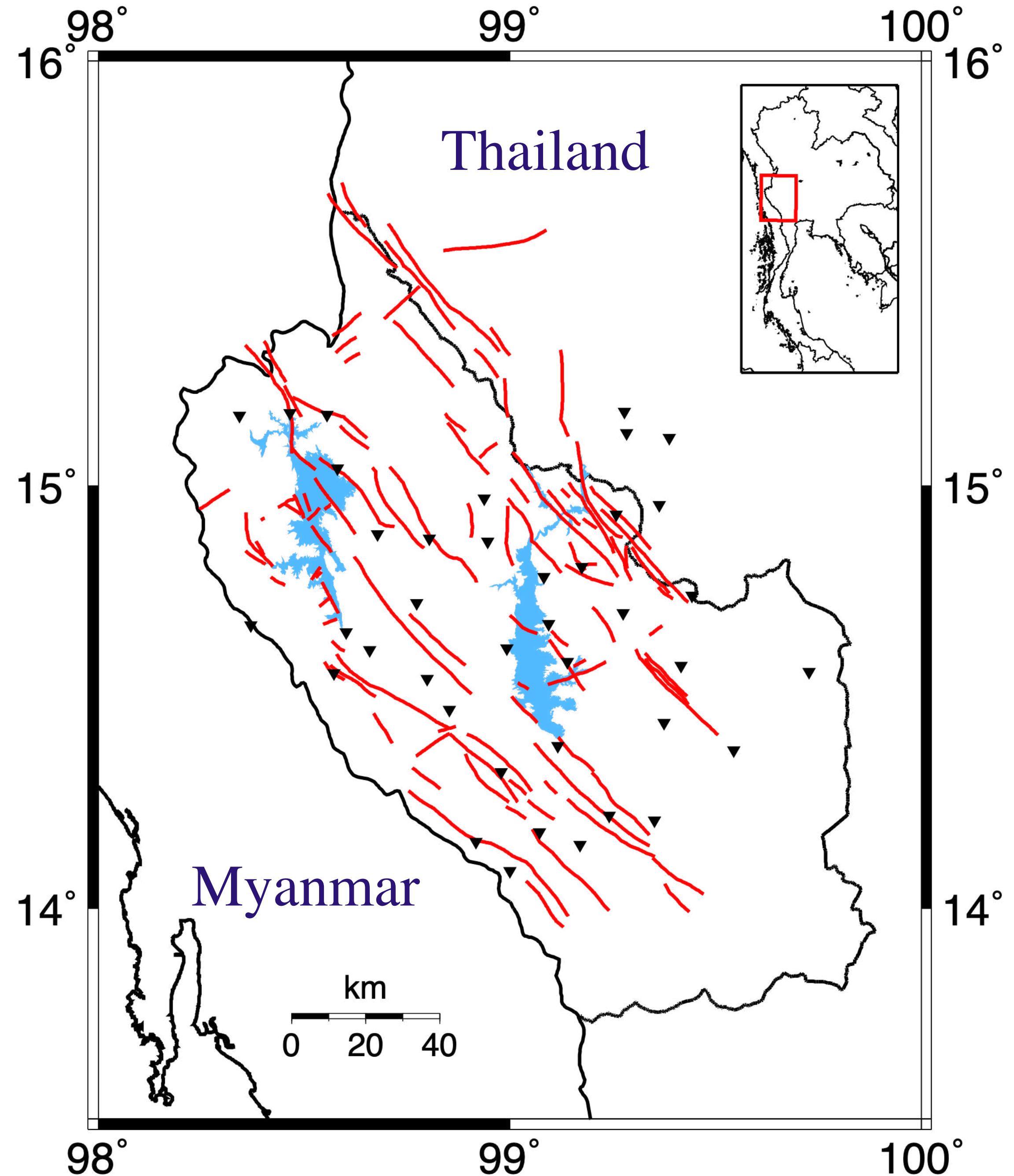
# What is MT?

## EM Induction

$$\nabla \times \mathbf{H} = \sigma \mathbf{E}, \quad \text{Varying } \mathbf{H} \text{ induces } \mathbf{E}.$$



# Site Locations



- ~3 months for scout trips
- ~2+ months for work permits
- 39 MT sites
- spacing ~ 15-50 km

# MTU-5 from Titech

change to Science TOKYO



Prof. Yasuo Ogawa



東京工業大学  
Tokyo Institute of Technology

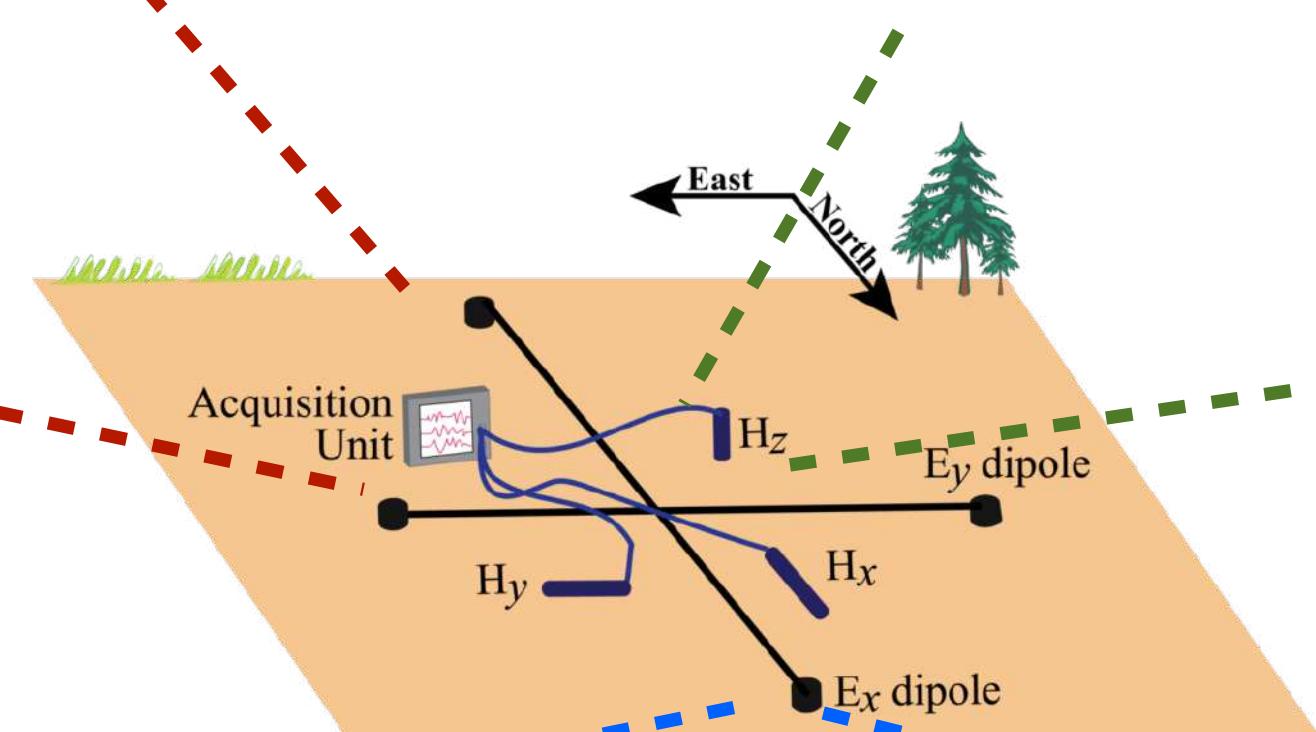
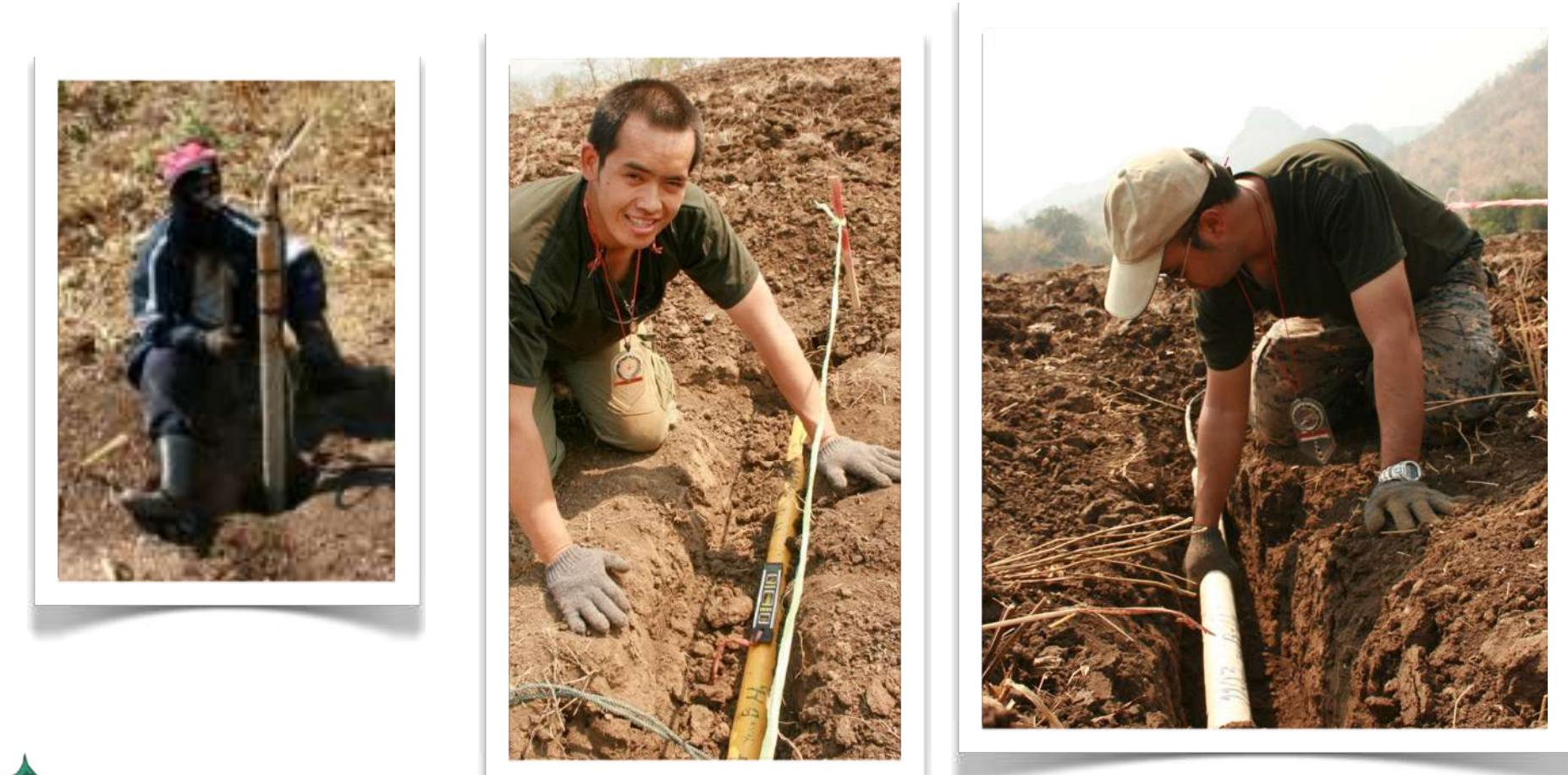
# trained with Prof. Yasuo Ogawa



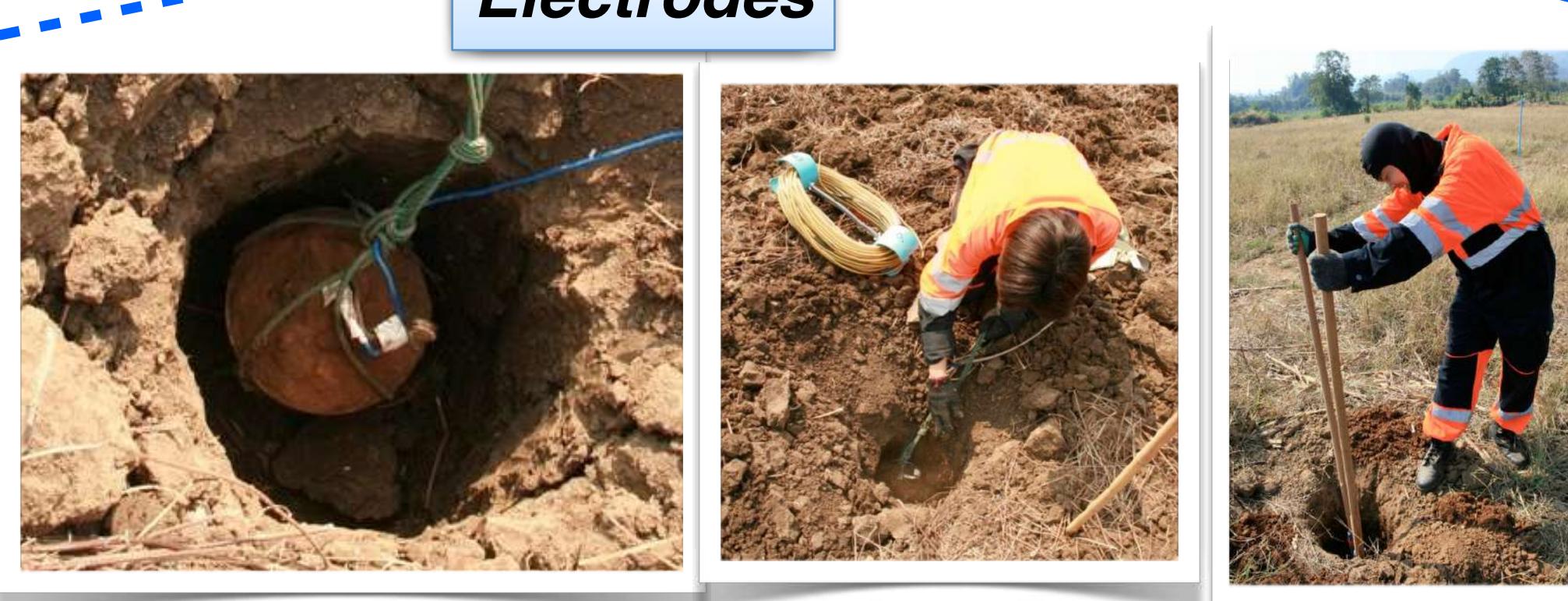
## Acquisition



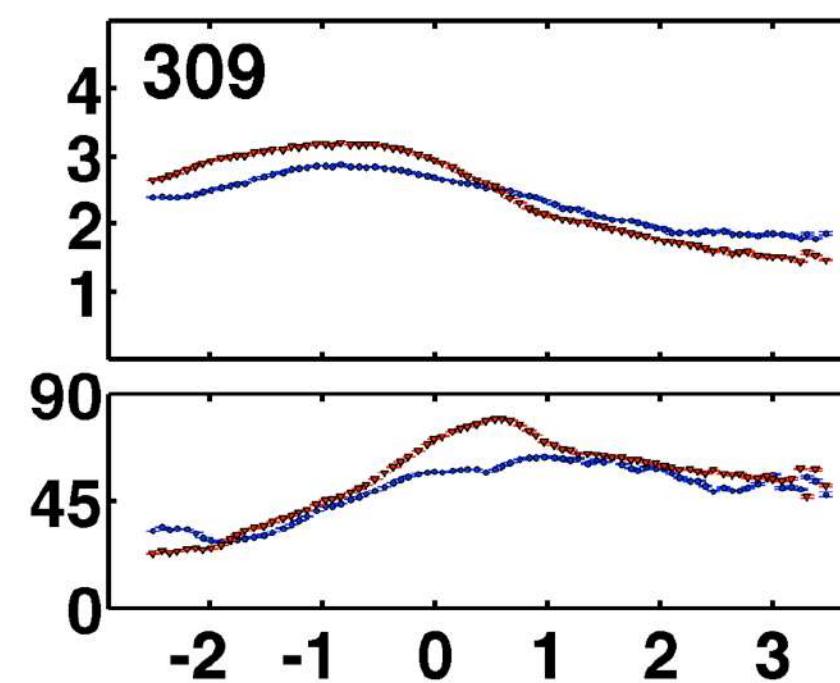
## Magnetometers



## Electrodes



IBM X3755 M3

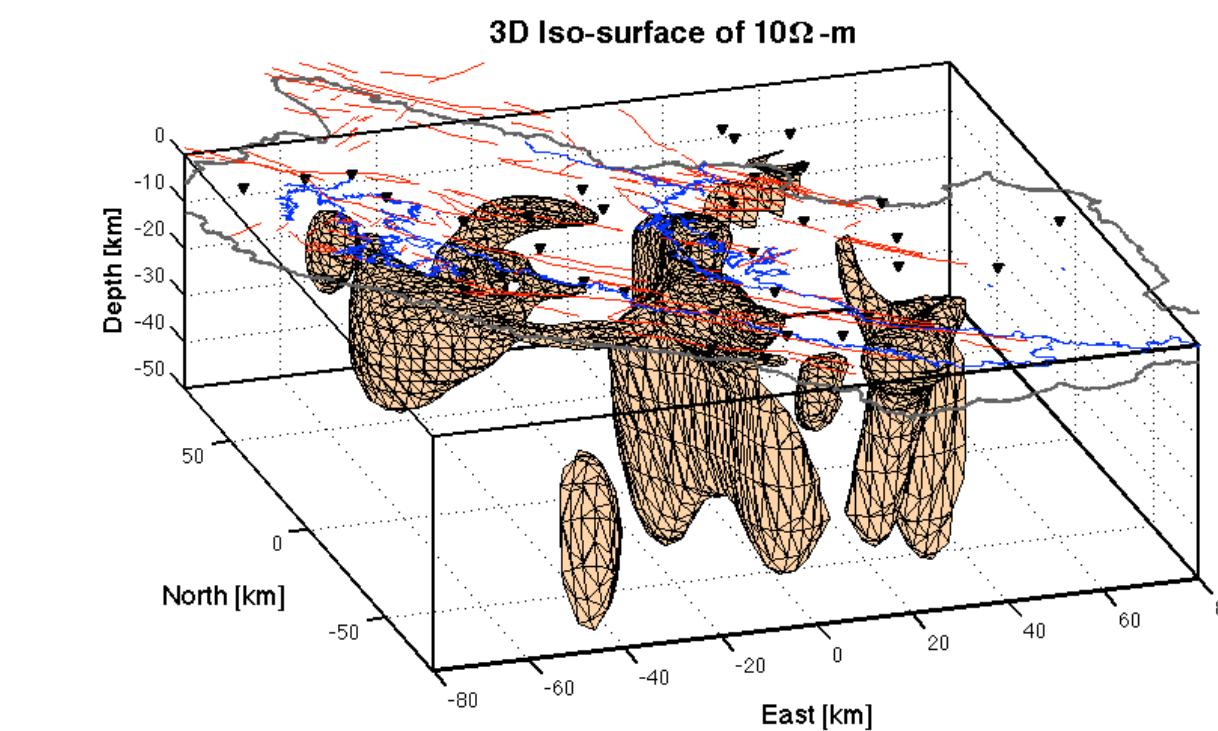


Observed Data

Inversion



48 processing cores  
128 GB memory



3-D Resistivity Model

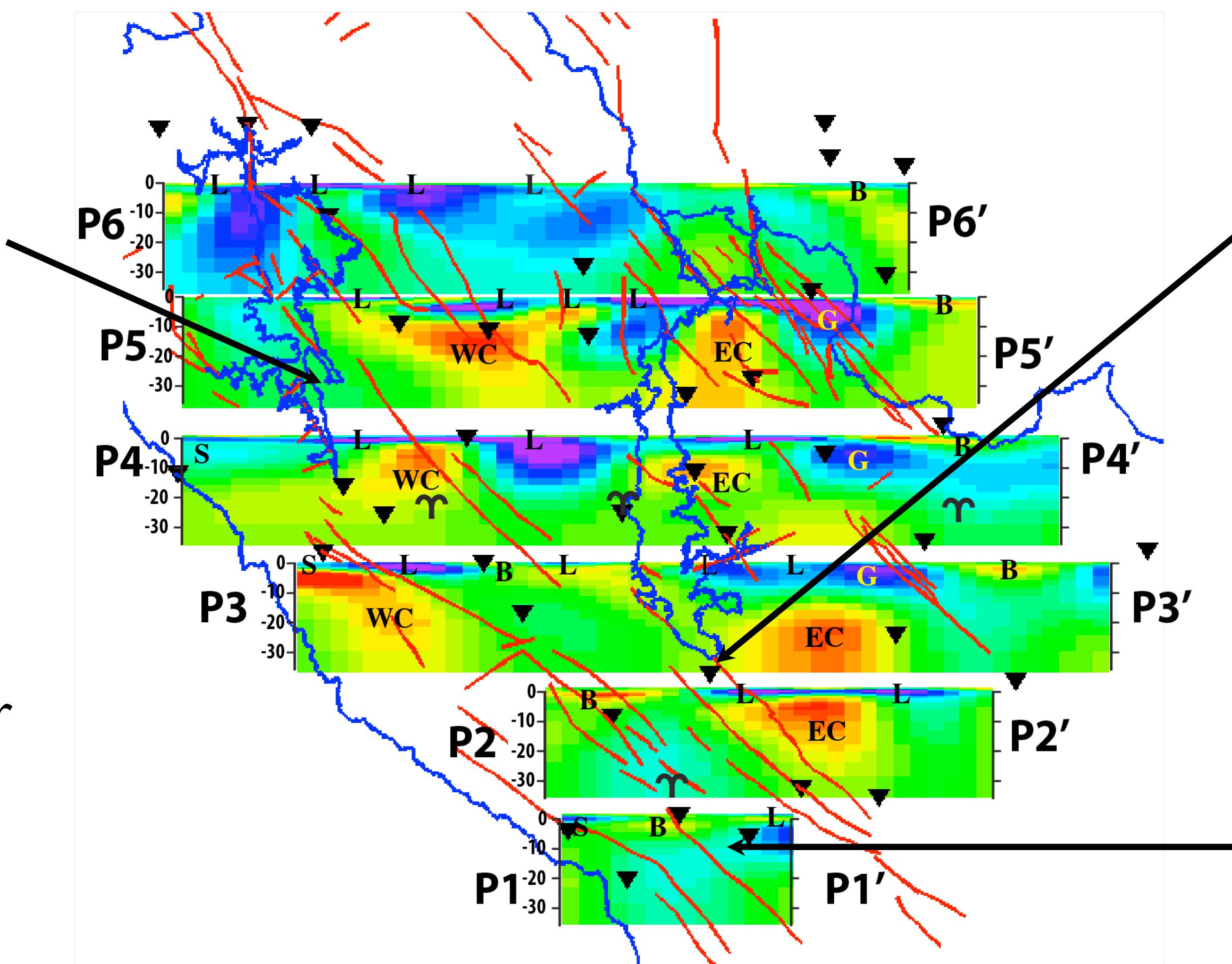
WSINV3DMT-VTF

(Siripunvaraporn et al., 2005, 2009)

Vachiralongkorn  
Dam

WC = west conductor  
EC = east conductor

fit to tipper data



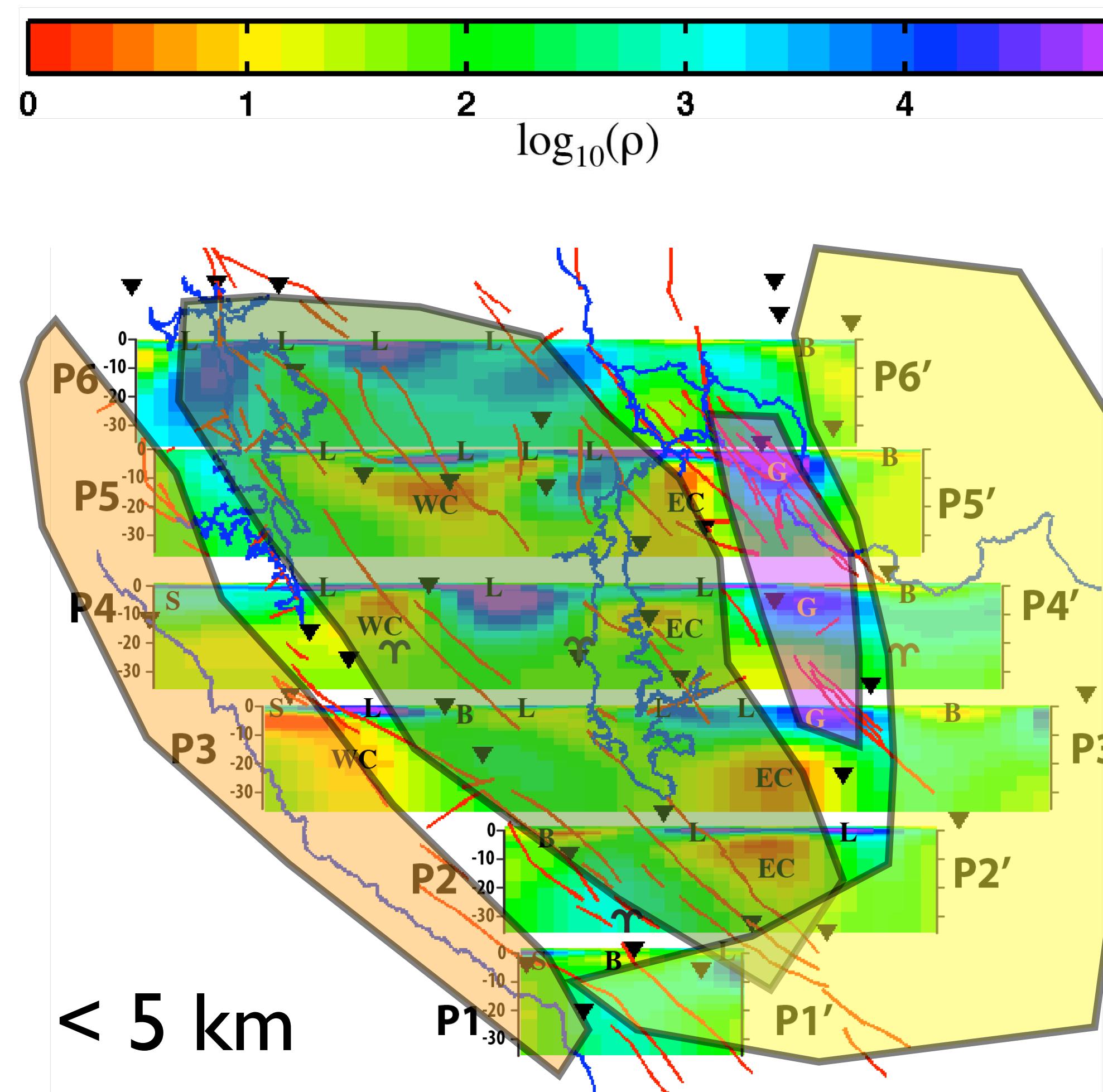
conductive

$\log_{10}(\rho)$

resistive

Srinakarin Dam

Mahidol University  
Kanchanaburi campus



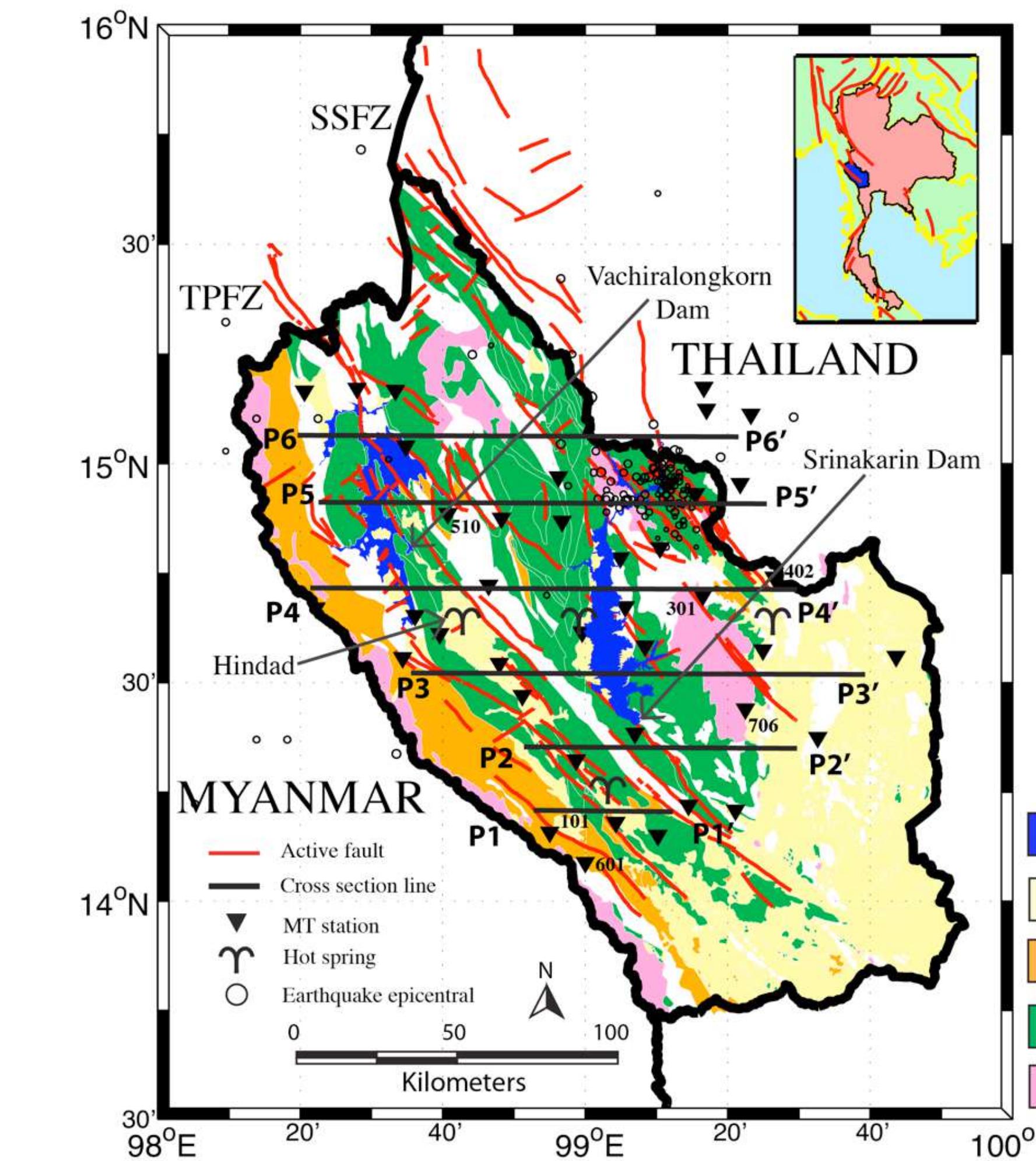
Reservoir

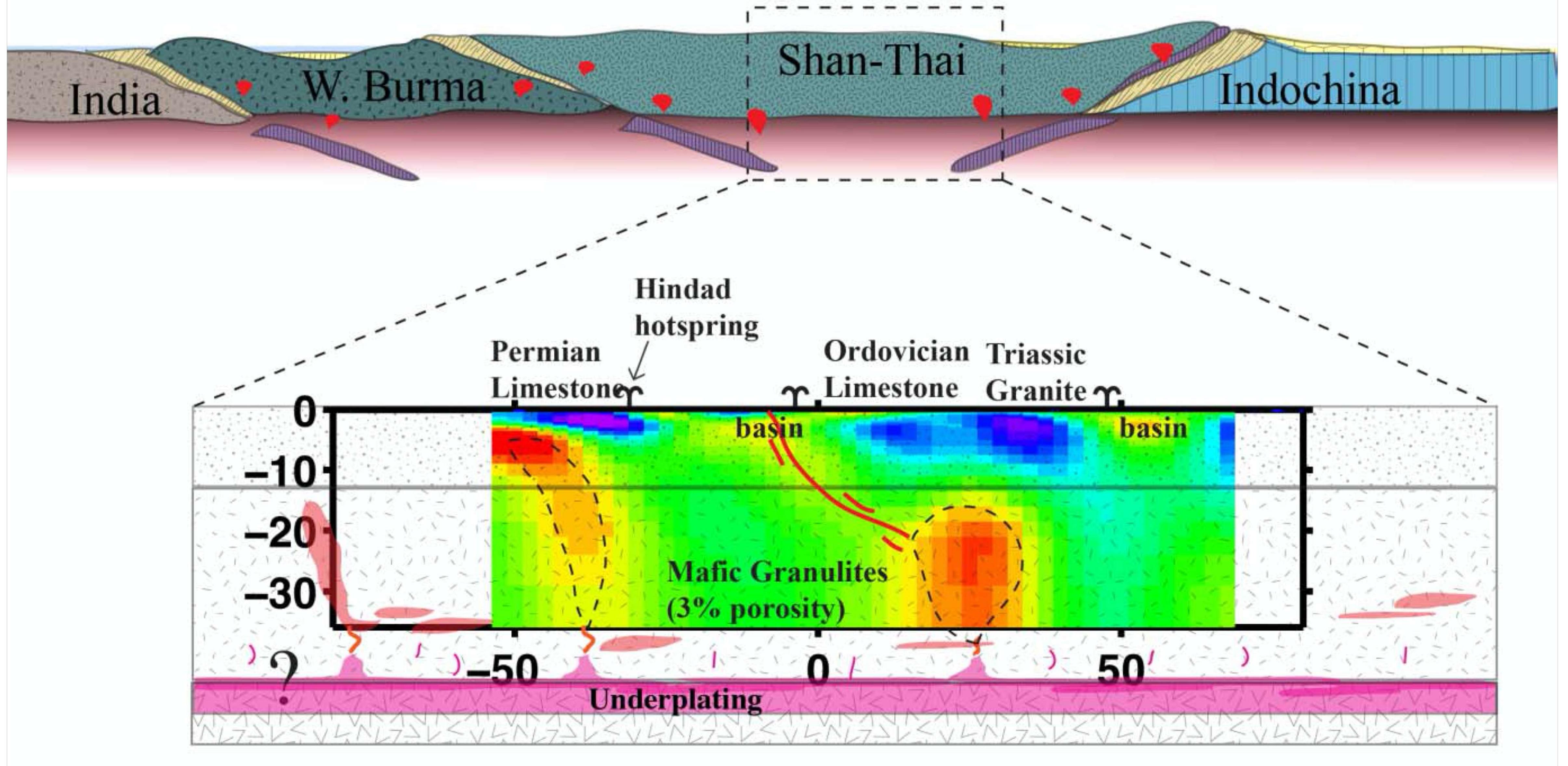
Sediment

Sandstone

Limestone

Granite







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## Gondwana Research

journal homepage: [www.elsevier.com/locate/gr](http://www.elsevier.com/locate/gr)



# Evidence for middle Triassic to Miocene dual subduction zones beneath the Shan–Thai terrane, western Thailand from magnetotelluric data

Songkhun Boonchaisuk <sup>a,b</sup>, Weerachai Siripunvaraporn <sup>a,b,\*</sup>, Yasuo Ogawa <sup>c</sup>

<sup>a</sup> Department of Physics, Faculty of Science, Mahidol University, 272 Rama 6 Road, Rachatawee, Bangkok 10400, Thailand

<sup>b</sup> ThEP Center, Commission on Higher Education, 328, Si Ayutthaya Road, Rachatawee, Bangkok 10400, Thailand

<sup>c</sup> Volcanic Fluid Research Center, Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro, Tokyo 152-8551, Japan

# 2010-2011 Japan Oshima



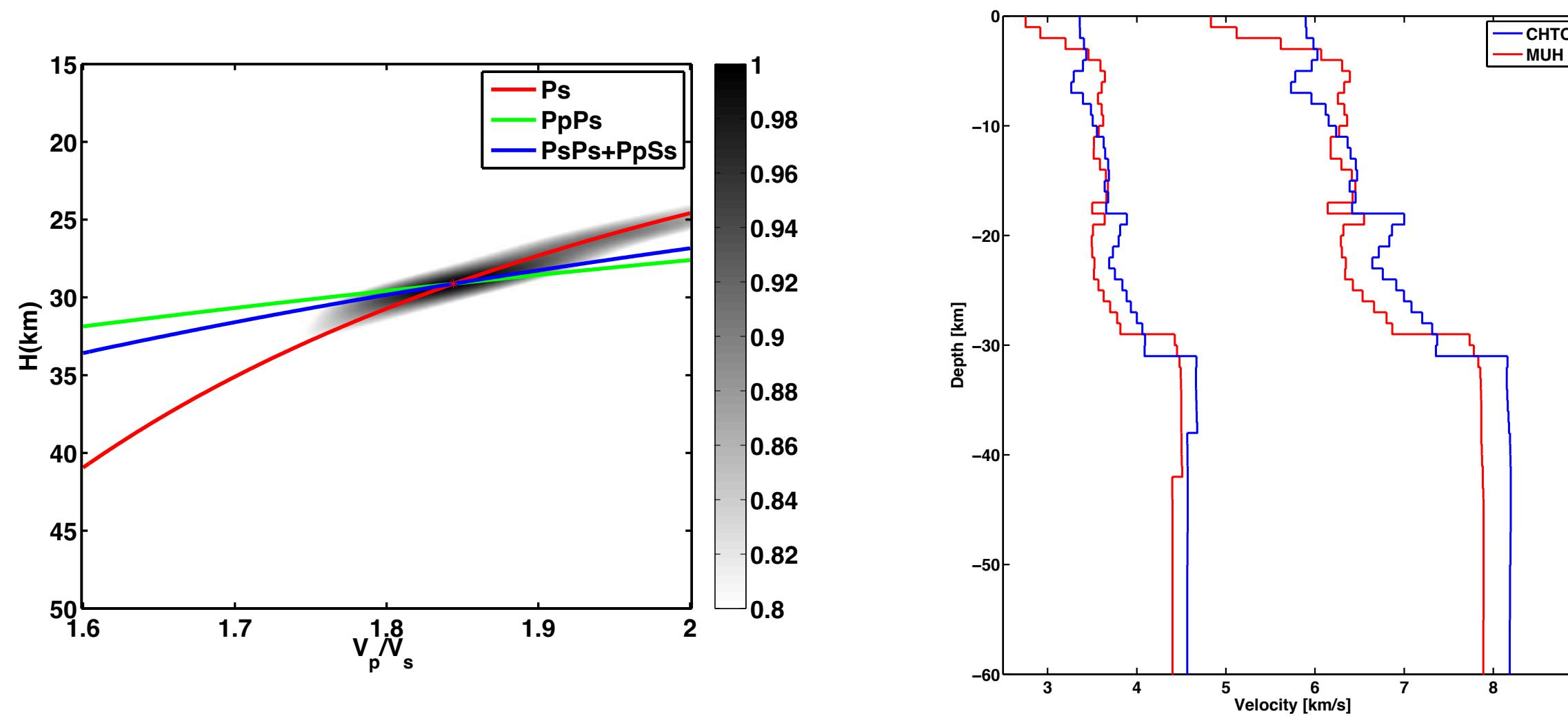
# Kagoshima



# Yamagata



# Velocity model by Receiver Function



# Vault construction



1.5m

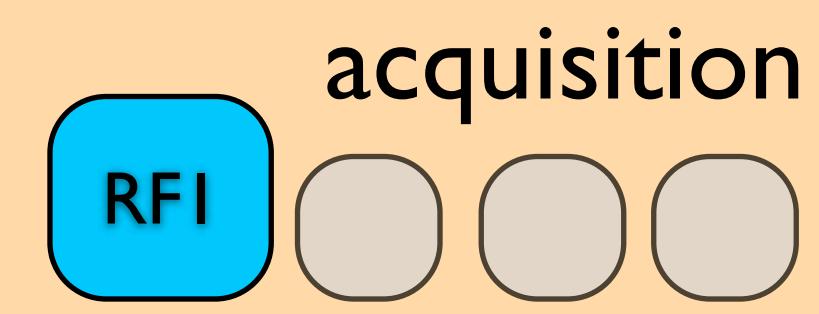


# Vault construction





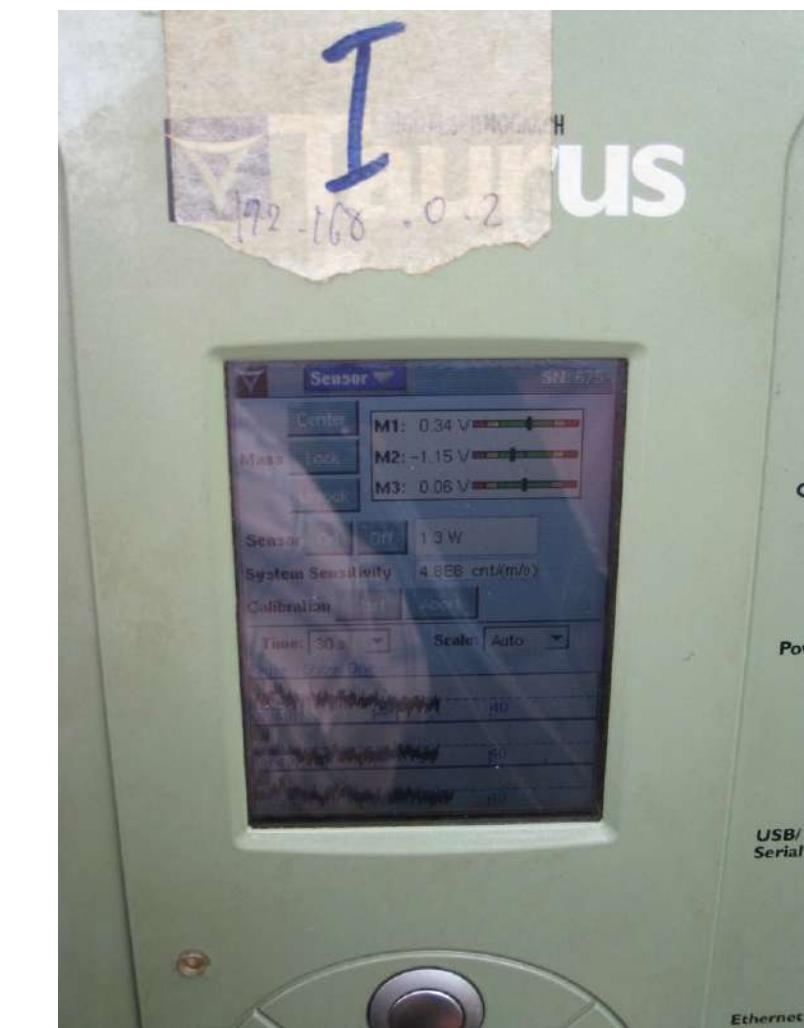
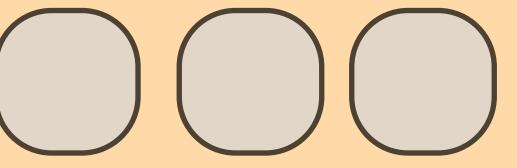
# Vault construction

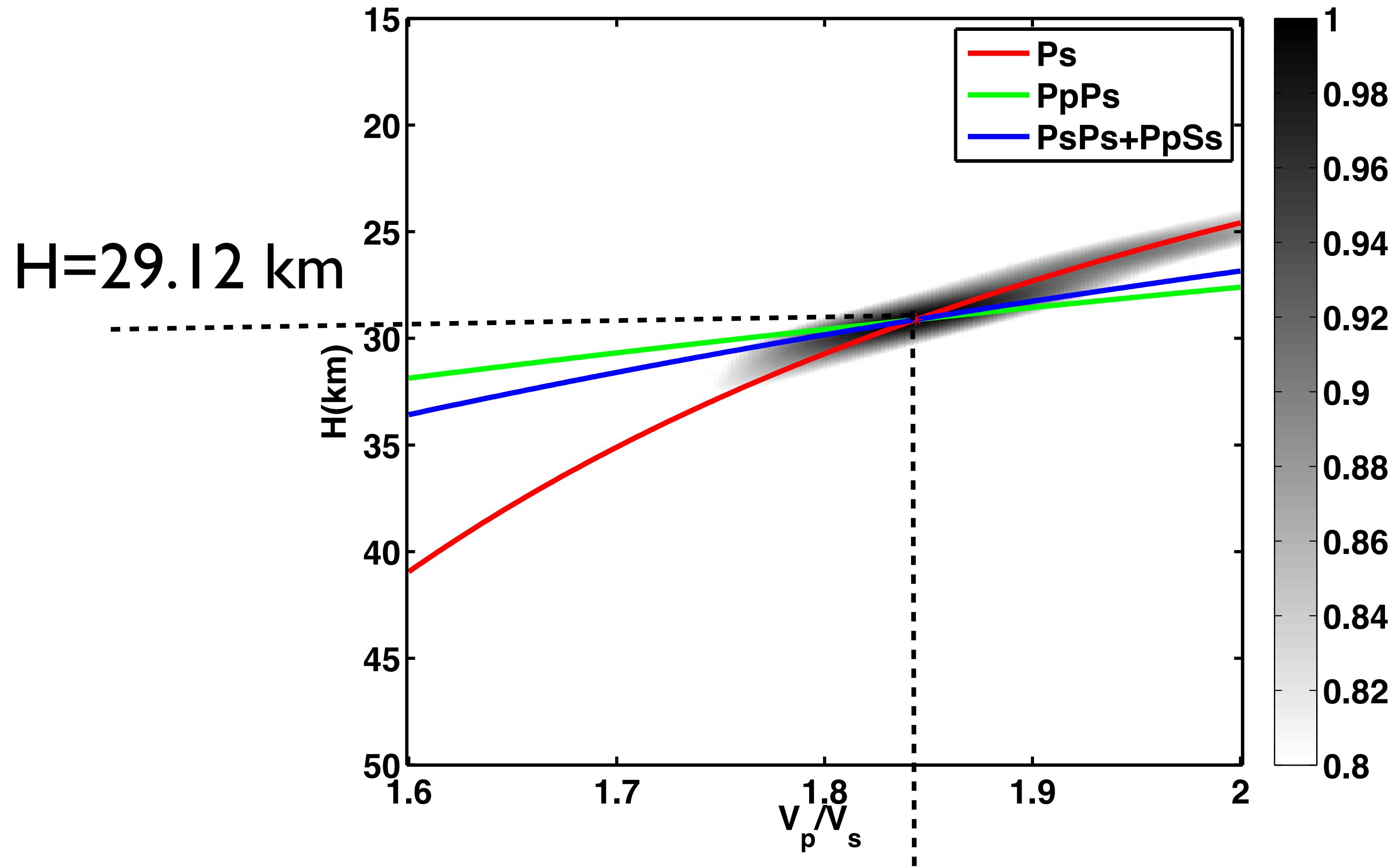


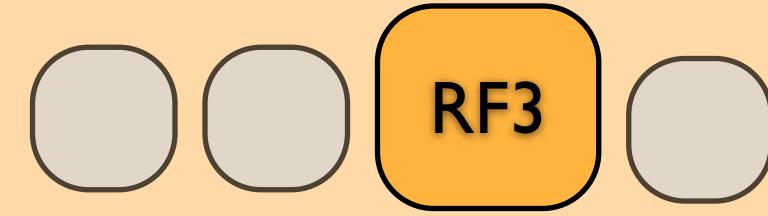
Wait 2 weeks for  
concrete curing

no water leak

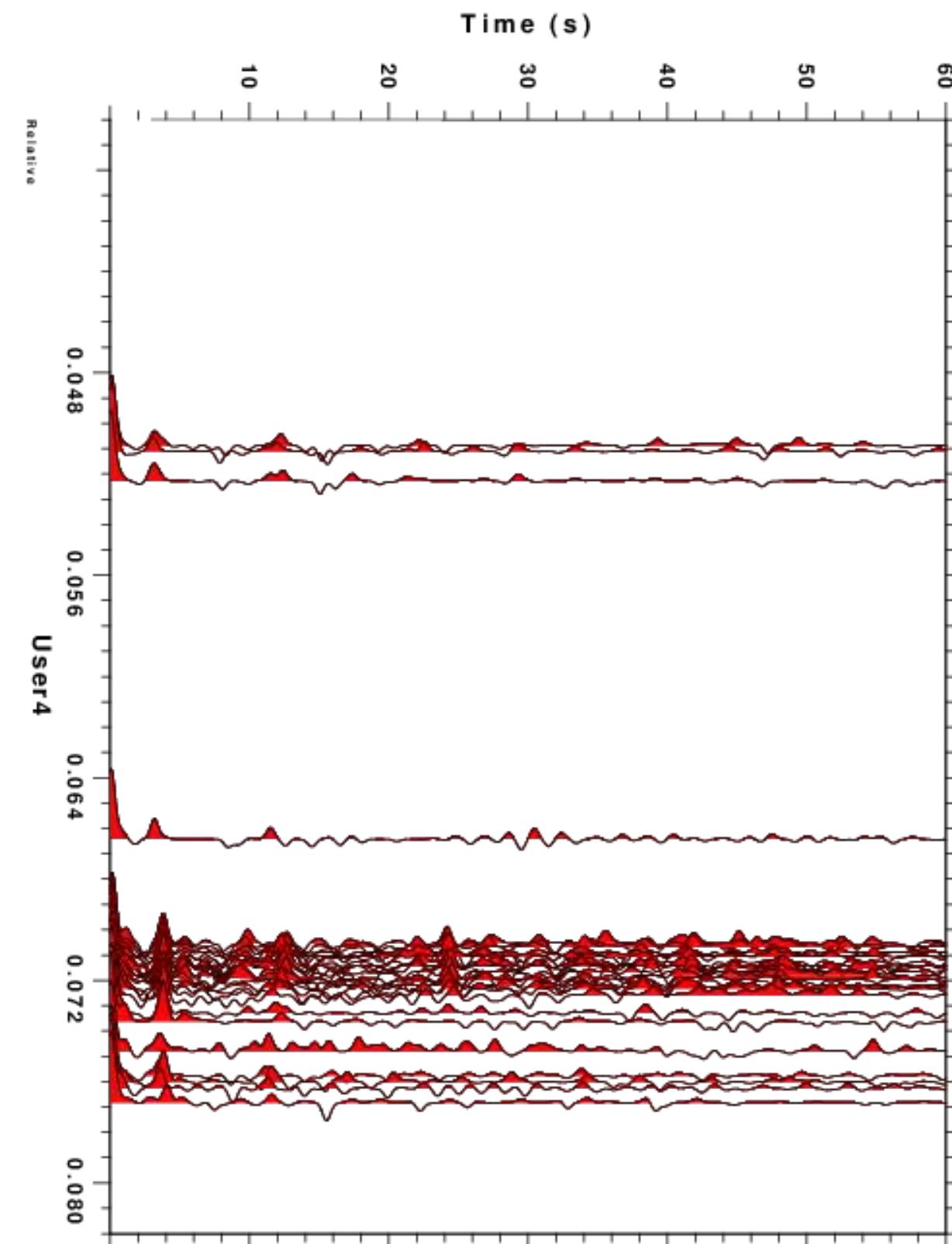
# Vault construction



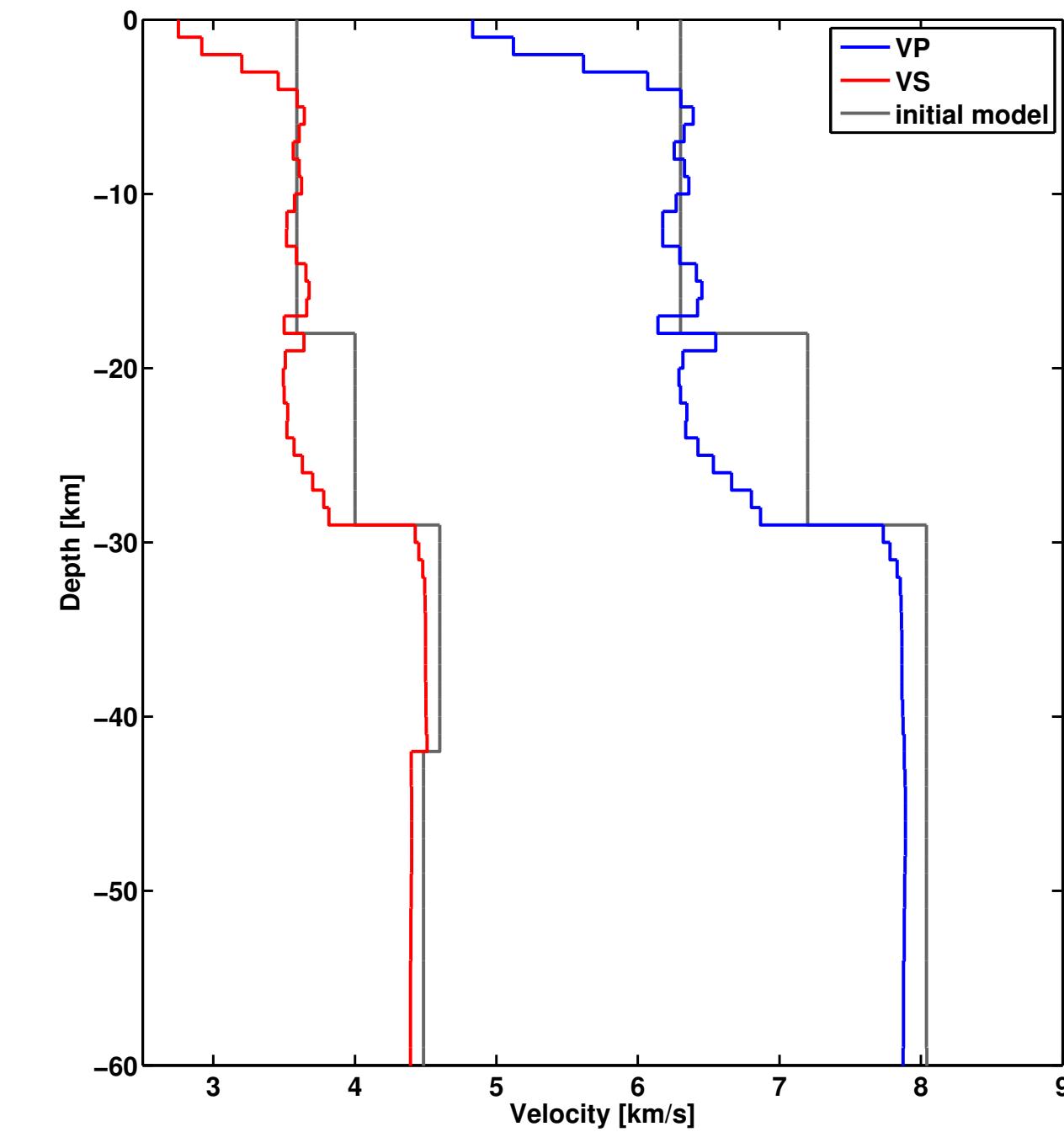
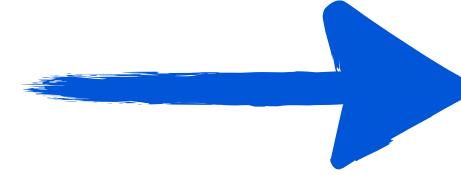
 $V_p/V_s = 1.84$



Bassin et al, (2000) + Hk 29.12 km



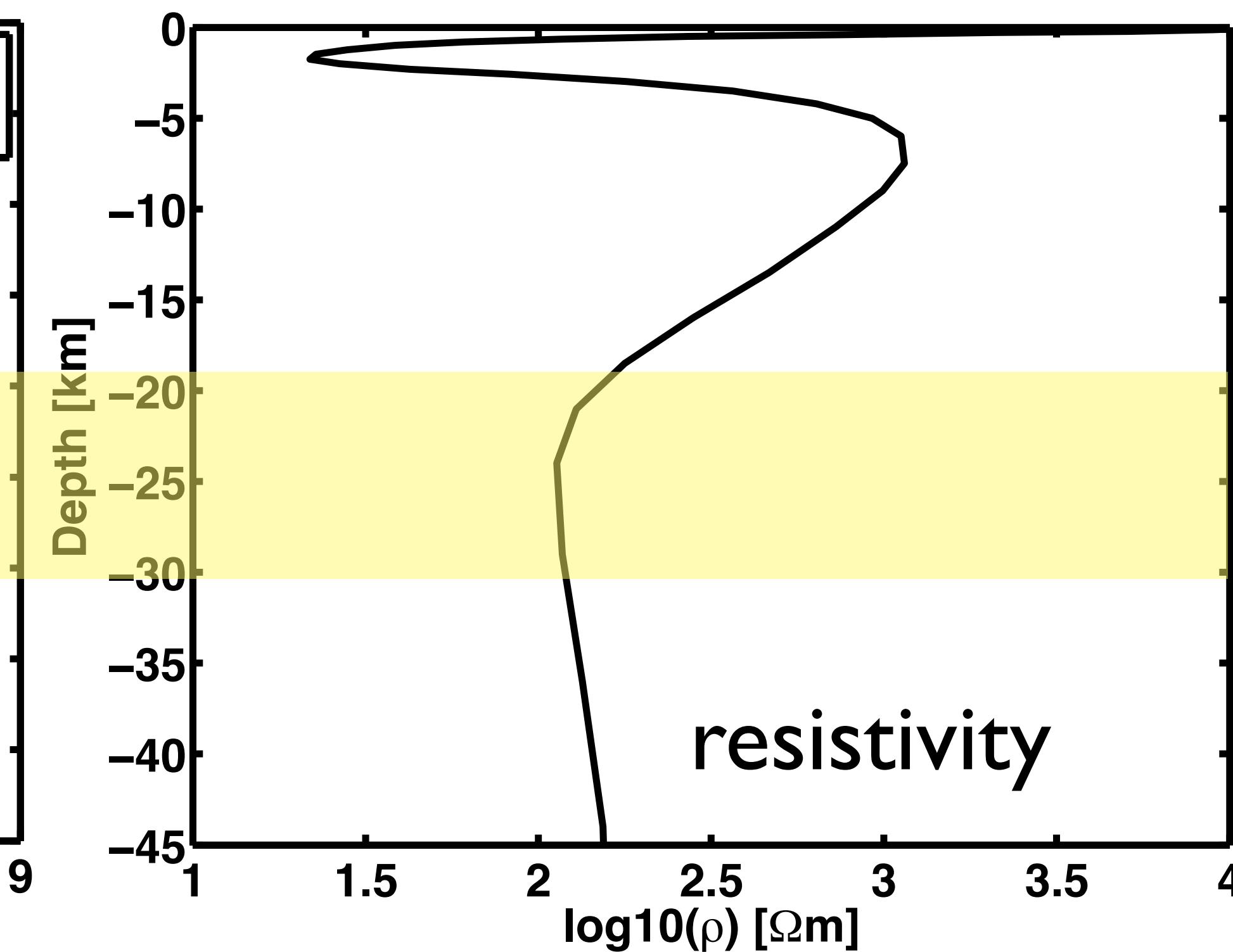
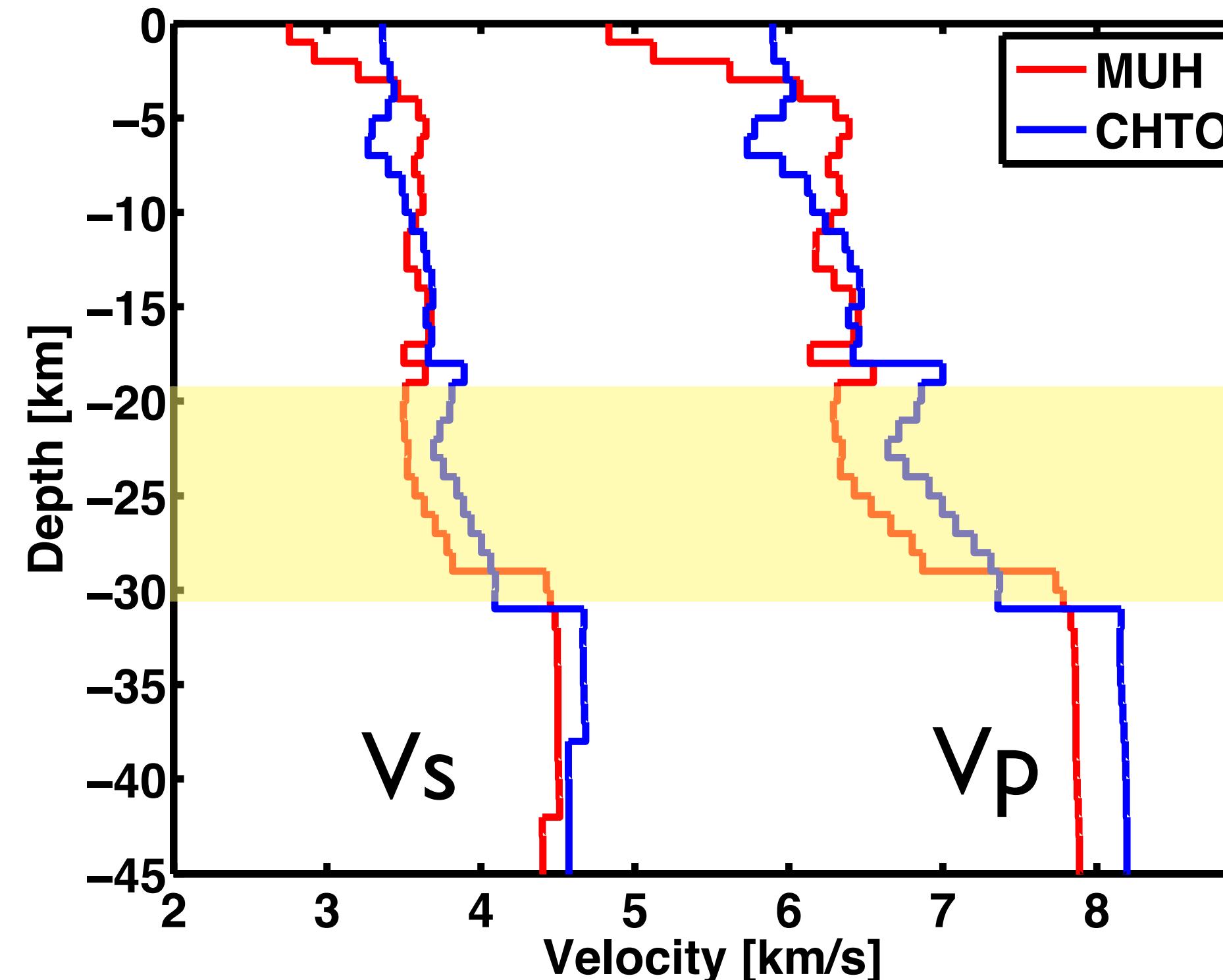
Inversion



CPS = Computer Program in Seismology

RFTN76

Herrmann & Ammon (2002)



- No obvious LVZ
- low velocity in mid-low crust compare to CHTO

- correspond to low resistivity => related to 3% fluid
- need more stations

# ARTICLE IN PRESS

TECTO-126355; No of Pages 12

Tectonophysics xxx (2014) xxx-xxx

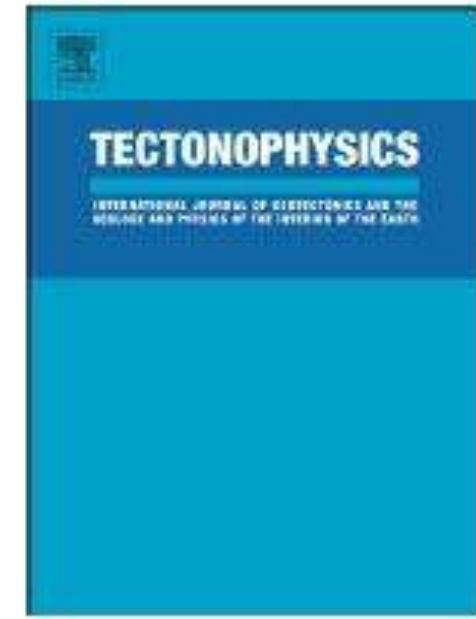


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journal homepage: [www.elsevier.com/locate/tecto](http://www.elsevier.com/locate/tecto)



## Thailand's crustal properties from tele-seismic receiver function studies

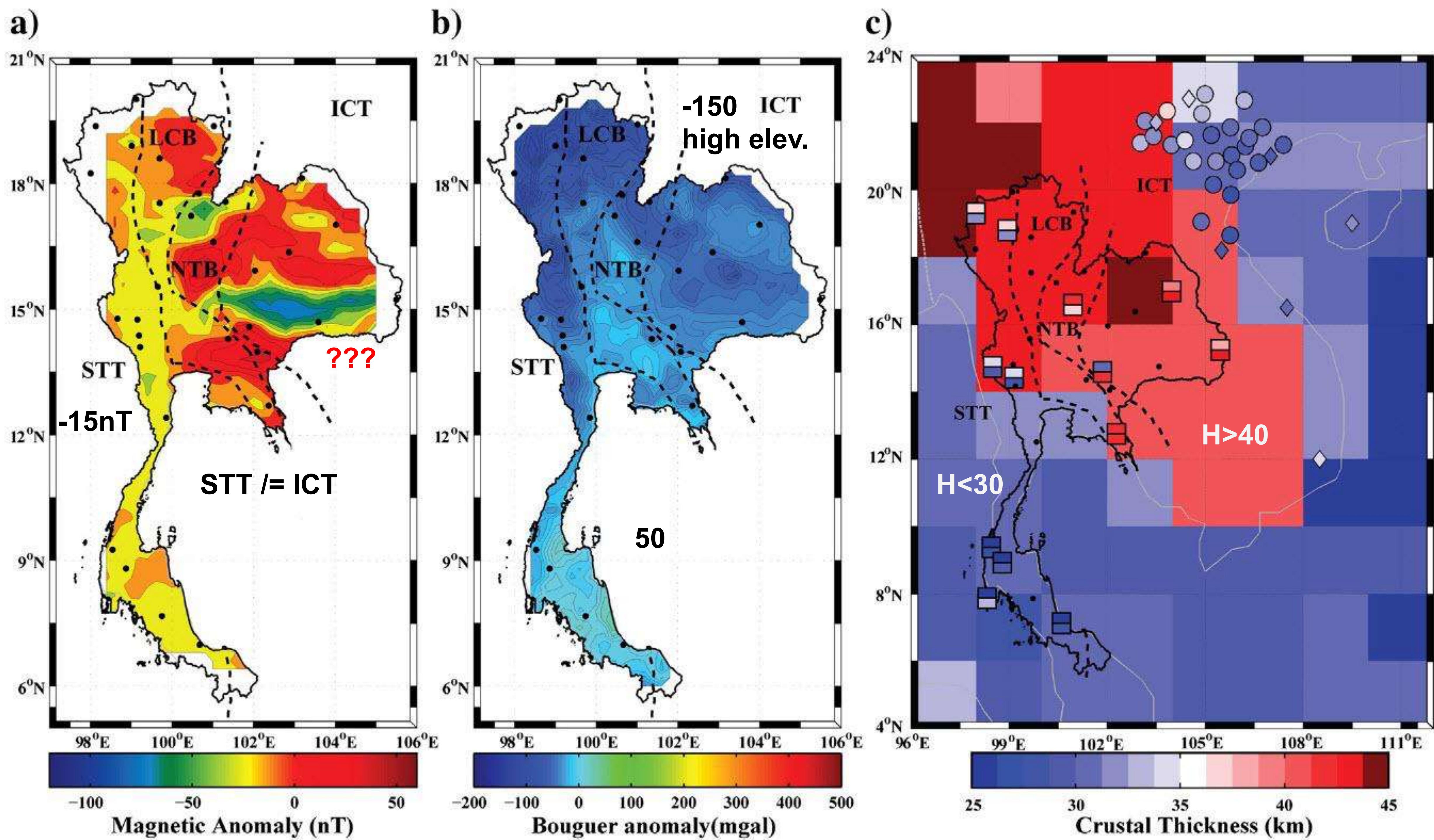
Suttipong Noisagool<sup>a</sup>, Songkhun Boonchaisuk<sup>c</sup>, Patinya Pornsopin<sup>d</sup>, Weerachai Siripunvaraporn<sup>a,b,\*</sup>

<sup>a</sup> Department of Physics, Faculty of Science, Mahidol University, 272 Rama 6 Road, Rachatawee, Bangkok, Thailand

<sup>b</sup> ThEP Center, Commission on Higher Education, 328, Si Ayutthaya Road, Rachatawee, Bangkok, Thailand

<sup>c</sup> Geoscience Program, Mahidol University, Kanchanaburi Campus, Saiyok, Kanchanaburi, Thailand

<sup>d</sup> Seismological Bureau, Thai Meteorological Department, 4353 Sukumvit Road, Bangna, Bangkok, Thailand



## Thai Seismic Array (TSAR) Project

Satoru Tanaka<sup>1)\*</sup>, Weerachai Siripunvaraporn<sup>2)(3)</sup>, Songkhun Boonchaisuk<sup>3)(4)</sup>,  
Suttipong Noisagool<sup>2)(3)</sup>, Taewoon Kim<sup>5)</sup>, Kenji Kawai<sup>6)</sup>, Yuki Suzuki<sup>6)</sup>,  
Yasushi Ishihara<sup>5)</sup>, Ryohei Iritani<sup>7)</sup>, Koji Miyakawa<sup>7)</sup>, Nozomu Takeuchi<sup>7)</sup>  
and Hitoshi Kawakatsu<sup>7)</sup>

<sup>1)</sup> Volcanoes and Earth's Interior Research Center, Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology

<sup>2)</sup> Department of Physics, Faculty of Science, Mahidol University

<sup>3)</sup> Thailand Center of Excellence in Physics, Commission on Higher Education

<sup>4)</sup> Geoscience Program, Mahidol University

<sup>5)</sup> Subduction Dynamics Research Center, Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology

<sup>6)</sup> Department of Earth and Planetary Science, School of Science, The University of Tokyo

<sup>7)</sup> Earthquake Research Institute, The University of Tokyo

2017-2019 JAMTEC  
ERI, University of Tokyo

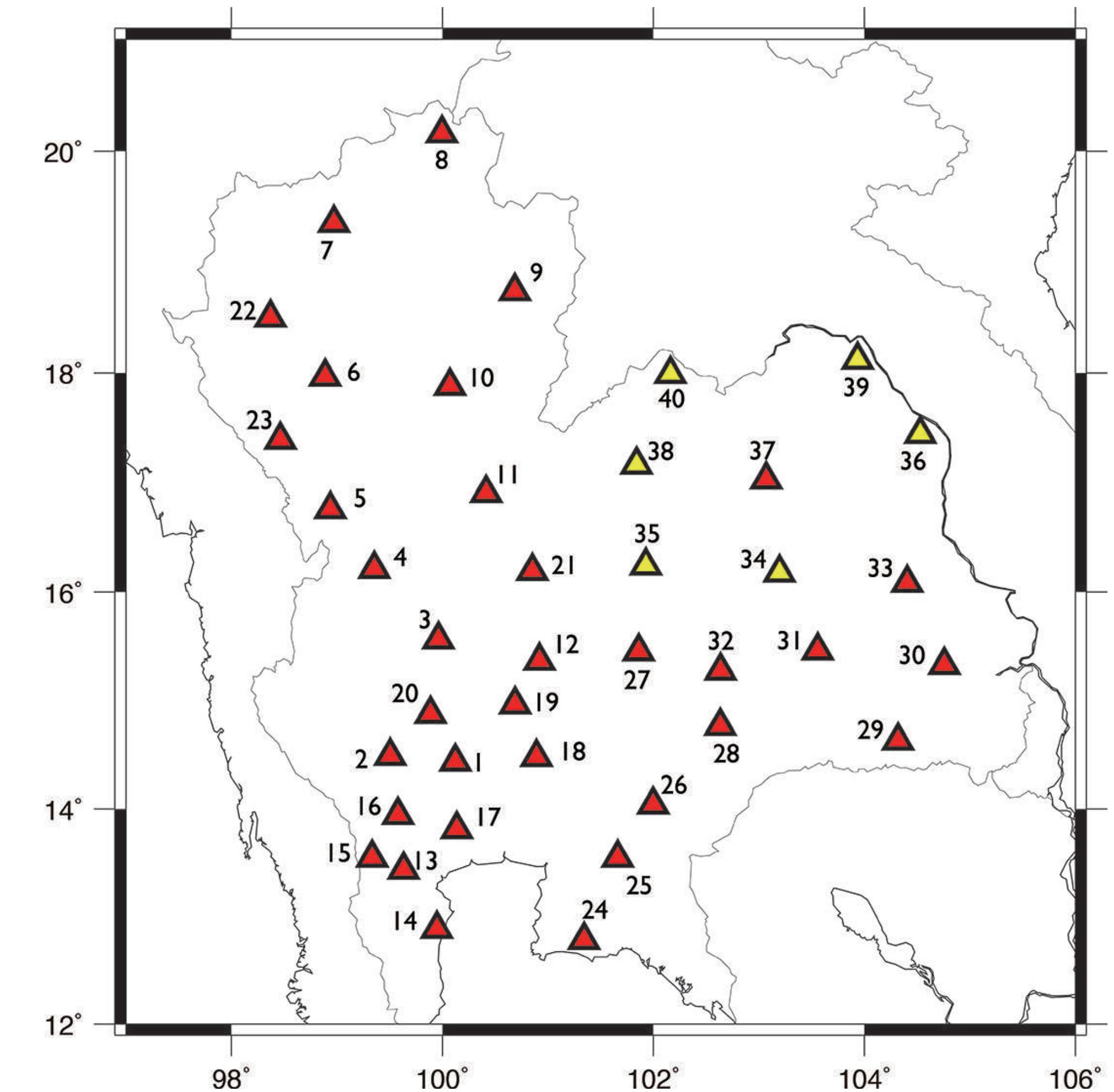


Fig. 1. Geographical distribution of seismic stations of the Thai Seismic Array (TSAR) as of February, 2017. Red and yellow triangles indicate CMG-3T and STS2, respectively.

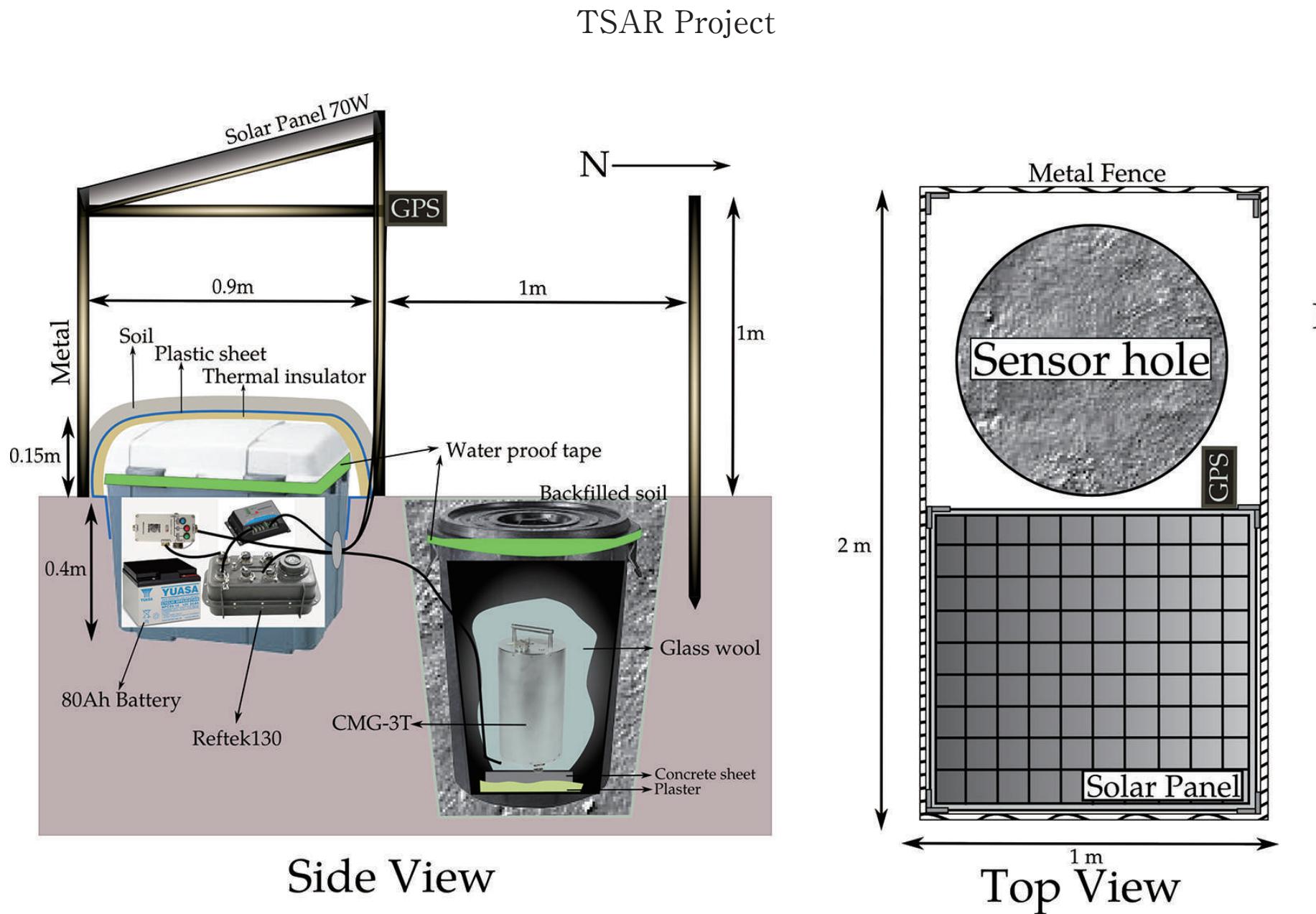


Fig. 3. Schematic image of the basic design of the seismic stations.

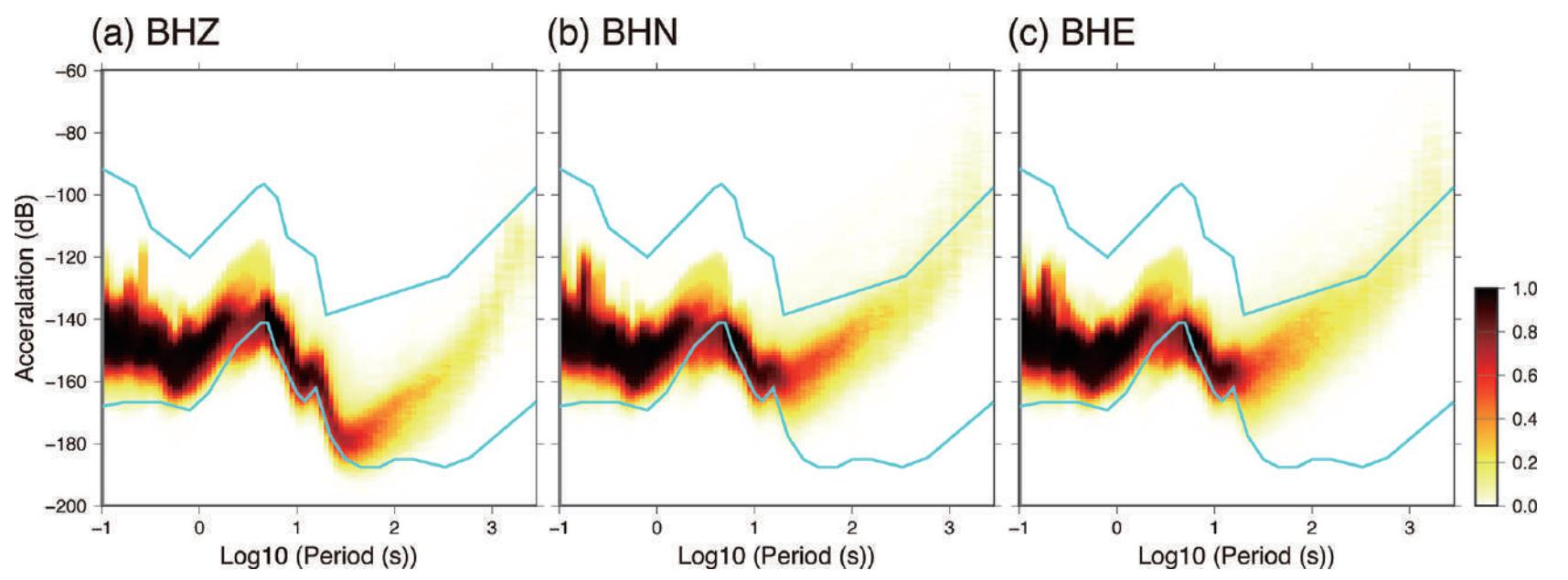


Fig. 4. Noise spectra of (a) UD (b) NS (c) EW components at TS13. Two blue lines denote new High Noise Model and new Low Noise Model (Peterson 1993).



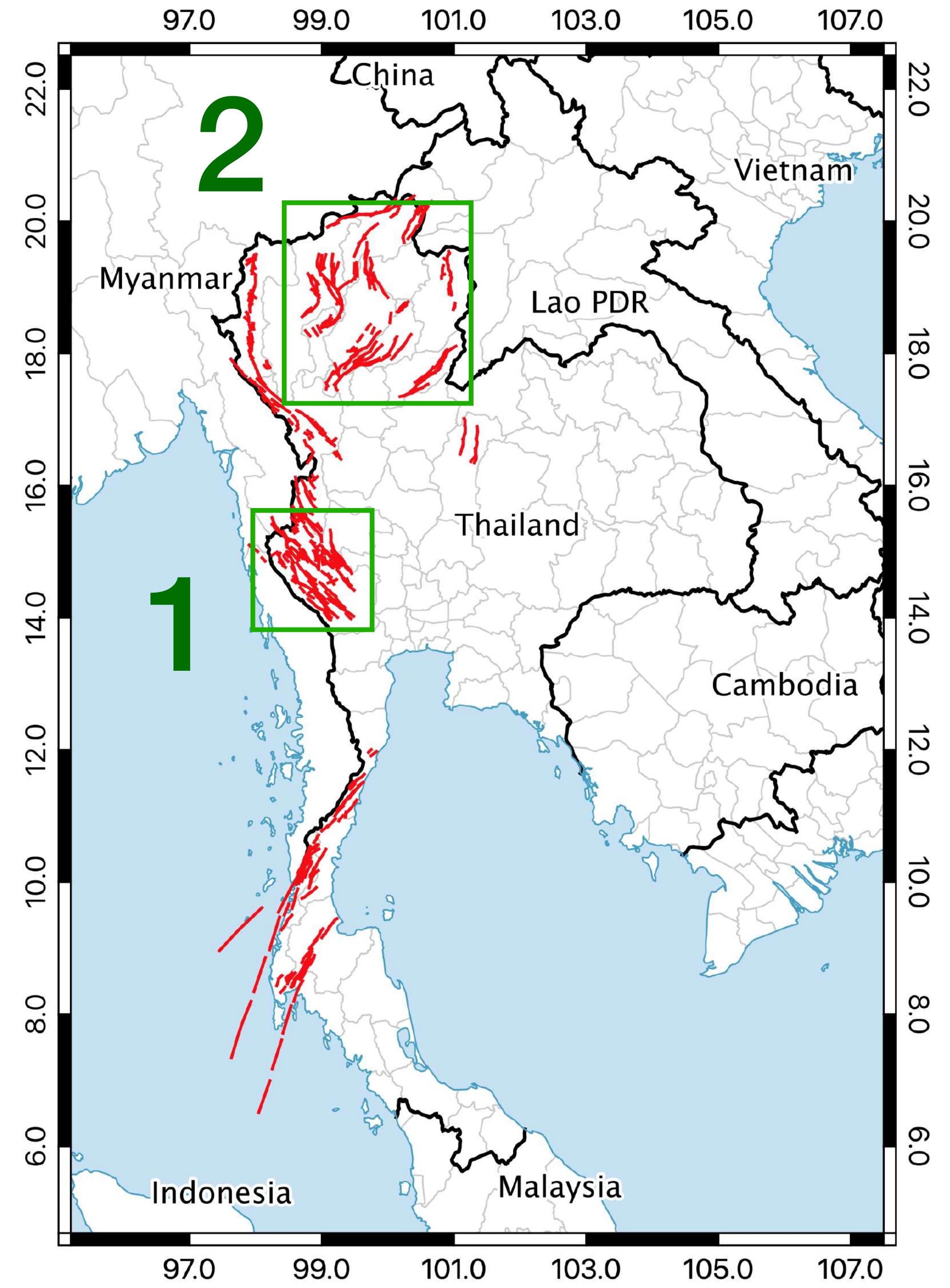
Photo 1. Snapshots of a series of a deployment process. (a) Digging a sensor hole. (b) Making up a basement. (c) Setting up a sensor with determination of the north-direction and leveling. (d) Putting a plastic bucket on the sensor and setting up the data logger, battery, etc., in the plastic box. (e) Fixing a solar panel and closing the logger box cover. (f) Completion of deployment. The station was enclosed with a wire-mesh fence.

# **1 Kanchaburi**

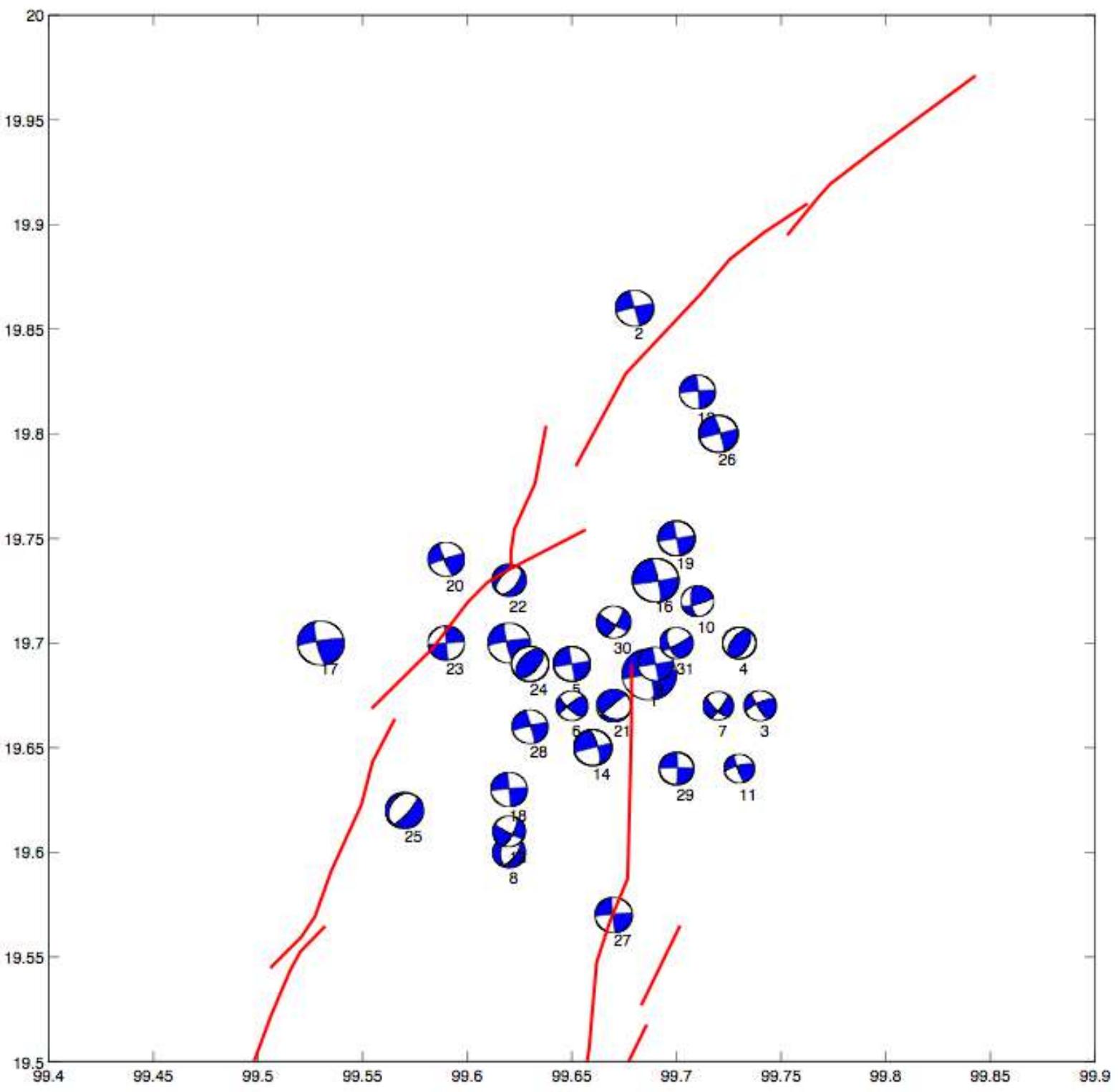
2009-2010

# **2 Chiang Rai**

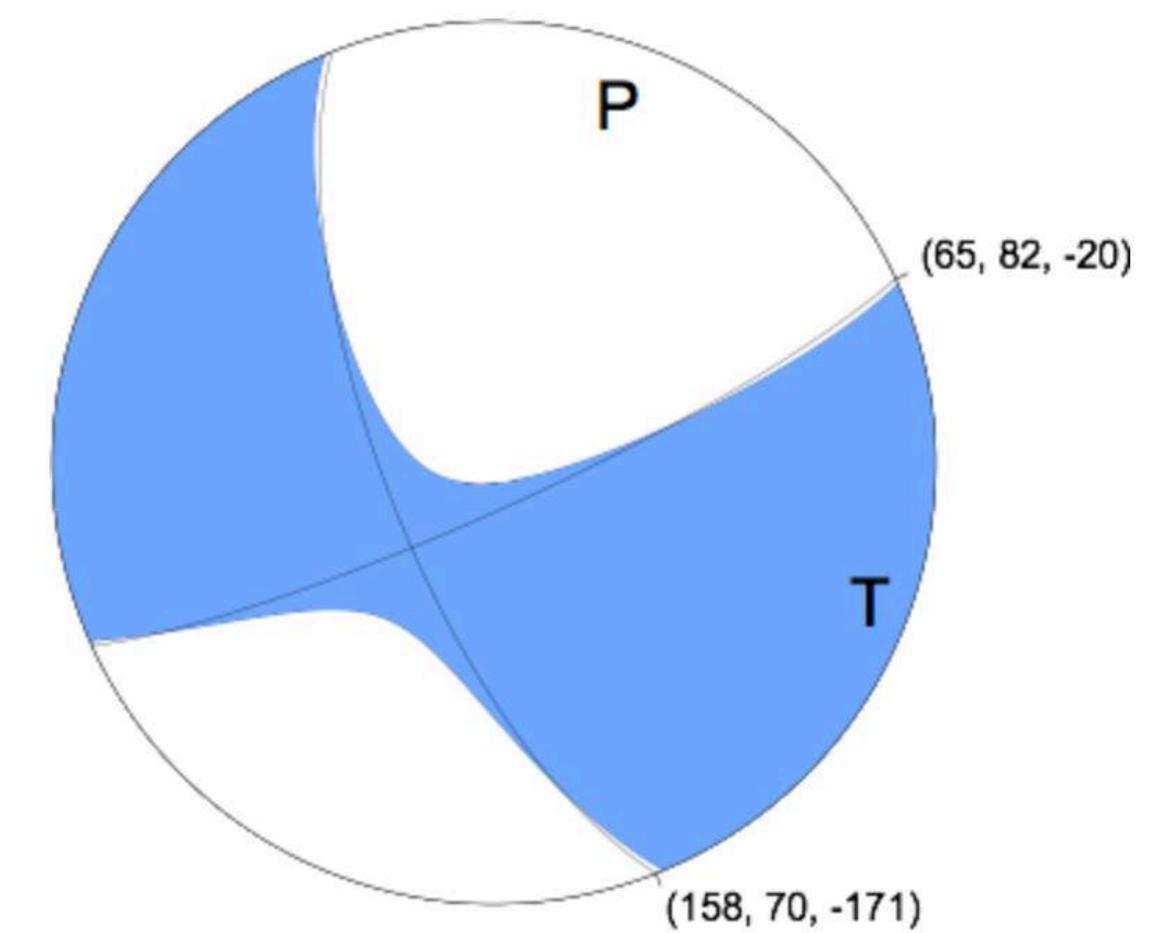
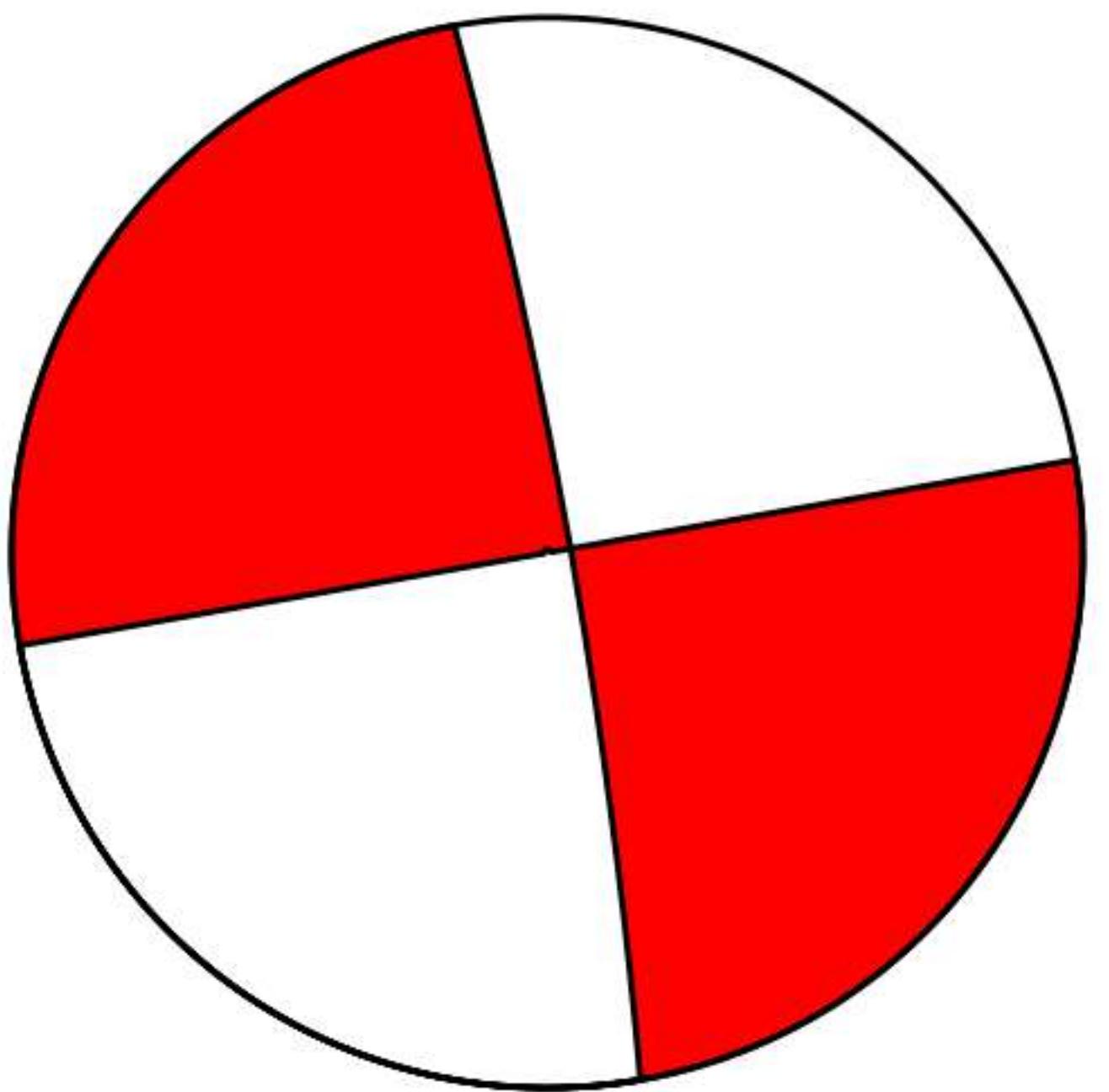
2014-2015



# Geofon



Noisagool et al, 2016



Journal of Asian Earth Sciences 127 (2016) 231–245

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Journal of Asian Earth Sciences

journal homepage: [www.elsevier.com/locate/jseaes](http://www.elsevier.com/locate/jseaes)



The regional moment tensor of the 5 May 2014 Chiang Rai earthquake ( $M_w = 6.5$ ), Northern Thailand, with its aftershocks and its implication to the stress and the instability of the Phayao Fault Zone

Suttipong Noisagool<sup>a</sup>, Songkhun Boonchaisuk<sup>c</sup>, Patinya Pornsopin<sup>d</sup>, Weerachai Siripunvaraporn<sup>a,b,\*</sup>

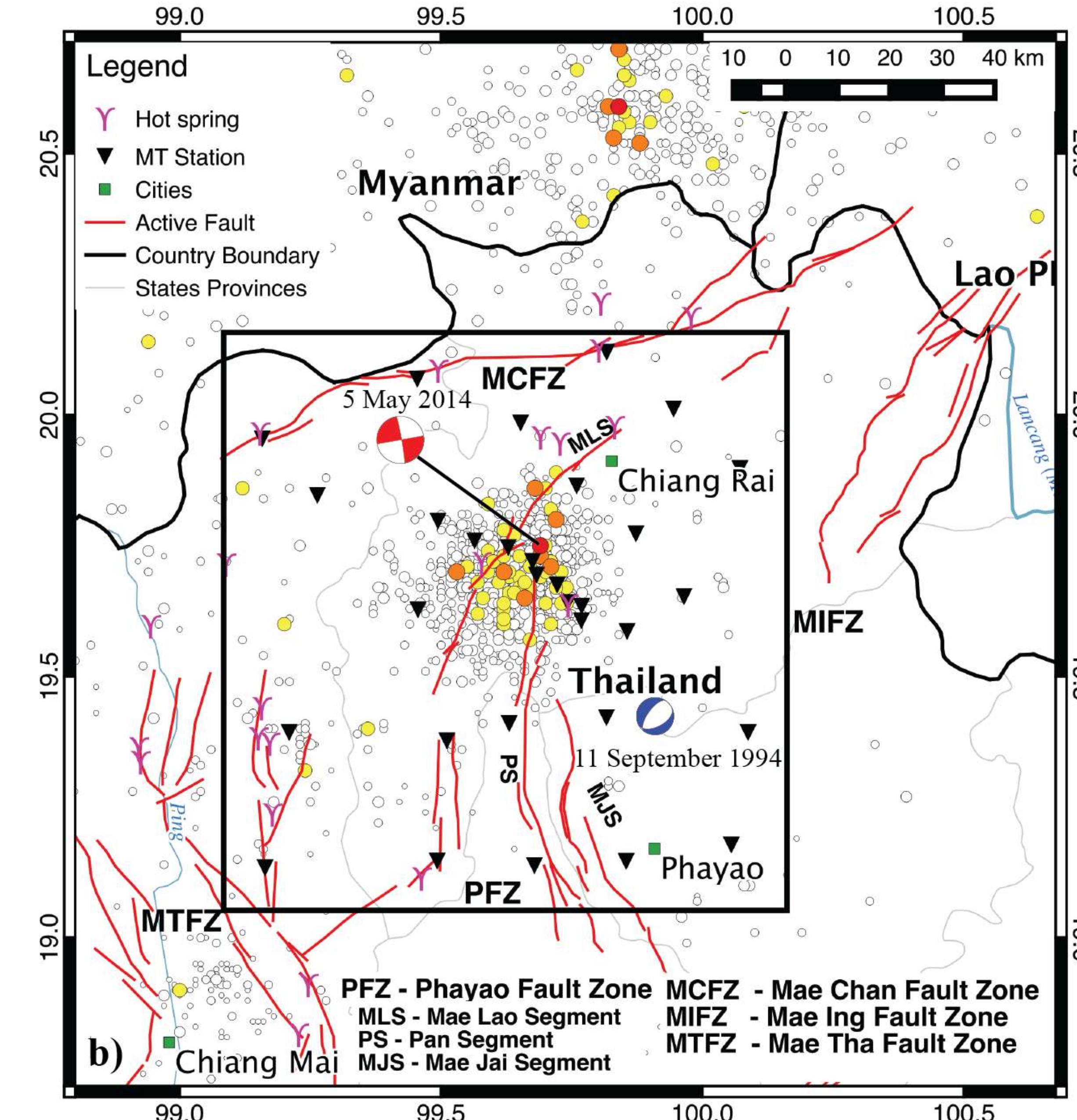
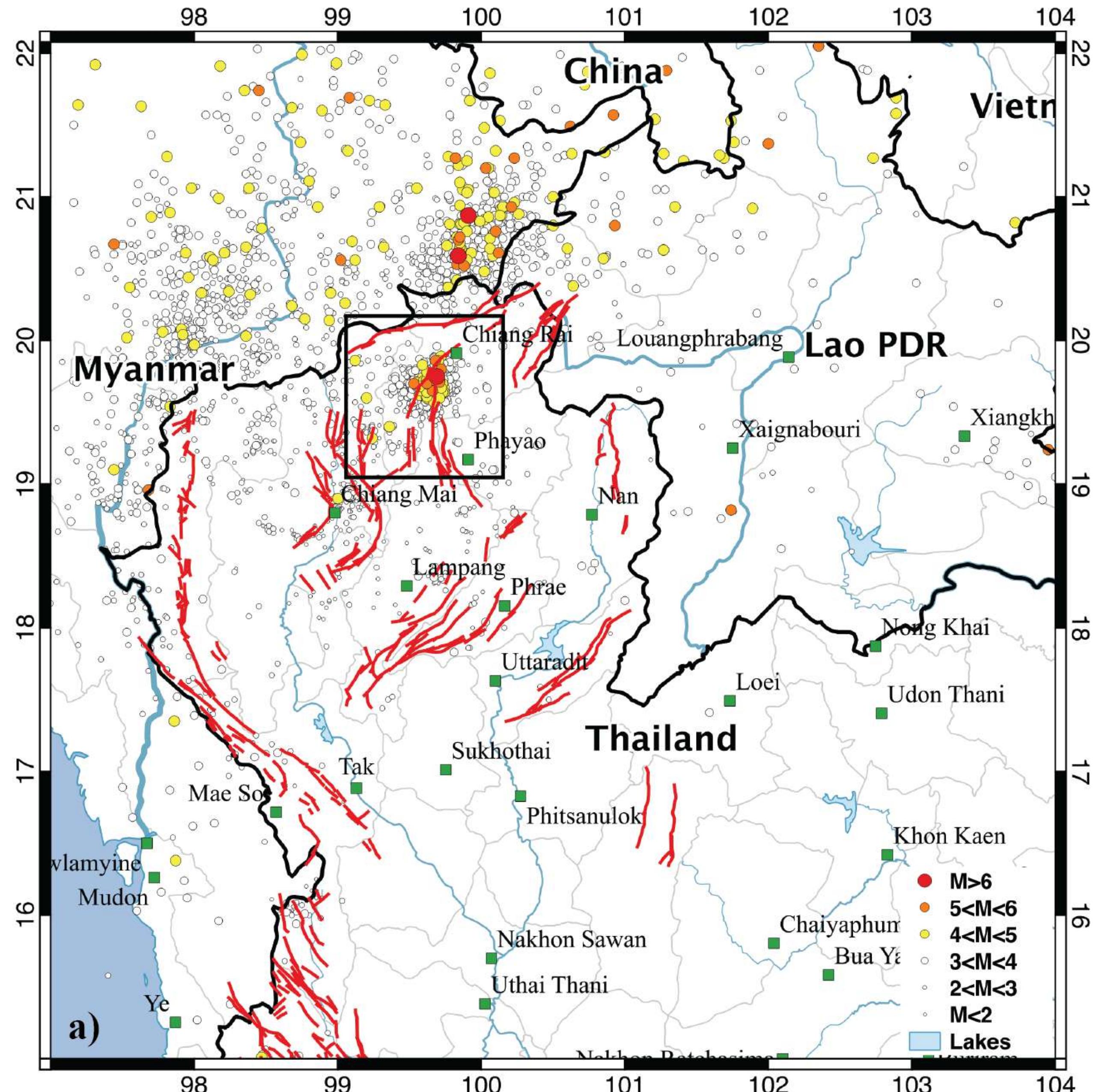
<sup>a</sup>Department of Physics, Faculty of Science, Mahidol University, 272 Rama 6 Road, Rachatawee, Bangkok, Thailand

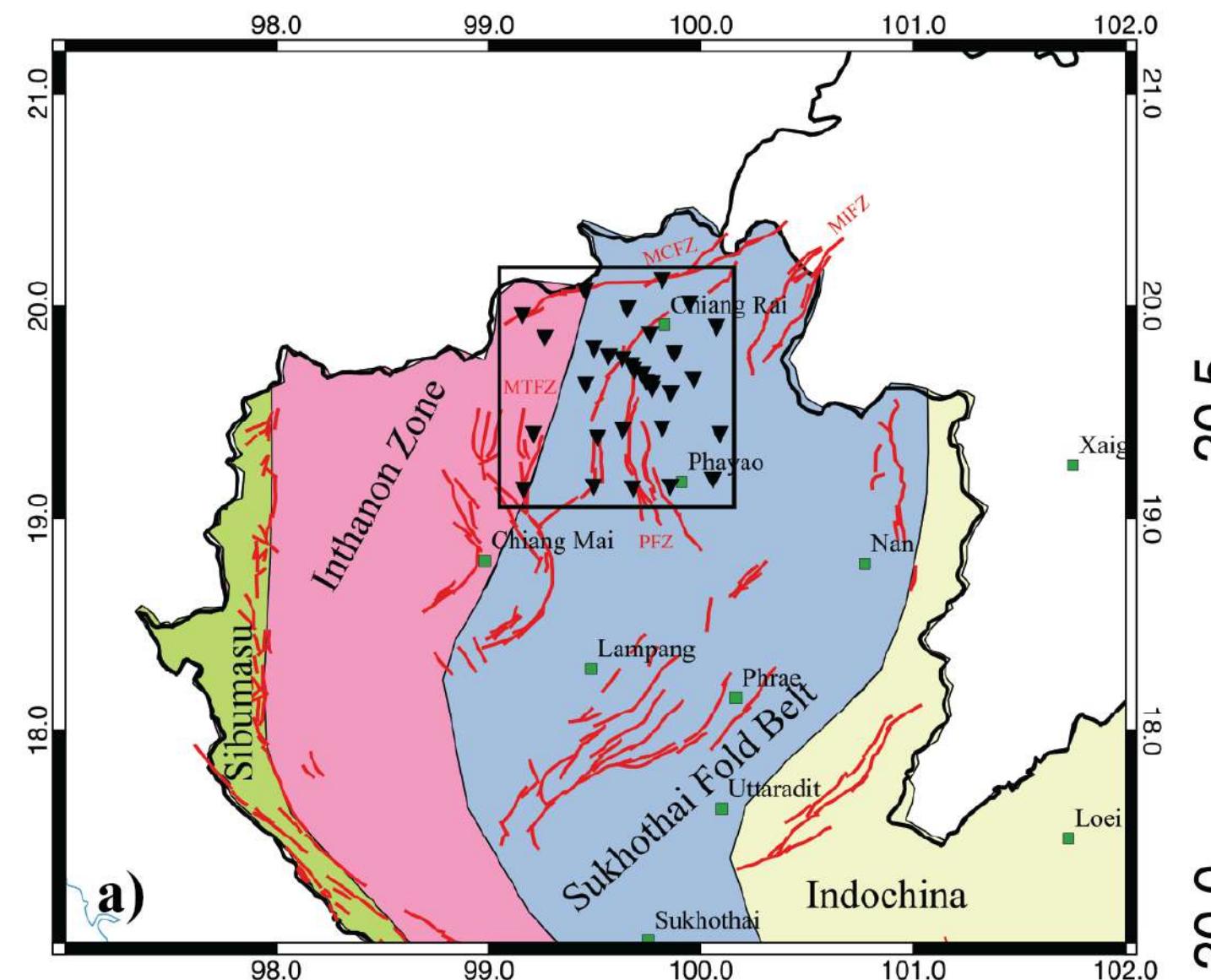
<sup>b</sup>ThEP Center, Commission on Higher Education, 328, Si Ayutthaya Road, Rachatawee, Bangkok, Thailand

<sup>c</sup>Geoscience Program, Mahidol University, Kanchanaburi Campus, Saiyok, Kanchanaburi, Thailand

<sup>d</sup>Seismological Bureau, Thai Meteorological Department, 4353 Sukumvit Road, Bangna, Bangkok, Thailand

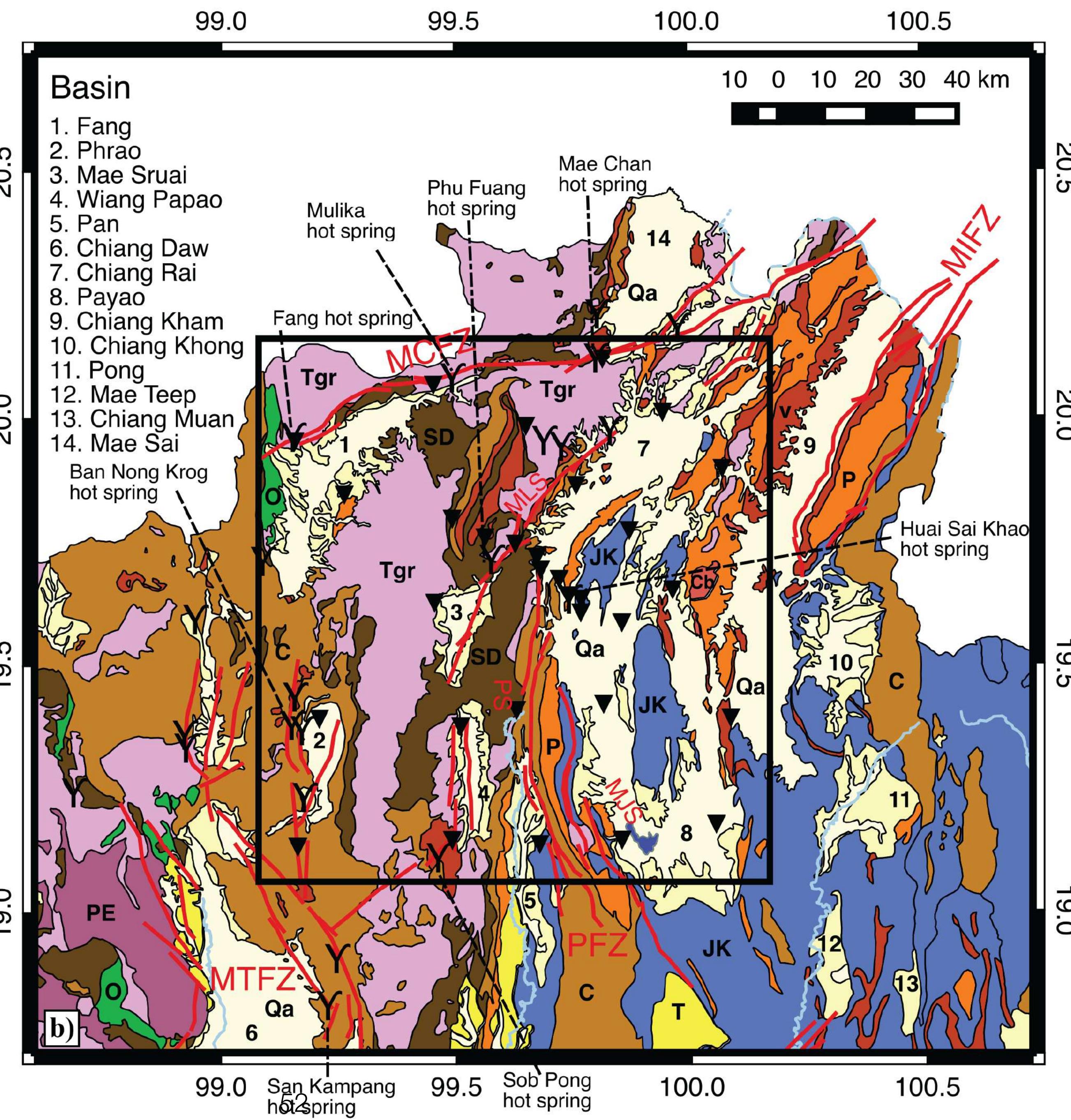
# USGS



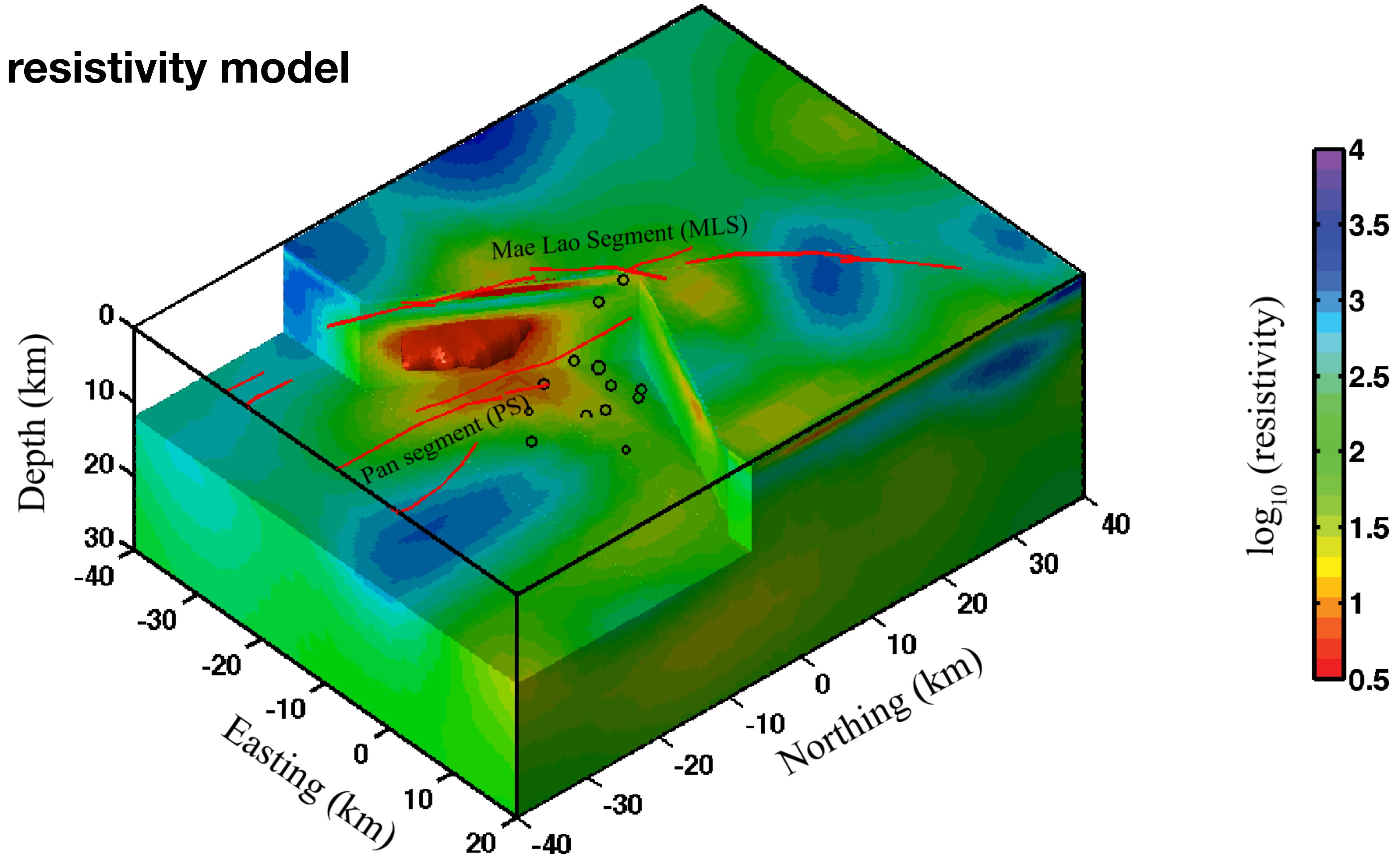


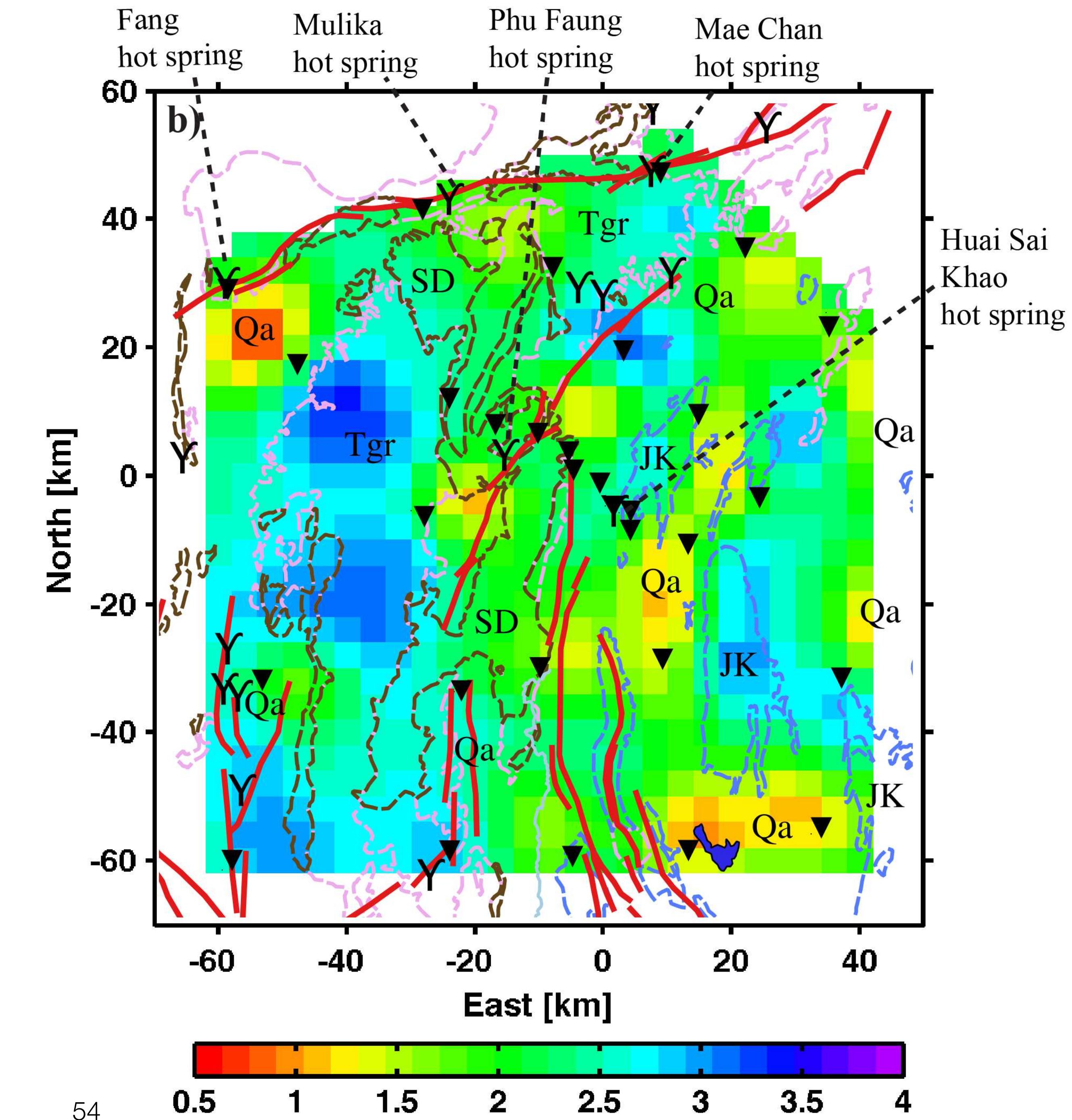
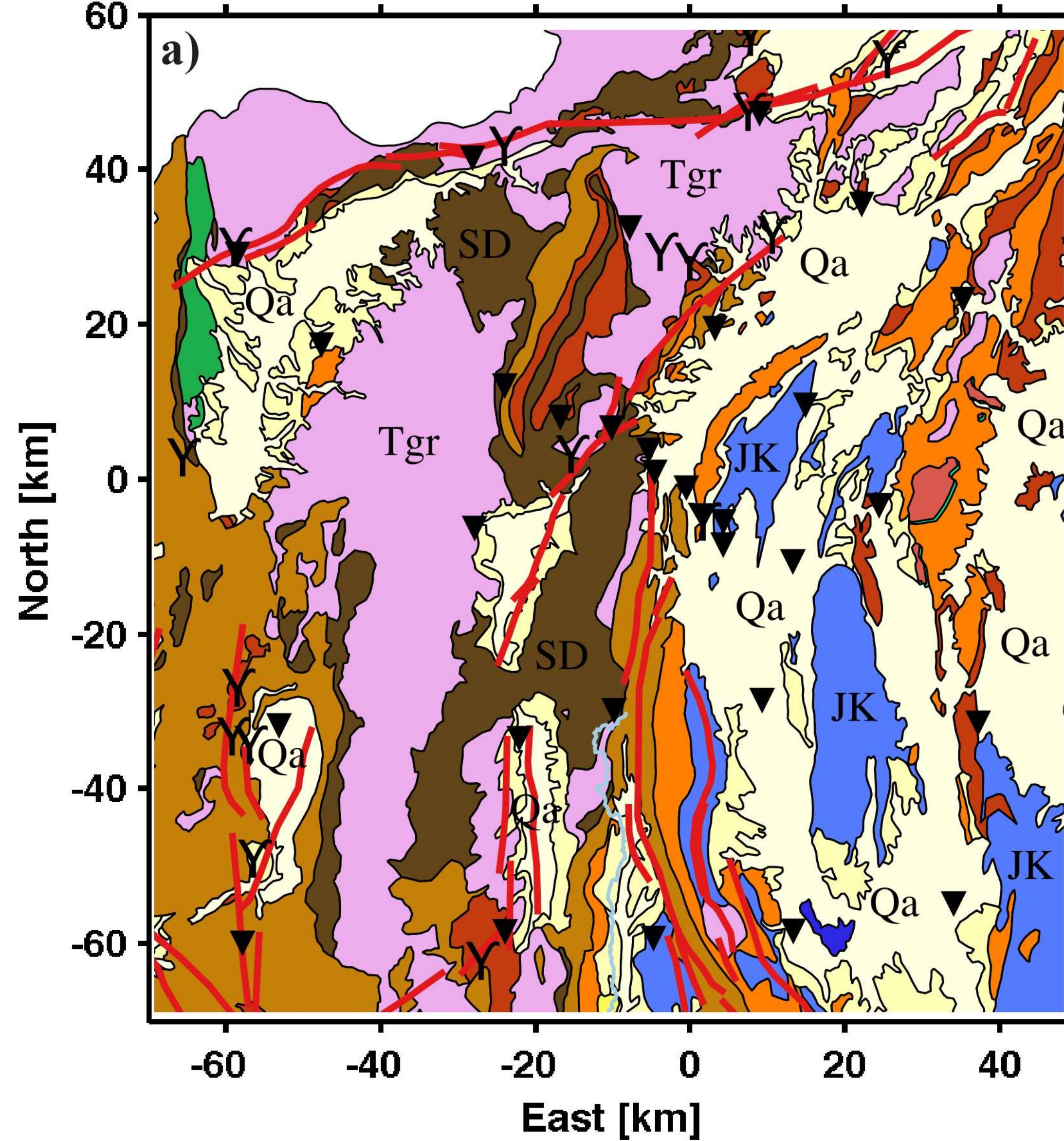
### Legend

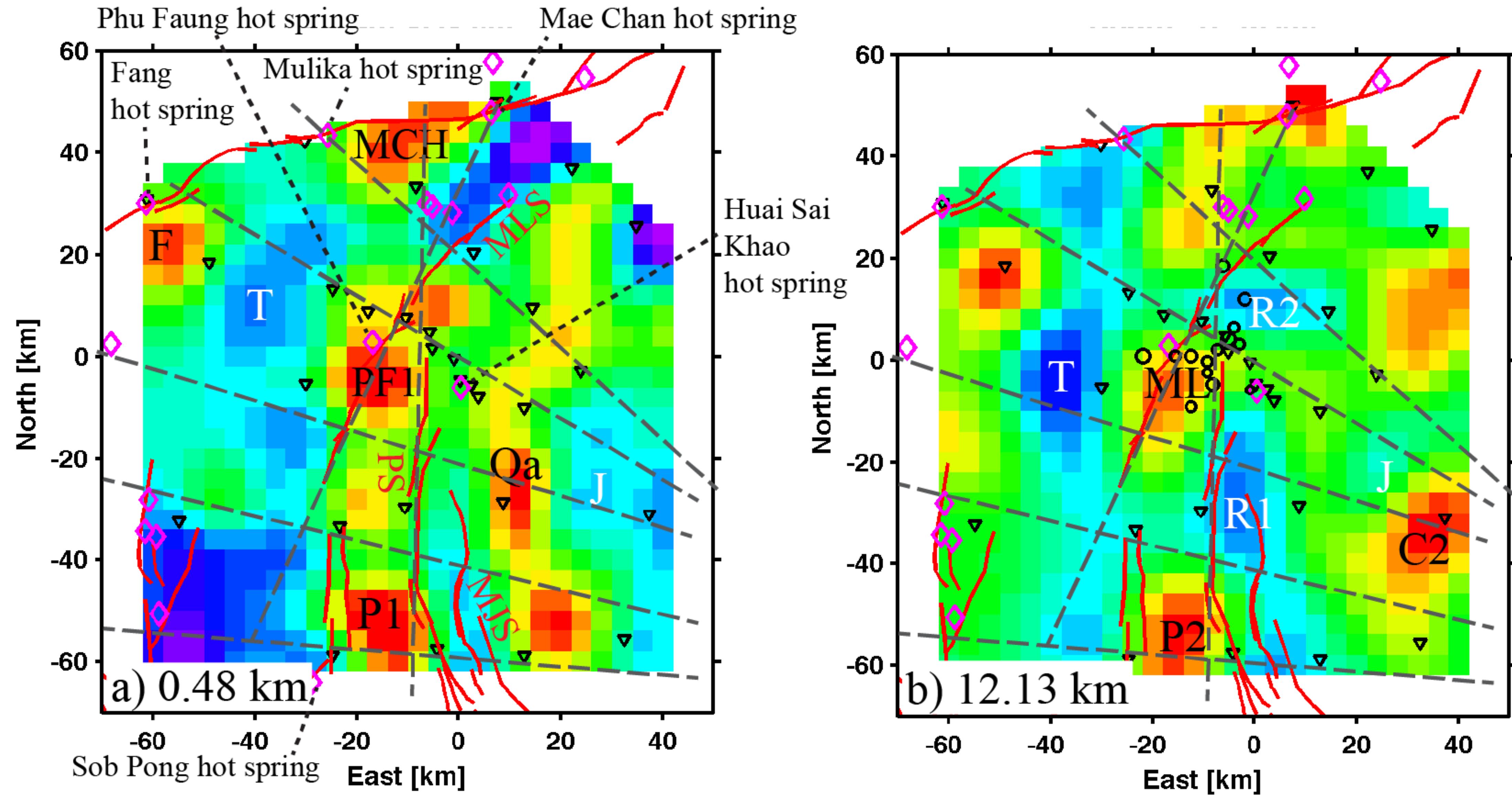
- Y Hot spring
- ▼ MT station
- Active Fault
- River
- Reservoir
- [Qa] Alluvial deposits
- [Qt] Terrace deposits
- [T] Tertiary sedimentary rocks
- [JK] Mesozoic non marine
- [P] Mesozoic marine
- [C] Upper Paleozoic sedimentary rocks
- [SD] Middle Paleozoic Metasediments
- [O] Lower Paleozoic Metasediments
- [PE] Proterozoic Metamorphic rocks
- [Cb] Cenozoic Basalts
- v extrusive rocks
- Tgr intrusive rocks

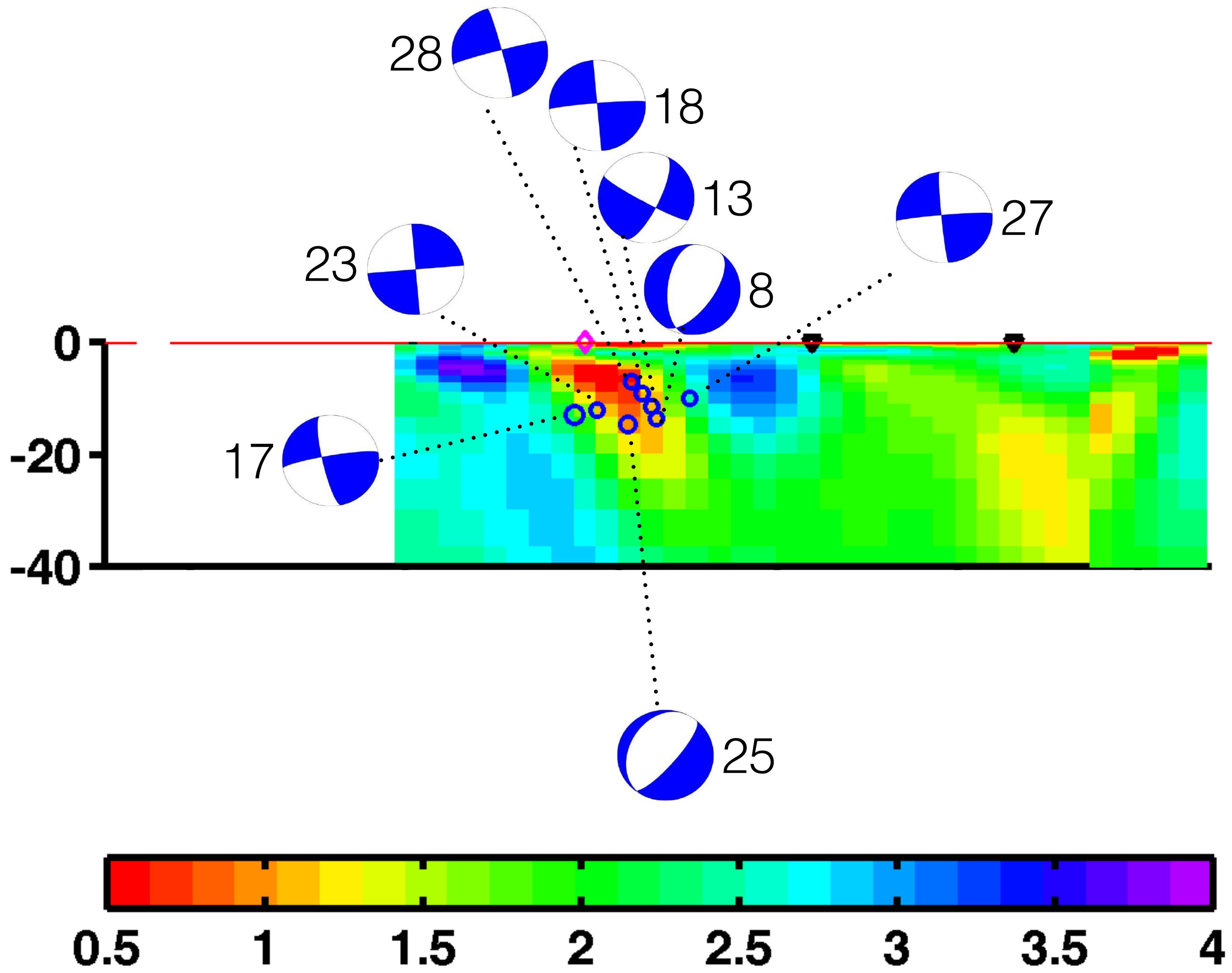
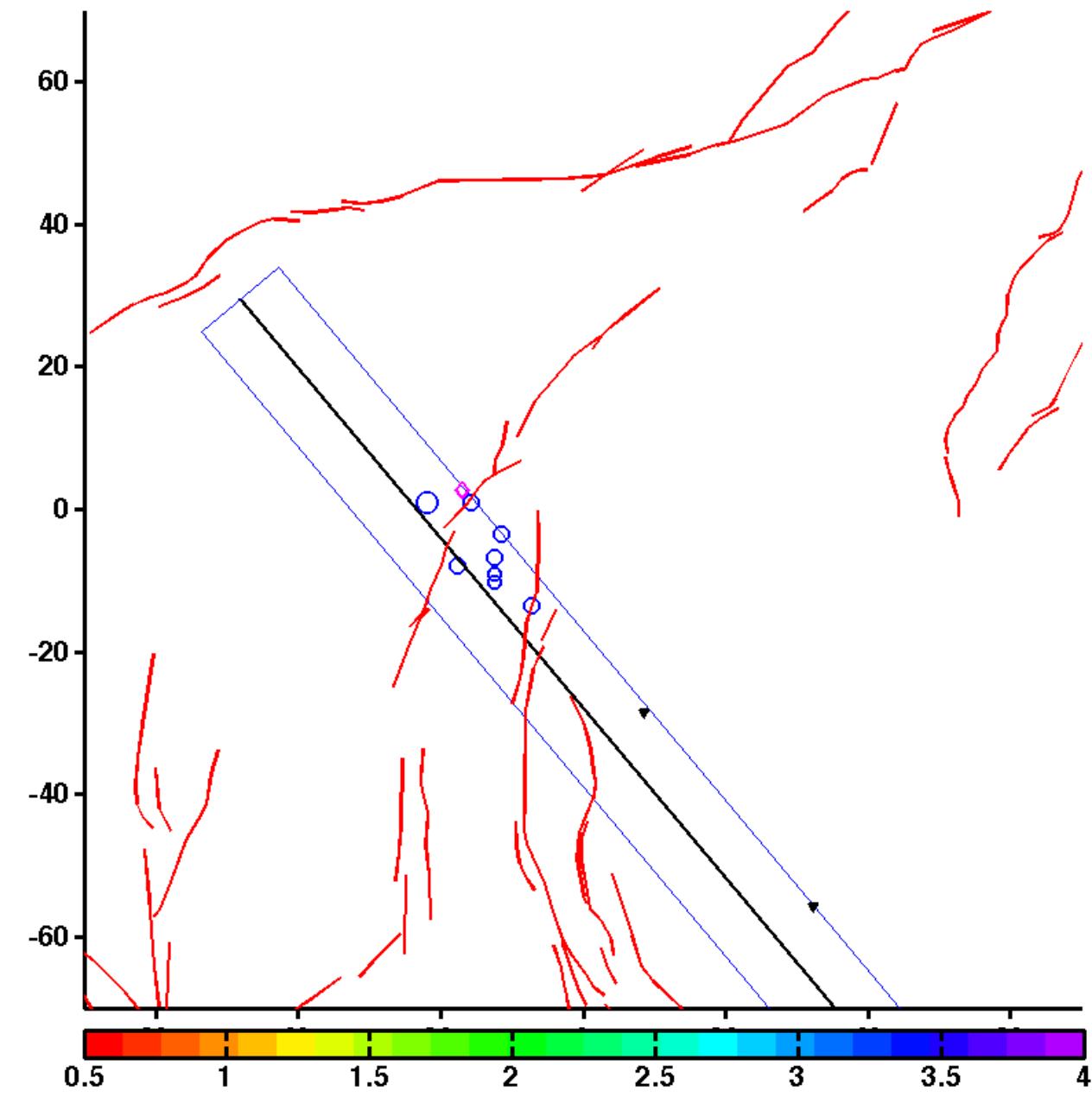


# 3D resistivity model

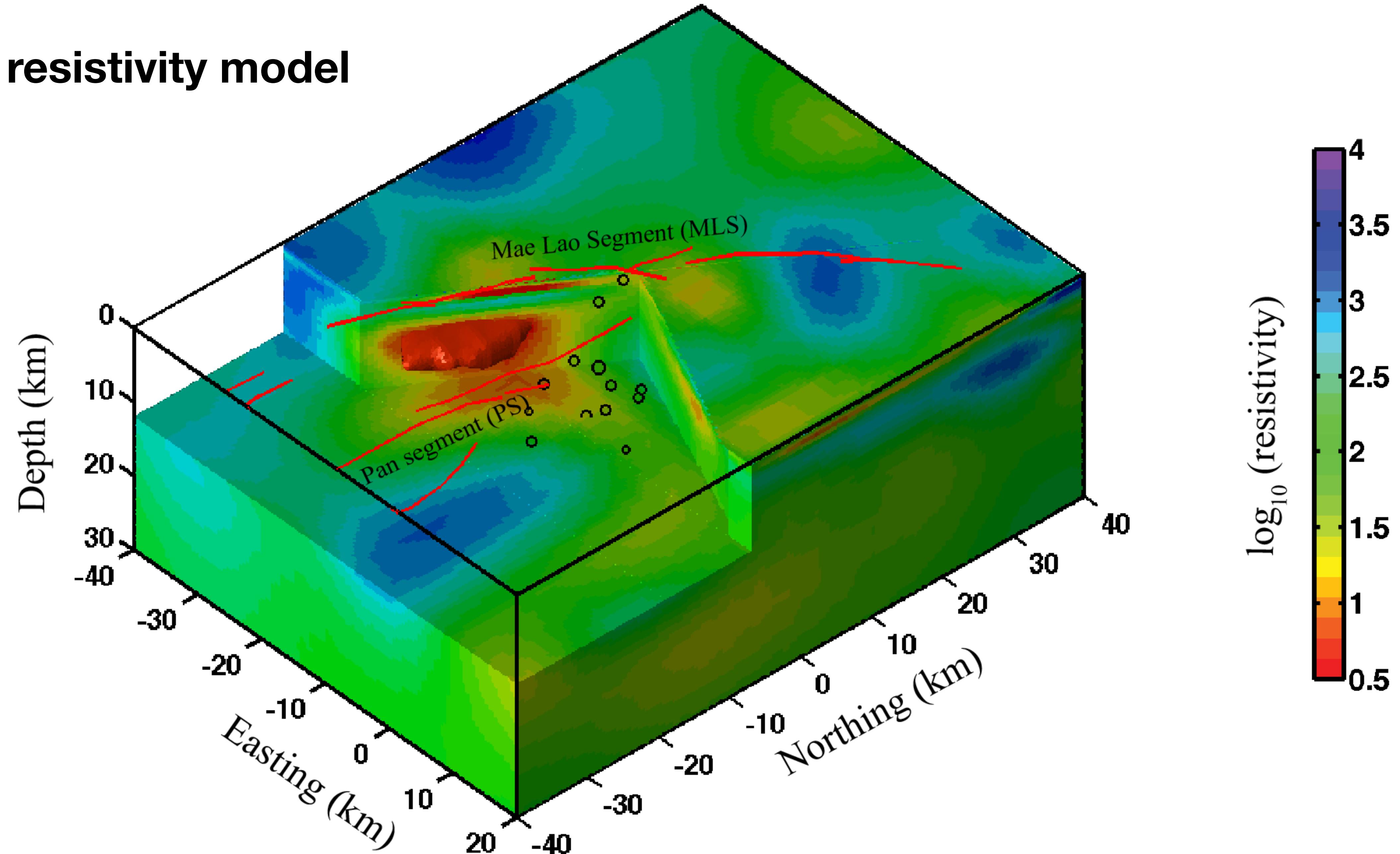






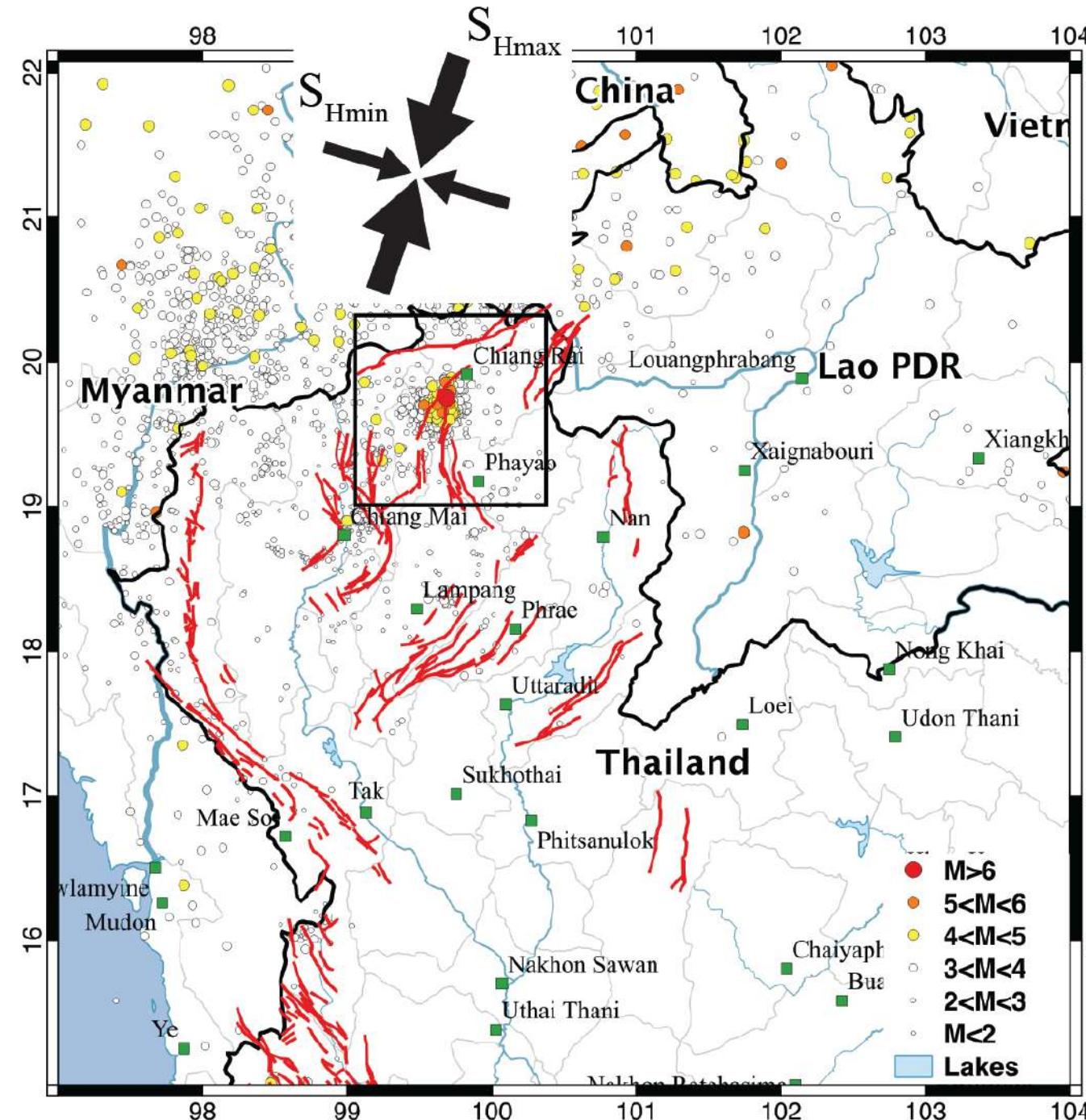


# 3D resistivity model

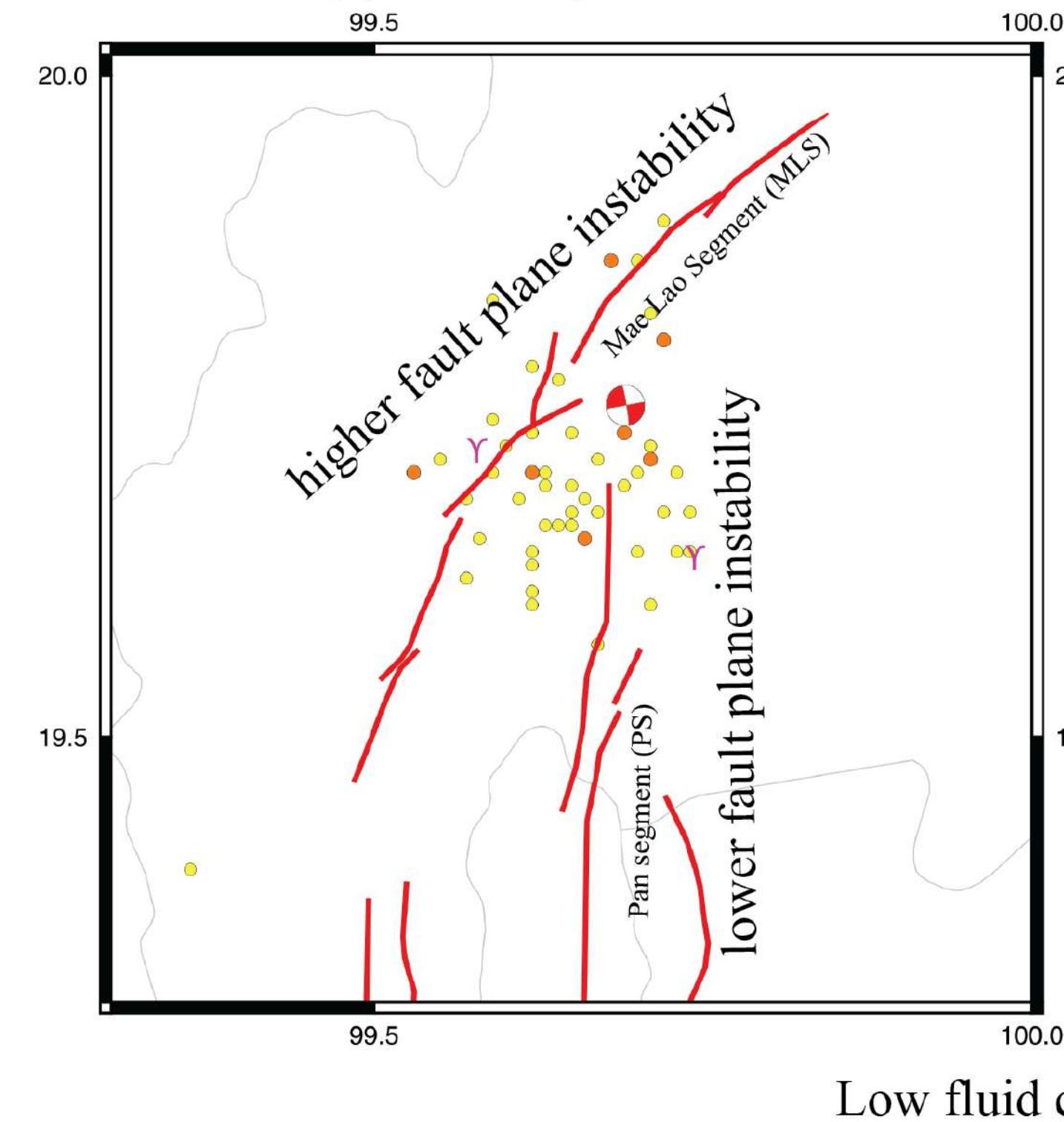


# conclusion

(1) Regional Stress

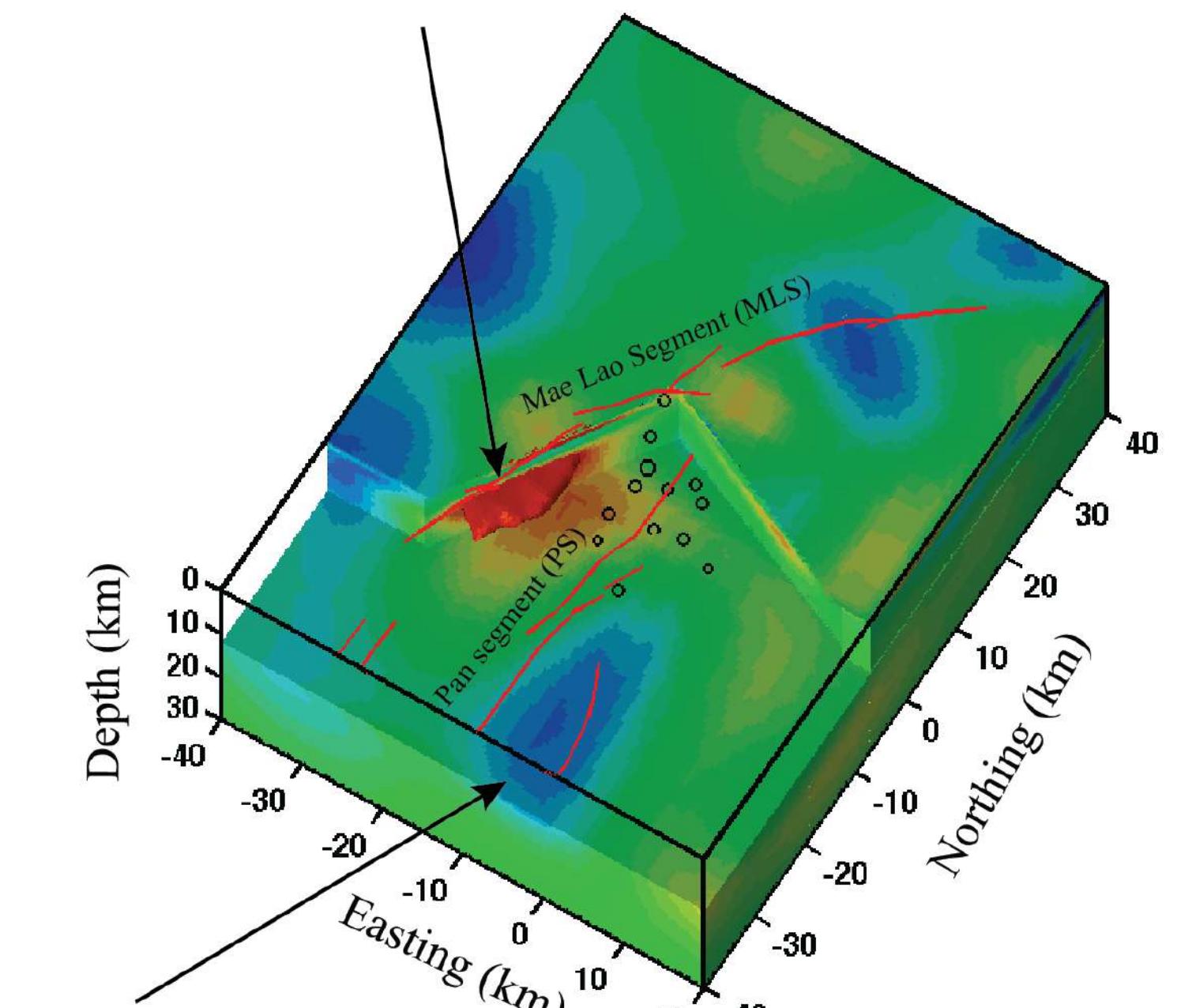


(2) Geometry of faults



(3) Fluid content

High fluid content beneath MLS



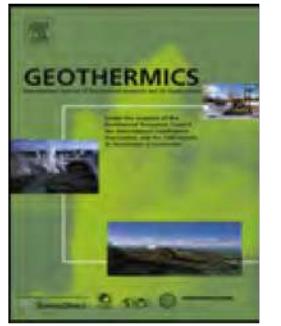
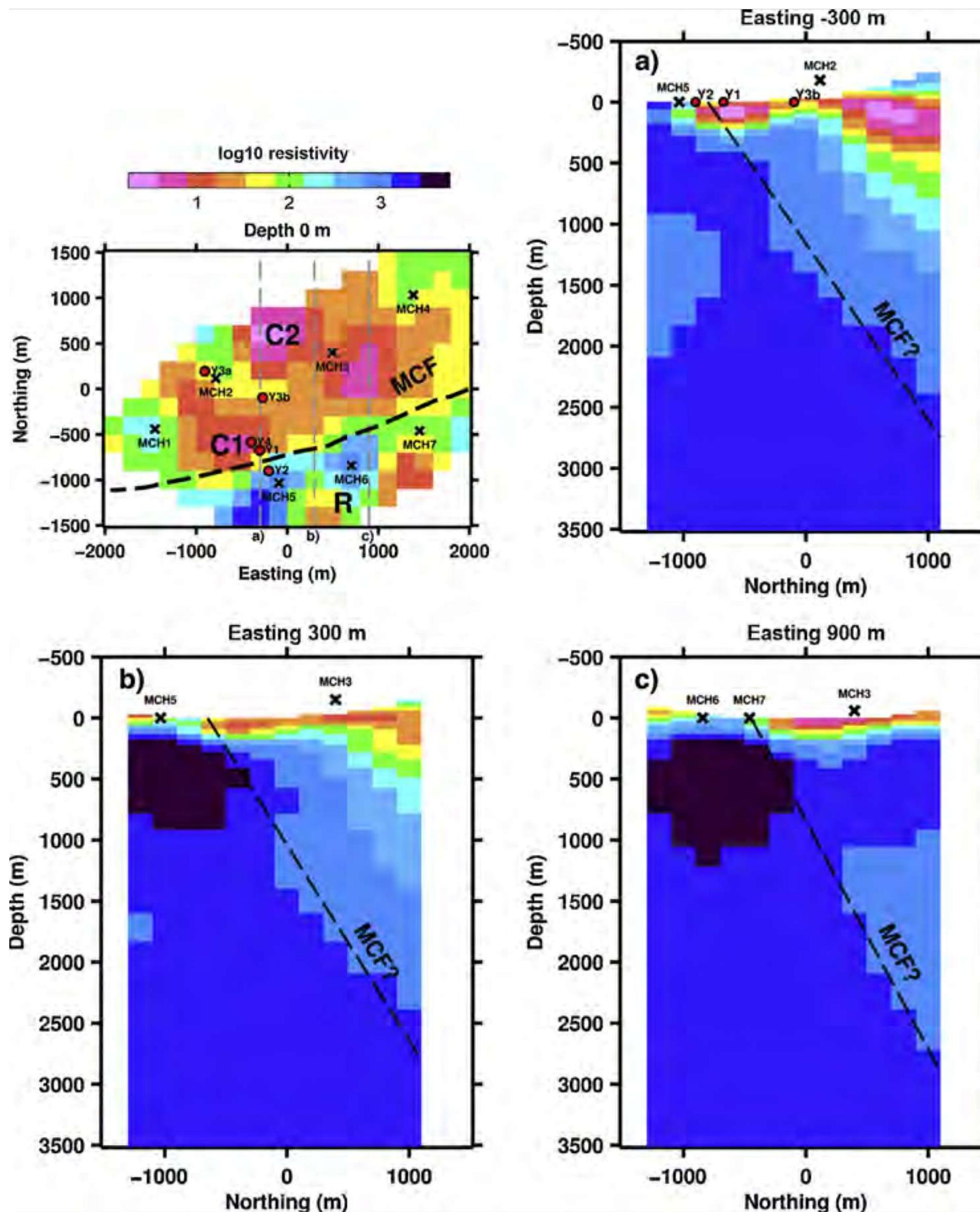
**accumulated tectonic stress**

**high fault plane instability**

$\log_{10}$  (resistivity)

0.5	1	1.5	2	2.5	3	3.5	4
-----	---	-----	---	-----	---	-----	---

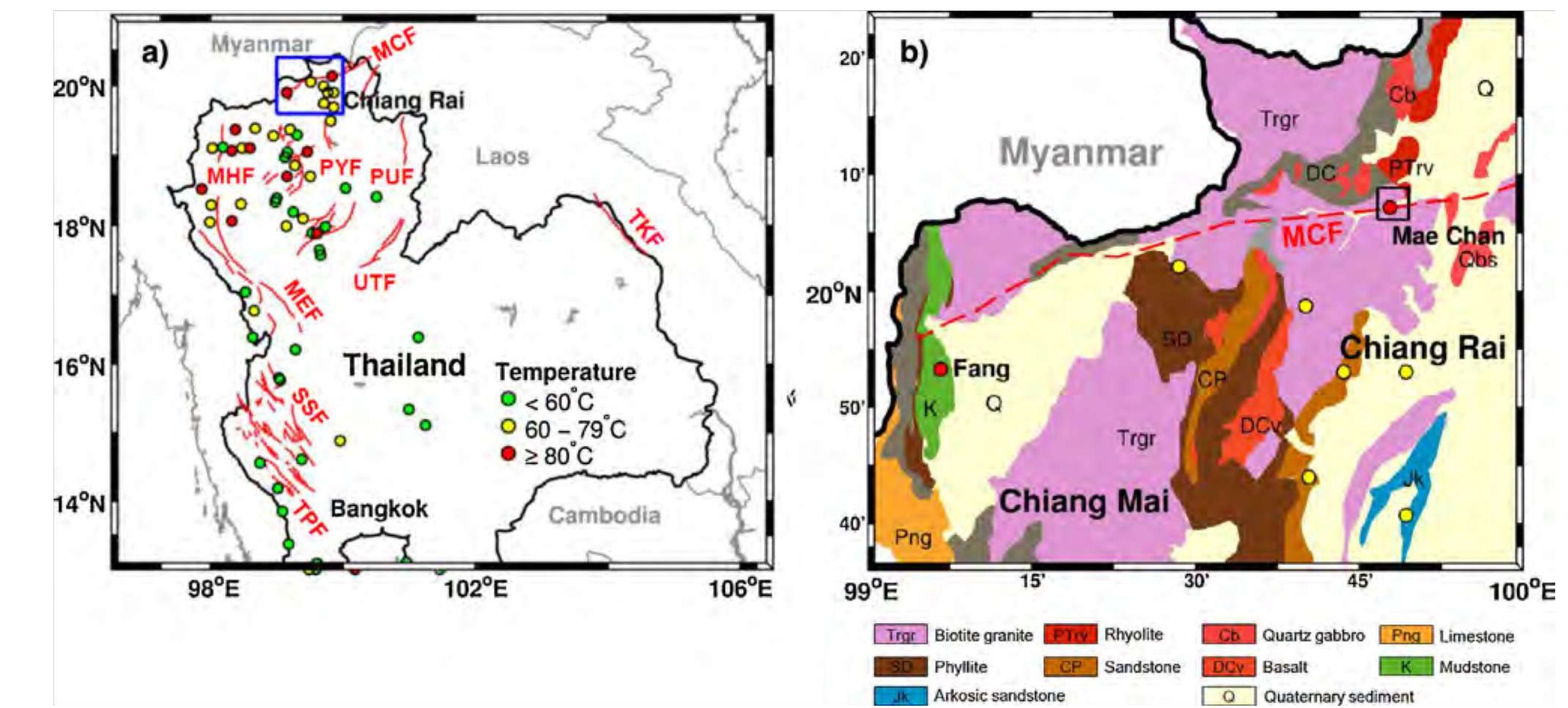
**High fluid content**

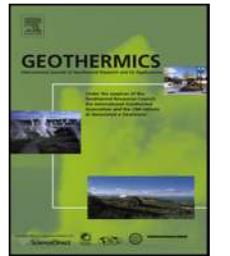


## A pilot magnetotelluric survey for geothermal exploration in Mae Chan region, northern Thailand

Puwis Amatyakul, Tawat Rung-Arunwan, Weerachai Siripunvaraporn \*

Department of Physics, Faculty of Science, Mahidol University, 272 Rama 6 Road, Rachatawee, Bangkok 10400, Thailand





## Exploring the shallow geothermal fluid reservoir of Fang geothermal system, Thailand via a 3-D magnetotelluric survey

Puwis Amatyakul<sup>a</sup>, Songkhun Boonchaisuk<sup>b</sup>, Tawat Rung-Arunwan<sup>c</sup>, Chatchai Vachiratiengchai<sup>c</sup>, Spencer H. Wood<sup>d</sup>, Kriangsak Pirarai<sup>e</sup>, Aranya Fuangswasdi<sup>e</sup>, Weerachai Siripunvaraporn<sup>a,f,\*</sup>

<sup>a</sup> Department of Physics, Faculty of Science, Mahidol University, 272 Rama 6 Road, Rachatawee, Bangkok, 10400, Thailand

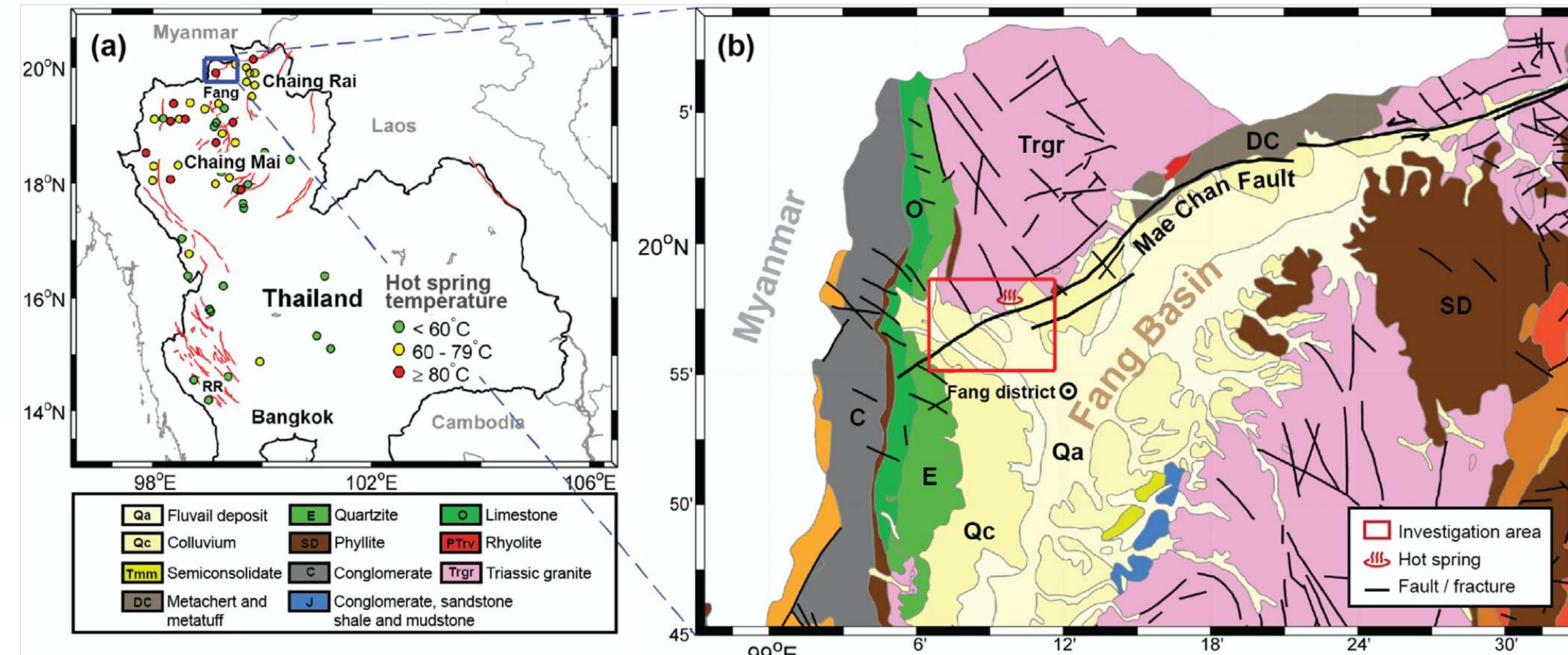
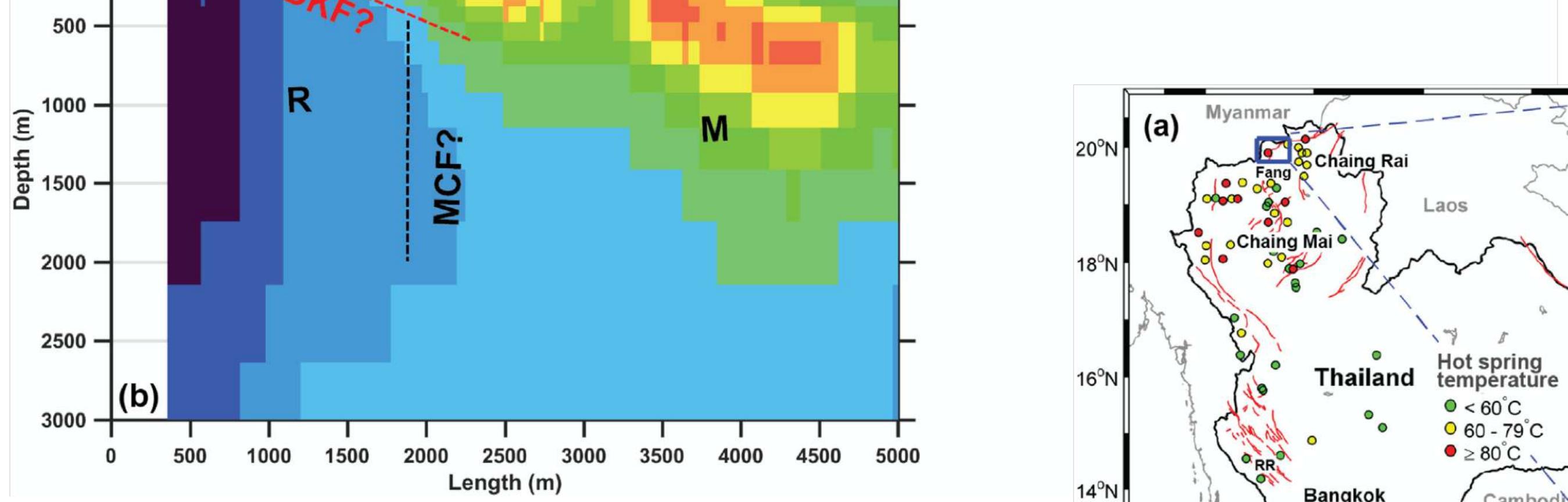
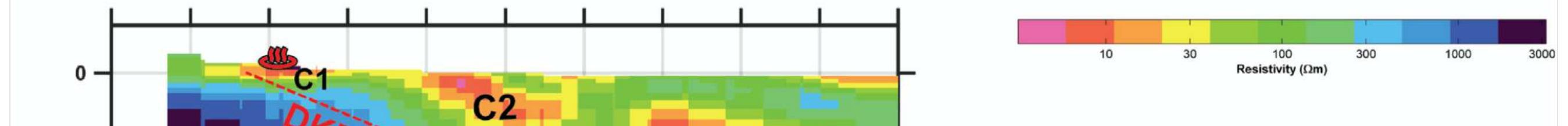
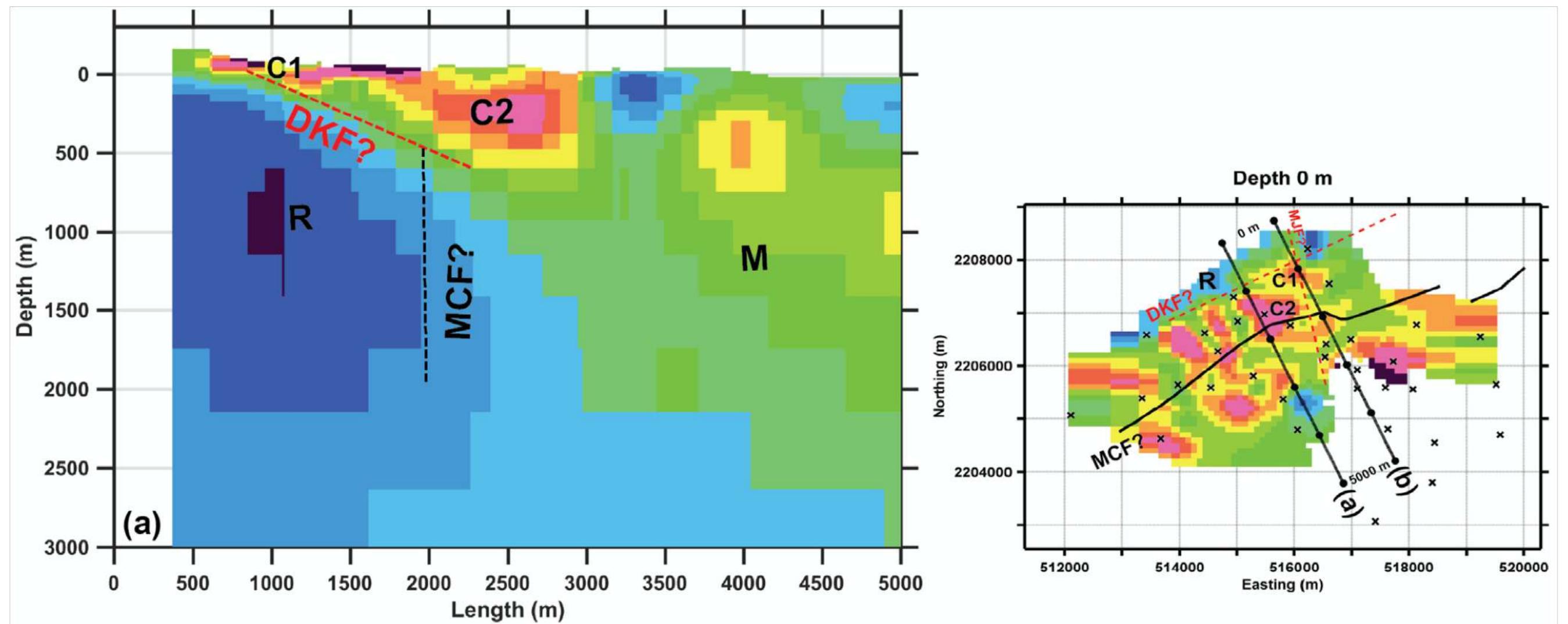
<sup>b</sup> Geoscience Program, Mahidol University, Kanchanaburi Campus, Saiyok, Kanchanaburi, Thailand

<sup>c</sup> Curl-E Geophysics Co., Ltd., 85/87 Nantawan Village, Uttayan-Aksa Road, Salaya, Phutthamonthon, Nakornpathom, 73170, Thailand

<sup>d</sup> Department of Geosciences, Boise State University, Boise, ID, 83701, USA

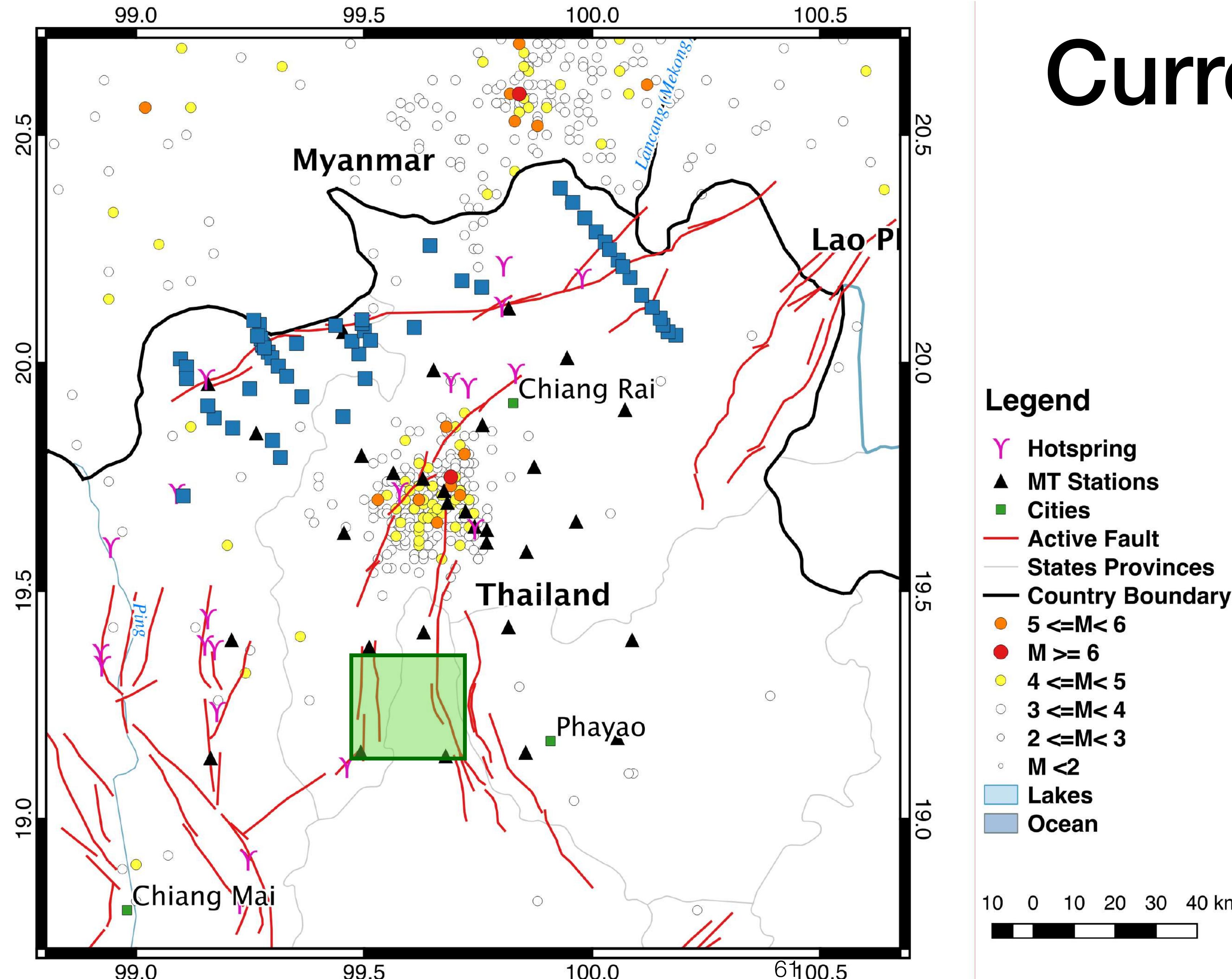
<sup>e</sup> Department of Groundwater Resources, Ministry of Natural Resources and Environment, 26/83 Soi Ngamwongwan 54, Ngamwongwan Road, Ladao, Chatuchak, Bangkok, 10900, Thailand

<sup>f</sup> ThEP Center, Commission on Higher Education, 328, Si Ayutthaya Road, Rachatawee, Bangkok, Thailand



Amatyakul et al., 2016

# Current work





# Machine Learning on DC Resistivity

# Machine Learning

- | Soil type classification (Stiff soil vs Soft soil)
- | resistivity map to SPT map

## Data

resistivity, water content, SPT, sieve200,  
soil characteristics, color, soil moisture

# Riverbank Soil Collapse



<https://i.ytimg.com/vi/dZkpf9uSSI/maxresdefault.jpg>



<https://s.isanook.com/ns/0/ud/1499/7498158/4559993.jpg?ip/crop/w670h402/q80.jpg>



<https://www.tnnthailand.com/static/images/c91cd097-a07f-4279-8c46-62ca89a7aa54.jpg>



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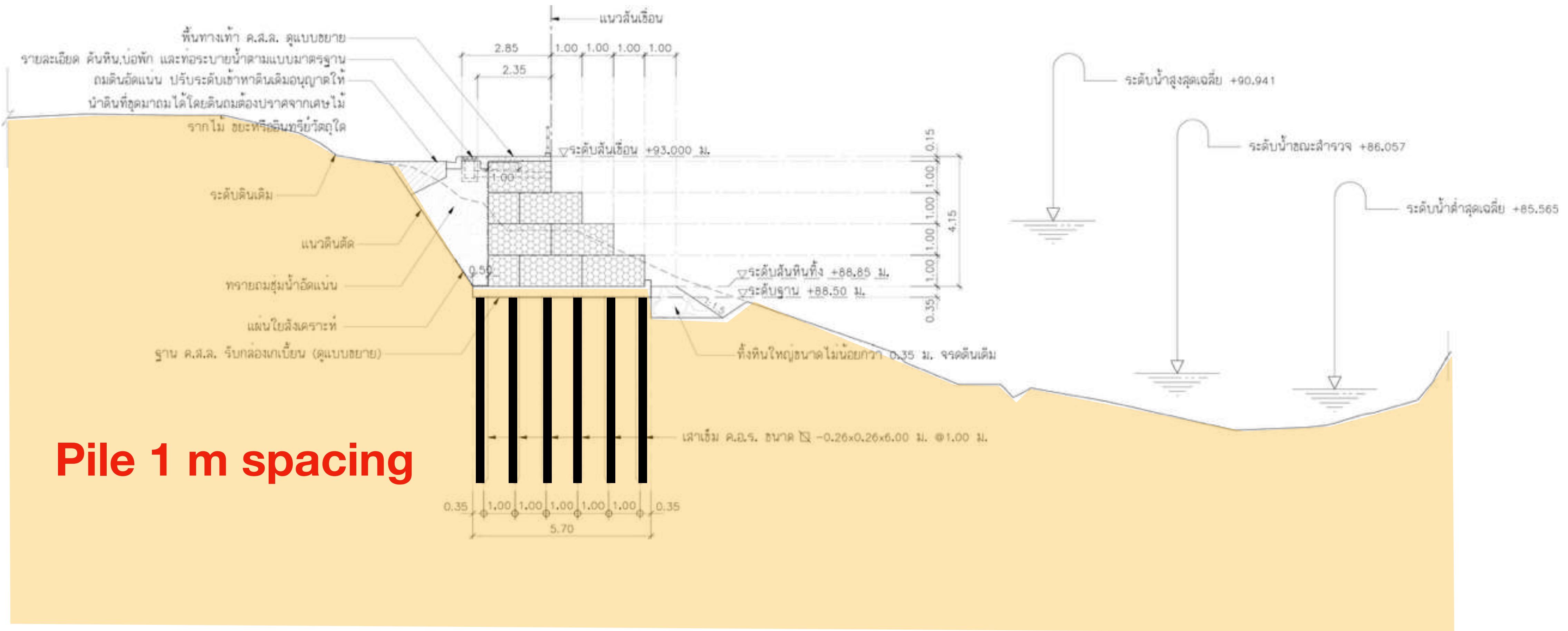
Embankment wall

riverbank protection



# No Pile

# Pile 1 m spacing







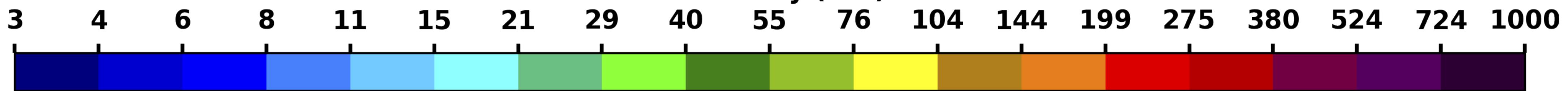
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study area

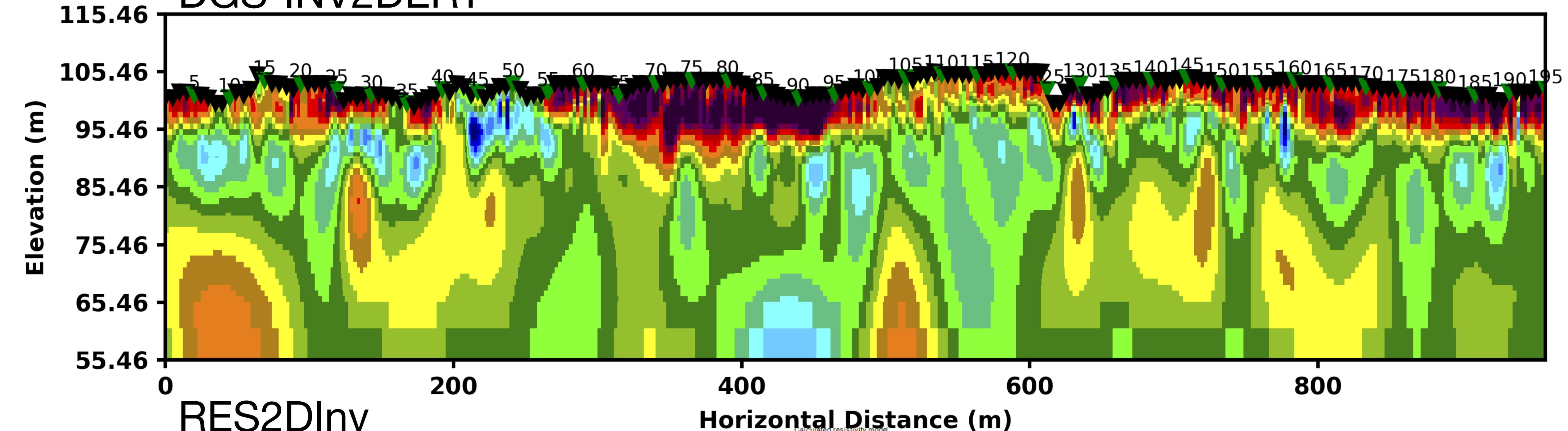
DC resistivity 950 m with 5 m a-spacing Schlumberger



Resistivity ( $\Omega\text{m}$ )



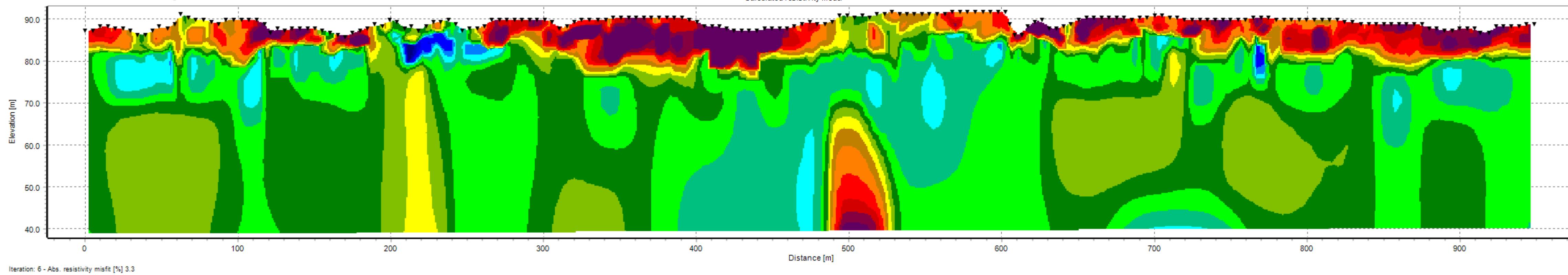
DGS-INV2DERT

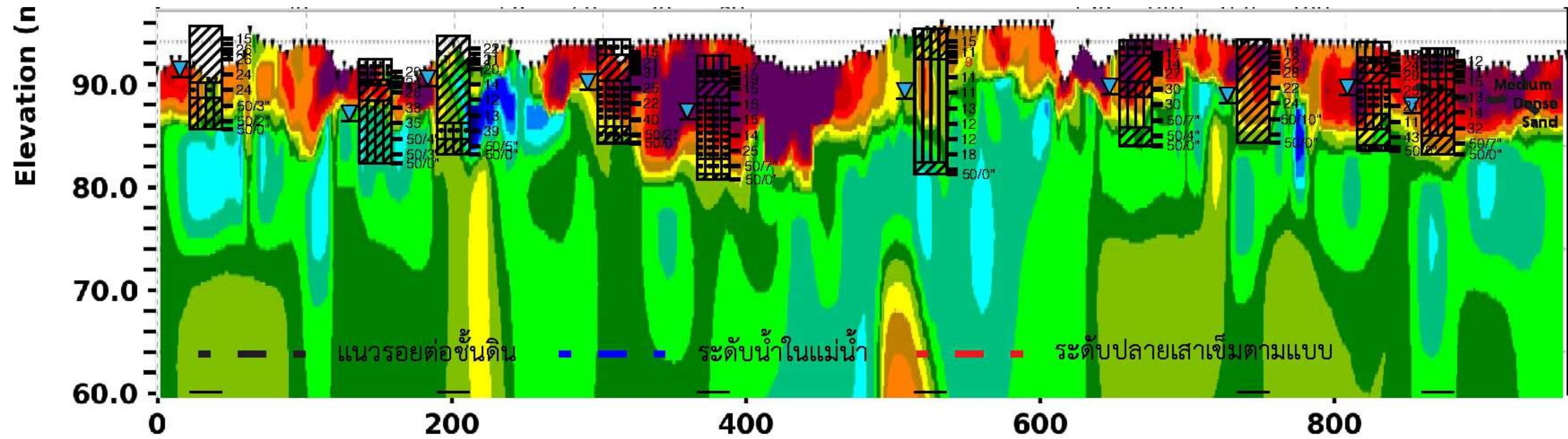
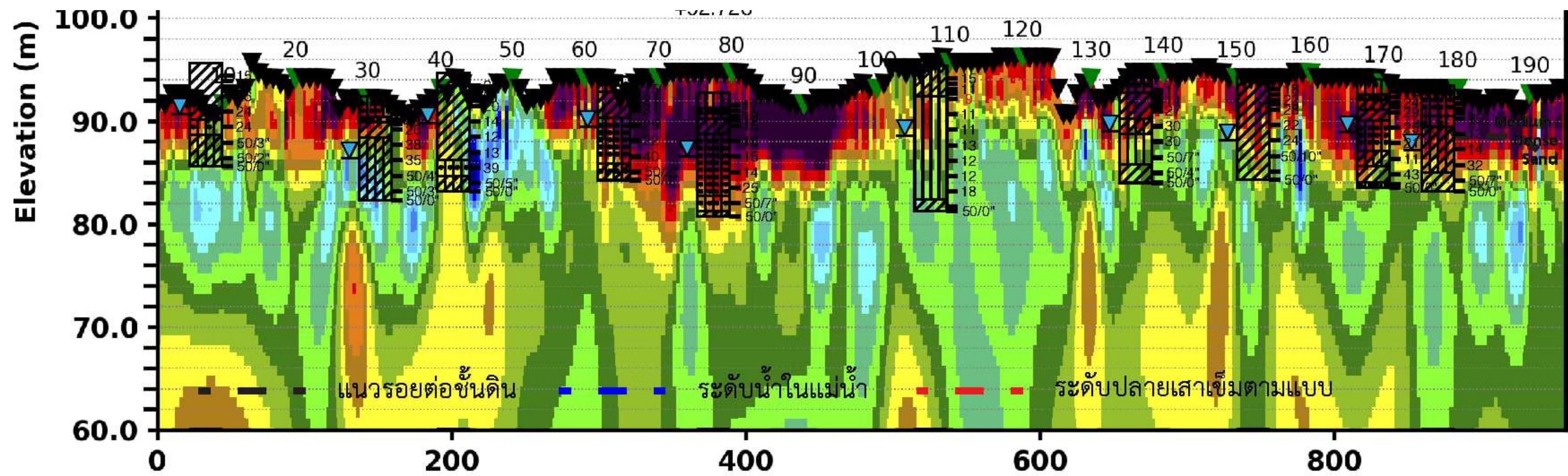


RES2DInv

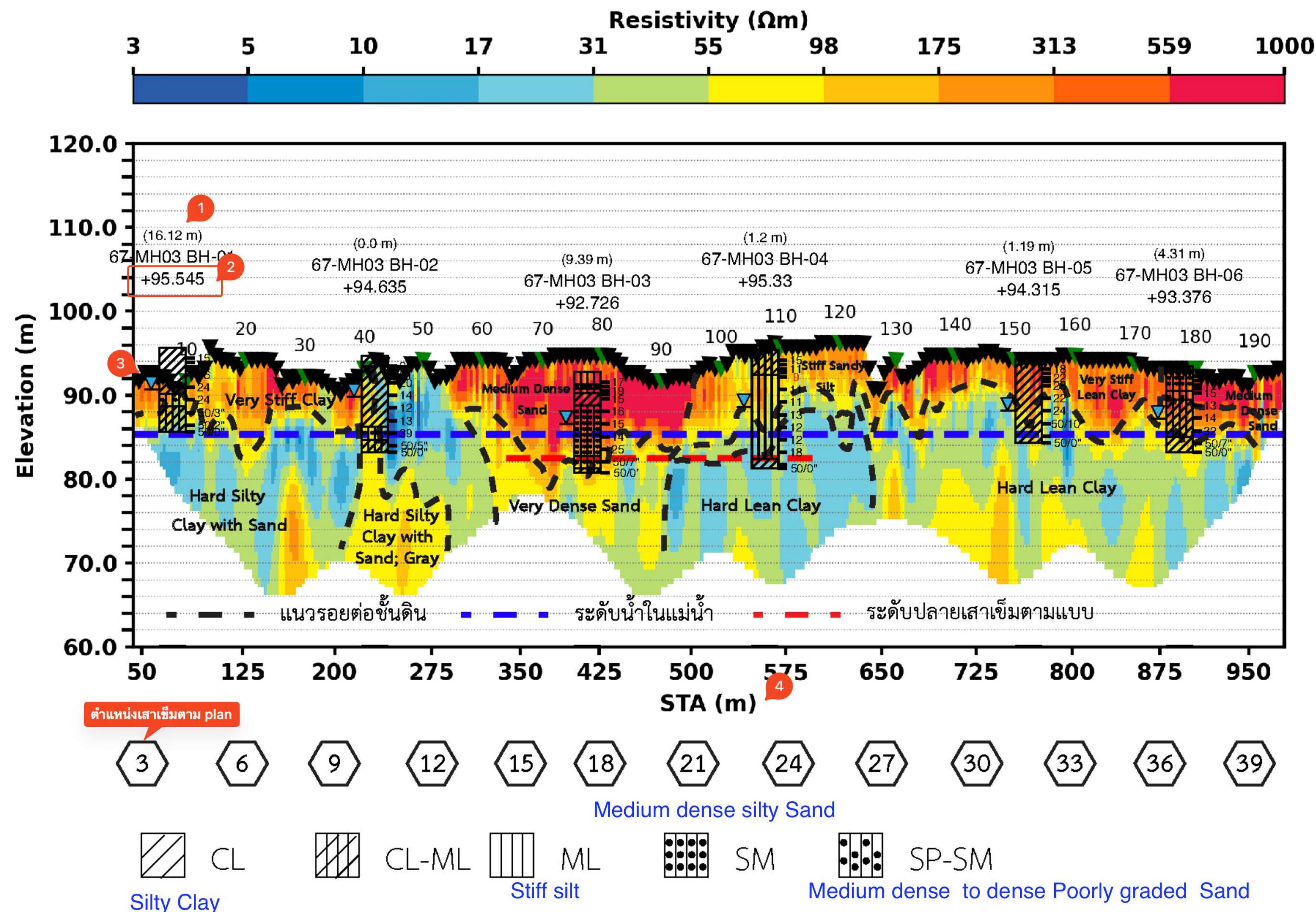
Horizontal Distance (m)

Calculated resistivity model

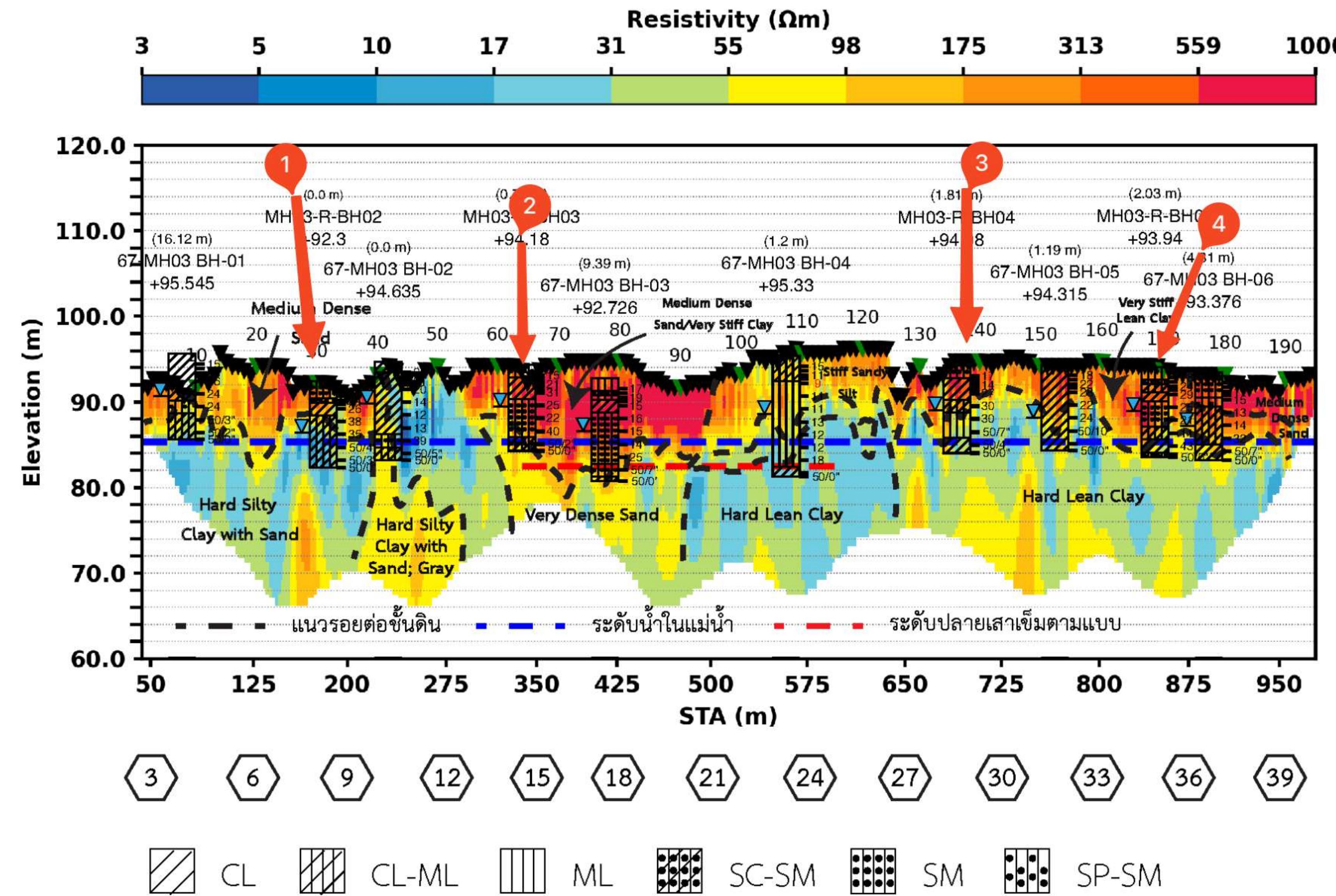




# DGS-INV2DERT: ตัวอย่างงานจากพื้นที่มุกดาหาร



# DGS-INV2DERT: ตัวอย่างงานจากพื้นที่มุกดาหาร



# Data: Layer

<b>id</b>	<b>borehole_id</b>	<b>start</b>	<b>end</b>	<b>soil_type</b>	<b>description</b>
1	1	0	2	SM	Loose Silty Sand; dark gray; moist.
2	1	2	5.5	SP	Loose to Medium Dense Poorly Graded Sand with Gravel; dark gray and yellowish brown; moist.
489	1	5.5	8.5	GP	Loose to Medium Dense Poorly Graded Gravel with Sand; dark gray to light; moist
490	1	8.5	12.45	CL	Hard Lean Clay; dark gray to dark greenish gray; moist
491	2	0	3	SP	Loose Poorly Graded Sand to Poorly Graded Sand with Gravel; yellowish brown; moist
492	2	3	8.5	SM	Very Loose to Medium Dense Silty Sand; dark gray; moist
493	2	8.5	12.35	CL	Hard Lean Clay; dark gray to greenish gray; moist
494	3	0	2	SM	Very Dense to Loose Silty Sand to Silty Sand with Gravel; yellowish brown; moist
495	3	2	2.5	SC	Very Loose Clayey Sand; yellowish brown; moist
496	3	2.5	3	SP	Very Loose Poorly Graded Sand with Gravel; dark gray; moist
497	3	3	4	CL	Medium Stiff Lean Clay with Sand; dark gray; moist
498	3	4	7	SP-SM	Loose to Medium Dense Poorly Graded Sand with Silt and Gravel; light gray to light brown; moist
499	3	7	8.5	CL	Hard Lean Clay with Sand; light greenish gray; moist
500	3	8.5	12.15	SM	Dense to Very Dense Silty Sand; light greenish gray; moist
501	4	0	2.5	SP	Medium Dense Poorly Graded Sand to Poorly Graded Sand with Gravel; light brown to brown; moist
502	4	2.5	4	GP	Medium Dense Poorly Graded Gravel with Sand; light brown to gray; moist
503	4	4	8.5	SP	Medium Dense to Dense Poorly Graded Sand; light brown and gray; moist
504	4	8.5	10	SM	Dense Silty Sand with Gravel; light brown and gray; moist

- **id**
- **borehole\_id**
- **start: borehole top**
- **end: borehole bottom**
- **soil type : SM, SP, GP, CL, etc.**
- **description: soil characteristics, color, soil moisture**

# Data: sample

Sample																					
<b>id</b>	<b>borehole_id</b>	<b>start</b>	<b>end</b>	<b>spt</b>	<b>wn</b>	<b>pl</b>	<b>ll</b>	<b>gamma</b>	<b>soil_type</b>	<b>rho</b>	<b>start_model</b>	<b>end_model</b>	<b>sieve12</b>	<b>sieve38</b>	<b>sieve4</b>	<b>sieve10</b>	<b>sieve40</b>	<b>sieve100</b>	<b>sieve200</b>	<b>CEC</b>	
1	1	1	1.45	7	21.74	0	0	1.62	SM	62.2133	3.7	4.15	0	0	87.74	72.48	61.73	34.21	28.42	NULL	284.58
2	1	1.5	1.95	5	0	0	0	1.52	SM	60.1667	4.2	4.65	0	0	0	0	0	0	0	0	0
3	1	2	2.45	4	22.41	0	0	1.44	SP	56.2732	4.7	5.15	0	0	84.26	67.75	6.43	5.67	2.73	NULL	166.84
4	1	2.5	2.95	8	20.41	0	0	1.44	SP	54.0191	5.2	5.65	0	0	82.74	61.78	5.43	3.78	1.26	NULL	154.99
8	17	1	1.45	6	10.73	20.18	26.45	1.7	CL-ML	48.14	7.98	8.43	0	0	100	100	99.13	72.48	64.84	NULL	436.45
7	16	1	1.45	12	24.38	23.07	35.43	1.83	CL	22.7	1.74	2.19	0	0	100	99.14	98.15	97.56	95.43	NULL	490.28
18	19	1	1.45	10	17.9	0	0	2.14	CL	19	1.21	1.66	0	0	0	0	0	0	0	0	NULL
11	6	2	3.5	13	0	0	0	1.78	CH	38.38	6.68	8.18	0	0	0	0	0	0	0	0	NULL
12	6	3.5	5	36	0	0	0	1.92	CL	43.63	8.18	9.68	0	0	0	0	0	0	0	0	NULL

- id
- borehole\_id
- start
- end
- **SPT**: standard penetration Test [blows/ft]
- **wn**: water content [%]
- pl: plastic limit
- ll: liquid limit

# Data: sample

id	borehole_id	start	end	spt	wn	pl	ll	sample															
								gamma	soil_type	rho	start_model	end_model	sieve12	sieve38	sieve4	sieve10	sieve40	sieve100	sieve200	CEC			
1	1	1	1.45	7	21.74	0	0	1.62	SM	62.2133	3.7	4.15	0	0	87.74	72.48	61.73	34.21	28.42	NULL	284.58		
2	1	1.5	1.95	5	0	0	0	1.52	SM	60.1667	4.2	4.65	0	0	0	0	0	0	0	0	0	0	0
3	1	2	2.45	4	22.41	0	0	1.44	SP	56.2732	4.7	5.15	0	0	84.26	67.75	6.43	5.67	2.73	NULL	166.84		
4	1	2.5	2.95	8	20.41	0	0	1.44	SP	54.0191	5.2	5.65	0	0	82.74	61.78	5.43	3.78	1.26	NULL	154.99		
8	17	1	1.45	6	10.73	20.18	26.45	1.7	CL-ML	48.14	7.98	8.43	0	0	100	100	99.13	72.48	64.84	NULL	436.45		
7	16	1	1.45	12	24.38	23.07	35.43	1.83	CL	22.7	1.74	2.19	0	0	100	99.14	98.15	97.56	95.43	NULL	490.28		
18	19	1	1.45	10	17.9	0	0	2.14	CL	19	1.21	1.66	0	0	0	0	0	0	0	0	0	0	NULL
11	6	2	3.5	13	0	0	0	1.78	CH	38.38	6.68	8.18	0	0	0	0	0	0	0	0	0	0	NULL
12	6	3.5	5	36	0	0	0	1.92	CL	43.63	8.18	9.68	0	0	0	0	0	0	0	0	0	0	NULL

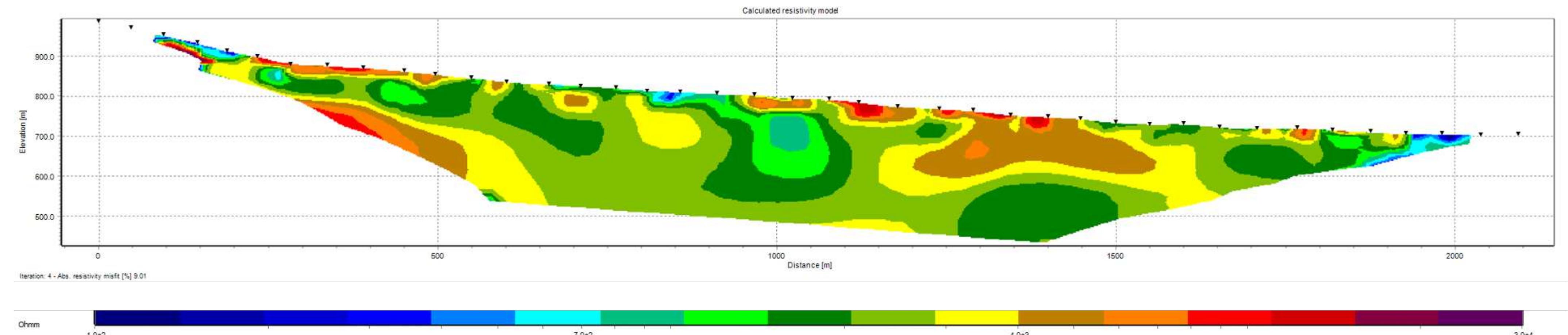
- gamma:
- soil\_type
- rho: average resistivity
- start\_model/end\_model: model depth
- sieve: **sieve No. 200**
- CEC

# Data: Borehole

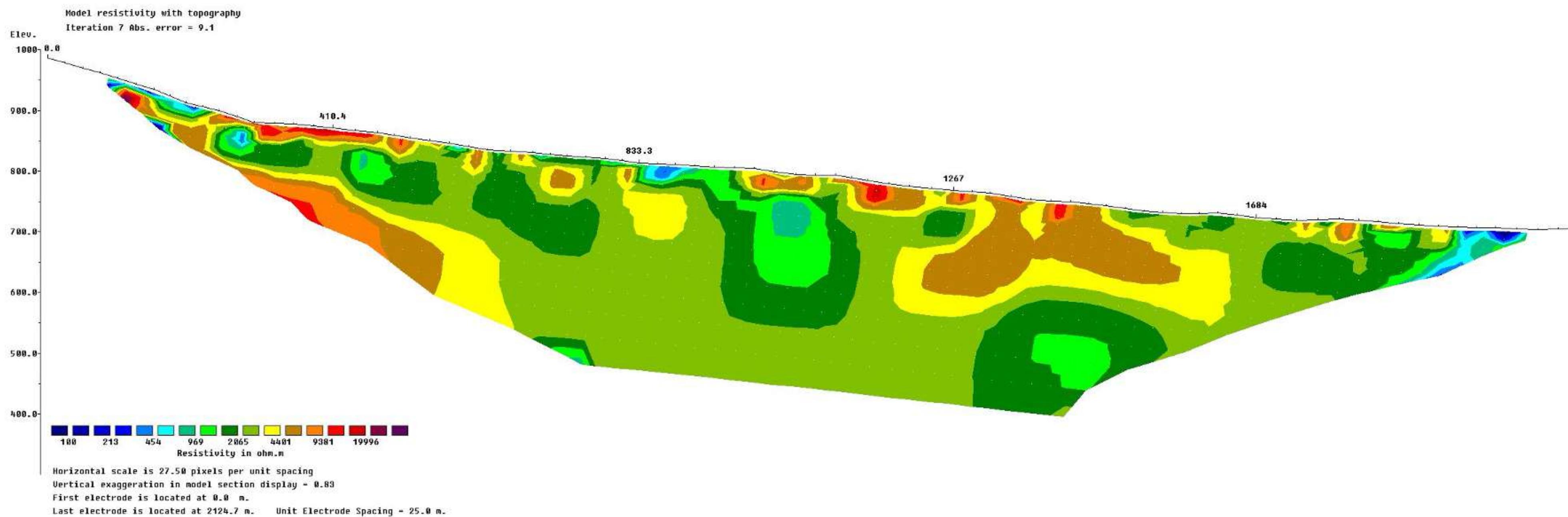
Borehole												
<b>id</b>	<b>project_id</b>	<b>profile_id</b>	<b>name</b>	<b>year</b>	<b>month</b>	<b>day</b>	<b>easting</b>	<b>northing</b>	<b>elev</b>	<b>water</b>	<b>offset</b>	
1	1003	1	65-LP01-01	2565	12	18	543636	2014170	97.11	-1.39	2	
2	1003	1	65-LP01-02	2565	12	20	543513	2014055	98.071	-1.44	12.99	
3	1003	1	65-LP01-03	2566	1	8	543394	2013966	98.225	-1.41	10.09	
4	1003	1	65-LP01-04	2566	2	17	543269	2013867	97.404	-4.65	3.06	
5	1003	1	65-LP01-05	2566	2	16	543130	2013767	96.416	-4	4.18	
70	1003	2	65-LP04-01	2565	11	21-22	519811	1943353	98	-4.81	8.37	
71	1003	2	65-LP04-02	2565	12	2-Mar	519993	1943289	94	-0.4	22.4	
72	1003	3	65-LP03-01	2565	11	22-23	519629	1943380	95.081	-2.81	11.8	
73	1003	3	65-LP03-02	2565	11	24	519440	1943405	95.470	-2.92	0	

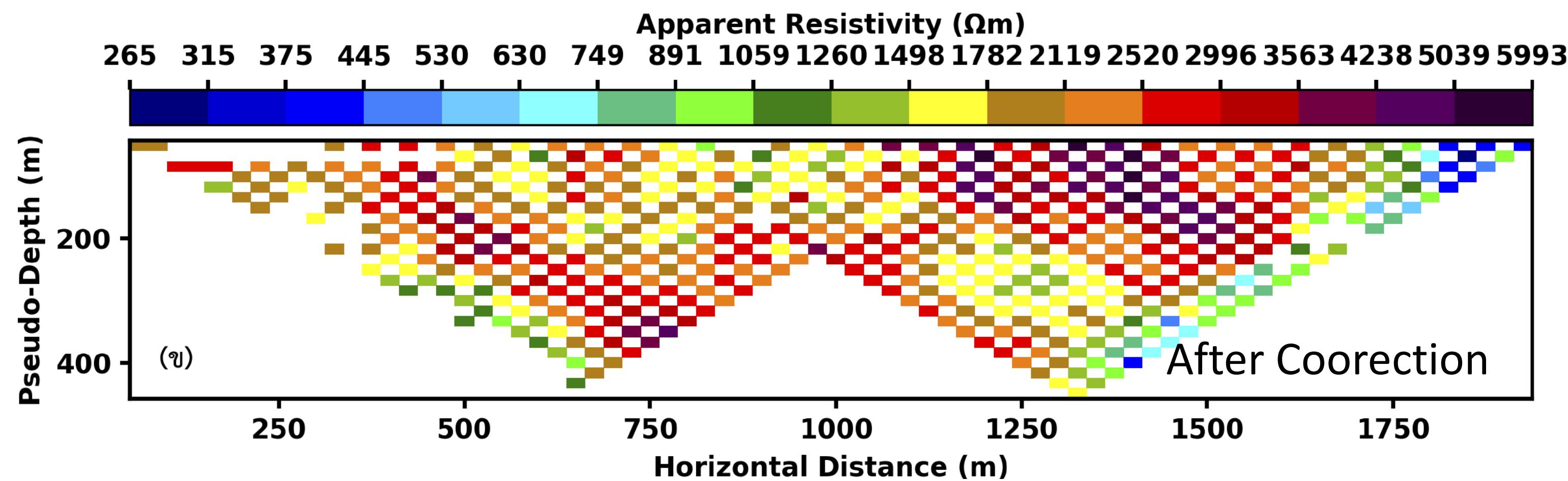
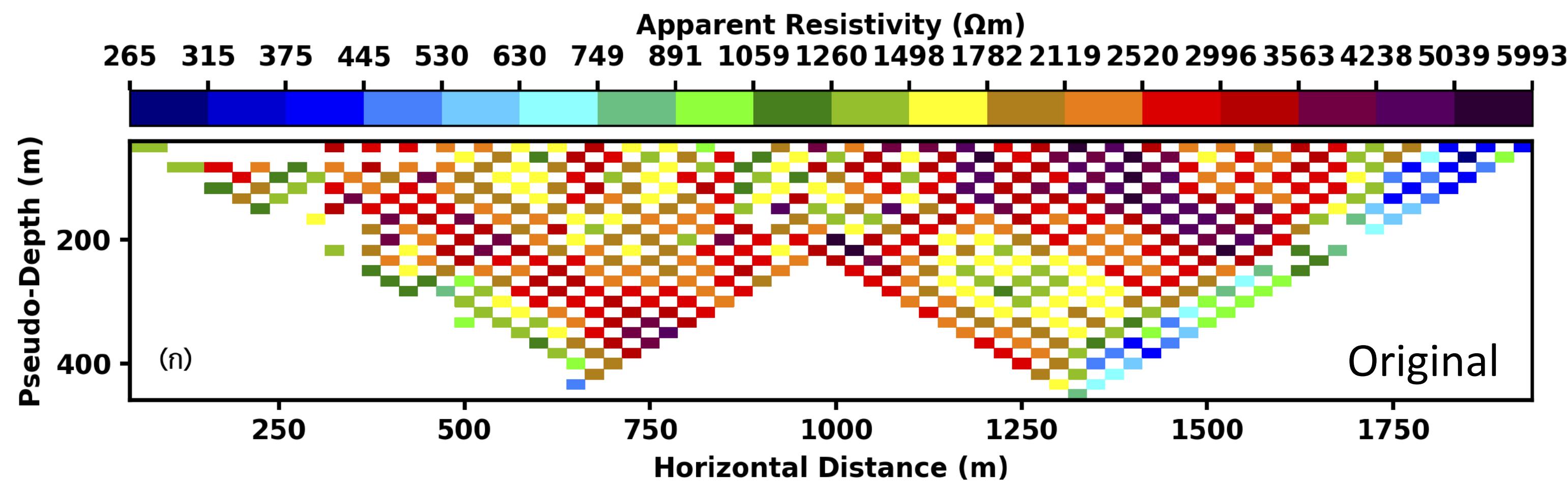
- id
  - year: thai
  - month
  - day
  - easting
  - northing
- project\_id
  - elev: elevation
  - water: water level from elevation
  - offset: distance from DCR profile to borehole
- Profile\_id
- name

# DC resistivity at Taebaek

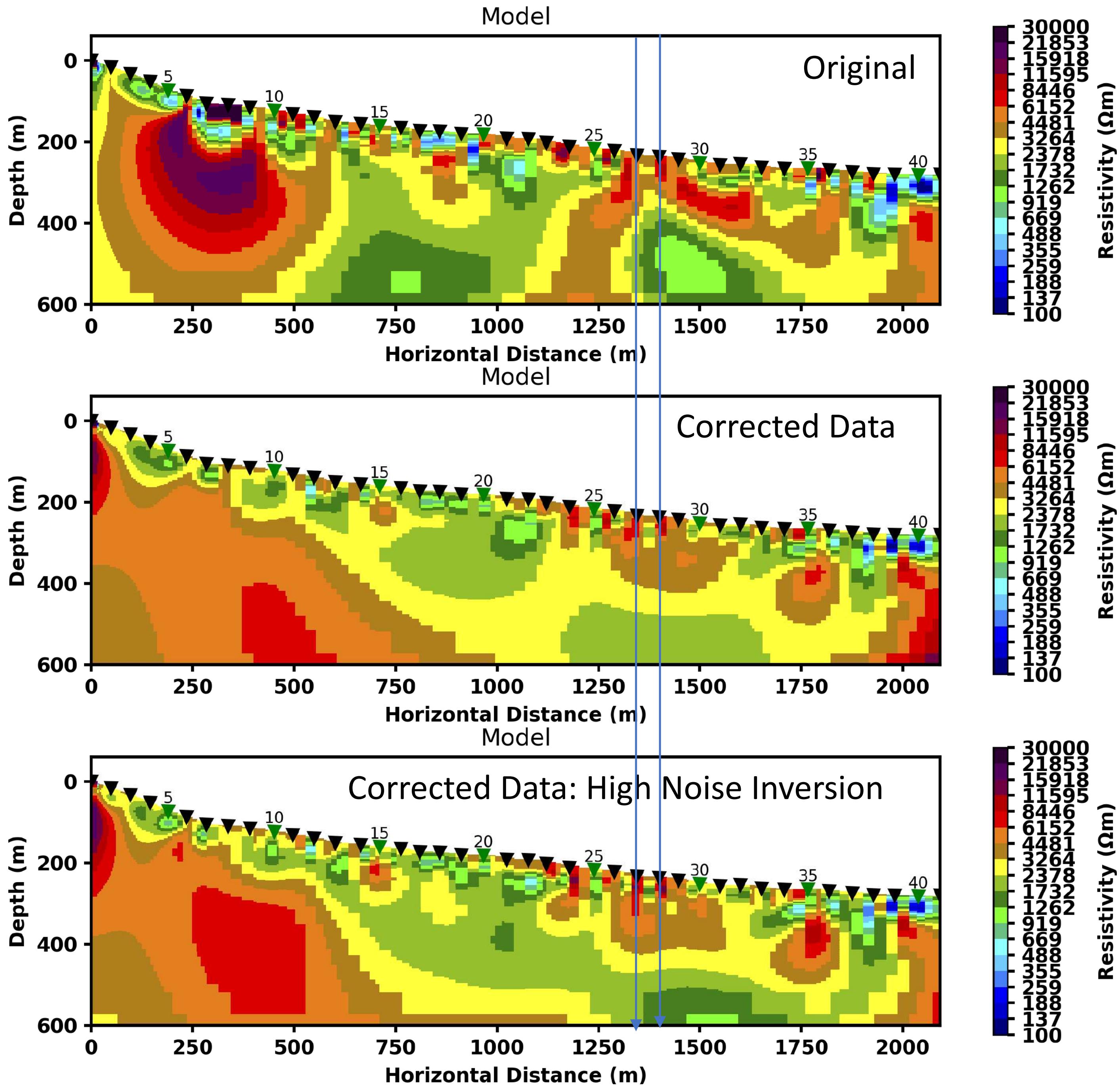


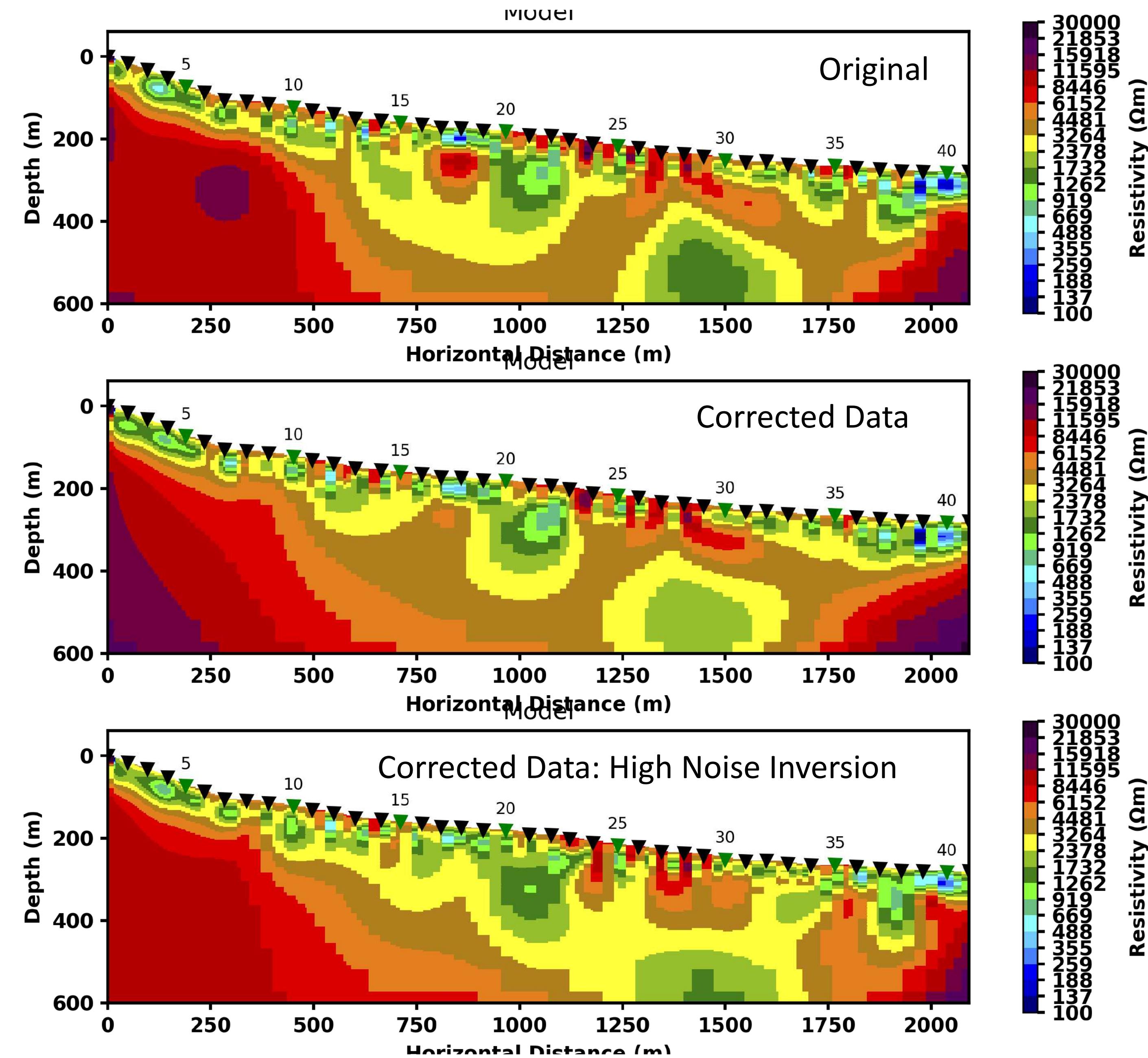
Taebaek



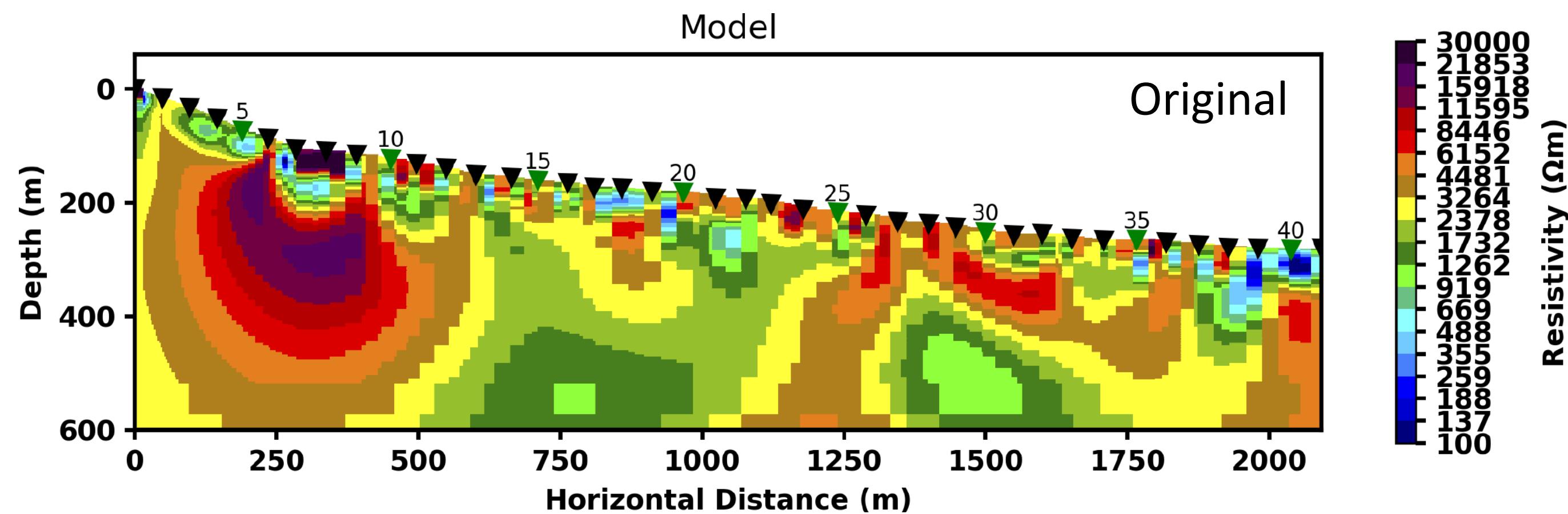


Data Difference: 25.04%

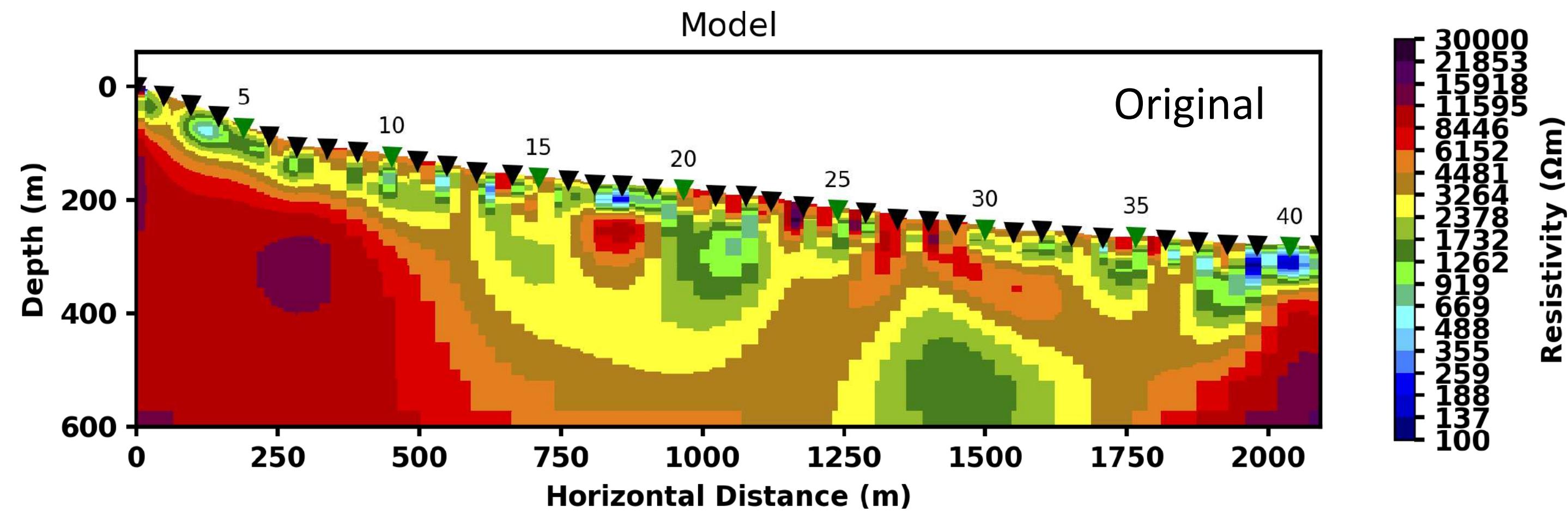




With gradien data

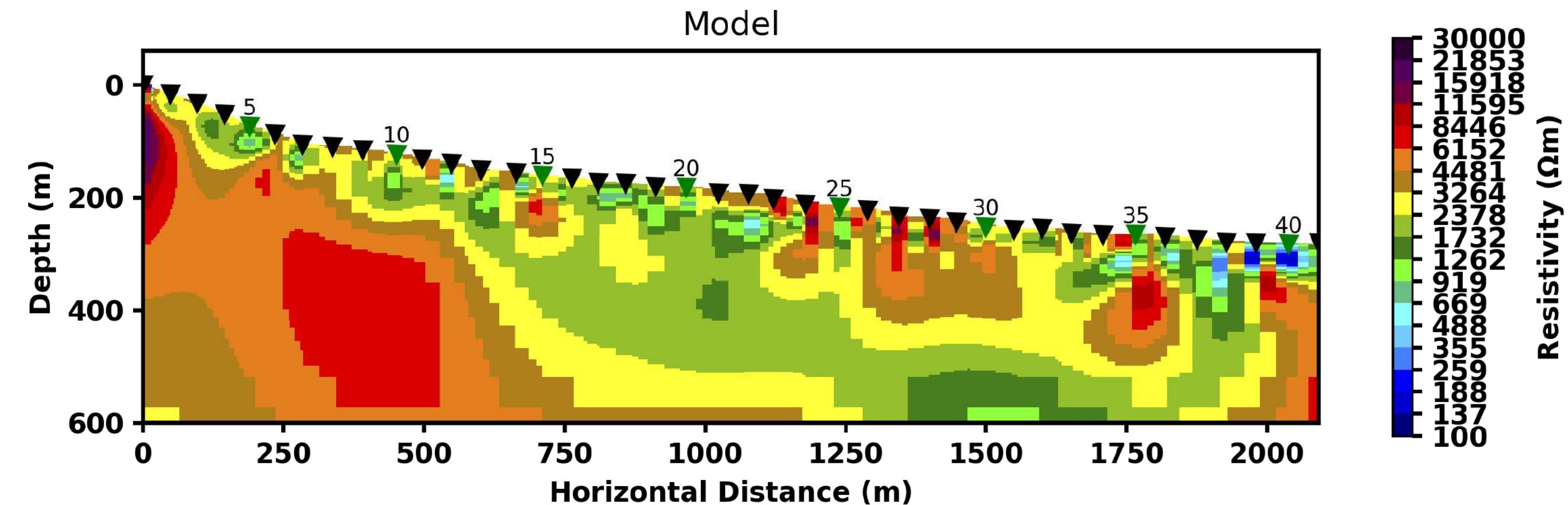


Without gradien data

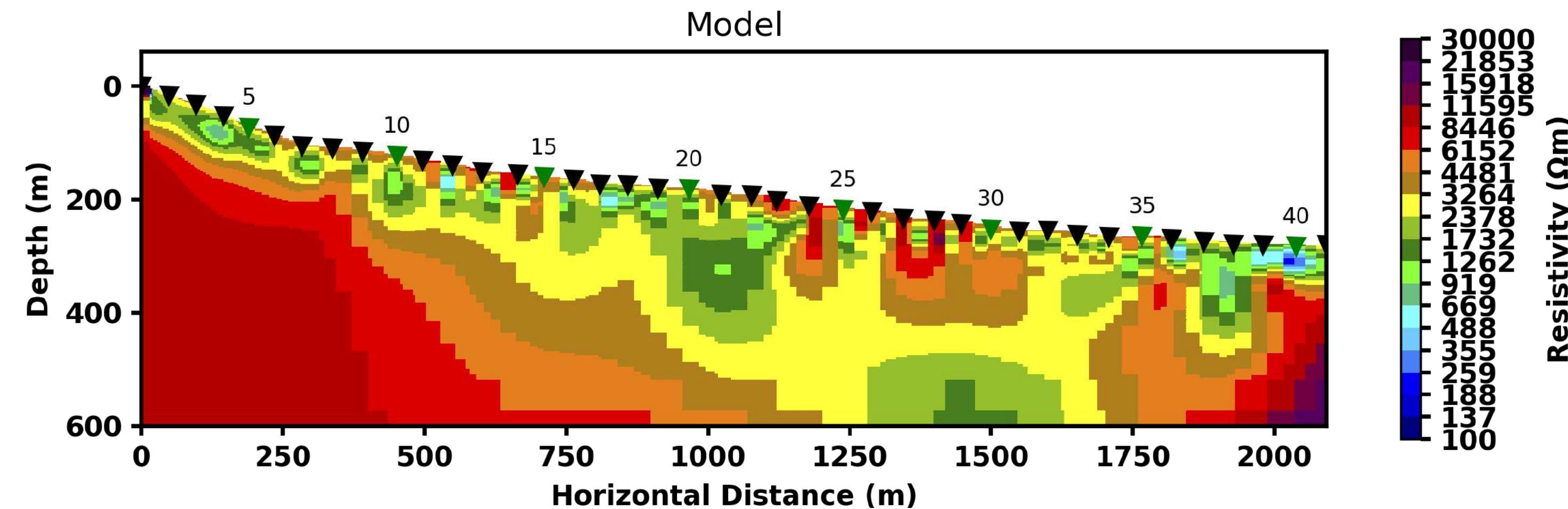


## Corrected Data: High Noise Inversion

With gradien data



Without gradien data





# Future Collaboration



## Geophysics

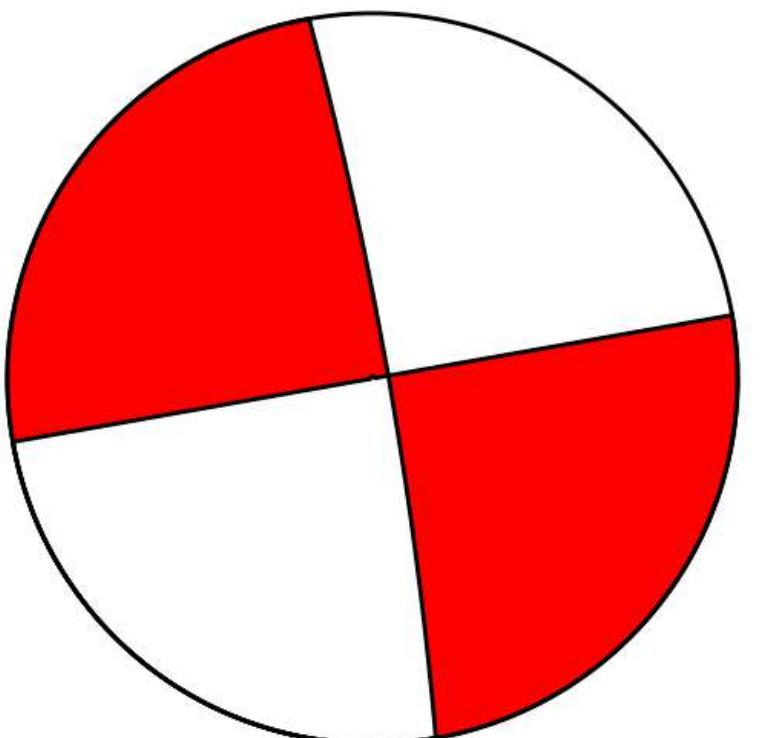
MT, DC, seismology, seismic reflection, refraction, etc.

crustal study, Earthquake,

**EARTH**

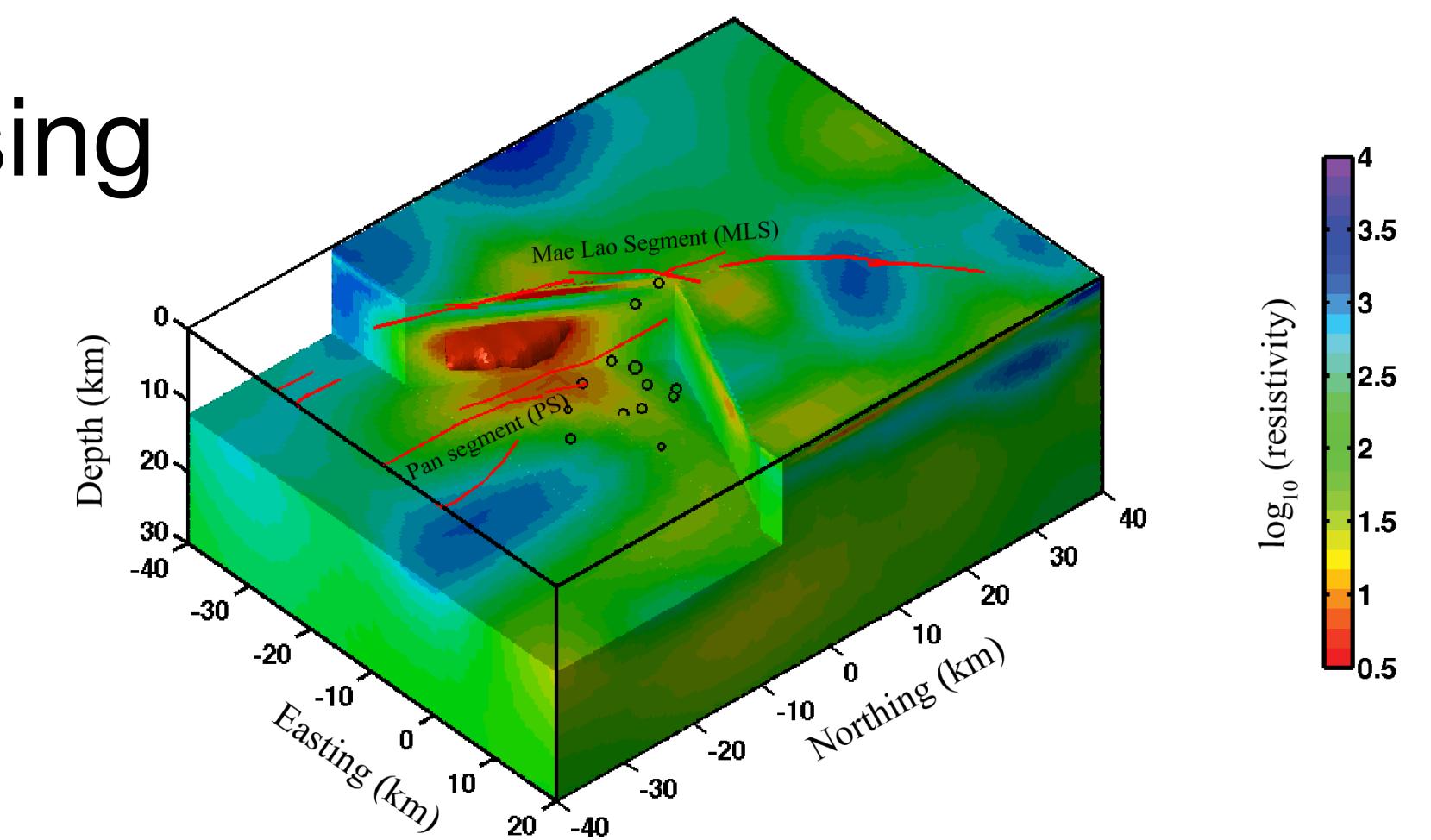
Machine learning, remote sensing

## CCS



**Songkhun Boonchaisuk,**  
Mahidol University, Kanchanaburicampus

[songkhun.boo@mahidol.edu](mailto:songkhun.boo@mahidol.edu)





**Dr. Patchawee Nualkhaeo**  
Instructor  
Division of Geoscience,  
School of Interdisciplinary Studies,  
Mahidol University Kanchanaburi Campus

### **Expertise**

1. Geochemistry
2. Granitoids and mineralization (Magmatism and Tectonics)
3. Petrography and Geochemistry of Granitoids
4. Geohazards (Landslide)
5. Paleoseismology (Remote Sensing and Trenching)

### **Interesting Projects**

1. Granitoids and mineralization (geochemistry and petrography)
2. Geochemistry in geothermal exploration
3. Landslide Modelling and tools for vulnerability assessment
4. Paleoseismology (Remote Sensing and Trenching)



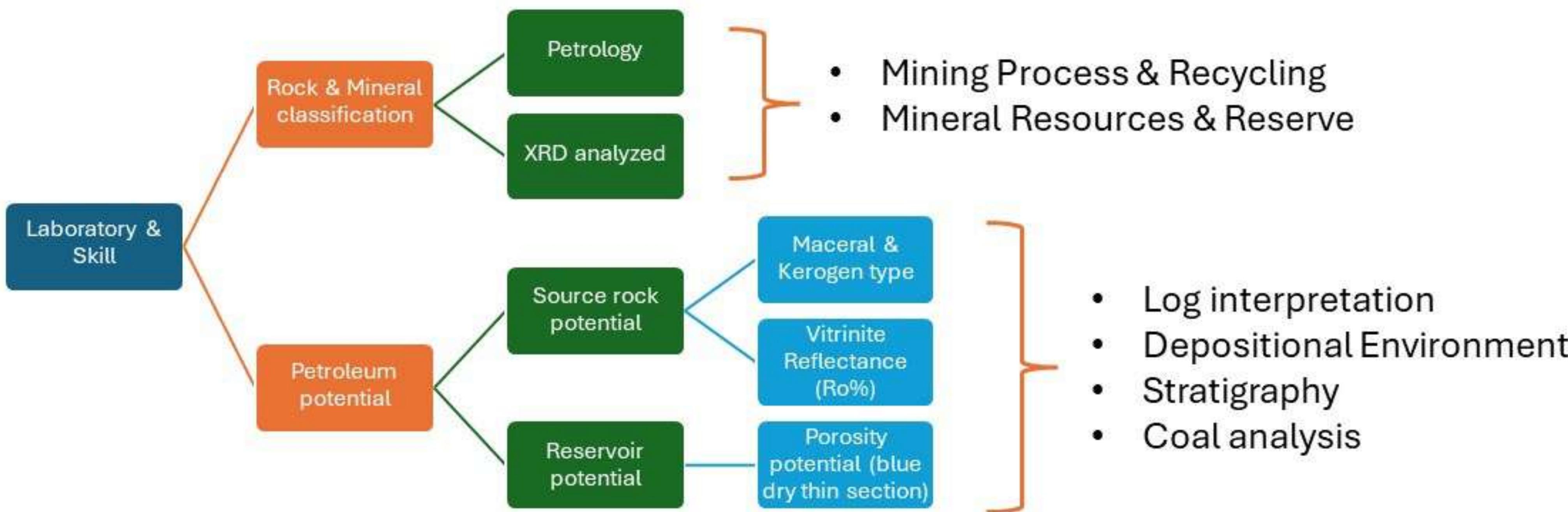
## Piyatida Sangtong

### Education

- B.S. (Geoscience) Mahidol University, THAILAND 2009
- M.Eng. (Georesources) Chulalongkorn, THAILAND 2011
- Ph. D. (Geotechnology) Suranaree University of Technology, THAILAND 2019

### Area of interested

- Petroleum Potential and hydrocarbon
- Deposition Environment of Organic Sequences
- Carbonate Platform Development
- Engineering geology (construction)





## Skills and Expertise

- Sedimentology
- Quaternary Geology
- Fluvial environment
- Coastal change
- Stratigraphy
- Geolomorphology

### Parisa Nimnate

- Late Paleozoic and Early Mesozoic radiolarians from chert conglomerates embedded in the Kaeng Raboet Formation (Upper Mesozoic continental red-bed), Kanchanaburi Province, western Thailand *Revue de Micropaleontologie / October 2023*
- Evidence of coastal landforms and age determination related to the sea-level change at Nakhon Si Thammarat province in southern Thailand *Songklanakarin Journal of Science and Technology / May-June 2023*
- Imaging and locating paleo-channels using geophysical data from meandering system of the Mun River, Khorat Plateau, Northeastern Thailand *Open Geosciences / 2020*



# Dr. Apivut Veeravinantanaku

Email: apivut.vee@mahidol.ac.th

# **AREA OF EXPERTISE**

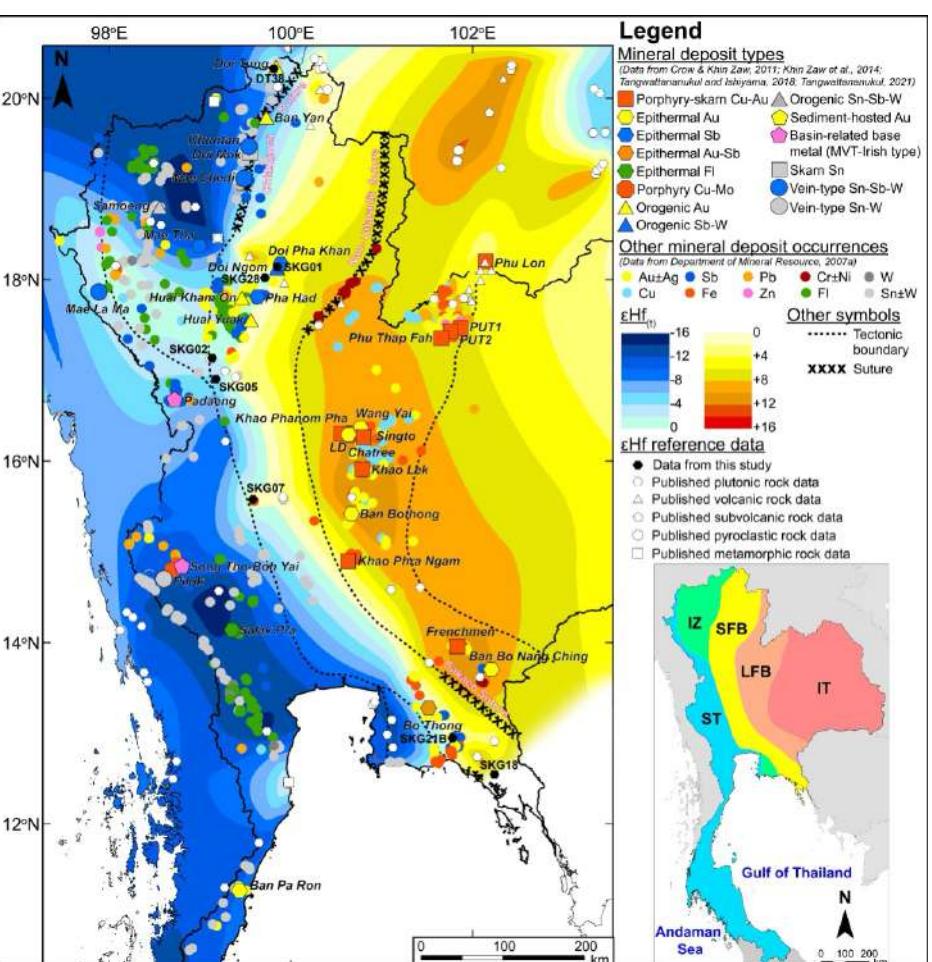
- Igneous and Metamorphic Petrology
  - Mineralogy
  - Geochemistry
  - Geochronology
  - Tectonic

# **ANALYTICAL INSTRUMENTS SKILLS**

- X-ray diffraction spectrometer (XRD),
  - X-ray Fluorescence Spectrometer (XRF),
  - Scanning Electron Microscope with Energy Dispersive X-Ray Spectroscopy and Cathodoluminescence (SEM-EDS-CL),
  - Electron Probe Microanalyzer (EPMA),
  - Inductively Coupled Mass Spectrometry (ICP-MS)
  - Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS)
  - Fluid inclusion microthermometry

# RESEARCH INTERESTS

- Formation and evolution of magma below the Earth's surface
  - Magmatism-related economic minerals
  - Mineral chemistry and ore formation
  - Microstructural analysis and P-T path reconstruction
  - Radiometric dating of geological events



Veeravinantanakul et al. (2021)



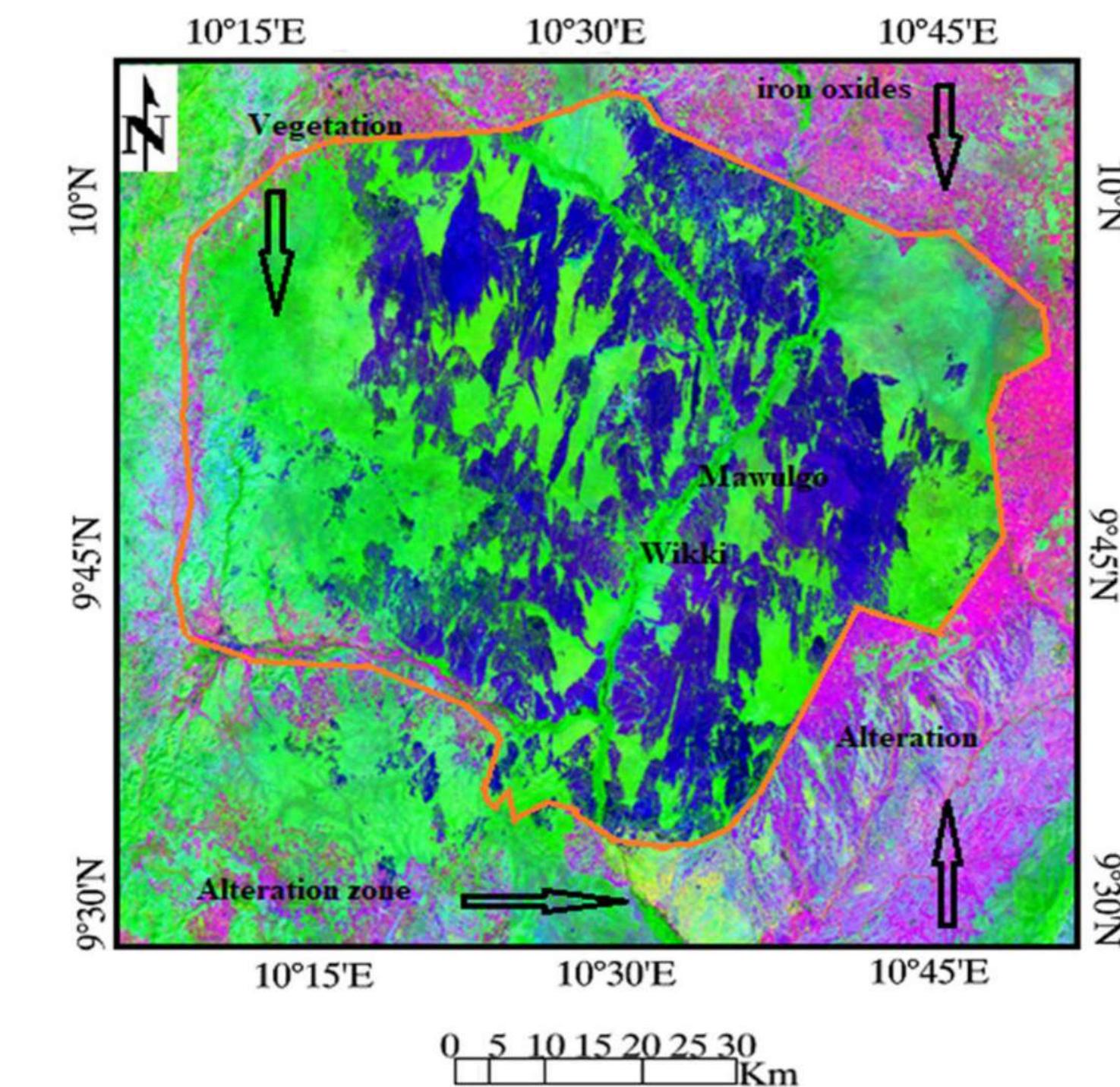
# Sutthikan Khamsiri, Ph.D.

Geoscience Division, School of Interdisciplinary Studies, Mahidol University Kanchanaburi Campus  
Email: Sutthikan.kha@mahidol.ac.th

- Luminescence Dating (TL/OSL)
- Spatial Analysis and Terrain Analysis (GIS-based tools)

## Research Interests

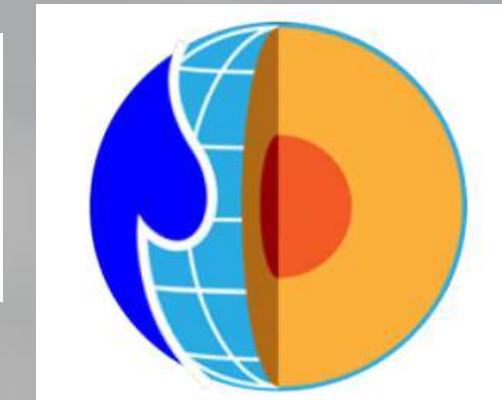
- Remote Sensing:  
Multispectral and composite images
- Archaeological Site:  
Survey of ancient metallurgical site



The example of composite image of Landsat8 by Abubakar et al. (2018)



東京工業大學  
Tokyo Institute of Technology



กลุ่มวิจัยธรณีฟิสิกส์  
มหาวิทยาลัยมหิดล



Kanchanaburi campus

EARTH



Thank you for your attentions

[songkhun.boo@mahidol.edu](mailto:songkhun.boo@mahidol.edu)