Construction of the detailed 3D velocity structure models in Japan.

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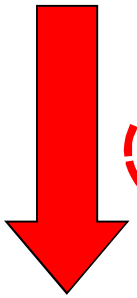
Objective of the Deep subsurface structure Model

Headquarters for Earthquake Research Promotion (HERP)

National Research Institute for Earth Science and Disaster Prevention (NIED)
Earth Research Institute of Tokyo Univ. etc…

Observed waveform data
(K-NET, KiK-net etc…) →

Seismic Faults data →



←**Subsurface structure model**

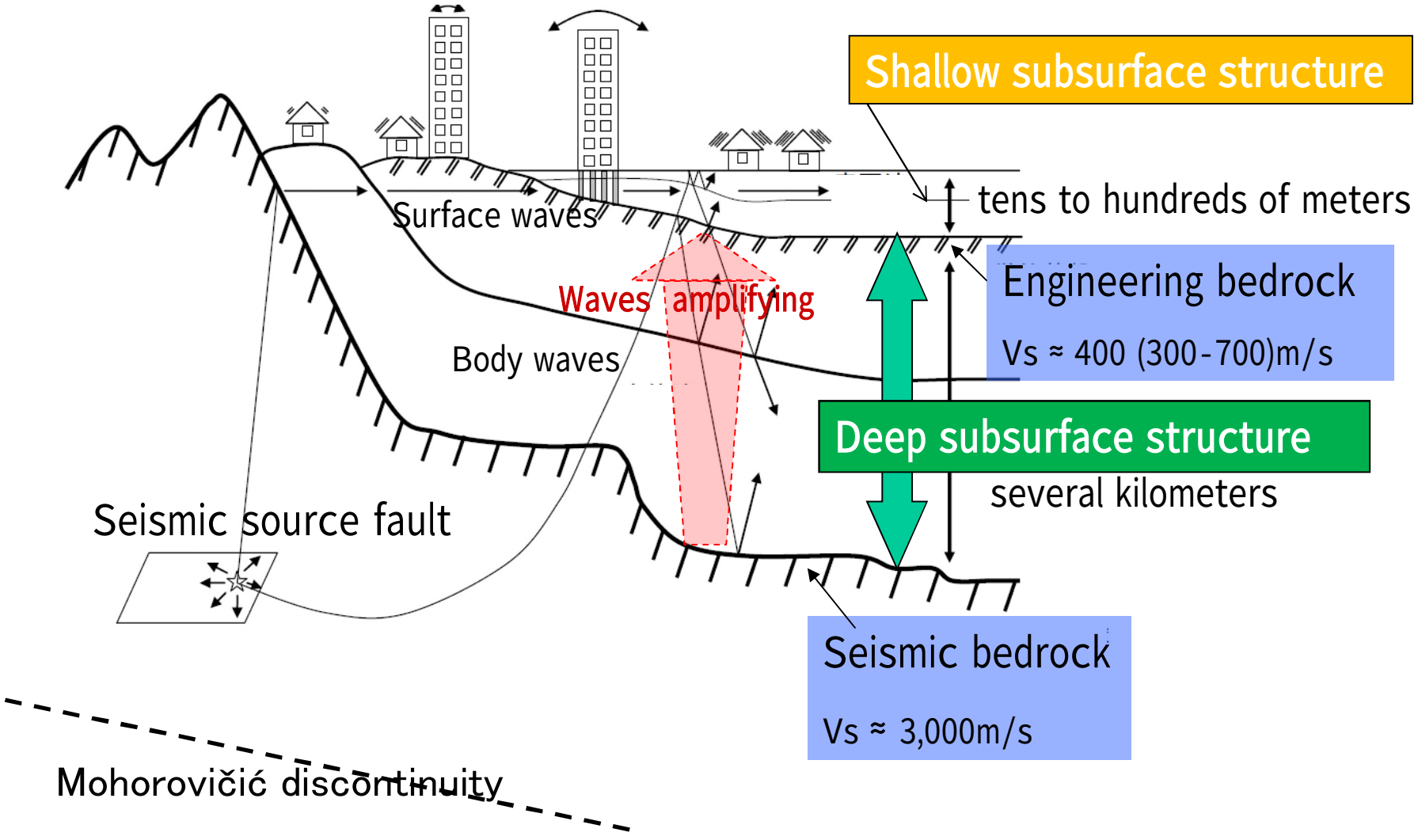
Seismic Hazard Analysis

Probabilistic Seismic Hazard Maps (PSHMs) etc…

→ **on the Web : J-SHIS (Japan Seismic Hazard Information Station)**

"strengthening disaster prevention measures, particularly for the reduction of damage and casualties from earthquakes "

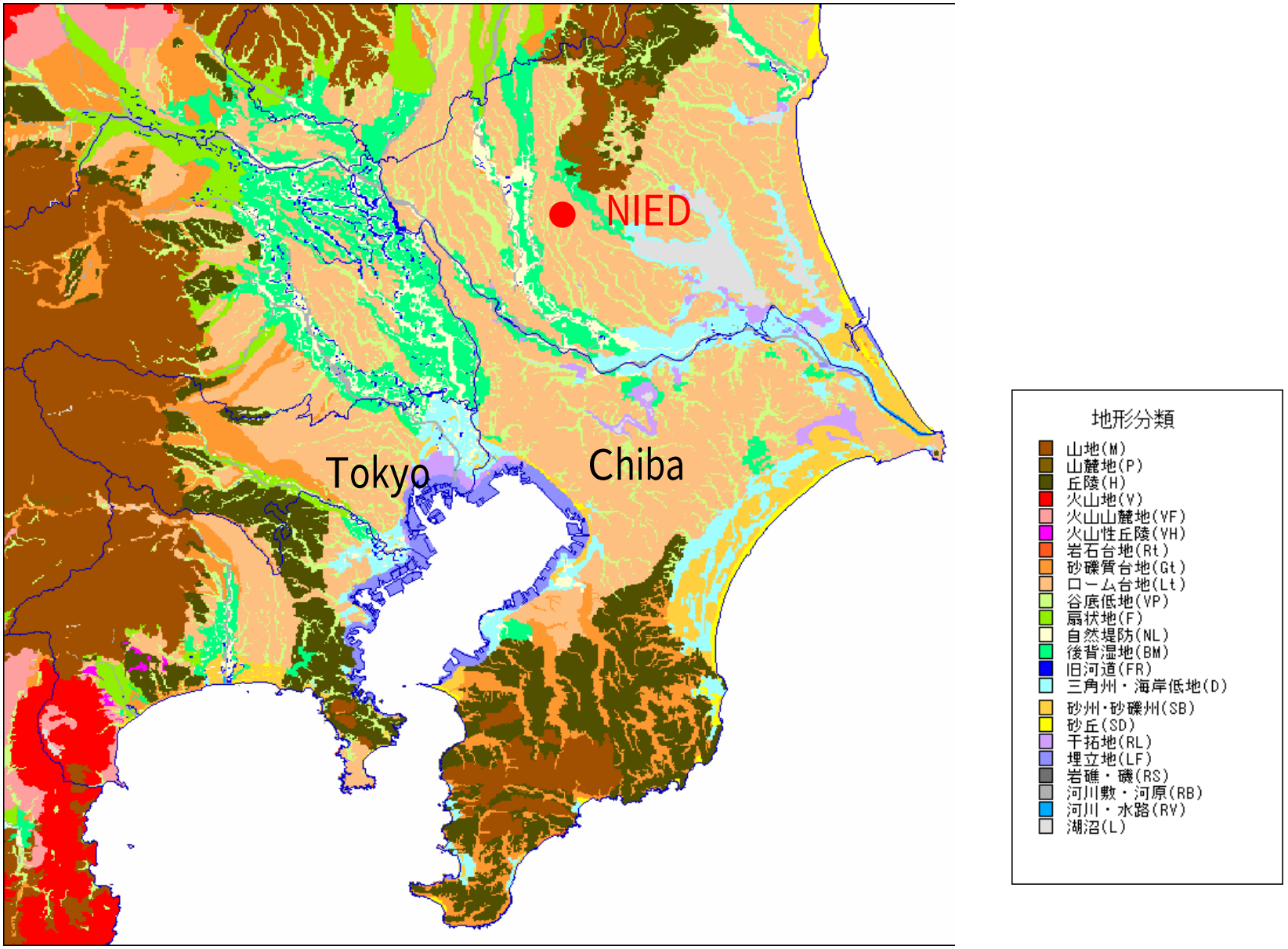
Strategy of subsurface structure model



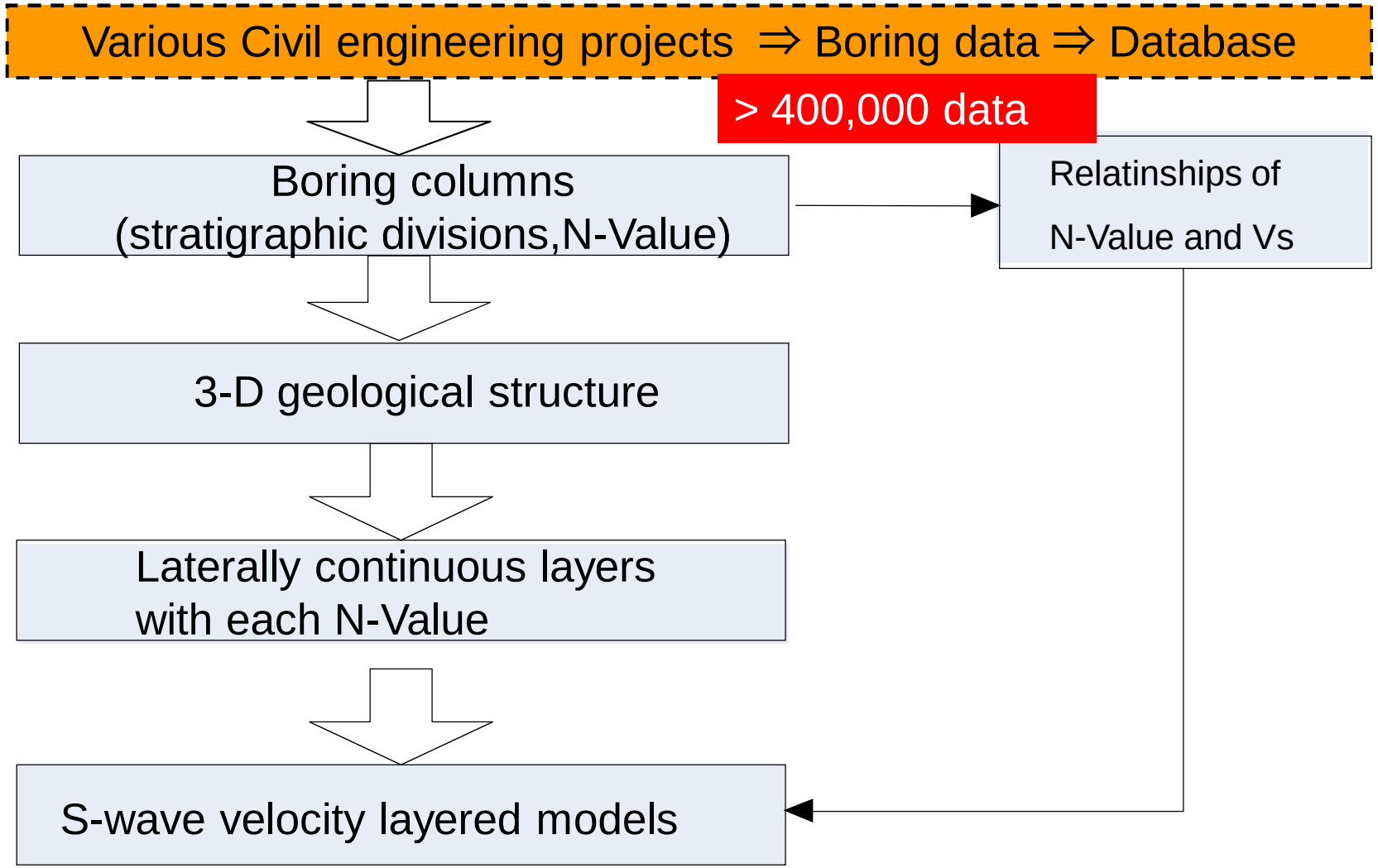
Contents of presentation

- 1 Basic modeling methods of Shallow subsurface structure.
  - Kanto area
- 2 Application of modeling method for Niigata area
- 3 Conclusions and future perspectives

Geomorphological subdivisions of Kanto area （Wakamatsu and Matsuoka）



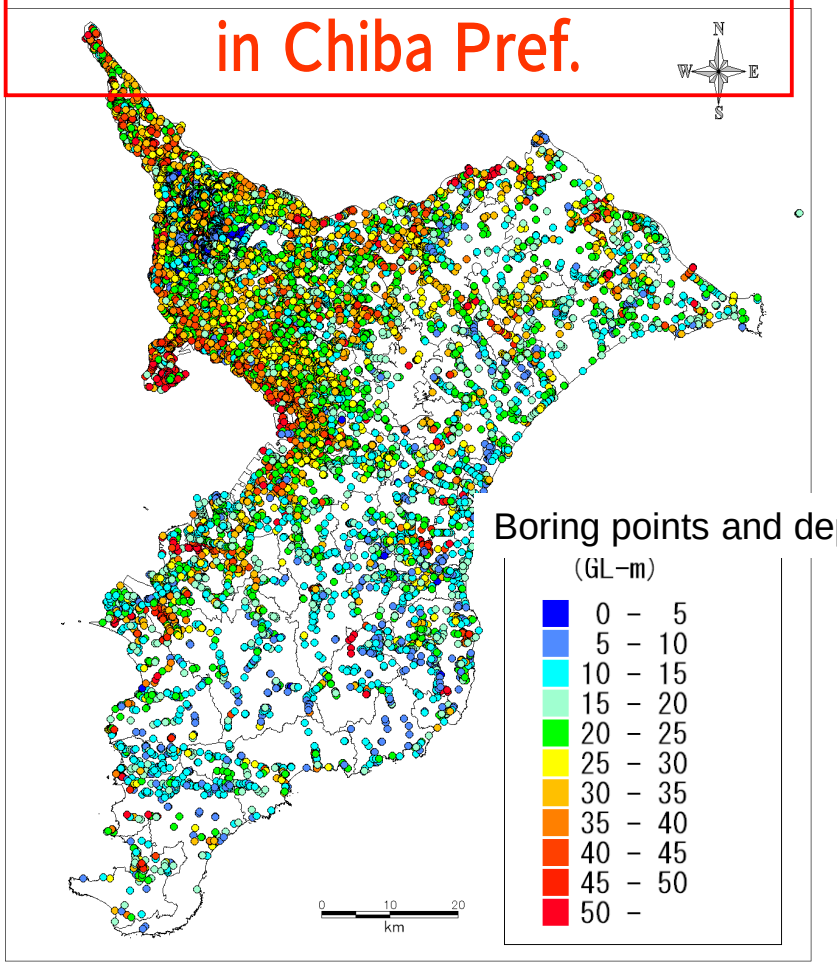
Flow chart of modeling the Shallw subsurface structure models



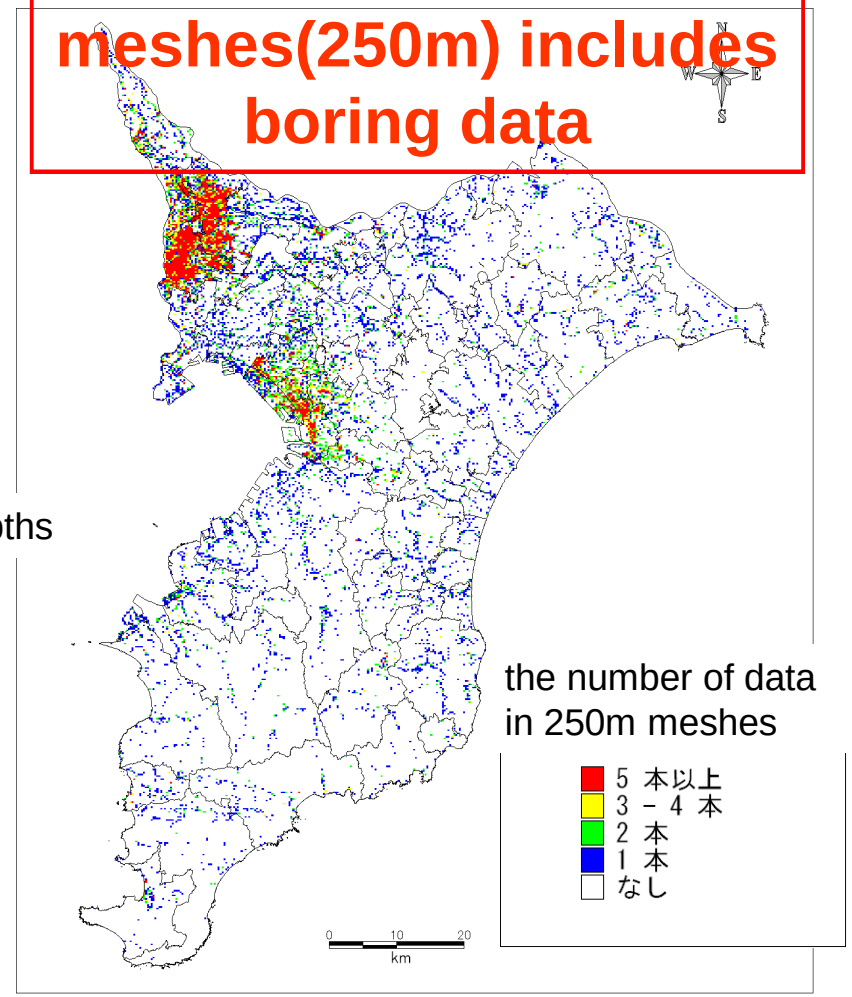
Boring Database of NIED

:about 400 thousands of geological column data

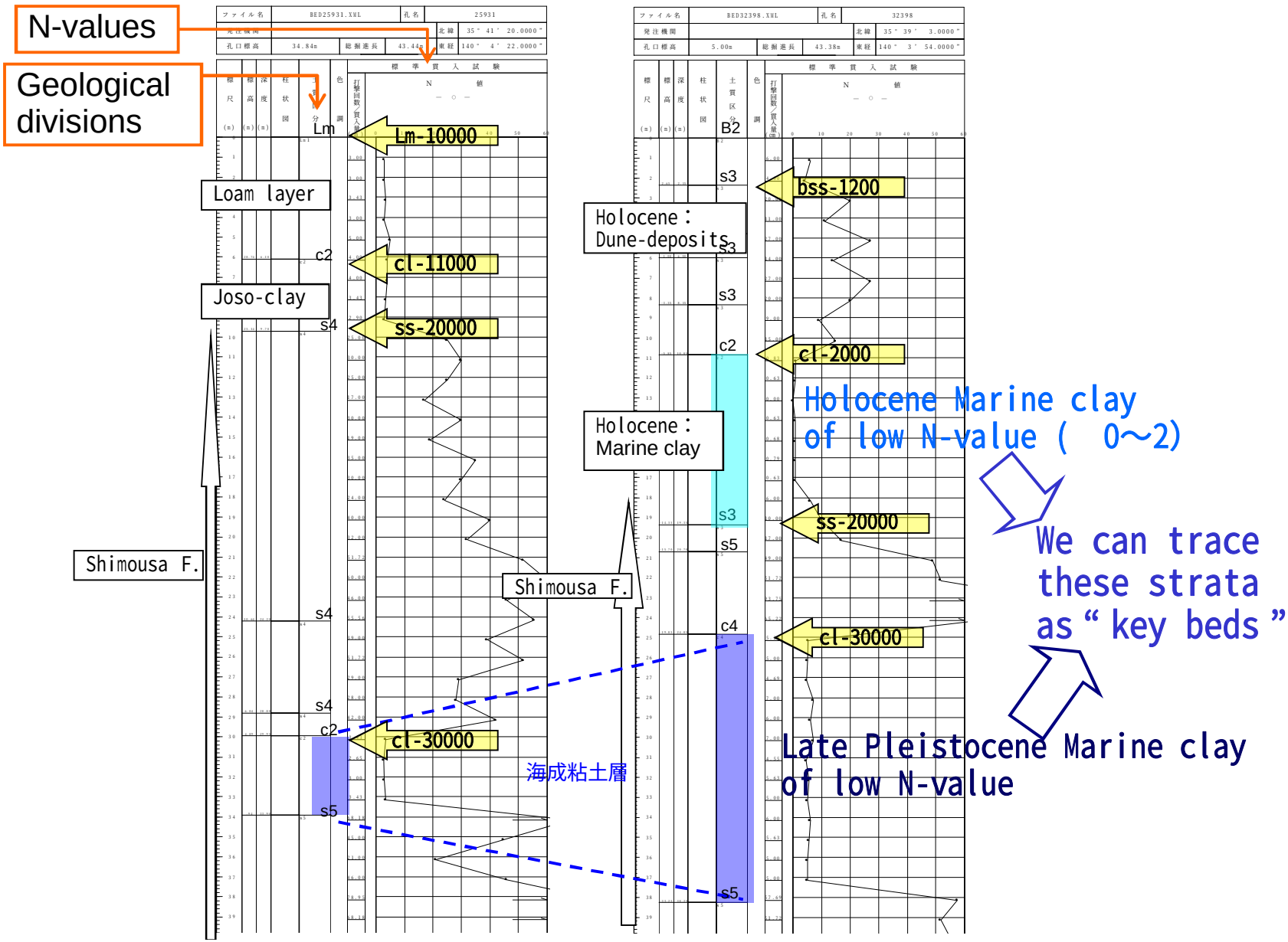
27 thousands data in Chiba Pref.



10 thousands meshes(250m) includes boring data



Gological columns : detecting layer-boundaries



Divisions of strata

Holocen sediments

	Sedimentary facies	Main deposits
Upper	topsoil, landfill	sand,silt
	modern river	sand,silt
	dune,beach	sand
middle	delta-front, pro-delta	sand,silt
	marine	clay,silt
	sand bar	sand
lower	meandering river	sand,silt
	braided river	gravel,sand

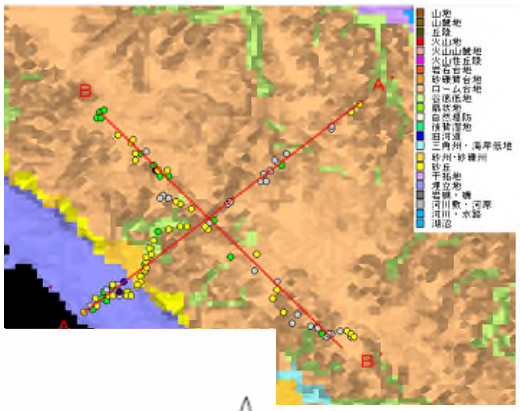
Pleistocene sediments

Geological divisions	Main deposits
Kanto Loam	volcanic ash, clay
Joso Clay	clauey deposits
Shimousa F.	fluvial sand, garvel
	marine clay
	sand
Kazusa F.	alternations of sandy and clayey layer

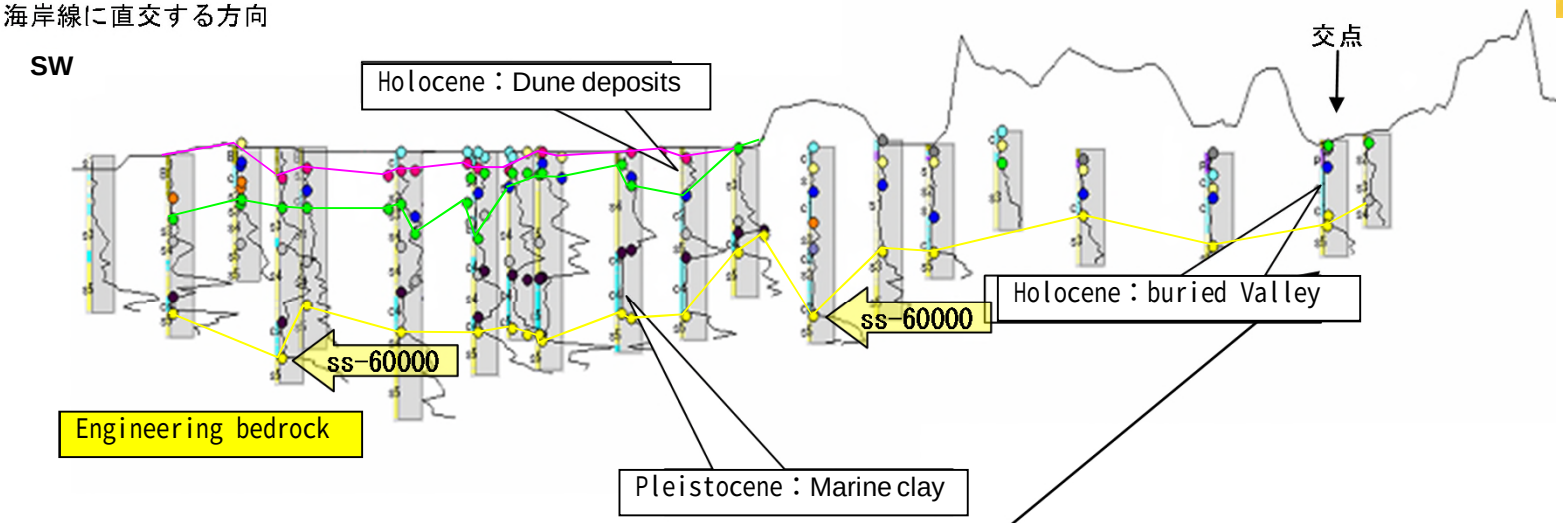
Engineering bed rocks :

N>>50

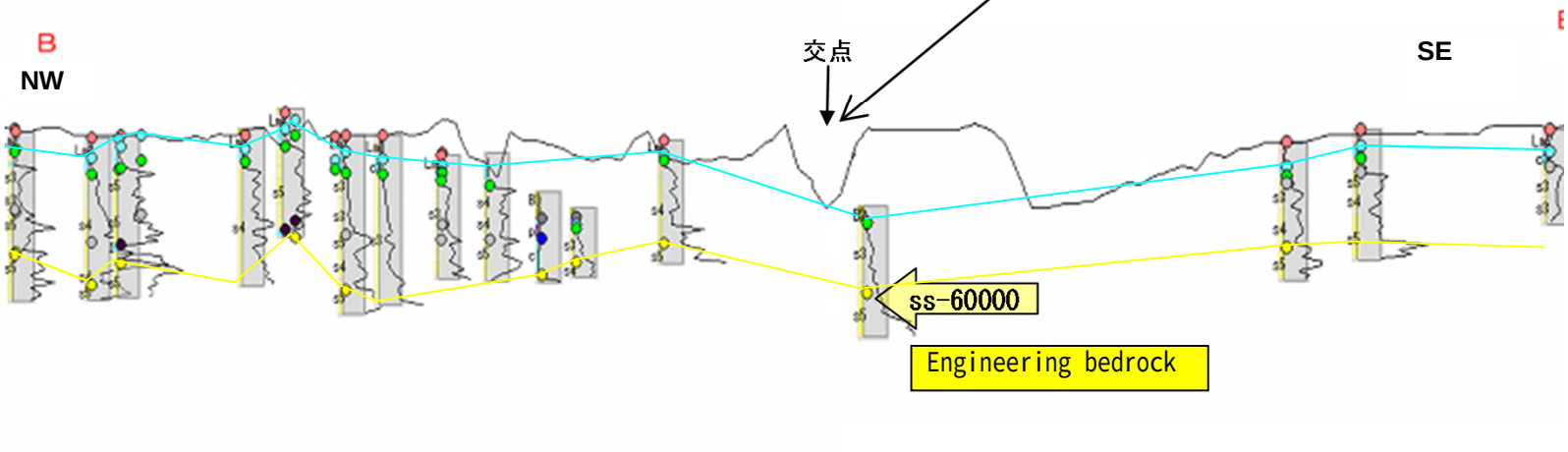
Tracing each stratum and profiling in 2-Dimension

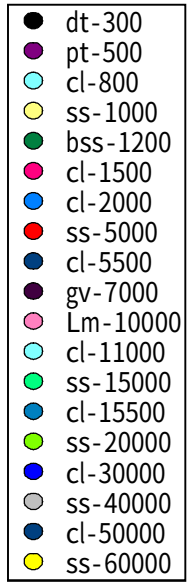


海岸線に直交する方向

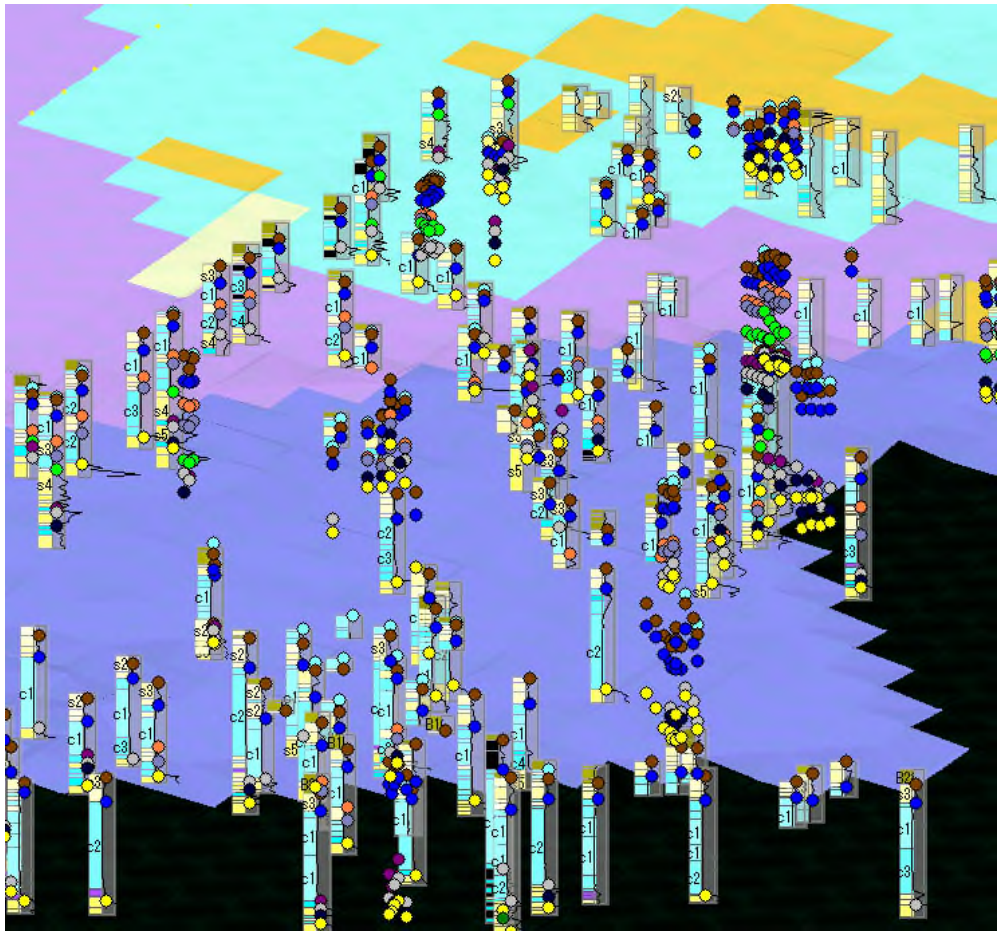


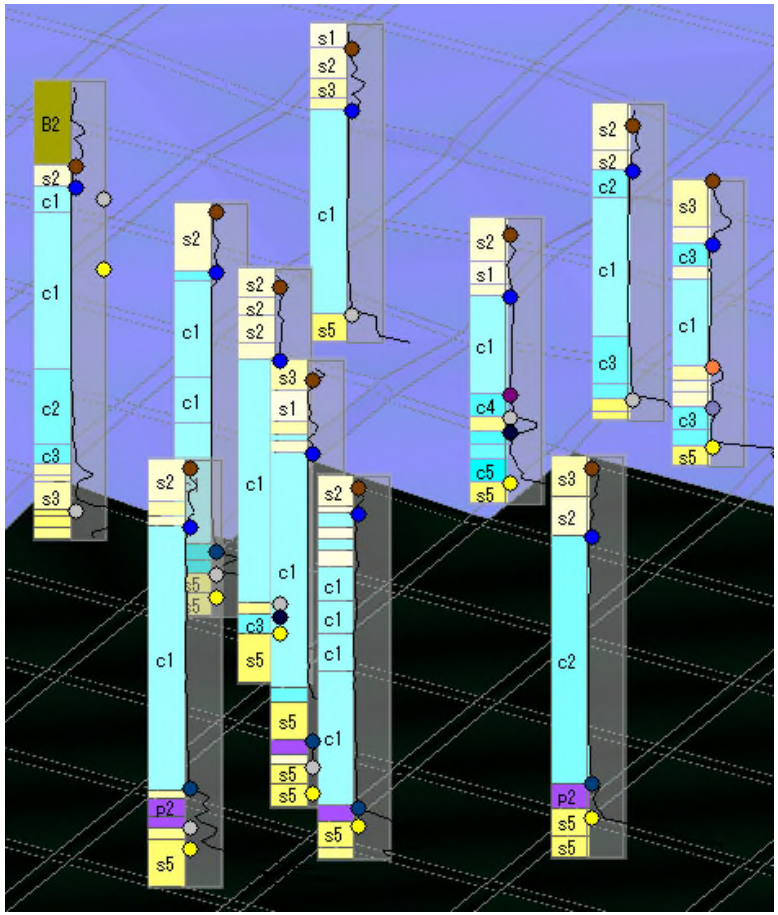
海岸線に平行する方向（台地上）





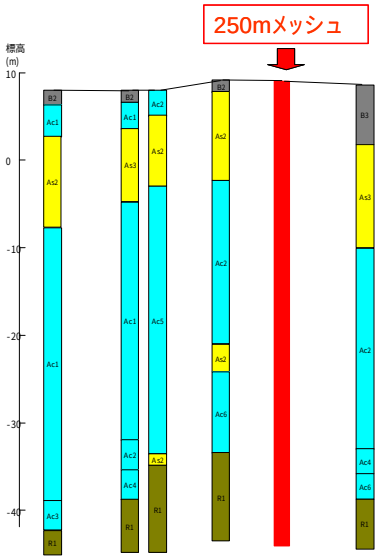
Constructing 3-Dimensional geological sturctures



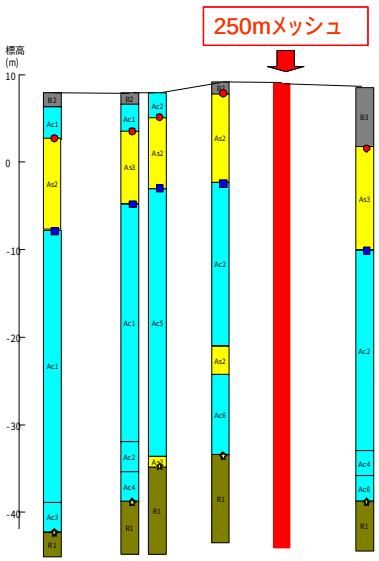


Same colored dots indicate same layer-boundaries.

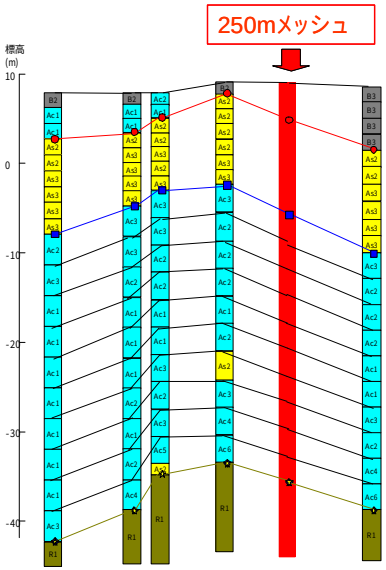
① 250m メッシュ周辺のボーリングデータを整理する。



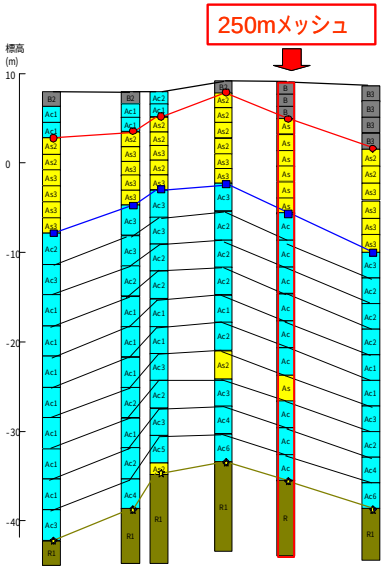
② ボーリングデータに地層境界を設定する。



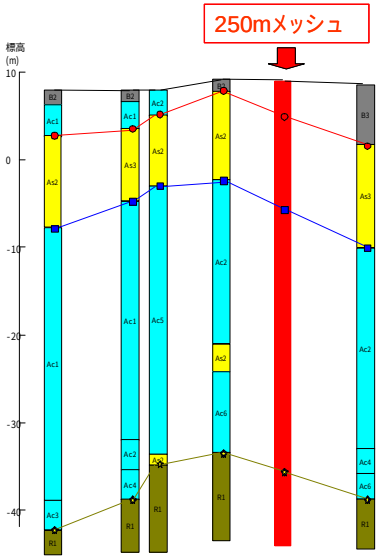
④ 各地層内を等分割してスライスを作成する。



⑤⑥ 各ボーリングの地層区分を元に 250m メッシュの土質区分を求める。



③ 補間により 250m メッシュの地層境界を設定する。



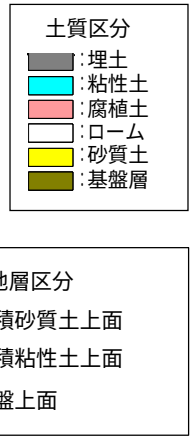
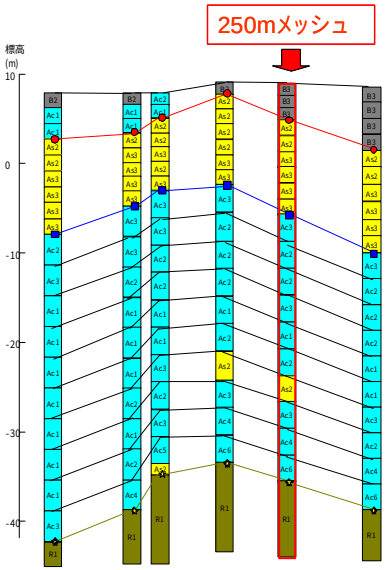


図 1-1-4　地質層序にもとづく浅部地盤モデルの作成手順（1）

⑦ 各ボーリングの N 値を元に 250m メッシュの N 値を求める。



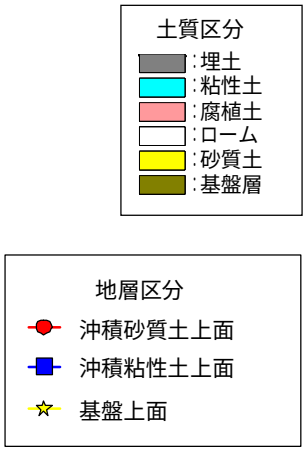
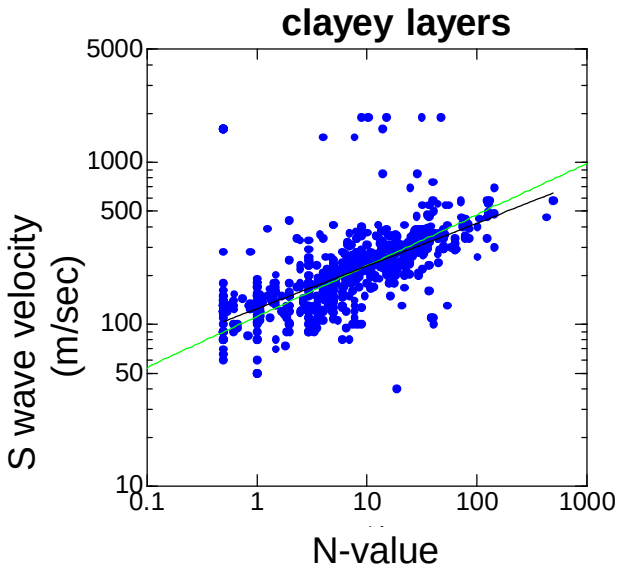
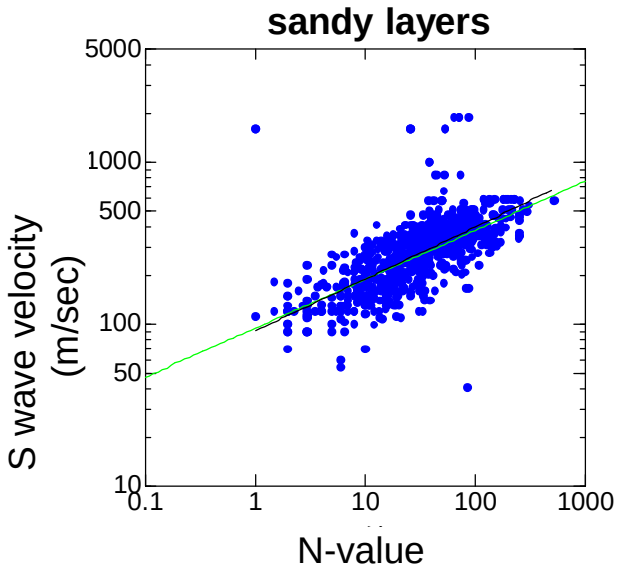
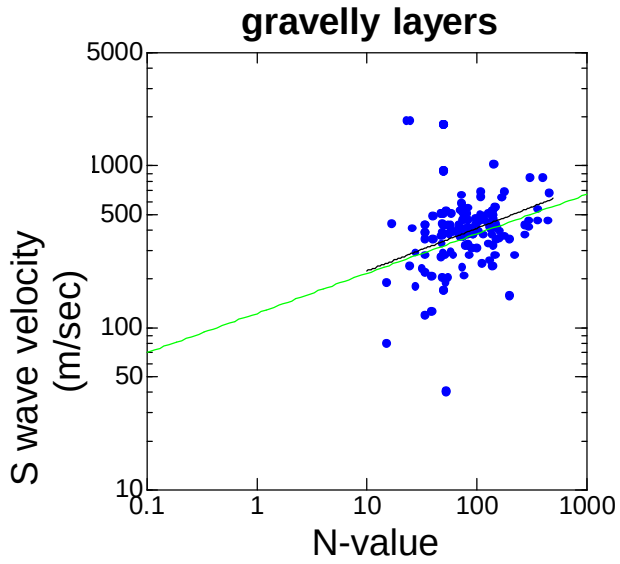


図 1-1-5　地質層序にもとづく浅部地盤モデルの作成手順（2）

Interrelations of N-values and S-wave velocities



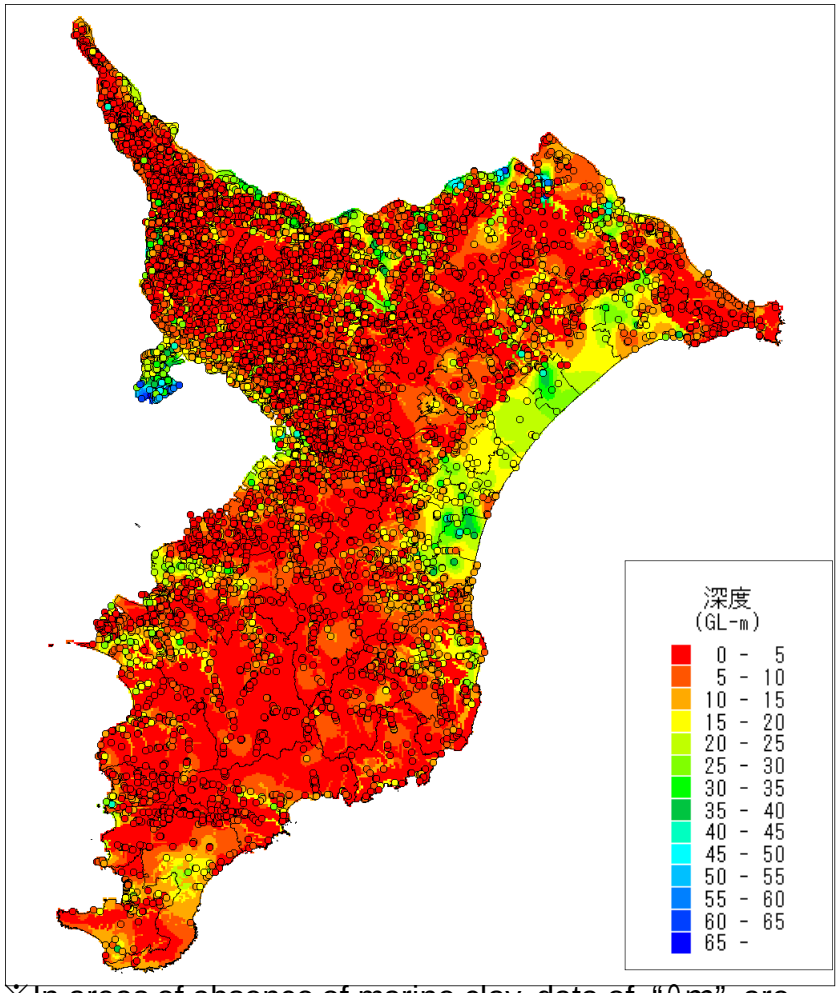




◆ shear wave velocity data by PS logging

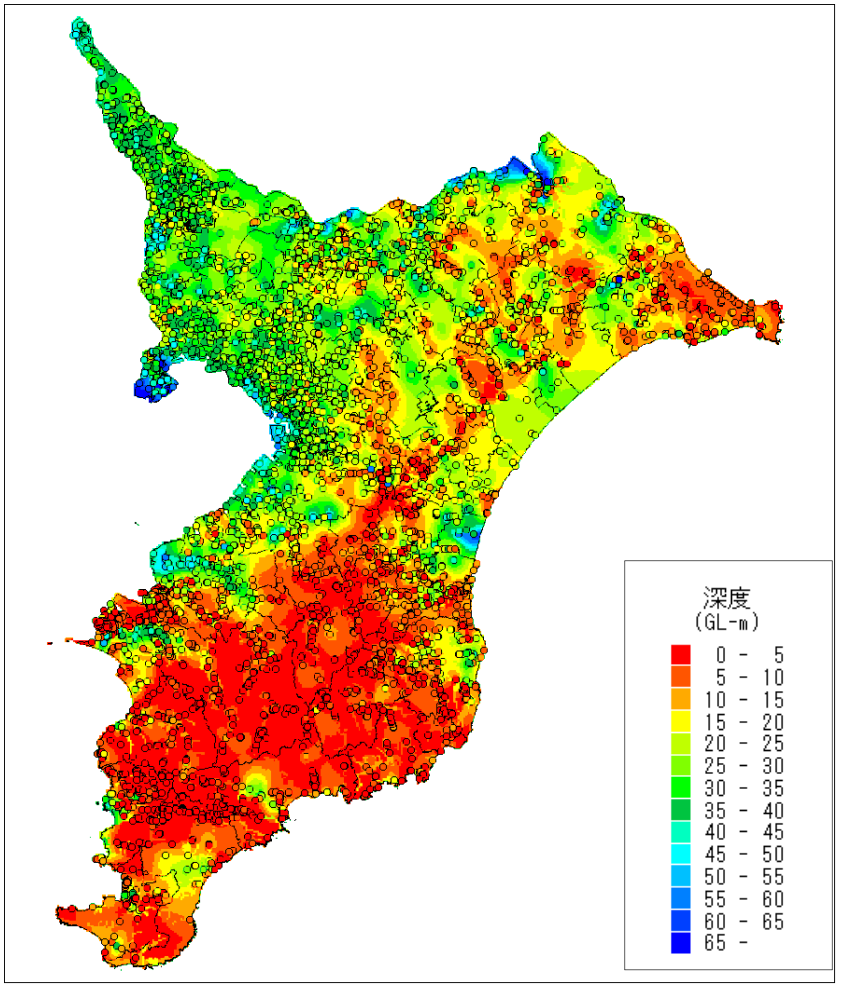
Shallow subsurface sturcture models: Depth contours of upper surfaces of layers

Holocene marine clay



※In areas of absence of marine clay, data of “0m” are shown as dummies.

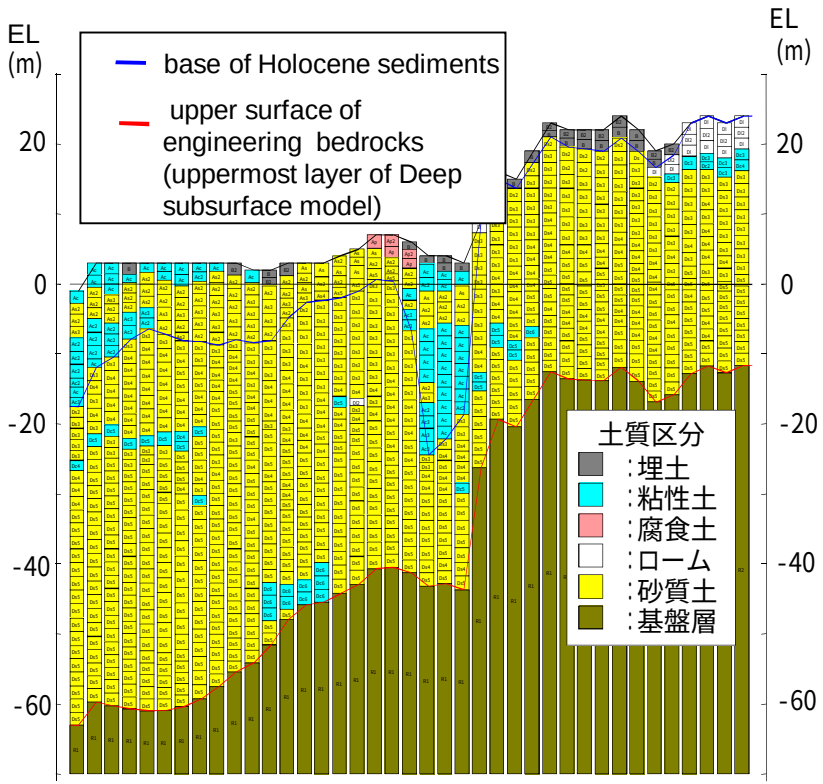
Engineering bedrocks (almostly N-values >50)



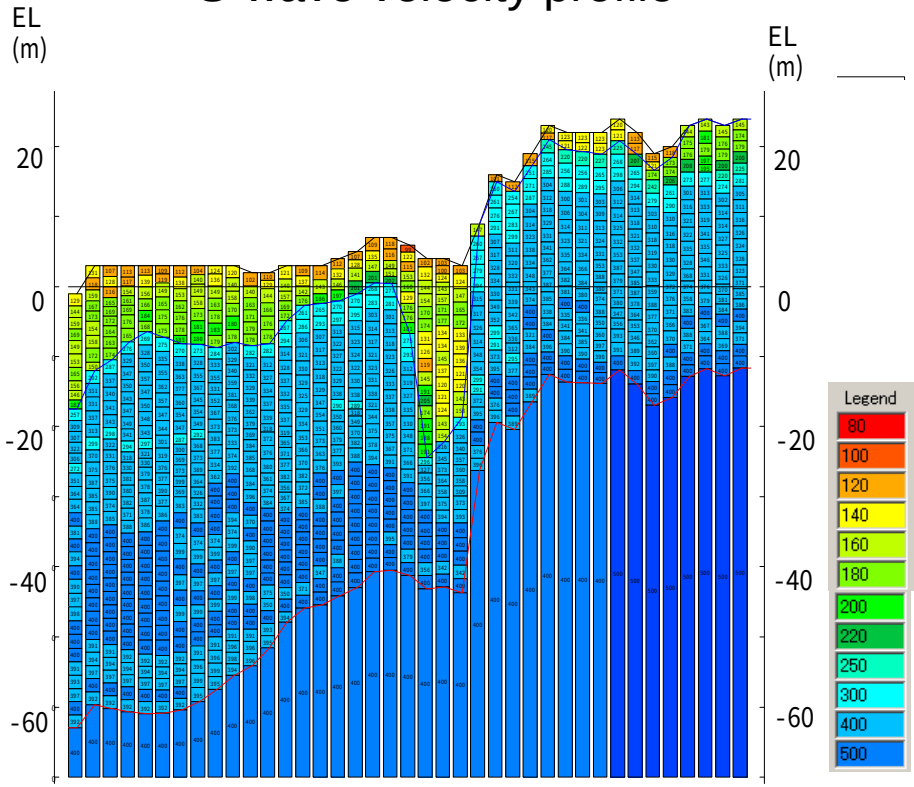
Shallow subsurface structure models
: Profiles of the ground

Vs(m/sec)

Geological Profile



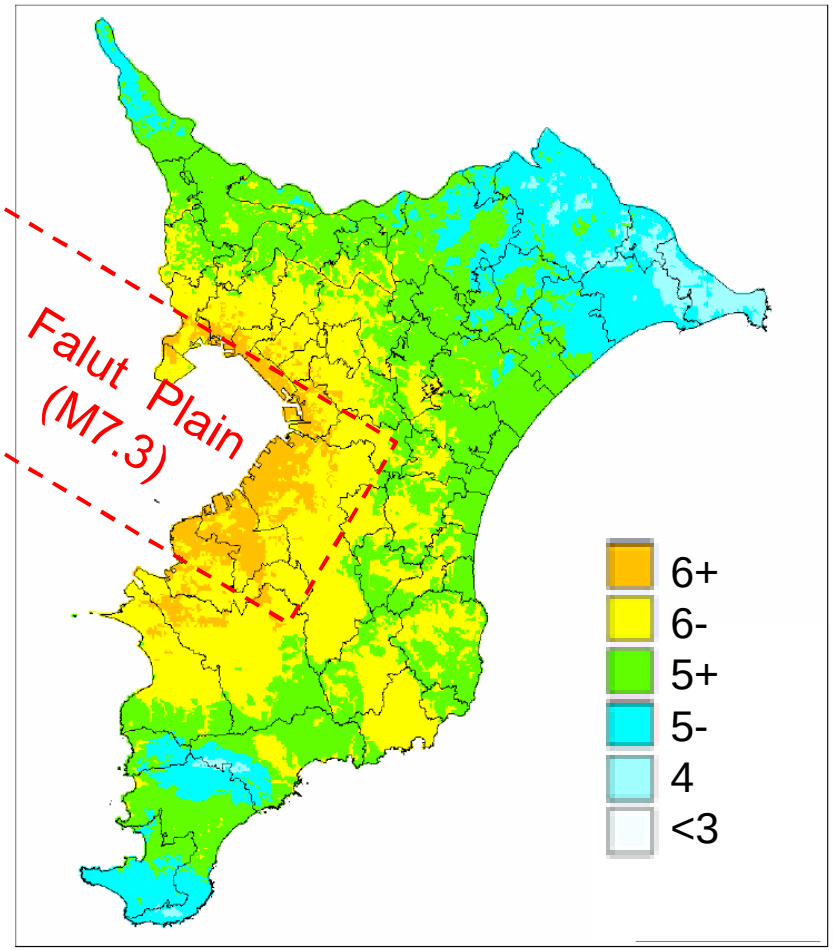
S-wave velocity profile



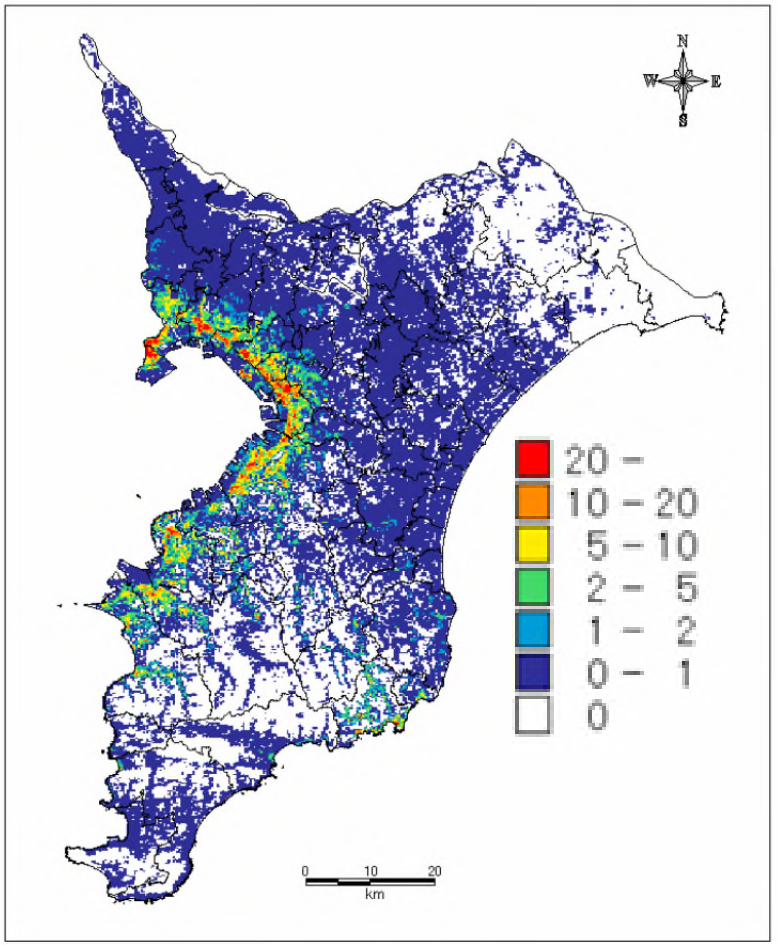
Hazard Analysis of “Northern Tokyo Bay Earthquake”

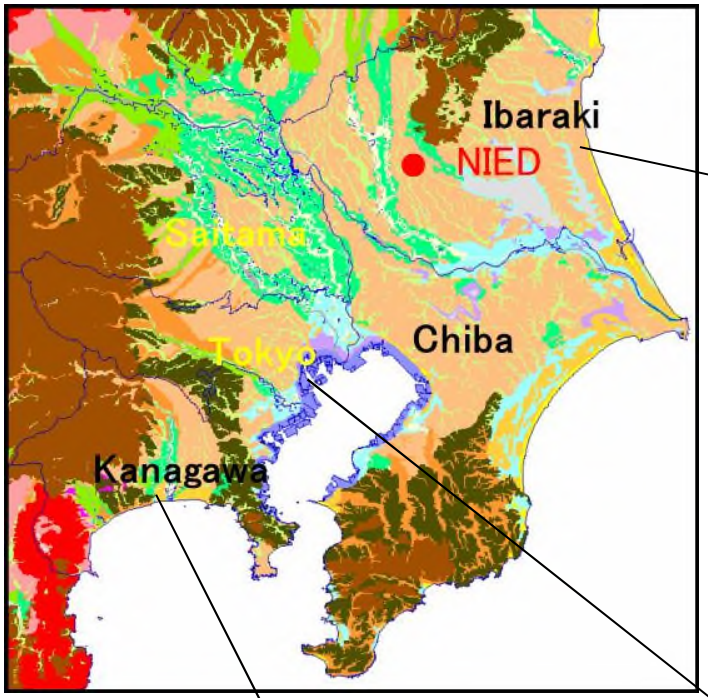
＜ the disaster prevention office of C.P.＞

Seismic Intensity(JMA)

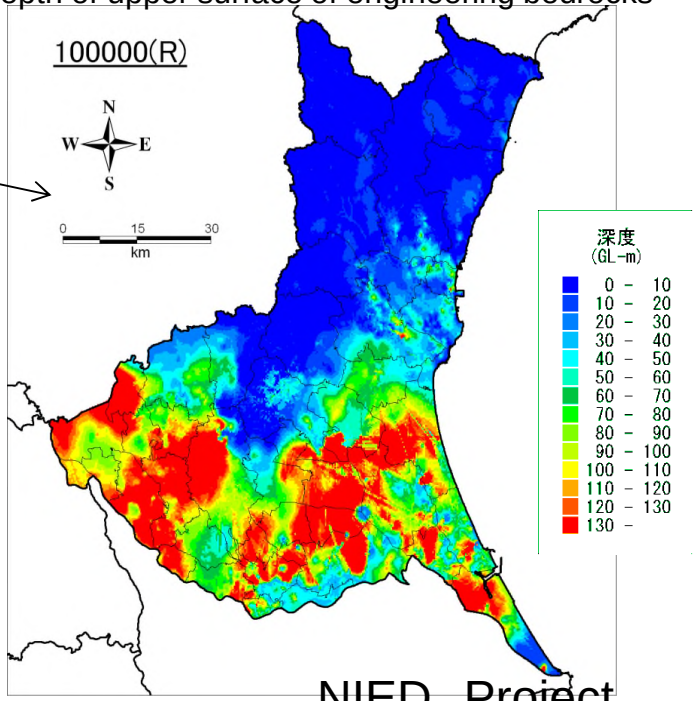


Estimation of numbers of collapsed houses in 250m meshes





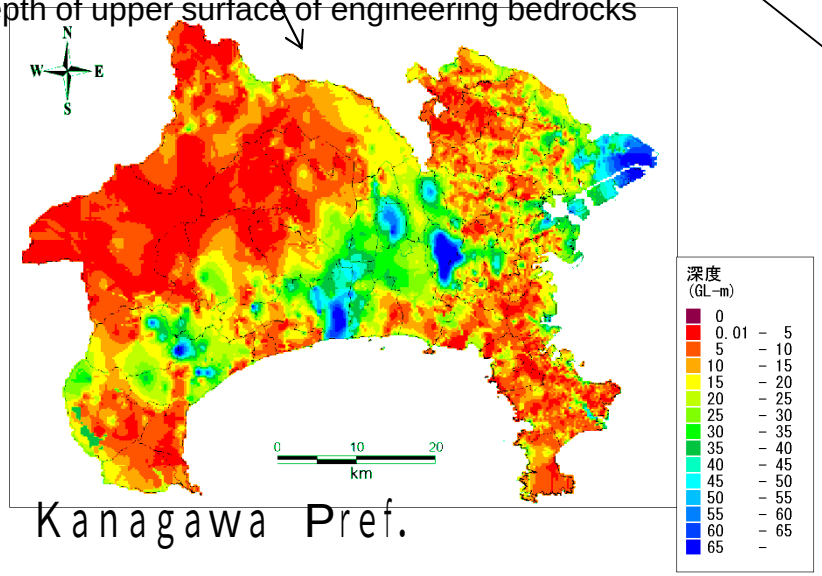
Depth of upper surface of engineering bedrocks



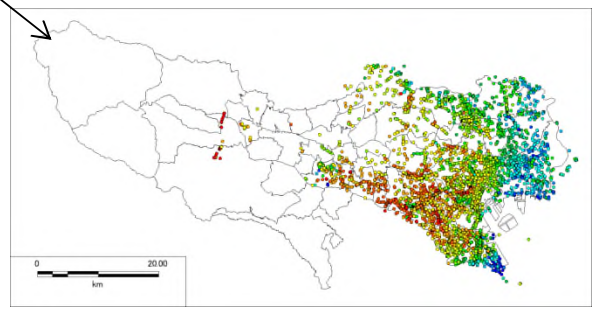
NIED Project

NIED Project on going

Depth of upper surface of engineering bedrocks

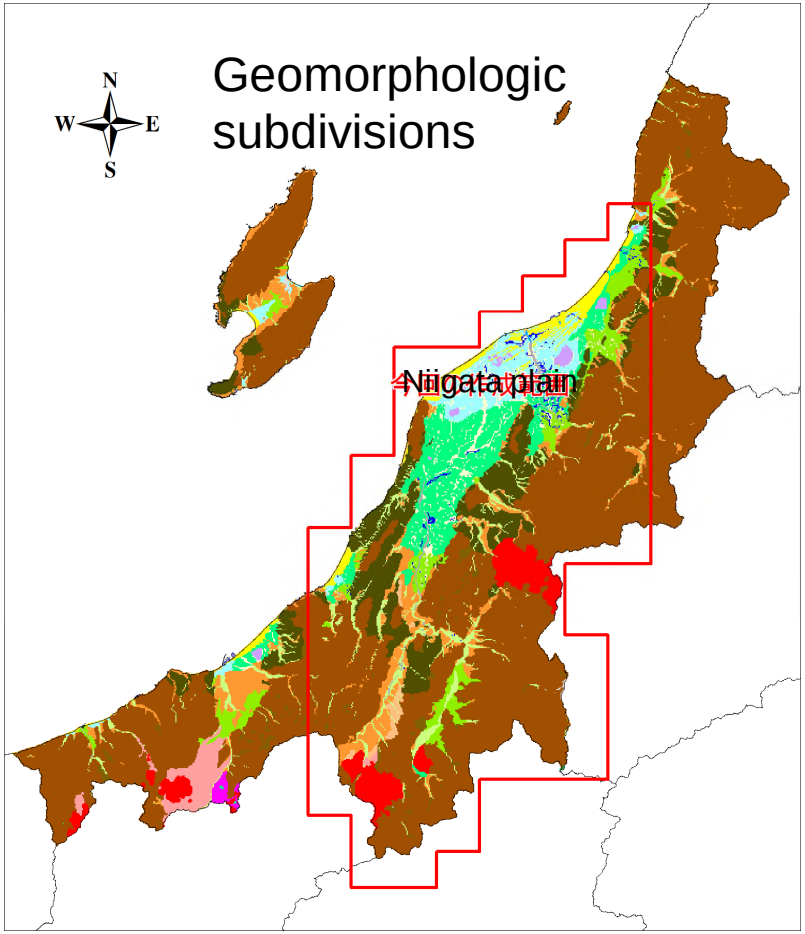


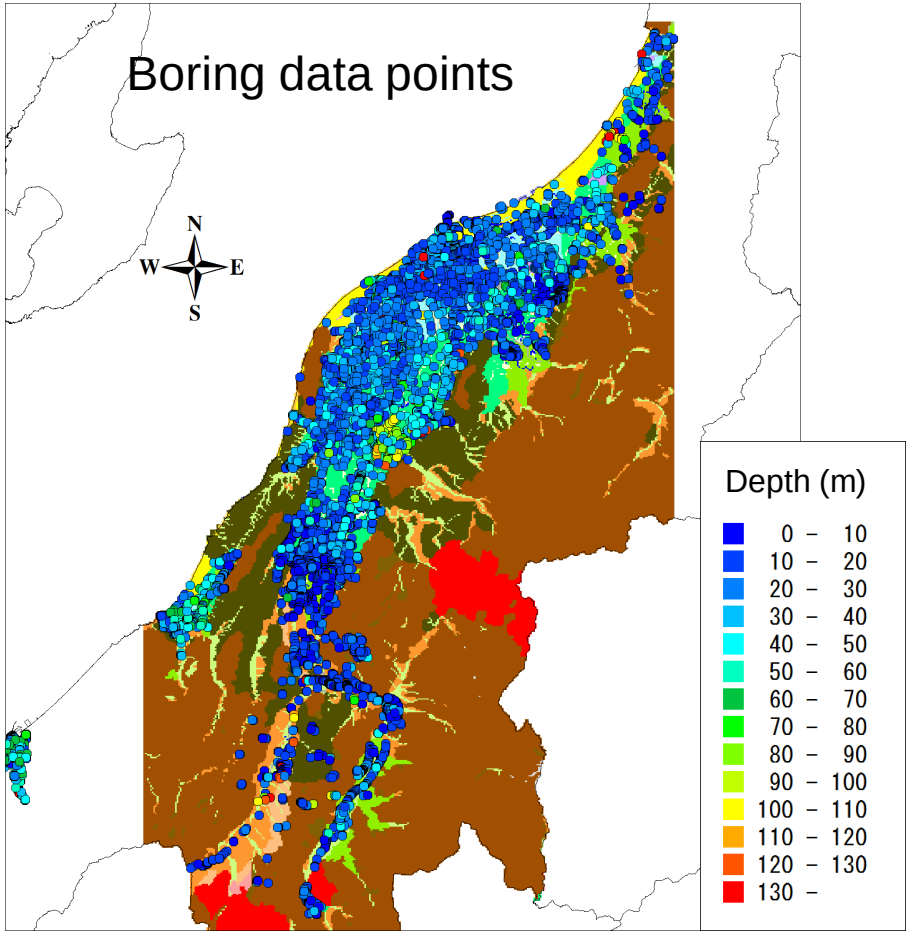
Kanagawa Pref.



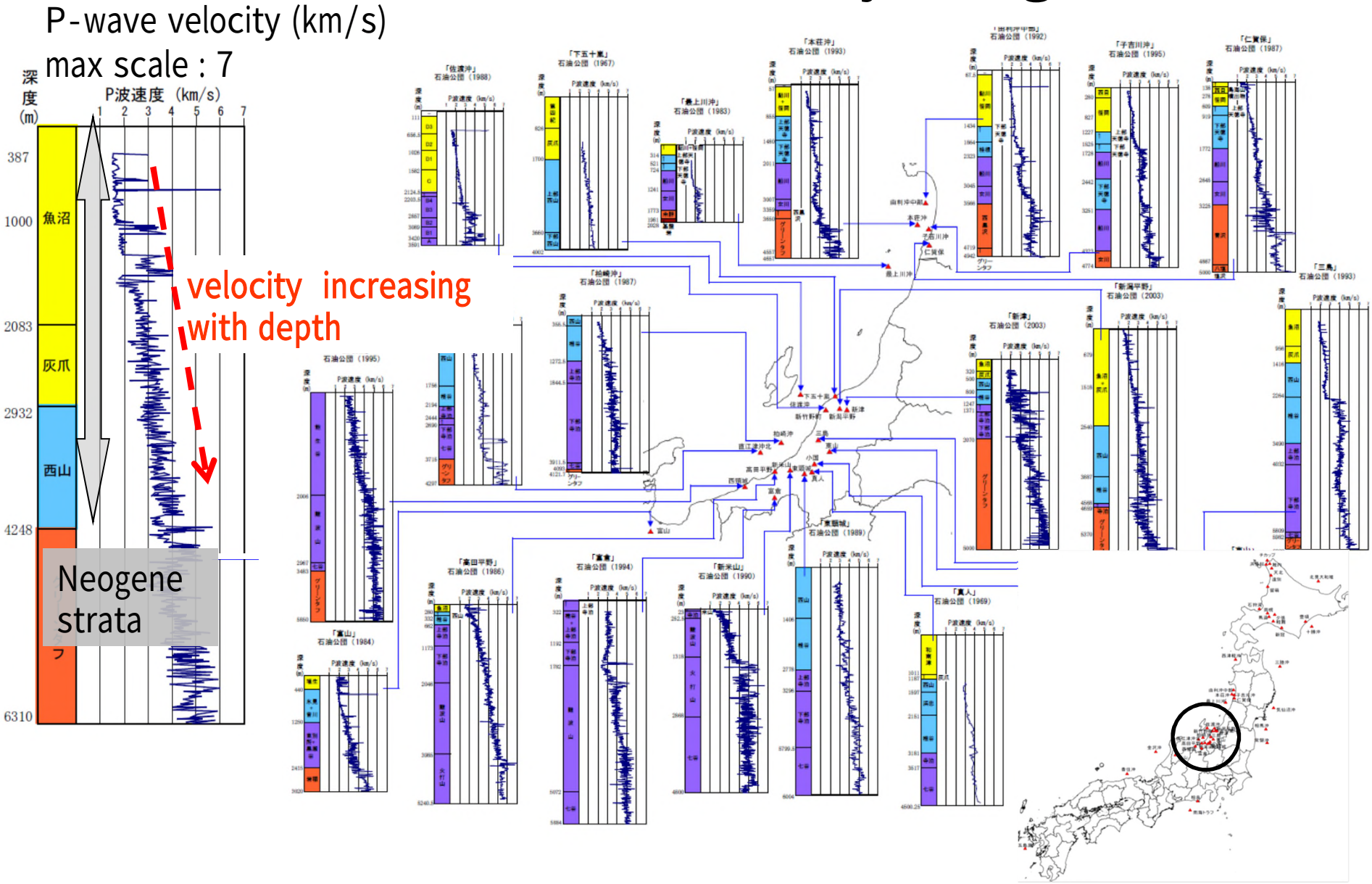
SSM in Kanto area

Shallow subsurface structure model
: Niigata Plain



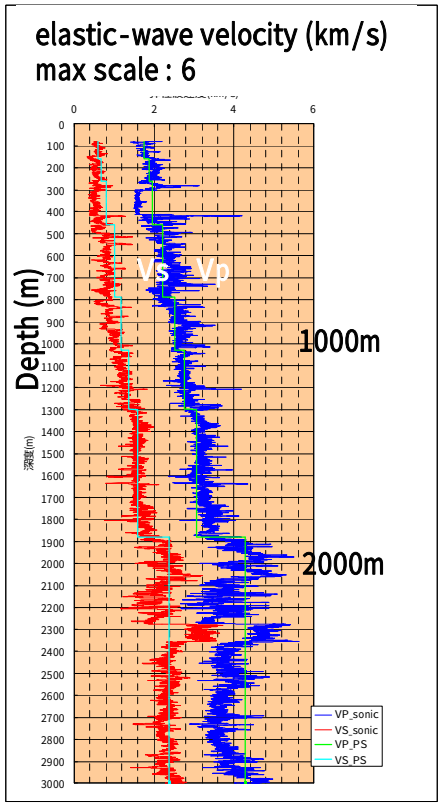


Deep borehole and seismic logging data
<Borehole and P-wave velocity : Niigata area>

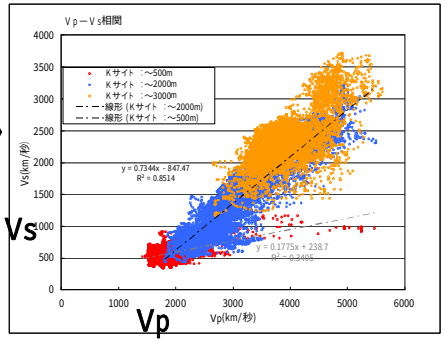


Area characterized Vs distribution trend

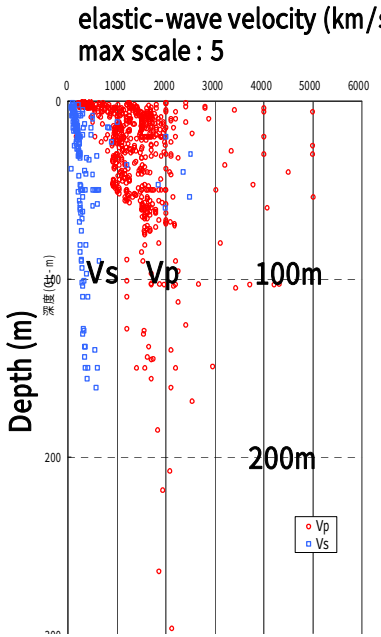
Vp-Vs Distribution with depth



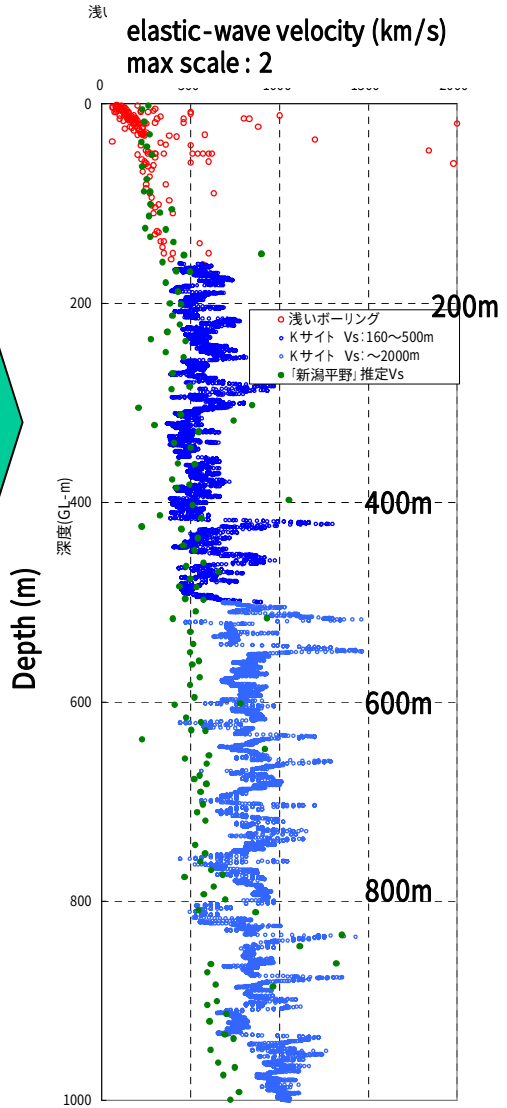
Vp-Vs Relation



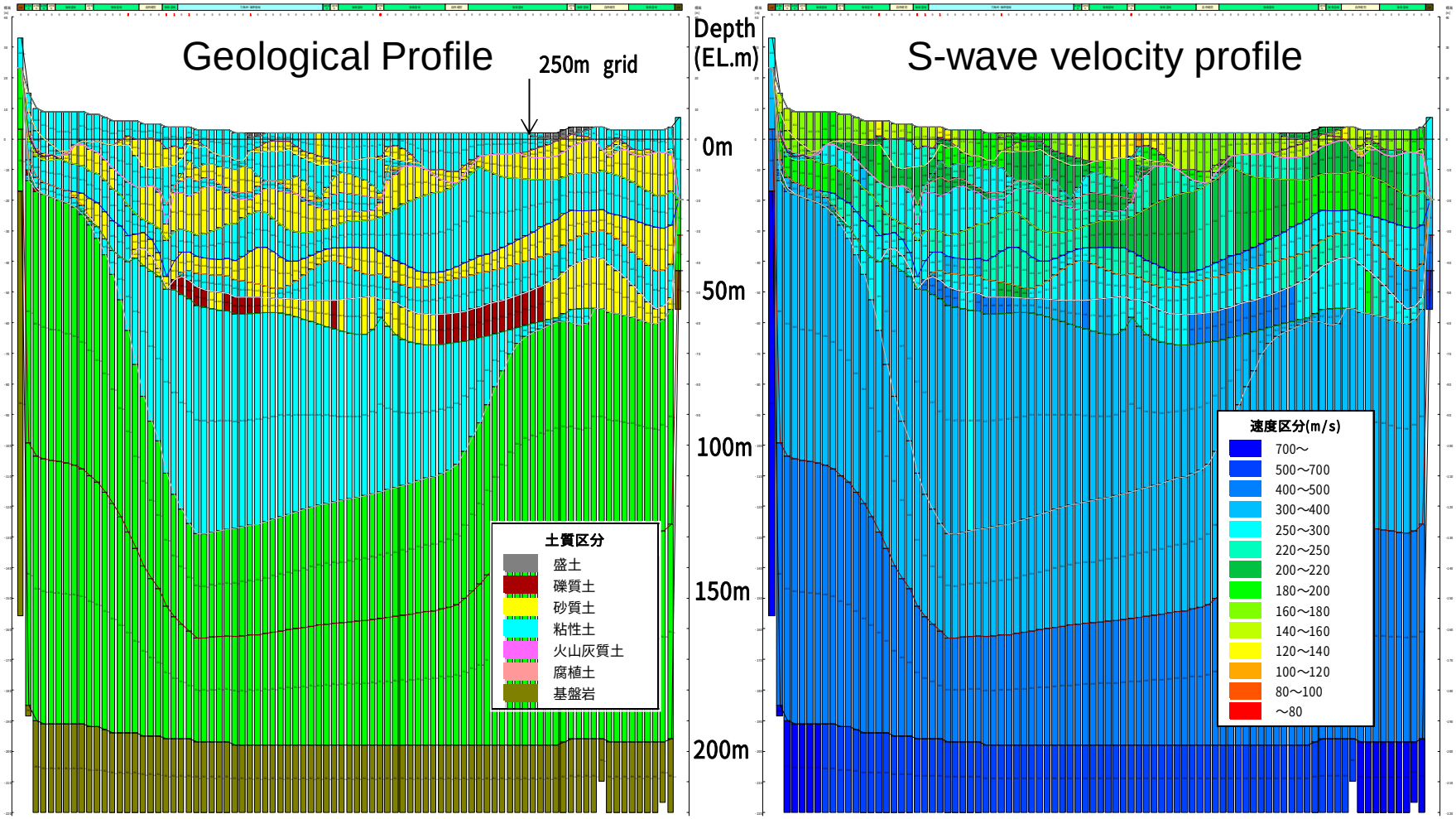
Shallow logging data



Area characterized Vs distribution with depth

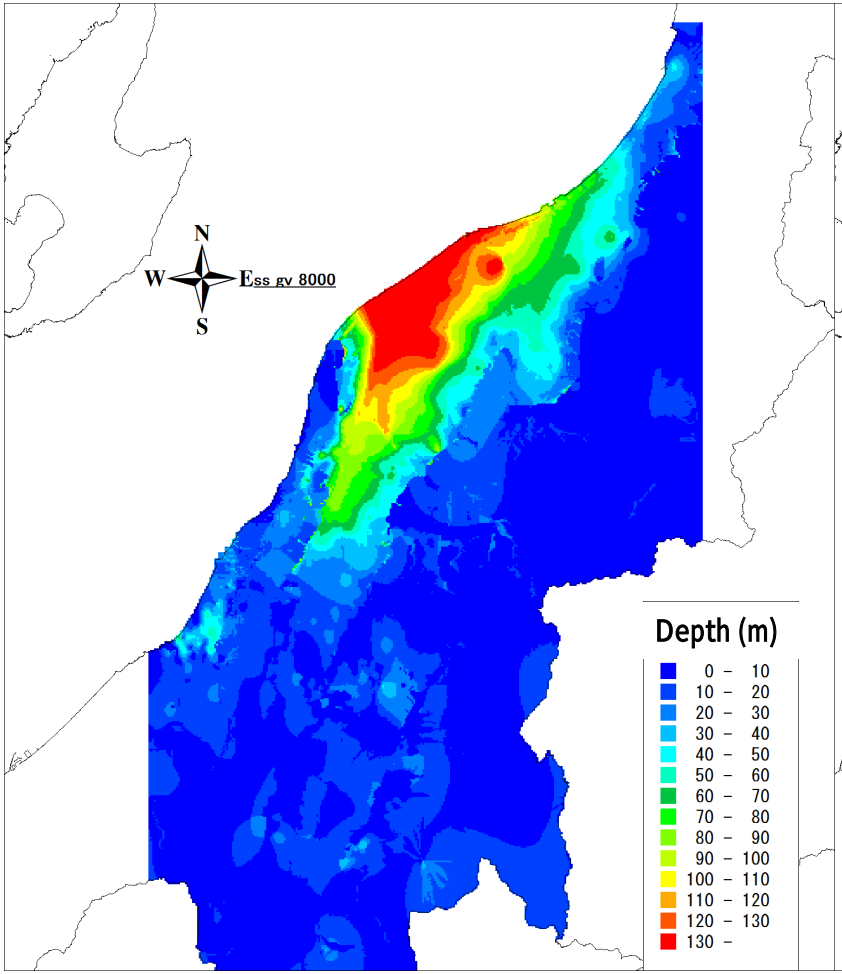


Shallow subsurface structure models
: Profiles of the ground

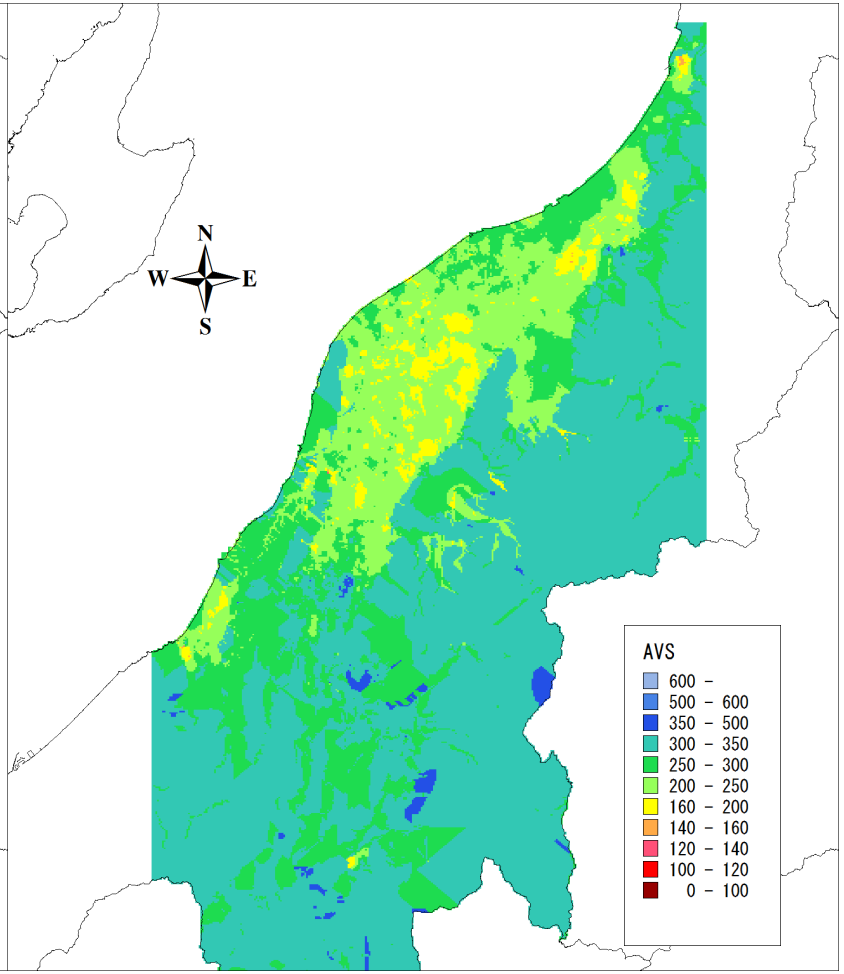


Shallow subsurface structure models

Lower boundary of Holocene deposits



AVS30



Conclusions :

・Shallow subsurface structure model based on geological data are being made in Kanto and Niigata areas.

・These models combined with deep subsurface structure model covering all over Japan are useful for Strong ground motion Evaluation of SHA and being standard methods in NIED Projects.

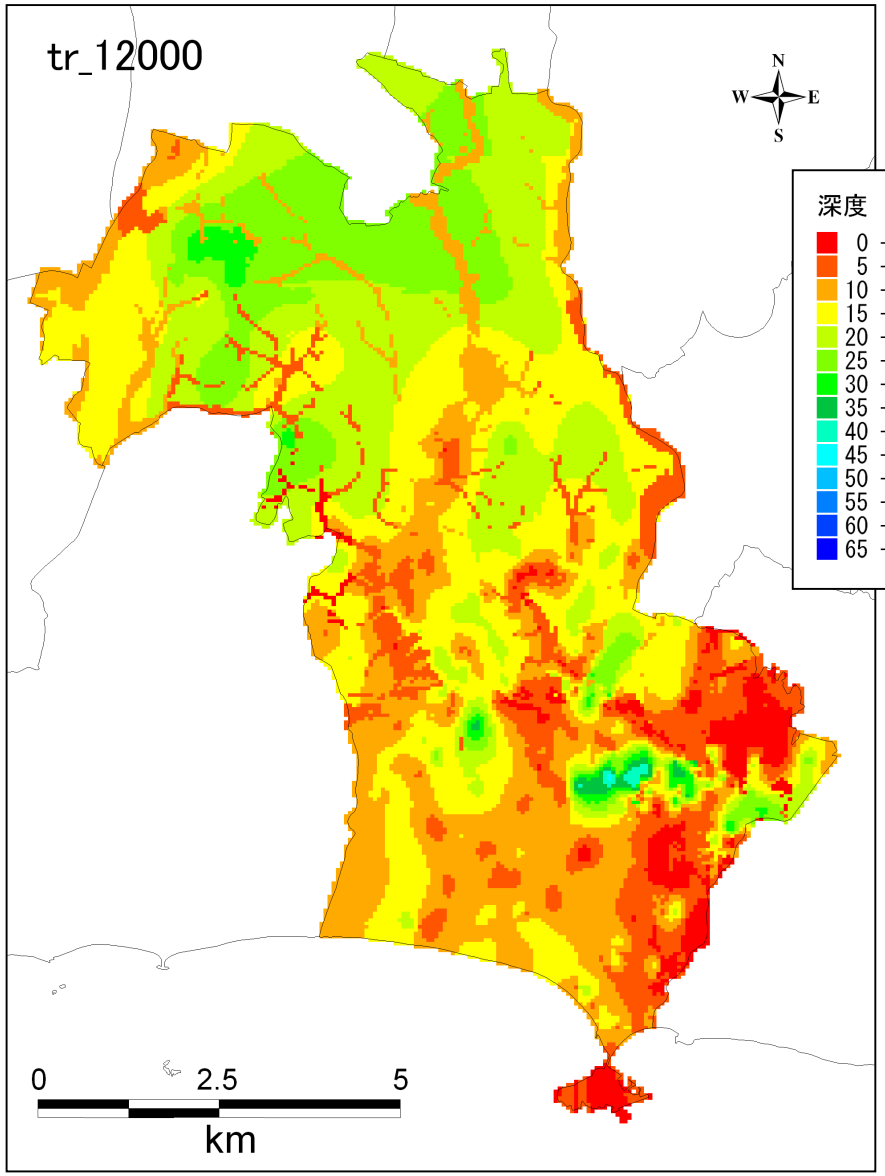
・More applicable and useful method are developed.

(Combining methods using micro-tremor data are shown in the poster of Dr.Senna of NIED).

Future perspectives:

・Around Niigata area, subsurface structure models are also needed in so-called “strain concentrated zone” , where probabilities of earthquake occurrence are rather high.

・ The methodology of constructing the models must be formulated and shown as a forms of “recipe”.



Depth of upper surface of engineering bedrocks

SSM of Fujisawa city
:50 m mesh
(NIED Project)

That’s all.

Thank you for your attention .