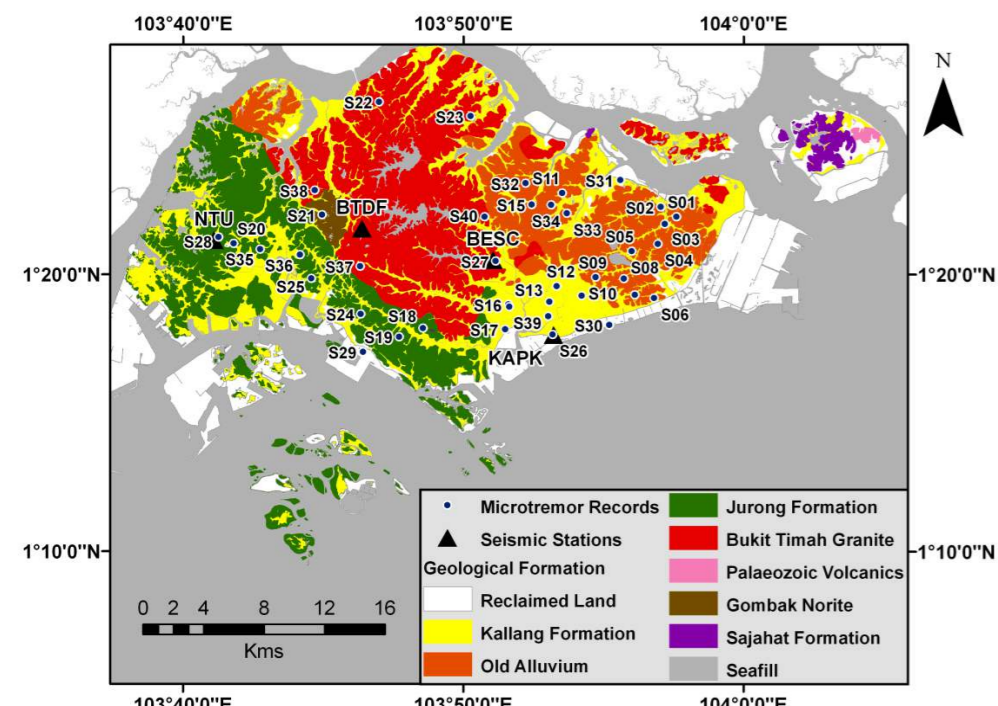


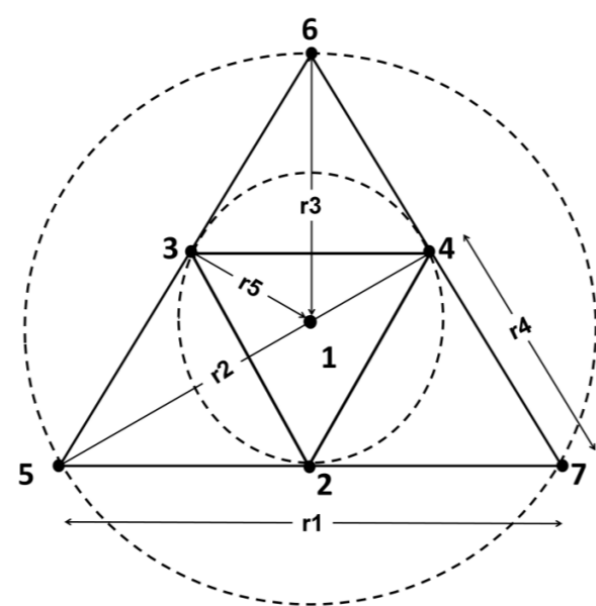
# Estimation of Shallow S-Wave Velocity Structure of Singapore based on Microtremor Array Recordings

Array microtremor recording is carried out in Singapore for 40 sites that encompasses the sites of all the major geological formations. The Spatial Autocorrelation (SPAC) method is employed to determine the phase velocity dispersion curves, which are subsequently inverted to determine the shallow shear-wave velocity ( $V_s$ ) and soil stratigraphy. The SPAC result is further compared with nearby borehole data.

Dr M Yanger Walling, ICRM  
Prof. Pan Tso-Chien, ED-ICRM



Microtremor recording sites overlaid on geology map of Singapore

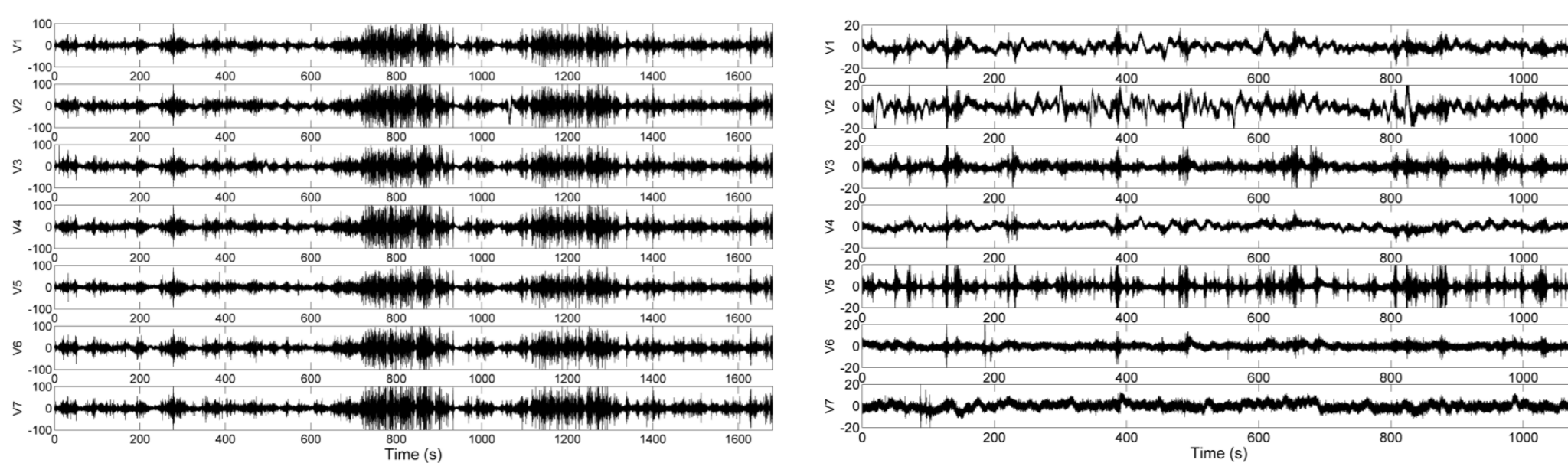


Array configuration for the microtremor recording with 7 stations. The lengths r1-r5 indicates the different interstation length combinations

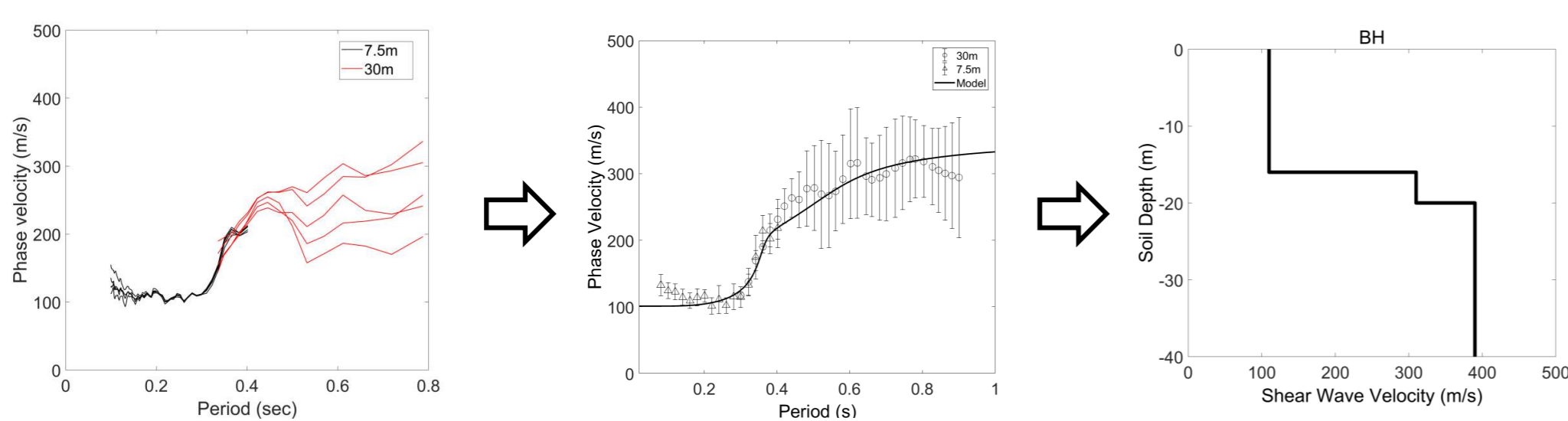
Symbol	Interstation Length	Interstation Length Combinations
r1	r1	5-6, 6-7, 5-7
r2	$0.866 * r1$	2-6, 4-5, 3-7
r3	$0.577 * r1$	1-5, 1-6, 1-7
r4	$0.5 * r1$	2-3, 2-4, 2-5, 2-7, 3-4, 3-5, 3-6, 4-6, 4-7
r5	$0.287 * r1$	1-2, 1-3, 1-4



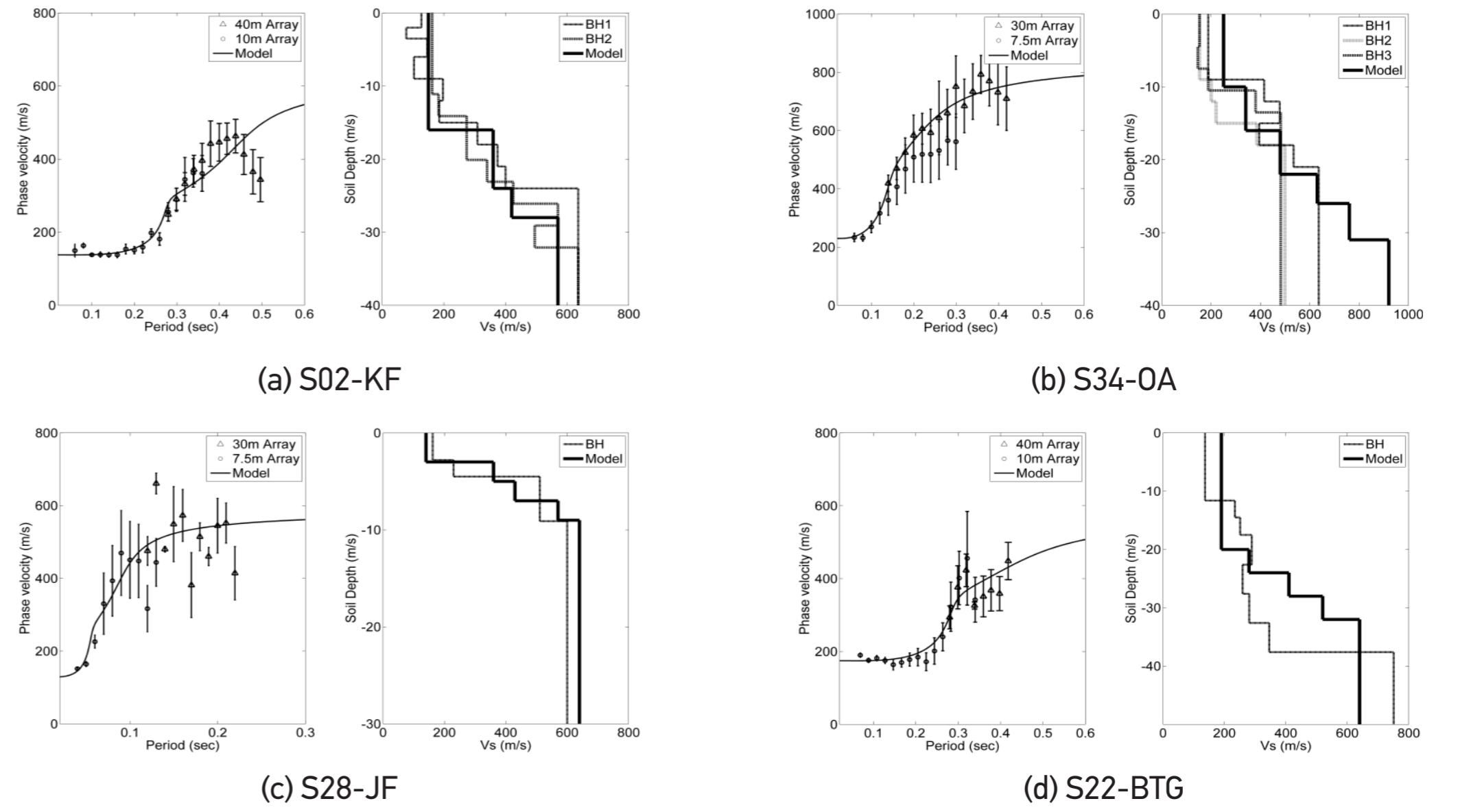
Microtremor recording sites at selected locations in Singapore



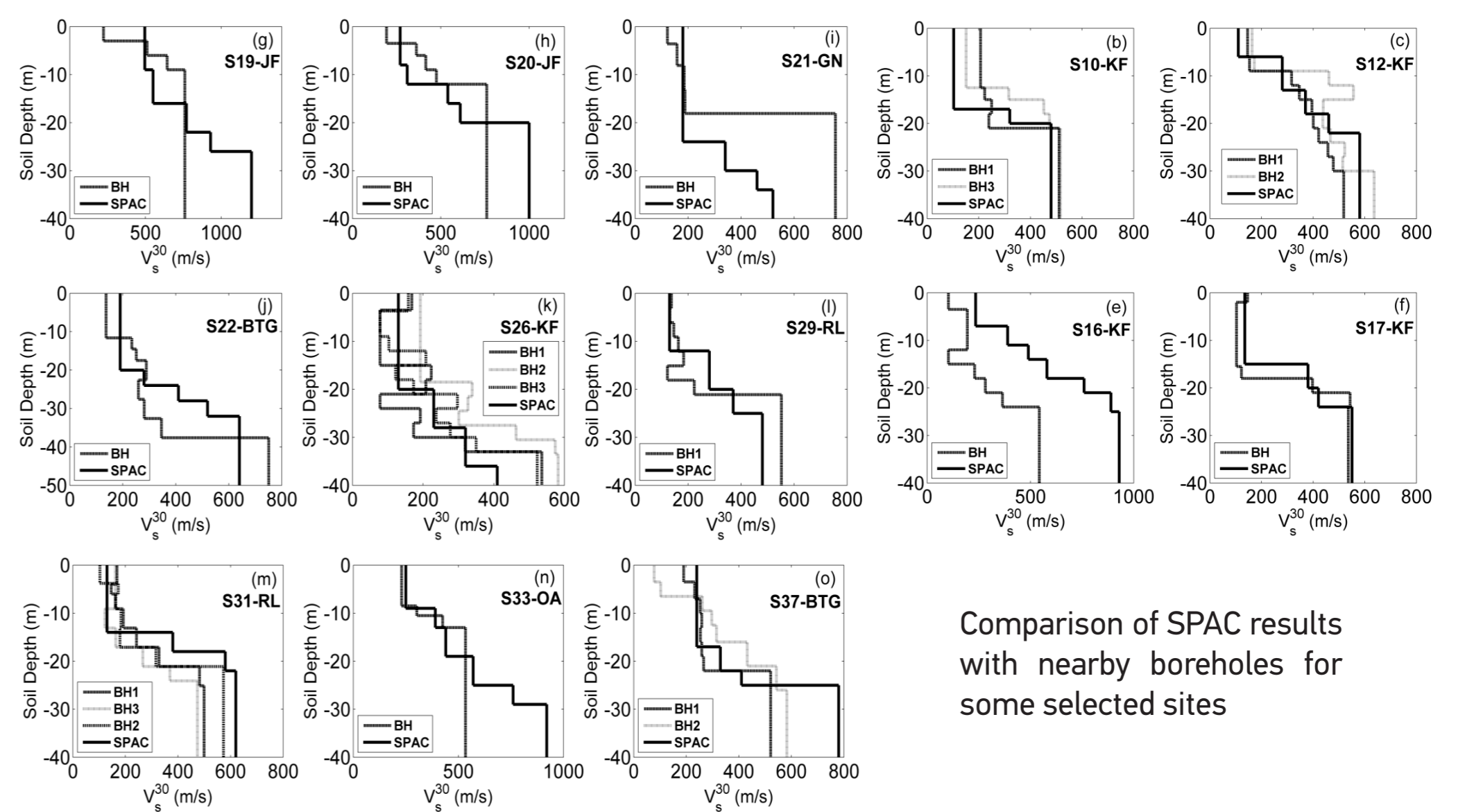
Time series depicting the vertical component of recorded microtremor from the 7 stations at site (a) S02 (consistent recording) and (b) S15 (inconsistent recording)



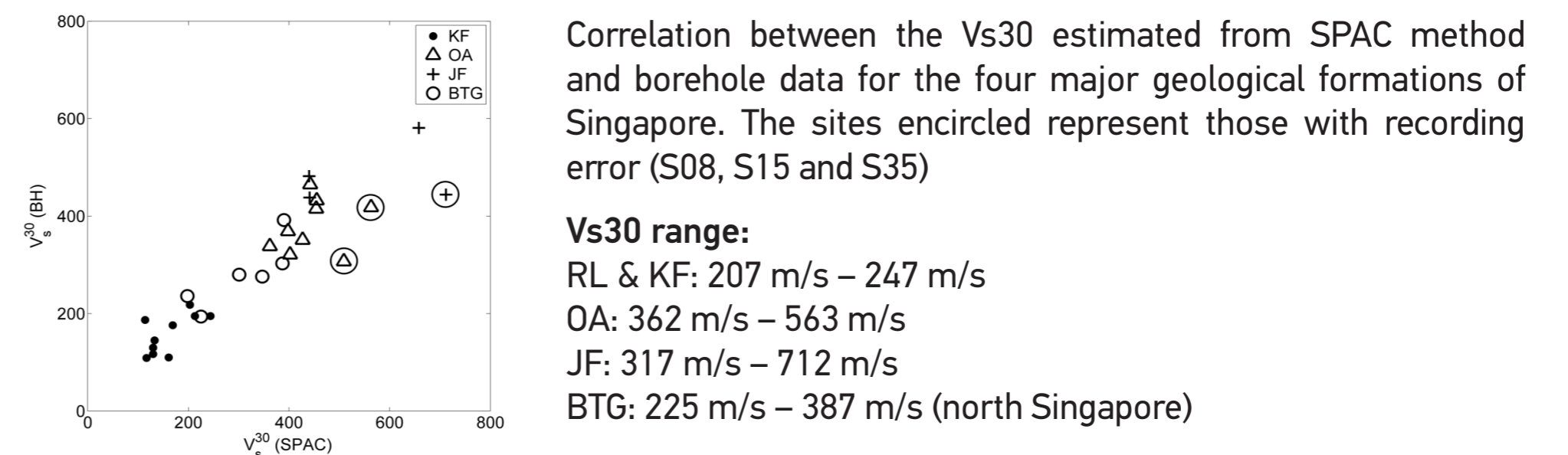
Inversion process is based on fitting the experimental dispersion curve to a theoretical model of the shear wave profile that depends on shear wave velocities and thickness of layers



Modelling of phase velocity for different geological formations, as a function of  $V_s$  and thickness. The bar represents the  $\pm 1$  standard deviation. The model is compared with the nearby boreholes (BH)



Comparison of SPAC results with nearby boreholes for some selected sites



Correlation between the  $V_{s30}$  estimated from SPAC method and borehole data for the four major geological formations of Singapore. The sites encircled represent those with recording error (S08, S15 and S35)

**$V_{s30}$  range:**  
 RL & KF: 207 m/s – 247 m/s  
 OA: 362 m/s – 563 m/s  
 JF: 317 m/s – 712 m/s  
 BTG: 225 m/s – 387 m/s (north Singapore)

Spatial variation of depth in KF based on the interpolation of Kriging method. The depth variation is considered along profiles AA' and BB'. General trend of depth increases towards the southern part of KF (BB'), whereas shallow depth is observed along the fringe of the KF, which borders with other older geological formations, and increases in depth towards the central part of KF (AA')

