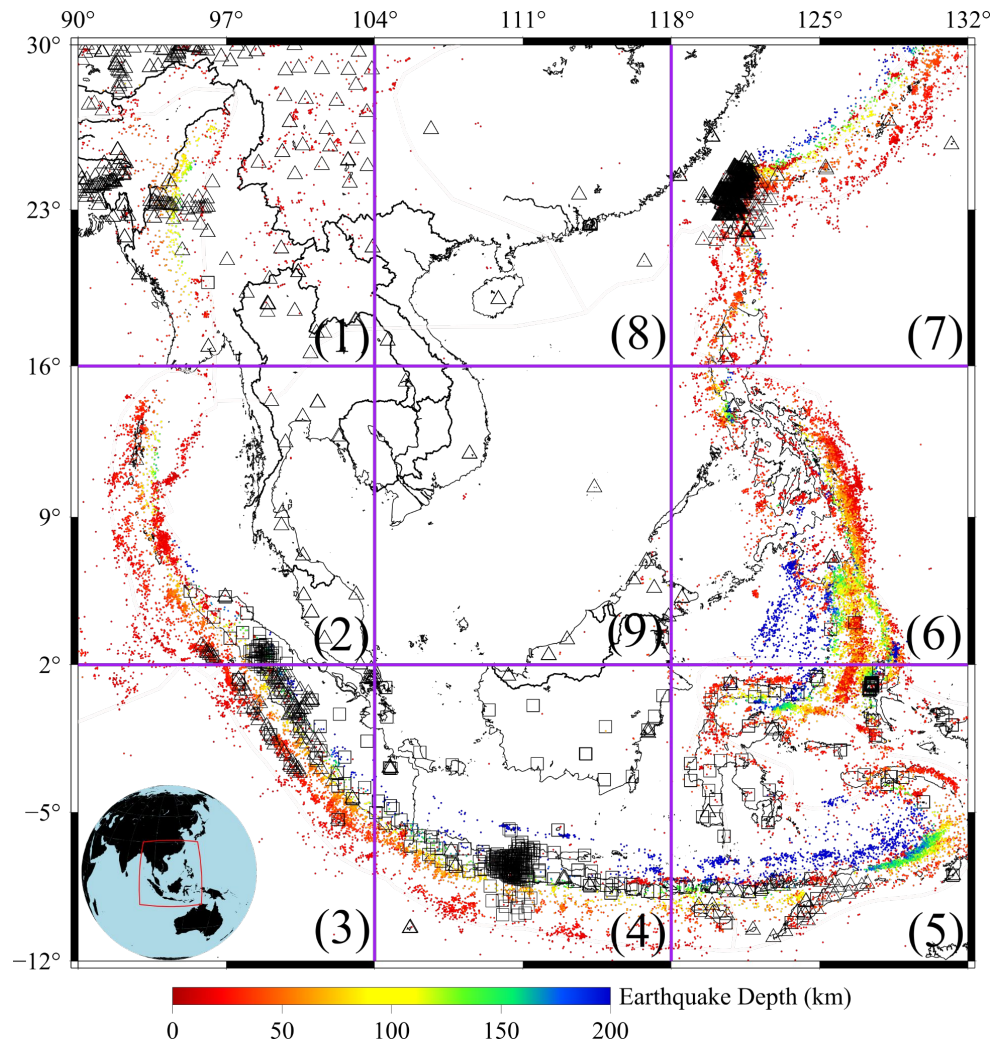


# Automatically pick P-wave arrivals in southeast Asia

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#SAPTARSHI ROY# 5

#SHASHWAT DROLIA# 4

#KUSH MUKESH KOTHARI# 3

#SIDDHARTH RANJAN BAJPAYI# 6

#VISHESH MITTAL# 1

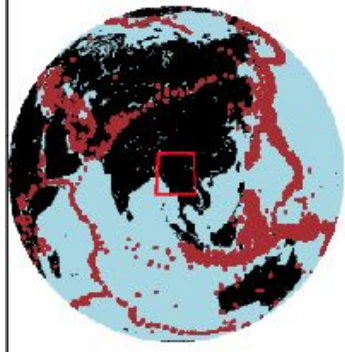
#RACCHIT JAIN# 2

#RISHIKESH S# (Take Examination) 7

#TUSHAR KHOKHAR# (Unwell) 8 & 9

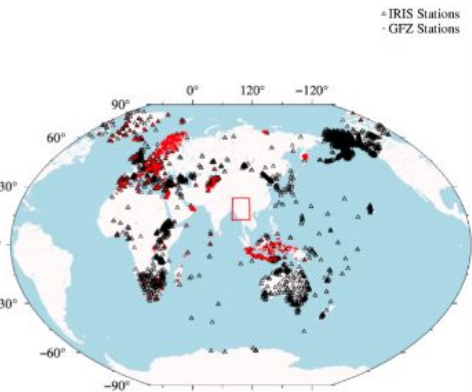
## Data processing

**Data analysis report** of the retained data (data distribution, time window, frequency band, SNR statistics, waveform plot in event gather, etc.)



Near Station Far Event (NSFE)

***Aim duration: 2000 - 2022.***



Near Event Far Station (NEFS)

***Aim duration: 2000 - 2019.***

Remove the instrument response



Resample and filter waveforms



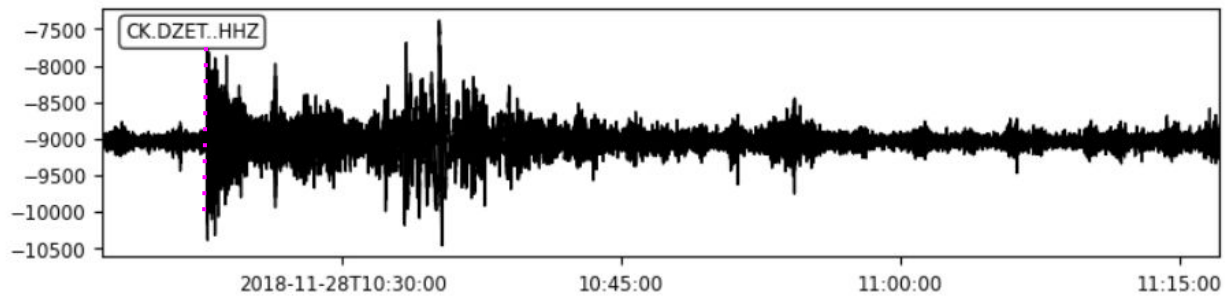
Mark the P-wave traveltimes on waveforms



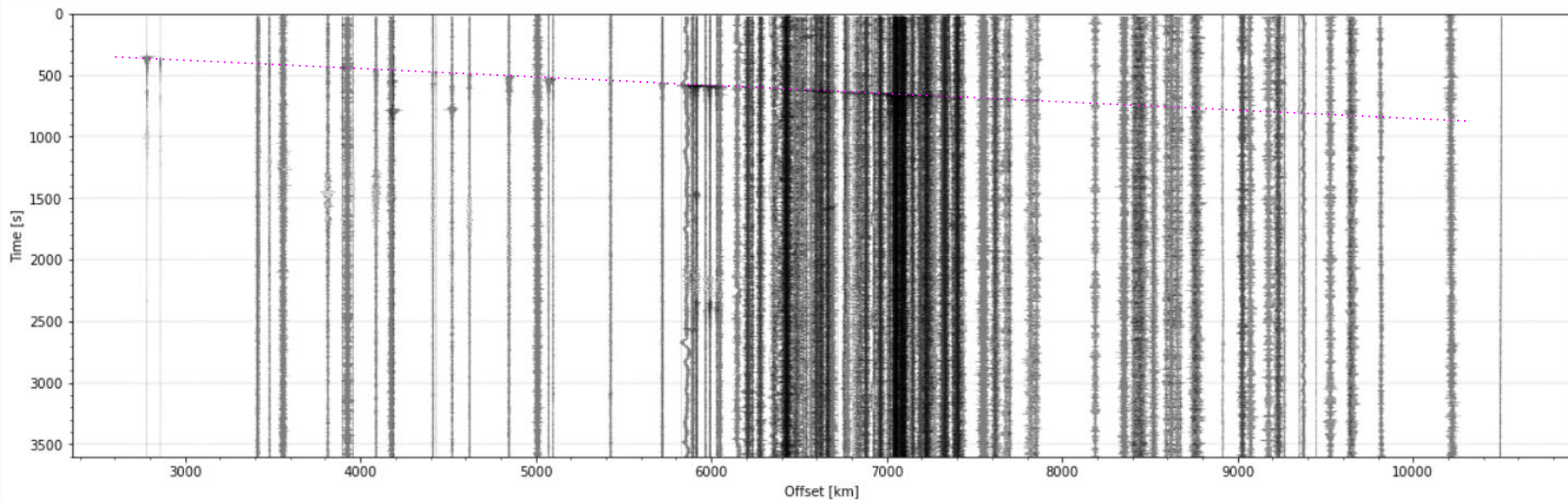
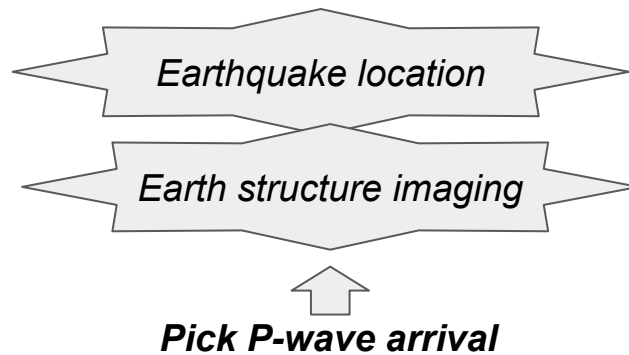
Select waveforms according to signal-to-noise ratio

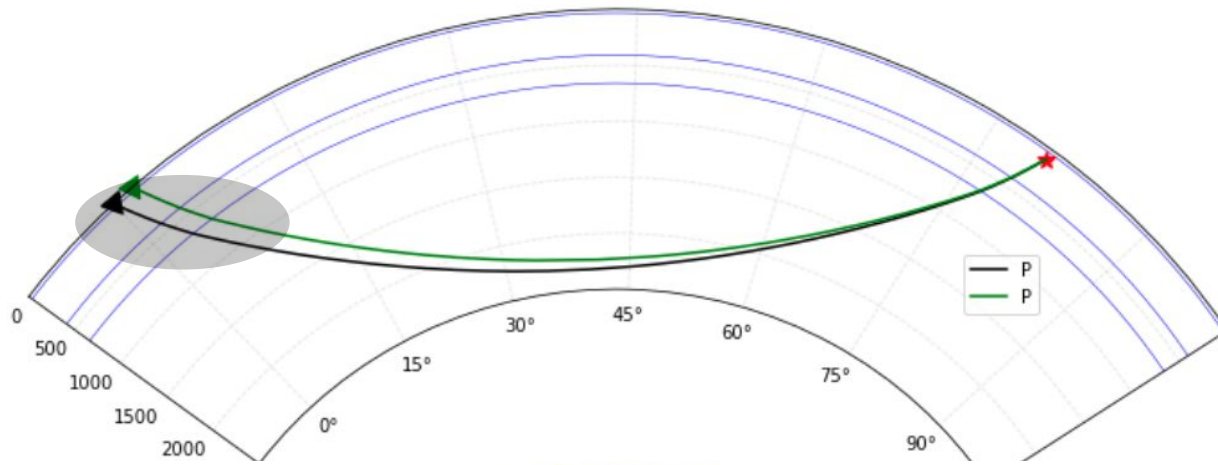
***Retain 3~5-year high-quality waveforms using SNR.***

2018-11-28T10:17:05.22 - 2018-11-28T11:17:10.37

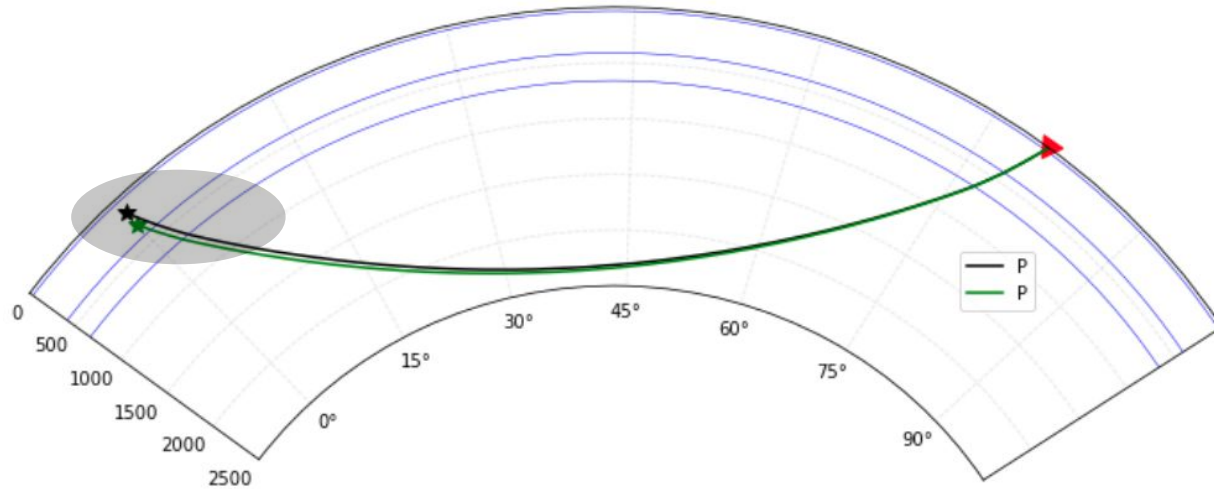


*First P*



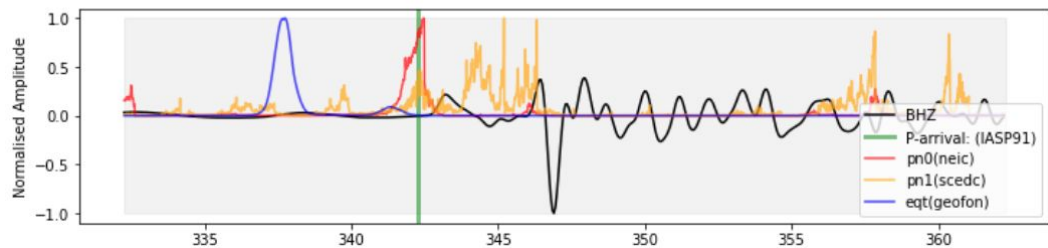
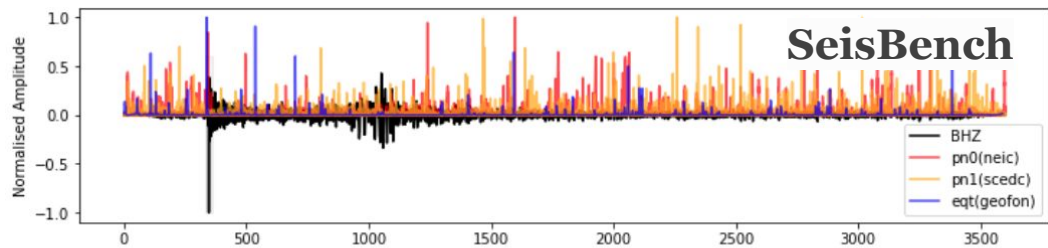
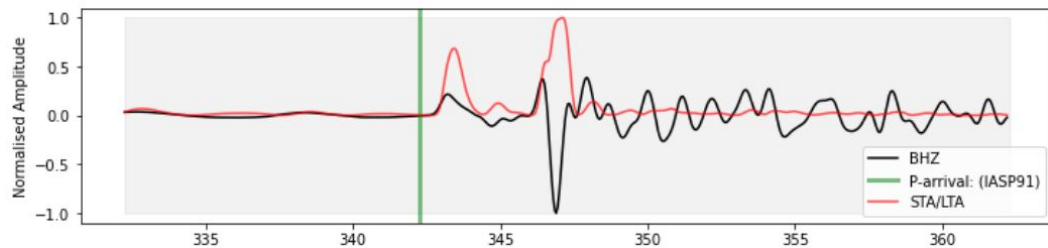
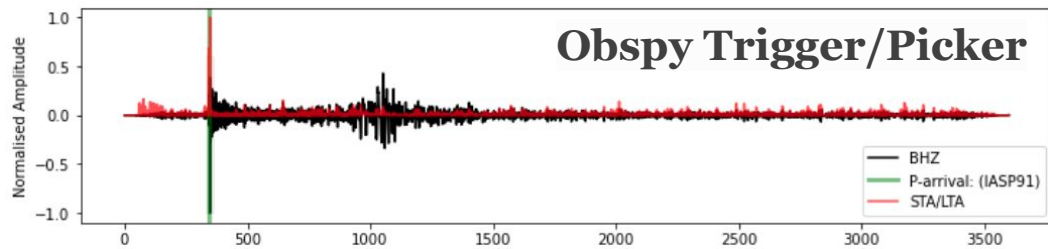


***NSFE → Common Source  
Double Difference***



***NEFS → Common Receiver  
Double Difference***

*Good estimate of P-wave arrival is the prerequisite for preparing double-difference data.*



## Traditional algorithms

Recursive STA/LTA.

Computes the carlSTAtrig characteristic function.

Computes the standard STA/LTA from a given input array a.

Delayed STA/LTA.

Z-detector.

Wrapper for P-picker routine by M.

Pick P and S arrivals with an AR-AIC + STA/LTA algorithm.

## ML algorithms

Integrated models	Task
BasicPhaseAE	Phase Picking
CRED	Earthquake Detection
DPP	Phase Picking
EQTransformer	Earthquake Detection/Phase Picking
GPD	Phase Picking
PhaseNet	Phase Picking

Next, download and process waveform data (3~5 years) if you haven't finished it;

During the time, try traditional and machine-learning algorithms to pick P-wave arrival and compare/summarize their ***pros and cons***.

Form your project report:

- ❖ Study background
- ❖ Study region and data types to deal with
- ❖ Distribution of the downloaded data and retained data (station and earthquake locations)
- ❖ SNR statistics of the retained data
- ❖ Data visualization in event gather (one earthquake and many stations)
- ❖ Pros and Cons of traditional and machine-learning algorithms in picking P-wave arrival



# Available computational resource

Use command **ssh** to remotely access the lab computer:

- ❖ Request NTU network account
- ❖ Request the intranet access permission from office secretary
- ❖ Set up VPN software (Global Protect)
- ❖ More info can be found at  
<https://www3.ntu.edu.sg/home/ehchua/programming/howto/NtuVpn.html>

→ If you need the computational resource, please send the email to Prof. Tong using your NTU account. Once the access is permitted, please send your NTU network account and your password to us. We will set up the **ssh** environment on the lab computer and give you the IP address to login the equipment.